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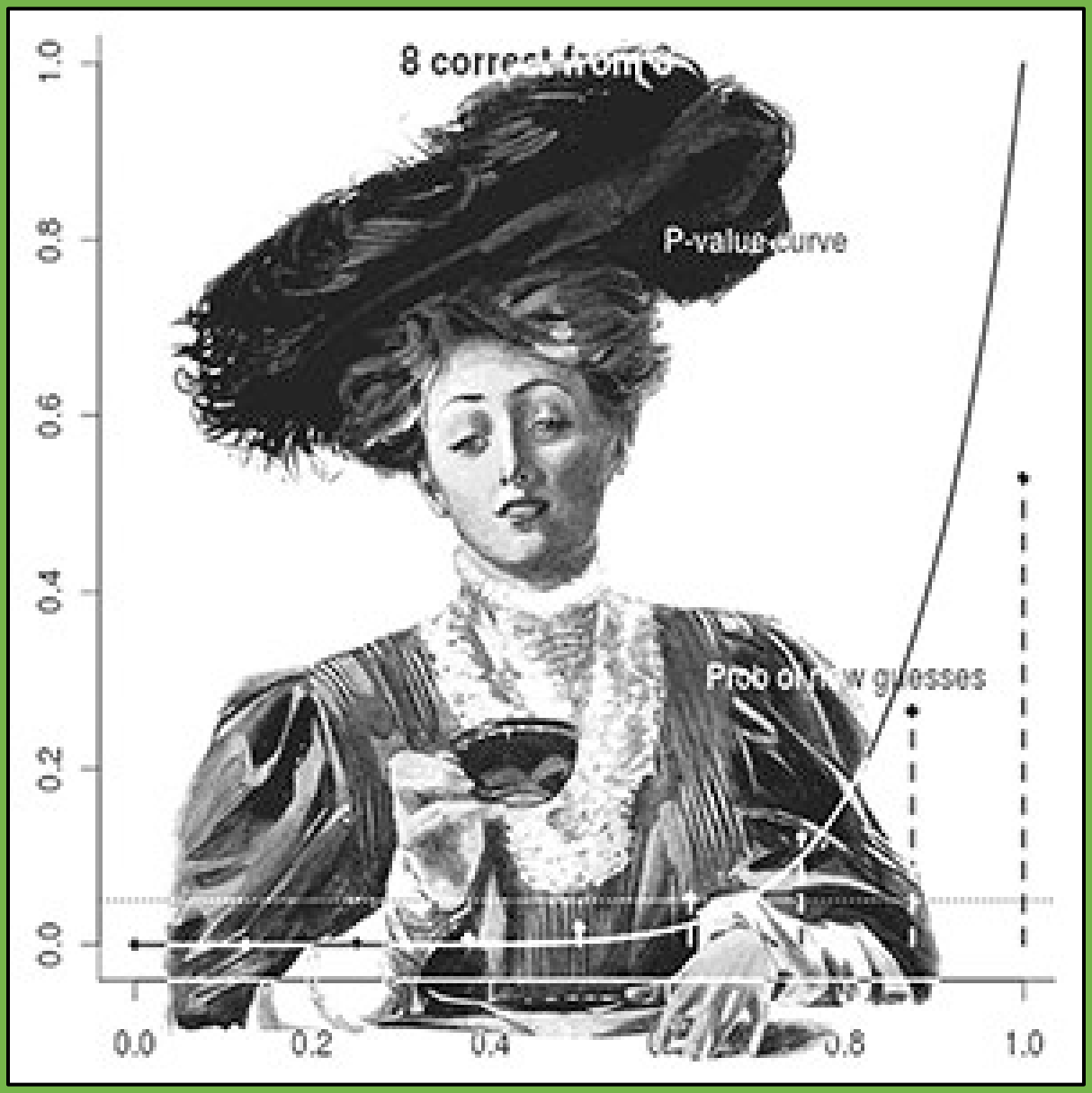
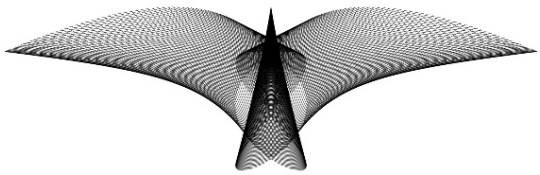
STATure



STATistical applications for undergraduate research exploration

McMaster University



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.

LIFESCI 3LL3 – Living Systems Laboratory Practicum is a lab-based statistics course that provides students with the opportunity to explore various areas of study within the Life Sciences in a small-group learning environment. Students work with large data sets and SPSS software to gain knowledge in the field of scientific research. They learn to develop research questions, run appropriate statistical tests on their data, and compose the basic requirements for a scientific manuscript.

This **STATure** (**STAT**istical applications for **u**ndergraduate **r**esearch **e**xploration) publication is a compilation of the final report submissions created by the students in the Winter 2021 course. Each report is unique, and tells an interesting statistical story while facilitating the formation of new learning.

I hope you enjoy learning about statistics as you read these reports.

Dr. Janet Pritchard (Course Creator and Instructor)

Cover Art – An artistic impression of Dr. Muriel Bristol (1888-1950) who claimed to be able to tell whether the tea or the milk was added first to a cup. This lead Dr. Ronald Fisher (1890-1962) to devise the steps to test this hypothesis and eventually create the foundations for modern statistical science. (downloaded from https://thedailyomnivore.net/2015/06/08/lady-tasting-tea/)

Inside Art - A Bird in Flight. Hamid Naderi Yeganeh (1990-) is an Iranian mathematical artist and digital artist. He is known for using mathematical formulas to create drawings of real-life objects, intricate illustrations, animations, fractals and tessellations. This image was chosen for this initial STATure publication to represent taking flight of this exciting course.
Wikimedia Creative Commons. (https://archive.org/details/ABirdInFlight_201504)

Editor – Russ Ellis

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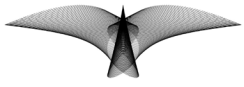


Oral Contraceptive Use Improves Relationship Satisfaction with Living Partner and Children in Women Aged 16-50 with Suicidal Thoughts

Authors: Khadija Brouillette, Cassandra Dumouchel, Olivia Kalau, Kathryn McQuillan

INTRODUCTION

Oral contraceptive (OC) medication, colloquially referred to as "*the pill*", are a class of contraceptives that contain synthetic ovarian hormones, including estrogen and progesterone, which inhibit ovulation and pregnancy. OCs are classified as hormonal contraceptives (HC). Other HCs include Intrauterine Devices (IUD), injections, vaginal rings, or skin patches (Edwards and Quinter 2011). Researchers have identified potential positive and negative non-contraceptive effects of HCs including improved quality of life (QOL) and increased risk of suicidal ideation (Arowojolu et al. 2012; Edwards and Quinter 2011; Egarter et al. 1999).

Positive Effects of Oral Contraceptives

There is evidence to suggest that OC use is associated with improved QOL (Egarter et al. 1999). Women using OCs report higher levels of relationship satisfaction and general life satisfaction compared to those who are not using OCs (Taggart et al. 2018). Roberts et al. (2011) reports an association between women meeting their partner while taking OCs and certain relationship outcomes, such as reproductive behaviour and quality of family life. The reported improved QOL may be due to a reduction in fear of unwanted pregnancy, which in turn reduces stress and improves sexual experiences (Egarter et al. 1999). However, OCs have also been shown to have biological effects on socio-emotional behaviors. High levels of estrogen are protective against the effects of stress and fear while progesterone plays a role in emotional regulation (Montoya and Bos 2017). These findings may suggest OCs provide benefits beyond preventing undesired pregnancies. Studies have shown that the ovarian hormones in OCs influence emotional recognition and empathy, both of which are essential to be a caregiver and to navigate social relationships. This may explain the increase in relationship satisfaction in women who are taking OCs (Montoya and Bos 2017).

Negative Effects of Oral Contraceptives

Generally, negative side effects of taking OCs include physical and mental symptoms (Pietrangelo 2014). There is conflicting literature investigating the association between the use of OCs and suicidal ideations and/or attempts. In a placebo-controlled study, the general well-being, self-control, and vitality of participants taking OCs were significantly lower than the placebo (Zethraeus et al. 2017). Edwards et al. (2020) found that OCs did not significantly influence symptoms of depression, however women susceptible to depression/anxiety were more likely to stop using OCs. Further results showed that HCs containing only progestin, a synthetic progesterone, were positively associated with suicidal behavior, particularly after one month's use (Edwards and Quinter 2011). Anderl et al. (2019) suggested that long term OC use in adolescents is associated with a risk of major depressive disorder (MDD). Similarly, results showed that women who had used OCs in adolescence were at a greater risk for depression in adulthood (Anderl, Li, and Chen 2020). Additionally, the use of HCs is positively associated with the likelihood of suicide attempts (Edwards and Quinter 2011). This association is

particular to adolescent women not previously diagnosed with depression, women who have not taken antidepressants, nor taken hormonal contraceptives before the age of 15 (Skovlund et al. 2018).

Social Support and QOL

The literature suggests that in addition to OCs, professional and social support can influence QOL and relationship satisfaction (Koivumaa-Honkanen et al. 1996; Wan, Jaccard, and Ramey 1996). A study on the relationship between social support and life satisfaction determined that married women benefit most from non-familial support, including psychologist or social worker help (Wan et al. 1996). In an analysis of perceived social support, anxiety, depression and QOL, research report that QOL can be improved by increasing social support (Sadoughi and Hesampour 2017). This previous literature indicates that social and professional support are important determinants of QOL and life satisfaction.

Study Rationale

Current literature provides conflicting data as to whether the use of OCs is beneficial or harmful to one's mental state. The literature provides evidence suggesting that OCs may increase QOL and relationship satisfaction, and that HC use may increase the risk of suicide. However, the literature lacks insight on the impact of OCs in women who have contemplated suicide. To our knowledge, no study has been published exploring how OCs influence relationship satisfaction in women who have previously had suicidal thoughts. We primarily investigate if a difference in social life satisfaction, satisfaction with the relationship with your children and satisfaction with the relationship with your living partner, exists for women aged 16 to 50 who have had suicidal thoughts based on whether they are taking OCs or not. We secondarily investigate the effects of professional help on our primary outcome and thirdly report the prevalence of taking OCs in the same population.

MATERIALS AND METHODS

Study Design and Database

The current study is a retrospective observational cross-sectional study. Data was collected from the Ontario Health Survey (OHS), 1990 database. The goal of the OHS was to collect baseline statistical information on the health of Ontarians as well as risk factors, health service use, and awareness related to smoking, alcohol, nutrition, and exercise. The database also includes information on demographic, geographic, social, and economic status (OHS, 1990).

A survey containing an interviewer-completed and a self-completed questionnaire provided the data for this study. The survey was divided in two parts. Part one focused on current or recent health problems and demographic information. One member of each household completed part one for all members of the household. Part two was completed individually by each member of the household. Part two was more specific to personal rated health and medication use. The survey period was from January 1990 to December 1990. Note that inmates, foreign service personnel, residents of Indigenous reverse and residents of remote areas were excluded from the survey. The response rate of the interviewer-completed and self-completed portions of the survey are 87.5% and 77.2%,

respectively. Overall, 61 230 participants are included in the database (OHS, 1990). The database was accessed through the Odesi portal.

Study Participants

The current study included women aged 16 to 50 inclusive who responded "Yes" to the question "Have you ever seriously thought about committing suicide (taking your own life)?" and either "Yes" or "No" to the question "Do you take oral contraceptives (either as a method of birth control or to regulate your menstrual cycle, or for another reason)?". Participants who answered, "Not Applicable", "Child Under 12" or "Not Stated" to the questions were excluded.

Participants who answered, "Not applicable", "Child Under 12", or "Not Stated" to all three outcomes of interest, were excluded from our study. To be included participants must have provided a valid answer to one of the three primary outcome questions. The experimental group consisted of participants that answered "Yes" to taking OCs, while the control group consisted of participants that answered "No" to taking OCs.

Study Outcomes

The primary outcome of the study examined differences in relationship satisfaction based on social life, one's relationship with their children and one's relationship with their living partner. Study participants were asked "How satisfied are you with your social life?", "How satisfied are you with your relationship with your children?" and/or "How satisfied are [you] with [your] relationship to [the person you are presently living with or married to?]". For each question, the participants could answer "Very satisfied", "Somewhat satisfied", "Somewhat unsatisfied" or "Very unsatisfied". The categories "Not applicable", "Child under 12" or "Not stated" are in the database, but not included in our study. The secondary outcome of the current study examined the potential influence of professional help on satisfaction levels. This was accomplished by asking participants "[How many times] did you see or talk to a psychologist or social worker about your health in the past 12 months?". The tertiary outcome examined the prevalence of women taking OCs in the population of women who have contemplated suicide. This was assessed using the same questions that defined the study population. Understanding how OCs influence relationship satisfaction in women who have had suicidal thoughts is of great clinical importance. Contrasting research in this field suggests that OC use may increase life and relationship satisfaction or may increase the risk of suicide in the first year of taking OCs (Skovlund et al. 2018; Taggart et al. 2018). Investigating the relationship between OC use and relationship satisfaction in women with suicidal ideation will provide health care practitioners with more evidence/resources when prescribing the pill. This research may provide insight into the influence of psychologist/social worker visits on relationship satisfaction and the prevalence of taking OCs in women with suicidal ideations.

Additional Data Collection

Our study included additional participant characteristics such age, employment status, visits to a psychologist or social worker, stress level, antidepressant use, age starting intercourse, and number of friends. We included these variables to assess the similarity between the population of women taking

and not taking OCs. We further examined the potential influence of psychologist or social worker visits on our primary outcome.

Statistical Analysis

Shapiro-Wilk Normality tests were run on the baseline continuous variables. Continuous data is reported as median (interquartile range, IQR) and categorical data is reported as frequency (%). Chi-square tests were used for the analysis of the primary research question. Each response category for each of the primary outcome questions was assessed separately between the two groups. Spearman's Rho test was used to determine correlations between number of psychologist or social worker visits and the primary outcomes. All statistical analyses were run using IBM SPSS Statistics Version 27. A $p < 0.05$ was considered statistically significant.

Missing Data

For our study population we excluded data listwise: any individuals that were not female, between the ages of 16-50 or did not answer if they were currently on OCs were excluded. We excluded data pairwise for our primary outcomes: individuals were excluded if they did not provide definitive answers for outcome questions. There was no missing data.

RESULTS

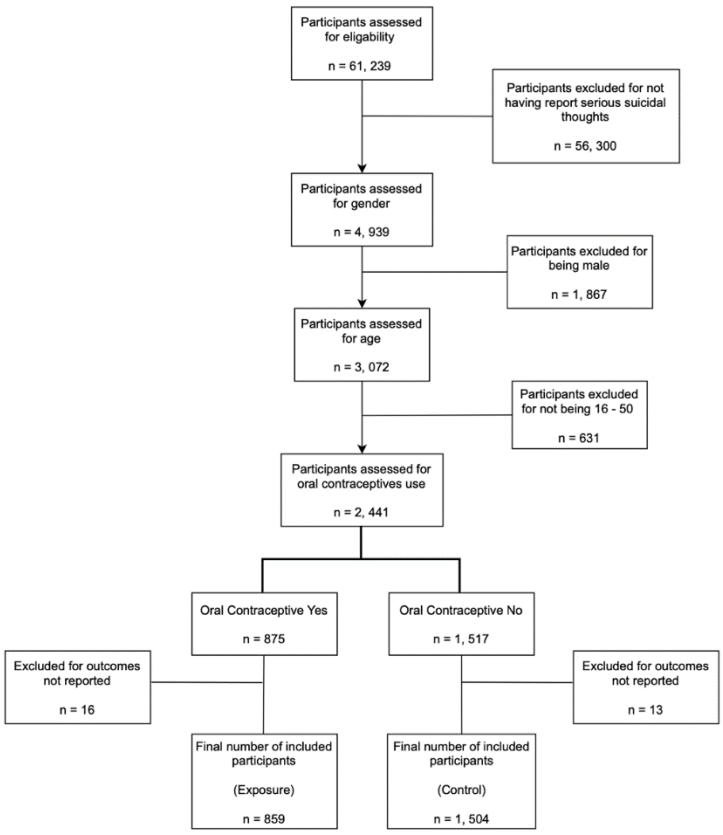
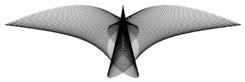


Figure 1. Participant Flow Diagram. Participants were collected from the 1990 OHS database accessed through the Odesi portal. Only women aged 16-50 with previous suicidal though who responded "yes" or "no" to being on oral contraceptives and answered definitively 1/3 research question were included. The flow diagram summarizes reasons for participant exclusions.

Table 1. Population Characteristics of Women Aged 16 – 50 who have had Suicidal Thoughts Taking and Not Taking Oral Contraceptives.

Characteristics	Women Taking Oral Contraceptive (Exposure) (N=859)	Women Not Taking Oral Contraceptive (Control) (N=1504)
Age, median (IQR), y	24 (10)	34 (16)
Psychologist /Social Worker Visits (Past 12 Months), median (IQR), n	4 (8)[a]	5 (8)[d]
Age Starting Intercourse, median (IQR), y	16 (3)[b]	17 (3)[e]
Number of Friends, median (IQR), n	4 (4)[e]	3 (4)[f]
Employment Status		
Working at a Job	455 (53)	795 (52.9)
Looking for a Job	13 (1.5)	32 (2.1)
Going to School	234 (27.2)	309 (20.5)
Keeping House	142 (16.5)	310 (20.6)
Retired	0 (0.0)	8 (0.5)
Other	12 (14)	43 (2.9)
Missing	3 (0.3)	7 (0.5)
Highest Level of Education		
Completed Primary School or Less	18 (2.1)	54 (3.6)
Some Secondary/High School	277 (32.2)	493 (32.8)
Completed Secondary/High School	232 (27.0)	376 (25.0)
Some Community College	93 (10.8)	144 (9,6)
Completed Community College	103 (12)	178 (11.8)
Some University Experience	55 (6.4)	103 (6.8)
Completed University Degree	81 (9.4)	148 (9.8)
Missing	0 (0.0)	8 (0.5)
Stress Level		
High	588 (68.5)	1102 (73.3)
Low	266 (31.0)	399 (26.5)
Missing	5 (0.6)	3 (0.2)
Antidepressants (Past 12 Months)		
Yes	41 (4.8)	122 (8.1)
No	736 (85.7)	1228 (81.6)
Missing	82 (9.5)	153 (10.2)

Note. Only women aged 16 -50 who have had suicidal thought were included. Values are reported as frequency (%) unless otherwise stated. [a] missing 730 (85), [b] missing 50 (5.8), [c] missing 17 (2.0), [d] missing 1257 (83.6), [e] missing 279 (18.6), [f] missing 49 (3.3).



The starting number of individuals in the database was 61,239. Figure 1. displays the reasons for participant exclusion. In total, the study included 2,363 participants. 859 women were assigned in the exposed group (taking oral contraceptives) and 1504 were assigned to the control group (not taking oral contraceptives). Population characteristics are described in Table 1. Briefly, the median (IQR) age in the exposed group and control group was found to be 24 (10) and 34 (16), respectively. Most women of both the control and exposure group were employed, 53.0% and 52.9%, respectively.

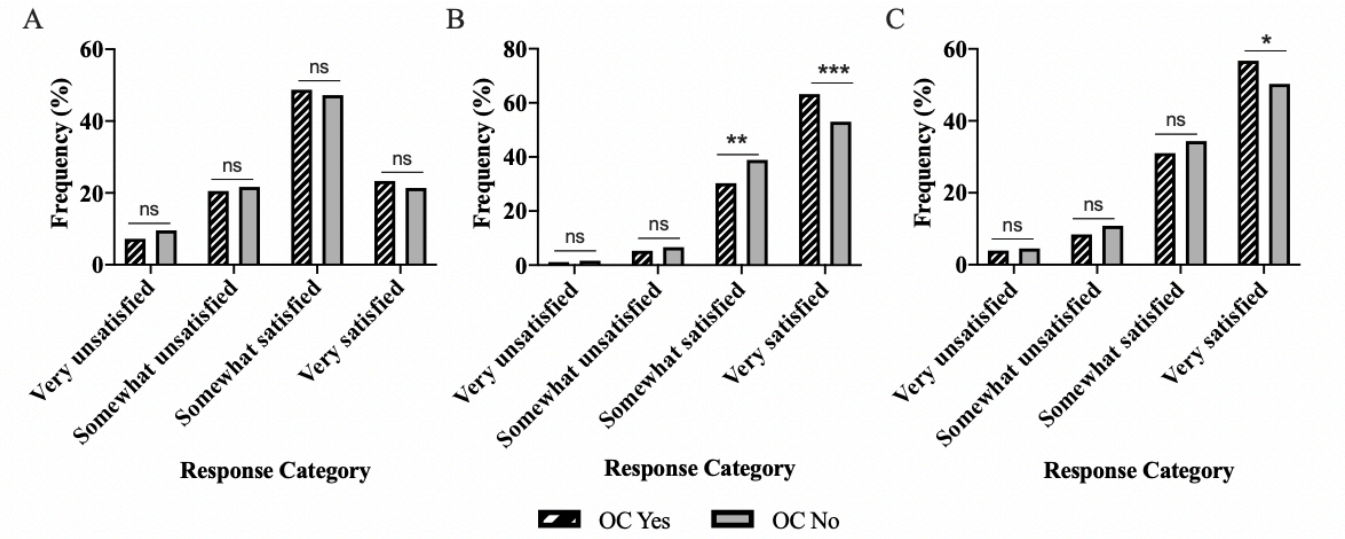


Figure 2. Relationship Satisfaction Outcomes in Women Taking and Not Taking OCs Aged 16 – 50 Who Have Had Suicidal Thoughts. (A) Social life satisfaction. From left to right: [χ^2 (1, N=207) = 3.675, p = 0.055], [χ^2 (1, N=502) = 0.367, p = 0.554], [χ^2 (1, N=1129) = 0.533, p = 0.465], [χ^2 (1, N=522) = 1.052, p = 0.305], missing = 3. (B) Satisfaction with the relationship with your children. From left to right: [χ^2 (1, N=19) = 0.064, p = 0.801], [χ^2 (1, N=81) = 0.509, p = 0.476], [χ^2 (1, N=475) = 7.952, ** = p = 0.006], [χ^2 (1, N=722) = 10.695, *** = p = 0.001], missing = 1066. (C) Satisfaction with the relationship with your living partner. From left to right: [χ^2 (1, N=57) = 0.149, p = 0.699], [χ^2 (1, N=133) = 1.579, p = 0.209], [χ^2 (1, N=442) = 1.416, p = 0.234], [χ^2 (1, N=696) = 4.630, * = p = 0.031], missing = 1035.

The primary objective of the study was to determine whether the use of OCs influenced relationship satisfaction in women aged 16-50 who have previously reported having suicidal thoughts. Chi Square tests were run between groups for each categorial-type response within each outcome (Fig. 2). A significantly higher proportion of women taking OCs reported being very satisfied with the relationship with their children [χ^2 (1, N=722) = 10.695, p = 0.001] and very satisfied with the relationship with their living partner [χ^2 (1, N=696) = 4.630, p = 0.031] compared to women not taking OCs. In contrast, a significantly higher proportion of women not taking OCs reported being somewhat satisfied with the relationship to their children compared to women taking OCs [χ^2 (1, N=475) = 7.952, p = 0.006].

Table 2. Number of Psychologist /Social Worker Visits and Satisfaction Outcomes

	Women Taking Oral Contraceptives (N=859) *Number of Psychologist/Social Worker Visits*		Women Not Taking Oral Contraceptive (N=1504) *Number of Psychologist/Social Worker Visits*	
Satisfaction with:	r_s	*p* value	r_s	*p* value
Social life	.145[a]	.100	.130[d]	.042*
The relationship with your children	.121[b]	.358	.156[e]	.041*
The relationship with your living partner	.237[c]	.076	-.003[f]	.974

Note. Only women aged 16–50 who have had suicidal thought were included. Spearman Rho correlation run between satisfaction outcomes and number of psychologist/social worker visits in women taking OC and women not taking OC. [a]N=129, [b] N=60, [c] N=57, [d] N=246, [e] N=172, [f]N=129 Data are reported as Spearman rho correlation coefficient (r_s). * = $p < 0.05$.

To assess the secondary objective, a Spearman's Rho correlation test was run between the number of psychologist/social worker visits and the outcomes of interest within each group (Table 2). A small positive correlation was found in the control group between number of psychologist or social worker visits and social life satisfaction ($r_s = 0.130$, $p = 0.042$) and one's satisfaction with their relationship with their children ($r_s = 0.156$, $p = 0.041$).

Table 3. Prevalence of Women Age 16–50 With Suicidal Thoughts Taking OC

Exposure and Control Groups	*Prevalence n (%)*
Women Taking Oral Contraceptives	859 (36.4)
Women Not Taking Oral Contraceptives	1504 (63.6)

Note. Only women aged 16 -50 who have had suicidal thought were included. Values are reported as frequency (%).

The prevalence of women aged 16–50 taking OCs was calculated to answer the tertiary objective. It was found that 36.4% of women in this population take OCs (Table 3).

DISCUSSION

Our main findings suggest that women aged 16-50 who have experienced suicidal ideation and are taking OCs are more likely to be very satisfied with the relationship with their children and with their living partner. In the population of women not taking OCs, professional help had a small positive correlation with social life satisfaction and satisfaction with one's children. Finally, our study found that around a third of women with suicidal thoughts use OCs.

Our findings that women taking OCs have higher satisfaction with the relationship with their living partner and children is supported by existing literature. Taggart et al. (2018) suggests that taking OC when meeting a partner leads to improved QOL. A study by Roberts et al. (2018) differentiated between sexual and non-sexual relationship satisfaction. Their results suggest that women who have previously used and/or currently use OCs are more sexually satisfied with their partner. The researchers observed no significant association between OC use and non-sexual relationship satisfaction (Roberts et al. 2012). Our study reports similar findings in that there is an association between OC use and relationship satisfaction. However, our study fails to differentiate between sexual and nonsexual relationship satisfaction.

Previous research indicates that the active ingredients in most OCs change the hormonal profile of the users (Montoya and Bos 2017). Specifically, levels of ovarian hormones in OCs can influence stress levels, emotional recognition, and empathy (Montoya and Bos 2017). We expected that the mood stabilizing ingredients of OCs would contribute to an association between OC use and women's satisfaction with their social life, living partner and children. However, our findings report no significant difference in social life satisfaction between suicidal women who are on the pill in comparison to suicidal women who are not on the pill. A sizeable difference exists between the median ages of exposure and control groups. We hypothesize that this could have influenced the interpretation of satisfaction within the groups and therefore our outcomes.

Our findings report that women taking OCs rated the satisfaction of their relationship with their children higher than those not taking OCs. This association may be a result of the emotional regulation provided by hormonal birth control (Montoya and Bos 2017). The primary objective of OCs is to prevent unwanted pregnancy, thus women's increased satisfaction with their relationships with their children may also be because they held more control over the timing of their respective pregnancies. Future research should investigate the impact of hormonal emotional regulation on women taking OCs who have experienced suicidal ideation.

In our control group, a significant association was found between the number of visits to a psychologist or social worker in the last year and women's satisfaction with their social life and the relationship with their children. This finding is consistent with previous research indicating that professional support can increase relationship satisfaction and QOL, in both psychiatric and non-psychiatric populations (Koivumaa-Honkanen et al. 1996; Wan et al. 1996). In our study, the correlation coefficient was small and explains less than 10% of the variance. The number of psychologist or social worker visits likely did not largely influence our outcomes. Future research should control for the possible effect of psychologist visits on women's satisfaction with their children and social life.

Our study reports that 36.4% of women, who have experienced suicidal ideation between 16-50 years of age were taking OCs at the time of the survey, while 63.6% were not. Estimates of OC use among all women aged 15-49 in Canada indicate a prevalence of approximately 16.0% (Government of Canada 2015). These estimates also suggest that OC use decreases with age, thus the greater percentage of OC users in our study is likely not a result of the expanded age range studied (Government of Canada 2015). The difference in prevalence of OC use between our study population and the Canadian estimate may suggest increased prescription of OCs to women who have experienced suicidal ideation.

Methodological caveats within the survey design may also have impacted our results. Certain questions in the survey lacked specificity and may have skewed our results. The term "satisfied" with a relationship was not defined to the participants and may have been subjectively interpreted. Additionally, when investigating satisfaction rates of participant relationships with their children, there was no identification of the type of relationship; foster children, adopted children, stepchildren, or biological children. A study by South et al. in 2012 suggests that predictors of relationship satisfaction with children of adoptive parents relied on socioeconomic status, partner support and enthusiasm of partner for being a parent. These factors differed from that of biological parents (South et al. 2013). This observation suggests that a fundamental difference exists in an adoptive mother's satisfaction with her relationship to her children in comparison to biological mothers. Understanding the different types of relationships between the participants of our study would allow for better interpretation of how OCs independently influence a mother's relationship satisfaction with her children. Different levels of marital satisfaction exist between adoptive and biological parents, where biological couples report a significant decrease in marital satisfaction after having children (South et al. 2013). This suggests that relationships with children may have an influence on our other primary outcomes, such as satisfaction with your living partner. It is possible that the genetic and environmental conditions under which the relationship with a parent is established plays a confounding role in the mother-child relationship.

Our study did not consider different brands or types of OCs used by participants. Different amounts of active ingredients may have differentially altered the hormonal profile of the women and by consequence have skewed our data and consequential results (Casper 2017; Schildkraut et al. 2002). Additionally, our study was not able to account for possible covariates, as the data for our primary outcomes was not normally distributed. To avoid the interpretation and use of erroneous data, we would have used the ANCOVA model to account for potential influences on our dependent variables had the data been normally distributed.

Our results further indicate that OC use has non-contraceptive benefits, particularly for mothers. The results demonstrate the OC may have a positive benefit on relationship satisfaction of women with their children, if they have experienced suicidal ideation. We recommend that healthcare practitioners consider the advantages and disadvantages of prescribing the pill to women who have experienced suicidal ideation, in terms of their relationship satisfaction with their children and living partner.

To our knowledge, this is the first study to consider the influence of taking oral contraceptives on relationship satisfaction in terms of social life, one's relationship to their children and one's relationship to their living partner and/or spouse who have had suicidal thoughts. Previous research has demonstrated that OC use can improve life satisfaction, however, no study has focused on specific non-contraceptive relationship satisfaction benefits of OC use in women who experience suicidal ideation. Future studies may look to investigate the effects of different types of OCs, differences in sexual and non-sexual satisfaction between OC users and if relationship satisfaction differs between long-term and short-term OC users. This research would help further the understanding of the non-contraceptive effects of OCs.

REFERENCES

Anderl, Christine, Gu Li, and Frances S. Chen. 2020. "Oral Contraceptive Use in Adolescence Predicts Lasting Vulnerability to Depression in Adulthood." Journal of Child Psychology and Psychiatry 61(2):148–56. doi: https://doi.org/10.1111/jcpp.13115.

Arowojolu, Ayodele O., Maria F. Gallo, Laureen M. Lopez, and David A. Grimes. 2012. "Combined Oral Contraceptive Pills for Treatment of Acne." The Cochrane Database of Systematic Reviews (7):CD004425. doi: 10.1002/14651858.CD004425.pub6.

Casper, Robert F. 2017. "Progestin-Only Pills May Be a Better First-Line Treatment for Endometriosis than Combined Estrogen-Progestin Contraceptive Pills." Fertility and Sterility 107(3):533–36. doi: 10.1016/j.fertnstert.2017.01.003.

Edwards, Kochung, and Migunde Quinter. 2011. "Factors Influencing Students Career Choices among Secondary School Students in Kisumu Municipality, Kenya." 7.

Egarter, C., M. A. Topcuoglu, M. Imhof, and J. Huber. 1999. "Low Dose Oral Contraceptives and Quality of Life." Contraception 59(5):287–91. doi: 10.1016/s0010-7824(99)00040-2.

Government of Canada, Statistics Canada. 2015. "Oral Contraceptive Use among Women Aged 15 to 49: Results from the Canadian Health Measures Survey." Retrieved April 9, 2021 (https://www150.statcan.gc.ca/n1/pub/82-003-x/2015010/article/14222-eng.htm).

Koivumaa-Honkanen, H-T., H. Viinamäki, R. Honkanen, A. Tanskanen, R. Antikainen, L. Niskanen, J. Jääskeläinen, and J. Lehtonen. 1996. "Correlates of Life Satisfaction among Psychiatric Patients." Acta Psychiatrica Scandinavica 94(5):372–78. doi: 10.1111/j.1600-0447.1996.tb09875.x.

Ministry of Health. (1990). Ontrario Heath Survey. Goverments of Ontario.

Montoya, Estrella R., and Peter A. Bos. 2017. "How Oral Contraceptives Impact Social-Emotional Behavior and Brain Function." Trends in Cognitive Sciences 21(2):125–36. doi: 10.1016/j.tics.2016.11.005.

Pietrangelo, Ann. 2014. “The Effects of Hormonal Birth Control on Your Body.” Healthline. Retrieved February 12, 2021 (https://www.healthline.com/health/birth-control-effects-on-body).

Roberts, S. Craig, Kateřina Klapilová, Anthony C. Little, Robert P. Burriss, Benedict C. Jones, Lisa M. DeBruine, Marion Petrie, and Jan Havlíček. 2012. “Relationship Satisfaction and Outcome in Women Who Meet Their Partner While Using Oral Contraception.” Proceedings of the Royal Society B: Biological Sciences 279(1732):1430–36. doi: 10.1098/rspb.2011.1647.

Sadoughi, Majid, and Fatemeh Hesampour. 2017. “The Relationship between Anxiety, Depression and Perceived Social Support and Quality of Life among Hemodialysis Patients.” Journal of Clinical Nursing and Midwifery 6.

Schildkraut, Joellen M., Brian Calingaert, Polly A. Marchbanks, Patricia G. Moorman, and Gustavo C. Rodriguez. 2002. “Impact of Progestin and Estrogen Potency in Oral Contraceptives on Ovarian Cancer Risk.” JNCI: Journal of the National Cancer Institute 94(1):32–38. doi: 10.1093/jnci/94.1.32.

Skovlund, Charlotte Wessel, Lina Steinrud Mørch, Lars Vedel Kessing, Theis Lange, and Øjvind Lidegaard. 2018. “Association of Hormonal Contraception With Suicide Attempts and Suicides.” The American Journal of Psychiatry 175(4):336–42. doi: 10.1176/appi.ajp.2017.17060616.

South, Susan, Karen Foli, and Eunjung Lim. 2013. “Predictors of Relationship Satisfaction in Adoptive Mothers.” Journal of Social and Personal Relationships 30(5):545–63. doi: 10.1177/0265407512462681.

Taggart, Tenille C., Nicholas R. Eaton, Katherine M. Keyes, Julia F. Hammett, and Emilio C. Ulloa. 2018. “Oral Contraceptive Use Is Associated with Greater Mood Stability and Higher Relationship Satisfaction.” Neurology, Psychiatry and Brain Research 30:154–62. doi: 10.1016/j.npbr.2018.10.004.

Wan, Choi K., James Jaccard, and Sharon L. Ramey. 1996. “The Relationship between Social Support and Life Satisfaction as a Function of Family Structure.” Journal of Marriage and Family 58(2):502–13. doi: 10.2307/353513.

Zethraeus, Niklas, Anna Dreber, Eva Ranehill, Liselott Blomberg, Fernand Labrie, Bo von Schoultz, Magnus Johannesson, and Angelica Lindén Hirschberg. 2017. “A First-Choice Combined Oral Contraceptive Influences General Well-Being in Healthy Women: A Double-Blind, Randomized, Placebo-Controlled Trial.” Fertility and Sterility 107(5):1238–45. doi: 10.1016/j.fertnstert.2017.02.120.

Exploring the Perceptions of Perceived Mental Health Among Young and Older Adults in Ontario in Relation to their Level of Concern for their Physical Health and Financial Impacts due to the COVID-19 Pandemic

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INTRODUCTION

In early December 2019, the emergence of a novel coronavirus SARS-CoV-2 (COVID-19) caused millions of deaths worldwide (World Health Organization, 2020). Within the following month, Canada identified its first positive case of COVID-19 in Toronto, Ontario (Scarabel et al., 2020). The rapid increase in deaths across the country resulted in travel restrictions and provincial lockdowns. Similar to many governments around the world, the province of Ontario, Canada has responded to the widespread disease with a series of public health measures to protect its citizens. This involved social distancing, wearing masks and the closure of nonessential businesses (Government of Ontario, 2020). These changes disrupted the daily routines of many Canadian families, causing them to stress and worry. The economy has also been negatively impacted, leaving many out of work (Carroll et al., 2020). It is believed that the implementation of quarantine has taken a significant toll on the mental health of all demographics.

Quarantine has affected the levels of depression and anxiety among adolescents and young adults. In attempts to flatten the curve, stay-at-home orders have caused students to experience a lack of structure, physical activity, and social interaction in their life (Daly et al., 2021). Canadians have been more reliant on screen time for entertainment, online learning and virtual work. This spike in sedentary time is associated with increased risks of depression, poor mental health, and poor physical health outcomes (Sultana et al., 2020). Symptoms of mental illness are expected to worsen during the pandemic (Chanchlani et al., 2020). Young adults, in particular, are exuding psychological distress. They are at a stage in their life where new responsibilities such as pursuing further education and job-seeking are prioritized. However, the constant closures of businesses have left many unemployed. Constant worries of receiving enough income to meet financial obligations and basic survival needs have become pressing concerns (Daly et al., 2021). As the pandemic restrictions continue to be enforced, Canadians will quarantine at home and experience heightened risk for adverse mental health consequences.

To date, several research studies have identified common themes of lifestyle modifications and changes in health-related behaviours in young adults during the COVID-19 pandemic (Violant-Holz et al., 2020). The influence of lockdown restrictions on stress and mental health is currently a large area of discussion. For example, a study by Varma et al., (2020) examined the psychological distress and its effects upon vulnerable groups during the early stages of the pandemic. The results from the global online survey revealed that respondents were significantly distressed about their financial situation, which were associated with poor sleep quality and loneliness. The younger age groups experienced a significant decline in mental health compared to middle age groups. Furthermore, the impact of COVID-19 on the mental health of the general Canadian population has also been explored in various

studies (Xiong et al., 2020). However, there has been limited attention given to health anxiety and stress levels related to the concern of COVID-19's impact on the perception of mental health and financial stability among adolescents, young adults and older adults in Canada. Previous research also suggests that the pandemic has contributed to the deterioration of perceived mental health in younger populations on a global scale, however, the reasons for this remain unexplored (Power et al., 2020). Concerns among individuals may vary depending on socioeconomic status.

Addressing this knowledge gap will allow for the development and improvement of health services that would help to reduce mental health issues for younger working populations, including high school students and young adults. It is also important to note that Canada's population is aging rapidly than ever before. Adults 65 years and older are expected to represent 25% of the country's population by 2035 (Chong et al., 2020). Many elderly people are living with dementia and disabilities. They are experiencing their own set of obstacles during the pandemic. This involves a delay in care for chronic conditions, reduced access to social support and being the most susceptible to contracting the virus (Chong et al., 2020). It is difficult to envision post-pandemic interventions to alleviate these intensified health risks. By comparing the effects of the pandemic between these age groups, there is a potential bridge for similarities and differences that may reveal new insights into factors affecting an individual's overall mental health - regardless of age. This will allow for improved quality of life across different lifespans in Canada.

The objectives of this study are to (1) determine if there was a difference in the perception of mental health between Ontarians aged 15 to 29 who were extremely concerned about the impact of COVID-19 on their physical health compared to Ontarians aged 15 to 29 who were not at all concerned about the impact of COVID-19 on their physical health, (2) determine the association between mental health perceptions of Ontarians aged 15 to 29 and those above the age of 65, and (3) determine whether the relationships are affected by the ability to meet financial obligations or fulfil essential needs.

MATERIALS AND METHODS

Study Design and Database

The dataset for this cross-sectional study was obtained from the Odesi database, titled "Impacts of COVID-19 on Canadians- Mental health, 2020: Crowdsource file". The data explored Canadians' mental health in 2020, specifically during the early stages of the COVID-19 pandemic. A total of 45,989 responses were reported. The sampling procedure used is a non-probabilistic approach without the use of a sample design (Statistics Canada, 2021). The voluntary data was collected via a self-administered online questionnaire using the Crowdsourcing application collected from April 24, 2020, to May 11, 2020. The survey consisted of questions pertaining to demographic questions related to age, gender and location. Additionally, questions on the concerns about the impact of COVID-19 on various determinants of mental and physical health and access to resources and economics.

Study Participants

This cross-sectional study was conducted with men and women ages 15-29 and ≥65 years from Ontario, Canada. This study included participants recruited for the purpose of comparing the perception of mental health among young and older adults in one of the leading hotspot regions for COVID-19 (Dougherty et al., 2021); therefore the exclusion criteria were; (1) participants 30-64 years old; and (2) other provinces in Canada.

Study Outcomes

The primary outcome of the research question is the measurement of perception of mental health among Ontarians aged 15 to 29 years old during the COVID-19 pandemic. Specifically, comparing the perceived mental health of participants with extreme concern about the potential impact of COVID-19 on their physical health, compared to those not at all concerned. Participants selected an option on a nominal scale ranging from 1 = Not at all [concerned] to 4 = Extremely [concerned]. For the purpose of the research question, the data from this question was narrowed to only the extreme values, Not at all and Extremely categories. This simplifies the examination of the relationship between overall perceived mental health and level of concern of the impact of COVID-19 on their own health. The perception of mental health is a self-reported measure obtained from the database. Participants had the option of selecting a categorical value ranging from 1 (Excellent) to 5 (Poor) to describe their perceived mental health. To further investigate other factors that might influence the primary outcome, the relationship between different age groups and perceived mental health during the COVID-19 pandemic was explored. Participants selected an interval containing their age group on a nominal scale. Recent studies on the mental health effects of COVID-19 suggest that older adults may be more resilient to mental health strains caused by the pandemic in comparison to young adults (Vahia et al, 2020). To further explore the reasoning of this finding, our second outcome examines the difference in perceived mental health in the working population aged 15 to 29 years and Ontarians aged 65 years or above. As a further investigation into the implications of age on perceived mental health, the tertiary outcome examines the ability of participants to meet their financial obligations and fulfil their needs during the pandemic.

Additional Data Collection

Data on the age of participants and the impacts of COVID-19 on the ability to meet financial obligations or essential needs was collected. The Age group variable was used to compare the perceived mental health of adolescents and young adults in Ontario in comparison to those above the age of 65. Participants selected an interval containing their age on a nominal scale. The intervals used for the purpose of this study were 15 to 24 years old and 25 to 29 years old which were collapsed into a single variable to account for the working population. The 65 years and older age group was used to conduct the comparison. The categorical COVID-19 impacts the ability to meet financial obligations or essential needs variables ranging from No impact to Major impact. This variable was used to further investigate the research question by conducting a comparison between perceived mental health and the ability to fulfil financial and essential needs during COVID-19 between age groups.

Statistical Analysis

Analyses were performed using the IBM SPSS Statistics (Version 26) software package. Descriptive data were presented as proportions and percents for categorical data. Statistical significance between proportions ($p < 0.05$) for each categorical descriptive characteristic was determined through Chi-square analysis. Between-group differences for each perceived mental health category for 15 to 29 year old Ontarians in the control and exposure group were determined using a Chi-square test. Bar graphs were constructed to compare results of the Chi-square test, as frequencies between perceived mental health and financial concerns among Ontarians 15 to 29 years old and those 65 years and older. A Spearman's Rho analysis was performed to determine the strength of the relationship between the ordinal variables; perceived mental health and COVID-19's impact on financial obligations in Ontarians 15 to 19 years old, and 65 years and older. Where a positive Spearman correlation coefficient, $\boldsymbol{\rho}$, indicates a positive association between variables with values ranging from 0.20-0.39 categorized as being weak. The dataset revealed that some values were reported as invalid, and 19 surveys were excluded from the analysis due to missing values.

RESULTS

Of 1324 participants, 383 individuals were Extremely concerned about their physical health and 891 individuals were Not at all concerned (control group). Descriptive data are presented in Table 1. Most participants who were Extremely concerned about the impact of COVID-19 on their physical health had Fair perceived mental health (8% [108/1324]). Meanwhile, most participants who were Not at all concerned were 15 to 29 year olds (52% [664/1324]) and had Very good perceived mental health (22% [284/1324]).

Table 1. Descriptive characteristics of Ontarians (N=1324) during the first-wave of the COVID-19 pandemic (April to May 2020)

Variable	Extremely (n = 383)	Not at all (n = 891)	p-value
Age group, years			<.001*
15 to 29	203 (16)	664 (52)	
≥65	180 (14)	227 (18)	
Gender			<.001*
Male	93(7)	318 (24)	
Female	305 (23)	609 (46)	

Perceived mental health			<.001*
Excellent	34 (3)	176 (13)	
Very good	75 (6)	284 (22)	
Good	104 (7)	266 (20)	
Fair	108 (8)	162 (12)	
Poor	62 (5)	53 (4)	

Note: Data are presented as the number (%) of individuals unless otherwise noted. *P < 0.05 considered significant.

The percentage of 15 to 29-year-olds who reported Very good, Good, and Fair perceived mental health was less in individuals who were Extremely Concerned about their physical health compared to those who were Not at all concerned (control group). Chi-square analyses revealed that there was a between-group difference in individuals who reported Very good, Good, Fair and Poor perceived mental health (Table 2).

Table 2. Perception of mental health reported by 15 to 29 year old Ontarians in either exposure or control group.

	Extremely (n = 159)	Not at all (n = 663)	p-value
Perceived mental health			
Excellent	11 (2)	61 (7)	0.090
Very good	21 (3)	167 (20)	< 0.001*
Good	49 (5)	221 (25)	0.008*
Fair	70 (8)	159 (18)	0.002*
Poor	53 (6)	55 (6)	< 0.001*

Note: Data are presented as the number (%) of individuals unless otherwise noted. *P < 0.05 considered significant.

The bar graph in Figure 1 illustrates the percentage of participants aged 15 to 29 and ≥65 in each perceived mental health category. The percentage of participants who reported Poor, Fair and Good perceived mental health was greater in participants 15 to 29 years old than those who were ≥65. There was also a greater percentage of participants ≥65 years old who reported Very good and Excellent perceived mental health compared to those who were 15 to 29 years old. There were significant differences between all the proportions, with p-values < 0.05.

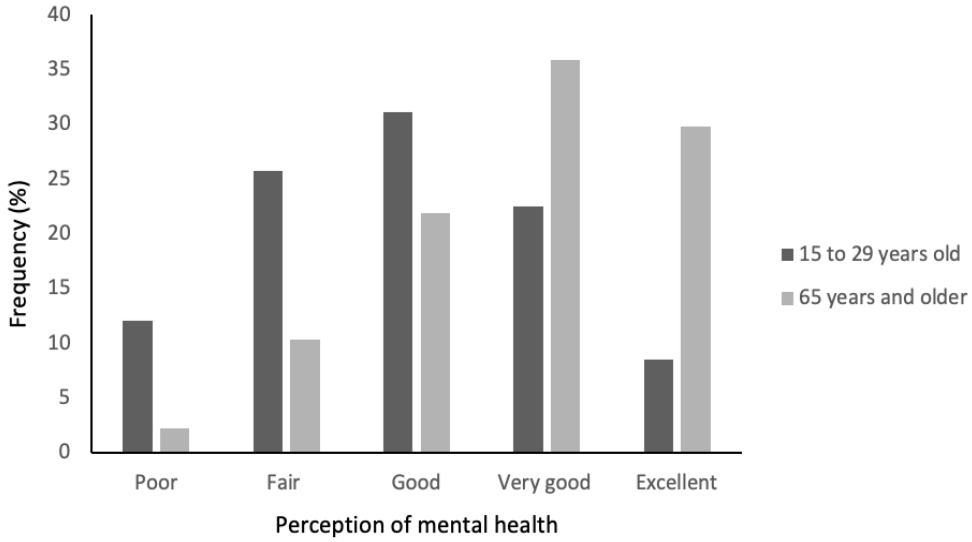

Figure 1. Perception of Mental Health Between Age Groups.

The bar graph in Figure 2 illustrates the percentage of participants aged 15 to 29 and ≥65 in each impact of COVID-19 level. There was a greater percentage of 15 to 29 year olds who reported Major impact, Moderate impact, and Minor impact levels of COVID-19 compared to adults 65 years and older. Meanwhile, 70% of adults ≥ 65 reported No impact compared to 48% of 15 to 29 year olds.

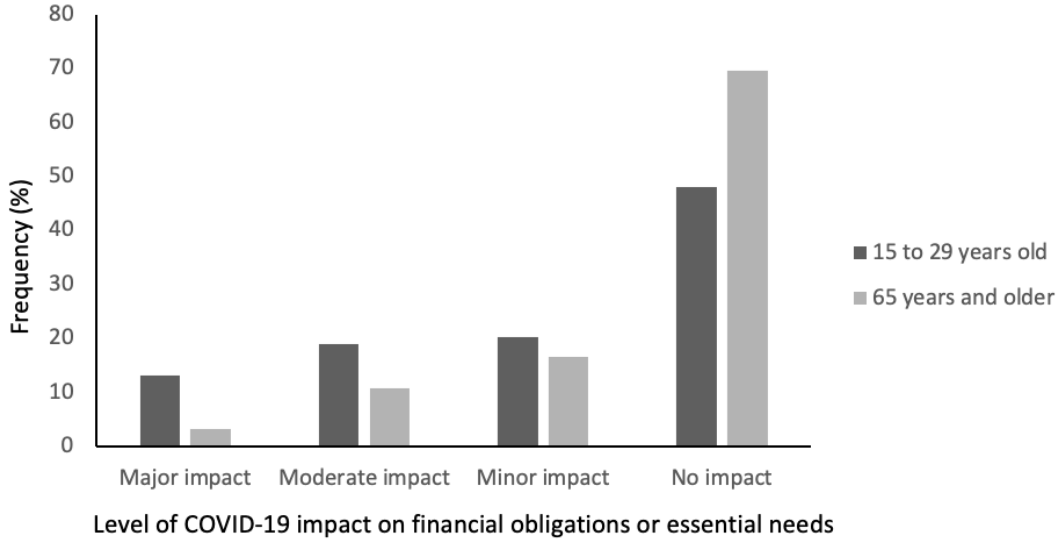

Figure 2. COVID-19 Impact On Financial Obligations or Essential Needs Between Age Groups.

DISCUSSION

This study demonstrated that during the initial stages of the COVID-19 pandemic, young adults were more likely to report poor mental health if they were concerned about the impact of COVID-19 on their own physical health (Table 2). The older population reported significantly better mental health perception compared to younger age groups (Figure 1), and had less of an impact on their financial burden due to COVID-19 (Figure 2). Young adults experienced greater financial concerns in comparison to older adults, however, we found that the relationship between the two is weak.

Previous research by Findlay et al. in 2020 similarly examined the self-perceived mental health of Canadians in relation to quarantine, with an earlier data collection period, from March 29 to April 3rd 2020, which received a lower rate of responses as specific individuals were invited to participate in their survey (Findlay et al., 2020). The 4,627 total responses from those older than 15 living in any of the 10 provinces reported Excellent, Very good, Good, Fair or Poor mental health and levels of concern regarding various socioeconomic and health situations while in periods of quarantine (Findlay et al., 2020). Results found that 54% of individuals reported Excellent or Very good mental health (Findlay et al., 2020). All age groups of participants except those over the age of 65 years reported lower perceived mental health compared to the control group of participants from the 2018 Canadian Community Health Survey (Findlay et al., 2020). Young adults and adolescents were less likely to report lower levels of family stress, ability to maintain social ties and showed increased concern about their own health. This data is reflective of earlier stages of quarantine in comparison to our study which had a later data collection period of late-April to early May. Both Findlay et al.'s results and our study suggest that the overall mental health of Canadians decreased during the COVID-19 pandemic, with the exception of adults over the age of 65. Unlike previous research, our research also accounted for differences in perceived mental health between age groups, as well as financial burden, insecurity and fear caused by the later stages of quarantine. Furthermore, we addressed the knowledge gap on the implications of the COVID-19 pandemic on the mental health of young working populations that include high-school students, specifically Ontarians.

There are several limitations in our study and database to be noted. The first being the vagueness of categories in the questions asked to participants. The categories Excellent, Very good, Good, Fair, and Poor as indicators of perceived mental health are subjective to an individual's interpretation of these levels as well as how they differentiate between them. It would be in future studies best interest to improve upon categories of perceived mental health by establishing more detailed objective measures when self-reporting. Secondly, approximately half of the participants in the database hailed from Ontario, which had different social distancing protocols in place than other provinces, thus limiting the applicability of these findings to reflect the entire Canadian population. Thirdly, there are regional differences between provinces and within Ontario jurisdictions in terms of the social distancing parameters in place during the study period. The limited period of data collection fails to account for the mental health impacts from extended and inconsistent lockdowns, and changes in social distancing measures. How the study participants endured or followed these regulations may have uniquely impacted these individuals' perceived mental health. Finally, the data collection period was short, done during the initial stages of the early evolving pandemic in an 18 day period which is

not indicative of the pandemic which has spanned over a year. This limits the ability to make any conclusions about the long-term implications that the pandemic has had on mental health.

The high impact of COVID-19 on the financial stability and poor mental health of the workforce was more prevalent in younger populations than other age groups in Ontario. This can be attributed to food insecurity and inability to fulfil essential needs in those dependent on jobs for financial support, whereas the older population may be primarily retired, receiving financial aid, and experiencing little-to-no financial concerns during the pandemic. Young adults have experienced a number of pandemic-related consequences, such as closures of universities and loss of income, that may contribute to poor mental health. As reported in existing literature, a recent study by Panchal et al., (2020) found that prior economic downturns show that job loss is associated with increased levels of depression, anxiety, and low self-esteem which may lead to higher rates of substance abuse and suicide. During the pandemic, adults in households with job loss or lower incomes reported higher rates of mental illness than those without (Panchal et al., 2020). The social distancing and lockdown measures have deprived young adults of their daily school structure and access to social groups. A study published by the Centers for Disease Control and Prevention showed that young adults were hit the hardest by loneliness during the pandemic (Czeisler, 2020). Young people are also often making critical decisions about their professional and personal lives and relationships, which can add to the stress and sense of isolation. The difference in mental health between the two age groups could be due to the financial support given to seniors. This includes being eligible for the Canada Emergency Response Benefit (CERB) and the extension of Guaranteed Income Supplement (GIS) and allowance payments. They are also prioritized to receive the COVID-19 vaccine, thus reducing their stress of contracting the disease. The majority of seniors reside in long-term care homes, which provides them with social support from their community, unlike younger populations experiencing quarantine in isolation from their social circles.

Future directions include extending the survey to a longer period of time, to account for the effects of changing social distancing measures and produce results that more accurately reflect the mental health impacts of different interventions during the pandemic. Additionally, examining other variables in the study such as the Increase in domestic violence, Household income and Level of home security during the pandemic would provide further insight into factors contributing to decreased mental health in the general population. Exploring implications of extended periods of time spent in the home could provide insight into the significance of our findings on poorer reported perceived mental health. Furthermore, it is possible that COVID-19 is both magnifying and contributing to the increased rates of poor mental health reported by young adults aged 15 to 29. Moreover, it would be informative to perform a longitudinal study by re-launching the survey. This would account for changes due to varying lockdown measures, and the newly launched financial benefit for individuals of this age group. This would provide important information to healthcare workers to identify individuals who may need mental health support in different lockdown measures. Finally, the pandemic has caused stress and mental health impacts for all people, but vulnerable populations including minorities, the mentally ill and the immunocompromised may have experienced more pronounced effects, due to unmet and unanticipated needs, which was not taken into account for this survey, nor specified in the database. Accounting for vulnerable populations in future data collection surrounding mental health impacts of

COVID-19 can provide insight into the fundamental reasons for variability in perceived mental health among citizens. This would assist healthcare workers in developing evidence-informed, standardized resources for different demographics, and tailor the support systems and resources to the needs of groups impacted in different ways by COVID-19.

REFERENCES

Czeisler, M. É., Lane, R. I., Petrosky, E., Wiley, J. F., Christensen, A., Njai, R., ... & Rajaratnam, S. M. (2020). Mental health, substance use, and suicidal ideation during the COVID-19 pandemic—United States, June 24–30, 2020. Centers for Disease Control and Prevention, 69(32). doi:10.15585/mmwr.mm6932a1

Chanchlani, N., Buchanan, F., & Gill, P. J. (2020). Addressing the indirect effects of COVID-19 on the health of children and young people. Canadian Medical Association Journal, 192(32). doi:10.1503/cmaj.201008

Chong, T., Curran, E., Ames, D., Lautenschlager, N. T., & Castle, D. J. (2020). Mental health of older adults during the COVID-19 pandemic: lessons from history to guide our future. International psychogeriatrics, 32(10), 1249–1250. https://doi.org/10.1017/S1041610220001003

Daly, Z., Slemon, A., Richardson, C. G., Salway, T., McAuliffe, C., Gadermann, A. M., Thomson, K. C., Hirani, S., & Jenkins, E. K. (2021). Associations between periods of COVID-19 quarantine and mental health in Canada. Psychiatry research, 295, 113631. https://doi.org/10.1016/j.psychres.2020.113631

Dougherty, B. P., Smith, B. A., Carson, C. A., & Ogden, N. H. (2021). Exploring the percentage of COVID-19 cases reported in the community in Canada and associated case fatality ratios. Infectious Disease Modelling, 6, 123-132. doi:10.1016/j.idm.2020.11.008

Findlay, L., Arim, R., & Kohen, D. (2020). Understanding the perceived mental health of Canadians during the COVID-19 pandemic. Statistics Canada. https://www.doi.org/10.25318/82-003-x202000400003-eng

Government of Ontario. COVID-10: Context: provincewide shutdown. Ministry of Health. https://www.ontario.ca/page/enhancing-public-health-and-workplace-safety-measures-provincewide-shutdown#section-5

Panchal, N., Kamal, R., Orgera, K., Cox, C., Garfield, R., Hamel, L., & Chidambaram, P. (2020). The implications of COVID-19 for mental health and substance use. Kaiser family foundation.

Power, E., Hughes, S., Cotter, D., & Cannon, M. (2020). Youth mental health in the time of COVID-19. Irish journal of psychological medicine, 37(4), 301–305. https://doi.org/10.1017/ipm.2020.84

Statistics Canada. (2021). Impacts of COVID-19 on Canadians- Mental Health, 2020: Crowdsource file (ICC-13-25-00022020001-E-2020-Version2) [Data set]. Retrieved from http://odesi2.scholarsportal.info.libaccess.lib.mcmaster.ca/webview/

Sultana, A., Tasnim, S., Bhattacharya, S., Hossain, M. M., & Purohit, N. (2020). Digital screen time during COVID-19 pandemic: A public health concern. doi:10.31235/osf.io/e8sg7

Vahia IV, Jeste DV, Reynolds CF. Older Adults and the Mental Health Effects of COVID-19. JAMA. 2020;324(22):2253–2254. doi:10.1001/jama.2020.21753

Varma, P., Junge, M., Meaklim, H., & Jackson, M. L. (2020). Younger people are more vulnerable to stress, anxiety and depression during COVID-19 pandemic: A global cross-sectional survey. Progress in neuro-psychopharmacology & biological psychiatry, 109, 110236. Advance online publication. https://doi.org/10.1016/j.pnpbp.2020.110236

Violant-Holz, V., Gallego-Jiménez, M. G., González-González, C. S., Muñoz-Violant, S., Rodríguez, M. J., Sansano-Nadal, O., & Guerra-Balic, M. (2020). Psychological Health and Physical Activity Levels during the COVID-19 Pandemic: A Systematic Review. International journal of environmental research and public health, 17(24), 9419. https://doi.org/10.3390/ijerph17249419

World Health Organization. (2020). Disease outbreak news: Novel coronavirus - China. Retrieved from: https://www.who.int/csr/don/12-january-2020-novel-coronavirus-china/en/

Xiong, J., Lipsitz, O., Nasri, F., Lui, L., Gill, H., Phan, L., Chen-Li, D., Iacobucci, M., Ho, R., Majeed, A., & McIntyre, R. S. (2020). Impact of COVID-19 pandemic on mental health in the general population: A systematic review. Journal of affective disorders, 277, 55–64. https://doi.org/10.1016/j.jad.2020.08.001

A Weak Relationship Between Education and Cigarette Consumption Behaviours Among Canadian Females: A Cross-Sectional Study

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INTRODUCTION

In Canada, the prevalence of cigarette smoking in adults is 3.3 million - with 2.5 million adults smoking cigarettes daily (Canadian Tobacco and Nicotine Survey [CTNS], 2020). By analyzing the literature regarding cigarette smoking consumption and cessation, it has become evident that an individual's education level represents a unique health opportunity to reduce cigarette consumption (Zhuang et. al, 2015).

Wetter et al. (2005) conducted research that considers education as one of the strongest sociodemographic predictors for smoking behaviours. The study found that smokers with a high school diploma were 10.8% more likely to quit smoking compared to individuals with a high school education or less (Wetter et al., 2005). This study suggests that higher education levels can contribute to increased smoking cessation. The figure presented below is created by Wetter et al. (2005) and shows that as education level increased, the smoking abstinence levels also increased - meaning smoking consumption lowered.

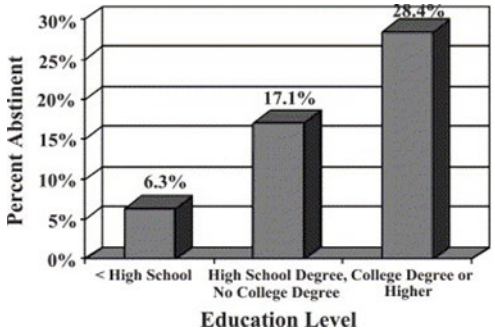

Figure 1. Smoking abstinence rates at the 4-year follow-up by baseline level of education (Wetter et al., 2005).

Gupta (2006) conducted a study looking to determine if educational background plays a significant role in tobacco consumption in developing countries. The study found that there was an inverse relationship between academic status and tobacco consumption. Specifically, smoking percentages of illiterate women were 25%, women with 1-10 years of formal education were 23%, while more than ten years were 2% (Gupta, 2006). The study concluded that improving the level of education impacted an individual's smoking behaviour.

Another study conducted by Walque (2007) also tried to determine the correlation between education and smoking behaviours in current smokers. This study indicates that individuals with a higher education level are less likely to smoke and more likely to quit. This is seen as only 26.2% of male smokers who were high school dropouts stopped smoking, compared to 57.6% of college graduates

that ceased smoking (Walque, 2007). This study continues to suggest that higher education levels are associated with increased smoking cessation.

Additionally, the Centers for Disease Control and Prevention (CDC) (2014) conducted a study to examine the correlation between cigarette smoking levels and education levels. The study found that 26% of current smokers had a high school diploma or less, compared to 19.7% of current smokers who attended some post-secondary education, and 7.9% with a bachelor's degree or higher (CDC Data, 2014). This study highlights that as the education level increases, smoking behaviours decrease.

Lastly, Tseng et al. (2004) conducted research that looks at the area-level characteristics and smoking behaviour in women. Tseng et al. found that continued smoking consumption was associated with women living in low education areas, high unemployment, and high crime rates (2004). This evidence is consistent with other studies that suggest that socioeconomic disadvantages (i.e. low education levels, high crime rates, and high unemployment rates) will influence individuals' smoking behaviours (Tseng et al., 2004). This research builds on the idea that education level impacts smoking behaviours, in addition to the importance of other socioeconomic factors.

Khuder et al. (1999) analyzed the relationship between smoking cessation and the age of when an individual starts smoking. The results show that 66% of the study population (consisting of 1700 males aged 35 years or older) started smoking before the age of 18. The odds of quitting smoking for those who started before 18 was 2.1, compared to men who began smoking before 13, whose odds were 1.6 (Khuder et al., 1999). This study displays that the younger the individuals start smoking, the less likely cessation occurs and continues into adulthood.

Various studies investigate the correlation between education level and smoking behaviours. These studies have consistently found that education is a predictor of cigarette smoking behaviours. Despite this, the research in these studies uses education level as a sub variable while assessing other sociodemographic factors. Thus, education is not used as the sole independent variable. There are several studies that discuss the association between age and cigarette consumption, but these studies primarily focus on the age at which individuals first start smoking in relation to their current smoking behaviours. Therefore, this study looks to examine how smoking behaviours can affect prolonged consumption habits in female adults who are current smokers. Moreover, a majority of the literature available is conducted outside of Canada, hence creating a knowledge gap and offering an opportunity for further investigation.

In this study, we aim to explore the patterns and associations across Canada with equal representations of provinces. By looking at data from Canadians, this will help provide insight into cigarette smoking behaviours across the country. This research investigates the association between educational level and the number of cigarettes smoked in women aged 24-55 in Canada compared to women of the same age with a high school diploma or lower education level. A secondary aspect of the research is to assess a relationship between age and cigarette consumption in women of the same age range.

MATERIALS AND METHODS

Study Design and Database

This cross-sectional and observational study design used information from the Canadian Tobacco, Alcohol and Drugs Survey, 2017 (CTADS). This dataset is from the website Odesi, a data portal that contains over 5500 datasets (Odesi, 2007). From Odesi, CTADS is described as a general population survey of tobacco, alcohol, and drug use among Canadians aged 15 and older, which was collected via structured questionnaires on Health Canada's behalf (Statistics Canada, 2017). This database involves the merging of content from the Canadian Tobacco Use Monitoring Survey and the Canadian Alcohol and Drug Use Monitoring Survey (Statistics Canada, 2017). This allows for more efficient data collection, making this database a vital tool for monitoring and comparing the use of substances with addictive properties (Statistics Canada, 2017). This dataset can be analyzed, assessed, and manipulated via SPSS software. This software allows for statistical analysis, machine learning algorithms, and interpretation of large data sets, among other applications (IBM, n.d.). SPSS is a leading software program that is user-friendly and widely used in academia (Frey, 2017).

Study Participants

This dataset contains information collected from 16,349 individuals. Considering that the study focuses on female smokers, specific inclusion criteria were used while selecting participants. We only included females from ages 24 to 55 in the study because, before 24 years of age, there may not be enough reliable information on one's education level. Keeping the ages between 24-55 allows for individuals who are within the working force and potentially participating in continuing education to be included. Likewise, individuals should have a cigarette consumption frequency of every day or occasionally, as well as answering "yes" to smoking in the past 30 days. These aspects will allow for a valid assessment of one's smoking behaviour as it ensures that they are current smokers with recent smoking activity. Moreover, participants were permitted to choose not to state their answer to a question, skip the question, or refuse to answer a question. When considering these options and any missing data in the dataset, females in the indicated age group who did not specify their education level, smoking status, smoking frequency, or how many cigarettes they smoked in a week, were excluded from the study. Answers for the education level were further divided into high school level and below, and trades certifications and above.

Study Outcomes

This study has the same primary and secondary outcome for the analyses: the total number of cigarettes smoked in a week. This is the dependent variable when assessing all relationships. We used the variable indicating the total number of cigarettes smoked in a week to get both outcomes. This variable is continuous and involves collecting data over seven consecutive days. Also, the analysis needed sex, age, and the variable identifying education level to achieve an accurate outcome of smoking behaviour in females ages 24-55. These are integral portions of the inclusion criteria as we only observed smoking behaviour in these specific individuals.

When assessing age, the specific question "For statistical purposes only, may we confirm your age, as of today?" was used to allow for further analysis opportunities with continuous variables. Denoting the

exact questioning for age allows this study to be easily reproducible. Lastly, the variable assessing education was categorical, with the question being "What is the highest certificate, diploma, or degree that you have completed?". As stated above, with age, the database provides the specific wording and options provided for educational background inquiries, showing high reproducibility.

Overall, this data collection is considered self-reported data as it involves a person speaking about themselves via questionnaires or surveys. This has a high validity as the variables measure what they intend to measure with distinct answer options and the ability to refuse to answer. Patrick et al. (1994) saw self-reported smoking data to be accurate across multiple studies. With these variables used and the simplicity in the wording and answer options, it allowed for proper analysis of the data.

Additional Data Collection

Although no covariates were used, this study utilizes other variables to understand relationships further. We used variables regarding smoking behaviour to understand the characteristics of the study participants. Participants were assigned as current smokers, former smokers, or never smoked. In addition, the question "At the present time, do you smoke cigarettes every day, occasionally, or not at all?" had categorical options of every day, occasionally, not at all, or a valid skip. Lastly, this study asked, "In the past 30 days, did you smoke any cigarettes?" with answers being yes or no, therefore also being categorical. These variables were selected to further solidify the smoking behaviour of the participants.

Statistical Analysis

Normality testing on continuous data was used to assess data distribution as it affects the types of tests later performed. After this, we performed chi-squared tests to identify a significant difference between education level and smoked cigarettes in a week. Total cigarettes smoked were binned into more than 70 a week or less than 70 a week. After this, we performed spearman rho correlation analysis to assess any associations between education level and cigarettes smoked and associations between age and cigarettes smoked. The P-value was 0.05, and all statistical tests were performed on SPSS software. Overall, these analyses fit our research question as we are assessing relationships and associations between variables.

RESULTS

Our study focused on the association between education level and the number of cigarettes smoked in women aged 24-55, in addition to relationships between age and total cigarettes smoked. The participants we included are females ages 24-55 who are current smokers, smoked every day or occasionally, and have smoked in the past month. Due to the inclusion and exclusion criteria, this resulted in a sample of 337 participants, while deleting 10 individuals with missing data. As seen in Table I, the sample population's descriptive characteristics are displayed. This provides information about the distribution of participants throughout Canada, as well as a further emphasis on participants' smoking behaviours.

Table I. Descriptive characteristics of the study population [n=337]. Participants were divided by education level.

Variable	High School or Less [N=125]	Trades Certification and Above [N=212]
Age (Years)	46(12.5)	43(15.0)
Total Number of Cigarettes Smoked per week	70(67.5)	63(68.0)
Average Number Cigarettes smoked per day	10 (10.0)	9(8.0)
Frequency Smoking Presently *(%)*		
Every day	84.8	73.11
Occasionally	12.8	22.17
Not at all	2.5	4.72
Province of Selected Respondent *(%)*		
Newfoundland and Labrador	9.6	11.3
Prince Edward Island	4.0	6.6
Nova Scotia	10.4	9.4
New Brunswick	17.6	9.9
Quebec	8.8	16.0
Ontario	12.8	22.6
Manitoba	9.6	5.1
Saskatchewan	10.4	4.24
Alberta	10.4	8.0
British Columbia	6.4	6.6
Missing	0.008	0.005

Values are reported in Median (IQR) unless stated otherwise (i.e. frequency (%) or number (n)).

Next, to analyze the data and effectively answer the research question, we first checked for normality using the Shapiro-Wilk test and determined that the value was less than 0.001 for total cigarettes smoked and age. Due to the data not being normal, median and interquartile range were used as opposed to mean and standard deviation. Additionally, a chi-squared test was performed to determine the between-group difference for the primary research analysis for education level and the total number of cigarettes smoked per week. The continuity correction value was 6.294 and was used to determine the asymptotic significance value of 0.012. The continuity correction value compensates for overestimating the difference between groups when running a chi-squared test, which determines the significance value. Since this value was less than 0.05 (p=0.012), this implied that there was a statistically significant difference between the education level and the number of cigarettes smoked per week. A spearman rho test was then conducted to determine whether there was a correlation between education level and the total number of cigarettes smoked. Table II

portrayed a weak negative association between education level and the total number of cigarettes smoked since the correlation coefficient is -0.171. The correlation is significant at the 0.01 level (2 sided).

Table II. Spearman rho analysis to determine correlations between education level and the total number of cigarettes smoked per week.

		Education level	Total number of cigarettes smoked per week (Binned)
Education level	Correlation Coefficient	1.000	-.171**
	Sig. (2-tailed)	.	0.002
Total number of cigarettes smoked per week	Correlation Coefficient	-.171**	1.000
	Sig. (2-tailed)	0.001	.

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

When exploring the secondary research question, a spearman rho analysis was used again to determine whether there is a correlation between age and the total number of cigarettes smoked per week. As seen in Table III, the analysis portrayed a weak, positive association between age and the total number of cigarettes smoked per week, as the correlation coefficient is 0.180. This correlation is also statistically significant at the 0.01 level (2 sided).

Table III. Spearman rho analysis to determine correlations between age and the total number of cigarettes smoked per week.

		Total number of cigarettes smoked per week	Age of respondent
Total number of cigarettes smoked per week	Correlation Coefficient	1.000	.180**
	Significance (2-tailed)	.	<0.001
Age of respondent	Correlation Coefficient	.180**	1.000
	Significance (2-tailed)	<0.001	.

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

Moreover, scatter plots were created to allow for a visual representation of the data to better assess the relationship between age and the number of cigarettes smoked per week. As seen in Figure 1, scatter plots were made between age and cigarettes smoked, while also accounting for education level. Figure 1A shows women with a high school education or less, while Figure 1B shows women with a trades certificate or higher.

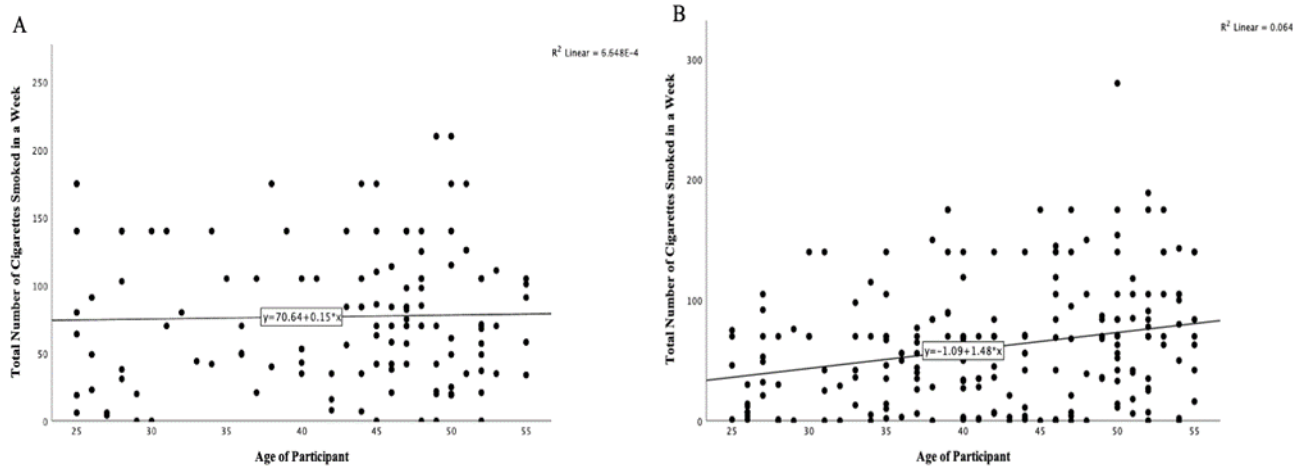

Figure 1. Assessing the relationship between age and cigarette smoking behaviour in a week.
A- Scatter plot depicting the relationship between age and the total number of cigarettes smoked per week in participants with an education level of high school or less. **B-** Scatter plot portraying the relationship between age and the total number of cigarettes smoked per week in women with an education level of a trades certificate or above. Both scatter plots indicate the line of best fit.

DISCUSSION

Summary of the Findings

This study found an association between education level and cigarette consumption behaviours. In higher education groups, cigarette consumption behaviours slightly decreased. On the contrary, for the secondary research question, which assessed the relationship between age and cigarette consumption, it was found that as age increased, there was also a slight increase in cigarette consumption behaviours.

Analysis of the Main Findings

After grouping the education variable into either "High School or Less" or "Trades Certification or Above," a Shapiro Wilk normality test was conducted to determine if the variables “Age” and “Total Number of Cigarettes Smoked Per Week” were normally distributed. The analysis found these variables to have Shapiro Wilk significance values of less than 0.001, which indicates that the data was not normally distributed. Given that the data was not normally distributed, a Spearman-Rho test was used to measure the strength of the association between the two variables: education level and the total number of cigarettes smoked per week. The Spearman-Rho analysis outlined a weak negative

correlation between the two variables; the analysis was significant at the 0.01 level, indicating a statistically significant association between the variables. Along with these analyses, a Chi-Square test was conducted to test the between-group difference between education level and the total number of cigarettes smoked per week. The Chi-Square test showed a significance value of 0.012; this is sufficient evidence to suggest that a relationship exists between education level and cigarette smoking consumption.

For the secondary research question, we also used a Spearman-Rho analysis to measure the correlation between age and smoking behaviour. The results indicate a weak positive correlation (rho = 0.180), and the correlation was statistically significant at the 0.01 level (2 tailed). This significance suggests that a statistically significant association exists between the two variables. After generating scatter plots, we can determine that these plots validate the Spearman Rho correlation results as they display a weak, positive correlation between the variables. As seen in Figure 1, the scatter plots show that women with a high school education or lower, had consistent smoking behaviours as they aged. However, for women with a trades certification or higher, their cigarette smoking behaviours slightly increased as they aged.

Comparison of Findings to Other Studies

Literature from peer-reviewed articles show both similar and contradicting findings as to the ones presented in this study. A study conducted by Wetter et al. examines the relationship between education and smoking cessation in Americans over a four-year test period (2005). The researchers found a strong positive relationship between education level and smoking cessation behaviour in which as education levels increased, smoking cessation behaviour also increased. These results relate to the spearman rho analysis findings in which a weak negative correlation between education and cigarette consumption was found. The study conducted by Wetter et al. is essential to our study, as it can give insights into trends across North America, including Canada. The study's findings are most in line with this paper's research direction and, therefore, provide sufficient evidence to support this study's results.

Similarly, Li et al. found that middle-aged people had a greater nicotine dependence (2015). The study used the Fagerström Test for Nicotine Dependence (FTND) to find that FTND scores in middle-aged people between 45–64 years of age are higher than those in the younger and older groups (Li et al., 2015). The results of Li et al. resemble this study's findings as there was a small peak in Figure 1A and 1B at the 45-55 age range where a weak negative correlation between education and cigarette consumption was found in both education groups.

Chen and Millar explored the relationship between initial smoking age and the probability of quitting (1998). The study took place in Canada with a study population consisting of 3449 participants who were current smokers. The study found that individuals who started smoking at 20 were 24% more likely to quit smoking than individuals who began smoking at 14. (Chen & Miller, 1998). The findings contradict this study's secondary research aspect examining age and cigarette consumption. We found that as age increased, cigarette consumption behaviours also slightly increased. Chen & Miller present that as age increased, smoking behaviours decreased somewhat (1998). It is essential to mention this contradiction, as Chen and Miller conducted their study in Canada, which provides insight

into trends and behaviours in similar populations. However, our study uses data from 2017 as compared to that of Chen and Miller from 1998, which may explain the discrepancies in smoking behaviours.

Limitations

Although this research noted significant differences between groups, some limitations can affect the results and implications of the findings. The CTADS collected the data via a public survey, which allows for a possibility of self-reporting bias. Bias is a common limitation of self-reported data, meaning that participants could have given biased responses to prevent judgment and to conform to social norms. In terms of the analysis that we conducted, the primary independent variable examined was the participants' education level. However, there could have been various other confounding variables that could have altered the results. A study conducted by Harakeh et al. found that parent-child relationships and parental smoking habits had indirect and direct effects on an individual's smoking habits (2004). Other confounding variables could include occupation level, history of family addiction, socioeconomic factors, and geographic location, among others. These factors can affect smoking behaviour and subsequently affect the conclusions that can be drawn solely from our study. Another limitation to this study is that it has a cross-sectional design rather than longitudinal. Having a cross-sectional design means that we cannot conclude the long-term relationship between age and cigarette consumption. This is because we cannot follow the same participants as they age to determine if there is a true association, or if it is due to other factors. Other factors in an individual's life can influence smoking behaviour, as seen in the studies mentioned above. It is essential to note that most available studies only examine an American or international population while this study solely focuses on the Canadian population. Thus, this study allows for a better understanding of the relationship between education and age on female Canadians' cigarette consumption behaviours.

Implications and Future Directions

Though this research has some limitations, the findings do allow for specific implications to be made. This study conducted a novel analysis of the data as it primarily focused on education level as the main independent variable on total weekly cigarette consumption. This differs from most other studies as they typically consider education as being a subgroup of a larger variable. Smoking consumption is a public health concern due to its addictive properties and health effects. This research further highlights the need for better smoking education at the high school level or less, given that it could have played a role as to why those with higher education were smoking less frequently. Most available studies also only examine an American or international population while this study solely focuses on the Canadian population. Thus, this study allows for a better understanding of the relationship between education and age on Canadian cigarette consumption behaviours.

Considering the limitations present in this study, further research should analyze the association of the confounding variables mentioned earlier and their relationship with cigarette consumption in Canada. Based on this study's findings, other analyses can be conducted to further examine the relationship between education and age. A comparison can also be made by looking at men of the same demographic and comparing their total weekly cigarette consumption to women of the same

education levels in Canada. Covariate relationships can also be assessed using ANCOVA analysis in which we can consider factors such as the types of cigarettes smoked by participants.

REFERENCES

CDC Data (2014). Oncology Times, 36(12), 63. doi:10.1097/01.cot.0000451745.43195.e5

Chen, J., & Millar, W. J. (1998). Age of smoking initiation: implications for quitting. Health reports-statistics Canada, 9, 39-48.

IBM. (n.d.). IBM SPSS software. Retrieved April 8, 2021, from https://www.ibm.com/analytics/spss-statistics-software

Frey, F. (2017). SPSS (software). The International Encyclopedia of Communication Research Methods. https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118901731.iecrm0237

Gupta, R. (2006). Smoking, educational status & health inequity in India. Indian J Med Res, 124, 15-22. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.493.8687&rep=rep1&type=pdf

Harakeh, Z., Scholte, R., Vermulst, A., De Vries, H., & Engels, R. (2004). Parental factors and adolescents smoking behavior: An extension of The theory of planned behavior. Preventive Medicine, 39(5), 951-961. doi:10.1016/j.ypmed.2004.03.036

Khuder, S. A., Dayal, H. H., & Mutgi, A. B. (1999). Age at smoking onset and its effect on smoking cessation. Addictive Behaviors, 24(5), 673-677. doi:10.1016/s0306-4603(98)00113-0

Li, H., Zhou, Y., Li, S., Wang, Q., Pan, L., Yang, X., Zhang, N., Jiang, F., Han, M., & Jia, C. (2015). The Relationship between Nicotine Dependence and Age among Current Smokers. Iranian journal of public health, 44(4), 495–500. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4441962/

<Odesi<. (2007). About <odesi>. Retrieved April 8, 2021, from https://search2.odesi.ca/#/about

Patrick, D. L., Cheadle, A., Thompson, D. C., Diehr, P., Koepsell, T., & Kinne, S. (1994). The validity of self-reported smoking: a review and meta-analysis. American journal of public health, 84(7), 1086–1093. https://doi.org/10.2105/ajph.84.7.1086

Sabol, S. Z., Nelson, M. L., Fisher, C., Gunzerath, L., Brody, C. L., Hu, S., Sirota, L. A., Marcus, S. E., Greenberg, B. D., Lucas, F. R. IV, Benjamin, J., Murphy, D. L., & Hamer, D. H. (1999). A genetic association for cigarette smoking behavior. Health Psychology, 18(1), 7–13. https://doi.org/10.1037/0278-6133.18.1.7

Statistics Canada. (2017). Canadian tobacco, alcohol and drugs Survey, 2017: person file. [Data set]. https://www.canada.ca/en/health-canada/services/canadian-tobacco-alcohol-drugs-survey/2017-summary.html

Tseng, M., Yeatts, K., Millikan, R., & Newman, B. (2004). Area-Level Characteristics and Smoking in Women. American Journal of Public Health, 94(11). doi:10.2105/ajph.94.11.1847

Walque, D. D. (2007). Does education affect smoking behaviors?: Evidence using the Vietnam draft as an instrument for college education. Journal of Health Economics, 26(5), 877-895. https://doi.org/10.1016/j.jhealeco.2006.12.005

Wetter, D. W., Cofta-Gunn, L., Irvin, J. E., Fouladi, R. T., Wright, K., Daza, P., Mazas, C., Cinciripini, P.M., & Gritz, E. R. (2005). What accounts for the association of education and smoking cessation? Preventive Medicine, 40(4). https://doi.org/10.1016/j.ypmed.2004.07.00

Zhuang, Y., Gamst, A. C., Cummins, S. E., Wolfson, T., & Zhu, S. (2015). Comparison of Smoking Cessation Between Education Groups: Findings From 2 US National Surveys Over 2 Decades. American Journal of Public Health, 105(2), 373-379. doi:10.2105/ajph.2014.302222

The Positive Relationship Between Fruit Intake and Girls' Self-Esteem: A Cross-Sectional Study

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INTRODUCTION

According to the 1992 Canada's Food Guide, children and adolescents are recommended to consume at least five servings of fruits and vegetables per day (Health Canada, 2002). These recommendations were set in the hopes of preparing children with a more balanced diet which includes more whole grain products, more vitamin-rich fruits and vegetables, and less fat. In addition, society has started to realize the importance of early psychological development. A review by Heather Membride (2016) found that approximately ten percent of Western children suffer from a mental illness so significant that it impacts their daily ability to function. This percentage rises to 23% in middle-to-late adolescence of the Western population (Membride, 2016). 50% of adults diagnosed with a chronic mental health disorder report they experienced symptoms before the age of 15 (Membride, 2016). The correlation between childhood mental illnesses and chronic mental illnesses is unfortunately clear but may be improved with the help of dietary intake (Dimov et al., 2021). For instance, the importance of diet is not limited to its impact on the physical wellbeing of children; it can also benefit their mental health (Dimov et al., 2021). A study by Stefanie Dimov and colleagues (2021) found a significant correlation between the diets of children aged 9 to 11, and their probability of showing symptoms of mental health problems. They evaluated approximately 1000 children, and even after adjusting for confounding factors, they found children with healthier diets had reduced risk of mental health issues later into adolescence (Dimov et al., 2021). A lowered sense of self-esteem is one way an individual's mental health can be impacted. This problem is especially prevalent in younger women who, on average, have a lower sense of self-esteem than men of the same age and social status (McMullin & Cairney, 2004). The impact of self-esteem has been found to start early on in childhood and can be linked to body perception (Paxton et al., 1990). A 1990 study by Paxton and colleagues found 27% of girls with a healthy body mass index (BMI) classified themselves as overweight or very overweight. 47% of girls attempted an extreme dieting measure, with 13% of them making weekly use of these extreme weight loss methods (Paxton et al., 1990). Diet and self-esteem are deeply linked, and to address one, the other must also be addressed.

Research shows overall intake of fruits plays a significant role in the mental state of individuals over an extended period of time, yet current research typically focuses on the impact of adult health (Brookie et al., 2018). As well, current research tends to focus on the broader perspective of mental health, relating to overall lifestyle changes. A study by Brookie et al. (2018) showed that adults who consumed raw fruits and vegetables had overall better mental health. Past studies that include children do not focus on mental health, let alone self-image (Glabska et al., 2020). Moreover, a systematic review conducted by Glabska et al. (2020) reviewed studies from PubMed and Web of Science databases until June 2019 that analyzed the influence of fruit and vegetable intake on mental health, where they found only 17 studies met these criteria. Overall, this systematic review concluded there is a positive association between fruit intake and mental health in adolescents. However, this study analyzed

overall mental health of individuals, and none of the variables assessed the effects of fruit intake on self-esteem specifically. With increasing depression amongst our youth, this knowledge gap must be filled to educate the public and raise more awareness for future studies. Therefore, we decided to research this topic, focusing on these factors that, to our knowledge, have yet to be investigated. Given the existing data, we want to answer the following question: how does the consumption of fruits more than daily compared to eating them rarely or not at all affect the self-confidence (primary), self-acceptance (secondary), and/or weight perception (tertiary) of females between the ages of 11 to 18?

MATERIALS AND METHODS

This study was a cross-sectional study designed to assess the effect of lifestyle choices, such as diet, on mental health. The dataset was obtained from Odesi, which is a data portal for researchers, teachers, and students. The data was collected from surveys conducted among school-aged children, which were carried out every four years since 1985. Cross-disciplinary groups of researchers in multiple countries conducted these surveys to increase the current knowledge and understanding of health behaviours, lifestyles, and their context within young people.

The final dataset was obtained by using specific criteria to narrow down the data to obtain more accurate results in reference to the research question. Due to the fact that we focused only on female participants, males were intentionally excluded from our sample dataset. The database was primarily focused on Canadian children between the ages of 11 and 18, therefore, the same age range was kept within our analysis. With this exclusion, we narrowed down the research question to specify if daily intake of fruits compared to inconsistent or no intake of fruits influenced the self-perception of female adolescents.

The research question focused on three main outcomes, the primary one being self-confidence, which included the statements “I have confidence in myself ‘yes' or ‘no’”, and “I think I look... ‘below average’ or ‘average and above’”. The purpose of including these variables was to determine how the daily intake of fruits affects the self-confidence of females within this age range. The secondary outcome focused on self-acceptance, which included statements such as “I like myself”, “I often wish I were someone else”, “I would change how I look if I could”, and “I would change something about my body if I could”. All four variables had the options of “yes” or “no” as responses. The third outcome revolved around the perception of weight which incorporated the statement, “I think my body is...”. To simplify the analyses, any answer that indicated an extreme response was combined into a single answer (thin or fat), with the following response options being: “about right” or “extreme, thin or fat”. We specifically chose these outcomes from the database because they best reflected the mental health of the individuals in terms of self-esteem, as discussed by McMullin & Cairney (2004).

We used the variables for age and sex to aid in the determination of demographics. The age variable represents how old the participants within the sample population were at the time of data collection. The sex variable allowed the division of data into female and male categories, and we used it to select the female participants. We chose to include the exercise variable due to of the close relationship between exercise and healthy eating habits. Finally, we included the on/off diet variable because of the potential relationship between dieting behaviours and fruit intake.

Table 1 outlines all the variables used in the analyses. It displays the frequencies and percentages of each categorical variable, and the median and range of the continuous variable. We displayed this in two columns, participants with daily fruit intake and participants with rare or no fruit intake. We determined the p-value of the continuous variable using a Mann-Whitney U Test, and for the categorical data, we determined the p-value using a Chi-Squared Test. For the research question, we used a Chi-Squared Test, and applied it to the outcome variables to determine their correlation to fruit intake. The p-value for significance in all cases was 0.05. We created Figure 1 to visually display the trends of the primary, secondary, and tertiary outcomes as they relate to the research question. We generated Figure 1 in Microsoft Excel using the frequencies and percentages of responses in each group. We also determined the p-values of significance for these variables using the Chi-Squared Test. The exclusion of the "don't know" and "don't think about it" options were due to their lack of relevance in answering the research question. All analyses were completed using the software IBM Statistical Package for the Social Sciences (SPSS) Software 27.

RESULTS

The initial population consisted of 11,272 participants and it was whittled down to a sample population of 5,794 containing only female participants. Looking at the exercise variable, the daily fruit intake group has a higher likelihood of reporting that they exercise more than once a week, while the rare or no fruit intake group is more likely to report exercising once a week or less (Table 1). Also, the latter group is five percent more likely to believe they need to lose weight but are not on a diet to do so (Table 1). Both these variables produced p-values of less than 0.001, indicating they are statistically significant.

Table 1: Descriptive Statistics

Variable	Options	Daily Fruit Intake (n = 4014)	Rare or No Fruit Intake (n = 1780)
Age (years)	N/A – *median (IQR)*	14 (3)	14 (2)
Sex	Female	4014 (100)	1780 (100)
Exercise	Never	221 (5)	167 (9)
	Less	261 (7)	212 (12)
	Once a month	327 (8)	228 (13)
	Once a week	838 (21)	371 (22)
	2-3 times a week	1160 (29)	437 (25)
	4-6 times a week	649 (16)	213 (12)
	Every day	545 (14)	145 (8)
On/Off Diet	No, weight is fine	2426 (61)	1029 (58)
	No, need to lose	1010 (25)	532 (30)
	Yes	561 (14)	215 (12)

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

The research question focused on three main outcomes. The primary outcome being self-confidence, the secondary being self-acceptance, and the tertiary being weight perception. The distribution of all negative responses for the variables that correspond to these outcomes are

presented in Figure 1. A negative response includes an answer with a negative connotation, such as having low self-confidence, low self-acceptance, or unfavourable interpretation of weight. As Figure 1 shows, there is a marked uptick in negative responses provided by the rare or no fruit intake group. The difference ranged from a minimum of three percent to a maximum of seven percent.

The three variables that most reflect the main outcomes within the research question, in order of primary, secondary, and tertiary, are as follows: "I have confidence in myself", "I like myself", and "I think my body is…". For the primary outcome, there is a seven percent increase in the negative response by the rare or no fruit intake group compared to the daily fruit intake group (Figure 1). The secondary outcome shows a percent difference of three between the two groups, with the rare or no fruit intake group having more negative responses (Figure 1). Finally, the tertiary outcome exhibits a percent increase of six by the rare or no fruit intake group, again for the negative answer (Figure 1). As was stated in the methods, any answers such as "don't know" or "don't think about it" were excluded, but their percentage values must be stated for full transparency. For the daily fruit intake group, following the order of the variables in Figure 1 from left to right: 20%, 7%, 17%, 9%, 14%, 6%, and 9% chose the opt-out response for the variables. For the rare or no fruit intake group, following the same order: 13%, 5%, 20%, 11%, 15%, 0%, and 8% chose the opt-out responses.

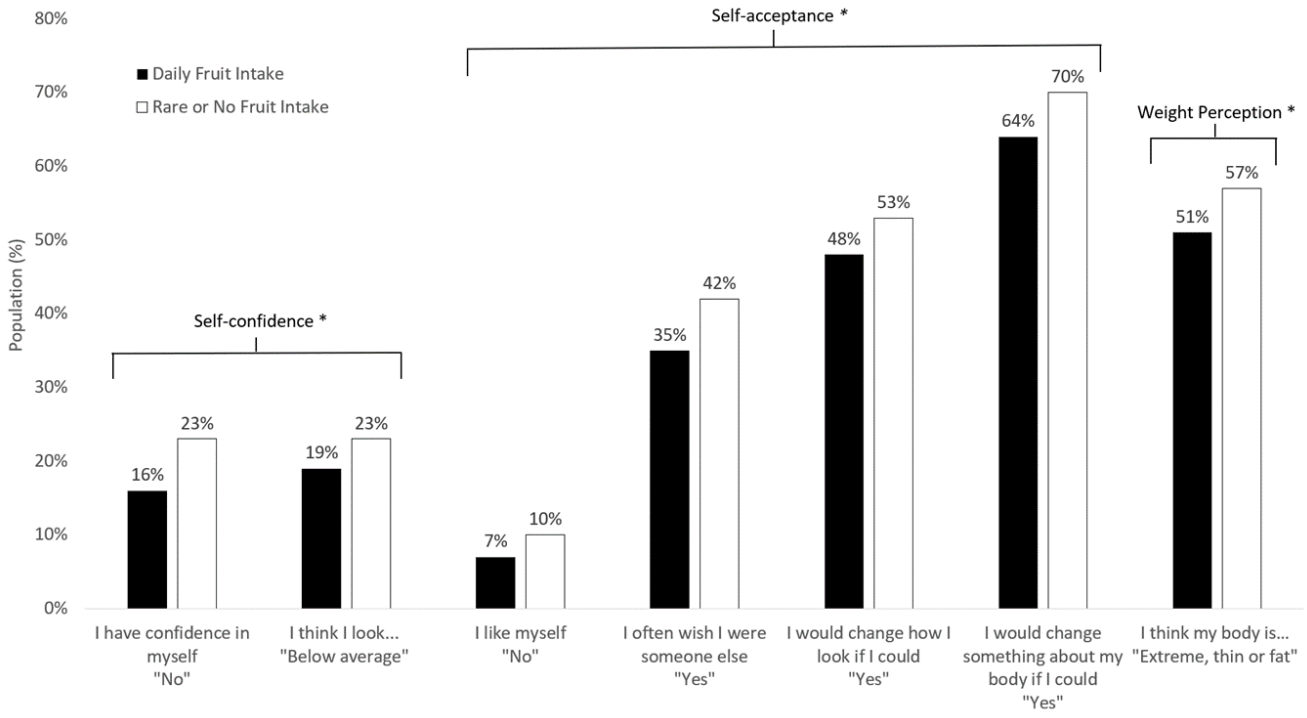

Figure 1: Frequency of responses relating to Self-confidence, Self-acceptance and Weight Perception. The percentage of low self-confidence, low-self acceptance and negative weight perception responses for each group. An asterisk (*) indicates a Chi-Squared p-value of < 0.001.

DISCUSSION

Using the Chi-Square and Mann-Whitney U analyses, the results showed that individuals who reported they rarely or did not consume fruits at all had overall less self-confidence (primary), lower self-acceptance (secondary), and worse weight perception (tertiary) than individuals who reported they intake fruits daily. In addition, the results showed that individuals who intake fruits daily seem to exercise more frequently than those who reported rare or no fruit intake. Finally, the rare or no fruit intake group were more likely to believe they needed to lose weight but were not on a diet to do so.

The trends observed closely align with work done by other researchers within this field. As stated before, there is little in the way of research on how fruit intake affects the self-esteem of adolescent girls. There are however some articles that look at overall nutrition and mental health in adolescent girls. While low self-esteem is not considered to be a mental illness, the two have been linked, particularly in adolescence (Henriksen et al. 2017). A cohort study found that fruits and vegetable consumption was longitudinally correlated to the development of mental health issues (Huang et al., 2019). This aligns well with our findings, though interestingly, they found this was independent of gender, while ours focused on female adolescents (Huang et al., 2019). This suggests that our findings may also be applicable to male adolescents as well, though further analysis would be required to ensure this is the case. Parental care was also found to be a factor in the mental health of young people, which may play a bigger role in self-esteem compared to fruit and vegetable intake (Huang et al., 2019). Additionally, better quality of parental care could mean that children are encouraged to eat more fruits, which in turn reflects better mental health compared to lower quality of parental care, leading to a decrease in the intake of fruits resulting in poorer mental health (Huang et al., 2019). Even though it is known that fruit and vegetable intake is associated with better mental health and lower depression rates, most studies fail to find significant evidence referring to adolescents (Huang et al., 2019). The biological pathways through which fruit intake affects mental health is still difficult to determine (Huang et al., 2019). Other dietary factors, such as regularity of meals and nutrient intake, contribute to the association between fruit and vegetable consumption and mental health (Huang et al., 2019). For example, irregularity in breakfast consumption was found to be an important indicator of dietary health patterns, something that was not accounted for within our analysis (Huang et al., 2019). Overall, research indicates there are more complexities in how diet plays a role in self-esteem. With that in mind, the role of fruits has been determined to be a crucial factor, which aligns with the findings of our study as well.

Despite the positive results determined by our research, the original cross-national study was performed between 1985 to 1998. An issue with analysing the data now, is that children's eating habits and the nutritional recommendations for children have changed over the past few decades (Health Canada, 2020). As well, mental health advocation has dramatically improved throughout the 21st century, therefore it is possible that measurements of self-esteem have become more accurately representative of individuals' self-esteem. Another limitation of the study is the ambiguous nature of many of the survey questions. For instance, "I like myself" can be interpreted in numerous ways, such as "I like the kind of personality I have" or "I like the way I look". These kinds of questions may have resulted in children's responses not being accurately representative of their feelings. As well, the amount of subjectivity required for each response may have influenced the concluded results. For

example, one response for the statement, "I think I look..." is "average", which can have varying meaning based on who is answering the question. To be "average" good looking to one individual may be a different level of good looking compared to another individual's interpretation. The subjective nature of the required data for this area of research should be accounted for in order to yield reliable and valid results.

To further study the relationship between fruit intake and self-confidence, self-acceptance, and weight perception among girls aged 11 to 18, a cohort study approach may be additionally beneficial. Following populations of girls throughout their school-age years, as well as getting to know the participants on a more personal level, may yield more accurate results, given the subjective nature of the questions needed to be answered. As well, a cohort approach would document any change in dietary consumption and self-esteem over time, considering neither of these factors are a constant in someone's life. If an individual has higher self-esteem when their fruit intake is increased, compared to when their fruit intake is lower, this may further support the hypothesis that fruit intake does positively impact self-esteem. Especially for girls in high school, self-esteem is quite likely to fluctuate based on life circumstances alone, so to record the impact of fruit intake may also be useful to see at what points of self-esteem level is fruit intake increased or decreased. Overall, due to the subjective nature of data required for this research, long-term and proximate data collection of participants should be used to ensure more reliable and valid results.

Most of the literature analyzed for this study lacked the inclusion of younger participants in terms of the relationship between fruit intake and mental health, and especially lacked supporting evidence related to self-esteem. In conclusion, this study provides evidence on the relationship between fruit intake and self-esteem, which suggests that daily intake of fruit may be associated with increased self-confidence, self-acceptance, and positive weight perception.

REFERENCES

Brookie, K. L., Best, G. I., & Conner, T. S. (2018). Intake of Raw Fruits and Vegetables Is Associated With Better Mental Health Than Intake of Processed Fruits and Vegetables. Frontiers in Psychology, 9. doi:10.3389/fpsyg.2018.00487

Canada, H. (2002, September 27). History of Canada's Food Guides from 1942 to 2007 [Education and awareness;guidance]. Aem. https://www.canada.ca/en/health-canada/services/canada-food-guide/about/history-food-guide.html#a2007

Canada, H. (2020, June 26). Canada's Dietary Guidelines. Canada Food Guide. https://food-guide.canada.ca/en/guidelines/

Dimov, S., Mundy, L. K., Bayer, J. K., Jacka, F. N., Canterford, L., & Patton, G. C. (2021). Diet quality and mental health problems in late childhood. Nutritional Neuroscience, 24(1), 62–70. https://doi.org/10.1080/1028415X.2019.1592288

Glabska, D., Guzek, D., Groele, B., & Gutkowska, K. (2020). Fruit and vegetables intake in adolescents and mental health: A systematic review. Roczniki Państwowego Zakładu Higieny, 71(1). doi:10.32394/rpzh.2019.0097

Henriksen, I. O., Ranøyen, I., Indredavik, M. S., & Stenseng, F. (2017). The role of self-esteem in the development of psychiatric problems: A three-year prospective study in a clinical sample of adolescents. Child and Adolescent Psychiatry and Mental Health, 11(1). Retreived from:

Hodder, R. K., Obrien, K. M., Tzelepis, F., Wyse, R. J., & Wolfenden, L. (2020). Interventions for increasing fruit and vegetable consumption in children aged five years and under. Cochrane Database of Systematic Reviews. doi:10.1002/14651858.cd008552.pub7

Huang, P., O'Keeffe, M., Elia, C., Karamanos, A., Goff, L. M., Maynard, M., . . . Harding, S. (2019). Fruit and vegetable consumption and mental health across adolescence: Evidence from a diverse urban British cohort study. International Journal of Behavioral Nutrition and Physical Activity, 16(1).

McMullin, J. A., & Cairney, J. (2004). Self-esteem and the intersection of age, class, and gender. Journal of Aging Studies, 18(1), 75–90. https://doi.org/10.1016/j.jaging.2003.09.006

Membride, H. (2016). Mental health: Early intervention and prevention in children and young people. British Journal of Nursing (Mark Allen Publishing), 25(10), 552–554, 556–557. https://doi.org/10.12968/bjon.2016.25.10.552

Paxton, S. J., Wertheim, E. H., Gibbons, K., Szmukler, G. I., Hillier, L., & Petrovich, J. L. (1991). Body image satisfaction, dieting beliefs, and weight loss behaviors in adolescent girls and boys. Journal of Youth and Adolescence, 20(3), 361–379. https://doi.org/10.1007/BF01537402

Wu, S., Fisher-Hoch, S. P., Reininger, B. M., & Mccormick, J. B. (2018). Association between fruit and vegetable intake and symptoms of mental health conditions in Mexican Americans. Health Psychology, 37(11), 1059-1066. doi:10.1037/hea0000646

Cardiovascular Disease in Women Over 50: The Impact of Exercise on Reducing Systolic Blood Pressure and LDL Cholesterol

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INTRODUCTION

Cardiovascular disease (CVD) is currently one of the most prevalent causes of death when analyzing the diseases in North America. However, the rate at which it affects women is highly imbalanced, with significantly higher occurrences in women compared to men (Ambramson, 2014). The effects of cardiovascular disease include hypertension, myocardial infarction, stroke and many other negative life-altering consequences (Ambramson, 2014). Despite these issues, very little awareness is present about the impacts it has on women as gender gaps in treatment are still very prevalent in society (Garcia, 2016). It has reached an extent to where it is responsible for approximately 1 in every 3 female deaths and it is even more prevalent in older women over 65 years old (Garcia, 2016). CVD increases the rate of mortality by thousands of individuals each year, and by doing so creates many severe financial issues on the economy in North America and on a global scale (Buttar, 2005). Due to this reason, it is crucial for CVD-related health complications, preventative measures, as well as any areas of concern to be analyzed.

There are various risk factors associated with CVD including age, diet, hypertension, and physical inactivity among many others (Buttar et al, 2005). However, the likelihood of obtaining this disease can be reduced through exercise (Buttar et al, 2005). Exercise is well known for its abundant amount of benefits ranging from stress relief to better mental and physical performance (Mikkelson, 2017). It is even more beneficial towards CVD due to the positive effects it has on the performance of the heart and efficacy of blood vessels (Braith et al, 2006). When investigating the impact of exercise on CVD occurrence, blood pressure (BP) measurements must also be observed, as high BP is one of the highest risk factors associated with CVD prevalence. Several studies have indicated that through the use of frequent exercise, these risk factors such as BP and hypertension are lower, even if the participants were originally inactive (Braith et al., 2006). Overall, regular exercise tends to lower systolic blood pressure by causing less damage to the walls of the arteries (Braith et al., 2006).
Also, lipoprotein levels play a pivotal role in maintaining cardiovascular health. Low Density

Lipoproteins (LDL) is the main mechanism used to transport lipoprotein in plasma from the liver, allowing it to bind to the receptors of the target cell so it can be absorbed by tissues (Nabel, 2003). It is then used by the tissues to perform certain cell functions. However, in high quantities, it can have negative impacts on a person's health. This allows for LDL to be measured in clinical settings and used as a predictor for CVD (Nabel, 2003). It has been shown that regular exercise can reduce LDL cholesterol and minimize the chance of plaque formation in blood vessels, ultimately leading to better heart health (Lira et al., 2009). Due to these factors, it is often recommended for everyone, especially the ageing population, to engage in some sort of exercise on a daily basis. An emphasis is placed on the ageing population as they are more susceptible to various illnesses due to the decline in the bodily functions that occur with age (Weiskopf, 2009). However, when examining the general population, one

of the groups most likely to live a sedentary lifestyle appears to be the elderly, in which the rates are even higher in women. It has changed to where the exercise prevalence rate among this population has descended to a staggering low of less than 10% (Singh, 2000). Therefore, understanding the effects exercise has on this population is quite crucial in determining the ways to provide better health outcomes for this group.

Although there is evidence that shows a relationship between exercise and reduced CVD risk, the exact mechanisms and duration in which physical activity lowers CVD risk are still not completely understood (Mora et al, 2007). An in-depth analysis is needed to clarify the dose-response relationship and health outcomes to understand why CVD has such prevalence among older women (Drenowatz et al, 2014). Therefore, through the use of data from an observational study, the objective of this research is to reveal an association between women, at least 50 years old participating in exercise (over 30 minutes, at least once a week), having lower systolic blood pressure and low-density lipoproteins (LDL) compared to women of the same age who do not participate in exercise.

MATERIALS AND METHODS

Study Design and Database

In the interest of understanding the relationship between CVD risk factors, exercise, and older women, an observational, cross-sectional analysis was conducted using survey data collected by the Canadian Heart Health Database Centre (1997). This data set, which was collected between 1986 and 1992, was the culmination of health initiatives among provincial health departments, Health Canada, and The Heart and Stroke Foundation of Canada. According to the authors, this comprehensive survey was designed to educate federal health agencies on the cardiovascular conditions of Canadians in hopes of developing extensive CVD prevention curriculums (MacLean et al., 1992). Specifically, they wanted to determine the categories and prevalence of risk factors participants encounter, basic demographic information, and the level of cardiovascular health knowledge present in Canadian homes. The methodological approach to data collection was similar between the ten provinces and involved a "stratified, multistage probability sample design [to] select an independent sample for each provincial survey" (Canadian Heart Health Database Centre, 1997). In order to achieve a proper picture of adult cardiovascular health, men and women from ages 18-74, were included in the study. Responses were collected in two parts. The first stage had each participant be visited by a public health nurse to conduct basic demographic and opinion-based questions; and the second part involved participants visiting clinics for specific anthropometric measurements (Canadian Heart Health Database Centre, 1997).

Study Participants

The target population for our analysis was defined as women who were equal to or above the age of 50 years. Men, and women below the age of interest, were excluded from the analysis. Additionally, considering the focus of our investigation was interested in how a longer exercise regiment influences CVD, only women who exercised longer than 30 minutes at least once a week (i.e. experimental group) (n = 821) and women who did not exercise at all (i.e control group) (n = 1171) were included in our sample population. As a result, women who exercised less than 30 minutes, regardless of the number of times

per week, were excluded from the analysis. Participants also had to have complete clinical information regarding their mean systolic blood pressure and the concentration of low-density lipoproteins in their system, as these were the primary and secondary outcomes of interest. The final number of participants included in the analysis was 1992.

Study Outcomes

Cardiovascular risk factors have been the focus of much epidemiological research due to their ability to predict the prevalence of CVD. Blood pressure and cholesterol levels -- specifically, systolic blood pressure and LDL levels -- have been among the most useful indicators of CVD, which is why they are our primary and secondary outcomes of interest, respectively. Epidemiological research has proven these markers to be significant predictors of disease, especially in older individuals (Hajar, 2017). According to the Heart and Stroke Foundation of Canada (2020), hypertension is considered to be the "number one risk factor" for heart disease, followed by high blood cholesterol. Luckily, both of these factors are controllable if certain healthy lifestyle behaviours are followed, like diet and exercise. Furthermore, diverse medications have been in use aimed directly at counteracting these markers for centuries; thus, indicating the importance of their analysis and understanding in the medical field. The collection of these outcomes was as such. Four blood pressure readings were conducted by certified nurses during the personal interview section of the survey, and two more additional readings were collected once the participants arrived at their assigned clinics. Collection of LDL levels were achieved by a blood sample analysis taken during their visit to the clinic, in which they had to fast for a minimum of eight hours before their arrival (Canadian Heart Health Database Center, 1997).

Additional Data Collection

In addition to the two primary outcomes (MSYS and LDL) used in our analysis, other variables of equal importance were required to complete our final result section. These included: SEX, AGE, EXER, EXERLONG, and EXERFINAL. The variables SEX and AGE were used to ensure our population only consisted of women who were 50-years-of-age or older. The variable EXER asked participants if they exercised regularly at least once a week through a simple yes or no questionnaire. And EXERLONG contained information on the specific length of time participants exercised. By using these two variables, a new variable was created, EXERFINAL, to group information from non-exercising individuals with that of individuals who had specific data concerning their length of exercise. EXERFINAL was used as the grouping variable for the two dependent variables.

Statistical Analysis

Given our outcomes of interest (in this case, systolic blood pressure and LDL concentrations) were both continuous variables, we conducted a Shapiro-Wilk Test of Normality. Using a p-value of <0.5, the data was determined to significantly veer from a normal distribution. As a result, the Mann-Whitney U test for continuous non-normal variables was conducted to answer our main research question. An additional statistical test, formally known as the Spearman Rho test, was used to quantify the correlation between LDL and systolic blood pressure -- two dependent continuous variables that were not normally distributed. Finally, IBM Statistical Product and Service Solutions (SPSS) 27 software was used to perform every statistical analysis mentioned, each with a significance threshold of $p \leq 0.05$.

Table 1 contains the measures of central tendencies for the two groups: women who did exercise (N=821) and who did not (N=1171); which make up the top column. The outcomes of interest, along with the age of participants, are listed on the left-hand side. Values shown are given as medians and interquartile range.

RESULTS

The objective of this study was to analyze the interaction between exercise and the risk factors of CVD of elderly women 50 years and older. Through this, the systolic blood pressure and LDL concentrations of these elderly women who exercised for at least once a week, 30 minutes were compared to women of the same age who abstained from exercise. The use of a cross-observational study was used to extract this information from the Canadian Health Data Base. The original study examined the effects of exercise on both genders as well as a broader age group (18-74) resulting in 23 129 participants. However, once the data was narrowed down to analyze the specific audience 1992 participants were left remaining. The risk factors examined in the original study were also reduced from 266 to 7 variables. These 7 variables consisted of the sex, age, systolic blood pressure, LDL, frequency of exercise, length of exercise and participation in exercise.

Table 1: Comparison of Low Density Cholesterol and Average Systolic Pressure of women over the age of 50 who partake in exercise and who do not.

Variables	Exercise (N=821)	No Exercise(N=1171)
Age (Years)	65 (12)	66 (12)
Average Systolic Blood Pressure (mmHg)	132 (25.300)	135.00 (24)
Low Density Lipoprotein (mmol/L)[1]	3.610 (1.270)	3.61 (1.300)

Descriptive Characteristics of Study Participants [N=1992]. Values are Median (IQR). The category exercise represents the number of women who exercise for at least once a week for over 30 minutes. The no exercise category consists of women who do not fit this criteria.

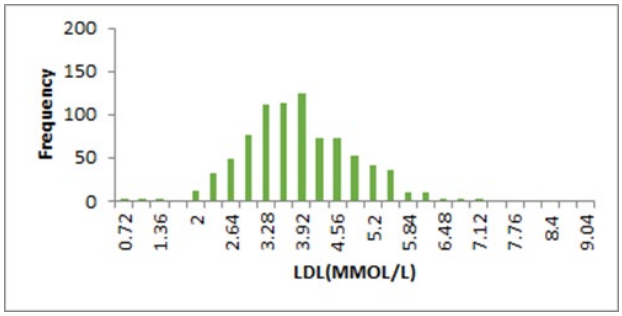

Figure 1: The Frequency of Low Density Lipoproteins in groups that exercise at least once a week for 30 minutes.

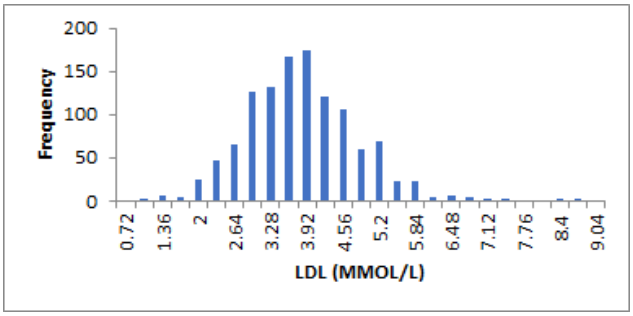

Figure 2: The Frequency of Low Density in groups that do not exercise.

Table 2: Independent-Samples Mann-Whitney U test of LDL

Total N	1992
Mann-Whitney U	491252.500
Standardized Test Statistic	0.835
Asymptotic Significance(2-sided test)	0.403

Significant at the $p<0.05$ level

The difference in mean rank numbers was revealed by the Mann- Whitney U value of 491252.500. Along with a z-score of 0.835, the significance level obtained through the Mann-Whitney U test for LDL was approximately 0.403 which is greater than 0.050. In the figures, the distribution between both groups appeared similar but the 'no exercise' group has a higher LDL value. This indicated that the distribution of LDL values was the same across groups who exercise and who do not exercise and so the null hypothesis could not be rejected.

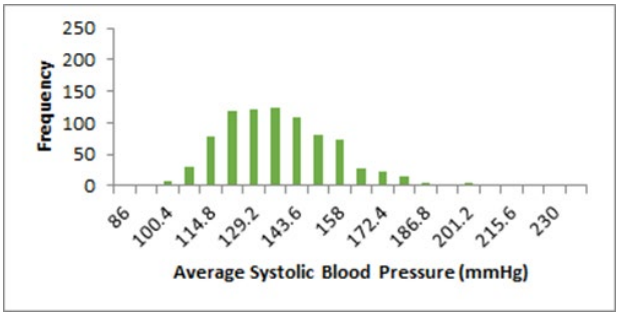

Figure 3: The Frequency of Average Systolic Blood Pressure in groups that exercise at least once a week for 30 minutes.

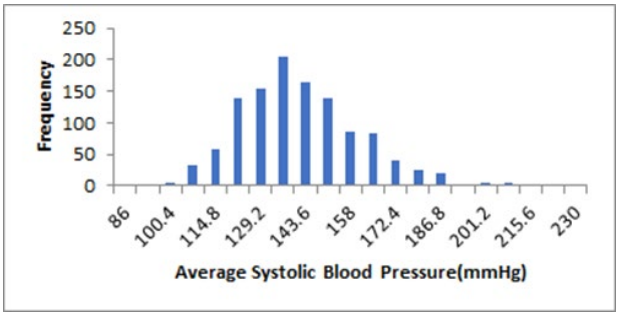

Figure 4: The Frequency of Average Systolic Blood Pressure in groups that do not exercise.

Table 3: Independent-Samples Mann-Whitney U Test of Systolic Blood Pressure

Total N	1992
Mann-Whitney U	419893.000
Standardized Test Statistic	-4.812
Asymptotic Significance(2-sided test)	<0.001

Significant at the $p < 0.05$ level

The difference in mean rank numbers was revealed by the Mann- Whitney U value of 419893.000. With a z-score of -4.812, the significance level obtained through the Mann-Whitney U test for average systolic blood pressure was <0.001 which is less than 0.050. In the figures, distribution of systolic blood pressure values between both groups also differed with a more pronounced and higher peak in the 'no exercise' group, while the "exercise" group had a softer curve. This indicated that the distribution of systolic blood pressure among those who exercise and who do not exercise had a significant difference and so the null hypothesis was rejected.

Table 4: Spearman's rho testing for correlation between LDL and Average Systolic Blood Pressure

		LDL(mmol/L)
LDL(mmol/l)	Correlation Coefficient	1.000
Average systolic blood pressure	Correlation coefficient	0.118
	Significance(2-tailed)	<0.001

LDL Low Density Lipoproteins. Correlation is significant at the p<0.01 level

With a rho value of 0.118 and p= <0.001 which is less than the 2 tailed significance of 0.01, the output reveals that there is a relationship between LDL and Average Systolic Blood Pressure. The correlation coefficient variable is equal to 1 which also demonstrates relatedness between LDL and Average Systolic Blood Pressure. In other words, as Systolic Blood Pressure increases, so does LDL levels.

DISCUSSION

The purpose of this observational study was to evaluate the association between exercise and CVD risk factors (systolic blood pressure and LDL cholesterol) in women aged 50 years and older. The results provide the support that exercise is associated with reduced blood pressure but is less clear with LDL. Specifically, women at least 50 years and older that participate in exercise at least once a week for 30 minutes were associated with lower systolic blood pressures compared to the no-exercise group. Interestingly, the results show that there was no significant difference in LDL cholesterol levels among the two groups. Although LDL is one of the strongest determinants of CVD risk, these findings indicate that exercise has a low impact on LDL levels among women. The overall findings from this study demonstrate that even 30 minutes of exercise per day is an effective way to reduce systolic blood pressure as a CVD risk factor, but not as effective in reducing LDL levels.

Consistent with the results of this study, positive effects of exercise on cardiovascular health outcomes have been shown in other previous studies. A cross-sectional analysis involving women with no history of heart disease showed that women who reported partaking in resistance exercise had lower total CVD risk at any age and was particularly associated with lower body fat, underling the potential

benefits of exercise in older women (Drenowatz et al., 2015). Another study focusing on the exercise effects in middle-aged Iranian women after a 12-week training program compared to a control group who did not change their physical activity. This study also found that participants who exercised for 30 mins/day, 3 days/week had significantly decreased in both systolic and diastolic blood pressure and reduction in 10-year risk of coronary heart disease (Amin-Shokravi et al, 2011). Additionally, a Women's Health Study that involved a 7-year follow-up of approximately 40,000 healthy middle-aged female health professionals, walking at least 1 hour/week was associated with a 50% reduction in coronary heart disease risk in women that were overweight, had increased cholesterol, or were smokers. (Lee et al, 2001). One more study compared 65 studies included in a meta-analysis aiming to determine the effectiveness of acute exercise interventions on the BP response. This study found that regardless of the participant, there was a reduction in BP in hours following an exercise session (Carpio-Rivera et al, 2016).

With regards to the relationship between LDL levels and exercise, previous literature reported a combination of similarities and differences in results. One study reported that there are inconsistencies regarding the effects of exercise on LDL and analyzed 11 studies on the effectiveness of low to moderate-intensity exercise training. A majority of the studies suggested that low to moderate-intensity exercise was non-significant in lowering LDL (Albarrati et al 2018). Contrastingly, moderate exercise had a significant effect in individuals with hyperlipidemia and among middle-aged sedentary healthy subjects (Albarrati et al 2018). In agreement with this, another study found that routine physical activity (3-5 days/week) markedly lowered the amount of LDL cholesterol in individuals (Buttar et al, 2005). This suggests that exercise must be combined with other dietary changes or more intense exercises to significantly lower LDL levels (Mann, et al., 2014). They also demonstrate that exercise may have different effects on LDL levels depending on the individual's health background and on the intensity of exercise, with higher intensities being more effective (Mann, et al., 2014).

Although the results from this study show great evidence for exercise as a potential treatment for CVD health risks, some limitations must be addressed. First, the data that was used for this study was from surveys conducted between 1986 and 1992. It is important to address that data from over 20 years ago may not accurately reflect or represent current information on this population. Furthermore, this data from this study was collected in the form of health surveys in which data was taken in two stages. When collecting data in this way, discrepancies in the reliability of responses may arise because respondents may not provide accurate, honest answers or provide answers that favorably present themselves. Particularly, the use of 'yes' or 'no' answer options can be problematic when being asked if an individual exercises because it may lead to choosing an option that is not completely applicable to them. This study also involved many respondents who did not know or state the length at which they exercise which may have created some bias in the data. Additionally, this study did not focus on specific types of exercise that were being performed by the participants. To better investigate the use of exercise that has the largest health benefits for women, the modalities of exercise such as resistance or moderate aerobic exercise should be included in the future.

Furthermore, the environment in which the blood pressure and LDL levels were taken may have affected the accuracy of measurements. In the first stage, survey information was collected from the respondent's homes, and during the second stage from a clinic. The difference in locations from the comfort of the individual's home to a clinic, as well as their diets that during that particular week, may have caused discrepancies in daily blood pressure or LDL measurements. Future studies should collect these measurements in a consistent location to avoid this limitation. Due to the nature of this study, we were unable to determine long-term changes in CVD risk outcomes in both groups to show a true effect of exercise on the disease, as it was not a longitudinal study. One reason the results may have not shown a difference in groups for LDL levels could be attributed to the sample size, in which further studies can increase to confirm the relationship between these exercises and LDL in older women.

As mentioned previously, it has been proven in previous studies that exercise as a lifestyle modification is highly recommended for hypertension and is effective in reducing blood pressure. Even small reductions in blood pressure are associated, in the long-term, with a decreased risk of CVD. It was important to analyze this variable in particular women in this age group because it has been observed that systolic blood pressure is a more potent CVD risk factor after the age of 50. The data from this study contributes to previous studies focusing on CVD in women because it provides evidence that even 30 minutes of exercise once a week is enough to reduce systolic pressure. These findings contribute to the evidence that physicians should encourage exercise as a health care model for CVD prevention to sedentary women.

Overall, CVD is a leading cause of death in women and closing the care gap must be achieved through multiple interventions. For many years, CVD research has focused primarily on men, leading to an under appreciation of the effects and therapeutic perspectives on older women (Garcia et al, 2016). The data from this study indicates that 30 minutes of exercise at least once a week is associated with lower systolic blood pressure levels and, thus lower CVD risk. However, the health benefits of exercise were not as clear with LDL cholesterol levels. More research is needed to clarify the dose-response relationship between the intensity of exercise with lowering LDL levels. For best results, exercise should be paired with healthier diets and at higher intensities to observe changes in LDL levels. This information may help health professionals in the promotion of regular exercise to reduce the risks of CVD in women and lower the mortalities and health complications affecting this population across the globe.

REFERENCES

Abramson, B. L., & Melvin, R. G. (2014). Cardiovascular risk in women: focus on hypertension. Canadian Journal of Cardiology, 30(5), 553-559.

Albarrati, A. M., Alghamdi, M. S. M., Nazer, R. I., Alkorashy, M. M., Alshowier, N., & Gale, N. (2018). Effectiveness of low to moderate physical exercise training on the level of low-density lipoproteins: a systematic review. BioMed research international, 2018.

Amin-Shokravi, F., Rajabi, R., & Ziaee, N. (2011). Exercise Effects on Risk of Cardiovascular Disease among Iranian Women. Asian journal of sports medicine, 2(1), 37–43.

Braith, R.W., & Stewart, K.J. (2006). Resistance Exercise Training- Its Role in the Prevention of Cardiovascular Disease. Circulation, 113(22), 2642-2650. https://doi.org/10.1161/CIRCULATIONAHA.105.584060

Buttar, H. S., Li, T., & Ravi, N. (2005). Prevention of cardiovascular diseases: Role of exercise, dietary interventions, obesity and smoking cessation. Experimental and clinical cardiology, 10(4), 229–249.

Canadian Heart Health Database Centre. (1997). Canadian Heart Health Database, 1986–1992 (chhd-E-1986-1992). St. John's, Newfoundland: Memorial University. https://search1.odesi.ca/#/details?uri=%2Fodesi%2Fchhd-E-1986-1992.xml

Carpio-Rivera, E., Moncada-Jiménez, J., Salazar-Rojas, W., & Solera-Herrera, A. (2016). Acute Effects of Exercise on Blood Pressure: A Meta-Analytic Investigation. Arquivos brasileiros de cardiologia, 106(5), 422–433. https://doi.org/10.5935/abc.20160064

Condition risk factors. (2020). Heart and Stroke Foundation of Canada. https://www.heartandstroke.ca/heart-disease/risk-and-prevention/condition-risk-factors

Drenowatz, C., Sui, X., Fritz, S., Lavie, C. J., Beattie, P. F., Church, T. S., & Blair, S. N. (2015). The association between resistance exercise and cardiovascular disease risk in women. Journal of science and medicine in sport, 18(6), 632-636.

Garcia, M., Mulvagh, S. L., Bairey Merz, C. N., Buring, J. E., & Manson, J. E. (2016). Cardiovascular disease in women: clinical perspectives. Circulation research, 118(8), 1273-1293.

Hajar, R. (2017). Risk factors for coronary artery disease: Historical perspectives. Heart Views, 18(3), 109. https://doi.org/10.4103/heartviews.heartviews_106_17

Lee IM, Rexrode KM, Cook NR, Manson JE, Buring JE. Physical activity and coronary heart disease in women: is "no pain, no gain" passé? JAMA. 2001 Mar 21;285(11):1447-54. doi: 10.1001/jama.285.11.1447. PMID: 11255420.

Lira, F.S., Zanchi, N.E., Lima-Silva, A.E., Pires, F.O., Bertuzzi, R.C., Santos, R.V., Caperuto, E.C., Kiss, M.A., & Seelaender, M. (2009). Acute high-intensity exercise with low energy expenditure reduced LDL-c and total cholesterol in men. European Journal of Applied Physiology, 107, 203-210. https://doi.org/10.1007/s00421-009-1115-5

Maclean, D., Petrasovits, A., Nargundkar, M., Connelly, P., Macleod, E., Edwards, A., Hessel, P., Heart, C., Balram, C., Connelly, P., Gelskey, D., Hogan, K., Joffres, M., Lessard, R., Macdonald, S., Maclean,

D., Macleod, E., Nargundkar, M., O'connor, B., & Petrasovits, A. (1992). Canadian heart health surveys: a profile of cardiovascular risk. Canadian Medical Association Journal, 146(1), 1969–1992. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1490359/pdf/cmaj00300-0107.pdf

Mann, S., Beedie, C., & Jimenez, A. (2014). Differential effects of aerobic exercise, resistance training and combined exercise modalities on cholesterol and the lipid profile: review, synthesis and recommendations. Sports medicine (Auckland, N.Z.), 44(2), 211–221. https://doi.org/10.1007/s40279-013-0110-5

Mikkelsen, K., Stojanovska, L., Polenakovic, M., Bosevski, M., & Apostolopoulos, V. (2017). Exercise and mental health. Maturitas, 106, 48-56. https://doi.org/10.1016/j.maturitas.2017.09.003

Mora, S., Cook, N., Buring, J. E., Ridker, P. M., & Lee, I. M. (2007). Physical activity and reduced risk of cardiovascular events: potential mediating mechanisms. Circulation, 116(19), 2110–2118. https://doi.org/10.1161/CIRCULATIONAHA.107.729939

Nabel, E.G. (2003). Cardiovascular Disease. Genomic Medicine,349, 60-72 DOI: 10.1056/NEJMra035098

Singh, M.A.F. (2000). Exercise, Nutrition and the Older Woman: Wellness for Women over Fifty. Health and Fitness.

Shepard, R.J., & Balady, G.J. (1999). Exercise as Cardiovascular Therapy. Circulation, 99(7), 963-972. https://doi.org/10.1161/01.CIR.99.7.963

Weiskopf, D., Weinberger, B., & Grubeck-Loebenstein, B. The aging of the immune system. Transplant International, 22(11), 1041-1050. https://doi.org/10.1111/j.1432-2277.2009.00927.x

Effect of Education and Age on Ontario Women's Preference for Receiving an Abortion when Maternal Health is At Risk

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INTRODUCTION

The prevalence of abortions in Canada has changed with the implementation of government policies over time. Some women may decide to proceed with their pregnancy while others turn to alternative options such as having an abortion due to different underlying factors (Cameron, 2010). Abortion was not always legal in Canada as it is the premature termination of a pregnancy and it has become a very controversial debate due to varying moral values (Shaw & Norman, 2020). In 1988, the Supreme Court of Canada and the Canada Health Act legalized and financed abortion for any stage of a woman's pregnancy (Shaw & Norman, 2020). In Ontario, OHIP coverage now helps to relieve the expense of medical and surgical abortions with a prescription from a doctor (Government of Ontario, 2017). However, access to abortion is not equal for all citizens depending on their resident location and socio-economic status in the country (Shaw & Norman, 2020).

When considering an abortion, most women are unaware of the health risks involved, such as infertility, spontaneous abortion and ectopic pregnancy (Roth et al., 2001). For example, in ectopic pregnancies, mothers must have an abortion since it puts their overall health at risk (Stubblefield et al., 2004). These health complications during pregnancy correlate with increasing maternal age (Luke & Brown, 2007). In addition, women who proceed with having abortions may also experience a decline in mental health and may experience depression, anxiety, substance use or have suicidal thoughts (Fergusson et al., 2006). Overall, women may not be aware of these health concerns due to a lack of health/sex education regarding contraceptives or have minimal to no prior personal/family experiences (Stubblefield et al., 2004). In developing countries such as Brazil and Iran, women with low education and income are less likely to terminate an unwanted pregnancy (Diaz et al., 2015; Moradinazar et al., 2020). However, women with a college education are more likely to have an abortion due to knowledge about the associated health risks (Diaz et al., 2015; Moradinazar et al., 2020).

In general, more research is necessary on the relationship between the effects of abortion on maternal health and the decision to have an abortion. Previous research on abortion rates is primarily based on maternal living circumstances and economic status that influence a woman's choice (LaRoche & Foster, 2018). The majority of the studies we analyzed were conducted by cross-sectional self-administered surveys that were subject to participant bias (Norman et al., 2016). In general, we found that women with a lower economic status were less likely to have an abortion than women with a higher socio-economic status (Huneeus et al., 2020). Although prior studies have focused primarily on developing countries, research about education level and maternal age in Canada has rarely been touched upon, even though it could heavily impact a woman's decision in regard to having an abortion (LaRoche & Foster, 2018). This research will fill knowledge gaps in the literature, including the relationship between maternal age, level of education, and understanding of how it influences a woman's consideration to have an abortion.

Based on previous research and the collected data, our goal is to examine the research question, **"Would women under the age of 40 in Ontario with >15 years of education favour having an abortion if her health was in danger, compared to women under the age of 40 in Ontario with ≤15 years of education?"** We want to compare women's education level in Ontario to analyze if education has a significant role in considering abortion if health is in danger. In addition, our follow-up question is, **"Would women between the ages of 30 and 40 favour having an abortion if health was in danger, due to the health risks involved with pregnancy and aging?"** This will test whether age plays a sole factor in deciding to have an abortion if a woman's health is at risk.

MATERIALS AND METHODS

Study Design and Database

Our analysis uses data from the "Canadian Fertility Survey, 1984" study, which was completed by the University of Western Ontario, University of Montreal, and University of Alberta. The database was designed to collect information on fertility, marriage, marital status, work history, contraceptive use, abortion, childcare, parenting and socio-economic distinctions. This observational study was conducted using a retrospective survey to gather information through random dialing, in order to hold telephone interviews. The selection of the study sample occurred in a two-stage probability process. The first stage was collecting households through a random generation of telephone numbers that ensured households that could be contacted by direct dialing were included. The second stage was selecting eligible respondents in each household, including reproductive women from the ages of 18 to 49. Data excluded populations not within households, without a telephone, and individuals unable to speak English or French.

Study Participants

Selected study participants included women aged 40 and under who reside in Ontario and were separated based on having more or less than 15 years of education. Specifically, women were split into two categories: >15 and ≤ 15. This task was completed on SPSS by selecting DATA > select cases > "If the condition is satisfied." Both ranges were computed using this process. Further, women were categorized based on whether they would or would not favour having an abortion due to maternal health risks involved with pregnancy. To accurately answer this research question, we excluded certain variables or study participants that were not relevant to the study. For example, we removed women over the age of 40 in Ontario to centralize our study population and focus on a specific group. Also, women who were 'FOR' or 'AGAINST' abortion due to factors other than maternal health risks were excluded as it could influence study outcomes. Participants who answered with "Don't Know" and "Prefer not to Answer" were also removed as it did not support our research question. This was completed by deleting the entire variable on SPSS under variable view.

Study Outcomes

The primary outcome that we intend to address from our research question is if education level impacts a woman's decision to have an abortion if her health is in danger. Research surrounding this topic is relevant as women with low socio-economic status, such as education level, have limited

knowledge on the risks associated with late-life pregnancies (Gil-Iacruz et al., 2012). Studies reveal that women with higher education can make informed decisions on having an abortion (Gil-Iacruz et al., 2012). Our second objective is if age is associated with a woman's decision to have an abortion if her health is at risk. This would indicate whether the population would favour having an abortion if her health was in danger due to increased health risks associated with maternal aging and pregnancy. To conduct our study, data for years of education was collected by asking participants, "In total, how many years of education did you complete?". In addition, the question "Assuming abortion were legal, would you be for or against having an abortion...if the pregnancy puts the mother's health in danger?" allowed for the retrieval of data regarding a women's decision to have an abortion. For variables such as 'ABORTION', participants chose an answer based on the categories 'FOR' and 'AGAINST'.

Additional Data Collection

In addition to our study outcomes, our database uses other variables to describe the study population. The first variable includes 'PROVINCE' to determine where participants in the database resided in. We chose to study the population of women in Ontario and excluded all other provinces in the original database. This helped to filter study participants based on a specific geographical location of focus. The second additional variable consists of the 'AGE (YEARS)' of the women in our study population. The study used this variable to separate study participants to answer our follow-up question, "Would women between the ages of 30 and 40 favour having an abortion if health was in danger, due to the health risks involved with pregnancy and aging?". Women were categorized based on the age ranges 18-29 and 30-40.

Statistical Analysis

The SPSS software helped to answer the research questions by conducting several statistical tests. Tests for normality were completed for continuous variables 'AGE (YEARS)' and 'EDUCATION (YEARS)'. A p-value of less than 0.05 for the Shapiro-Wilk significance proved that the data is not normally distributed. Further, Table 1 displays the number and frequency (%) of education years for the categorical variable 'ABORTION.' This signifies the number of participants 'FOR' and 'AGAINST' abortion based on education level ($\leq$15 years or >15 years). The median and interquartile range (IQR) is also listed for age groups (18-29 & 30-40). We completed a 2x2 Chi-squared test to determine the between-group differences in proportions of participants belonging to categorical variables. This helped to conclude how many participants answered 'FOR' or 'AGAINST' abortion based on their education level. Separating age into categories (18-29) and (30-40) provided the information necessary to answer our follow-up research question. Therefore, we repeated another Chi-squared test to compare between-group differences between age and abortion 'FOR' or 'AGAINST.' To visualize this relationship, a Man U Whitney test was conducted between variables 'AGE' and 'ABORTION' to generate a histogram of findings.

RESULTS

Table 1. Descriptive characteristics of participants with >15 years of education or ≤ 15 years of education [N=1388].

Variable		EDUCATION (YEARS)	
		>15 (n=284)	≤ 15 (n=1104)
AGE(YEARS)	18-29	17(1)*	12(2)*
	30-40	17(2)*	12(2)*
ABORTION	FOR	259(91.2)	969(87.8)
	AGAINST	25(8.8)	135(12.2)

Data values as listed as n(%) of participants unless otherwise noted, *median(IQR)

The median number of education years was 17 (for >15) and 12 (for ≤ 15) between age groups (18-29 & 30-40) (Table 1). Frequency of study participants 'FOR' abortion if woman's health is in danger with >15 years of education was higher (91.2%) compared to study participants with ≤ 15 years of education (Table 1). After running a Chi-Squared analysis, there was no significant group difference between

Table 2. 2x2 Chi-Squared analysis for variables abortion ('FOR' or 'AGAINST') separated by age (years).

Variable		ABORTION					
		FOR	AGAINST	Total	df	Pearson Chi-Squared	*p*-Value
AGE (YEARS)	18-29	651(86.8)	99(13.2)	750	1		
	30-40	577(90.4)	61(9.6)	638	1	4.476	0.034
Total		1228	160	1388	1		

*Data values listed as n(%)

Participants in the age group 30-40 displayed a higher frequency (90.4%) 'FOR' abortion if woman's health is in danger compared to the age group 18-29 (86.8%) (Table 2). Frequency of participants 'AGAINST' abortion if woman's health is in danger was higher in the 18-29 age group (13.2%) (Table 2). Between group differences were statistically significant as the p-value was 0.034 (Table 2).

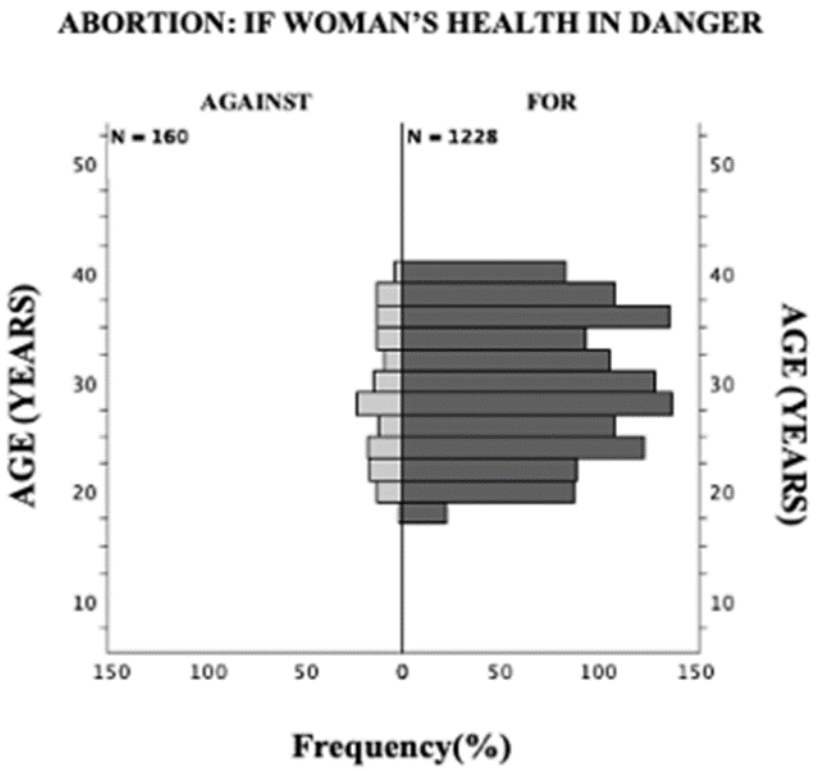

Figure 1. Frequency (%) of study participants 'FOR' and 'AGAINST' abortion if woman's health is in danger based on age (years). [N = 1388].

A Mann U Whitney analysis was performed to generate a histogram for age distribution across abortion 'FOR' or 'AGAINST' (Fig. 1). The distribution of age is different across categories of abortion (p-value = 0.048). Frequency of participants in the age group 30-40 'FOR' abortion is greater than participants age 18-29 (Fig. 1). Further, frequency of participants in the age group 18-29 'AGAINST' abortion is greater than participants age 30-40 (Fig. 1).

DISCUSSION

In this study, we looked into whether or not women in Ontario would favour abortion if their health was in danger based on years of education. We hypothesized that women with >15 years of education would be more likely to have an abortion due to greater knowledge on pregnancy's health risks. For our follow-up question, we further hypothesized that women between the ages of 30-40 would favour abortion due to the health dangers associated with pregnancy and increasing maternal age. We found that education does not impact a woman's decision to have an abortion if maternal health is at risk. Contrary, age does influence a woman's preference for having an abortion if her health is in danger. Previous research has primarily focused on women in developing countries and considered the socio-economic status and living conditions (LaRoche & Foster, 2018). However, there is limited literature on Canadian women, mainly from Ontario, and whether their decisions are influenced by age or education level. After conducting this study, we noted no significant difference between the decision

"FOR" or "AGAINST" abortion and the total years of education when the mother's health was in danger. However, we observed a significant difference between age groups (18-29 & 30-40) and the decision between "FOR" or "AGAINST" abortion. Specifically, women between 30-40 years of age showed a higher frequency of participants for abortions if their health was in danger.

Based on the results, we can infer that there is no significant difference between years of education and the decision between 'FOR' or 'AGAINST' abortion. This was determined by conducting a chi-square test, and since the p-value was 0.107, it suggested that the results were not statistically significant. These findings display that our first hypothesis was inconclusive and that years of education did not play an important role when women are deciding to have an abortion or not. Unlike what was seen in a study conducted by Kozinszky et al. in 2001, where women with lower education levels were less likely to have an abortion, our study showed no significance between years of completed education and abortion preference. A possible reason for this insignificant result is the way that data was collected. For example, some individuals were unaware of the total years of education they had completed, which presented recall bias in our study. Another cause for the obtained finding is that abortion was not legalized when this survey was conducted. Although the question was framed as "Assuming abortion were legal, would you be for or against having an abortion...if the pregnancy puts the mother's health in danger?", women may not have considered abortion as an option due to current laws when the survey was conducted. This could have inflicted participant bias when answering questions, therefore future studies should be run with the new legal abortion policy in place for accuracy of findings. Further, most women in our study sample did not complete additional studies after high school because they may have been married at a young age with low educational expectations (Barber et al., 1998). As well, some women may have left the education system early to focus on family planning as their priority (Gallos, 1989).

However, we found a significant difference between age groups 18-29 and 30-40 (p-value of 0.034). More women between the ages of 30 and 40 were in favour of abortions if health is in danger compared to women between 18 and 29. The Mann U Whitney analysis provided similar results for age distribution across abortion categories ‘FOR’ or ‘AGAINST’. The p-value of 0.048 indicated that there is a significant difference between age and abortion preference. This was in line with our second hypothesis and suggested that women between the ages of 30-40 are more willing to have abortions if their health was at risk due to the dangers associated with pregnancy and aging. Similar results were seen in a study conducted by Santelli et al. in 2009, where 26% of women over the age of 30 stated they would have an abortion because they were "too old". Furthermore, approximately 34% of older women perceived physical or mental health issues when deciding to have an abortion (Larsson et al., 2002). According to our findings and previous academic literature, women over the age of 30 considered personal factors while deciding to have an abortion.

Our study limitations stem from how the database was built and the data collection methods, which involved randomly dialing households across Ontario. Since missing data from the research design involves people who do not live in households with a functioning telephone, the study may not be generalizable to a wider population. Further, the study design may underestimate results since some women who were eligible based on inclusion criteria may have not been reached via telephone. Our

findings could have also been overstated due to data collected via telephone interview. Information may have been poorly relayed from study participants if survey questions were misunderstood or unclear. Similar to a study conducted by Santelli et al., results were limited by the use of a questionnaire survey where participants could have been subject to confusion or answered untruthfully. Another disadvantage of our study design is that we excluded certain age groups and provinces to focus solely on our intended study population (women 18-40 in Ontario). Therefore, these results cannot be applied to a larger population. We also removed answers to survey questions such as 'Don't know' and 'Prefer not to answer' from the survey results, which adds to the possibility of an overestimation of data. Furthermore, the total number of participants in the age groups 18-29 and 30-40 were unequal. The sample size of age group 30-40 was smaller [N=638] which can affect reliability of results and lead to higher variability. Finally, the data that was used in this study was collected in 1984 and is outdated. Conducting this study in present day may yield different results as laws have changed and societal views towards abortion have progressed over the decades.

In regard to future directions and implications, our study opens up more opportunities to look into other factors that affect deciding 'FOR' or 'AGAINST' an abortion if maternal health is in danger. Other factors could include whether or not the mother had the support of a partner, their occupational situation, their access to healthcare, and their previous sexual education received. These considerations to the mother's overall mentality could influence their choice and thinking involved in their decision. Since previous research solely focuses on socioeconomic status and education level in developing countries, our study improves upon research that can be applied to residents in Canada, specifically Ontario. Understanding why women decide 'FOR' or 'AGAINST' abortion based on age and the associated health risks will help women in Ontario be informed about certain populations that are at risk for pregnancy complications. Further, this information will help women to better understand statistics that they see in the news or other forms of media.

Since there is limited research on factors of age and education, our study findings can help Ontario women make well-informed decisions when considering abortion. When looking at a bigger picture, women across the globe may also experience increased risks of pregnancy dangers with increasing age, therefore future studies should compare statistics on a larger scale. Our study and future studies ultimately add to meta-analysis databases which will be useful for long term research applications. Overall, the analyses conducted suggest the need for better understanding of women's intentions for abortion if their health is at risk and the factors that affect a woman's decision. Such recognition may improve the knowledge surrounding pregnancy dangers that increase with maternal age.

REFERENCES

Barber, J. S., & Axinn, W. G. (1998). Gender role attitudes and marriage among young women. The Sociological Quarterly, 39(1), 11-31.

Cameron, S. (2010). Induced abortion and psychological sequelae. Best Practice & Research Clinical Obstetrics & Gynaecology, 24(5), 657-665.

Dias, T. Z., Passini Jr, R., Duarte, G. A., Sousa, M. H., & Faúndes, A. (2015). Association between educational level and access to safe abortion in a Brazilian population. International Journal of Gynecology & Obstetrics, 128(3), 224-227.

Gallos, J. V. (1989). implications for career theory, practice. Handbook of career theory, 110.

Gil-Lacruz, A. I., Gil-Lacruz, M., & Bernal-Cuenca, E. (2012). Socio-economic determinants of abortion rates. Sexuality Research and Social Policy, 9(2), 143-152.

Government of Ontario (April 21, 2017). What OHIP Covers. Retrieved from: https://www.ontario.ca/page/what-ohip-covers#:~:text=Abortion%20services,a%20prescription%20from%20your%20doctor

Fergusson, D. M., John Horwood, L., & Ridder, E. M. (2006). Abortion in young women and subsequent mental health. Journal of Child Psychology and Psychiatry, 47(1), 16-24.

Huneeus, A., Capella, D., Cabieses, B., & Cavada, G. (2020). Induced abortion according to socioeconomic status in Chile. Journal of pediatric and adolescent gynecology, 33(4), 415-420.

Kozinszky, Z., Boda, K., & Bártfai, G. Y. (2001). Determinants of abortion among women undergoing artificial termination of pregnancy. The European Journal of Contraception & Reproductive Health Care, 6(3), 145-152.

LaRoche, K. J., & Foster, A. M. (2018). Exploring Canadian women's multiple abortion experiences: implications for reducing stigma and improving patient-centered care. Women's Health Issues, 28(4), 327-332.

Larsson, M., Aneblom, G., Odlind, V., & Tydén, T. (2002). Reasons for pregnancy termination, contraceptive habits and contraceptive failure among Swedish women requesting an early pregnancy termination. Acta obstetricia et gynecologica Scandinavica, 81(1), 64-71.

Luke, B., & Brown, M. B. (2007). Elevated risks of pregnancy complications and adverse outcomes with increasing maternal age. Human reproduction, 22(5), 1264-1272.

Moradinazar, M., Najafi, F., Nazar, Z. M., Hamzeh, B., Pasdar, Y., & Shakiba, E. (2020). Lifetime Prevalence of Abortion and Risk Factors in Women: Evidence from a Cohort Study. Journal of pregnancy, 2020.

Norman, W. V., Guilbert, E. R., Okpaleke, C., Hayden, A. S., Lichtenberg, E. S., Paul, M., ... & Jones, H. E. (2016). Abortion health services in Canada: Results of a 2012 national survey. Canadian Family Physician, 62(4), e209-e217.

Roth, L. K., & Taylor, H. S. (2001). Risks of smoking to reproductive health: assessment of women's knowledge. American journal of obstetrics and gynecology, 184(5), 934-939.

Santelli JS, Speizer IS, Avery A, Kendall C (2009) An exploration of the dimensions of pregnancy intentions among women choosing to terminate pregnancy or to initiate prenatal care in New Orleans, Louisiana. Am J Pub Health 96:2009–2015

Shaw, D., & Norman, W. V. (2020). When there are no abortion laws: A case study of Canada. Best Practice & Research Clinical Obstetrics & Gynaecology, 62, 49-62.

Stubblefield, P. G., Carr-Ellis, S., & Borgatta, L. (2004). Methods for induced abortion. Obstetrics & Gynecology, 104(1), 174-185.

The Impact of Education Level, Sex and Smoking Status on the Health Consciousness of Adults: An Observational Analysis on Smoking in Canada 1994

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INTRODUCTION

Currently, The World Health Organization estimates that smoking accounts for approximately 6 million deaths globally and causes half a trillion dollars in economic damage annually (Ekpu and Brown, 2015). The most common type of smoking involves tobacco use, with nicotine being the primary reinforcing component that drives addiction within its user. Nicotine causes a rush of adrenaline when burnt and inhaled by users, leading to an increased likelihood of addiction and dependency (Mishra, 2013). As of 2019, the prevalence of cigarette smoking in Canada is approximately 3.7 million (12% of population), with youth prevalence at 5%, adult males at 18.6 %, and adult females at 13% (Canada, 2020). At first, smoking may seem harmless for experimental and recreational uses, however, it can lead to various adverse health consequences over time. Commonly reported health impacts associated with smoking include increased risk of cancer, lung disease, stroke, and cardiovascular diseases (CDC, 2020). There are also many factors that predispose an individual to a greater likelihood of smoking within their lifetime, such as education and sex.

As education is a key component of a successful society, teachers within the public education system have the responsibility to teach students about substance abuse and the adverse health consequences associated with dependency. As cigarette usage impacts many individuals, it remains one of the most preventable causes of premature mortality (Rogers & Crimmins, 2011). Ideally, individuals should be knowledgeable enough to make fully autonomous and informed decisions when deciding to engage in activities such as recreational cigarette smoking. Educational inequalities are impeding individuals from learning the adverse health effects of smoking which are thus contributing to the high prevalence of smoking within lower education groups (Denney et al., 2010).
Smoking differences and behaviors between sexes are primarily shaped by socioeconomic factors, sex norms, and general expectations regarding gender-appropriate behavior (Chinwong et al., 2018, Short et al., 2013, Waldron, 1991). Pampel (2006) found that females are less likely than males to be smokers due to traditional gender norms such as smoking being unfeminine and for males, it being a sign of masculinity. Males are also more predisposed to engage in risky behaviors that can affect their physical and mental well-being (Croisant, 2013). These factors influencing one sex to be more prevalent smokers than the other ultimately illuminates a disparity in demographics.

Educated individuals may also achieve higher levels of health consciousness, corresponding to self-awareness about one's health, and the willingness to engage in health and wellness-promoting behaviors (Espinosa and Kadic-Maglajlic, 2018). These individuals may choose to monitor their health and take actions that help maintain or achieve improved health (Hanspal and Devasagayam, 2017). Actions may include adopting a healthier lifestyle and diet, partaking in more exercise, monitoring

drug and alcohol intake, and frequently visiting a physician. Thus, individuals with higher health consciousness are overall healthier compared to those with lower health consciousness.

In literature, it is commonly reported that adults with higher education live healthier and longer lives compared to their less-educated peers (Zajacova and Lawrence, 2018). One study conducted by Tomioka et al. (2019) found that independent of socioeconomic status and health conditions, both men and women have educational inequalities when concerning smoking. In a global study with 187 countries, Ng et al. (2014) also revealed a general trend of smoking prevalence being higher among men than women. With the current research, however, there are few studies that have investigated the association between health consciousness, varying levels of education, and sex, within Canada.

Evidently, cigarette smoking presents as a major issue intertwined with many factors influencing one's choice to consume this product. Education and sex are crucial factors that can potentially influence health consciousness and the decision to purchase cigarettes. Adding onto the limited literature, this paper will address the following research question, "Are adults (aged 35-44) within Canada, more likely to be health-conscious (measured by 4 point Likert scale questionnaire) if they have completed a higher level of education (less than secondary/secondary/community college/university) compared to adults with only secondary education or lower?". Answering this research question, we examined the primary outcome of this study which was to measure the association between an education level and an individual's health consciousness. A secondary research question addressed within this study was, "Based on the educational background (less than secondary/secondary/community college/university) of participants is there a correlation between male or female adults (aged 35-44) within Canada being active smokers?". The secondary outcome of this study was to investigate the differences in smoking prevalence among males and females of varying educational backgrounds and determine whether this was potentially associated with participants' smoking activity. This research will advocate for further implementations of public health awareness programs, giving individuals the tools to think consciously about their health and which demographics to target more heavily (male or female).

MATERIALS AND METHODS

Study Design and Database

This observational study used data provided by Statistic Canada's survey on smoking in Canada in 1994, retrieved from the Odesi digital repository. The survey aimed to monitor the smoking patterns of Canadians over a 12-month period, measuring changes in smoking habits after a decrease in taxes on cigarettes. The survey gained insight into attitudes towards cigarette smoking and respective behaviours. Responses were collected via computer-generated random telephone numbers in consensus metropolitan areas, 15804 valid participant responses were recorded using Likert scale options across all age groups (15 – 65+ y.o).

Study Participants

This research included Canadian male and female participants aged 35 – 44 (y.o) who participated in the 1994 smoking survey questionnaire. Level of education was categorized into, less than secondary,

completed secondary, completed community college, and completed university. Participants were asked their perception on whether smoking could cause a particular illness and answered with the given Likert scale options on the questionnaire as such, very likely, somewhat likely, not at all likely, valid skip, don' know, refuse to answer, and not stated. Within these options, refuse to answer and not stated were excluded. These options were excluded as they added no significant value to the conclusion if higher education level or lower-level education level influenced health consciousness when examining if one perceives smoking to cause an illness/health problem. All participants with missing data in any chosen perception question were excluded as these participants would reduce the statistical power of the study and influence statistical analysis leading to invalid conclusions. After exclusion and inclusion criteria was applied, a total of (N = 1381) participants were analyzed within this study.

Study Outcomes

The primary outcome of the first research question was to identify the relationship between an individual's education level and their relative association with health consciousness regarding smoking in Canada. This outcome was useful as it would aid in answering whether education influenced health consciousness, supporting advocation for preventing smoking which would help reduce adverse health outcomes. One study noted that targeted tobacco control policies and programs are effective in the decline of smoking among lower-educated groups (Giskes et al., 2005). The purpose of the survey was to determine smoking status and identify changes in the prevalence of smoking in Canada. The data collected includes several questions related to adverse health outcomes that can occur from smoking. Over the telephone, questions asked whether the participant believed smoking to cause a specific illness without the influence of others, to limit biased results. Questions were asked in a categorical manner using Likert scale options. Options included very likely, somewhat likely, not at all likely, and don't know. Levels of education included less than secondary, completed secondary school, completed community college, and completed post-secondary. Based on the level of education and the survey question asked, we were able to assess the research question with various statistical analysis. Similar methods were used when assessing our second research question and outcome relating to educational background and prevalence of active smoking between sexes to determine specific demographics to target. The survey included a yes or no questionnaire to identify active smokers in the population with various ages based on sex. This question is reproducible in future studies and limits the potential of biases and or confounding elements.

Cooper and Johnson (2016) noted that many participants are often comfortable responding to questions in an ordinal Likert scale format. However, it is essential that there are balanced options when researchers are constructing surveys to minimize confusion on behalf of the participant (Colton and Covert, 2007). We exercised this strategy, creating equally balanced options in an ordinal manner, providing reliable and valid results. As the Likert scale is commonly used today, the methods within this survey provide for replicability in the future. The widespread use of the Likert scale and surveys allows researchers to measure specific outcomes. For example, if education is a factor in health consciousness concerning smoking and its effects. The importance of our data aids in the implementation of further public health education and awareness programs to inform various demographics of smoking-related health risks.

Additional Data Collection

Additional variables, including sex and smoking status, were used from the original database. These variables were analyzed with education to examine the prevalence of smoking between males and females of various educational backgrounds. These variables were used to identify specific demographics needing educational programs pertaining to health risks related to smoking and to determine if there was a correlation present. As our study did not contain continuous data, we were unable to use the ANCOVA model and analyze the impact of covariates.

Statistical Analysis

Using the SPSS software, this study utilized two statistical analyses. The first research question regarding education level and health consciousness was examined using a Pearson Chi-Square test and the Spearman Rho Correlation Test set at p-value < 0.05 to indicate significance. The second research question concerning the prevalence of smoking between males and females of various educational backgrounds and smoking habits was analyzed using the Spearman Rho Correlation Test set at p-value < 0.05 to indicate significance. The frequency of responses was recorded within **Table 1** and **Table 2** and participants' responses were reported as n (%) generated by SPSS.

RESULTS

Table 1. Descriptive statistics analyzing participants' various levels of education and their perceptions of various health outcomes potentially related to and caused by smoking (N = 1381).

Variable	Frequency (N = 1381)	Chi-Square Test	Spearman Rho Coefficient
Sex			
Male	**651 (47%)**		
Female	**730 (53%)**		
Age *35- 44 years old*	**1381(100%)**		
Level of Education			
Less than secondary	**226 (16.4%)**		
Completed secondary	**619 (44.8%)**		
Completed community college	**225 (16.3%)**		
Completed university	**311 (22.5%)**		
Smoking many years causes-Emphysema*			
Very likely	**952 (68.9%)**	Chi-Square Value: 17.22	[r] = - 0.09
Somewhat likely	**333 (24.1%)**	Df: 6	p-value: 0.001 **
Not at all likely	**59 (4.3%)**	p-value: 0.009 **	
Don't know	**37 (2.7%)**		
Smoking many years causes - Multiple Sclerosis (MS)*			
Very likely	**46 (3.3%)**	Chi-Square Value: 19.96	[r] = 0.084
Somewhat likely	**142 (10.3%)**	Df: 6	p-value: 0.006 **
Not at all likely	**890 (64.4%)**	p-value: 0.003 **	
Don't know	**303 (21.9%)**		
Smoking many years causes - Lung Cancer*			
Very likely	**1185 (85.8%)**	Chi-Square Value: 29.74	[r] = - 0.113
Somewhat likely	**167 (12.1%)**	Df: 6	p-value: < 0.001 **
Not at all likely	**22 (1.60%)**	p-value: < 0.001 **	
Don't know	**7 (0.05%)**		
Smoking many years causes - Bladder Cancer*			

Very likely	**125 (9.10%)**	Chi-Square Value: 14.79	[r] = - 0.027
Somewhat likely	**381 (27.6%)**	Df: 6	p-value: 0.369
Not at all likely	**619 (44.8%)**	p-value: 0.022 **	
Don't know	**256 (18.5%)**		
Smoking many years causes - A stroke*			
Very likely	**678 (49.1%)**	Chi-Square Value: 27.59	[r]= - 0.059
Somewhat likely	**493 (35.7%)**	Df: 6	p-value: 0.033 **
Not at all likely	**152 (11.0%)**	p-value: < 0.001 **	
Don't know	**58 (4.2%)**		
Smoking many years causes - Asthma*			
Very likely	**913 (66.1%)**	Chi-Square Value: 7.65	[r] = 0.004
Somewhat likely	**314 (22.7%)**	Df: 6	p-value: 0.891
Not at all likely	**121 (8.8%)**	p-value: 0.265	
Don't know	**33 (2.4%)**		

(*) indicates a perception that smoking may cause this illness. (**) indicates a p-value ≤ 0.05. [r] indicates correlation coefficient. Df indicates degrees of freedom within Pearson Chi-Square Analysis. Values are reported as the number of participants and frequency percent, n (%).

The frequencies of the demographic variables and the survey questions asked are summarized in **Table 1**. In the population of the specific age group (Age = 35-44), a major proportion of the study population completed secondary education than any other education level (N = 619/1381) within **Table 1**. There was a relationship between education level and the perception of acquiring emphysema, MS, lung cancer, bladder cancer, and stroke ($p \leq 0.05$). There was no significance in the level of education and the perception of acquiring Asthma ($p > 0.05$). The test statistic for each chi-square analysis was similar to the expected value for the respective degree of freedom of 6 thus, showing significance ($p \leq 0.05$) between education and all other perceptions of health outcomes except for Asthma ($p > 0.05$). The Spearman Rho Coefficient [r] for grouped highest levels of Education/Emphysema, MS, Lung cancer, and Stroke were -0.09, 0.084, - 0.013, and - 0.059 respectively, indicating a negative correlation. These correlation coefficients were significant as well as with the p-values (≤ 0.05), however, indicating a very weak relationship to almost 0 relationship amongst grouped highest levels of education and the listed health outcomes in **Table 1**.

The distribution of the participants' answers to the various perceptions of health outcomes caused by smoking many years from the Pearson Chi-Square analysis is summarized in **Figure 1**. The **x-axis** represents the number of participants who answered each question on the Likert scale. The **y-axis** represents the level of education. All health outcomes were significant ($p \leq 0.05$), except for Asthma which was not significant ($p > 0.05$). A notable finding in **Figure 1**. **A** was that 76% of people with a university level of education answered very likely which was the largest percentage to do so for all education level categories. This trend followed with university-level education participants having the highest percentage of answering very likely based on proportions in each health consciousness question.

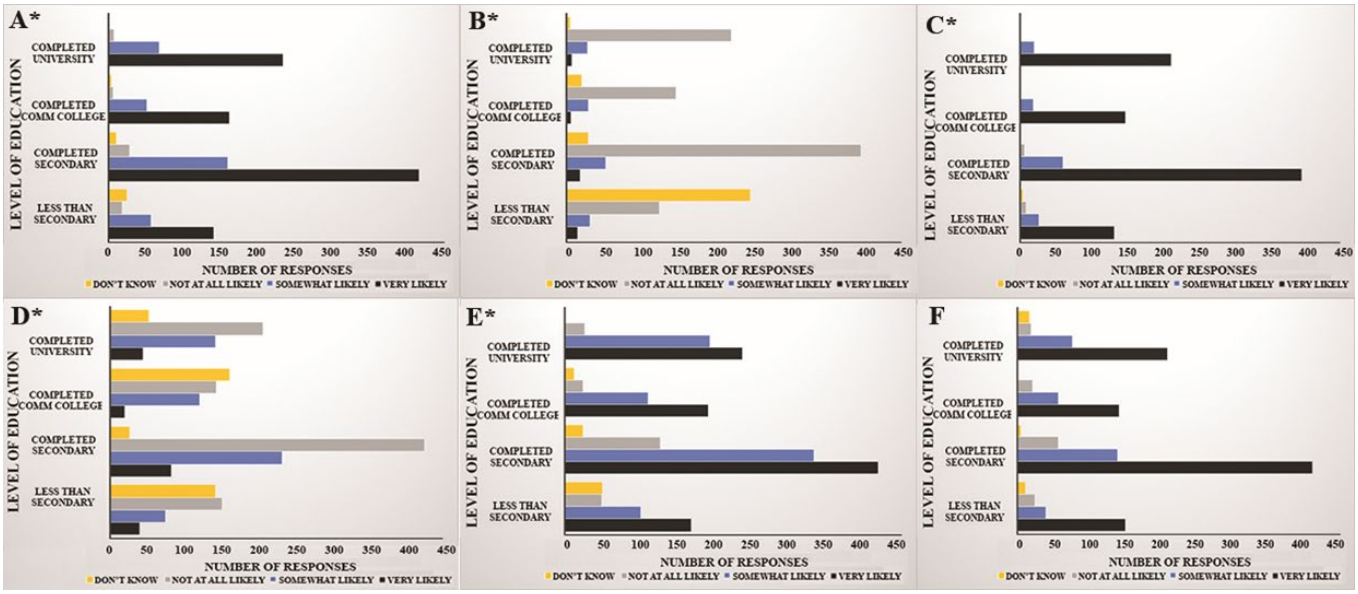

Figure 1. Canadian 1994 surveyors smoking, proportional analysis of study participants' perception on whether smoking can cause various illnesses (N =1381). *indicates a p-value ≤ 0.05. (**A**: Smoking Many Years Can Cause Emphysema; **B**: Smoking Many Years Can Cause MS; **C**: Smoking Many Years Can Cause Lung Cancer; **D**: Smoking Many Years Can Cause Bladder Cancer; **E**: Smoking Many Years Can Cause Stroke; **F**: Smoking Many Years Can Cause Asthma)

Table 2. Frequency Distribution of male and female participants within the Canadian survey of smoking (1994), categorized by smoking status and educational background. (N = 1381). Values reported as the number of participants and frequency percent, n (%).

		Level of Education				
		Completed less than secondary	**Completed secondary**	**Completed Community College**	**Completed University**	**Total**
Smoking						
Yes						
	Male	**92 (41%)**	**240 (39%)**	**52 (23%)**	**13 (4%)**	**397 (29%)**
	Female	**80 (36%)**	**223 (36%)**	**24 (11%)**	**11 (3%)**	**338 (25%)**
No						
	Male	**41 (18%)**	**28 (5%)**	**54 (24%)**	**142 (46%)**	**265 (19%)**
	Female	**11 (5%)**	**128 (20%)**	**97 (42%)**	**145 (47%)**	**381 (27%)**
		224(100%)	**619(100%)**	**227 (100%)**	**311 (100%)**	**1381 (100%)**

Table 2 displays the frequency distribution of smoking status (does the individual smoke presently?) in males and females of various educational backgrounds within the 1994 survey of smoking in Canada.

The majority of individuals who smoked during the survey in 1994 had completed less than secondary school. Respondents who did not smoke conversely were more prevalent in participants with higher levels of education completed (completed community college and completed university). The largest magnitude of percent difference was examined in the completed community college level of education between males and females who did not smoke, as there was a greater number of females than males who did not smoke within **Table 2**.

Table 3. Spearman Rho correlation assessing the relationship of grouped highest educational level and sex in relation to smoking status (N = 1381).

	Grouped Highest Level of Education	Sex
Smoking Status		
Correlation Coefficient :	**0.532 ***	**0.129 ***
P - value :	**< 0.001 ****	**< 0.001 ****

(**) indicates a p-value ≤ 0.05. (*) indicates a significant correlation between variables.

Table 3 displays the Spearman Rho correlation coefficient and p-value for the variables of smoking status compared to grouped highest level education and sex. The correlation coefficients for smoking habits/grouped highest level education and smoking habits/sex were 0.532 and 0.129. Both correlation coefficients were significant as well with p -values < 0.001 indicating a relationship amongst the variables compared within **Table 3**. It was seen that smoking status and grouped highest level of education had the strongest significant relationship with an r-value of 0.532 indicating a moderate positive correlation.

DISCUSSION

A key finding within the study is that level of educational attainment was found to be significantly related to differences in perceptions of smoking-related diseases. A second finding was that smoking is more prevalent among less-educated individuals and less prevalent among higher educated individuals, however, regardless of education, more males were active smokers than females. Our analyses thus demonstrate a relationship between education attainment level, sex, health consciousness, and smoking.

In our study, no difference was found between education level and perception of asthma as a health outcome of smoking. In addition, our Spearman Rho analysis reported very weak correlations between education level and perception of emphysema, multiple sclerosis, bladder cancer, and stroke. We take note that factors other than education are also involved in the health consciousness of an individual. It was hypothesized that socioeconomic status also played a crucial role which was not examined within this study. Arpey et al. (2017) noted a positive correlation between lower socioeconomic status and perceived negative health outcomes. Environmental factors such as upbringing and social networks influence one's perception of developing health complications due to implicit bias.

Consistent with prior studies, our results showed that higher education influences health consciousness. A study conducted in Korea found educational attainment to be independently associated with at-risk health behavior; less educated participants had less desirable health habits than those with higher education (Kim et al., 1994). In contrast to our findings, Giskes et al. (2005) saw opposite trends in British and Italian men, with greater smoking declines amongst the least educated. However, this may be a consequence of effective tobacco control policies that specifically targeted behaviors of lower-educated groups. Ultimately, higher levels of educational attainment were found to be associated with higher health consciousness and potentially other wellness-promoting behaviors. Our study adds to the mounting literature regarding the relationship between education and health consciousness and can be used in public health education contexts within Canada targeted towards lower-educated groups.

We noted a higher prevalence of male than female smokers, despite the level of education. Ng et al. (2014) reported similar findings when a global general trend of smoking prevalence was found to be higher among men than women. Contrastingly, Kirkland et al. (2004) found the prevalence of smoking to be similar between men and women in Canada. This could be attributed to a range of factors such as increased smoking awareness to the public and increased access to education for women. It is also important to note the limitations of the studies mentioned above, as different methods were used for each and not all studies were conducted in Canada. The results from our study further the understanding between education and its impact on health consciousness highlighting the disparities in smoking between sex groups and can be used to support policies and programs regarding smoking and education within Canada.

When examining our study there were several limitations. One of which was the type of sample that was used within our demographic of age (35–44 y.o). Due to statistical power constraints, we did not randomly choose participants who completed the survey within the specified age range. Stratified random sampling survey participants from a larger pool of individuals would provide for more generalizable results and allow for effect sizes to be obtained from categories separately, showing between-group differences more effectively (Elfil & Negida, 2017). For example, within the secondary research question concerning the difference in smoking prevalence between males and females of various educational backgrounds, having multiple random groups would aid in explaining results and provide for more valid data.

Concerning data collection, the original survey of smoking in Canada was performed by means of a random number generation telephoning. This study design limitation impedes those without landlines to be contacted and possibly partake in the survey. Considering this implication, households without landline telephones are more prevalent among socio-economically disadvantaged groups which can skew the representativeness of results (Boland et al., 2006). The computer generation of random telephone numbers will tend to call more numbers that lead to fax, business, and invalid numbers as there are more of these numbers leading to increased time to achieve desirable survey completions thus increasing costs (Boland et al., 2006). To combat these limitations in the future, surveys pertaining to smoking should be administered online allowing for an increased time of completion, thus improving overall valid results and answers of participants.

The original database contains the collection of survey responses through ordinal Likert scale options. This limits variability of responses into an option a participant may not fully agree with when answering a specific question (Cooper, 2016). Collecting subjective data in a written questionnaire will allow for the participant to voice their true perception on whether they think smoking could cause a particular illness. Although, to have a large enough sample size the collection of variables and addressing of questions accurately affirms the use of Likert scale options as a benefit within this survey. However, providing participants with an optional space to voice their opinion along with their chosen option proves the aforementioned suggestion of conducting this survey online in the future. Overall, there are limitations within the study, however, there are solutions to implement when examining these variables in the future.

This database provides valuable information regarding the prevalence of smoking along with attitudes and behaviours of citizens within Canada; however, improvements could be made in terms of geographical coverage and by adding more variables that can measure health consciousness. For example, the survey only covered urban areas in Canada, leaving out many rural areas, and smaller towns. Measuring only urban areas could discard vital trends and outcomes to be discovered in rural Canada. For example, when discussing various smoking-related health outcomes, they may be more prevalent in rural Canada as health care availability is scarce in inhabited areas. A study that provided data on health status in rural areas found higher incidences of negative health outcomes in rural areas than in urban areas due to fewer health care amenities (Smith et al., 2008). Therefore, if our database included data from rural Canada and its respective health outcomes related to smoking, a possible healthcare disparity may have been identified similar to that of Smith et al., (2008) research. This would have brought attention to the Canadian healthcare system to improve rural healthcare. Thus, the study should implement data from both urban and rural Canada in the future.

Finally, adding more variables that can measure health consciousness can further aid in answering our research question. For example, a literature review revealed five major dimensions comprising the concept of health consciousness: engagement in health behaviors, psychological attention to one's health, health information seeking and usage, personal responsibility, and health motivation (Hong, 2009). Adding variables that incorporate these five dimensions such as hours of physical activity, number of doctor visits, and specific dietary habits within the database could further aid in measuring health consciousness.

Our overall findings provide valuable insights into the relationship between education and health consciousness in adults. This research can potentially facilitate the decision-making process of policymakers and other organizations when implementing public health education programs and demographics to target within the future.

REFERENCES

Arpey, N. C., Gaglioti, A. H., & Rosenbaum, M. E. (2017). How socioeconomic status affects patient perceptions of health care: a qualitative study. Journal of primary care & community health, 8(3), 169-175.

Boland, M., Sweeney, M. R., Scallan, E., Harrington, M., & Staines, A. (2006). Emerging advantages and drawbacks of telephone surveying in public health research in Ireland and the U.K. BMC public health, 6, 208. https://doi.org/10.1186/1471-2458-6-208

Canada, H. (2020, July 07). Government of Canada. Retrieved February 08, 2021, from https://www.canada.ca/en/health-canada/services/canadian-tobacco-nicotine-survey/2019-summary.html

Centers for Disease Control and Prevention (CDC). (2020, April 28). Health effects. Retrieved February 08, 2021, from https://www.cdc.gov/tobacco/basic_information/health_effects/index.htm#:~:text=Smoking%20causes%20cancer%2C%20heart%20disease,immune%20system%2C%20including%20rheumatoid%20arthritis

Chinwong, D., Mookmanee, N., Chongpornchai, J., & Chinwong, S. (2018). A Comparison of Gender Differences in Smoking Behaviors, Intention to Quit, and Nicotine Dependence among Thai University Students. Journal of addiction, 2018, 8081670. https://doi.org/10.1155/2018/8081670

Colton, D., & Covert, R. W. (2007). Designing and constructing instruments for social research and evaluation. John Wiley & Sons.

Cooper, I. D., & Johnson, T. P. (2016). How to use survey results. Journal of the Medical Library Association : JMLA, 104(2), 174–177. https://doi.org/10.3163/1536-5050.104.2.016

Croisant, S. A. P., Laz, T. H., Rahman, M., & Berenson, A. B. (2013). Gender differences in risk behaviors among high school youth. Global advances in health and medicine, 2(5), 16-22.

Denney, J. T., Rogers, R. G., Hummer, R. A., & Pampel, F. C. (2010). Education inequality in mortality: The age and gender specific mediating effects of cigarette smoking. Social science research, 39(4), 662–673. https://doi.org/10.1016/j.ssresearch.2010.02.007

Ekpu, V. U., & Brown, A. K. (2015). The economic impact of smoking and of reducing smoking prevalence: review of evidence. Tobacco use insights, 8, TUI-S15628.

Elfil, M., & Negida, A. (2017). Sampling methods in Clinical Research; an Educational Review. Emergency (Tehran, Iran), 5(1), e52.

Espinosa, A., & Kadić-Maglajlić, S. (2018). The Mediating Role of Health Consciousness in the Relation Between Emotional Intelligence and Health Behaviors. Frontiers in Psychology, 9. doi:10.3389/fpsyg.2018.02161

Giskes, K. (2005). Trends in smoking behaviour between 1985 and 2000 in nine European countries by education. Journal of Epidemiology & Community Health, 59(5), 395-401. doi:10.1136/jech.2004.025684

Hanspal, S., & Devasagayam, P. R. (2017). Impact of Consumers' Self-Image and Demographics on Preference for Healthy Labeled Foods. SAGE Open, 7(1), 215824401667732. doi:10.1177/2158244016677325

Hong, H. (2009). Scale development for measuring health consciousness: Re-conceptualization. that Matters to the Practice, 212.

Kim, K., Shin, H. R., & Nakama, H. (1994). Health Consciousness in Relation to Education in Korea—Focusing on seven preventable health risk factors. Asia Pacific Journal of Public Health, 7(1), 3-9. doi:10.1177/101053959400700101

Mishra, S., & Mishra, M. B. (2013). Tobacco: its historical, cultural, oral, and periodontal health association. Journal of International Society of Preventive & Community Dentistry, 3(1), 12.

Ng, M., Freeman, M. K., Fleming, T. D., Robinson, M., Dwyer-Lindgren, L., Thomson, B., Wollum, A., Sanman, E., Wulf, S., Lopez, A. D., Murray, C. J. L., & Gakidou, E. (2014). Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. JAMA, The Journal of the American Medical Association, 311(2), 183.

Pampel F. C. (2006). Global Patterns and Determinants of Sex Differences in Smoking. International journal of comparative sociology, 47(6), 466–487. https://doi.org/10.1177/0020715206070267

Pärna, K., Pürjer, M. L., Ringmets, I., & Tekkel, M. (2014). Educational differences in cigarette smoking among adult population in Estonia, 1990–2010: does the trend fit the model of tobacco epidemic?. BMC Public Health, 14(1), 1-8.

Rogers, R. G., & Crimmins, E. M. (Eds.). (2011). International handbook of adult mortality (Vol. 2). Springer Science & Business Media.

Short, S. E., Yang, Y. C., & Jenkins, T. M. (2013). Sex, gender, genetics, and health. American journal of public health, 103 Suppl 1(Suppl 1), S93–S101. https://doi.org/10.2105/AJPH.2013.301229

Smith, K. B., Humphreys, J. S., & Wilson, M. G. (2008). Addressing the health disadvantage of rural populations: how does epidemiological evidence inform rural health policies and research?. Australian journal of rural health, 16(2), 56-66.

Tomioka, K., Kurumatani, N., & Saeki, K. (2020). The Association Between Education and Smoking Prevalence, Independent of Occupation: A Nationally Representative Survey in Japan. Journal of Epidemiology, 30(3), 136-142. doi:10.2188/jea.je20180195

Trofor, A. C., Papadakis, S., Lotrean, L. M., Radu-Loghin, C., Eremia, M. Vardavas, C. I., & EUREST-PLUS consortium (2019). Knowledge of the health risks of smoking and impact of cigarette warning labels among tobacco users in six European countries: Findings from the EUREST-PLUS ITC Europe Surveys. Tobacco induced diseases, 16, A10. https://doi.org/10.18332/tid/99542

Zajacova, A., & Lawrence, E. M. (2018). The Relationship Between Education and Health: Reducing Disparities Through a Contextual Approach. Annual Review of Public Health, 39(1), 273-289. doi:10.1146/annurev-publhealth-031816-044628

Effects of Financial Obligations on Generalized Anxiety Symptoms in Female Adults during COVID-19

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INTRODUCTION

The COVID-19 pandemic has led to drastic lifestyle changes for Canadians. Public health measures such as provincial lockdowns and social distancing have been strictly enforced in order to mitigate the spread of the virus. Many people have been forced to work from home, non-essential businesses have largely shut down, and many working adults have experienced financial burdens and unemployment (Carroll et al., 2020). Although these measures are critical to ensure the health and safety of Canadians, they have had adverse effects on mental health illnesses including Generalized Anxiety Disorder (GAD) (Asmundson et al., 2020).

A study by Dozois and Mental Health Research Canada (2020) examined how Canadians were managing the pandemic and whether it had any impacts on one's level of anxiety and depression. A survey completed by 1803 participants found that the percentage of individuals who indicated 'high to extremely high' anxiety levels quadrupled (5% to 20%) compared to their self-reported anxiety levels prior to the pandemic (Dozois, 2020). They also found that self-reported depression more than doubled, from 4% to 10%, since the pandemic began (Dozois, 2020). A study by Amsundson et al. (2020) found that pre-existing anxiety disorders have played a role in the adverse effects of the pandemic on mental health. Researchers found that those diagnosed with an anxiety disorder prior to COVID-19 had significantly higher stress symptoms and were more negatively impacted by the pandemic, compared to those without a pre-existing diagnosis (Asmundson et al., 2020).

COVID-19 has had major economic and financial impacts on Canadians. A study by Beland et al. (2020) showed that in April 2020, unemployment rates increased by 8%, labour force participation decreased by 5%, and hours of work and wage both also decreased. COVID-19 was found to have an effect on labour outcomes for both males and females with no significant differences; however, there was a greater negative impact on work for women without kids than those with kids (Beland et al., 2020). Due to the pandemic, less educated, unmarried, and younger workers aged 15-34 were most affected financially, compared to their counterparts (Beland et al., 2020). A study by Carroll et al. (2020) surveyed 254 families to assess how health behaviours, stress levels, and financial and food security have all been affected by the pandemic. They found that about 19% of mothers and 14% of fathers experienced some form of financial stress. This number only increased when they were asked to think about the future; 22% of mothers and 18% of fathers were concerned about what their financial situation would be in 6 months' time (Carroll et al., 2020).

Economic impacts can also exacerbate mental health symptoms, including those of GAD. A study by Zajacova et al. (2020) cross-sectionally surveyed 4627 Canadian adults in March 2020 and 4600 in May 2020. They then correlated the mental health statuses with ongoing economic concerns and found that overall mental health significantly worsened from March to May. The magnitude of Canadian

adults who reported mental health in the categories of "good/fair/poor" grew from 46% in March to 52% in May, as opposed to "excellent" or "very good". Younger age, female gender, and economic consequences including essential needs such as food security, played a substantial role in "bad" mental health (Zajacova et al. 2020).

Females have been found to experience greater unemployment rates during the pandemic (Richardson & Denniss, 2020). A paper examining the differences between the experiences of men and women as a result of the pandemic has found that although the COVID-19 unemployment rates rose faster for men than for women, female participation rates had a significantly higher decrease (female participation in the workforce decreased by 2.9%, whereas male participation only decreased by 1.9%) (Richardson & Denniss, 2020). Females were also more likely to experience mental illness compared to men (Almeida et al., 2020). Due to school and daycare closures, parents, especially mothers, reported greater anxiety and depression due to limited financial resources and unemployment (Almeida et al., 2020). In an early study conducted on the psychological effects of COVID-19, it was established that women were at a higher risk for anxiety and depression, and suffered from a greater psychological impact and higher levels of stress than men (Wang et al., 2020). For these reasons, females were used as the target population for the study.

The aforementioned studies addressed the financial impact of COVID-19 on Canadian adults from a general mental health perspective, but have not yet addressed its effects on a specific mental health condition such as GAD; nor have they addressed the effects experienced by the working female population in particular. This paper will address whether there is a difference between GAD symptoms in Canadian females aged 30-49 who experienced major financial strain during COVID-19, compared to Canadian females ages 30-49 who experienced no financial strain during COVID-19. Understanding this relationship will help to address the knowledge gap and determine which populations may be disproportionately affected by COVID-19; it also has the potential to provide insight into the need for governmental financial and mental health services.

MATERIALS AND METHODS

Study Design and Database

The study design implemented was observational and cross-sectional. All variables were assessed at one point in time and the independent variable was not manipulated. The database entitled "Impacts of COVID-19 on Canadians-Mental Health, 2020: Crowdsource file" was provided through Statistics Canada and the Ontario Data Documentation, Extraction Service and Infrastructure (ODESI). The database was collected using crowdsourcing and did not contain any missing data. Crowdsourcing is a type of convenience sampling that collects information on a voluntary basis through an online questionnaire. According to the ODESI website, the questionnaires were delivered directly to participants and completed anonymously through the Statistics Canada website. Crowdsourcing was used as an efficient means of collecting data from willing participants and provided the opportunity for the entire Canadian population to participate (Statistics Canada, 2020). Canadians were encouraged to participate through the use of social media and external organizations such as government agencies, associations, and news channels. The database was designed to understand

the impact of the COVID-19 pandemic on Canadians' livelihood, mental health, and their ability to meet financial obligations (Statistics Canada, 2020). This will allow researchers to understand its impact on mental health and use this data as evidence to address both economic and health issues.

Study Participants

The original database included both sexes, aged 15 and older across Canada. However, the population included in the final database was targeted towards the specific demographic used to address the research question. A target population of females, aged 30-49 was chosen as females were found to be disproportionately impacted due to the pandemic, with a higher prevalence of mental illness and unemployment compared to males. Participants who responded with either "major" (i.e intervention group) or "no" (i.e. control group) self-reported financial strain were included in the study, and those who chose a different answer were excluded.

Study Outcomes

The primary study outcome assessed was the severity of GAD symptoms divided into five categories; no, minimal, mild, moderate and severe symptoms; this was chosen because anxiety is a relevant topic amidst the ongoing COVID-19 pandemic. The severity of symptoms was measured using a modified version of the Generalized Anxiety Disorder Assessment (GAD-7), which is a self-administered patient questionnaire developed by Spitzer et al. (2006). The survey has been validated in 2740 patients with a sensitivity of 89% and a specificity of 82%. The survey directly asks participants how often they have been bothered by the following problems in the past two weeks: "feeling nervous, anxious or on edge"; "not being able to stop or control worrying"; "worrying too much about different things"; "trouble relaxing, being so restless that it's hard to sit still"; "easily annoyed or irritable"; and "feeling afraid as if something awful might happen" (Spitzer et al., 2006). The options provided for all 7 questions included: "not at all", "several days", "more than half the days", and "nearly every day".

Additional Data Collection

Additional data and variables assessed include age, gender and financial strain/stress during the pandemic, described in Table 1. Gender and age were used to define the population of interest. Age was a categorical, ordinal variable stratified into intervals of 5 years such as 30-34, 35-39 etc., up until the age of 49. Gender was considered to be a categorical and nominal variable which includes the number of female participants in this study. Level of financial stress was defined as a categorical, nominal and independent variable used to assess differences in mental health outcomes (i.e severity of anxiety symptoms).

Statistical Analysis

Differences between groups were assessed using a chi-square ($\chi 2$) test as our database consisted entirely of categorical variables. This is also why a normality test could not be performed. As previously mentioned, the severity of GAD symptoms were classified into five categories and represent ordinal categorical variables. A chi-square test for a 2x5 contingency table was transformed into a 2x2 table as it was not possible to determine which proportions were different, or similar, with one chi-squared significance value for the entire table. Therefore, GAD symptoms were transformed from five to two

categories; no, minimal, and mild symptoms were grouped into a category labelled "no/few symptoms", and moderate and severe symptoms were categorized as "moderate or more symptoms".

The characteristics of the population examined in this study are described in Table 1. This table includes the frequency and percentage of female participants aged 30-49 (n=9715) who experienced one of the following five GAD symptoms: "no", "minimal", "mild", "moderate", or "severe", and the severity of financial impact of these participants during the COVID-19 pandemic (i.e major or no financial impact). The analysis was conducted using SPSS Statistics and the figure was created using Microsoft Excel. A p value of <0.05 was used to measure significance between groups. This indicates a 5% probability that the null hypothesis is true.

RESULTS

45989 participants voluntarily completed the Impacts of COVID-19 on Canadians online survey, but after narrowing down the population based on the exclusion criteria, only 9715 participants were included in this analysis. There was no missing data for any of the participants that were included.

Table I. Characteristics of Canadian Female Participants (aged 30-49) Assessing Impacts of Financial Stress on Generalized Anxiety Symptoms during COVID-19 (N=9715)

Variable	Major Financial Impact (n = 1817)	No Financial Impact (n = 7898)
Age group at time of survey (years)		
30 to 34	429(23.6)	1898(24.0)
35 to 39	517(28.5)	2250(28.5)
40 to 44	479(26.4)	2063(26.1)
45 to 49	392(21.6)	1687(21.4)
Severity of Generalized Anxiety Symptoms		
No/Few Symptoms	831(45.7)	5890(74.6)
No symptoms	46(2.5)	524(6.6)
Minimal symptoms	226(12.4)	2504(31.7)
Mild symptoms	559(30.8)	2862(36.2)
Moderate or More Symptoms	986(54.3)	2008(25.4)
Moderate symptoms	418(23.0)	1268(16.1)
Severe symptoms	568(31.3)	740(9.4)

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

As seen in Table I, there were a total of 1817 participants in the “major financial impact” group and 7898 participants in the “no financial impact” group. There was a similar distribution of age within each of the two financial impact conditions and between the two conditions as well. There was a larger difference in distribution between the different GAD symptom groups, both within the same financial impact group and between the two financial impact groups.

Referring to Table I, 986 (54.3%) of the women who experienced major financial impacts were found to have moderate or more symptoms of GAD, while the other 831 (45.7%) of women had no/few GAD symptoms. On the other hand, those who experienced no financial impact were less likely to show moderate or more anxiety symptoms, as 5890 (74.6%) of those who experienced no financial impacts had no/few GAD symptoms and only 2008 (25.4%) of women with no financial impact experienced moderate or more GAD symptoms.

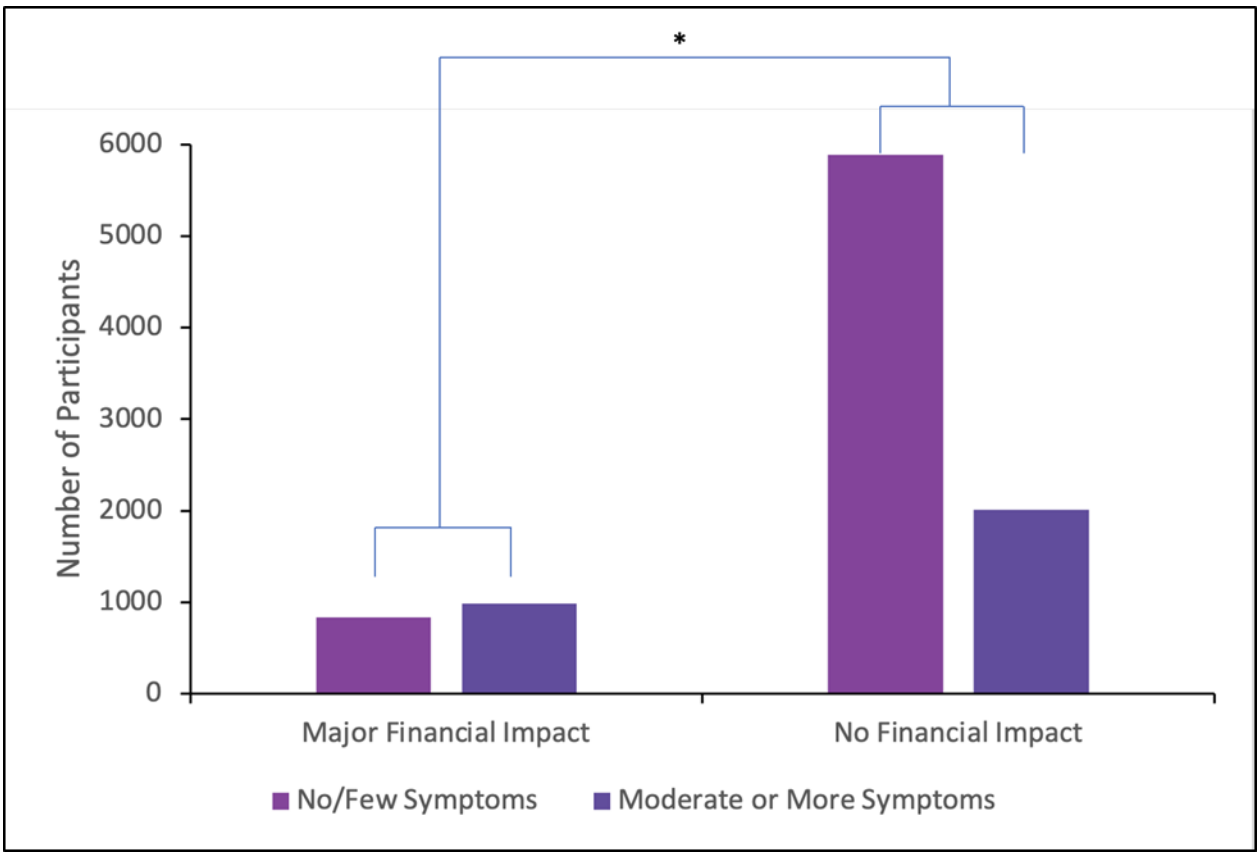

Figure 1. Severity of anxiety symptoms in female Canadian participants who experienced major or no financial impact. $X2 = 574.95$, (df=1), $p < 0.001$. Note: *$p<0.05$. N=9715.

Figure 1 displays the difference in anxiety symptoms between the major financial impact group and the no financial impact group. There was a significant difference in the anxiety symptoms between the major and no impact financial groups as indicated by the asterisk. Looking at the continuity correction of the asymptotic significance (2-sided), the p-value was <0.001, which was deemed significant as it was less than 0.05.

DISCUSSION

The aim of this investigation was to examine whether the severity of GAD symptoms was related to financial impacts amongst Canadian women aged 30-49 during the early stages of the COVID-19 pandemic. Our results show that there is in fact a significant difference in GAD symptom levels between women who experienced major financial strain compared to the women who did not experience any financial strain during the pandemic. The results demonstrate that those who experienced a major financial impact were more likely to experience higher levels of GAD. This correlation is largely supported through external literature; however, some external literature chose to focus on different populations than those examined in the present study. Overall, our study contributes to previous literature by focusing on the specificity of GAD symptoms among Canadian women aged 30-49.

Few studies have looked at the relationship between the impacts that COVID-19 has on GAD symptoms and financial strain, but in comparing the results obtained in this study to those conducted in similar experiments, the findings appear to be supported. One particular study looked at the effects that COVID-19 had on an individual's financial strain and their GAD symptoms (Nelson et al., 2020). They found that loss of employment was positively correlated with greater COVID-19 concern, greater depressive symptoms, and greater anxiety symptoms (Nelson et al., 2020). This supports what was seen in the present study, as those with major financial impacts experienced greater GAD symptoms compared to those with no financial impacts. The study by Nelson et al. (2020) was limited by a lack of non-white and middle aged individuals; however, the present study focused on those typically considered "middle aged."

In an American study by Wilson et al. (2020), participants took part in a survey similar to the one in the present study where the GAD-7 test was also used to assess for anxiety symptoms, in addition to questions pertaining to job insecurity and financial concern (Wilson et al., 2020). The results showed that a greater level of job insecurity and financial concern corresponded with greater depressive and anxiety symptoms, which supports the present study (Wilson et al., 2020). Additionally, Wilson et al. (2020) examined participants longitudinally, something the present study did not do and is limited by. This study also examined residents of the United States while the present study examined residents of Canada.

A study by Solomou & Constantinidou (2020) surveyed the general population of Cyprus which aimed to comprehend the psychosocial effects of the pandemic including a measure of mental health through the GAD-7 score similar to our present study. The majority of the participants were female and almost half indicated significant financial concerns. 41% of the respondents reported mild anxiety symptoms and 23.1% of the respondents reported severe anxiety symptoms (Solomou & Constantinidou, 2020). They concluded that women aged 19-29 were at the highest risk for developing both anxiety and depressive symptoms, compared to men (Solomou & Constantinidou, 2020). This is consistent with our rationale for choosing women as our population of focus; however, the age group was younger than what the present study examined. Although the study assessed psychosocial effects in residents of Cyprus, the Cyprus government enforced similar lockdown restrictions to those in Canada.

There are also several limitations to the study. Firstly, GAD diagnoses were self-reported as opposed to being obtained through clinical evaluation. There is also a high level of comorbidity between anxiety and mood-related disorders such as depression (Huppert, 2008); therefore, there is the possibility that a participant may be self-reporting symptoms of a mood disorder instead, or suffering from both illnesses. This confounding variable may decrease the significant difference between the two groups if it was not properly accounted for. Another limitation is that the study was cross-sectional and it was not a prospective cohort study, and the researchers did not follow the group over an extended period of time. Therefore, it is unclear if these symptoms or financial strains would have increased or decreased as the pandemic progressed. Considering that the survey data was obtained between April 24 and May 11, 2020, this information may have changed over time had the data been collected at a different time point or at multiple time points. Crowdsourcing in and of itself is also a method that comes with its own set of limitations. Online recruitment can lead to the underrepresentation of certain groups such as racial and ethnic minorities, those from lower socioeconomic status, as well as older adults. There is also a possibility of volunteer bias, which is the idea that participants who are likely to volunteer to participate do not represent the population as a whole; this could also result in a sampling bias that could limit the generalizability of the findings.

The COVID-19 pandemic has resulted in a global health crisis and posed unprecedented threats to the financial security of Canadians across the country. In the face of nation-wide lockdowns and business closures, the crisis has led to an abrupt drop in employment, income, and savings for individuals and businesses across the country. In terms of future directions, researchers should perform a longitudinal study to assess how mental health and financial stress change over time during the ongoing pandemic. Mental health may have improved with time, or worsened with the prolonged restrictions and closing of businesses. This research could be used to better understand the long term effects of the pandemic on GAD symptoms of those who have been financially impacted. Additionally, future research could target specific racial or socioeconomic populations. The present study looked at a general population of women aged 30-49; however, the pandemic may have impacted marginalized groups disproportionately and this was not assessed.

In response to the pandemic, various measures have been implemented by the federal and provincial governments in order to mitigate financial strain. The Canadian government has financially invested in emergency benefits to alleviate the financial burdens from COVID-19, covering employment and caregiving benefits and wage subsidies. The creation of more employment opportunities for middle-aged female workers and reopening daycare facilities may help to stimulate female employment and reduce financial stresses. In addition to providing adequate financial benefits, access to proper mental health resources should be implemented through collaboration between government agencies, public health professionals, community health workers, and mental health organizations. Greater access to these resources may mitigate the disproportionate impact of the pandemic among women aged 30-49. In addition, there should be greater promotion and education of mental health resources targeted towards this demographic in order to break the possible stigma associated with seeking help in a mental health context. Workplace posters, as well as school/daycare emails, may be effective ways to do this, as it is likely that our population may have school and daycare-aged children. All of

these resources function to mitigate the financial strains placed on Canadian middle aged women during the pandemic.

REFERENCES

Almeida, M., Shrestha, A. D., Stojanac, D., & Miller, L. J. (2020). The impact of the COVID-19 pandemic on women's mental health. Archives of Women's Mental Health, 23(6), 741-748. doi:10.1007/s00737-020-01092-2

Asmundson, G. J., Paluszek, M. M., Landry, C. A., Rachor, G. S., McKay, D., & Taylor, S. (2020). Do pre-existing Anxiety-related and mood Disorders differentially impact COVID-19 stress responses and coping? Journal of Anxiety Disorders, 74, 102271. doi:10.1016/j.janxdis.2020.102271

Beland, L., Brodeur, A., Mikola, D., & Wright, T. (2020). The Short-Term Economic Consequences of COVID-19: Occupation Tasks and Mental Health in Canada. IZA Institute of Labour Economics Discussion Paper Series.

Carroll, N., Sadowski, A., Laila, A., Hruska, V., Nixon, M., Ma, D. W., & Haines, J. (2020). The impact of covid-19 on health Behavior, STRESS, financial and food security among middle to high Income Canadian families with young children. Nutrients, 12(8), 2352. doi:10.3390/nu12082352

Dozois, D. J. (2020). Anxiety and depression in Canada during the Covid-19 pandemic: A national survey. Canadian Psychology/Psychologie Canadienne. doi:10.1037/cap0000251

Huppert, J. D. (2008). Anxiety disorders and depression comorbidity. Oxford Handbooks Online. doi:10.1093/oxfordhb/9780195307030.013.0044

Nelson, B.W., Pettitt, A., Flannery, J.E., Allen, N.B. (2020) Rapid assessment of psychological and epidemiological correlates of COVID-19 concern, financial strain, and health related behaviour change in a large online sample. PLoS ONE, 15(11): e0241990. doi: 10.1371/journal.pone.024199

Richardson, D., & Denniss, R. (2020). Gender experiences during the COVID-19 lockdown. The Australia Institute.

Solomou, I., & Constantinidou, F. (2020). Prevalence and predictors of anxiety and depression symptoms during the Covid-19 pandemic and With Precautionary measures: Age and sex matter. International Journal of Encompliancevironmental Research and Public Health, 17(14), 4924. doi:10.3390/ijerph17144924

Spitzer RL., Kroenke K., Williams JB., Löwe B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med, 166(10):1092–1097. doi: 10.1001/archinte.166.10.1092.

Statistics Canada. (2020). Impacts of COVID-19 on Canadians-Mental Health, 2020: Crowdsource file. Ontario Data Documentation, Extraction Service and Infrastructure (ODESI).Retrievedfrom http://odesi2.scholarsportal.info.libaccess.lib.mcmaster.ca/webview/

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., & Ho, R. C. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 Coronavirus Disease (covid-19) epidemic among the general population in China. International Journal of Environmental Research and Public Health, 17(5), 1729. doi:10.3390/ijerph17051729

Wilson, J.M., Lee, J., Fitzgerald, H.N., Oosterhoff, B., Sevi, B., Shook, N.J. (2020) Job Insecurity and Financial Concern During the COVID-19 Pandemic Are Associated With Worse Mental Health. Journal of Occupational and Environmental Medicine, 62(9):686-691. doi: 10.1097/JOM.0000000000001962

Zajacova, A., Jehn, A., Stackhouse, M., Choi, K. H., Denice, P., Haan, M., & Ramos, H. (2020). Mental health and economic concerns from March to May during the COVID-19 pandemic in Canada: Insights from an analysis of Repeated Cross-sectional surveys. SSM - Population Health, 12, 100704. doi:10.1016/j.ssmph.2020.100704

Investigating the Association Between the Psychological Well-Being and Active Commuting by Walking in Canadian Individuals Aged 15-29 Years Old

Authors: Muhammad Mustafa Azhar, Saadiya Pathan, Haoyang Wang, Lu Qiao

INTRODUCTION

Given the surging COVID-19 cases globally, many countries have implemented stringent measures such as self-isolation and lockdown to contain the disease's spread. These rigorous methods can effectively mitigate the transmission. However, they can negatively affect individuals' psychological well-being and lifestyle. A systematic review article by Stockwell et al. (2021) found that individuals' physical activity levels have drastically declined due to the COVID-19 pandemic. The COVID-19 pandemic has impacted individuals' mental health across all populations. Young adults aged from 15-24 years old were the least likely amongst all age groups to report good or excellent mental health before the pandemic (Statistics Canada, 2020). This group reported the most significant decline in mental health (from 60% to 40%) during the pandemic, making them a vulnerable population (Statistics Canada, 2020). This study examined the relationship between active commuting and mental health among this population before the COVID-19 pandemic. Based on the results of this article, other researchers could further investigate the impact of COVID-19 on active commuting and individuals' psychological well-being.

Over the years, researchers have investigated the association between active commuting and psychological well-being. Zijlema et al. (2018) concluded that commuting in the natural environment can benefit mental health. However, there was no significant correlation between mental health and active commuting itself. Sun et al. (2015) researched Chinese students from grade 4 to grade 12 (approximately 9 years old to 18 years old) to investigate the relationship between mental health and active commuting. This study showed that active commuting to school could promote mental well-being, as students reported fewer depressive symptoms than those who do not actively commute (Sun et al., 2015). As psychological well-being is a broad category, it is critical to consider the impacts of stress on mental health. Studies have shown that stress and mental health were closely related. Bovier et al. (2004) found that increased self-perceived stress was strongly related to poor mental health.

The primary aim of this study was to examine the association between the psychological well-being in the past month of individuals aged 15 to 29 years old who actively commuted by walking to school, work, or while running errands (in the past three months) and individuals of the same age who did not actively commute. Since Zijlema et al. (2018) claimed that there was no substantial evidence to prove that active commuting can improve mental health except in natural environments, this study aimed to re-examine this relationship and focus on active commuting that is not specific to natural environments. Therefore, this study addressed active commuting to work, school, and any other destination through natural and urban settings alike as there are several routes to take. Sun et al. (2015) investigated the impacts of active commuting on mental health in the Chinese population aged from 9 to 18 years old. This article was the first research that examined these effects on the Canadian

population aged 15 to 29 years old. There were limited amounts of studies that precisely assess this age group.

The secondary aim of this research was to determine if there is a relationship between the number of hours spent actively commuting by walking to school, work, or while running errands (in the past three months) and overall self-perceived stress in individuals aged 15 to 29 years old, as stress is significantly correlated with mental health.

MATERIALS AND METHODS

Study Design and Database

The Canadian Community Health Survey (CCHS) conducted a survey to gather data on the health status, health care use, and health determinants of participants between May 2002 and December 2002 in ten Canadian provinces. The prevalence rates for certain mental disorders were determined. Additional information included socio-demographic information, occupation, stress level, marital status, and sex. This survey was completed to investigate the impact that these illnesses cause. The survey was observational and cross-sectional.

Study Participants

The study participants were young individuals aged 15 to 29 years old in ten provinces in Canada, including British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island. Individuals living in three territories, Indian Reserves, Crown Lands, the residents of institutions and certain remote regions, and the full-time Canadian Armed Forces members were excluded. This study selected the 15 to 29 age group to minimize the impact of the confounding factors such as vulnerability and higher chances of physical activity of younger individuals (e.g. below 15 years old).

Study Outcomes

The primary outcome of this study was the psychological well-being of participants (15-29 years old) in the past month in relation to whether they actively commuted or did not actively commute by walking. The psychological well-being was presented as a continuous scale in the data set, with responses ranging from 3-100 on the scale. The survey results did not outline how the data for the psychological well-being scale was obtained. During the COVID-19 pandemic, the percentage of actively commuting Canadians has dropped from 7% to 5% (Turcotte & Savage, 2020). It is likely that the majority of these Canadians fall between the ages of 15 and 29 years old. As active commuting reduces amongst this population, it is crucial to analyze the psychological impact of this change. Understanding the relationship between active commuting by walking and self-perceived psychological well-being can be used to promote good mental health amongst this population during the pandemic.

The secondary outcome of this study was the participants' self-perceived stress level in the overall lives with the number of hours they spent actively commuting by walking in the past three months. To obtain the data on this variable, the participants were asked, "Thinking about the amount of stress

in your life, would you say that most days are: (not at all stressful, not very stressful, a bit stressful, quite a bit stressful, extremely stressful)?". Self-perceived stress can be used to define one aspect of psychological well-being, which helped to identify the association between stress and psychological well-being as well as active commuting.

Additional Data Collection

Other variables used in our dataset to define the sample population include the province in which the participants lived, their age, sex, marital status, occupation, and the total number of hours spent walking to work/school in the past three months. The total_hours_walking variable was the independent variable in this study. The participants' age was used to narrow down the sample population to those between the ages of 15 and 29.

Statistical Analysis

Table 1 summarized the descriptive characteristics of Canadians between the ages of 15 and 29 years old. The leftmost column of the table identified the variables used to describe the population, the dependent variables, and the number of responses for each variable. The marital status, province, and occupation variables were collapsed. The median and range of the number of participants that fall into the control and experimental groups were outlined for the dependent variables. The control group, participants who do not actively commute by walking, and the experimental group, those who actively commute by walking, were presented at the top of the table. The control group consisted of participants that reported spending no time actively commuting. The experimental group consisted of 5 categories that reported at least some active commuting by walking. The frequency and percentage described participants who fall into each category of the population characteristics. On the far right, the p-values for the dependent variables were indicated.

Since the dependent variable psychological well-being was continuous, a normality test was conducted, as multiple statistical tests require and assume that data is normally distributed. However, the primary dependent variable (psychological well-being) was not normally distributed, and the independent variable (commuted or did not commute) was a dichotomous categorical variable. A correlation analysis could not be conducted. Therefore, the Mann-Whitney U test was used to compare the psychological well-being medians between those who commute by walking and those who do not commute. Chi-Squared tests were used to compare the proportions of participants that fell into the different categories of self-perceived stress and commuted by walking or did not commute by walking. Lastly, a Spearman's Rho test was conducted to assess the correlation between self-perceived stress and the number of hours spent actively commuting. The IBM SPSS Statistics 27.0 software was used to run these tests. A p-value of 0.05 was used to demonstrate significance in all tests conducted, indicating the confidence that the possibility of the difference between two groups occurred by chance is less than 5%.

RESULTS

Table 1. Descriptive characteristics of Canadians aged 15-29 years old (N=8215).

	Does not commute (N=2030)	Commute (N=6185)					
Population characteristics	None	Less than 1 hour	1 to 5 hours	6-10 hours	11-20 hours	More than 20 hours	P-value
Age (N=8215)	N=2030	N=1143	N=2612	N=989	N=503	N=931	
15-19 years	591 (29.1)	462 (40.2)	975 (37.3)	355 (35.9)	190 (37.8)	291 (31.3)	
20-24 years	771 (35.0)	351 (30.7)	848 (32.5)	366 (37.0)	184 (36.6)	344 (36.9)	
25-29 years	728 (35.9)	330 (28.9)	789 (30.2)	268 (27.1)	129 (25.6)	296 (31.8)	
Sex (N=8215)	N=2030	N=1143	N=2612	N=989	N=503	N=931	
Male	1043 (51.4)	536 (46.9)	1124 (43.0)	425 (43.0)	222 (44.1)	457 (49.1)	
Female	987 (48.6)	607 (53.1)	1148 (57.0)	564 (57.0)	281 (55.9)	474 (50.9)	
Marital Status (N=8202)[1,5]	N=2025	N=1141	N=2608	N=989	N=503	N=930	
Province (N=8215)[5]	N= 2030	N= 1143	N= 2612	N= 989	N=503	N=931	
Occupation (N=6935)[2,5]	N=1742	N=955	N=448	N=837	N=412	N=821	
Dependent Variables							
Self-Perceived Stress (N=8215)	N=2030	N=1143	N=2612	N=989	N=503	N=193	
Not at all	237 (11.7)	98 (8.6)	223 (8.5)	103 (10.4)	46 (9.1)	84 (9.0)	
Not very	525 (25.9)	328 (28.7)	735 (28.1)	256 (25.9)	132 (26.2)	249 (26.7)	0.004*
A bit	862 (42.5)	488 (42.7)	1166 (44.6)	431 (43.6)	226 (44.9)	402 (43.2)	
Quite a bit	346 (17.0)	206 (18.0)	427 (16.3)	180 (18.2)	86 (17.1)	159 (17.1)	

Extremely	60 (3.0)	23 (2.0)	61 (2.3)	19 (1.9)	13 (2.6)	37 (4.0)	
Psych Well-being Scale (N=8164)[3]	N=2016	N=1134	N=2598	N=985	N=500	N=925	
Median	82	79	79	81	82	82	
Interquartile Range	88 (12-100)	84 (16-100)	87 (13-100)	73 (27-100)	67 (32-100)	68 (32-100)	<0.001*[4]

The data for the Age, Sex, Marital Status, Province, Occupation, and Self-Perceived Stress is represented as a number (percentages). The numbers in the bracket for the interquartile range is the range.

[1]This variable contains missing values. [2]This variable contains missing values. [3]This variable contains missing values. [4]The p-value is for the commuting group and the non-commuting group. All of the commute groups are combined into one variable for this p-value. [5]These variables were collapsed.

The sample population used for this analysis was narrowed down to individuals between the ages of 15 and 29 years old and consisted of 8215 participants. The original Canadian Community Health Survey of 2002 had a total of 36984 participants. The sample size used was 0.22% of the original database population. The sample population was defined by the province where the participants lived, their age, sex, marital status, and occupation. The normality test for the psychological well-being scale showed that the data was left-skewed (skewness value = -0.772). There were deviations from the expected values on the Q-Q plot and a large number of outliers on the box plot. Since the sample size was larger than 2000, a Kolmogorov-Smirnov test was conducted to investigate this variable's normality. The results indicated a p-value less than 0.001, which concluded that psychological well-being was not normally distributed. In the Mann-Whitney U test, the null hypothesis was that the medians of the psychological well-being scale in the past month were the same in participants who commuted by walking and participants who did not. This null hypothesis was rejected with a significance level of less than 0.001. The p-value was smaller than 0.05, which suggested that the medians of the psychological well-being scale in the past month were different in participants who commuted by walking and participants who did not. Figure 1.0 showed that the median of the psychological well-being scale in the Non-commuting group was higher than in the actively commuting group.

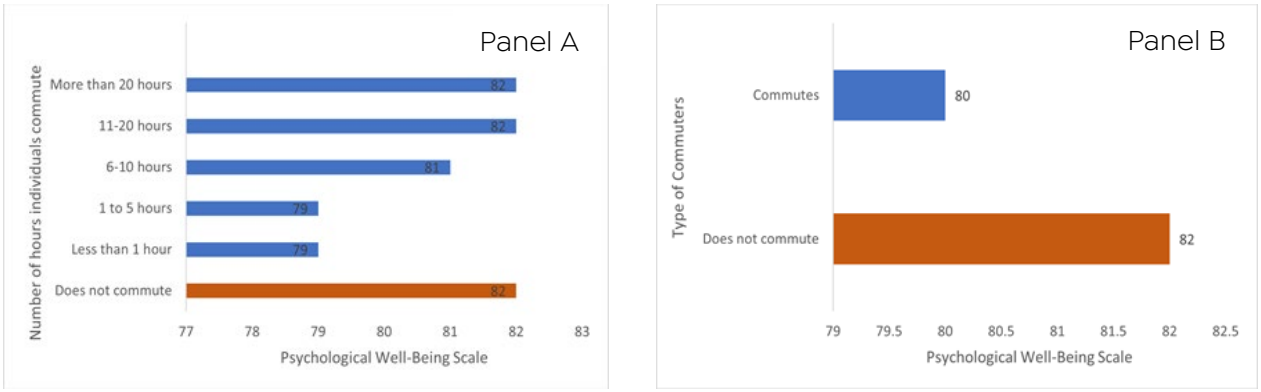

Figure 1. Panel A: Comparison of the psychological well-being scale responses among commuting groups in the past month. The x-axis represents the median of the psychological well-being scale responses. The y-axis represents the number of hours individuals spent commuting. **Panel B: Comparison of the psychological well-being scale responses between active commuters and non-active commuters in the past month.** The x-axis represents the median of the psychological well-being scale responses. The y-axis represents the type of commuters; those who commute and those who do not commute.

In the first Chi-square test, the control group consisted of individuals who did not commute by walking, and the experimental groups consisted of individuals who commuted by walking. The null hypothesis for the chi-square test was that there is no difference between these two groups. The degrees of freedom for the Chi-Square Tests was 4. The Chi-square value was 15.192. The Pearson Chi-square significance value was 0.04, which was smaller than 0.05, indicating that the proportions were significantly different between groups. This significant value applies to the entire table. It cannot be concluded which proportions are different or similar. The second Chi-square table contained a dichotomous variable with the categories No stress and At least some stress. No cells in the table had an expected count less than 5. The continuity correction significance value was less than 0.001, which was smaller than 0.05, indicating that the proportions were significantly different between groups. The degree of Freedom was 1, and the Chi-square value was 12.663.

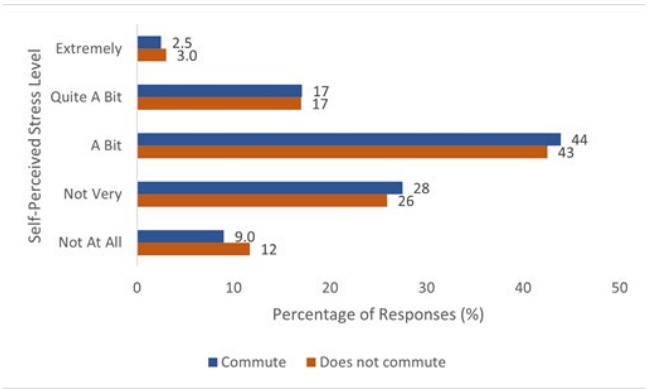

Figure 2. The percentage of responses obtained for the self-perceived stress level. The x-axis represents the percentage of responses. The y-axis represents the type of response individuals chose for their self-perceived stress level.

According to Figure 2.0, 237/2030 (12%) participants who did not commute actively by walking and 554/6185 (9%) participants who commuted by walking had no stress at all. 1793/2030 (88%) participants who did not commute actively and 5631/6185 (91%) participants who actively commuted by walking stated self-perceived stress. 44% of the commuters, which was the largest group, reported a bit of stress. The spearman's rho value was 0.015, with a p-value of 0.187. This indicated no correlation between self-perceived stress and the number of hours spent actively commuting.

DISCUSSION

This analysis was unable to identify an association between psychological well-being and active commuting by walking. However, there was a difference in the medians of the psychological well-being scale in the past month between participants who commuted by walking and participants who did not. Notably, the statistical analysis showed that the median psychological well-being of those who did not actively commute by walking was significantly higher than those who actively commuted by walking. This result might be due to significant differences in the sample size of the control group and the experimental group. There were nearly three times as many participants who actively commuted by walking as participants who did not actively commute by walking.

The main findings of our study contributed to two previous studies by Martin et al. (2014) and Humphreys et al. (2013), which examined the association between active commuting and psychological well-being. Martin et al. (2014) found a positive association between people who walk to their destinations and their psychological well-being. The researchers concluded that physical activities, including actively commuting (i.e. walking), can improve a person's mental health. An in-group difference in psychological well-being supported a potential positive association between actively commuting by walking and psychological well-being. One major limitation in this research is that there were only a few active commuters among the participants despite having a significant sample size. This could lead to a sampling bias. Due to a similar limitation in this study, the results of our study were inconclusive in determining whether active commuting by walking benefits the participants' psychological well-being. Humphreys et al. (2013) discovered that there was no significant relationship between the two variables. Despite these results, our study assumed that there would be a relationship between active commuting and mental health during the pandemic since COVID-19 has dramatically impacted individuals' lifestyles.

The second analysis for the stress levels indicated a significant difference in the proportion of participants who perceived no stress and those who perceived at least some stress in their lives, and participants who actively commuted by walking and those who did not. This analysis concluded that the proportion of participants who actively commuted by walking and had at least some stress was higher than those who did not actively commute by walking and had at least some stress. In both the control and experimental groups, there was a higher proportion of participants who perceived at least some stress compared to those that perceived no stress. This may be due to the grouping of the categories within the perceived stress level variable, making the variable dichotomous. The No stress category only consisted of the NOT AT ALL answer from the original data. Meanwhile, the At least some stress category contained the remaining four categories in the perceived stress level variable, including NOT VERY, A BIT, QUITE A BIT, and EXTREMELY. The Spearman's Rho test indicated no

correlation between self-perceived stress levels and the number of hours spent actively commuting by walking. Our analysis contributed to a recent study by Sattler et al. (2020), who discovered a small negative association between active commuting and self-perceived stress, meaning that those who actively commuted more perceived less stress. A downside of this study was sampling bias. The researchers selected a small sample size (n=188) since it was easier to perform analysis. This could result in incorrect or partial data, since a greater sampling size might be necessary to obtain precise findings. Our results reflected a similar trend with a high proportion of participants who commuted by walking with at least some stress. Despite this, our study found no association between the two variables. Contrary to this result, we would expect a negative association between stress level and active commuting, as individuals who actively commuted should be less stressed. Multiple studies have shown that physical activity such as active commuting can alleviate stress levels.

There were several limitations in our study. The confounding factors such as age, sex, occupation, participants' medical history and individual behaviours were not analyzed in this study. Occupation is associated with financial status, which may have an impact on psychological well-being and stress. Overall stress levels tend to be higher amongst females in comparison to males, and younger age groups are more vulnerable to stress (Brougham et al., 2009). It is crucial to minimize the impacts of these confounding variables, as participants' psychological well-being and stress levels could be affected by their gender and financial status. Although the sample population size was large (n=8215), the unequal size of participants in the experimental group (n=6186) and the control group (n=2030) might not be optimal as there was not a proper comparison between the two groups. Our results might not be accurate due to these differences. Using self-perceived stress and self-perceived psychological well-being could be subjective in evaluating individuals' mental health, although this is a common practice in the field. It would be beneficial to use medically approved mental health/illness questionnaires to assess variables such as psychological well-being for a more accurate response. Solely assessing walking to school or work might not accurately reflect individuals' active commuting level as there are other modes of transportation.

Future studies should collect more recent data on individuals' active commuting level, psychological well-being, and self-perceived stress to reconfirm this study's results. It is encouraged to develop advanced mental health/illness questionnaires to assess variables such as psychological well-being for a more accurate response. Researchers should further assess individuals' active commuting levels in multiple aspects, such as biking and running. If future data is normally distributed, it would be beneficial to determine the correlation between active commuting and psychological well-being through analyses, such as linear regressions. As COVID-19 is restricting individuals' physical activities including active commuting, prospective studies should investigate the relationship between people's mental health and limited active commuting during the pandemic. The association between the numbers of hours spent on commuting and psychological well-being, prior to and during the COVID-19 should be further researched. If active commuting was not prevalent during this time, it would be beneficial to study the association between outdoor recreational activities and psychological well-being. These studies can then inform policy makers in regards to COVID-19 lockdown restrictions as it may be beneficial to keep recreational centres open to increase physical activity amongst Canadians and in turn improve their mental health. It is crucial to research all aspects of Canadian's mental health

during the pandemic to ensure their best interest is considered when implementing federal laws regarding COVID-19 safety.

REFERENCES

Bovier, P. A., Chamot, E., & Perneger, T. V. (2004). Perceived stress, internal resources, and social support as determinants of mental health among young adult. Retrieved February 14, 2021, from https://journals-scholarsportal-info.libaccess.lib.mcmaster.ca/details/09629343/v13i0001/161_psirasomhaya.xml

Brougham, R. R., Zail, C. M., Mendoza, C. M., & Miller, J. R. (2009). Stress, sex differences, and coping Strategies among college students. Current Psychology, 28(2), 85-97. doi:10.1007/s12144-009-9047-0

DeVault, J. (1970, January 01). Active and restorative campus: Designing a garden street for student's mental and physical well-being. Retrieved February 03, 2021, from https://krex.k-state.edu/dspace/handle/2097/19238#?

Fluetsch, N., Levy, C., & Tallon, L. (2019). The relationship of physical activity to mental health: A 2015 behavioral risk factor surveillance system data analysis. Journal of Affective Disorders, 253, 96–101. https://doi.org/10.1016/j.jad.2019.04.086

Hamer, M., Stamatakis, E., & Steptoe, A. (2009). Dose-response relationship between physical activity and mental health: The Scottish Health Survey. British Journal of Sports Medicine. 43(14), 1111–1114. https://doi.org/10.1136/bjsm.2008.046243

Humphreys, David K., Anna Goodman, and David Ogilvie. (2013). Associations between Active Commuting and Physical and Mental Wellbeing. Preventive Medicine 57(2):135–39. doi: 10.1016/j.ypmed.2013.04.008.

Lukmanji, A., Williams, J., Bulloch, A., Dores, A., & Patten, S. (2020). The Association of ACTIVE living environments and mental Health: A Canadian Epidemiological Analysis. Retrieved February 02, 2021, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7142646/

Martin, A., Goryakin, Y., & Suhrcke, M. (2014). Does active commuting improve psychological wellbeing? Longitudinal evidence from eighteen waves of the British Household Panel Survey. Preventive Medicine. 69, 296–303. https://doi.org/10.1016/j.ypmed.2014.08.023

Sattler, M. C., Färber, T., Traußnig, K., Köberl, G., Paier, C., Dietz, P., & Van Poppel, M. N. (2020). Cross-sectional Association between ACTIVE commuting and perceived COMMUTING stress in austrian adults: Results from THE HOTWAY STUDY. Mental Health and Physical Activity, 19, 100356. doi:10.1016/j.mhpa.2020.100356

Statistics Canada. (2020, October 20). Impacts on mental health. Retrieved February 10, 2021, from https://www150.statcan.gc.ca/n1/pub/11-631-x/2020004/s3-eng.htm

Stockwell, S., Trott, M., Tully, M., Shin, J., Barnett, Y., Butler, L., McDermott, D., Schuch, F., & Smith, L. (2021). Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: A systematic review. BMJ Open Sport & Exercise Medicine, 7(1), e000960. https://doi.org/10.1136/bmjsem-2020-000960

Sun, Y., Liu, Y., & Tao, F.-B. (2015). Associations Between Active Commuting to School, Body Fat, and Mental Well-being: Population-Based, Cross-Sectional Study in China. Journal of Adolescent Health, 57(6), 679–685. https://doi.org/10.1016/j.jadohealth.2015.09.002

Turcotte, M., & Savage, K. (2020). Commuting to work during COVID-19. Retrieved April 09, 2021, from https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00069-eng.htm

Zijlema, W. L., Avila-Palencia, I., Triguero-Mas, M., Gidlow, C., Maas, J., Kruize, H., Andrusaityte, S., Grazuleviciene, R., & Nieuwenhuijsen, M. J. (2018). Active commuting through natural environments is associated with better mental health: Results from the PHENOTYPE project. Environment International, 121, 721–727. https://doi.org/10.1016/j.envint.2018.10.002

Mental Health Perceptions Associated with the COVID-19 Pandemic Amongst Canadians of Indigenous Identity or Minority Status Aged 30-49: An Observational Study

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INTRODUCTION

Recent data suggest that the COVID-19 pandemic is negatively affecting the mental health and wellbeing of millions around the world (Khan et al., 2020). Studies are reporting higher scores of depression and anxiety, as well as greater levels of stress amongst the general population relative to pre-pandemic conditions (Raihan et al., 2020). Researchers have identified factors such as fear of job loss, contracting the virus, and social isolation as indirect mediators of the relationship between the COVID-19 pandemic and poor mental health outcomes (Daly et al., 2021). In Canada, studies have documented alarming trends regarding the mental health outcomes associated with the COVID-19 pandemic. Data by the Angus Reid Institute (2020) revealed that 50% of Canadian adults reported a deterioration in their self-perceived mental health, and 43% believe that they have become more anxious since the onset of the pandemic.

Indigenous and minority groups, in particular, often suffer from relatively poor mental health outcomes. According to a report from Statistics Canada (2020) prior to the onset of the pandemic, all Indigenous groups were more than twice as likely to develop a mood or anxiety disorder relative to the general population. Such disparities in mental health outcomes are linked to intergenerational trauma, and associated with the increased prevalence of poverty and unemployment amongst Indigenous populations (King et al., 2009). Another survey by Ontario Health found that visible minorities self-reported elevated symptoms of depression and anxiety, as well as lower access to mental health services and social supports (Grace et al., 2016).

New studies are suggesting that the impacts of COVID-19 on mental health have been disproportionately felt by Indigenous populations and visible minorities. For example, Biddle et al., (2020) reported elevated levels of distress and nervousness amongst Australian adults of Indigenous identity relative to the general population. Studies from the US and the UK revealed that adults of visible minority status experienced elevated levels of mental distress, anxiousness, and suicidal ideation relative to non-minority adults since the onset of the COVID-19 pandemic (Centers for Disease Control and Prevention [CDC], 2021; Proto & Quintana-Domeque, 2021).

Similar findings were reported in Canada, where a study conducted in Quebec found that individuals of visible minority status experienced elevated levels of distress and anxiousness relative to non-minority individuals during the COVID-19 pandemic (Miconi et al., 2021). Despite the concerning disparities in mental health outcomes, such studies remain scarce within the Canadian context and contain several limitations. Miconi et al., (2021) highlighted the importance of conducting studies with larger sample sizes and a greater proportion of visible minorities. Such studies are also limited in scope due to their exclusion of Indigenous people, and narrow geographic criteria (e.g., Quebec residents

only). Studies also focus on specific age groups, such as those aged 18-24 or 65 and older (Mo et al., 2020), while neglecting others (e.g., those aged 30-49). Such limitations impede on the generalizability and accuracy of the findings.

Additionally, previous research has implicated community size as a determinant of mental health outcomes. A study conducted by Schweda et al., (2021) looked at the association between generalized anxiety as well as COVID-19 related fear and community size. The study findings highlighted a significant difference between smaller and larger communities for anxiety and COVID-19 related fear and also reported elevated COVID-19 fear among larger communities whereas smaller communities portrayed higher levels of anxiety (Schweda et al., 2021). However, the research investigating the association between community and metropolitan influence zones size and mental health during the Covid-19 pandemic is scarce and this relationship needs to be further investigated.

Our study addresses such knowledge gaps by investigating three research questions. Firstly, it examines the difference in perceived mental health (primary outcome) and feelings of nervousness and anxiousness (secondary outcome) assessed during the exposure i.e., COVID-19 pandemic among participants (population) that are Canadians of visible minority status and Indigenous identity aged 30-49 compared to the control group of non-visible minorities/non-Indigenous individuals aged 30-49 in Canada. Secondly, we aim to examine the difference in current self-perceptions of mental health compared to before the exposure of COVID-19 pandemic (outcome) amongst participants (population) that are Canadians of Indigenous identity or minority status aged 30-49 compared to the control group of Canadians of non-Indigenous and non-minority status aged 30-49. Lastly, our third research question addresses the association between community size and metropolitan influence zones and perceived mental health (outcome) during the exposure i.e., COVID-19 pandemic amongst participants (population) that are Canadians of Indigenous identity or visible minority status aged 30-49 compared to the control group of non-visible minority and non-Indigenous individuals aged 30-49. Findings from our study could potentially identify groups that are more vulnerable to the adverse psychosocial effects of the COVID-19 pandemic. This could subsequently aid in a more equitable allocation of resources in order to mitigate any poor mental health outcomes.

MATERIALS AND METHODS

Study Design and Database

The design of the study was observational and cross-sectional. The database was accessed through odesi and was designed using a crowdsourcing initiative that collects information through an online questionnaire (from April 24th to May 9th, 2020). The initiative invited Canadians to participate voluntarily to determine how they are responding to COVID-19, particularly in relation to their mental health. A study by Statistics Canada used the same database to report on the overall mental well-being of all Canadians during the COVID-19 pandemic. This data collection method was chosen to accommodate safety protocols and accelerate data collection in response to the urgent need for information to help the country respond to the COVID-19 impacts (Statistics Canada, 2020).

Inclusion and Exclusion Criteria

Initially, the database had about 46,000 participants. To prepare the database for our study, we excluded individuals who were missing data for all the variables employed in the study. Next, we included individuals satisfying our age requirement criteria (30-49 years old) while eliminating all other respondents. Our final database included 22,262 participants.

Study Outcomes

In research question one, our primary outcome is the difference in self-perceptions of mental health during the COVID-19 pandemic amongst Canadians of Indigenous identity or minority status aged 30-49 relative to non-minority and non-Indigenous Canadians of the same age group. Participants were asked to rank their mental health status by picking one of the five provided categories; "excellent", "very good", "good", "fair", and "poor". Our secondary outcome is to examine the difference in perceptions of nervousness and anxiousness assessed during the COVID-19 pandemic amongst Canadians of Indigenous identity or minority status aged 30-49 relative to non-Indigenous and non-visible minority Canadians of the same age group. To measure this outcome, participants were asked to report their levels of anxiousness and nervousness in the last two weeks prior to doing a survey by picking one of the following responses; "not at all", "several days", "more than half the days", and "nearly every day".

Our reported outcome for the second research question is the differences in current self-perceptions of mental health compared to before the COVID-19 pandemic amongst Canadians of Indigenous identity or minority status aged 30-49 relative to Canadians of non-Indigenous and non-minority status aged 30-49. Participants were asked to categorize their current perceived mental health status as compared to before the COVID-19 pandemic. Five response categories were provided for participants to select from; "excellent", "very good", "good", "fair", and "poor".

The outcome in our third research question is the potential correlation between community size and metropolitan influence zones with perceived mental health amongst Canadians of Indigneous identity or visible minority relative to Canadians of non-Inidgenous or non-visible minority aged 30-49. The participants were categorized in five categories based on the size of the community i.e. "non-CMACA", size range of "10,000 - 99,999", "100,000 - 499,999", "500,000 - 1,499,999" and "1,500,000 +".
Previous studies have demonstrated that self-reported measures can predict mental health outcomes to a considerable extent. Research by Ahmad et al., found that self-reported mental health (SRMH) correlated with clinically-utilized mental health scales (e.g., PHQ-9 and K6 screening scale) in a review spanning 57 studies, concluding that SRMH was reliable at gauging mental health status. Of relevance to our study, research has shown that there was a weaker correlation between SRMH and access to mental health services in minority relative to non-minority populations (Zuvekas & Fleishman, 2008), and that racial variations played a role in determining SRMH and DSM-IV psychiatric disorders (Kim et al., 2011; Kim et al., 2012).

Additional Data Collection

The additional data we collected included age, gender, and rural/urban indicator. These descriptive variables are included in table 1 and highlight the demographic characteristics of our sample

population. This helps us ensure that our database is representative of the general population, and provides a potential avenue to explore limitations or confounding variables that may be rooted in the descriptive characteristics.

Statistical Analysis

Statistical analysis was performed using SPSS version 27, and a significance level of 0.05 was set as a threshold to evaluate statistical significance in our result section. All data with one or more missing values for the dependent variables and extra variables were deleted. The categories for the three dependent variables were dichotomized using the "recode into different variables" option on SPSS. The practice of dichotomization is in-line with the protocols implemented by similar articles and is useful because it increases the interpretability and cohesion of our findings (Findlay et al., 2020). A Chi-square test was then employed to assess the between group differences of the descriptive variables among the different groups as reported in table 1. The same method was employed to report on the frequencies of dependent variables among the identity groups in figure 1. We created figure 1 using Microsoft Excel to address the primary and secondary research questions. Moreover, a spearman's rho test was performed to explore the correlation between community size and metropolitan influence zones and perceived mental health. We addressed the tertiary research question using the spearman's correlation coefficient and the sig. (2-tailed) value.

RESULTS

Table 1. Descriptive characteristics of the study population. Characteristics of the participants (aged 30-49) in the Statistics Canada Survey on the Impacts of COVID-19 on Canadians Mental Health, 2020. (N=22,262)

	Indigenous Identity Flag		Visible Minority Flag	
	Indigenous	Non-Indigenous	Visible minority	Not a visible minority
Age				
30-34 years old	197 (27%)	5,385 (25%)	681(30%)	4,901 (25%)
35-39 years old	204 (28%)	6,190 (29%)	687 (30%)	5,707 (29%)
40-44 years old	170 (23%)	5,437 (25%)	530 (23%)	5,077 (25%)
45-49 years old	156 (22%)	4,523 (21%)	385 (17%)	4,294 (21%)
Gender				
Male	118 (16%)	5,189 (24%)	771 (34%)	4,536 (23%)
Female	609 (84%)	16,346 (76%)	1,512 (66%)	15,443 (77%)
Rural/Urban Indicator				
Rural	163 (22%)	2,066 (10%)	29 (1%)	2,200 (11%)
Urban	564 (78%)	19,469 (90%)	2,254 (99%)	17,779 (89%)

Community Size & Metropolitan Influence Zones ***	99 (14%)	6,315 (29%)	1,260 (55%)	5,154 (26%)
1,500,000 +	187 (26%)	6,931 (32%)	725 (32%)	6,393 (32%)
500,000 - 1,499,999	155 (21%)	4,432 (21%)	218 (10%)	4,369 (22%)
100,000 - 499,999	123 (17%)	1,791 (8%)	51 (2%)	1,863 (9%)
10,000 - 99,999	163 (22%)	2,066 (10%)	29 (1%)	2,200 (11%)
Non-CMACA				

Note. Data are presented as the number (%) of individuals unless otherwise noted.
*** (P≤ 0.001)

We included 22,262 participants in our study and had 1,361 missing cases. According to table 1, a greater number of participants were females amongst the different identities and the majority belonged to urban areas. Also, we showed that two times more non-Indigenous participants reside in bigger communities compared to Indigenous participants. On the other hand, the number of visible minority participants living in larger communities was twice that of non-visible minority participants. There was also a significant difference in the community size in both Indigenous versus non-Indigenous participants and visible minority versus non-visible minority individuals.

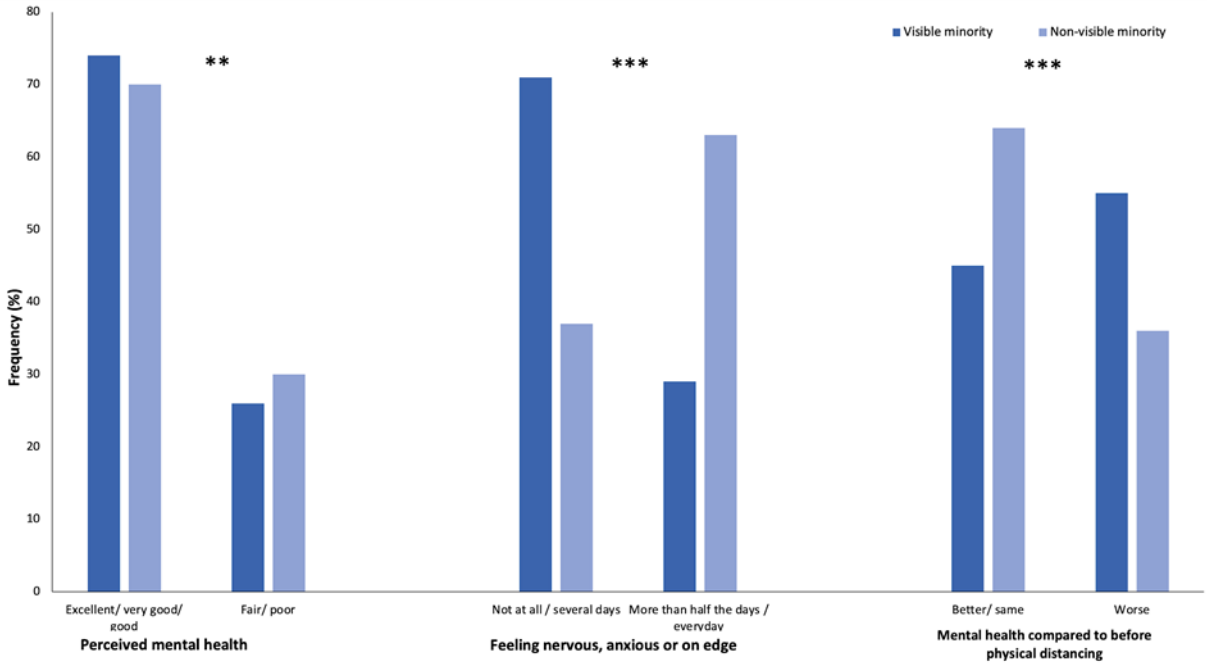

Figure 1A. Proportion of participants by mental health outcomes and specific population groups designated as visible/ not a visible minority. The percentage distribution of perceived mental health, mental health compared to before physical distancing, and feeling nervous, anxious or on edge among participants of visible minority and non-visible minority status.

Our results in figure 1A showed that 74 % of visible minority participants (1,679) and 70% of participants of non-visible minority status (14,170) self-reported excellent/ very good/ good mental health. Therefore, visible minority participants occupied a greater proportion of those who self-reported better mental health status. Additionally, 71% of the visible minority participants (1,615) and 64% of the non-visible minority participants (12,845) reported "not at all/ several days" for feelings of nervousness and anxiousness or on edge. This showed that visible minority participants tended to report less frequent feelings of nervousness and anxiousness. We also found that 63% of the non-visible minority participants (12,669) reported worse mental health compared to before physical distancing while 55% of the visible minority participants (1,264) reported worse mental health since physical distancing. Our results suggested that visible minority participants self-reported a lesser degree of deterioration of mental health deterioration of mental health since the start of physical distancing relative to non-visible minority participants. According to table 1A, there is a significant difference in perceived mental health (P value = 0.010), feelings of nervousness, anxiousness, or on edge (P value < 0.001), and mental health compared to before physical distancing (P value < 0.001) in participants of visible minority status relative to non-visible minority participants.

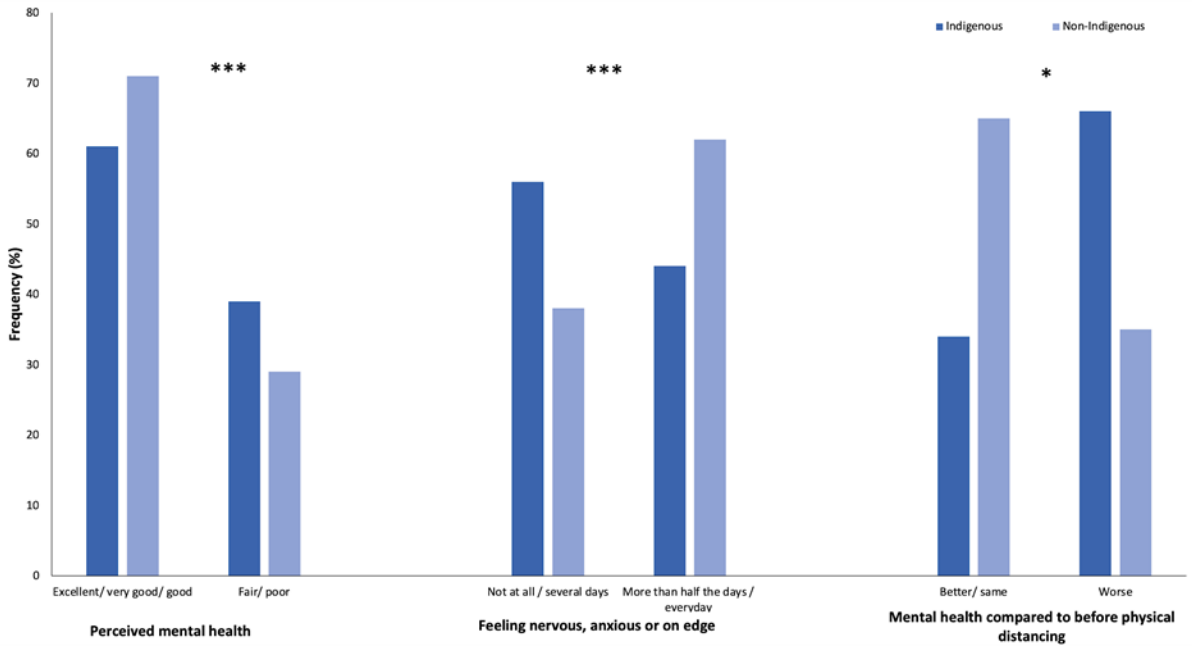

Figure 1B. Proportion of participants by mental health outcomes and specific population groups designated as Indigenous/ non-Indigenous. The percentage distribution of perceived mental health, mental health compared to before physical distancing, and feeling nervous, anxious or on edge among participants of Indigenous and non-Indigenous status.

Our results showed that 39% of Indigenous participants (281 individuals) and 29% of non-Indigenous participants (6,132 individuals) self-reported fair/ poor mental health. According to figure 1B, a higher proportion of Indigenous participants reported fair/ poor mental health compared to non-Indigenous participants. 44% of Indigenous participants (323 individuals) and 35% of non-Indigenous participants (7,479 individuals) reported feeling nervous, anxious, or on edge on more than half the days/ every day. Our results in figure 1B showed that Indigenous participants tended to report more frequent feelings of nervousness and anxiousness relative to non-Indigenous participants. 481 Indigenous participants (66%) and 13,452 non-Indigenous (62%) self-reported worse mental health compared to before physical distancing. We found that Indigenous participants self-reported a greater deterioration of mental health since the start of physical distancing relative to non-Indigenous individuals. According to table 1B, there is a significant difference in perceived mental health (P value < 0.001), feelings of nervousness, anxiousness (P value < 0.001) , or on edge, and mental health compared to before physical distancing in participants of visible minority status relative to non-visible minority participants (P value = 0.047).

Table 2. Relationship between community size and perceived mental health. Spearman's Rho analysis for the association between community size and metropolitan influence zones and perceived mental health among Canadians with respect to Indigenous identity or minority status.

	Control/Compare Groups		Perceived Mental Health
Community Size and Metropolitan Influence Zones	Visible Minority	Correlation Coefficient	-0.028
		Sig. (2-tailed) N	0.175
	Non-Visible Minority	Correlation Coefficient	0.020**
		Sig. (2-tailed) N	0.006
	Indigenous	Correlation Coefficient	-0.009
		Sig. (2-tailed) N	0.805
	Non-Indigenous	Correlation Coefficient	0.019
		Sig. (2-tailed) N	0.006

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

Table 2 results show that the correlation coefficient (r) is lower than the minimum association cut-off (r < 0.1) amongst all four identities. According to table 2, the relationship between community size and perceived mental health is extremely weak and almost doesn't exist.

DISCUSSION

Our results suggest that participants of Indigenous identity and non-visible minority self-reported worse mental health and more frequent feelings of nervousness and anxiousness. Secondly, we showed that Indigenous and non-visible minority participants reported a higher degree of deterioration of their mental health. We also showed that there was no association between community size and perceived mental health among the different identity groups.

Our findings on the discrepantly poor mental health outcomes and feelings of nervousness and anxiousness in Indigenous populations were substantiated by the literature. For example, in a comprehensive literature review spanning over 200 papers (2006-2016), Nelson and Wilson (2017) concluded that Indigenous populations experienced higher levels of mental health problems (e.g., emotional distress and suicide) relative to the general population. Our findings on the disproportionately negative mental health outcomes experienced by Indigenous populations relative to non-Indigenous populations during the COVID-19 pandemic are also mirrored by the literature. For example, a study by Arriagada et al., (2020) found that 38% of individuals of Indigenous identity reported fair/poor mental health relative to 23% of those reporting the same status amongst non-Indigenous individuals. Research studies have implicated factors such as intergenerational trauma, elevated levels of poverty, overcrowded housing, and limited access to mental health resources as possible explanations for these negative mental health outcomes (Nelson & Wilson, 2017).

Our findings on the disproportionately better mental health outcomes and feelings of nervousness and anxiousness amongst visible minorities were partially in-line with the literature. For example, research studies found that visible minorities self-reported better mental health compared to non-minority individuals, and they were less likely to be diagnosed with depression and anxiety based on the DSM-IV criteria (Islam et al., 2014; Stafford et al., 2011). However, research by Tiwari and Wang (2006) explained such discrepancies by concluding that visible minorities accessed mental health services significantly less than non-visible minorities, and therefore, were much less likely to be diagnosed. However, it is important to note that other literature has found the opposite relationship (Grace et al., 2016; McKnight-Eiley et al., 2020) and more research is needed before a conclusion can be drawn.

Our study also found that visible minorities experienced less of a deterioration in mental health as a result of the COVID-19 pandemic, which is in opposition to the current literature. For example, research by Moyser (2020) found that 27.8% of visible minority respondents reported experiencing poor mental health compared to 22.9% of non-visible minority individuals during the COVID-19 pandemic. The literature has attributed this discrepancy to the disproportionate impact by factors such as food shortages, loss of income and a rise in domestic violence (Jenkins et al., 2021; McKnight-Eily et al., 2020). However, it is important to note that much of the literature tends to focus on indirect correlational evidence as a means of predicting poor mental health outcomes, whereas our study directly measured self-reported mental health. This contrast in data interpretation and collection may have confounded the outcomes of previous studies, and thus explaining our discrepant findings.

Our study also found that there was no association between community size and mental health outcomes, and this finding was mirrored by the equally disparate literature. For example, a research

paper by Schweda et al., found that although self-reported anxiety was higher in smaller communities, COVID-19 related fear was higher in larger cities and metropolitan areas. Conversely Arriagada et al., (2020) found that roughly one-quarter of Indigenous individuals residing in larger cities experienced poor mental health outcomes, which were mainly related to issues revolving around financial insecurity (e.g., food shortages, income loss, etc.). The conflicting nature of these results is mirrored by pre-pandemic data as well. For example, previous findings have suggested that rural residents were less vulnerable to adverse mental health outcomes, due to the high sense of community and social support. Other data suggests that prevalence of depression and suicide are higher in rural relative to urban residents due to diminishing resources (e.g., jobs and financial strain) and disparities in mental health services. A potential explanation for the discrepancy between our results and the literature is the overpowered nature of our study (i.e., large sample size). As such, it could have been more difficult to establish significant correlations between mental health and community size.

Limitations

In spite of our significant findings, our study has several limitations. First, there is a possibility of sampling bias in the database as Indigenous, or minority populations typically reside in areas with less access to devices required for filling out the survey. For instance, a study done by the government of Canada in 2017 showed that only about 24% of households in Indigenous communities had access to high-speed internet (Government of Canada, 2019). Therefore, our sample population may not accurately represent the Canadian population, undermining the external validity of our study. Second, response biases are prevalent particularly in self-report studies such as online surveys, influencing validity of the studies (Althubaiti, 2016). For instance, social or cultural beliefs may lead to extreme biases, which drive participants to only pick the extreme options available (Meisenberg & Williams, 2008). It is also worth mentioning that the database was very limited in the number of variables provided (43 variables total), and it consisted entirely of categorical data which limited the type of analyses performed. This study did not take into account the potential in-group differences. For example, the original survey question asked respondents to specify whether they identify themselves as First Nation, Metis or Inuit. However, when compiling the data, all three identities were combined into a single category of Indigenous identity, disregarding any in-group differences.

Implications

Nevertheless, the findings of this study could be used to identify vulnerable groups and create proactive strategies to limit the adverse impacts of COVID-19 on the mental health of Canadians. For instance, since the beginning of the pandemic, many mental health services have already shifted to online platforms (Giallonardo et al., 2020). However, the majority of Indigenous and minority populations are currently struggling with poor internet connectivity and lack of access to culturally relevant information on ethics, privacy, and liability of these services (Dawson et al., 2020). Therefore, one potential solution could be increasing investments in connectivity and technology required for sustained access to virtual care in rural areas. The Government of Canada also has launched distinctions-based Indigenous Community Support Funds (total of over $1 billion) to address immediate needs in First Nations, Inuit, and Métis Nation communities in response to the COVID-19 pandemic (Government of Canada, 2021). These resources aim to give Indigenous leadership the flexibility required for planning and executing solutions catered to this population's specific needs

(Government of Canada, 2021). The findings of this study further emphasize the importance of equitable resource allocation and provide more context as to why these types of initiatives should continue to grow in the process of recovery from the pandemic.

REFERENCES

Althubaiti, A. (2016). Information bias in health research: Definition, pitfalls, and adjustment methods. Journal of Multidisciplinary Healthcare, 9, 211–217. https://doi.org/10.2147/JMDH.S104807

Angus Reid Institute. (2020, April). Worry, Gratitude & Boredom: As COVID-19 affects mental, financial health, who fares better; who is worse? http://angusreid.org/wp-content/uploads/2020/04/2020.04.27_COVID-mental-health.pdf

Biddle, N., Edwards, B., Gray, M., & Sollis, K. (2020). Initial impacts of COVID-19 on mental health in Australia. Australian National University. https://openresearch-repository.anu.edu.au/handle/1885/213198

Daoud, N., O'Brien, K., O'Campo, P., Harney, S., Harney, E., Bebee, K., Bourgeois, C., & Smylie, J. (2019). Postpartum depression prevalence and risk factors among Indigenous, non-Indigenous and immigrant women in Canada. Canadian Journal of Public Health = Revue Canadienne De Sante Publique, 110(4), 440–452. https://doi.org/10.17269/s41997-019-00182-8

Daly, Z., Slemon, A., Richardson, C. G., Salway, T., McAuliffe, C., Gadermann, A. M., Thomson, K. C., Hirani, S., & Jenkins, E. K. (2021). Associations between periods of COVID-19 quarantine and mental health in Canada. Psychiatry Research, 295, 113631. https://doi.org/10.1016/j.psychres.2020.113631

Dawson, A. Z., Walker, R. J., Campbell, J. A., Davidson, T. M., & Egede, L. E. (2020). Telehealth and indigenous populations around the world: A systematic review on current modalities for physical and mental health. MHealth, 6. https://doi.org/10.21037/mhealth.2019.12.03

Findlay, L. C., Arim, R., & Kohen, D. (2020). Understanding the perceived mental health of Canadians during the COVID-19 pandemic. Health Reports, 31(4), 22–27. https://doi.org/10.25318/82-003-x202000400003-eng

Grace, S. L., Tan, Y., Cribbie, R. A., Nguyen, H., Ritvo, P., & Irvine, J. (2016). The mental health status of ethnocultural minorities in Ontario and their mental health care. BMC Psychiatry, 16, 47. https://doi.org/10.1186/s12888-016-0759-z

Giallonardo, V., Sampogna, G., Del Vecchio, V., Luciano, M., Albert, U., Carmassi, C., Carrà, G., Cirulli, F., Dell'Osso, B., Nanni, M. G., Pompili, M., Sani, G., Tortorella, A., Volpe, U., & Fiorillo, A. (2020). The Impact of Quarantine and Physical Distancing Following COVID-19 on Mental Health: Study Protocol of a Multicentric Italian Population Trial. Frontiers in Psychiatry, 11. https://doi.org/10.3389/fpsyt.2020.00533

Government of Canada, S. C. (2020a, June 23). Indigenous people and mental health during the COVID-19 pandemic. https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00035-eng.htm

Government of Canada, S. C. (2020b, September 2). The mental health of population groups designated as visible minorities in Canada during the COVID-19 pandemic. https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00077-eng.htm

High-Speed Access for All: Canada's Connectivity Strategy - Get connected. (2019, June 27). Government of Canada. https://www.ic.gc.ca/eic/site/139.nsf/eng/h_00002.html

Indigenous Community Support Fund. (2021, Spring). Government of Canada. https://www.sac-isc.gc.ca/eng/1585189335380/1585189357198

Jenkins, E., McAuliffe, C., Hirani, S., Richardson, C., Thomson, K., McGuinness, L., Morris, J., Kousoulis, A. and Gadermann, A., 2021. A portrait of the early and differential mental health impacts of the COVID-19 pandemic in Canada: Findings from the first wave of a nationally representative cross-sectional survey. Preventive Medicine, 145, p.106333.https://doi.org/10.1016/j.ypmed.2020.106333

King, M., Smith, A., & Gracey, M. (2009). Indigenous health part 2: the underlying causes of the health gap. The Lancet, 374(9683), 76–85. https://doi.org/10.1016/s0140-6736(09)60827-8

Islam, F., Khanlou, N., & Tamim, H. (2014). South Asian populations in Canada: Migration and mental health. BMC Psychiatry, 14(1), 154. https://doi.org/10.1186/1471-244X-14-154

McKnight-Eily, L. R., Okoro, C. A., Strine, T. W., Verlenden, J., Hollis, N. D., Njai, R., Mitchell, E. W., Board, A., Puddy, R., & Thomas, C. (2021). Racial and Ethnic Disparities in the Prevalence of Stress and Worry, Mental Health Conditions, and Increased Substance Use Among Adults During the COVID-19 Pandemic—United States, April and May 2020. Morbidity and Mortality Weekly Report, 70(5), 162–166. https://doi.org/10.15585/mmwr.mm7005a3

Miconi, D., Li, Z. Y., Frounfelker, R. L., Santavicca, T., Cénat, J. M., Venkatesh, V., & Rousseau, C. (2020). Ethno-cultural disparities in mental health during the COVID-19 pandemic: a cross-sectional study on the impact of exposure to the virus and COVID-19-related discrimination and stigma on mental health across ethno-cultural groups in Quebec (Canada). BJPsych Open, 7(1), 1–10. https://doi.org/10.1192/bjo.2020.146

Meisenberg, G., & Williams, A. (2008). Are acquiescent and extreme response styles related to low intelligence and education? Personality and Individual Differences, 44(7), 1539–1550. https://doi.org/10.1016/j.paid.2008.01.010

Mo, G., Cukier, W., Atputharajah, A., Boase, M. I., & Hon, H. (2020). Differential Impacts during COVID-19 in Canada: A Look at Diverse Individuals and Their Businesses. Canadian Public Policy, 46(S3), S261–S271. https://doi.org/10.3138/cpp.2020-072

Nelson, S. E., & Wilson, K. (2017). The mental health of Indigenous peoples in Canada: A critical review of research. Social Science & Medicine, 176, 93–112. https://doi.org/10.1016/j.socscimed.2017.01.021

Proto, E., & Quintana-Domeque, C. (2021). COVID-19 and mental health deterioration by ethnicity and gender in the UK. PLOS ONE, 16(1), 1–16. https://doi.org/10.1371/journal.pone.0244419

Raihan, M. M. H. (2020). Mental health consequences of COVID-19 pandemic on adult population: a systematic review. Mental Health Review Journal, 277-of, 55–64. https://doi.org/10.1108/mhrj-07-2020-0044

Statistics Canada. (2020, August). Understanding the perceived mental health of Canadians prior to the COVID-19 pandemic. https://www150.statcan.gc.ca/n1/daily-quotidien/200806/dq200806a-eng.htm

Stafford, M., Newbold, B. K., & Ross, N. A. (2011). Psychological Distress Among Immigrants and Visible Minorities in Canada: A Contextual Analysis. International Journal of Social Psychiatry, 57(4), 428–441. https://doi.org/10.1177/0020764010365407

The mental health of population groups designated as visible minorities in Canada during the COVID-19 pandemic. (2020, September 2). Government of Canada. https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00077-eng.htm?fbclid=IwAR0AqfuJP7L_bGKwFZ3V287DFO57oa-Ta1uaRrNsmFEKoghCJRp25NZTa78

Tiwari, S. K., & Wang, J. (2008). Ethnic differences in mental health service use among White, Chinese, South Asian and South East Asian populations living in Canada. Social Psychiatry and Psychiatric Epidemiology, 43(11), 866–871. https://doi.org/10.1007/s00127-008-0373-6

Investigating Differences in Prevalence of Physical and Intellectual Impairments Across Canadian Provinces: Pediatric Cohort

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INTRODUCTION

The definition of disability has been fluid and ambiguous due to the broad variety of different conditions, the degree of their severity, their origin and duration, and their implications on the individual, the healthcare system, and the economy. This generates difficulties in developing policies, facilitating social and healthcare support services, and treatment regimens.

At this time, the Canadian government does not offer an official definition of disability, however, the term is defined by the World Health Organization (WHO) as conditions that are restrictive to the individual's capacity to interact with social environments at equal merit with other members (GC, 2013). Impairments of physical, mental, intellectual, and sensorimotor character all belong to this umbrella definition of disability (GC, 2013). Physical and sensorimotor disabilities are conditions that confine the person's range of mobility, stamina, or dexterity (GC, 2013). Mental and intellectual disabilities, although may not be visibly evident, are conditions that are highly isolating and are in itself misconstrued in modern society. They affect social interactions, self-concept, and capacities pertaining to all aspects of life.

Sex differences in the etiology of various health conditions have been established and well-publicized for a long time now (Verloove-Vanhorick et al., 1994). Sex is a contributing factor when considering options for treatment, diagnosis, and prevention in health care. Men and women face different risks and outcomes in several diseases. For example, Attention Deficit Hyperactivity Disorder (ADHD) is more prevalent among men than women, but women experience a greater variety of symptoms than men. In Canada, an estimated 30.3% of children ages 6-11 were reported to have one or more chronic physical health conditions or impairments in 1994-95 (McDougall et al., 2004). The United States National Survey of Health and Development followed a cohort of >5000 born in 1946 to adulthood. From that cohort, serious illnesses were more common among males than females from birth to age 5. Learning disabilities such as ADHD and dyslexia, requiring special education, are more prevalent in males than in females (Leveille et al., 2000). However, according to McDougall et al, girls aged 9 to 11 with activity-limiting chronic conditions were found to have higher rates of psychological or nervous system difficulties than boys with the same conditions. This suggests that younger females with chronic disabilities are in need of mental health assistance but are not receiving it. More investigations are to be conducted to identify potential sex differences in various health conditions for other pediatric age categories.

Although healthcare remains one of Canada's most valued social programs, there is some variability in medical services across different provinces and territories. Benefits for persons with impairments are mandated on both, the federal and provincial levels, further contributing to prospective discrepancies and inequalities in access and administration of various social and healthcare support

services (Allin, 2008). British Columbia was identified as the province with the most attainable and regulated healthcare services, whereas Newfoundland was reported to have suboptimal management of and delivery of healthcare (Conference Board of Canada, 2015). Moreover, children with chronic health conditions are visiting the hospitals two times more frequently than children with no health conditions, with an increase of more than 2-folds per year (McDougall et al., 2004). That said, this highly suggests the need for more research to see whether these children are receiving the appropriate services.

The Participation and Activity Limitation Survey (PALS) is a self-reporting survey conducted by the Government of Canada, across 10 provinces. The rate of disability was 14.3% in 2006 where only 5.6% of Canadians have severe to very severe disabilities with the majority having mild to moderate impairments; the disability rate also varied greatly across provinces (GC, 2013).

Together, the featured literature posits that there are characteristic differences in sex with respect to the etiology and outcomes of disability. There is also evidence for the lack of uniformity of health administration and accessibility of benefits across Canadian provinces. However, no studies were conducted to explore whether there are significantly different incidences of disabilities in Canada between sexes. This research is dedicated to investigating sex differences in the types and prevalence of disabilities recorded in male and female children of ages 11-14 across Canadian provinces.

MATERIALS AND METHODS

Study Design and Database

Odesi database was used to retrieve the data collected from the Canadian Health and Disability Survey (CHDS) for this descriptive, cross-sectional study. CHDS was administered as an addendum to the Labor Force Survey (LFS) in 1983 and 1984 to evaluate the accessibility and efficacy of social and medical services for children living with activity limitations. Data captured from both years and across ten Canadian provinces (Quebec, Ontario, British Columbia, Saskatchewan, Alberta, Manitoba, Prince Edward Island, Newfoundland, Nova Scotia, and New Brunswick), was amalgamated into a single repository. The format of the survey entailed face-to-face proxy-interviews to collect responses on behalf of the guardian's dependents of ages 14 years or younger.

Study Participants

This study surveyed a nationally-representative cohort, where households were the sampling units. Since CHDS was a follow-up to LFS, the collected data only represents households with one or more dependant(s) of 14 years or younger. Residents of Yukon, Nunavut, and NorthWestern Territory were excluded as these regions constituted 3% of the total Canadian population at the time. Institutionalized populations were also excluded from the survey's coverage. All minors (n=5,326) were Canadian residents, and responses were collected for subjects of both sexes. Of the 5,326 children, we only included males (n=404) and females (n=322) of ages 11-14 years whose guardians reported a disability preventing the child from participating in daily activities (n=726).

Study Outcomes

The primary objective of this study was to determine if there are differences in the prevalence of activity limitations across Canadian provinces in children of ages 11-14 years. Records of a disability were made if the guardian responded "Yes" to "Does your child have an activity limitation which limits his/her participation in daily activities that otherwise healthy children would be capable of partaking in?". Activity limitation was defined as a long-term condition lasting for six or more months, which restricts the child's capacity to participate in the activities of daily living. Terms "disability", "condition", and "activity limitation" are used interchangeably in this study.

Given that the etiology of disorders varies between males and females, the study further intended to understand whether the difference in the prevalence of activity limitations varies by sex irrespective of the province of residence. As such, the impact of sex can be observed independently from the differences in province populations. Finally, we aimed to obtain a comprehensive assessment of whether different sexes are consistently characteristic to the prevalence of certain activity limitations across the provinces.

Additional Data Collection

Respondents from Prince Edward Island, Newfoundland, Nova Scotia, and New Brunswick were grouped into 'Maritime Provinces' due to lower total population counts. The new category constituted 24.24% of the surveyed cohort.

Options for activity limitations included 15 categories to cover the breadth of possible conditions irrespective of their origin or duration: 'Congenital Anomalies', 'Endocrine Disorders', 'Circulatory System Diseases', 'Mental Disorders', 'Learning Disabilities', 'Sight Disorders', 'Hearing Disorders', 'Other Central Nervous System Disorders', 'Back Musculoskeletal Disorders', 'Lower Limb Musculoskeletal Disorders', 'Other Musculoskeletal Problems', 'Asthma', 'Allergies', 'Other Respiratory Conditions', 'Other', and 'Unknown'. For analytical purposes, these categories were further combined into broader clusters by the overarching etiology, with aims to obtain a more uniform number of responses for each group of conditions. Six new condition categories were 'Mental and Learning', 'Respiratory', 'Musculoskeletal', 'Central Nervous System', 'Unknown', and 'Other'; conditions previously classified as 'Congenital Anomalies', 'Endocrine Disorders', and 'Circulatory System Diseases' and 'Other' were merged into the new 'Other' condition cluster.

Statistical Analysis

We summarized the re-grouped activity limitations and province of residence by sex for all children aged 10-14 years. A Pearson Chi-square statistic was then computed to determine whether there are differences in counts of disabilities across provinces for all children. Because of substantial differences in the number of respondents by place of residence, the prevalence of disabilities was calculated by province. To assess whether there are differences in prevalence of disabilities between the sexes in Canada, we conducted the Chi-square test for all provinces combined. To adjust for the difference in the number of female and male respondents, the prevalence was calculated by sex. For the final objective of this study, the low counts of responses did not permit for the Chi-square test; prevalence was calculated by sex per province.

The alpha level was set at 0.05 to depict significant statistical differences. We used Statistical Package for Social Sciences (SPSS), version 27, for all statistical analyses, and R-Studio for data visualization.

RESULTS

Table 1. Counts and percentage of responses recorded in children aged 11-14 years for Activity Limitations and Canadian provinces.

Variable	Sex (*n*=726)		*Total*
	Male (*n*=404)	Female (*n*=322)	*n (%)*
Region/Provinces			
Maritime Provinces	92	84	176 (24.24)
New Brunswick	20	25	45
Nova Scotia	26	27	53
Prince Edward Island	7	12	19
Newfoundland	39	20	59
Quebec	35	26	61 (8.4)
Ontario	76	61	137 (18.9)
Manitoba	49	29	78 (10.7)
Saskatchewan	48	47	95 (13.1)
Alberta	66	35	101 (13.9)
British Columbia	38	40	78 (10.7)
Activity Limitation			
Mental and Learning	37	22	59 (8.1)
Mental Disorders	13	10	23
Learning Disability	24	12	36
Respiratory	81	43	124 (17.1)
Asthma	54	32	86
Allergies	19	9	28
Other Respiratory Conditions	8	2	10
Musculoskeletal	52	88	140 (19.3)
Back Musculoskeletal Disorders	9	17	26
Lower Limb Musculoskeletal Disorders	21	37	58
Other Musculoskeletal Disorders	22	34	56
Central Nervous System	80	35	115 (15.8)
Sight Disorders	12	3	15
Hearing Disorders	25	10	35
Other Central Nervous System Disorders	43	22	65
Other	89	71	160 (22.0)
Endocrine Disorders	9	9	18
Circulatory System Diseases	9	14	23
Congenital Anomalies	29	14	43
Other	42	34	76
Unknown	65	63	128 (17.6)

Source: Canadian Health and Disability Survey, 1983-1984: Child File; Study ID (chds-E-1983-1983-ch)

We described our cohort (n=726) by count and total percentage of responses by sex, region of residence and activity limitations (Table 1). Males (n=404) constituted 55.6% of the study population, and females (n=322) represented 44.4% of all respondents. Across all provinces, most responses were collected from the Maritime Provinces with the greatest count collected in Newfoundland, and the lowest from Prince Edward Island. Between the individual provinces, residents of Ontario were comprising 18.9% of the sample size, and Quebec accounted for 8.4%, as the highest and lowest percentages, respectively. Activity limitations were described by the original category and by the clustered group of conditions. Between all categories, conditions classified as 'Other' (n=160) were described most frequently, among which 84 conditions belonged to a subgroup and 76 disabilities were originally also classified as 'Other'. Mental and learning disabilities were less frequently described, comprising only 8.1% of total encounters. Among the original categories, asthma (n=86) was reported at the greatest count, whereas endocrine disorders (n=18) were recorded least frequently.

The difference in prevalence was significant (χ^2=44.5; p=0.023) across provinces (Fig. 1). Saskatchewan and Alberta have two most prevalent condition types each, 'Musculoskeletal', 'Unknown' and 'Respiratory' and 'Mental and Learning', respectively. Manitoba and Quebec, have the highest prevalence of 'Central Nervous System' and 'Other' types of disabilities, respectively. The prevalence of any activity limitations in Ontario, British Columbia, and Maritime Provinces did not rank highest in Canada. We further compared the prevalence of each condition type within each of the latter provinces. Activity limitations under the category 'Musculoskeletal' were the most abundant in British Columbia and Ontario in comparison to other groups of disabilities, and conditions classified as 'Other' were most common in Maritime Provinces.

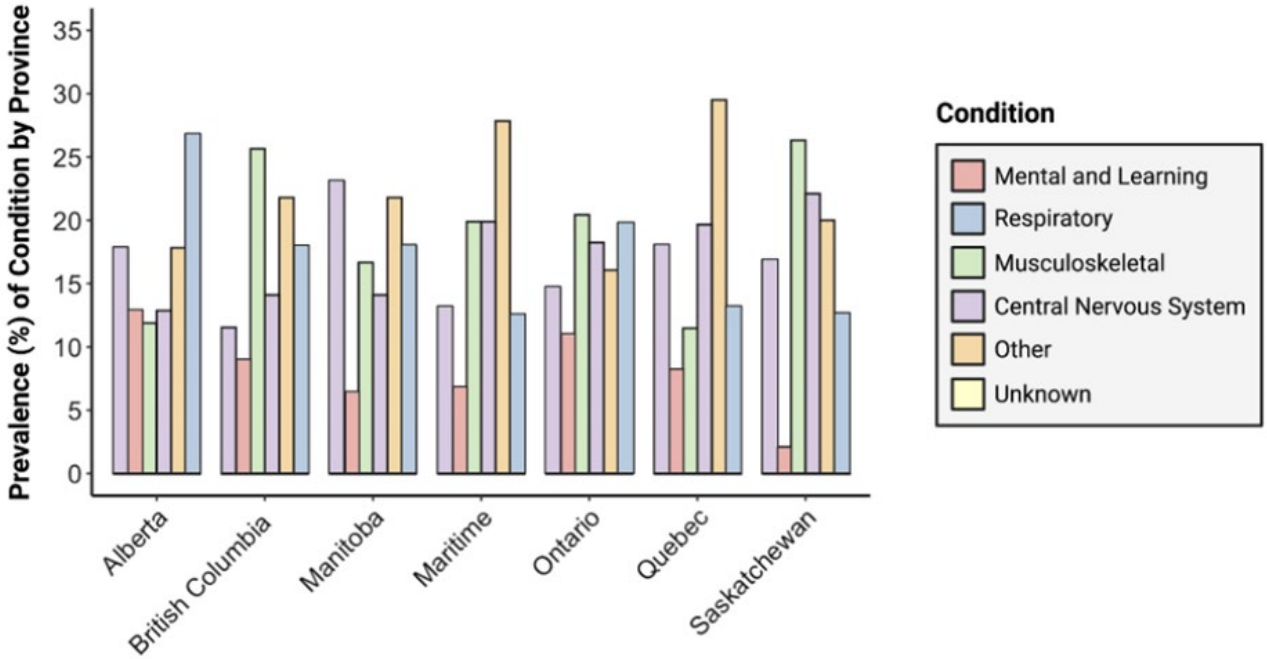

Figure 1. Stacked bar graph of prevalence (%) of activity limitations in Canada.

Given that some condition clusters were substantially more prevalent across the provinces, we plotted the prevalence of each condition by sex in Canada (Fig. 2). Indeed, sex is a significant factor when accounting for the difference in prevalence between our condition clusters (χ^2=35.6; p<0.001). Central nervous system disorders are nearly twice as prevalent in males, whereas musculoskeletal disorders are twice as prevalent in females. For other groups, less substantial variation between sexes was observed. Respiratory conditions as well as the disabilities under the 'Unknown' category were more prevalent in females compared to males, and mental and learning disorders were marginally more frequently recorded in boys. Conditions classified as 'Other' were nearly identically prevalent between the sexes.

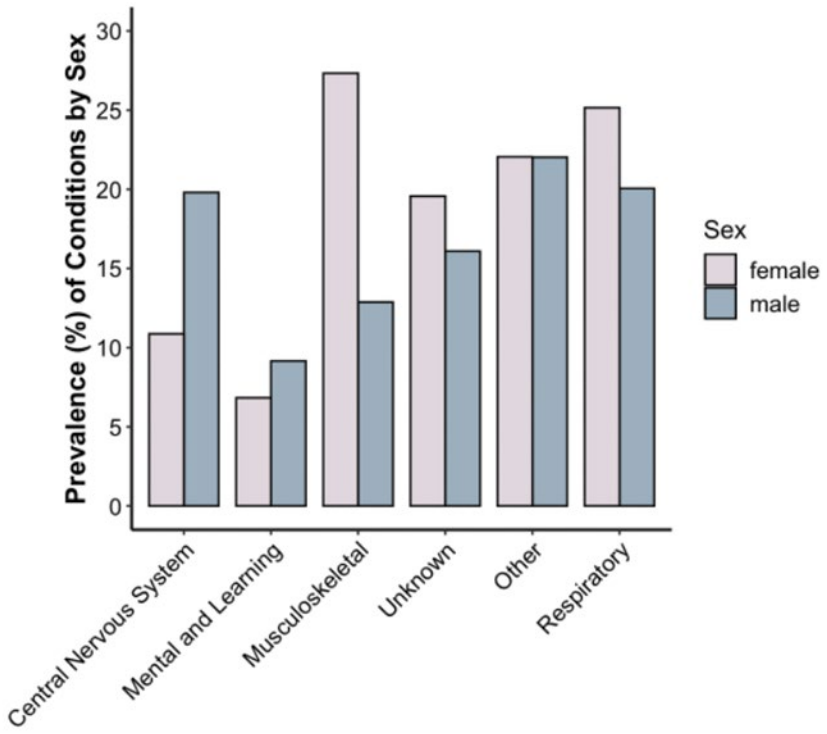

Figure 2. Bar graph depicting the prevalence (%) of activity limitations in males (n=404) and females (n=322).

Finally, we captured a snapshot of the prevalence of each condition across provinces by sex (Fig. 3). This panel makes the following outcomes the most evident: 1) Alberta and Ontario and British Columbia and Manitoba are the most similar 2) Maritime Provinces is rather inconsistent with other provinces; and 3) the prevalence of nearly all conditions is higher in males of Alberta, and females of British Columbia.

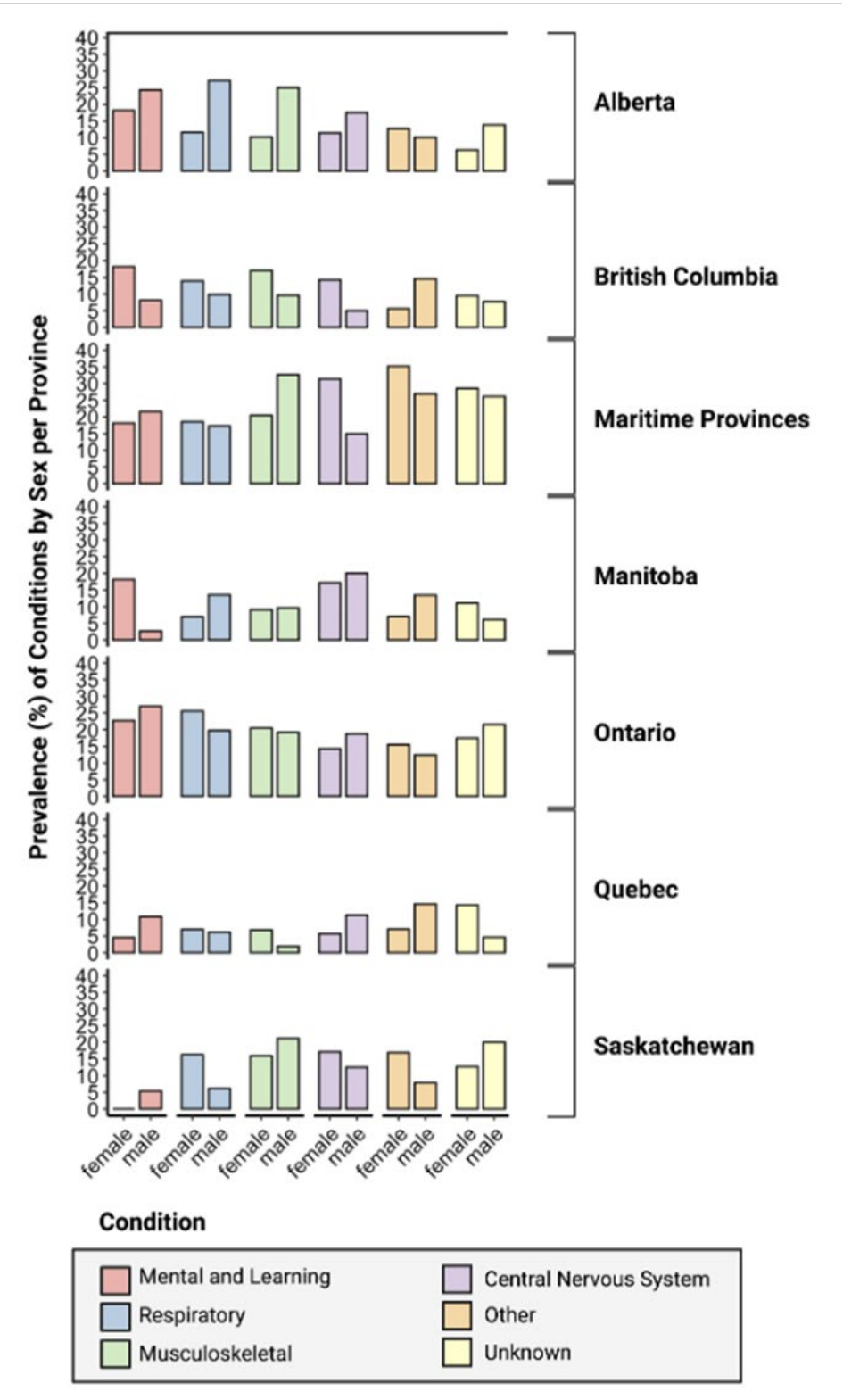

Figure 3. Panel of bar graphs featuring the prevalence (%) of males (n=404) and females (n=322) reporting activity limitations in each province.

DISCUSSION

The central outcomes of this study posit that there is significant difference in prevalence of condition types across provinces and between sexes. We identified that Alberta and Saskatchewan were the hosts to the highest prevalence of four different activity limitation types in Canada, and that Ontario, British Columbia and Maritime Provinces did not have the highest ranking condition groups. We also compared the prevalence of disabilities by sex across provinces and determined that Ontario and Alberta, and Manitoba and British Columbia are the most similar to each other, whereas Maritime Provinces demonstrated highly distinct trends. Notably, we were not able to conduct statistical analyses to determine the significance of the results of our final objective. When comparing the prevalence of activity limitations by both, place of residence and by sex, the results were inconclusive due to the low statistical power in the analysis.

When comparing studies, we can further support and improve our analysis. We compared our study to three cross-sectional investigations alike, which examined the prevalence of disabilities over various study cohorts. All three studies had more activity limitation options which were also substantially more descriptive and showed a greater prevalence of disabilities in females than in males. This differs from our study as it had a less descriptive survey and did not have an overall predominance of types disabilities between sexes across Canada. These studies also had a larger sample size, thereby providing more robust outcomes and analysis. Finally, these studies examined adults of age 18 years and above, whereas our study featured 10-14 year children cohort.

The first study examines the prevalence and most common causes of disability among adults across the United States in 2015. Although the study did not compare the rate of disabilities across states, it does examine the difference between females and males aged 18 and over (CDC, 2009). However, the study did allude to the fact that any variation across the country is a result of differences in the public's education, levels of medical intervention, and the amount of access to assistive technology which varies amongst the different socioeconomic groups (CDC, 2009).

The second study was a global analysis of the rate of disabilities. Similar to our study they had collected data via a survey, but the surveys differed for every country (Mont et al., 2007). While our study compared provinces, this study compared countries and it was seen that developing countries tend to report the lowest rates of disabilities. This result was most likely not because developing countries have fewer disabilities, but more so because they do not have proper access to health care, and many could be undiagnosed. This could be the result of why certain provinces such as Saskatchewan and Alberta have a higher prevalence of disability because there are more rural communities, such as those in developing countries, residing in these provinces.

The third study examined the prevalence of disabilities in the United States across urban-rural classification (CDC, 2014). This study used the NCHS Urban-Rural classification scheme to split the country into 6 urbanization levels (ranges from most urban to most rural): large central metro, large fringe metro, medium metro, small metro, micropolitan, and noncore (CDC, 2014). The results of this study showed that more urban cities, in specific large fringe areas have higher rates of disabilities (CDC, 2014). This is most likely a result of increased access to health care sites and providers, a more

accommodating education system, and support within the community. This in turn can explain why our results depicted British Columbia as having one of the lowest prevalence of disabilities as it is one of the most urbanized provinces in Canada (Government of Canada, 2015). In 2019, British Columbia has the third largest number of hospitals in Canada, of around 161 hospitals which benefits the population and contributes to the low rates of disabilities in the province ("Number hospitals Canada by province", 2019).

The findings in this report are subject to a few limitations. When considering data collections some limitations could be that some individuals may be undiagnosed and some may choose not to respond, which can result in a smaller sample size. Also, the survey given to the participants was not thoroughly descriptive for the conditions. This lack of options and range in options inhibits respondents to correctly describe their condition and may lead to an incorrect response or no response at all.

As previously reported in our description of the cohort, the counts of Mental and Learning disabilities were the lowest group for which responses were collected. In contrast, conditions classified as 'Other' were the most abundant. This presents evidence that the types of conditions were not surveyed equivalently, potentially introducing bias in the prevalence of these disabilities across provinces and between sexes.

Reflecting on the analytical methods used in this study, we only conducted Chi-square tests to calculate the difference in prevalence for the primary and secondary objectives of the study. This serves as a caveat to the degree of extensiveness in our statistical approach, and in the future, multivariate analysis such as multivariate logistic regression and principal component analysis, to compute correlations between our variables, may be warranted.

The CHDS was conducted in the 1980s, thus the findings may be rather outdated. The trend in prevalence of activity limitations could have changed across Canadian provinces. It is important to investigate any change in the trend in order for the Canadian government to cope with social and medical services for children experiencing activity limitations. Collecting up-to-date data should take place in order to make appropriate policy recommendations in terms of preparing resources and personnel and to actively cope with the various kinds of needs for the families with children with disability. Furthermore, improved data collection techniques and strategies can be implemented for the future surveys. The use of online surveys is an effective method as it would allow the access of more participants which would in turn make the study more reliable with larger sample size. Telephonic surveys is another method to reach the wider population. Focusing on collecting the data from the provinces with lower response rates could further enhance the balance between the provinces. Paper surveys can also be used for the provinces with low socioeconomic status to accommodate for the lack of internet access.

Of the diseases listed in the survey the conditions classifying under the 'Other Respiratory', 'Other Musculoskeletal' and 'Other' categories constituted the highest portion of responses. This is a source of potential error as it does not specify the type of disability that the participants have. For future

research, adding more descriptive conditions and categories to the survey would allow for the detection of more representative conditions in order to access the wider variety of mental and physical disabilities in children. Surveying the duration, the origin, and the degree of the disability further could also be useful in establishing a more robust measure of disability.

Although this study surveyed a nationally-representative cohort, the minors of Indigenous communities residing in the Northern Territories were excluded. Future research must be dedicated to investigating the difference in prevalence and types of disabilities in these cohorts to obtain an impartial portfolio of the Canadian population, especially given the high rate of disabilities in rural communities, as suggested by other studies.

REFERENCES

Allin, S. (2008, May). Does equity in healthcare use vary across canadian provinces? Retrieved February 09, 2021, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2645154/

Conference Board of Canada. (2015, February). Provincial and Territorial ranking: Health. Retrieved February 11, 2021, from https://www.conferenceboard.ca/hcp/provincial/health.aspx

Government of Canada, S. C. (2015, April 13). Canada goes urban. https://www150.statcan.gc.ca/n1/pub/11-630-x/11-630-x2015004-eng.htm

Government of Canada. (2013, August 5). Disability in Canada: A 2006 Profile. Government of Canada. Retrieved from https://www.canada.ca/en/employment-social-development/programs/disability/arc/disability-2006.html

Leveille, S. G., Resnick, H. E., & Balfour, J. (2000). Gender differences in disability: Evidence and underlying reasons. Aging Clinical and Experimental Research, 12(2), 106–112. https://doi.org/10.1007/BF03339897

McDougall, J., King, G., De Wit, D. J., Miller, L. T., Hong, S., Offord, D. R., Laporta, J., &

Meyer, K. (2004). Chronic physical health conditions and disability among Canadian school-aged children: A national profile. Disability & Rehabilitation, 26(1), 35–45. https://doi.org/10.1080/09638280410001645076

Mont, D., Loeb, M., Vega, J. M., & Rockhold, P. (2007). By. Retrieved April 5, 2021, from https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.370.2535&rep=rep1&type=pdf

Number hospitals Canada by province. (2019.). Statista. Retrieved April 10, 2021, from https://www.statista.com/statistics/440923/total-number-of-hospital-establishments-in-canada-by-province/

Prevalence and MosWHO. (2002). Towards a Common Language for Functioning, Disability and Health. World Health Organization. Retrieved from https://www.who.int/classifications/icf/icfbeginnersguide.pdf

Prevalence and Most Common Causes of Disability Among Adults — United States, 2005. (2009). Morbidity and Mortality Weekly Report, 58(16), 421–426. Retrieved April 5, 2021, from http://www.jstor.org/stable/23318607

Sweeting, H. (1995). Reversals of fortune? Sex differences in health in childhood and adolescence. Social Science & Medicine, 40(1), 77–90. https://doi.org/10.1016/0277-9536(94)E0059-2

Verloove-Vanhorick, S. P., Veen, S., Ruys, J. H., Ens-Dokkum, M. H., Schreuder, A. M., & Brand, R. (1994). Sex Difference in Disability and Handicap at Five Years of Age in Children Born at Very Short Gestation. Pediatrics, 93(4), 576–579.

2013 NCHS Urban-Rural Classification Scheme for Counties. (2014). Vital and Health Statistic, 2(166). Retrieved April 5, 2021, from https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf Common Causes of Disability Among Adults — United States, 2005. (2009). Morbidity and Mortality Weekly Report, 58(16), 421–426. Retrieved April 5, 2021, from http://www.jstor.org/stable/23318607

Immigrant Canadians experienced different psychosocial outcomes than non-immigrants in the context of the COVID-19 pandemic

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INTRODUCTION

Human history is no stranger to pandemics. From the Black Plague to the Spanish Flu, pathogens have proven their ability to traverse across the globe (Huremović, 2019). The COVID-19 (SARS-Cov-2) pandemic represents a new era in infectious disease management, where an inter-connected, globalized economy drives transmission at unprecedented rates (Zinsstag et al, 2020). The psychosocial effects of this pandemic have been at the forefront of recent medical research. Dubey and colleagues (2020) discussed general psychological consequences of isolation and quarantine protocols; including irritability, loneliness, paranoia, anxiety, depression, insomnia, PTSD, and even suicide. Meanwhile, Chu and colleagues (2020) reviewed social consequences; citing rising food insecurity, financial instability, diminished access to health services, and disrupted access to education. It is clear that the COVID-19 pandemic has had negative impacts on the average citizen's psychosocial health. However, Bambra and colleagues (2020) noted that these psychosocial impacts are unevenly distributed across global populations. Marginalized and disadvantaged communities faced greater risks for negative outcomes than other groups. They asserted that pre-established systematic inequalities exacerbated the psychosocial burden of the pandemic in these communities. For example, unequal access to health services, mental health services, green space, and more crowding conditions, all contributed to this notion (Bambra et al., 2020). In the Western world, research on this topic focused on racialized, American communities. Separate analyses by Tai and colleagues (2020) and Louis-jean and colleagues (2020) concluded that African American, Latinx, and Native American communities were disproportionately affected by the pandemic from a healthcare and a psychosocial standpoint. These studies concurred with the work of Bambra and colleagues (2020), pointing to differences in the social determinants of health to explain these disparities. There are no analytical studies based in Canada that confirm if these trends are being replicated across the border. Although preliminary findings from Statistics Canada suggested that a similar disparity is present (Subedi et al., 2020), it is still a significant gap in the literature.

Other gaps in the literature are important to consider as well. Current studies in this field have focused on distinct racial groups. Other disadvantaged groups, including immigrant and LGBTQ+ communities are not well represented. There is evidence that these disadvantaged groups face exacerbated burdens in many facets of healthcare (Gushulak et al, 2011; Kraun et al., 2015; Hafeez et al., 2017), so it is reasonable to expect that their psychosocial burdens relating to the COVID-19 pandemic are also exasperated. For Canadians, this gap in the literature is compounded by limited studies on racialized groups. Of special consideration for Canadians is the distribution of psychosocial burden in immigrant communities. Immigration represents two-thirds of the country's annual population growth (Gushulak et al, 2011), and immigrants make up a high proportion of essential workers (Turcotte & Savage, 2020).

Our analysis aims to investigate the psychosocial consequences of the COVID-19 pandemic in Canadian immigrants, using the database Impacts of COVID-19 on Canadians-Mental Health, 2020: Crowdsource file. We are addressing 2 gaps in the current literature. First, the gap regarding a lack of Canadian-based analyses, and second, the gap regarding a lack of representation for immigrant communities. We are employing 3 outcomes that equally represent psychosocial burden: personal stress, family stress, and concerns about maintaining social ties. Each of these outcomes gives insight to a participant's psychological and social life. The research question is as follows: **In the context of the COVID-19 pandemic, does being an immigrant to Canada (age>15) have an association with personal stress, family stress, and/or concerns about maintaining social ties, compared to non-immigrant Canadians (age>15)?**

MATERIALS AND METHODS

Study Design and Database

We conducted a cross-sectional, observational study using the database Impacts of COVID-19 on Canadians-Mental Health, 2020: Crowdsource file, published by Statistics Canada. This database is a specific iteration of the Canadian Perspectives Survey Series (CPSS), a project launched by Statistics Canada to aid in the rapid understanding of pertinent social issues (Statistics Canada, 2020). The main goal of this database was to investigate how Canadians are navigating through the COVID-19 pandemic and its impact on their overall mental health. The target population for the database were all Canadians aged 15 or older. The crowdsourcing initiative was broadcasted by numerous government agencies, various public and private organizations, news channels and social media (Statistics Canada, 2020). Participation in the study was voluntary. Data was collected from April 24 to May 11, 2020, using an online survey questionnaire in a non-probabilistic approach, without a sample design (Statistics Canada, 2020). Participants completed the self-administered questionnaire via an anonymous online portal on Statistics Canada's website. Participants answered specific demographic-based and mental health orientated questions (Statistics Canada, 2020). The questionnaire was approximately five minutes in length and available in both English and French. Standardized wording and practices were implemented into the computer-assisted portal (Statistics Canada, 2020).

Study Participants

We identified all participants aged 15 or older in the dataset. Only participants that were residing in one of the ten provinces and three territories of Canada during the data collection period were included. Participants that self-identified as either "Non-Immigrant" and "Immigrant" were used in all analyses, while those participants that identified as "Non-Permanent Resident" were excluded from the database. Any participants that selected "Valid skip", "Don't know", "Refusal", or "Not stated" for their immigration status for the three research outcomes (personal stress, family stress and concern about maintaining social ties) were also not considered in the analysis. A total of 45 669 participants were included in the final analysis.

Study Outcomes

We compared self-identified immigrant and non-immigrant study participants to determine if there was an association between immigration status and the following outcomes in the context of the

COVID-19 pandemic: perceived life stress, family stress from confinement, and concerns about maintaining social ties. For each outcome, respectively, study participants answered the following questions: thinking about the amount of stress in your life, how would you describe most of your days?; how concerned are you about each of the following impacts of COVID-19: family stress from confinement?; how concerned are you about each of the following impacts of COVID-19: maintaining social ties? Participants responded to each question on a Likert Scale to identify the impact of COVID-19 on the aforementioned psychosocial factors. For the first question, participants responded from the following options: "Not at all stressful", "Not very stressful", "A bit stressful", "Quite a bit stressful", "Extremely stressful", "Valid skip", "Don't know", "Refusal", or "Not stated". For the second question, participants selected one of the following categories: "Not at all", "Somewhat", "Very", "Extremely", "Valid skip", "Don't know", "Refusal", or "Not stated". For the third question, participants chose from: "Not at all", "Somewhat", "Very", "Extremely", "Valid skip", "Don't Know", "Refusal", or "Not Stated". The aforementioned psychosocial factors are important mental health indicators and assessments of the pandemic's impact on the study participants. These outcomes represent psychosocial burden, as they cover personal effects, family effects, and social effects. All of which are important contributors to an individual's mental health (Bambra et al., 2020). An investigation into the consequences of these psychosocial factors allowed for adequate representation of the immigrant population and a specific Canadian-based analysis, both of which are underrepresented in current Canadian literature (Subedi et al., 2020; Kalich et al., 2016). Self-reported health data, as in our outcomes, has also been described as reliable and an accurate indicator of true health (Vaillant & Wolf, 2012). Cross-sectional studies are also an effective method of quick and widespread data collection that can be used to study multiple outcomes (Mann, 2003).

Additional Data Collection

Our database also included several demographic indicators about our study population summarized in Table 1. These variables were used to describe the population and are separated by immigration status. The variables include sex, age, geographic location, and minority status.

Statistical Analysis

In Table 1, we organized study participants based on their immigration status: immigrants and non-immigrants. Descriptive variables (sex, age, geographic location, and minority status) and study outcomes (personal stress, family stress, concerns about social ties) were compared between these two population groups. Due to the categorical nature of our database, normality testing could not be conducted. We evaluated differences in proportions between immigrant and non-immigrant participants for study outcomes through chi-squared tests. Any statistically significant result between immigrant and non-immigrant populations for our study outcomes was further evaluated by collapsing larger chi-squared tables to create 2x2 contingency tables. Statistical analyses were conducted using SPSS for Mac version 27.0 (SPSS Inc., Chicago, IL). A p value of 0.05 was considered as the criterion for a statistically significant result.

RESULTS

Recruitment and Response of Participants

Participants were recruited through government organizations, news channels, and social media to complete the online survey questionnaire. Individuals aged 15 that resided in Canada during the data collection period were included in the study. At baseline, the database included 45 989 participants. Of that number, 320 (0.70%) were excluded for the following reasons: 72 responded with "Non-Permanent Resident" for their immigration status; 62, 89, and 97 responded with either "Valid skip", "Don't know", "Refusal", or "Not stated" for personal stress, family stress, and concerns about social ties, respectively. Complete data was available for 45 669 participants.

Descriptive Sample Characteristics

According to their immigration status, study participants were organized into two different categories: "Non-Immigrant" and "Immigrant" (Table 1). Of the 45 669 participants, 39 921 (87.4%) self-identified as non-immigrant and 5748 (12.6%) self-identified as immigrants. From the "Non-Immigrant" group, 9524 (23.9%) identified as male and 30397 (76.1%) identified as female; from the "Immigrant" group, 1889 (32.9%) identified as male and 3859 (67.1) identified as female (Table 1). A summary of other demographic characteristics is included in Table 1.

Main Findings

The percentage of respondents for the different categories in each study outcome ("Perceived Life Stress from COVID-19", "Concern about Impact of COVID-19 on Family Stress from Confinement", and "Concern about Impact of COVID-19 on Maintaining Social Ties") can be seen in Figure 1. Study participants with different immigration status responded differently to the survey questionnaire (Figure 1).

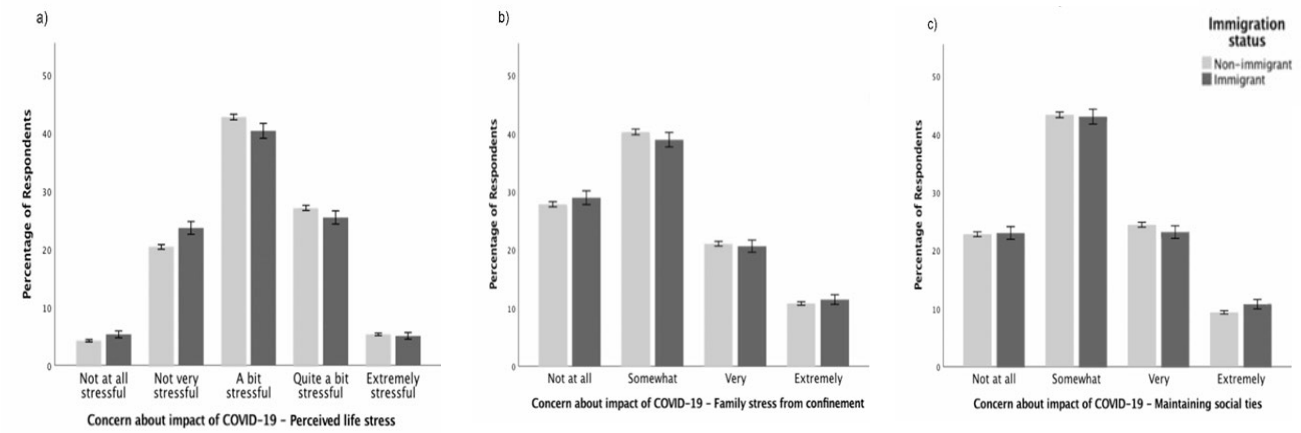

Figure 1. A clustered bar graph showing the responses from 39,921 Canadian non-immigrants, and 5, 748 Canadian immigrants. Participants evaluated how concerned they were about a) the impact of COVID-19 on their perceived life stress, b) about the impact of COVID-19 on them maintaining social ties, and c) about the impact of COVID-19 on family stress from confinement. Error bars represent 95% confidence interval.

Chi-squared testing identified statistically significant differences (Table 1) in the proportions between the "Non-Immigrant" and "Immigrant" groups with respect to "Perceived Life Stress from COVID-19" ($p < 0.001$) and "Concern about Impact of COVID-19 on Maintaining Social Ties" ($p < 0.003$). No significant difference in proportions was observed for "Concern about Impact of COVID-19 on Family Stress from Confinement" between the two groups (Table 1).

Table 1. Results from a database of Canadian (N=45 669) comparing descriptive characteristics and psychosocial factors between immigrants and Non-immigrants in context of the COVID-19 pandemic.

Characteristics	Non-Immigrant (n=39921)	Immigrant (n=5748)	P Value
Sex			
Male	9524 (23.9)	1889 (32.9)	--
Female	30397 (76.1)	3859 (67.1)	
Age			
15 to 24 years old	1994 (5.0)	319 (5.5)	
25 to 34 years old	8760 (21.9)	1190 (20.7)	
35 to 44 years old	10821 (27.1)	1456 (25.3)	--
45 to 54 years old	7774 (19.5)	1158 (20.1)	
55 to 64 years old	6548 (16.4)	819 (14.2)	
65 years and older	4024 (10.1)	806 (14.0)	
Rural Urban Indicator			
Rural	5054 (12.7)	355 (6.2)	
Urban	34352 (86.0)	5309 (92.4)	--
Not stated	515 (1.3)	84 (1.5)	
Visible Minority Status			
Visible minority	1819 (4.6)	2398 (41.7)	
Not a visible minority	37687 (94.4)	3257 (56.7)	--
Not stated	415 (1.0)	93 (1.6)	
Perceived Life Stress from COVID-19			
Not at all stressful	1703 (4.3)	307 (5.3)	
Not very stressful	8156 (20.4)	1361 (23.7)	
A bit stressful	17082 (42.8)	2323 (40.4)	<0.001*
Quite a bit stressful	10835 (27.1)	1465 (25.5)	
Extremely stressful	2145 (5.4)	292 (5.1)	
Concern about Impact of COVID-19 on Family Stress from Confinement			
Not at all	11115 (27.8)	1665 (29.0)	
Somewhat	16088 (40.3)	2239 (39.0)	0.071
Very	8412 (21.1)	1186 (20.6)	
Extremely stressful	4306 (10.8)	658 (11.4)	
Concern about Impact of COVID-19 on Maintaining Social Ties			
Not at all	9110 (22.8)	1323 (23.0)	
Somewhat	17317 (43.4)	2475 (43.1)	<0.003*
Very	9759 (24.4)	1325 (23.2)	
Extremely stressful	3735 (9.4)	618 (10.8)	

Data are presented as number (%) of participants.

*A p value of 0.05 was considered as the criterion for a statistically significant result.

Further analysis for "Perceived Life Stress from COVID-19" and "Concern about Impact of COVID-19 on Maintaining Social Ties" was conducted by collapsing these outcomes to create 2x2 chi-squared tables. The first outcome was collapsed into the following two categories (Table 2): "Low Stress" (included "Not at all stressful", "Not very stressful", "A bit stressful") and "High Stress" (included "Quite a bit stressful" and "Extremely stressful"). The proportion of the "Non-Immigrant" population that were categorized as "High Stress" was significantly higher ($p < 0.003$) than the "Immigrant" population. For the "Non-Immigrant" population the proportion was 32.5% (12980/39921); for the "Immigrant" population the proportion was 30.6% (1757/5748). The second outcome was collapsed into the following two categories (Table 3): "Extremely concerned about maintaining social ties" (included only "Extremely") and "Not extremely concerned about maintaining social ties" (included "Not at all", "Somewhat", and "Very"). The proportion of the "Immigrant" population that was categorized as "Extremely concerned about maintaining social ties" was significantly higher ($p < 0.001$) than the "Non-Immigrant" population. For the "Immigrant" population the proportion was 10.8% (618/5748); for the "Non-Immigrant" population the proportion was 9.4% (3735/39921).

Table 2. Results from a database of Canadian (N=45 669) comparing perceived life stress between immigrants and Non-immigrants in context of the COVID-19 pandemic.

Perceived Life Stress from COVID-19	Non-Immigrant (n=39921)	Immigrant (n=5748)	P Value
Low Stress	26941 (67.5)	3991 (69.4)	0.003*
High Stress	12980 (32.5)	1757 (30.6)	

Data are presented as number (%) of participants. Chi-squared test comparing high and low stress between immigrants and non-immigrants.

*A p value of 0.05 was considered as the criterion for a statistically significant result.

Table 3. Results from a database of Canadian (N=45 669) comparing concern about social ties between immigrants and Non-immigrants in context of the COVID-19 pandemic.

Concern about Impact of COVID-19 on Maintaining Social Ties	Non-Immigrant (n=39921)	Immigrant (n=5748)	P Value
Not extremely concerned about maintaining social ties	36186 (90.6)	5130 (89.2)	<0.001*
Extremely concerned about maintaining social ties	3735 (9.4)	618 (10.8)	

Data are presented as number (%) of participants. Chi-squared test comparing concern about maintaining social ties between immigrants and non-immigrants.

*A p value of 0.05 was considered as the criterion for a statistically significant result.

DISCUSSION

In regards to the psychosocial burden of the COVID-19 pandemic between immigrant and non-immigrant Canadians, our results indicated that factors regarding personal stress and concerns about maintaining social ties differed significantly, while those regarding concerns about family stress did not differ significantly. Of the 3 outcomes that demonstrated psychosocial burden, each led to a new conclusion about between-group differences. Immigrants faced more of a burden in the context of concerns about social ties than non-immigrants, but less in the context of life stress, and no significant difference in the context of family stress. Unlike the findings of Bambra and colleagues (2020), who showed that disadvantaged, minority communities in the USA uniformly saw worse psychosocial outcomes during the pandemic, our data showed that there is more complexity to these relationships among immigrant Canadian groups. Immigrants' greater concerns about maintaining social ties in this study concurs with the findings of a 2011 paper by Hynie, Crooks, & Barragan. They found that Canadian immigrants face more pressure to build social networks and obtain social support than their non-immigrant counterparts. They pointed to an absence of pre-established support systems and racial discrimination as underlying factors to explain why immigrants face more social pressure. During the COVID-19 pandemic, it is possible that this social pressure continued to be exerted or even exacerbated, which led to a greater concern about maintaining social ties as was seen in our study. Although, the work of Hynie, Crooks, & Barragan (2011) was limited by a small, female-only sample size (n = 52). Until a more rigorous investigation into the basis of this relationship is performed, the connection is still speculative, albeit promising. When considering the history of research on the topic of immigrant health, it is unusual that immigrants in our study perceived high life stress at a significantly lesser proportion than non-immigrants. A review article by George and colleagues (2015) outlined that for Canadian immigrants, economic uncertainty, social stigma, and less-established support systems contributed to higher life stress and worse mental health outcomes. But in the context of the COVID-19 pandemic, our data suggests that other factors caused immigrants to have better outcomes. Potential factors that explain this discrepancy include higher resilience among Canadian immigrants, stronger family support, or stronger community support. Beiser and colleagues (2002) noted that immigrant families tend to be more resilient due to the standardized and non-random immigration approval policies in Western nations. In Canada, a family that is approved for immigration is likely to be healthy, well-educated, and occupationally skilled. Additionally, a 2010 review by Knight and Sayegh purported that immigrant families value family solidarity and community ties more than their country counterparts. During the quarantine and isolation of a pandemic, strong family and community values could have been beneficial in mitigating life stress for immigrant groups. The review by Knight and Sayegh (2010) only addresses Latinx and African American minorities, so it is unclear if their results are fully translatable for immigrant Canadians. It was also interesting to find that immigrant and non-immigrant groups did not significantly differ about their concerns regarding family stress during the pandemic. As previously mentioned, ample research suggested that immigrant families should be facing more stress across the board (Bambra et al, 2020; George et al., 2015). But our data showed that during a healthcare crisis like a pandemic, concern for one's family is not dependent on factors like immigration status. It could be that the extra stress for immigrants is mitigated by stronger family values (Knight & Sayegh, 2010). Or, both groups simply care equally for their families in times of crisis.

It is important to consider the limitations of our analysis. The database that our study employed was based on a self-reported survey. While self-reporting is convenient for a large survey, it also introduces the risk of social desirability bias and recall bias. Participants may feel pressure to conform to social standards and/or an imperfect memory may have altered participant's responses. Due to these reasons, self-reported data may not present a valid assessment of stress. A more rigorous method of stress assessment would add to the external validity of future studies. The survey questionnaire itself may have also been ambiguous leading to inaccurate or unrepresentative answers from participants. For instance, "family stress from confinement" may have been interpreted differently between participants and it may be difficult to quantify exactly what one perceives as social ties. There are also limitations in employing an observational study design. These kinds of studies are more susceptible to the effect of confounding variables, which were not accounted for in our analysis. For example, social status can have a dramatic effect on an individual's ability to cope during a crisis and was not accounted for in our study. This is compounded by the risk of sampling bias; people who would take part in a survey may share characteristics that differentiate them from those who choose not to take part. As well, the database only included categorical data, which limited the analyses to tests of proportion. This took away the option of correlational analysis and comparing means between groups. During data analysis, we collapsed 4-5 variables into 2 variables for each psychosocial factor, in order to use a 2x2 Chi-squared test. It is possible that combining variables led to more or less significant results than are truly representative of the data. This was exacerbated by a notable difference in sample sizes between the grouping variables, as there were about 40 000 non-immigrant respondents compared to about 6000 immigrant respondents. These issues raise questions about if the dataset was truly representative of the real population.

Our study contributes to understanding the complex intersection of the COVID-19 pandemic and healthcare inequalities. It highlighted the importance of support systems in immigrant households versus those available in non-immigrant households. Our results shed light on the social pressures that discrimination and marginalization bring to immigrants in high stress time periods. At the same time, we show that effects from the pandemic are not universally worse for immigrant Canadians. Future research should further investigate how immigrant and non-immigrant populations have managed their social and family lives throughout large-scale crises like COVID-19 pandemic and beyond. A more rigorous investigation that looks into the effects of moderating and mediating variables on immigrant perceptions of life stress, family stress, and social stress, is an important next step. This way, researchers will not only confirm the trends that we have outlined but will work towards addressing them. For example, family income is a possible moderating variable that may be affecting immigrant families' ability to cope during the pandemic. As well, incorporating more valid tools for stress assessment, and stepping away from cross-sectional towards longitudinal study designs, would ensure that future work on this topic is representative of the real world. For example, assessing stress with standardized tools like the Perceived Stress Scale-10 (PSS-10) can be performed with the same participants over several months (Baik et al., 2019). This field of research has special implications for public health. Informed public policymaking is crucial for modern healthcare systems across the world. The COVID-19 pandemic has exposed weaknesses in our health infrastructure. While some members of society have experienced minor inconveniences, others have suffered greatly during this time. Identifying vulnerable populations in order to understand who needs the most help during times of crisis is the

first step towards efficient, ethical resource allocation. In the future, this opens the way for proactive strategies that prevent these groups from suffering in the first place. We have the opportunity to create a healthcare system that is resilient, equitable, and takes care of the vulnerable.

REFERENCES

Baik, S. H., Fox, R. S., Mills, S. D., Roesch, S. C., Sadler, G. R., Klonoff, E. A., & Malcarne, V. L. (2019). Reliability and validity of the Perceived Stress Scale-10 in Hispanic Americans with English or Spanish language preference. Journal of health psychology, 24(5), 628–639. https://doi.org/10.1177/1359105316684938

Bambra, C., Riordan, R., Ford, J., & Matthews, F. (2020). The COVID-19 pandemic and health inequalities. Journal of Epidemiology and Community Health, 74(11), 964. https://doi.org/10.1136/jech-2020-214401

Beiser, M., Hou, F., Hyman, I., & Tousignant, M. (2002). Poverty, family process, and the mental health of immigrant children in Canada. American journal of public health, 92(2), 220–227. https://doi.org/10.2105/ajph.92.2.220

Chu, I. Y.-H., Alam, P., Larson, H. J., & Lin, L. (2020). Social consequences of mass quarantine during epidemics: A systematic review with implications for the COVID-19 response. Journal of Travel Medicine, 27(taaa192). https://doi.org/10.1093/jtm/taaa192

Dubey, S., Biswas, P., Ghosh, R., Chatterjee, S., Dubey, M. J., Chatterjee, S., Lahiri, D., & Lavie, C. J. (2020). Psychosocial impact of COVID-19. Diabetes & metabolic syndrome, 14(5), 779–788. https://doi.org/10.1016/j.dsx.2020.05.035

George, U., Thomson, M. S., Chaze, F., & Guruge, S. (2015). Immigrant Mental Health, A Public Health Issue: Looking Back and Moving Forward. International journal of environmental research and public health, 12(10), 13624–13648. https://doi.org/10.3390/ijerph121013624

Gushulak, B. D., Pottie, K., Hatcher Roberts, J., Torres, S., DesMeules, M., et al. (2011). Migration and health in Canada: health in the global village. CMAJ : Canadian Medical Association journal, 183(12), E952–E958. https://doi.org/10.1503/cmaj.090287

Hafeez, H., Zeshan, M., Tahir, M. A., Jahan, N., & Naveed, S. (2017). Health Care Disparities Among Lesbian, Gay, Bisexual, and Transgender Youth: A Literature Review. Cureus, 9(4), e1184. https://doi.org/10.7759/cureus.1184

Huremović D. (2019). Brief History of Pandemics (Pandemics Throughout History). Psychiatry of Pandemics: A Mental Health Response to Infection Outbreak, 7–35. https://doi.org/10.1007/978-3-030-15346-5_2

Hynie, M., Crooks, V.A., & Barragan, J. (2011). Immigrant and refugee social networks: determinants and consequences of social support among women newcomers to Canada. Canadian Journal of Nursing Research, 43(4), 26-46.

Kalich, A., Heinemann, L., & Ghahari, S. (2016). A Scoping Review of Immigrant Experience of Health Care Access Barriers in Canada. Journal of Immigrant and Minority Health, 18(3), 697–709. https://doi.org/10.1007/s10903-015-0237-6

Knight B.G., & Sayegh P. (2010) Cultural values and caregiving: the updated sociocultural stress and coping model. J Gerontol B Psychol Sci Soc Sci, 65B(1), 5-13. doi: 10.1093/geronb/gbp096.

Krahn, G. L., Walker, D. K., & Correa-De-Araujo, R. (2015). Persons with disabilities as an unrecognized health disparity population. American journal of public health, 105 Suppl 2(Suppl 2), S198–S206. https://doi.org/10.2105/AJPH.2014.302182

Louis-Jean, J., Cenat, K., Njoku, C. V., Angelo, J., & Sanon, D. (2020). Coronavirus (COVID-19) and Racial Disparities: a Perspective Analysis. Journal of racial and ethnic health disparities, 7(6), 1039–1045. https://doi.org/10.1007/s40615-020-00879-4

Mann, C. J. (2003). Observational research methods. Research design II: Cohort, cross sectional, and case-control studies. Emergency Medicine Journal, 20(1), 54–60. https://doi.org/10.1136/emj.20.1.54

Statistics Canada. (2020). Impacts of COVID-19 on Canadians- Mental Health, 2020: Crowdsource file (ICC 2020: Mental Health). [Data set]. https://www150.statcan.gc.ca/n1/en/catalogue/13250002

Subedi, R., Greenberg, L., & Turcotte, M. (2020, October 28). COVID-19 mortality rates in Canada's ethnocultural neighborhoods [Press release]. Statistics Canada. Retrieved from https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00079-eng.htm.

Tai, D., Shah, A., Doubeni, C. A., Sia, I. G., & Wieland, M. L. (2021). The Disproportionate Impact of COVID-19 on Racial and Ethnic Minorities in the United States. Clinical infectious diseases : an official publication of the Infectious Diseases Society of America, ciaa815. Advance online publication. https://doi.org/10.1093/cid/ciaa815

Turcotte, M., & Savage, K. (2020, June 22). The contribution of immigrants and population groups designated as visible minorities to nurse aide, orderly and patient service associate occupations [Press release]. Statistics Canada. Retrieved from https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00036-eng.htm

Vaillant, N., & Wolff, F.-C. (2012). On the reliability of self-reported health: Evidence from Albanian data. Journal of Epidemiology and Global Health, 2(2), 83–98. https://doi.org/10.1016/j.jegh.2012.04.003

Zinsstag, J., Utzinger, J., Probst-Hensch, N., Shan, L., & Zhou, X.-N. (2020). Towards integrated surveillance-response systems for the prevention of future pandemics. Infectious Diseases of Poverty, 9(1), 140. https://doi.org/10.1186/s40249-020-00757-5

Analyzing Differences in Contraception Method Awareness and Pregnancy Prevalence in Women with Different Education Levels Living

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INTRODUCTION

Until 1969, contraceptives were illegal in Canada (Liu & Fisher, 2002). Unintended pregnancies, caused by contraceptive failure or misuse, can be a difficult experience for many women. It invites unwanted social, mental, and public health problems in the sense that it affects neonatal development and causes life altering changes for the mother such as postpartum depression, financial problems and a halt in their education status (Hauck & Costescu, 2015). Access to effective contraceptives is imperative for both sexual and social health. Since the introduction and legalization of contraceptives, women were now able to request contraceptive prescriptions from their doctors, control their fertility timeline for family planning and ensure their security within the job market. Legalizing contraceptives has also helped reduce the rates of unintended pregnancies and the severe medical risks associated with them (Kallner & Danilsson, 2016). However, despite such advancements and easy access to contraceptives, there are still stigmas around their sexual acceptability and their effect on sexual experiences which can further influence the consequences and chances of unintended pregnancies through the stigma-induced reduction in contraception use (Higgins & Smith, 2016).

Despite many institutions' concentration on the consequences of childbearing and sex education curriculums' emphasis on the harms (specifically for women) of sexual intimacy (rather than the benefits) which increased the use of certain contraceptives, it contributed to stereotypical gender notions towards women's sexual choices (Higgins & Smith, 2016). The lack of education and resources surrounding the variety of contraception methods available further de-emphasizes the contraception's medical convenience (Higgins & Smith, 2016). Other major factors affecting the convenience of use, aside from efficacy, determine the extent to which contraceptives will be embraced and used in society, including social and sexual acceptance.

The number of women striving for higher educational levels over the past few decades has increased dramatically (Turcotte, 2015). In 1990, only a small percentage of women aged 25-40 did not receive their high school diploma (Turcotte, 2015). By 2009, the proportion of women without a high school education dropped and the number of women graduating with a degree higher than high school doubled from 1990 (Turcotte, 2015). Overtime, the social significance of higher education has increased, causing a positive effect on the proportion of women who want to partake in post-secondary education (De Wit & Rajulton, 1992). During the 1960s to 1980s, educators were afraid of the influence that the sexual revolution had on young people and wanted to discourage sexually scandalous behaviour (Hutchinson Grondin, 2015). People lacked faith in parents' ability to teach their kids about sex education, and school boards felt obligated to teach about traditional sexual values and emphasized on the significance of having a traditional nuclear family (Hutchinson Grondin, 2015). Physical and health education regarding sex was subjective and limited to how much and how willing a teacher would divulge into the topic. It wasn't until the AIDS crisis in 1987, where the Ministry of

Education officially enforced a mandatory sex education curriculum across all school boards (Hutchinson Grondin, 2015).

Overall knowledge of different contraceptive methods varies widely across populations particularly among minority and younger populations who have less awareness and knowledge of various contraceptive methods (Eisenberg et al., 2012). Current research on contraceptive method awareness focuses on knowledge difference among minority and younger populations. Therefore, we have decided to focus on analyzing how general education level among adult women who obtained education levels in 1984 (at a time where sex education curriculums were rigid, restricted and less informative as opposed to now) affects contraceptive method awareness, particularly between different provinces as opposed to within (as seen in current literature). Doing so will allow us to solely test the effects of general education (excluding sex ed). Filling this knowledge gap will give new insights to understanding how education level alone affects contraceptive knowledge and how this information can help reduce unplanned pregnancies.

We will be conducting statistical analyses on the data obtained from the Canadian Fertility Survey (1984), obtained from the Odesi database. This primary research question of this study will assess whether there is a difference in contraception method awareness between two different education level groups ("high school and below" and "degree higher than high school") among women aged 18-30 years old. The secondary question will then analyze the difference in the prevalence of pregnancy in women aged 18-30 with varying education levels living across different Canadian provinces. Finally, we will look at the distribution of the highest education obtained (by women aged 18-30) across different Canadian provinces and then extrapolate information from the primary and secondary research questions to explain the varying prevalence of pregnancy outcomes across provinces.

MATERIALS AND METHODS

To determine if there is an association between the prevalence of pregnancy and contraception use, we extracted data from an online database (Odesi), and we conducted statistical tests using IBM SPSS software (version 27).

Study Design and Database

The study population of the Canadian Fertility Survey (CFS-1984) database surveyed women ages 18 to 49. The survey was produced by the Data and Government Information Centre (DGIC) at Queen's University (Kingston, ON) on January 28, 2013 [Identification: CFE-E-1984] to analyze fertility and contraceptives among women of reproductive age to counteract the little data that was collected before 1984 on patterns and trends of fertility and contraceptive use. The original study was conducted from April to June 1984, where a retrospective survey was conducted exclusively through telephone. The sampling procedure was done using a two-stage probability process. In the first stage, random dialling was used to overcome obstacles dealing with missing numbers commonly associated with relocation and unlisted numbers. The second stage filtered out the eligible respondents based on the participant selection criteria. Those within the target population, but not in a household or do not have a telephone in their household, were excluded. Due to cost and efficiency, the 3 Canadian territories

(Northwest Territories, Nunavut, and Yukon) were excluded from the survey and women residing at institutions or those who were unable to communicate in English or French, were excluded as well. We conducted an observational study using data obtained on January 25, 2021, from the Odesi database.

Study Participants

In the original database, there were 5,315 study participants and 477 variables. After filtering and selecting cases aged 18 to 30 (the age range where a woman is most fertile), we were left with 2,523 cases and 5 variables for our analysis. We filtered those cases using the two education level categories that were transformed earlier, bringing the case number from 2,523 to 1,609 (after the exclusion of missing cases). In the primary analysis, the case number 1,609 (age and education level filter applied) was used. However, for the secondary research question analysis, we used 2,523 (age filter only) as the number of cases to measure pregnancy outcomes across locations regardless of the education level obtained by women residing in those areas. Finally, for the tertiary research question, we used the case number of 1,609 to analyze the difference in the number of women who belonged to either education level groups across provinces and to examine a correlation between the two variables.

Study Outcomes

To answer the research questions, several outcomes have to be assessed and analyzed. The most important outcome for our primary research question is assessing how education level impacts women's knowledge and awareness of different contraception methods. Participants were asked about the highest degree, certificate, diploma or grade that they have obtained and were given different response options/categories to choose from, including "no diploma", "high school certificate", "university degree" and several more. Response options that indicated an educational level of high school or lower were transformed and grouped while options that indicated a degree higher than a high school certificate were grouped to make a new variable with two categories (of either "degree higher than high school" or "high school degree or lower"). Participants were also asked if they have heard of certain contraception methods (ex. "Have you heard of Intra-Uterine Device?") and were given response options of either a "yes" or a "no" to choose from. To answer the primary question, we used the grouped educational level variable (two categories), as well as the contraception method awareness variable (two categories). For the secondary question, the important outcome is how the province in which women reside can affect pregnancy prevalence outcomes (prevalence of pregnancy across provinces). At the time the survey was taken, participants were asked if they have ever been pregnant up to now ("So you have never been pregnant up to now?") and were given response options of either "never pregnant" or "has been pregnant" to choose from. They were also asked about their province of residence and given response options of all ten provinces to choose from. The lifetime conception variable (two categories) and the province of residence variable (ten categories) were then used to answer the secondary research question. Finally, the tertiary outcome was to see how the education level obtained correlates with the province of residence and to look at the distribution of the highest education level obtained by women across all provinces (done by constructing a population pyramid count), which will be used along with the primary and secondary outcomes to explain the varying pregnancy prevalence across residency locations.

The primary outcome is important because education level can affect women's fertility through its effect on women's health, their ability to control birth and the number of kids conceived as well as their knowledge of different contraception methods. Therefore, it is important to consider this outcome to help women fulfill their fertility desires whether that be their wish to conceive or their desire to control for birth in a more efficient way to have fewer children (Kim, 2016). The secondary outcome is important because it will be used to further show how pregnancy outcomes can vary across provinces with varying distributions of highest education level obtained, which will be demonstrated by the tertiary outcome. This is important because education is dependent on the provinces' circumstances and its relevance may change along with the provinces' economic advancements (Kim, 2016). Therefore, by considering those outcomes we can help improve education on topics like contraception in locations where it's lacking which in turn will allow for the control of high pregnancy prevalences observed in some areas compared to other ones.

Additional Data Collection

The study collected several categories of data including, knowledge of contraceptive methods, lifetime pregnancy status, level of education and province of residence. Age (women between 18-30 years) is a continuous variable that was not normally distributed and was used as a filter in selecting included cases for this study. Knowledge of contraceptive methods was used to determine the extent of knowledge about contraceptive methods among participants. Lifetime pregnancy status was a variable used to determine whether or not participants have been pregnant at some point in their lives and their knowledge of contraceptive methods for further analysis on whether there was a correlation between the two categories. Province of residence was a variable used to determine significant differences between knowledge of contraceptive methods across all 10 Canadian provinces.

Statistical Analysis

Descriptive statistics were produced for all variables used in our analyses (**Tables 1A and 1B**). Using all categorical variables, we ran several chi-square analyses to look at the relationships between level of education and knowledge of contraception. Using a separate chi-square test, the relationship between pregnancy prevalence and the province of residence was examined using the chi-square test statistics and 2-sided significance p-values. Finally, to look at the frequency distribution between the level of education and province of residence, a Spearman rho correlation analysis was conducted.

RESULTS

Descriptive characteristics of the population

Table 1A represents the descriptive statistics for the variables that were used in our primary and tertiary research questions and Table 1B represents those used in the secondary research question. Overall, the mean age of participants with a high school diploma or lower was 24 (IQR 6) while those with a degree higher than high school diploma was 25 (IQR 5). Both groups were also more knowledgeable of contraception methods like pills, IUD, FJC, condoms, diaphragm, abstinence and withdrawal and

rhythm methods than not. Finally, participants were found to be distributed across the 10 Canadian provinces with the highest distributions being in Ontario and Quebec.

Table 1A: The descriptive statistics for the education level of women are linked to their knowledge of various forms of contraception, and their current province of residence. N = 1609 women aged 18–30 years old.

Variable	Highest Education Level obtained		p-value	χ^2 test statistic
	High school diploma and below (N = 955)	Degree higher than high school diploma (N = 654)		
Age 18–30 (in years)	24 (6)	25 (5)	---	
Knowledge of contraception methods (Yes, No)	950 (99.7), 3 (0.3)	653 (99.8), 1 (0.2)	0.896	0.017
Pill	915 (96.1), 37 (3.9)	646 (98.8), 8 (1.2)	0.002	9.143
Intrauterine Device	913 (95.8), 40 (4.2)	639 (97.7), 15 (2.3)	0.055	3.696
Foam/Jelly/Cream	940 (98.6), 13 (1.4)	650 (99.4), 4 (0.6)	0.230	1.441
Condoms	912 (95.7), 41 (4.3)	640 (97.9), 14 (2.1)	0.028	4.848
Diaphragm	848 (89.1), 104 (10.9)	615 (94.0), 39 (6.0)	<0.001	11.160
Withdrawal method	682 (71.6), 271 (28.4)	565 (86.4), 89 (13.6)	<0.001	48.205
Abstinence + 1 month	901 (94.5), 52 (5.5)	640 (97.9), 14 (2.1)	0.002	10.002
Rhythm method				
Province of residence				
Alberta	103 (10.8)	72 (11.0)		
British Columbia	108 (11.3)	70 (10.7)		
Prince Edward Island	7 (0.7)	2 (0.3)		
Manitoba	47 (4.9)	36 (5.5)	<0.001	30.069
New Brunswick	28 (2.9)	8 (1.2)		
Nova Scotia	39 (4.1)	17 (2.6)		
Ontario	389 (40.7)	224 (34.3)		
Quebec	184 (19.3)	184 (28.1)		
Saskatchewan	39 (4.1)	37 (5.7)		
Newfoundland	11 (1.2)	4 (0.6)		

Data are presented as frequency (valid %) for categorical data, except for age (in years) which is a continuous variable and was reported as median (IQR). *p*-values were calculated using the chi-square tests in SPSS.

Table 1B: The descriptive statistics for the lifetime pregnancy status of women are linked to their current province of residence. N = 2523 women aged 18-30 years old.

Variable	Lifetime Pregnancy Status		p-value	χ^2 test statistic
	Never been pregnant (N = 1144)	Has been pregnant (N = 1379)		
Province of residence				
Alberta	105 (9.2)	134 (9.7)		
British Columbia	113 (9.9)	151 (10.9)		
Prince Edward Island	4 (0.3)	8 (0.6)		
Manitoba	51 (4.5)	68 (4.9)	0.013	20.821
New Brunswick	32 (2.8)	42(3.0)		
Nova Scotia	41(3.6)	46 (3.3)		
Ontario	391 (34.2)	455 (33.0)		
Quebec	347 (30.3)	352 (25.5)		
Saskatchewan	44 (3.8)	78 (5.7)		
Newfoundland	16 (1.4)	45 (3.3)		

Data are presented as frequency (valid %) for categorical data, except for age (in years) which is a continuous variable and was reported as median (IQR). *p*-values were calculated using the chi-square tests in SPSS.

Main Findings

Statistically significant differences in most of the characteristics of participants was observed when grouped according to either their education level or pregnancy status. The primary analysis involved the running of 8 chi-square tests in SPSS for each type of contraception method using the contraception methods awareness variable and the fixed, highest educational level obtained variable (Table 2 shows an example of a chi-square table for one of the contraception methods which was replicated for the other seven contraception methods). The continuity correction value (2 x 2 table) for the use of the intrauterine device, diaphragm, withdrawal method, abstinence and rhythm method were 9.143, 4.848, 11.160, 48.205 and 10.002 respectively with statistically significant p values of 0.002, 0.028, p <0.001, p <0.001 and 0.002 respectively. Out of eight contraception methods analyzed, three showed statistically insignificant results. Those were pills, foam/jelly/cream and condoms which had p values of 0.896, 0.055 and 0.230 respectively.

Table 2: Knowledge of IUD contraception method (N=1609)

Survey question: Have you heard of...		Highest education level obtained		Total	χ^2 test statistic	*p*-value
		High school degree or lower	Degree higher than high school			
...Intrauterine device?	Yes	915	646	1561	9.143	0.002*
	No	37	8	45		
Total		952	654	1606		

* represents a statistically significant result.

The secondary research question looked at the link between the prevalence of pregnancy (N = 1609), level of education and province of residence. A chi-square test was conducted in SPSS to determine the between-group differences in the categorical variables. The Pearson Chi-Square value was 20.821, with a statistically significant *p*-value of <0.001 (Table 3).

Table 3: Prevalence of pregnancy across all 10 Canadian provinces (N=2523)

	Lifetime Pregnancy Status		Total	χ^2 test statistic	*p*-value
	Never been pregnant	Has been pregnant			
10 Canadian Provinces	1144	1379	2523	20.821	0.013

The tertiary research question examined whether there was a relationship between the province of residence (N = 2523) and the highest education level obtained (N = 1937/2523). A Spearman *rho* correlation analysis was conducted in SPSS. At a statistically significant level of <0.001, the correlation coefficient was reported to be 0.152. This finding represented a weak positive correlation, as the observed correlation coefficient is less than 0.5. To answer the tertiary question, a chi-square test was performed in SPSS. The test compared the difference in the highest education level obtained across 10 different provinces. Findings from this analysis showed Pearson chi-square value of 30.069 with a *p*-value of p<0.001. The tertiary analysis also involved creating a split distribution bar graph in SPSS, which compared the transformed variable of highest degree/diploma/grade educational levels for each of the 10 Canadian provinces (Figure 2).

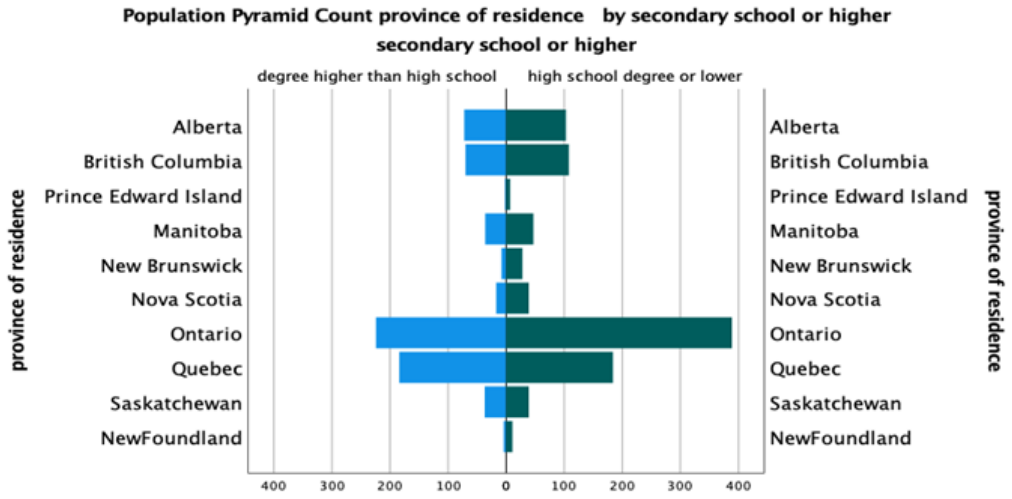

Figure 2. The distribution of participants and their respective education levels and province of residence.

DISCUSSION

Summary of main findings

Women aged 18-30 with an education level higher than high school, living across all 10 Canadian provinces seem to have better knowledge of the IUD, diaphragm, withdrawal, abstinence and rhythm contraception methods compared to women with an education level of high school or lower. However, from our results, knowledge of condoms, FJC and pills did not appear to vary across the two education level groups. Pregnancy prevalence in women aged 18-30 of all education levels also varied across all provinces. This may be related to the findings observed for the analysis of the tertiary outcome where a small positive correlation between education level and province of residence was observed across Canada. Both, the small positive correlation between education and province of residence and the difference in contraception awareness across different education levels suggest that differences in pregnancy outcomes observed across provinces may be attributed to the education available in those areas. The unexpected result between province and education level can be attributed to the way that the question was framed in the original 1984 survey, suggesting that there may be additional information linking geographical location and more information on the level of education that wasn't accounted for by the 1984 questionnaire. Insignificant results observed with the difference in knowledge of condom and pills contraception methods across education levels was expected due to the fact that those are the two most common methods used by women compared to any other ones (Martin & Wu, 2000; Al Sheeha, 2010). However, the insignificant findings observed for FJC methods were not expected in our results, but could be explained by their high availability (over the counter with no prescription), their inexpensiveness and their minimal side effects compared to other methods (Raymond et al., 2004).

Comparison of findings from the literature

Similar to our findings, data from other literature suggests that increased contraception knowledge and use in women with higher education levels show up to 60% more contraception awareness in

educated women compared to those who are not (Al Sheeha, 2010; Sajid & Malik, 2010). External data also shows that pills, IUDs and condoms are the most widely known and used contraception methods. This supports our idea that the common use of condoms and pills causes the insignificant results observed in the results of our study (Daniels & Abma, 2019).

Unlike our research which looked at overall pregnancy outcomes as well as differences in educational levels across Canadian provinces, the literature focuses mainly on teenage pregnancy prevalence in Canada, with much of the research assessing the effect of sexual education on the knowledge and use of contraception methods, compared to the few studies that look at the effects of general education levels.

Significance of findings

Our research contributes to the growing field of knowledge and awareness about the effectiveness of pregnancy prevention using contraception, education and awareness. The research presented in this paper fills in existing knowledge gaps related to the impact of general education on contraception methods between different provinces (instead of within provinces), in addition to looking at pregnancy prevalence in adult women (instead of in female adolescents). The implications of this study could help policymakers and governmental bodies determine the most effective ways to implement family planning and health education into the society. Also along with the changes that have happened with regards to women's rights over the past decades, an increasing number of women striving to obtain a high educational level can be observed, whereby the desire to control for unwanted pregnancies is also increasing. Therefore, to allow for that to happen education curriculums should start working on eliminating negative perceptions of sex and advocating for abstinence from sexual intercourse and instead work on providing intensive curriculums on all the different birth-control options possible

Limitations of this study

Given the nature of this study, there were many limitations that were encountered when analyzing the data and deciding which statistical analyses should be used. Based on the variables that were given in the original study questionnaire and those that were incorporated into the statistical analyses, the availability and effectiveness of contraceptives across provinces was not able to be directly tested using the methods. With each statistical analysis that was used, there are specific assumptions and restrictions that control for an accurate interpretation of the results. The chi-square tests examine the between-group differences related to the proportion of responses to categorical variables. As many of the survey questions included variables with more than 2 categories, it is not appropriate to extrapolate this information to determine which variables are significant in relation to other variables. This means that the information gathered from the chi-square test analyses is limited due to the confines of the test.

There is a lack of awareness regarding the knowledge of contraception and family planning methods, which does contribute to the increased prevalence of teenage pregnancies (Coles et al., 2011). A study done in 2017 demonstrated that 56% of people are aware of different contraception methods, while 44% of people are unaware (Gaikwad et al., 2017). In today's society, there seems to be stigmas that

may be affecting the social acceptance and use of contraceptives, such as socioeconomic status, cultural and religious backgrounds. It was found that religion also influences what contraceptive (i.e., barrier methods) were used to prevent pregnancy.

Implications and future directions

Future research could look at surveying the target population by re-phrasing some of the key questions that were used in this study to determine whether the relationships and conclusions hold true. Some statistical bias can be attributed to generalizing the results to make it more applicable to the main research questions. Further research should be done on the more invasive methods of contraception (excluded from our analyses), including male and female sterilization techniques (such as tubal ligations and vasectomies). Future studies should look at how sterilization rates have changed since this original survey was conducted in 1984 and potential factors that may have contributed to this change.

The findings from this study help to address public health concerns associated with knowledge about contraceptives, pregnancy prevalence, and province of residence within Canada. It also helps to raise awareness for knowledge gaps that we see in the current sexual education curriculum, regarding lack of knowledge about the effectiveness of various contraception methods that can be used to prevent unintended pregnancies.

REFERENCES

Al Sheeha, M. (2010). Awareness and Use of Contraceptives Among Saudi Women Attending Primary Care Centers in Al-Qassim, Saudi Arabia. Int J Health Sci (Qassim), 4(1), 11–21.

Balakrishnan, T. R., Krotki, K., & Lapierre-Adamcyk, E. (1985). Contraceptive use in Canada, 1984. Family Planning Perspectives, 17(5), 209. doi:10.2307/2135087

Coles, M. S., Makino, K. K., & Stanwood, N. L. (2011). Contraceptive experiences among adolescents who experience unintended birth. Contraception, 84(6), 578–584. doi:10.1016/j.contraception.2011.03.008

Daniels, K., & Abma, J. C. (2019, February 14). Current Contraceptive Status Among Women Aged 15–49: United States, 2015–2017. Retrieved April 10, 2021, from https://www.cdc.gov/nchs/products/databriefs/db327.htm

De Wit, M. L., & Rajulton, F. (1992). Education and timing of parenthood among Canadian women: A cohort analysis. Social Biology, 39(1-2), 109–122. doi:10.1080/19485565.1992.9988808

Dunn, S., Anderson, G. M., & Bierman, A. S. (2009). Temporal and regional trends in IUD insertion: A population-based study in Ontario, Canada. Contraception, 80(5), 469–473. doi:10.1016/j.contraception.2009.04.004

Eisenberg, D. L., Secura, G. M., Madden, T. E., Allsworth, J. E., Zhao, Q., & Peipert, J. F. (2012). Knowledge of contraceptive effectiveness. American Journal of Obstetrics and Gynecology, 206(6). doi:10.1016/j.ajog.2012.04.012

Fisher, W. A., & Black, A. (2007). Contraception in Canada: a review of method choices, characteristics, adherence and approaches to counselling. Canadian Medical Association Journal, 176(7), 953–961. https://doi.org/10.1503/cmaj.060851

Gaikwad, R. A., Gadappa, S. N., & Deshpande, S. S. (2017). Awareness of contraception in post-partum women in a tertiary care centre. International Journal of Reproduction, Contraception, Obstetrics and Gynecology, 6(9), 3850. doi:10.18203/2320-1770.ijrcog20173717

Hauck, B., & Costescu, D. (2015). Barriers and Misperceptions Limiting Widespread Use of Intrauterine Contraception Among Canadian Women. Journal of Obstetrics and Gynaecology Canada, 37(7), 606–616. https://doi.org/10.1016/S1701-2163(15)30198-5

Higgins, J. A., & Smith, N. K. (2016). The Sexual Acceptability of Contraception: Reviewing the Literature and Building a New Concept. Journal of Sex Research, 53(4-5), 417–456. https://doi.org/10.1080/00224499.2015.1134425

Hulme, J., Dunn, S., Guilbert, E., Soon, J., & Norman, W. (2015). Barriers and facilitators to family Planning access in Canada. Healthcare Policy | Politiques De Santé, 10(3), 48-63. doi:10.12927/hcpol.2015.24169

Hutchinson Grondin, M. (2015). More than plumbing: the history of sexual education in Ontario, 1960-1979. Electronic Thesis and Dissertation Repository, 3457.

Kallner, H. K., & Danielsson, K. G. (2016). Prevention of unintended pregnancy and use of contraception-important factors for preconception care. Upsala Journal of Medical Sciences, 121(4), 252–255. https://doi.org/10.1080/03009734.2016.1208310

Kim, J. (2016). Female education and its impact on fertility. IZA World of Labor, 1–10. https://doi.org/10.15185/izawol.228

Liu, K. E., & Fisher, W. A. (2002). Canadian physicians' role in contraception from the 19th century to now. Journal of obstetrics and gynaecology Canada, 24(3), 239–244. https://doi.org/10.1016/s1701-2163(16)30224-9

Martin, K., & Wu, Z. (2000). Contraceptive use in Canada: 1984-1995. Family planning perspectives, 32(2), 65–73.

Raymond, E. G., Chen, P. L., Luoto, J., & Spermicide Trial Group (2004). Contraceptive effectiveness and safety of five nonoxynol-9 spermicides: a randomized trial. Obstetrics and gynecology, 103(3), 430–439. https://doi.org/10.1097/01.AOG.0000113620.18395.0b

Sajid, A., & Malik, S. (2010). Knowledge, Attitude and Practice of Contraception Among Multiparous Women at Lady Aitchison Hospital, Lahore. Annals of King Edward Medical University, 16(4), 266. doi:https://doi.org/10.21649/akemu.v16i4.243

Trussell J. (2009). Understanding contraceptive failure. Best Practice & Research Clinical Obstetrics & Gynaecology, 23(2), 199–209. https://doi.org/10.1016/j.bpobgyn.2008.11.00

Turcotte, M. (2015). Women and education. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/89-503-x/2010001/article/11542-eng.htm

The Impact of Financial Stress on Anxiety Levels in the COVID-19 Pandemic

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INTRODUCTION

Ever since the great financial crisis in 2010, household debt worldwide has continued to rise (Lombardi et al., 2017). This debt is not exclusive to third-world countries, as richer countries in North America continue to increase in debt (Simone & Walks., 2019). Canada in particular has become one of the most vulnerable countries to debt worldwide (Simone & Walks., 2019). According to Statistics Canada, household debt of all ages across Canada has almost doubled since 2005 (Statistics Canada, 2021). Previous literature has shown that debt plays an important role in our identity and behaviour (Simone & Walks., 2019). Since debt is intensively linked with our personal lives, increasing debt has been repeatedly associated with poor health and relationship strain (Stevenson et al., 2020).

Research has shown that there are negative effects on mental health during financial crises (Drydakis, 2015; Kokaliari, 2016). During the 2008-2013 financial crisis in Greece, unemployment was more detrimental to mental health in periods of high unemployment compared to low unemployment (Drydakis 2015). Involuntary unemployment was also reported to have a negative effect on mental health, and women were more negatively affected by unemployment than men (Drydakis 2015). When Greek citizens were evaluated on the Depression Anxiety Scale (DASS), researchers found higher levels of stress, depression, and anxiety in Greece compared to control (Kokaliari 2016). Higher income was negatively correlated with stress and anxiety, while Greek adults with lower incomes had higher anxiety and stress scores (Kokaliari 2016). Recent studies have found similar results, as their main findings indicated that high financial concerns and anxiety symptoms were positively correlated (Wilson et al., 2020; Griffiths et al., 2021).

The Covid-19 pandemic has amplified these concerns (Peteet 2020). Research shows that there is increasing levels of anxiety among the general population as individuals face uncertainty about the future, financial troubles, physical and emotional isolation, and other stresses associated with the pandemic (Peteet 2020). Financial strain has been increasing due to stay-at home orders which has resulted in major job loss and global supply chains becoming disrupted (Nicola et al., 2020). Because of this, many individuals are finding it difficult to meet basic needs such as paying rent to their landowners and being able to fulfill household expenditures (Nicola et al., 2020). Job insecurity and the accompanying distress is frequent during this pandemic because many individuals have to learn how to adjust with their impacted incomes (Wilson et al., 2020). Preliminary studies on the COVID-19 pandemic have shown that there may be a correlation between anxiety symptoms and increased job insecurity (Wilson et al., 2020).

This research primarily focuses on the mental health of young adults such as students or patients with mental illness prior to the pandemic (Li et al., 2021; Pan et al., 2021). The closest research that pertains to this subject area is on job loss and mental health for Australians above the age of 18 (Griffiths et al., 2021). This study has documented that increased job security may benefit both the physical and

mental health of these individuals (Griffiths et al., 2021). However, this research does not comment on the severity of anxiety experienced due to financial strain in particular. Since this research focuses on Australians, there is a lack of knowledge about how COVID-19 induced financial stress is impacting citizens of other countries, like Canadians. That's why research surveys from 'Impacts of COVID-19 on Canadians- Mental Health, 2020' were analyzed to answer the following research question: Are adults aged 25-54 undergoing financial stress brought on by the COVID-19 pandemic at greater risk of experiencing severe anxiety symptoms compared to adults aged 25-54 that do not have increased financial stress?

MATERIALS AND METHODS

Study Design and Database

Crowdsourcing: Impacts of COVID-19 on Canadians - Mental Health, 2020 is an observational cross sectional study (Statistics Canada, 2020). This study is the second in a continuing series of crowdsourcing cycles (Statistics Canada, 2020). The researchers designed this study with the purpose of assessing the quality and viability of a time-effective model with online data collection (Statistics Canada, 2020). The researcher's main goal was to invite all Canadians to voluntarily participate in a survey to determine how the COVID 19 pandemic is impacting their mental health (Statistics Canada, 2020). Data was collected using an anonymous online self-administered questionnaire found on Statistic Canada's website (Statistics Canada, 2020). To recruit participants, the researchers campaigned on social media with the help of larger corporations, such as government agencies, associations, and news channels (Statistics Canada, 2020).. The questionnaire was available in English and French and took approximately five minutes to complete (Statistics Canada, 2020). The researchers ensured that the questionnaire followed ethical guidelines, used appropriate wording, and worked properly on desktop computers (Statistics Canada, 2020).

Study Participants

The database includes Canadians aged 15 and up that were currently living in one of the ten provinces or three territories. The inclusion criteria for our study is Canadians between the ages of 25-54 that reported no impact, minimal impact, moderate or major impacts of Covid 19 on the ability to meet financial needs. We included all genders and the thirteen geographic regions because we wanted our study to be inclusive to all of Canada. The organization of age groups in the database was only available in increments of 10. Because of this, we decided to focus on the age range of 25-54 because they are most likely to have a job. We excluded the age range of 15-24 because this age group would most likely depend on their parents for financial support. We excluded Canadians 55 years and older because a majority of this population may have entered retirement. We excluded participants that reported that the financial impact of the pandemic was "too early to tell". We excluded these participants because their financial impacts were unknown. Since these participants made up less than 10% of our study population, this increased the statistical power of our study.

Study Outcomes

The intervention used in this study is financial strain and the primary outcome of interest is the severity of anxiety. Independent variables used for our analysis included: ID, age, gender, severity of anxiety

and province of residence, fear of losing source of income and the impact of COVID-19 on financial needs. These variables gave us demographic information on the study population. The survey question on the impact of COVID-19 on financial needs stratified our study population into two categories of financial impact. No financial impact, and minor impact made up the low financial impact group, while moderate and major impact became the severe financial impact group.

Dependent variables included perceived mental health, perceived life stress, and MH15 categorical anxiety symptom variables. Perceived mental health had the following answers to choose from: excellent, very good, good, fair, poor, valid skip, don't know, refusal and not stated. Perceived life stress had choices such as: not at all stressful, not very stressful, a bit stressful, quite a bit stressful, extremely stressful valid skip, don't know, refusal and not stated. Participants also classified how often they felt symptoms of anxiety over the past two weeks. The categorical variables that we included from these symptoms were: feeling anxious/nervous/on edge, not being able to control/stop worrying, worrying too much about different things, trouble relaxing, being so restless to sit still, becoming easily annoyed/irritable, and feeling afraid as if something awful might happen. Alongside with the set time frame, the categories to choose from these variables were all similar and consisted of not at all, several days, more than half the days, nearly every day, valid skip, don't know, refusal and not stated. Answers to the previous questions stratified participants into five different categories of anxiety: no symptoms, minimal, moderate, mild and severe anxiety.

The mental health variables that we chose include the most frequent Canadian anxiety symptoms, such as increased worry and restlessness (Katzmen et al., 2014). Previous research shows that financial strain is most likely to increase the prevalence of anxiety disorders (Dijkstra-Kersten et al., 2015). It is evident that financial strain during the pandemic has also been most frequently associated with increased anxiety prevalence (Peteet, 2020). This supported our decision to select severity of anxiety as our primary outcome when dealing with the intervention of financial strain. It was important to highlight the severity of anxiety as a primary outcome to explore these findings in depth and expand the findings already present within this field.

Statistical Analysis

All statistical analyses were run with the Statistical Package for the Social Sciences (SPSS) IBM Premium ver. 27.0. The Crowdsourcing: Impacts of COVID-19 on Canadians – Mental health, 2020 dataset was imported from the ODESI database into SPSS. We grouped participants in low financial impact or severe financial impact. We then evaluated group differences between age, gender, province of residence, mild anxiety levels and severe anxiety levels. Table 1 displays these descriptive characteristics. No continuous data was present so tests for normality were not run. We tested for group differences with a Chi-square test since the data was categorical. We tested for significant correlations between groups using a Spearman Rho test. The p-value for significance was 0.05 for both tests.

RESULTS

This study focuses on the impact financial stress has had on the severity of generalized anxiety symptoms. Data pertaining to the impact of COVID-19 on Canadians, for 45,989 individuals was available in the dataset. We excluded 17,491 individuals as they did not meet our inclusion criteria. The low financial impact group had 20,337 participants out of the 28,497 individuals total. The high financial impact group had the remaining 8,160 participants. Table 1 contains the characteristics of our sample population.

Table 1 Descriptive statistics of Sample Population (N=28,497)

	Financial Impact of COVID-19		
Variable	**Low (N = 20337)**	**High (N = 8160)**	***p*-Value***
Age group (years)			0.017
25 to 34	6396 (31.5)	2708 (33.2)	
35 to 44	8060 (39.6)	3144 (38.5)	
45 to 54	5881 (28.9)	2308 (28.3)	
Gender			0.849
Male	4974 (24.5)	1987 (24.4)	
Female	15363 (75.5)	6173 (75.6)	
Province of Residence			<0.001
Newfoundland and Labrador	123 (1.2)	68 (1.6)	
Prince Edward Island	40 (0.4)	16 (0.4)	
Nova Scotia	720 (6.8)	366 (8.4)	
New Brunswick	219 (2.1)	88 (2.0)	
Quebec	1280 (12.1)	403 (9.3)	
Ontario	5092 (48.1)	2069 (47.7)	
Manitoba	307 (2.9)	127 (2.9)	
Saskatchewan	266 (2.5)	121 (2.8)	
Alberta	931 (8.8)	402 (9.3)	
British Columbia	1520 (14.4)	649 (15.0)	
Territories	93 (0.9)	28 (0.6)	
Severity of Generalized Anxiety			<0.001**
No Symptoms	1550 (7.6)	288 (3.5)	
Minimal Symptoms	6378 (31.4)	1390 (17.0)	
Mild Symptoms	7133 (35.1)	2638 (32.3)	
Moderate Symptoms	3317 (16.3)	1880 (23.0)	
Severe Symptoms	1959 (1.9)	1964 (24.1)	

Sample size was N = 28,497. All data was presented as the number (%) of participants. P-value obtained using Chi-square test. **p*-Value < 0.05 indicates statistically significant difference between low financial impact and high financial impact groups. **There is a statistically significant difference between financial impact groups for severity of generalized anxiety.

There were many strong positive correlations from our findings. These strong positive correlations include: Strong positive correlation (p = 0.809, p = <0.001) between reported severity of generalized anxiety and survey question "Feeling nervous, anxious or on edge". There was a strong positive correlation (p = 0.831, p = <0.001) between reported severity of generalized anxiety and survey question "Not able to stop or control worrying". Strong positive correlation (p = 0.822, p = <0.001) between reported severity of generalized anxiety and survey question "worrying too much about different things". Strong positive correlation (p = 0.800, p = <0.001) between reported severity of generalized anxiety and survey question "Having trouble relaxing". Strong positive correlation (p = 0.656, p = <0.001) between reported severity of generalized anxiety and survey question "Being so restless that it is hard to sit still". Strong positive correlation (p = 0.694, p = <0.001) between reported severity of generalized anxiety and survey question "Becoming easily annoyed or irritable". Strong positive correlation (p = 0.715, p = <0.001) between reported severity of generalized anxiety and survey question "Feeling afraid as if something awful might happen". Strong positive correlation (p = 0.534, p = <0.001) between reported severity of generalized anxiety and perceived life stress. Based on correlation of survey questions with reported severity of generalized anxiety, reported severity was determined to be an accurate assessment of current levels of anxiety.

For the group of individuals that reported high financial impact due to COVID-19, the frequency of individuals increased as the severity of anxiety increased (Figure 1). The frequency of individuals experiencing low financial impact due to COVID-19 decreased as severity of generalized anxiety decreased (Figure 1). The number of individuals who reported severe symptoms of anxiety was equal for both impact groups. However, the frequency of individuals was higher in the high financial impact group compared to the low financial impact group (Figure 1).

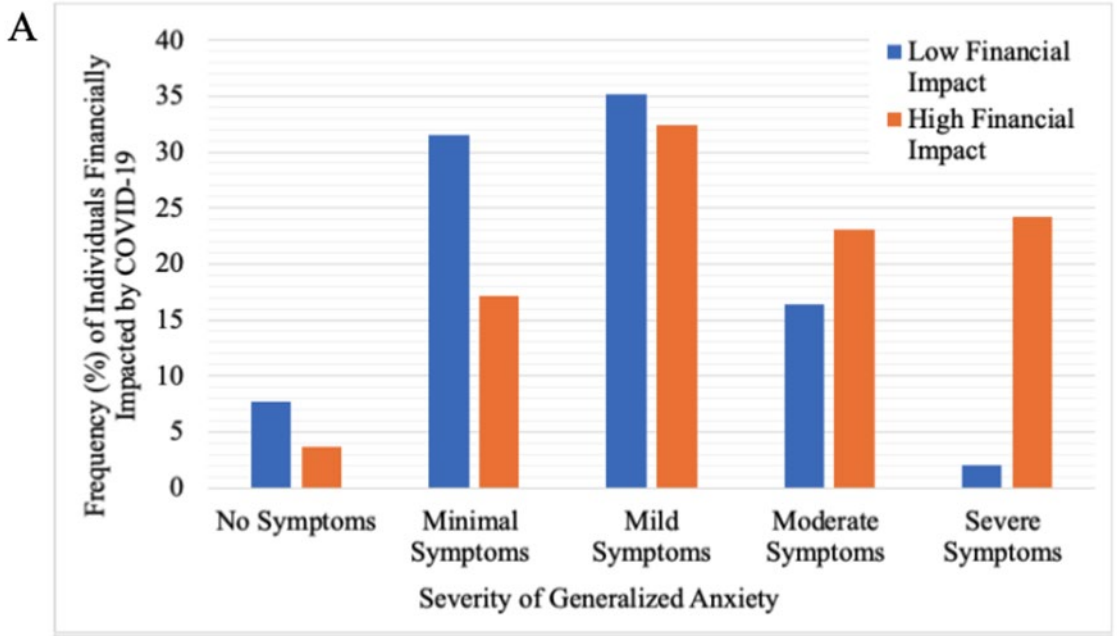

Figure 1. Individuals Within Each Category of Severity of Generalized Anxiety. (A) The frequency (%) of individuals within each category of severity.

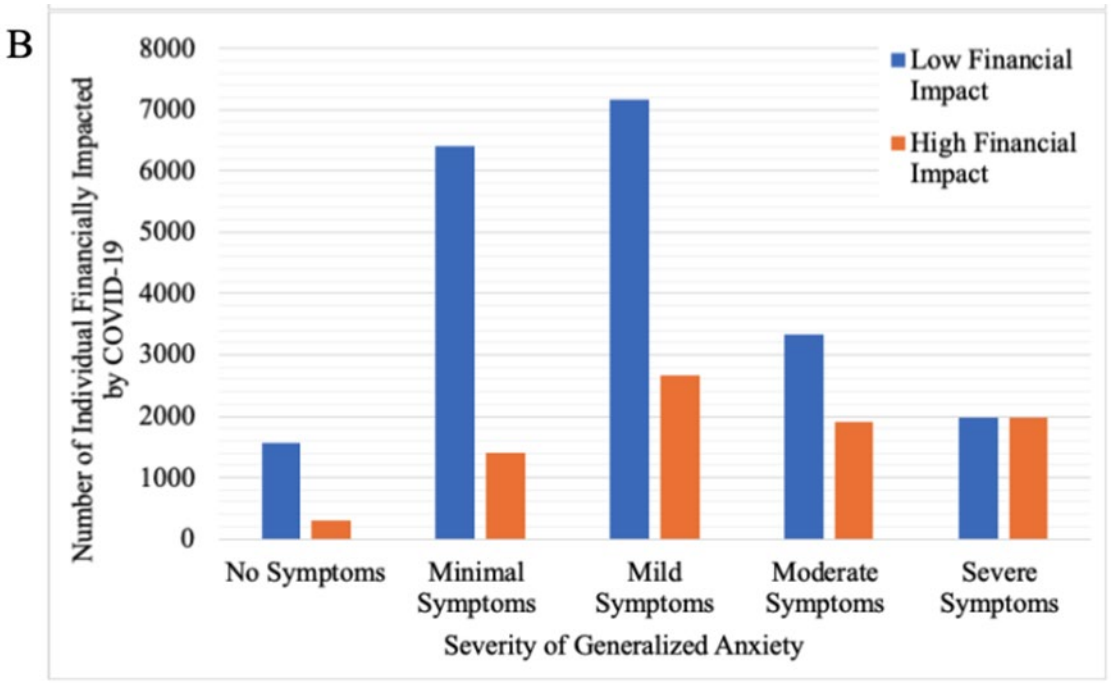

Figure 1. Individuals Within Each Category of Severity of Generalized Anxiety. (B) The number (count) of individuals within each category of severity. 20,337 individuals in the low financial impact group and 8160 individuals in the high financial impact group.

A weak positive correlation (ρ = 0.231, p = <0.001) between financial impact of COVID-19 and severity of generalized anxiety was computed using the Spearman rho correlation test using SPSS (Table 2).

Table 2 Correlation Table

	Financial Impact	Severity Of Generalized Anxiety	Perceived Mental Health	Fear of Losing Income
Financial Impact	1.00	0.231*	0.155*	0.456*
Severity Of Generalized Anxiety		1.00	0.559*	0.149*
Perceived Mental Health			1.00	0.056*
Fear of Losing Their Job				1.00

Correlation coefficient computed using the Spearman Rho test in SPSS. * p = <0.001. p-value is less than 0.05 indicating statistical significance.

When asked to disagree, neither agree nor disagree, agree or strongly agree with the following statement, "I might lose my main job or main self-employed income in the next four weeks, a majority of individuals in the low impact group report 'disagree'. A majority of individuals in the high financial impact group reported 'agree' or 'strongly agree'. A moderately positive ($p = 0.456$, $p = <0.001$) correlation found between financial impact and fear of losing income.

DISCUSSION

The main findings from our research show that there is a weak positive correlation between financial debt and severe anxiety. The higher financial strain is for an individual, the more likely they are to experience more severe anxiety symptoms compared to those with less financial strain. Mental health variables within the survey were positively correlated with the severity of anxiety in our database. This finding verified that the mental health variables used to create the anxiety categories was a valid measure of testing for anxiety severity. Job insecurity was also moderately correlated with anxiety.

When we compare these results to the literature in the field, we see the same findings in research published before the pandemic (Drydakis, 2015; Kokaliari, 2016). Previous studies have shown that debt is an important contributor to poor mental health (Kokaliari 2016; Wilson et al., 2020). Job insecurity has also been linked to an increase in anxiety symptoms (Griffiths et al., 2021; Too et al., 2020). This consensus between our study and the research in the field supports the notion that financial strain may lead to anxiety disorders. Our findings supplemented this research by showing that the severity of anxiety may also be impacted by financial strain.

Research conducted during the pandemic has also shown an increase in anxiety prevalence (Lai et al., 2020; Zhang et al., 2020; Luo et al., 2020). A systematic review by Luo et al evaluated over 60 studies with participants from 17 different countries and found an increase in anxiety amongst the public during COVID-19. However, the studies within the systematic review found a wide variety of predictors and risk factors for anxiety increases (Luo et al., 2020). This included variables such as a history of past mental illness, gender, and social isolation from others (Luo et al., 2020). Other research has also indicated that women have a higher risk of anxiety compared to men (Lai et al., 2020; Zhang et al., 2020). In past financial crises, women have also been shown to have higher anxiety levels in response to unemployment (Drydakis 2015). This research within the field indicates that there may be a variety of confounding factors present in our study. Financial strain may not be the only variable playing a causative role in the rise of anxiety levels in our study. While the survey questions were specific and carefully written, they were missing questions about mental illness history and covid-related events. Our sample population in our database also had a larger proportion of women in comparison to men. The rise in severity of anxiety in our study may not be solely attributed to financial strain, and instead could be attributed to gender or other confounding factors.

The biggest limitation present in our study were the confounding variables that may have altered our results. Since this was a retrospective study with limited survey questions, we couldn't control for factors like family covid-related deaths, impact of social isolation, online work environments, etc. This may have influenced the outcome of our research. It is possible that financial strain could be just one of the many factors associated with higher anxiety levels. The design of our survey also played a role

in our limitations, because the survey only recorded subjective data about financial strain and anxiety levels. Without objective data, we lack a way to test the validity of these claims. Our data was also limited by the absence of survey follow-ups within the survey. Since participants were only asked to rate their mental health and financial strain once, we lack longitudinal data that could help verify their claims or provide data on the duration of anxiety. Our sample population was also over-represented by women, which made it less generalizable to the Canadian population.

Despite these limitations, our study did have strengths, which included the generalizable sample population in our study. Our study included a large sample size including participants from all 13 provinces and territories. This allowed us to generalize our findings to the entire Canadian population. This data is a great starting point for future research. We can use this pre-existing data to learn about risk factors that could help us predict the prevalence of anxiety disorders in Canada. This information will also help us identify populations that are at risk for anxiety disorders, which has important implications for our health care system.

Future directions include research with stricter criteria and more dependent variables. Questions should include COVID-related events, job environments, and medical history. To validate study outcomes, future research needs objective measures such as income tax assessments and anxiety diagnoses. Research should include follow-ups to identify if COVID is affecting our anxiety levels in the long-term. If the results are consistent with the rest of the field, we should consider implementing more funding for mental health resources. Previous research has shown that long term anxiety plays a causative role in the development of cardiovascular disease and impaired daily functioning (Kandola & Stubbs, 2020). We need to implement treatments as soon as possible to reduce the risk of increasing cardiovascular disease in the future. Mental health treatments like Cognitive behavioural therapy (CBT) improve quality of life and reduce severe anxiety symptoms (Hofmann et al., 2014). If financial strain continues to increase anxiety, CBT and other effective therapies could treat these symptoms and prevent poor health outcomes.

REFERENCES

Dijkstra-Kersten, S. M., Biesheuvel-Leliefeld, K. E., Van der Wouden, J. C., Penninx, B. W., & Van Marwijk, H. W. (2015). Associations of financial strain and income with depressive and anxiety disorders [Abstract]. Journal of Epidemiology and Community Health, 69(7), 660-665. doi:10.1136/jech-2014-205088

Drydakis, N. (2015). The effect of unemployment on self-reported health and mental health in Greece from 2008 to 2013: a longitudinal study before and during the financial crisis. Social science & medicine, 128, 43-51. doi: 10.1016/j.socscimed.2014.12.025

Griffiths, D., Sheehan, L., van Vreden, C., Petrie, D., Grant, G., Whiteford, P., Sim, M. R., & Collie, A. (2021). The Impact of Work Loss on Mental and Physical Health During the COVID-19 Pandemic: Baseline Findings from a Prospective Cohort Study. Journal of occupational rehabilitation, 1–8. Advance online publication. https://doi.org/10.1007/s10926-021-09958-7

Hofmann, S. G., Wu, J. Q., & Boettcher, H. (2014). Effect of cognitive-behavioral therapy for anxiety disorders on quality of life: a meta-analysis. Journal of consulting and clinical psychology, 82(3), 375–391. https://doi.org/10.1037/a0035491

Kandola, A., & Stubbs, B. (2020). Exercise and Anxiety. Advances in experimental medicine and biology, 1228, 345–352. https://doi.org/10.1007/978-981-15-1792-1_23

Katzman, M. A., Bleau, P., Blier, P., Chokka, P., Kjernisted, K., Van Ameringen, M., Canadian Anxiety Guidelines Initiative Group on behalf of the Anxiety Disorders Association of Canada/Association Canadienne des troubles anxieux and McGill University, Antony, M. M., Bouchard, S., Brunet, A., Flament, M., Grigoriadis, S., Mendlowitz, S., O'Connor, K., Rabheru, K., Richter, P. M., Robichaud, M., & Walker, J. R. (2014). Canadian clinical practice guidelines for the management of anxiety, posttraumatic stress and obsessive-compulsive disorders. BMC psychiatry, 14 Suppl 1(Suppl 1), S1. https://doi.org/10.1186/1471-244X-14-S1-S1

Kokaliari, E. (2018). Quality of life, anxiety, depression, and stress among adults in Greece following the global financial crisis. International social work, 61(3), 410-424. Doi: 10.1177/0020872816651701

Lai, J, Ma, S, Wang, Y, Cai, Z, Hu, J, Wei, N, et al., 2020. Factors associated with mentalhealth outcomes among health care workers exposed to coronavirus disease 2019.JAMA Netw Open 3 (3), e203976.https://doi.org/10.1001/jamanetworkopen.2020.3976

Li, X., Fu, P., Fan, C., Zhu, M., & Li, M. (2021). COVID-19 stress and mental health of students in Locked-down colleges. International Journal of Environmental Research and Public Health, 18(2), 771. doi:10.3390/ijerph18020771

Lombardi, M. J., Mohanty, M. S., & Shim, I. (2017). The real effects of household debt in the short and long run.

Luo, M., Guo, L., Yu, M., Jiang, W., & Wang, H. (2020). The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public - A systematic review and meta-analysis. Psychiatry research, 291, 113190. https://doi.org/10.1016/j.psychres.2020.113190

Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., . . . Agha, R. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. International Journal of Surgery, 78, 185-193. doi:10.1016/j.ijsu.2020.04.018

Pan, K., Kok, A. A., Eikelenboom, M., Horsfall, M., Jörg, F., Luteijn, R. A., . . . Penninx, B. W. (2021). The mental health impact of the COVID-19 pandemic on people with and without depressive, anxiety, or obsessive-compulsive disorders: A longitudinal study of three Dutch case-control cohorts. The Lancet Psychiatry, 8(2), 121-129. doi:10.1016/s2215-0366(20)30491-0

Peteet, John R. "COVID-19 anxiety." Journal of religion and health 59 (2020): 2203-2204.

Statistics Canada (2021). Table 11-10-0016-01 Assets and debts held by economic family type, by age group, Canada, provinces and selected census metropolitan areas, Survey of Financial Security (x 1,000,000) https://doi.org/10.25318/1110001601-eng

Statistics Canada (2020). Impacts of COVID-19 on Canadians- Mental Health, 2020: Crowdsource file.

Simone, D., & Walks, A. (2019). Immigration, race, mortgage lending, and the geography of debt in Canada's global cities. Geoforum, 98, 286-299.

Stevenson, C., Costa, S., Wakefield, J. R., Kellezi, B., & Stack, R. J. (2020). Family identification facilitates coping with financial stress: A social identity approach to family financial resilience. Journal of Economic Psychology, 78, 102271.

Too, L. S., Leach, L., & Butterworth, P. (2020). Cumulative impact of high job demands, low job control and high job insecurity on midlife depression and anxiety: a prospective cohort study of Australian employees. Occupational and environmental medicine, oemed-2020-106840. Advance online publication. https://doi.org/10.1136/oemed-2020-106840

Wilson, J. M., Lee, J., Fitzgerald, H. N., Oosterhoff, B., Sevi, B., & Shook, N. J. (2020). Job insecurity and financial concern during the COVID-19 pandemic are associated with worse mental health. Journal of occupational and environmental medicine, 62(9), 686-691. doi: 10.1097/JOM.0000000000001962

Zhang, Y, Ma, ZF., 2020. Impact of the COVID-19 Pandemic on mental health and quality of life among local residents in Liaoning province, China: a cross-sectional study. Int.J. Environ. Res. Public Health 17 (7), 2381.https://doi.org/10.3390/ijerph17072381

Association between Alcohol Consumption in Males aged 15-30 years & Self-Reported Mental Health

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INTRODUCTION

Over the past decade, the association between mental health and levels of alcohol consumption has been extensively examined in literature among young adults (Bell & Britton, 2014). Those who excessively drink alcohol have the potential to exacerbate undesirable symptoms for both physical and mental health (Azaga & Sharaf, 2011). Several clinical studies suggest that alcohol intake could potentially be the primary causal factor for poor mental health, especially individuals who show alcohol dependence (Bell & Britton, 2014). This study conducted by Bell & Britton (2014) demonstrates the complexity of the relationship between different levels of weekly alcohol consumption and mental health. They found that participants who already had poor mental health consumed higher levels of alcohol, leading to an overall decrease in mental health (Bell & Britton, 2014). The researchers concluded that existing mental health conditions could be a factor that retains heavy alcohol consumption as well (Bell & Britton, 2014). This can be explained by the utilization of alcohol as a coping mechanism for certain mental illnesses like depression and/or anxiety (Bell & Britton, 2014). Bell et al., (2015) evaluated adults living in England over a 10-year period, collecting self-reported data on mental health symptoms and drinking habits. Changes in mental health were a predicting factor for heavy drinking days, suggesting that struggles with mental health can be a trigger for excessive drinking behaviours (Bell et al., 2015). Another study done by Tembo et al., (2017) yielded results that show the significant association between high levels of consuming alcohol and poor mental health outcomes, coupled with poor academic performance among young university students, who were 18-24 years of age. They found that males had a higher likelihood of engaging in hazardous drinking compared to females (Tembo et al., 2017).

In a study seeking to discover participants' perspectives on men's mental health, men expressed more stigmatizing views than women (Oliffe et al., 2016). Both men and women were lenient to agree with the statement that "men with depression are unpredictable" which suggests stigmatization among men's mental health (Oliffe et al., 2016). Men are less likely to be diagnosed with mental illnesses, partly because they are less likely to seek help (Oliffe et al., 2016). These results suggest that social stigmas can influence men's experiences with mental health. This data helps to outline some potential underlying factors as to why men who suffer from poor mental health display risky drinking behaviours.

Furthermore, social stigmas can differ across cultures. When considering these factors, it must be noted that they can change between countries and across time. Our evaluated literature consists of studies conducted outside of Canada, and across a wide age range. There is limited research that examines mental health and alcohol consumption among young men in Canada. This is why we specifically looked at young men who are 15-30 years of age because we believe that their behaviours

and ideals are influenced by current societal pressures in Canada. Their expectations of gender roles, mental health, and drinking culture are more reflective of today's society than older generations.
According to Centers for Disease Control and Prevention (CDC), heavy drinking for men is translated as consuming 15 or more alcoholic drinks weekly (CDC, 2021). Based on these guidelines, we defined heavy drinking as 15 or more drinks per week for men. Our primary research question aims to address whether there is an association in the self-reported mental health among men aged 15-30 years of age who consume 15 or more alcoholic beverages weekly, compared to men who drink fewer than 15 alcoholic beverages. Our secondary research question explores if there is an association in the self-reported mental health among the men aged 15-30 years and how frequently they consume alcoholic beverages. Overall, we aim to further investigate if there is a direct relationship between heavy drinking and self-reported mental health among young adult men.

MATERIALS AND METHODS

Study Design and Database

In this observational study, a two-phase stratified random sampling of telephone numbers was conducted when reaching out to participants for the survey. This design was used to get an increased representation of Canadians between the ages of 15 and 30 years. Statistical weights were calculated and placed for each household, and a separate statistical weight was calculated and placed for each individual. Adding statistical weights allows for the sample data to be a better representation of the target population. Using statistical weighting also allows for adjustments to be made to data to increase accuracy and compensate for individuals who did not respond. Please refer to the Canadian Tobacco, Alcohol and Drugs (CTAD) Survey (2017) for more information on the calculation of statistical weights and two-phase stratified random sampling conducted for this study. Computer-assisted telephone interviewing (CATI) system was utilized to collect data. CATI consists of several generic modules that are capable of adapting to various survey types. One of the modules includes response codes that can deal with every potential call outcome from interviewees and scripts that were read by interviewers.

Study Participants

In our study, we included male participants between the ages of 15 and 30 years old. We excluded all female respondents. We also excluded all males that were above 30 years old, and stated that they consumed any other drugs as it influenced our study outcomes. All participants that had missing or not stated responses were excluded from our study.

Study Outcomes

The main outcome of this study was self-reported mental health. Primarily, this study explored the association between self-reported mental health in males and consuming 15 or more alcoholic beverages a week. Participants were asked the question, "In general, would you say your mental health is…?" and given 5 options. These options were "Excellent", "Very Good", "Good", "Fair" and "Poor". Participants were also asked to state the estimated number of drinks they consumed in a week over the past 12 months. Secondarily, the study also looked at the association between self-reported mental health in males with the frequency of alcoholic beverage consumption. Participants were

asked “How often did you drink alcoholic beverages during the past 12 months?” They were given 8 options which included “daily or almost daily”, “4 to 5 times a week”, “2 to 3 times a week”, “once a week”, “2 to 3 times a month”, “once a month”, “less than once a month” and “never”. There is high reproducibility as the outcomes were measured based on responses from a phone interview which will result in similar outcomes if repeated again. There is low validity of the outcomes as they might not be accurately measured and the questions asked could be subject to participant interpretation. The outcome of mental health associated with alcohol consumption was selected since adolescents who abuse alcohol or use it excessively often have high rates of coexisting mental health disorders, like anxiety or depression (Clark & Bukstein, 1998). Drinking patterns and frequency of drinking can also provide a better picture of the role of alcohol consumption in mental health rather than solely looking at the volume of alcohol consumption (Stranges et al., 2006). Given this relationship between mental health and alcohol consumption, it was important to further investigate the association between the two variables in young adults.

Additional Data Collection

Some additional variables in the database include gender, age and other drug use. Gender was used to narrow down our participant pool as we were interested in solely looking at males. Age was also used to narrow down our participant pool as we were interested in looking at young adult males, i.e. between 15 to 30 years old. In an attempt to avoid confounding results, other drug use was also included as a variable in the study. All participants in the survey who stated that they used any other drugs were eliminated from the participant pool.

Statistical Analysis

The median and interquartile range was determined for continuous variables and the frequency (%) was determined for categorical variables. To answer our primary research question, a Spearman’s rho test was used to determine the relationship between self-reported mental health and the number of drinks consumed per week. A chi-squared test was conducted to determine whether there was a difference in proportions between self-reported mental health and drinking 15 or more alcoholic beverages per week or less than 15 alcoholic beverages per week. This amount was chosen as the Centers for Disease Control and Prevention (CDC) marked heavy drinking for men as the consumption of 15 or more alcoholic drinks weekly (CDC, 2021). A Spearman’s rho test was also used to answer our secondary research question and to determine the relationship between mental health and the frequency of alcoholic beverage consumption. A chi-squared test was conducted to determine whether there was a difference in proportions between self-reported mental health and the frequency of alcohol consumption. Statistical analyses were accomplished using IBM SPSS Statistics version 27.0 for Windows. A p-value of less than 0.05 is considered significant for this study.

RESULTS

Our study consisted of 3608 male participants out of the 16,349 total participants from the CTAD survey (Table 1). There were 273 missing responses for the variables that were included in the outcomes, such as mental health, the number of drinks consumed per week and frequency of alcohol consumption. Descriptive characteristics for males who consumed less than 15 alcoholic beverages per week and for males who consumed 15 or more alcoholic beverages per week are summarized in Table 1. A larger

proportion of participants reported their mental health as “Excellent” and “Very good” out of both groups (Table 1).

Table 1. Descriptive characteristics of males between the ages of 15 and 30 who consume alcoholic beverages [N = 3608]

	Males who consumed less than 15 alcoholic beverages a week (N=3498)	Males who consumed more than 15 alcoholic beverages a week (N=110)
Age, years*	19 (5)	22 (3)
Drank alcoholic beverages - 12 mo.		
Daily or almost daily	23 (0.7)	10 (9.1)
4 to 5 times a week	27 (0.8)	32 (29.1)
2 to 3 times a week	211 (6.0)	64 (58.2)
Once a week	328 (9.4)	3 (2.7)
2 to 3 times a month	464 (13.3)	1 (0.9)
Once a month	368 (10.5)	0 (0)
Less than once a month	697 (19.9)	0 (0)
Never	1380 (39.5)	0 (0)
Mental Health		
Excellent	1474 (42.1)	44 (40.0)
Very good	1259 (36.0)	42 (38.2)
Good	597(17.1)	19 (17.3)
Fair	140 (4.0)	4 (3.6)
Poor	28 (0.8)	1 (0.9)

Data are presented as number (%) of participants unless otherwise noted. * Data are presented as median and interquartile range

Mental Health and Number of Drinks consumed Per Week

A Spearman’s Rho test was conducted to determine the relationship between mental health and the estimated number of drinks consumed per week (Table 2). The correlation coefficient for primary analysis and significance value can be seen in Table 2. This suggests a weak correlation between “Mental Health” and “Estimated Num Standard Drinks Per Week- 12 months” (Table 2).

Table 2. Correlation coefficient and significance (2-tailed) values from a Spearman's rho test between mental health and number of drinks consumed per week. A p-value of <0.05 is considered significant.

		Estimated # standard drinks per week - 12 mo.
Mental health	Correlation Coefficient	-0.139
	Sig. (2-tailed)	0.147

A chi-squared test was used to determine whether there was a difference in proportions in mental health between those that consumed less than 15 drinks per week and those that consumed 15 or more drinks per week. The variable "mental health" had 5 categories which were further categorized into "good mental health" and "poor mental health". Excellent, very good and good mental health were categorized into "good mental health" and fair and poor mental health were categorized into "poor mental health". Categories were collapsed due to the expected values being smaller than the minimum amount. The p-value was 1.00, suggesting that there is no difference between proportions, as a p-value <0.05 is considered significant.

Figure 1 was created to visualize the difference between groups and the observed values from the chi-squared test. There were more participants that rated their mental health as "Good" regardless of consuming less than 15 drinks per week or 15 or more drinks per week. The percentage was 95.5% (105/110) in the intervention group compared to 95.2% (3330/3498) in the control group.

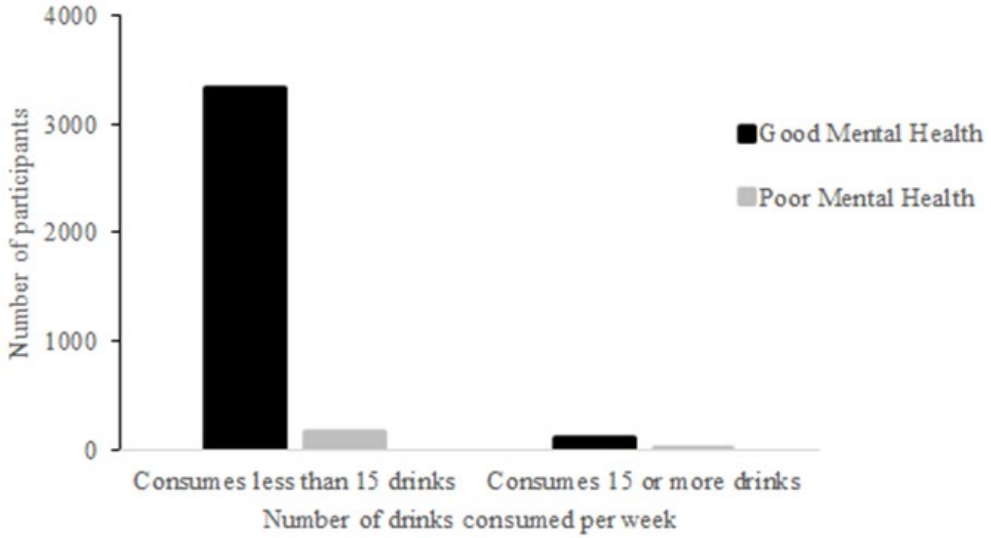

Figure 1. Clustered bar chart depicting observed values from chi-squared test for mental health vs. number of drinks consumed per week.

Mental Health and Frequency of Drinking

A Spearman's Rho test was conducted to determine the relationship between mental health and the frequency of drinking alcoholic beverages over the past 12 months. The correlation coefficient for the secondary analysis and significance value can be seen in Table 3. This suggests a weak correlation between “Mental Health” and “Drank Alcohol Beverages- 12 months” (Table 3).

Table 3. Correlation coefficient and significance (2-tailed) values from a Spearman’s rho test between mental health and frequency of drinking. A p-value of <0.05 is considered significant.

		Drank alcohol beverages- 12 mo.
Mental health	Correlation Coefficient	-0.006
	Sig. (2-tailed)	0.699

A chi-squared test was also used to determine whether there was a difference in proportions in mental health between those that had frequent alcohol consumption and those with infrequent alcohol consumption. The variable “mental health” had 5 categories which were further categorized into “good mental health” and “poor mental health”. Excellent, very good and good mental health were categorized into “good mental health” and fair and poor mental health were categorized into “poor mental health”. The variable “Drank alcoholic beverages - 12 mo.” had 8 categories which were further categorized. Those that drank more than once a week were considered frequent drinkers. Those that drank fewer than once a week were considered infrequent drinkers. Categories were collapsed due to the expected values being smaller than the minimum amount. The p-value was 0.434, suggesting that there is no difference between proportions as a p-value <0.05 is considered significant.

Figure 2 was created to visualize the difference between groups and the observed values from the chi-squared test. There were more participants that rated their mental health as good regardless of the frequency of alcohol consumption. The percentage was 95.8% (669/698) in the frequent drinking group compared to 95.5% (2766/2910) in the infrequent drinking group.

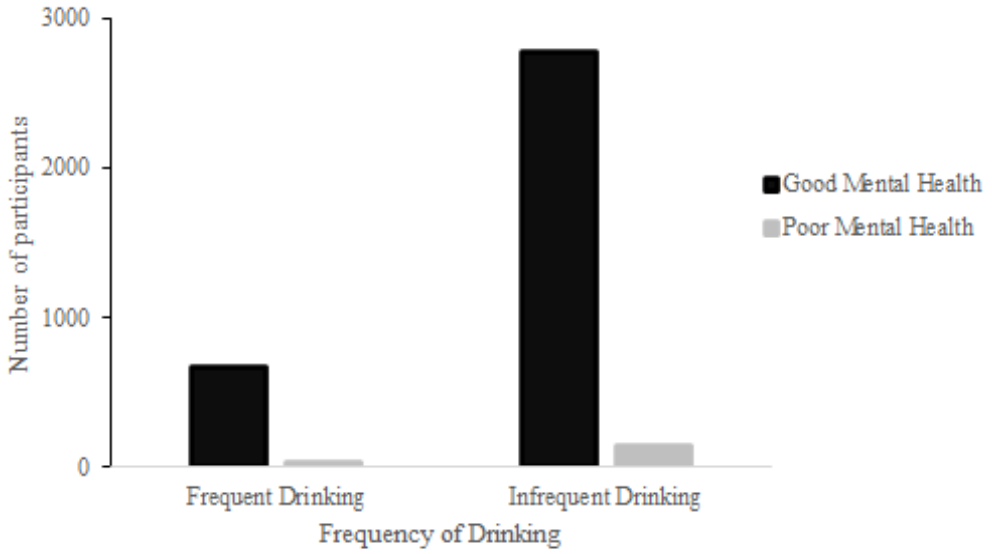

Figure 2. Clustered bar chart depicting observed values from chi-squared test for mental health vs. frequency of drinking

DISCUSSION

Our study suggests that there is no association between the estimated number of drinks consumed per week and the self-reported mental health of participants. Likewise, we did not find an association between the frequency of alcohol consumption and self-reported mental health.

Direct comparisons to other studies were difficult due to differences in sample characteristics in the population and inconsistent findings. When compared to other similar studies, it was found that Hong Kong adolescent boys are more likely to experience excessive drinking (Huang et al., 2016). It was also found that adolescents who drink alcohol excessively, have coexisting mental conditions like anxiety and depression (Huang et al., 2016). However, this study is conducive to recall bias similar to our study, since it relies on self-reported data. Moreover, residual confounding could not be eliminated which could possibly shroud the findings of the study (Huang et al., 2016). In contrast, another study had findings that were consistent with the findings from our study. They reported no gender differences between alcohol consumption and mental health (Stranges et al., 2006). They also found that daily drinkers reported significantly better mental health compared to life-time abstainers (Stranges et al., 2006). The researchers did not find any differences in the outcomes of alcohol drinking patterns on mental health among men across groups of current drinkers (Stranges et al., 2006). Since this study also used self-reported data in which participants gave their perceptions of health, there is a potential for recall bias.

Our study adds to the current body of evidence by examining the relationship between mental health and alcohol consumption in young males who are 15-30 years of age since there is a lack of evidence and studies focusing specifically on this age group. Likewise, there are limited research studies surrounding this topic conducted in Canada, therefore, our paper adds valuable findings to the

current repository of Canadian research on mental health and alcohol consumption. With the growing prevalence of mental health issues in young adults, findings from our study are more important now than ever to help shape public health and to highlight the urgency of exploring relationships between mental health and alcohol consumption in young males.

One limitation of this study is potential recall bias. Participants might not have been able to accurately describe their alcohol intake, especially dating back 12 months. They might not have remembered their mental health status well enough to report an accurate response to the survey. Since the data was self-reported, participants may have overestimated or underestimated their alcohol consumption and/or mental health status, leading to inaccurate data.

Another limitation of this study was the quality of questions. This survey only consisted of one question pertaining to mental health. This question was very general and did not address any specific symptoms. Participants might not have been able to recognize that certain symptoms they face are related to mental health, and therefore might not have given an accurate response. Other studies used more in-depth questionnaires that addressed physical and emotional symptoms. Huang et al. (2016) evaluated the mental health of adolescence using the Strengths and Difficulties Questionnaire. This consisted of 5 subcategories of questions including emotional symptoms, conduct problems, hyperactivity, peer relationship problems and prosocial activity (Huang et al., 2016). In a study by Best et al. (2006), 14-16 year-olds completed a questionnaire from the Maudsley Addiction Profile evaluating anxiety and depression. This questionnaire rated anxiety and depression symptoms on a 5-point scale indicating the symptoms' frequency (Best et al., 2006). It may be easier for participants to recall specific symptoms than to generalize their mental health, and they might not have been aware that these symptoms are related to mental health. The question associated with the variable "estimated number of drinks per week - 12 months" was also not the most effective at assessing alcohol consumption. The CTAD survey was vague and did not state what question the participants were asked. Participants were not asked to specify how they reached their estimated number of drinks. To allow for consistent and accurate responses, participants should be asked "On average, how many drinks did you consume in the past week?" and given options to choose from rather than simply stating numbers.

A third limitation was using a small sample size in which there were not many participants who consumed large amounts of alcohol and reported poor mental health in this survey. There was a limited number of male participants who fit the criteria of consuming 15 or more alcoholic beverages weekly. To obtain more accurate data, data collection methods should be altered to specifically seek out men who consume large amounts of alcohol. The CTAD database used in this study contained a randomized set of participants and consisted of many general questions related to several different substances. For more accurate results, pertaining to alcohol consumption and mental health specifically, heavy alcohol consumers should be targeted.

In our study, we did not find a significant association between our variables, but it is important to continue research in this area to gain a better understanding of how alcohol consumption and mental health are related. Since findings from other research studies vary pertaining to alcohol consumption and self-reported mental health, it is crucial that more prospective cohort studies be conducted to

determine the long-term effects of alcohol consumption on mental health. For more accurate and generalizable results, future studies should include a larger sample size. As well, using questionnaires that ask more in-depth questions to gauge mental health will provide researchers a more accurate idea of the participants' true mental health status. Questionnaires should ideally include questions about different mental health symptoms that the participants can easily recall. It is important that research into this topic continues within Canada, as drinking culture and gender roles that affect men in different countries are not applicable to Canadians.

Although we did not find a significant association between mental health and frequency of alcohol consumption, as well as mental health and number of alcoholic drinks consumed per week, our study contributes to investigating the relationship between alcohol consumption and m

REFERENCES

Azagba, S. & Sharaf, M.F. (2011). The effect of job stress on smoking and alcohol consumption. Health Economics Review 1(15). https://doi.org/10.1186/2191-1991-1-15

Bell, S. & Britton, A. (2014). An exploration of the dynamic longitudinal relationship between mental health and alcohol consumption: a prospective cohort study. BMC Medicine, 12(91). http://www.biomedcentral.com/1741-7015/12.91

Bell, S., Orford, J., & Britton, A. (2015). Heavy Drinking Days and Mental Health: An Exploration of the Dynamic 10-Year Longitudinal Relationship in a Prospective Cohort of Untreated Heavy Drinkers. Alcoholism: Clinical and Experimental Research, 39(4), 688–696. https://doi.org/10.1111/acer.12681

Best, D., Manning, V., Gossop, M., Gross, S., & Strang, J. (2006). Excessive drinking and other problem behaviours among 14–16 year old schoolchildren. Addictive Behaviours, 31(8), 1424–1435. https://doi.org/10.1016/j.addbeh.2005.12.002

CDC. (2021). Alcohol and public health. https://www.cdc.gov/alcohol/faqs.htm

Clark, D. B., & Bukstein, O. G. (1998). Psychopathology in Adolescent Alcohol Abuse and Dependence. Alcohol Health and Research World, 22(2), 117–121, 126. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6761811/

Huang, R., Ho, S. Y., Wang, M. P., Lo, W. S., & Lam, T. H. (2016). Reported alcohol drinking and mental health problems in Hong Kong Chinese adolescents. Drug and Alcohol Dependence, 164, 47–54. https://doi.org/10.1016/j.drugalcdep.2016.04.028

Oliffe, J. L., Ogrodniczuk, J. S., Gordon, S. J., Creighton, G., Kelly, M. T., Black, N., & Mackenzie, C. (2016). Stigma in Male Depression and Suicide: A Canadian Sex Comparison Study. Community Ment Health J, 52, 302–310. doi:10.1007/s10597-015-9986-x

Stranges, S., Notaro, J., Freudenheim, J. L., Calogero, R. M., Muti, P., Farinaro, E., . . . Trevisan, M. (2006). Alcohol drinking pattern and subjective health in a population-based study. Addiction, 101(9), 1265–1276. https://doi.org/10.1111/j.1360-0443.2006.01517.x

Tembo, C., Burns, S., & Kalembo, F. (2017). The association between levels of alcohol consumption and mental health problems and academic performance among young university students. PLoS ONE, 12(6). https://doi.org/10.1371/journal.pone.0178142

The Impact of COVID-19 on Mental Health According to Age and Urbanization

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INTRODUCTION

Mental health is described by the World Health Organization as "a state of well-being in which the individual can cope with the normal stresses of life, can work productively, and is able to make a contribution to his or her community" (Kostenius, Gabrielsson & Lindgren, 2019). Well-being dictates our overall quality of life and may be influenced by life stressors and/or illnesses. Research shows that poor mental health and well-being in elderly populations are a result of natural aging, such as physical disabilities impeding on day-to-day life (Bamonti & Fiske, 2019). Whereas mental health in young adults is not often affected by illness, but is rather influenced by social factors. Studies conducted in Sweden on the adolescent population revealed some of these external stressors as education and job security (Kostenius, Gabrielsson & Lindgren, 2019). With the closures of schools and universities due to COVID-19, many young adults report symptoms of anxiety & depressive disorders as a result of online education, workload increase, and loss of income (Panchal et al., 2021). The elderly population tends to have a greater concern for their physical health as they are most at risk for contracting COVID-19. There is a higher likeliness of distress for these elderly individuals as they are required to isolate due to their vulnerability to the virus. This will greatly impact their mental health (Banerjee, 2020). Overall, research findings specifically in the context of COVID-19 and mental health have indicated increases in suicidal ideation, (O'Connor et al., 2020) and a 90% increase in young adult participants of being at-risk for depression (Giunttella et al., 2021). Other studies have found that anxiety symptoms, depression symptoms, and sleep problems increase during COVID-19 (Huang, 2021), while younger participants (aged <35) were more likely to develop anxiety and depressive symptoms than participants aged >35. This points to the COVID-19 pandemic generally having a negative effect on mental health.

Other potential negative factors highlighted during the pandemic are disparities in physical and mental health care access, which are obvious between urban and rural communities. In general, rural communities have poorer access to health care, as well as less availability of healthcare professionals, which is noted as the reasoning for the disparities. COVID-19 has restricted access to physical and mental health resources even further in rural areas (Summers-Gabr, 2020). Thus, prompting the research question, does COVID-19 affect the mental well-being of those aged 15-24 more than those 65 years or older? Plus, is the mental health of these people aged 15-24 and 65 or greater impacted differently in rural communities compared to urban communities?

Following our analysis, we hope to first fill the knowledge gap regarding which of the two age groups are more affected by COVID-19 in terms of mental health. We chose to study two age groups in particular; 15-24 and 65 and older because we theorize these age groups are most affected. There is plenty of research supporting the theory that COVID-19 impacts the mental health of young adults, yet there is a lack of studies for those 65 and older. We believe that their mental health status should be taken into consideration because of their vulnerability of contracting COVID-19. All in all, this

portion of the analysis will determine which group appears to suffer the greatest impact on their mental health during COVID-19. Using this information, we can help decide where to allocate mental help resources and staff according to the numbers. With this in mind, we also began to wonder if this resource availability varies between rural and urban communities. Naturally, as a result of a smaller population, rural communities do not have multiple hospitals or hundreds of grocery stores to provide supplies. In fact, it may be very possible that those living in rural communities may experience mental health concerns as a result of an inadequate availability of living essentials. For this reason, it is also possible those living in rural communities may feel more impacted by COVID-19. On the other hand, those populating urban communities with more people have a greater risk of COVID-19 exposure. To reduce this exposure, large cities will often impose stricter lockdown measures and social distancing protocols, enhancing feelings of isolation for residents and in turn directly impacting their mental health. For this reason, we look to uncover any variation observed between the two groups of people aged 15-24 and >65 in both rural and urban communities. Since Canada is a geographically diverse country with many citizens living beyond cities, it is important to understand how COVID-19 affects both of these regions in regard to mental health.

MATERIALS AND METHODS

Study Design and Database

The study being conducted is an observational study as we will be assessing whether or not COVID-19 influences mental health according to urbanization and age, without manipulating any other variable. The study is based on the ODESI series 1 database: impacts of COVID-19 from the Canadian Perspective Survey Series which involved randomly selected individuals participating in the Canadian Labor Force Survey. This database consists of data obtained from online cross-sectional surveys, administered to participants living in the Canadian Provinces from March 29th, 2020 to April 3rd, 2020. This survey was the first to be conducted within the Canadian Perspective Survey Series and aimed to gather essential information related to the COVID-19 pandemic and any of its related social, health, economic or employment impacts on Canadians. Initial participant recruitment was done through a letter in the mail which outlined the purpose of the survey and gave instructions on how to join. Those who joined the panel were then asked to give some demographic information. The survey was officially released on March 29th, 2020, and reminder emails as well as computer-assisted telephone follow-up interviews were sent throughout the week until it's official closing date, April 3rd, 2020. The target population for all Canadian Perspective Survey Series comprise of Canadian citizens aged 15 years or older residing in any of the Canadian provinces; Canadians living in the territories were excluded.

Study Participants

The original database underwent modifications according to the research question when considering which variables to include in the new dataset. The database was reduced to remove any variables that were not relevant. Inclusion markers included variables involved in the assessment of mental health, age and urban/rural residency. Exclusion criteria included the categories or variables that didn't affect the research question. Additionally, the participants that were not part of the 15-24 age group or 65+ age group were excluded, as well as participants with missing data in the dependent variables. Thus,

some of the variables that were excluded from the database for our study were household size, weight and marital status of the respondents. For example, the household size variable was excluded as it did not provide any information about mental health, age or community. The dependent variables in our analysis included: perceived mental health, mental health compared to before COVID-19 impacts, and perceived life stress. The independent variables were rural/urban indicators and age group

Study Outcomes

Primary study outcomes include determining if there were any significant difference between the proportion of responses for 'perceived mental health', 'mental health compared to before distancing' and 'perceived life stress' for individuals aged 15-24 years and 65+ years, before differentiating for community type. To obtain this study outcome, questions on the survey asked participants to rank their perceived mental health, their perceived mental health after physical distancing and their perceived life stress. All of the variables in this survey were ordinal, giving the participant the ability to 'rank' their given responses. For the perceived mental health variable, participants were asked to rank their mental health on a scale of '1=excellent' to '5=poor'. Plus, the respondents were given the option to skip the question if they preferred not to answer. For the perceived mental health after distancing variables, participants were asked to rate their mental health as 'better now', 'the same as before' and 'worse now'. Finally, for the perceived life stress variable, participants were asked to rank their perceived life stress as either 'Not stressful at all', 'Somewhat stressful' and 'Stressful'. Plus, the respondents were given the option to answer 'prefer not to answer' if they weren't comfortable answering. The secondary outcome included determining whether there were significant differences between rural and urban communities in terms of the effects of Covid-19 on mental health for both the 15-24 age group and 65+ age group. To compute our secondary outcome, we used the Rural/Urban indicator variable to group both participants aged 15-24 years old and participants 65+ according to rural residence and urban residence. Then, results from the primary outcome could be compared now in terms of community type. In the survey, participants were asked to indicate if they're primary residence was found in a 'rural community' or an 'urban community'.

Additional Data Collection

The additional variables used in our database that are excluded from the study outcome were kept as descriptive statistics; they assist with describing the participants from this survey. The descriptive statistics include sex, indigenous identity, immigration status and visible minority indicator. We chose to keep the sex variable to visualize the gender representation of our dataset. Next, we kept indigenous identity, immigration status, and minority indicators to visualize the ethnicity of our participants. Furthermore, we had originally kept variables that could act as covariates, such as community size. Since our variables are all categorical, the ANCOVA analysis could not be used and we could not test the validity of our covariates, and thus were removed. Please refer to the limitations section for further information.

Statistical Analysis

For our study, we used SPSS to summarize our descriptive characteristic data in Table 1. The frequency distribution was calculated as the primary measure of central tendency. Our data consisted of categorical variables and as such, tests for normality were not suitable for this study. Instead, chi-

square analyses were done to determine any possible correlations both within & between the age-groups and community types. The categorical data given is ordinal with several possible responses, so any data that did appear to be associated was then further analyzed using the Spearman's rho test to determine which response proportions differed significantly. Our study used a p-value of < 0.005 to distinguish between significant and non-significant proportions.

RESULTS

Our study focused on the comparison of participants aged 15-24 years old & 65+ years old living in rural or urban communities. To create an appropriate sample from the population, we removed any individual who did not provide an answer for any of the dependent variables. This included the responses "don't know", "refusal" and "not stated". After the removal of unnecessary data, our sample size included 6947 participants. Out of these participants, 2255 of them were in the 15–24-year-old group and 4602 participants in the 65+ age group. Furthermore, out of the 6947 participants, 1056 participants lived in rural communities and 5891 participants lived in urban communities.

Table 1: Descriptive characteristics of the sample population

Descriptive Characteristics	Whole Sample			Rural communities			Urban Communities		
	Total (N = 6947)	15-24 y.o. (N = 2255)	65+ y.o. (N = 4692)	Total (N = 1056)	15-24 y.o. (N = 202)	65+ y.o. (N = 854)	Total (N = 5891)	15-24 y.o. (N = 2053)	65+ y.o. (N = 3838)
Demographic characteristics									
Sex (%)									
Female	4914(71)	632(28)	3291(70)	771(73)	162(80)	609(71)	4143(70)	1461(71)	2682(70)
Male	2033(29)	1623(72)	1401(30)	285(27)	40(20)	245(29)	1748(30)	592(29)	1156(30)
Indigenous identity (%)									
Indigenous	149(2)	87(4)	62(1)	32(3)	18(9)	14(2)	117(2)	69(3)	48(1)
Non-indigenous	6798(98)	2168(96)	4630(99)	1024(97)	184(91)	840(98)	5774(98)	1984(97)	3790(99)
Immigration status (%)									
Immigrant	1088(16)	304(13)	784(17)	119(11)	7(3)	112(13)	969(16)	297(14)	672(18)
Non-immigrant	5859(84)	1951(87)	3908(83)	937(89)	195(97)	742(87)	4922(84)	1756(86)	3166(82)
Visible minority flag (%)									
Visible minority	676(10)	552(24)	124(2.6)	13(1)	8(4)	5(1)	663(11)	544(26)	119(3)
Not visible minority	6271(90)	1703(76)	4568(97.3)	1043(99)	194(96)	849(99)	5228(89)	1509(74)	3716(97)

The data presented is categorical data and thus descriptive statistics will be presented as number of participants (%) unless stated otherwise.

Table 2: Cases removed from each dependent variable due to insufficient data

Variable	Count
Perceived Mental Health	19
Mental Health now compared to before physical distancing	34
Perceived life stress	61
Urban / Rural Indicator	591

To answer our primary research question regarding the impacts of COVID-19 on mental health between people aged 15-24 years old & 65+ years old, a preliminary analysis was done comparing the proportion of answers between both age groups without separating for urban or rural residency. Our preliminary analysis included calculating the number and frequency of participants according to their answers for each of the survey questions (Table 3). During the analysis, it was found that for the perceived mental health survey question, 31. 2% of the participants aged 15-24 years old rated their mental health as good and 30.7% rated their mental health as fair. For the same question, 41.2% of participants aged 65+ rated their mental as very good. The perceived mental health of those aged 15-24 appeared to be somewhat worse than those aged 65+ (Figure 1). For the mental health before distancing survey question, 66.2% of participants in the 15-24 age group rated their mental health as worse whereas 55.9% of 65+ participants rated it as the same (Table 3). Finally, for the perceived life stress survey, the majority of both age groups rated their stress level as 'some stress' (Table 3).

Table 3: Summary statistics for each survey question response from people 15-24 years old & people 65+ without differentiating for community type. *p-value < 0.001

Questionnaire		Age Group		Correlation coefficient (r_s)
		15-24 y.o. (N = 2255)	65+ y.o. (N = 4692)	
Perceived M.H. (%)	Poor	270(11.9)	73(1.5)	0.225*
	Fair	694(30.7)	461(9.8)	0.263*
	Good	704(31.2)	1223(26)	0.054*
	Very good	455(20.1)	1935(41.2)	-0.208*
	Excellent	132(5.8)	1000(21.3)	-0.196*
M.H. compared to before distancing (%)	Better	213(9.4)	348(7.4)	0.035*
	Same	549(24.3)	2624(55.9)	-0.297*
	Worse	1493(66.2)	1720(36.6)	0.278*
Perceived Life Stress (%)	Not at all stressful	70(3.1)	575(12.2)	-0.148*
	Some stress	1395(61.8)	3493(74.4)	-0.129*
	Stressful	790(35)	624(13.2)	0.253*

For each of the survey responses, a p-value of < 0.001 was determined using a chi-squared test indicating that results were statistically significant and mental health differed between participants aged 15-24 compared to those 65+. Additionally, The Spearman's rho (rs) values were calculated to determine the strength of the relationships. Each of the Spearman's rho calculations revealed a correlation coefficient of <0.29 indicating a small relationship between the variables (Table 3). Plus, responses that yielded a higher proportion from the 65+ age group were associated with negative correlation coefficients.

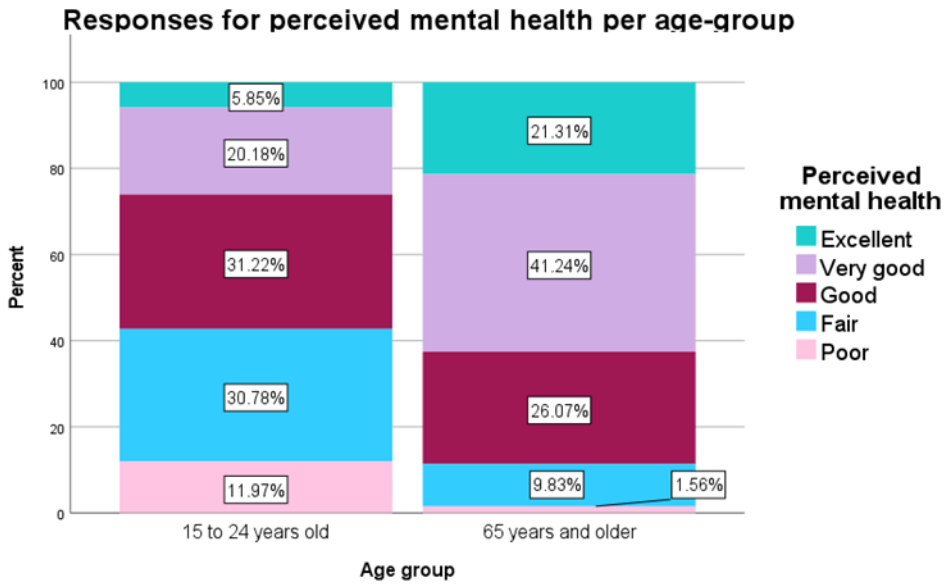

Figure 1: A graph of the responses for the question "rate your perceived mental health" categorized per age group and color coded according to their ranked perceived mental health.

Our secondary outcome aimed to determine whether there was any significant difference between responses between rural and urban communities. A preliminary analysis was run to determine frequency and percent of participants for each survey question. Frequency and percent for each of the three survey questions were extremely similar for both rural and urban communities. This was consistent for both the 15-24 age group and the 65+ age group (Table 4). A chi-square analysis and a Spearman's rho analysis were performed to determine whether there was a significant difference between the responses. The proportion of responses for 15-24 age group & 65+ age group in each community were compared and found that there were minimal significant differences between the mental health of those in rural communities and urban communities. The Spearman's rho correlation coefficients were all small, the highest correlation coefficient being 0.048 for both age groups measured. The p-values were all > 0.05, indicating that results were not statistically different from one another (Table 4).

Table 4: Secondary analysis for both participants 15–24 years old and participants 65+ comparing the survey answers for rural communities and urban communities. Analysis included determining frequency and percent as well as running a chi-squared test and Spearman's rho test.

Secondary outcome for 15 – 24 y.o. (N = 2255)		Community type		Non-parametric analyses	
		Rural (N = 202)	Urban (N = 2053)	Spearman's *rho*	P-value
Perceived M.H. (%)	Poor	29(14.4)	241(11.7)	0.023	0.274
	Fair	70(34.7)	624(30.4)	0.026	0.211
	Good	52(25.7)	652(31.8)	-0.037	0.078
	Very good	42(20.8)	413(20.1)	0.005	0.820
	Excellent	9(4.4)	123(6)	-0.019	0.375
M.H. compared to before distancing (%)	Better	16(7.9)	197(9.6)	-0.016	0.438
	Same	36(17.8)	513(24.9)	-0.048	0.024
	Worse	150(74.3)	1343(65.4)	0.053	0.011
Perceived Life Stress (%)	Not stressful	5(2.5)	65(3.2)	-0.011	0.589
	Some stress	120(59.4)	1275(62.1)	-0.016	0.451
	Stressful	77(38.1)	713(34.7)	0.02	0.336

Secondary outcome for 65+ y.o. (N = 4692)		Community type		Non-parametric analyses	
		Rural (N = 854)	Urban (N = 3838)	Spearman's *rho*	P-value
Perceived M.H. (%)	Poor	13(1.5)	60(1.6)	-0.001	0.930
	Fair	83(9.7)	378(9.8)	-0.002	0.908
	Good	227(26.6)	996(25.9)	0.006	0.705
	Very good	338(39.6)	1597(41.6)	-0.016	0.275
	Excellent	193(22.6)	807(21)	0.015	0.310
M.H. compared to before distancing (%)	Better	64(7.5)	284(7.4)	0.001	0.924
	Same	501(58.7)	2123(55.3)	0.026	0.075
	Worse	289(33.9)	1431(37.3)	-0.028	0.059
Perceived Life Stress (%)	Not stressful	124(14.5)	451(11.8)	0.033	0.026
	Some stress	643(75.4)	2850(74.3)	0.009	0.531
	Stressful	87(10.2)	537(13.9)	-0.043	0.03

DISCUSSION

Following our analysis, the primary outcome is that COVID-19 did in fact affect the mental health of those aged 15–24 more than the mental health of those aged 65+. However, our secondary outcome did not go as predicted, there was no significant difference in the mental health of those aged 15–24 and 65+ between rural and urban communities. We believe we obtained our primary outcome because, like mentioned in the background information, the mental health of young adults is more affected by social factors according to Kostenius, Gabrielsson & Lindgren, as well as education and job security according to Panchal et al. (Kostenius, Gabrielsson & Lindgren, 2019, Panchal et al., 2021). In other words, the mental health of people aged 15–24 is more affected by things like province wide stay-at-home orders, lost jobs and lack of income, and an increase in course load as a result of school being transferred online. On the other hand, the mental health of people aged 65+ is more affected by illness and disability (Bamonti & Fiske, 2019). Overall, the mental health of those aged 65+ is minimally affected until illness actually affects them, whereas the mental health of those aged 15–24 is largely affected by the social repercussions of the COVID-19 pandemic as opposed to the virus itself. This is evident when looking at the results; 50% of the 15–24 group noted that their mental health is worse now compared to before physical distancing and 56% of the 65+ group reported that their mental health is about the same as before social distancing.

Our secondary outcome was not significant. There was no significant difference in the mental health of those aged 15–24 and those aged 65+ between rural and urban communities. In a study done by Liu et al., they reported that the effects of the COVID-19 pandemic on mental health were greater in urban areas compared to rural areas because of the greater number of COVID-19 cases in urban

communities (Liu et al., 2021). Our results do not support the findings of the Lie et al. study (2021). An explanation for our findings could be that the survey administered by Statistics Canada was conducted from March 29th, 2020 to April 3rd, 2020, which was very early in the pandemic. At that point, Canada had declared a state of emergency less than a month before, so the pandemic was still fresh and the social repercussions like job loss, bankruptcy and months of social isolation had not fully taken form yet. If we were to redo the survey and analysis now, a year after the beginning of the first lockdown, we believe that we would see results supporting those found in the Liu et al. research paper; mental health would be worse for those living in urban communities than rural communities because of the greater number of COVID-19 cases.

There were no limitations when it came to the entire participant pool; it was a fairly large sample of participants. We started with 45 989 participants in total and ended with 6927 participants after the modifications, which is an appropriate number of participants for a proper analysis. However, there were some limitations with data collection i.e. the survey itself, which was offered on March 29th, 2020 and ended on April 3rd, 2020. We know now, after a year of on and off lockdown, that this week was only the beginning of the global pandemic and it does not accurately reflect the mental state of those now. For future research, this survey should be conducted again, a year after the initial lockdown and for a longer period of time. Furthermore, due to the ordinal nature of the questionnaire and the method in which the data was collected, our results could have been affected by participant bias and participant subjectivity. Even though this mode of data collection was the only viable option due to the lockdown, it is still a limitation since participants could have deliberately modified their answers or responded to the questions inaccurately due to the subjectivity of their perceived mental health. For example, one of the questions in the survey was "rate your perceived mental health now as either excellent, very good, good, fair or poor". In this case, participants could rate their mental health score as "good" when it should have been scored as "fair" or "poor". When it comes to our analysis, there were some limitations due to the type of data collected in the survey; the data in the survey was all categorical. Thus, the statistical analysis was limited to the chi-squared test or the Spearman's rho test, which are equally good tests but neither of them account for covariates. During the process of deciding which variables to keep, we had chosen to keep extra variables like COVID-19 concern about self, COVID-19 concern about Canada, community size and essentials impact which could all act as covariates. For example, the essentials impact variable measured how much COVID-19 impacted the ability to meet financial obligations or essential needs. However, since all variables were categorical, it was not possible to run an ANCOVA test with covariates. Thus, we cannot conclude whether or not these variables had an influence on perceived mental health.

After our analysis, we know that COVID-19 has had a greater impact on the mental health of those aged 15-24 compared to those aged 65 or older. Thus, we can use this information for future uses in both mental health funding and resource allocation, as well as planning for future incidents that could affect mental health in ways similar to COVID-19. We can also use this data to modulate mental health funds and resource allocations. For example, increasing community-based care for people 15-24 years old which includes primary care clinics, social services, and residential services (Canadian Institute for Health Information, 2019). By doing this, we could eventually reduce the need for acute mental health services which include psychiatric hospitals and on call services (Canadian Institute for Health

Information, 2019). Secondly, this data can be used to predict future incidences of crisis like this pandemic and can even be used as a resource for future COVID-19 waves. Ontario is currently entering a third wave of COVID-19 outbreaks which now include the new strains. Now that we've analyzed mental health patterns according to age and urbanization, we can predict which communities will take the largest hit and prepare for action early in terms of mental health.

In conclusion, this survey and our research was a great start to understanding the impact that COVID-19 has on mental health; whether it has a greater impact on those aged 15-24 or those aged 65 or more and whether or not the impact is greater in rural vs. urban communities. After our analysis, we concluded that the impact of COVID-19 on mental health was worse in those aged 15-24 than those aged 65+ and that urbanization had no significant impact. Furthermore, we believe a new survey should be administered now, a year after the first lockdown, which began on March 13th, 2020. This new survey would allow us to see the long-term effects that the COVID-19 pandemic has on mental health, and whether our findings that mental health is worse in those aged 15-24 than those aged 65 or more and mental health does not vary according to urbanization, are supported in a longer-term study

REFERENCES

Bamonti, P. M., & Fiske, A. (2019). Engaging in pleasant events explains the relation between physical disability and mental health outcomes in older adults. Aging & Mental Health, 25(2), 225-233. doi:10.1080/13607863.2019.1683811

Banerjee, D. (2020). The impact of covid-19 pandemic on elderly mental health. International Journal of Geriatric Psychiatry, 35(12), 1466-1467. doi:10.1002/gps.5320

Canadian Institute for Health Information. Health System Resources for Mental Health and Addictions Care in Canada, July 2019. Ottawa, ON: CIHI; 2019.

Giuntella, O., Hyde, K., Saccardo, S., & Sadoff, S. (2021). Lifestyle and mental health disruptions during Covid-19. Proceedings of the National Academy of Sciences, 118(9).

Huang, Y., & Zhao, N. (2021). Mental health burden for the public affected by the COVID-19 outbreak in China: Who will be the high-risk group? Psychology, health & medicine, 26(1), 23-34.

Kostenius, C., Gabrielsson, S., & Lindgren, E. (2019). Promoting mental health IN SCHOOL—YOUNG people from Scotland and Sweden sharing their perspectives. International Journal of Mental Health and Addiction, 18(6), 1521-1535. doi:10.1007/s11469-019-00202-1

Liu, L., Xue, P., Li, S. X., Zhang, J., Zhou, J., & Zhang, W. (2021). Urban-rural disparities in mental health problems related to COVID-19 in China. General hospital psychiatry, 69, 119–120. https://doi.org/10.1016/j.genhosppsych.2020.07.011

O'Connor, R. C., Wetherall, K., Cleare, S., McClelland, H., Melson, A. J., Niedzwiedz, C. L., ... & Robb, K. A. (2020). Mental health and well-being during the COVID-19 pandemic: longitudinal analyses of adults in the UK COVID-19 Mental Health & Wellbeing study. The British Journal of Psychiatry, 1-8.

Panchal, N., Kamal, R., Garfield, R., & Cox, C. (2021, February 10). The Implications of COVID-19 for Mental Health and Substance Use. The Implications of COVID-19 for Mental Health and Substance Use. Retrieved February 12, 2021, from https://www.kff.org/coronavirus-covid-19/issue-brief/the-implications-of-covid-19-for-mental-health-and-substance-use/

Summers-Gabr, N. M. (2020). Rural–urban mental health disparities in the United States during COVID-19. Psychological Trauma: Theory, Research, Practice, and Policy.

The Impact of Education Level on the Rate of Cocaine Consumption in Canadian Men and Women Age 20 – 30 is Inconclusive: An Observational and Cross-sectional Study

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INTRODUCTION

The rate of cocaine consumption in Canada remains quite low, and there seems to be a decline in its popularity today relative to the 1980s (Harder & Chilcoat, 2007). However, cocaine is still consistently ranked in the top five most used drugs by Canadians following alcohol and cannabis (Canadian Centre on Substance Use and Addiction, 2019). Furthermore, second to alcohol, cocaine is the costliest substance to the Canadian justice system (Canadian Centre on Substance Use and Addiction, 2019). These facts cannot be ignored, and while cocaine may not be discussed as much in the mainstream as other substances, it clearly is still impacting the Canadian public.

Cocaine addiction has almost always been at higher rates for men than women (Kosten et al., 1993). However, recent studies show that cocaine addiction among women is only increasing, and women are just as vulnerable to severe addiction (Kosten et al., 1993). In fact, much of the data that reports men as suffering from addiction more than women can be linked to other external factors, such as opportunity rather than genuine sex differences (Becker & Hu, 2008). The data shows that men and women respond differently to drug addiction (Becker & Hu, 2008). For example, women tend to develop a drug addiction more readily following their first use, when compared to men, due to higher estrogen levels (Becker & Hu, 2008). The increasingly equal rates of cocaine addiction in men and women suggests there must be other factors to attribute for these changes in addiction beyond biology (Kosten et al., 1993).

The link between cocaine use and education has been reported in correlational studies, as well as through data examining how cognitive ability can be impaired by prolonged cocaine abuse (Harder & Chilcoat, 2007; Mittenberg, 1993). Yet, a clear understanding of the trends in this area is still lacking. Most studies that focus on factors impacting drug addiction often look at many factors at once such as race, age, income level, and education level, rather than focusing on one variable. Furthermore, a wide range of drugs are often grouped together when examining data, but different drugs affect the population in different ways, and more studies on individual drugs are needed. Most data on cocaine addiction in relation to education level is outdated, while also involving a very broad age range. Considering that the popularity of cocaine has decreased over time, the older participants in studies may have been influenced by its popularity in the past, unlike the younger participants.

This study will examine men and women, as any significant results attained would be attributed to the independent variable of education level rather than sex. Education is an important tool in the development of young adults' behaviour. Furthermore, only individuals aged between 20 and 30 will be examined. Being of a similar generation, they will have experienced the same cultural attitudes towards cocaine. Finally, the four options for the highest education level achieved will be "some high

school", "a high school diploma", "some bachelor's level education" and "bachelor's degree". Eliminating other forms of post-secondary education such as colleges, trade programs, and post-graduate studies allows for our results to represent the majority of Canadians. Over 80% of Canadians have a high school diploma, and of the types of post-secondary education, the majority of Canadians have a bachelor's degree (Government of Canada, 2017).

Cocaine remains to be a very widely consumed drug, the reasons for which are not fully understood. This study aims to investigate how the rates of cocaine consumption in Canadian men and women, aged 20-30, with a bachelor's level university education compare to that of a high school level education. Understanding how education affects cocaine use could inform the types of interventions needed to decrease cocaine addiction, as well as when to implement said interventions.

MATERIALS AND METHODS

Study Design and Database

This study was designed as an observational and cross-sectional study. The data was collected through the Canadian Addictions Survey (CAS) performed by Health Canada and the Canadian Executive Council on Addictions from 2003-2004. Beirness and Davis (2007) described the CAS as a telephone survey based on a two stage random sample of 13,909 Canadian residents who were 15 years of age and older. Weights were applied based on 252 population classes, stratified by 21 regional areas by six age groups and by sex to yield a sample that was representative of the Canadian population who were 15 years of age and older (Beirness & Davis, 2007). The main objectives of this database were to determine the incidence, prevalence, and frequency of alcohol and other drugs used in the Canadian population, in ages 15 years and older. Additionally, the database studies the context of use and the extent of harms that result from using drugs, identifying protective and risk factors related to drug use (in the general Canadian population and in specific sub-groups), to assess the public's opinions, views, and knowledge on existing and potential addiction policies, and to identify emerging policy issues.

Study Participants

The entire data set produced by the Canadian Addiction Survey (2004) was reorganized as needed, and any data unrelated to the research question had been deleted. The inclusion criteria were: (1) Canadian men and women; (2) ages between 20 and 30; (3) participants who have used cocaine in their lifetime; and (4) participants who possessed a high school or a Bachelor's level university education. The exclusion criteria included participants who: (1) have not stated their gender; (2) fall outside the age range of 20 to 30; (3) never consumed cocaine; and (4) did not have a high school or Bachelor's level university education.

Data Collection and Study Outcomes

The primary outcome of this study was to examine if there was a relationship between the level of education and the rate of cocaine consumption, in men and women, between the age of 20 to 30 years old. The four variables focused on are "Gender", "Age", "Cocaine Usage", and "Education". Regarding the Gender variable, the participants were questioned "Can I ask you your gender please?"

with the response options of “Male”, “Female”, and “DK” which stands for “Don’t Know”. This variable and its categories were essential in differentiating the use of cocaine between both genders. As mentioned earlier, recent investigations show that cocaine addiction in women was increasing, and women were just as vulnerable to severe addiction as men (Kosten et al., 1993). Therefore, by assessing the gender variable, we have recognized the cocaine usage trends among both men and women combined. For the Age variable, participants were required to state their age with the selection options of “15” to “101”, “103”, and “999”. This variable allowed for the observation and analysis of the rate of cocaine consumption between different generations and age groups. However, in this study, the age variable was used to narrow down the participants to a specific age group, as each age group will have diverse life experiences due to differences in lifestyles, routines, and physical health.

Concerning the Education Variable, participants were questioned “What is the highest level of education you have completed?” with the response options of “No schooling”, “Some elementary”, “Completed elementary”, “Some high school”, “Completed high school”, “Some community college”, “Some technical”, “Completed community college”, “Completed technical”, “Some university”, “Completed bachelor”, “MA, MSc, MSW”, “Doctorate”, “Professional degree”, “DK”, and “Refused”. This variable had been chosen to observe and analyze if the education level of an individual had an impact on whether they were compelled to use cocaine, and if yes, how often.

Lastly, regarding the Cocaine Usage variable, participants were asked two separate questions. The first question denotes “Have you ever used or tried cocaine or crack?” with the response options of “Yes, just once”, “More than once”, “No”, “DK”, and “Refused”. The second question related to cocaine usage asks “How often did you use cocaine or crack in the past 3 months?” with the response options of “Never”, “Once or twice”, “Monthly”, “Weekly”, “Daily”, “DK”, and “Refused”. This variable was the dependent variable within the study, where the use of cocaine and the rate of cocaine consumption was examined when looking at the other independent variables of Age, Gender, and Educational level. In this study, the Cocaine Usage variable displayed whether the rate of cocaine consumption changes based on the educational level of an individual.

Statistical Analysis

Table 1 summarizes all of the collected data. There were two main variables of interest for the statistical analysis and they were both categorical. Therefore, no tests of normality were run, and there were no reported measures of central tendency. Instead, the data was presented through a frequency table and reported as percentages, and all statistical analysis was conducted using SPSS software. When analyzing the frequencies, it was found that there was no missing data present in the sample population.

A Chi-Square Analysis was performed with a 2x2 contingency table. The variables were collapsed into two categories that best represented the two possible outcomes; yes, education level affects cocaine use or no, education level does not affect cocaine usage. The education level variable was collapsed into “High School” and “Bachelor’s”. The high school category was composed of all those who have completed some high school, and those who have finished high school and obtained a diploma. The bachelor’s category includes those who completed some university-level education and those who

have completed and received a bachelor's degree. The cocaine usage was also collapsed into "Infrequent Cocaine Use" and "Regular Cocaine Use". The infrequent cocaine use included those who had tried cocaine only once or twice in the past 3 months. The regular cocaine use category included all those who had used it monthly or weekly over the past 3 months.

A 2x2 contingency table was used to ensure the results are indicative of the relationship between the treatment group and the outcome. This was in line with previous studies that used 2x2 Chi-Square analysis when examining drug use with categorical data (Cipriano dos Santos Raposo et al., 2017; Farrell et al., 1992; McDermott, 1984). A Chi-Square analysis using SPSS was performed with the categories described above for individuals between 20 and 30 years of age. A Fisher's Exact Test was performed with a p-value of significance of 0.05, due to one group (those who use cocaine regularly while having a bachelor's level education) having a sample size less than 5. A p-value less than 0.05 on the Fisher's Exact Test would indicate significant results in this analysis.

RESULTS

Table 1: Assessing Frequency for Age, Gender and Cocaine Use Based on Education Level. [N=45][1]

	High School Level Education [N=24]	Bachelor's Level Education [N=21]	Total [N=45]
Age			
20	4.8% (n=1)	9.5% (n=2)	6.7% (n=3)
21	20.8% (n=5)	14.3% (n=3)	17.8% (n=8)
22	16.7% (n=4)	4.8% (n=1)	11.1% (n=5)
23	4.8% (n=1)	9.5% (n=2)	6.7% (n=3)
24	4.8% (n=1)	9.5% (n=2)	6.7% (n=3)
25	16.7% (n=4)	23.8% (n=5)	20.0% (n=9)
26	12.5% (n=3)	4.8% (n=1)	8.9% (n=4)
27	4.8% (n=1)	19.0% (n=4)	11.1% (n=5)
29	16.7 (n=4)	0% (n=0)	8.9% (n=4)
30	0% (n=0)	4.8% (n=1)	2.2% (n=1)

Gender			
Male	70.8% (n=17)	66.7% (n=14)	68.9% (n=31)
Female	29.2% (n=7)	33.3% (n=7)	31.1% (n=14)
Cocaine Use			
Infrequent	50% (n=12)	81.0% (n=17)	64.4% (n=29)
Regular	50% (n=12)	19% (n=4)	35.6% (n=16)
p-value[2]	0.06		

[1] All frequencies are reported as percent within their respective education level and reported to one decimal place.

[2] Due to n = 4 in the category of regular cocaine use with a bachelor's education, a Fisher's Exact Test was run, this p-value represents the two-sided exact significance.

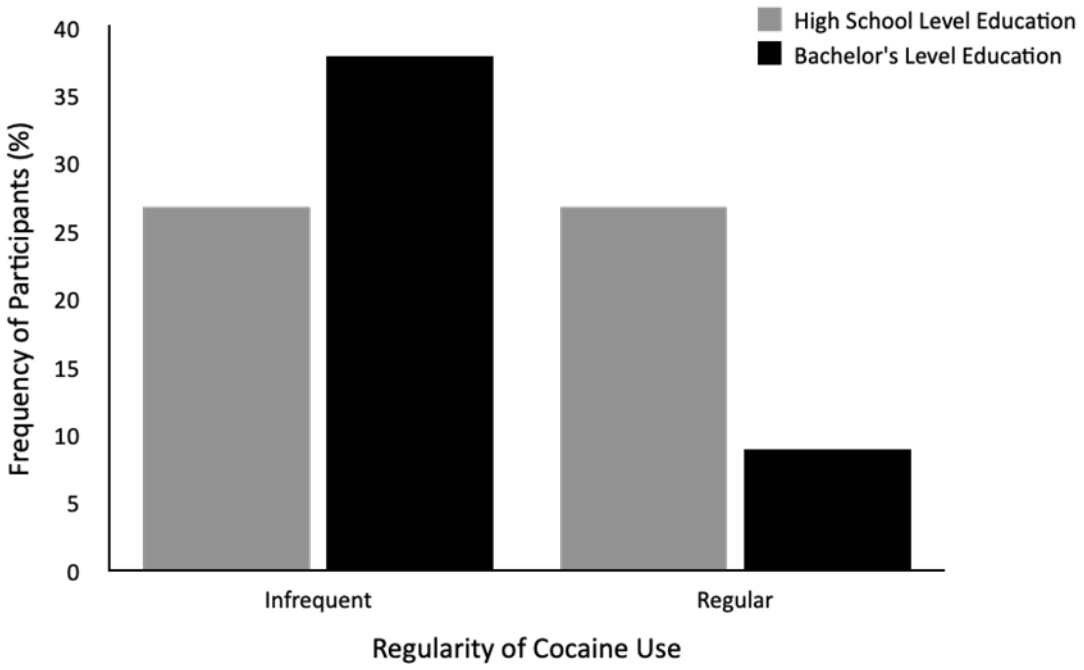

Figure 1. A bar graph showing the difference in the frequencies of participants who used cocaine infrequently versus frequently depending on their education level. Frequencies refer to the total population where N=45.

A total of 45 participants were used for the analysis based on the inclusion and exclusion criteria, and the number of variables in the original data set. This is in comparison to the 13,909 participants in the original data set. There were 24 participants in the high school level education group (53.3%) and 21 participants in the bachelor's level education group (46.7%) (Table 1). In both educational level groups, there were more men (68.7%) than women (31.1%) (Table 1). The frequency of cocaine use, either infrequent or regular, within the high school level education group was the same for both categories (50%) (Table 1). Whereas within the bachelor's level group, 81% of the participants were considered infrequent users and 19% were considered regular users (Table 1).

The Chi-Square Test of Independence was conducted based on a 2x2 contingency table with four different groups; high school level education and infrequent cocaine use, high school level education and regular cocaine use, bachelor's level education and infrequent cocaine use and bachelor's level education and regular cocaine use. The number of participants in each of those four groups respectively was: 12, 12, 17 and 4. Furthermore, 64.4% (n = 29) of the study population were infrequent cocaine users, and 35.6% (n = 16) were regular cocaine users. The majority of the population who used cocaine regularly were in the high school group (75%; n = 16), when compared to those in the bachelor's education group (25%; n = 16). The Fisher's Exact Test for the contingency table yielded a p-value for the two-sided exact significance of 0.06 (Table 1).

Figure 1 shows the differences between the frequencies of cocaine use based on the educational levels. The grey bars (representing the high school group), were equal between the "infrequent" and "regular" cocaine use categories. The black bars (representing the bachelor's level group) were unequal, where the "infrequent" use category was greater than the "regular" use category (Fig. 1). Furthermore, the highest frequency of infrequent cocaine corresponds to the black bar (bachelors group), but for the regular cocaine users, this was reversed, and the highest frequency corresponds to the grey bar (high school group).

DISCUSSION

Key Findings

The comparison between the education level and the rate of cocaine consumption resulted in a p-value (0.06) that was greater than the test statistic (0.05). Given these results, there is no significant impact by an individual's education level on the rate of their cocaine consumption. In other terms, we cannot reject the null hypothesis which is that education level had no impact on the rate of cocaine consumption. The results suggest that there is a 6% chance that the results observed would occur only by chance and not due to a relationship between variables. In order to have been statistically significant, the results would need to have a 5% or lower probability of occurring by chance. Considering the small difference between the values of 6% and 5%, significant results can occur in subsequent analyses if some of the study's limitations were to be resolved. Still, the value of significance was not met and therefore the results of the study are inconclusive.

Given that the data used was categorical, the only test performed was a Chi-Square Analysis. This restriction limited the ability to run other tests, like a within-groups test of significance on the infrequent and regular cocaine users in the bachelor's level group for example. However, when the data was visually examined, a clear difference between the two groups is revealed, where the bachelor's level group had less cocaine use than the high school group. Statistical significance is one part of the end result, but there is merit in looking over the raw data and seeing the trends among it. These results were consistent with the findings presented by Harder & Chilcoat (2007), where it was concluded that there was no difference in persistent cocaine usage between high school graduates and college graduates. The same study found that there was an inverse correlation between the highest level of education achieved, and persistent cocaine use (Harder & Chilcoat, 2007). This data supports the current study's trends, where individuals with a bachelor's level of education had less cocaine use than those with a high school education only.

The percentage of participants in the high school level group who were infrequent users of cocaine was equal to the percentage of regular cocaine users in the same group. However, the gap between the percentage of bachelor educated participants who were infrequent users compared to the regular users was quite large. Within the bachelor's educated group (n = 21), the large majority (81%), were infrequent users, but only 19% were regular users. When looking at the entire sample size (n = 45), 38% were infrequent users with bachelor's level education and only 9% were regular users in the same group (Table 1). This suggested that while having only a high school level education may not affect the regularity of your drug use, having a bachelor's level education could greatly prevent one from regular drug use (see Figure 1). Finally, the majority of infrequent cocaine users were in the bachelor's level group, but the majority of regular users were in the high school level group. This corresponds to the idea that the education level of an individual can impact their potential use of cocaine. However, this distinction was not statistically significant, and therefore cannot be supported beyond just observing Table 1 and Figure 1.

Previous studies have consistently provided evidence that a lack of education about the risks and effects of cocaine, as well as increased impulsivity are related to increases in cocaine usage (Bachman et al., 1990; Moeller et al., 2001). Furthermore, prolonged cocaine usage impacts memory and cognition and regular users perform worse on memory retention activities even if their IQ is comparable to a non-user (Mittenberg, 1993). It is possible that the reason for why there were so few regular cocaine users at the bachelor's level is related to this prior research. Pursuing higher education could provide individuals the opportunity to further improve cognitive ability and memory as well as become a more mature person versus if one were to stop their education after high school. For this reason, it would not be sustainable to use cocaine so regularly while studying at the university level and the results of this study supports that. Furthermore, this study supports the findings of Bachman et al. (1990), where increased knowledge on the subject of cocaine use decreases usage as the more educated members of the study population were the least frequent users.

Limitations

A few limitations were present when conducting this study. The first limitation was the inclusion of a small sample size of 45 participants. With a larger sample size, it would be easier to assess the

representativeness of the sample, generalize the results, provide a smaller margin of error, and identify outliers that can skew the data when working with a smaller sample. Next, an outdated database from 2004 was used. If collected today, the data could result in a different outcome. Recently, the Canadian Centre on Substance Use and Addiction released a Canadian drug summary that stated that cocaine use for the Canadian population between 20 to 24 and over 25 years old, had increased significantly compared to the previous year data was collected (CCSA, 2019). Furthermore, considering the data was being reported by the participants themselves, this allows for human error to affect the data collection process. For instance, the participants could have falsified their answers, misinterpreted the questions, or simply forgotten the accurate response to the questions. The inaccuracy of the response would skew the data. Next, there was no way to determine the exact amount of cocaine consumption of the participants. For example, a participant who answered "yes" to "once or twice in the past 3 months" could have consumed a significantly larger amount in that time compared to another participant who answered "yes" for the same category. Knowing the exact amount of cocaine consumption would allow for more specific categories into which to place the participants, leading to increased effectiveness in our result. Lastly, the restriction of the question asked was another limitation. The survey asked the participants "how often did you use cocaine in the past 3 months" from the time of the study. If the survey had increased the timeline, then it could lead to a better representation of the use of cocaine for a participant.

Future Directions and Conclusions

Ultimately, some suggestions can be taken into consideration when tackling the limitations discussed for future investigations. Firstly, a larger sample size of participants is recommended as larger sample sizes are more representative of the population as a whole. In addition, larger sample sizes avoid the errors that stem from questioning a small number of participants with possible atypical responses. Larger sample sizes also present a smaller margin of error, while revealing outliers that could potentially skew the data in a smaller participant sample. Secondly, considering the data used in this study had been collected in the year 2004, new data collection and replication of the study is suggested to produce updated findings and observe a possible shift in cocaine usage trends from 16 years ago compared to today. Thirdly, updated data would allow opportunities for future studies to examine several other variables that influence cocaine usage such as; differences between Canadian universities, genders, ages, income level, racial background, geographical location and more. As more studies are produced, and similar results are replicated, the findings become more valid and can be generalized to the whole population. Lastly, it would be interesting to observe the findings of similar studies conducted for other hard drugs such as hallucinogens, ecstasy, heroin, and methamphetamine. Overall, with these suggestions, more accurate and generalizable results can be produced. In summary, the effect of one's education level on their rate of cocaine consumption for Canadian men and women aged 20-30 is inconclusive, but with further research and ameliorations of the study's limitations, this relationship could be understood better.

REFERENCES

Bachman, J. G., Johnston, L. D., & O'Malley, P. M. (1990). Explaining the Recent Decline in Cocaine Use among Young Adults: Further Evidence That Perceived Risks and Disapproval Lead to Reduced Drug Use. Journal of Health and Social Behavior, 31(2), 173. doi:10.2307/2137171

Becker, J. B., & Hu, M. (2008). Sex differences in drug abuse. Frontiers in Neuroendocrinology, 29(1), 36–47. doi:10.1016/j.yfrne.2007.07.003

Beirness, D. J., & Davis, C. G. (2007). Driving After Drinking in Canada. Canadian Journal of Public Health, 98(6), 476–480. https://doi.org/10.1007/bf03405442

Canadian Centre on Substance Use and Addiction. (2019). Canadian Drug Summary: Cocaine. Canadian Centre on Substance Use and Addiction. Retrieved from https://www.ccsa.ca/sites/default/files/2019-04/CCSA-Canadian-Drug-Summary-Cocaine-2019-en.pdf

Farrell, A. D., Danish, S. J., & Howard, C. W. (1992). Relationship between drug use and other problem behaviors in urban adolescents. Journal of Consulting and Clinical Psychology, 60(5), 705–712. doi:10.1037/0022-006x.60.5.705

Government of Canada, S. C. (2017). Education in Canada: Key results from the 2016 Census. Government of Canada. Retrieved from https://www150.statcan.gc.ca/n1/daily-quotidien/171129/dq171129a-eng.htm

Harder, V. S., & Chilcoat, H. D. (2007). Cocaine Use and Educational Achievement: Understanding a Changing Association Over the Past 2 Decades. American Journal of Public Health, 97(10), 1790–1793. doi:10.2105/ajph.2006.091108

Hartman, D. M., & Golub, A. (1999). The Social Construction of the Crack Epidemic in the Print Media. Journal of Psychoactive Drugs, 31(4), 423–433. doi:10.1080/02791072.1999.10471772

Kosten, T. A., Gawin, F. H., Kosten, T. R., & Rounsaville, B. J. (1993). Gender differences in cocaine use and treatment response. Journal of Substance Abuse Treatment, 10(1), 63–66. doi:10.1016/0740-5472(93)90100-g

McDermott, D. (1984). The Relationship of Parental Drug Use and Parents' Attitude Concerning Adolescent Drug Use to Adolescent Drug Use. Adolescence, 14(73), 89–97.

Mittenberg, W. (1993). Effects of chronic cocaine abuse on memory and learning. Archives of Clinical Neuropsychology, 8(6), 477–483. doi:10.1016/0887-6177(93)90048-6

Moeller, F., Dougherty, D. M., Barratt, E. S., Schmitz, J. M., Swann, A. C., & Grabowski, J. (2001). The impact of impulsivity on cocaine use and retention in treatment. Journal of Substance Abuse Treatment, 21(4), 193–198. doi:10.1016/s0740-5472(01)00202-1

Raposo, J. C., Costa, A. C., Valença, P. A., Zarzar, P. M., Diniz, A. D., Colares, V., & Franca, C. D. (2017). Binge drinking and illicit drug use among adolescent students. Revista De Saúde Pública, 51. doi:10.11606/s1518-8787.2017051006863

The ratio of LDL-C to HDL-C in Males Compared to Females who Have Had a Previous Heart Attack and Among Different Weight Categories

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INTRODUCTION

Due to the burden of cardiovascular disease (CVD) in Canada, health professionals are working diligently to combat the issue since 1921 (Nair et al., 1989). Nair et al. (1989) suggested that in 1987, more than 77,000 Canadians died from CVD, representing the leading cause of death in Canada. Today, Statistics Canada (2017) states that heart disease is the second leading cause of mortality in Canada, the leading cause of hospitalization, and the primary cause of years of life lost, ultimately making it an economic burden and health crisis.

Fernandez and Webb (2008) identified that specific target levels of low-density lipoprotein (LDL) and high-density lipoprotein (HDL) are standard tools for assessing the risk of CVD for all people. LDL-C is responsible for carrying cholesterol into peripheral tissue cells through the artery (Hao & Friedman, 2014). Cholesterol carried by excess LDL-C accumulates on the arterial wall to form plaque, leading to thickening and hardening of the arterial wall, narrowing of the vessel lumen, and significantly increasing the risk of heart disease, like atherosclerosis (Hao & Friedman, 2014). Contrary, HDL-C is responsible for transporting cholesterol to visceral metabolism, helping prevent atherosclerosis (Hao & Friedman, 2014).

The association between LDL-C and the risk of CVD is well recognized among scientists and health professionals. Large randomized clinical trials demonstrate a significant reduction in the CVD events and CVD mortality rates when plasma LDL-C is reduced through lipid-lowering agents. Epidemiological studies (e.g. Castelli, 1984; Stamler, 1993), conducted over the last 50 years have propelled scientists to develop identification markers for CVD development and assess the risk for atherosclerosis. All traditional clinical guidelines evaluate LDL-C as the critical marker for CVD development and disregard HDL-C importance in protecting against CVD. It is now widely accepted that the ratio between LDL/HDL-C is the most optimal method in assessing CVD risk development (Després et al., 2000).

Existing research shows that there is a correlation between higher weight in elderly people (65 years or older) and risk factors for CVD (Harris et al., 1997). Risk factors usually include high insulin, low HDL-C and high LDL-C (Harris et al., 1997). Women in particular who have lower education, low income and low levels of physical activity have a stronger correlation between their weight and CVD (Harris et al., 1997). The choice of weight as a covariate variable in this article has a significant impact on the CVD mortality rate. The BMI and CVD mortality rate are analyzed through risk regression. Regardless of whether it is an overweight middle-aged and elderly person (BMI >=27.8) whose body indicators are in the health category, or normal weight (BMI=19.0 to <25.0), their mortality rates are similar (Lee et al., 1998).

However, it is important to acknowledge that limited research on risk assessment has been completed by looking at the difference in the ratio of LDL/HDL-C in elderly patients among different weight categories who have self-reported a previous heart attack. In addition, limited to no research has been done to assess and compare the weight with the LDL/HDL-C ratio. Besides, the paper by Després et al. (2000) concluded that the relative reduction in CVD events through lipid-reducing agents was limited to approximately 30%, suggesting that treated CVD patients are still at high risk of recurrent CVD events, and innovative techniques for risk assessment and treatment are necessary (Després et al., 2000).

This report seeks to assess the difference in the ratio of LDL/HDL-C in elderly men and women in different weight categories reported to have had a previous heart attack. The objective is to address the gap in knowledge related to the assessment of high LDL/HDL-C and provide a perspective on the role of high LDL and high HDL in predicting heart attacks in women in comparison to men.

Research question #1

Is there a difference in the ratio of LDL-C to HDL-C in males (aged 65 to 74 years) who have had a previous heart attack compared to females (aged 65 to 74 years) who have had a previous heart attack?

Research Question #2

Is there a difference in the ratio of LDL-C to HDL-C among males and females (65 to 74 years of age) who have had a previous heart attack and among different weight categories?

MATERIALS AND METHODS

Study Design and Database

Between the years 1986 and 1992, the Canadian Heart Health Database (CHHDB) initiated and completed an observational study through Provincial Heart Health Surveys across ten different provinces. The data collection integrated CVD information as part of the Canadian Heart Initiative, in cooperative work with Health Canada and The Heart and Stroke Foundation of Canada (Edwards, 1997). The CHHDB consists of two sets of integrated databases, including basic information obtained by the ten provincial surveys, and family history information obtained by only four provinces (Quebec, Saskatchewan, Ontario, and Alberta). The primary objective of the survey and data collection was to assess the prevalence of CVD risk factors at a provincial level, estimate the public education and awareness levels of CVD causes, evaluate the burden of CVD, and review the lifestyle choices and risk factors (Edwards, 1997).

The sample for each provincial survey was chosen using a stratified multistage probability sample design (Edwards, 1997). Each provincial sample size consisted of 2,000 responses and there was oversampling for the younger age group of (18 to 64) compared to the older age group (65 to 74) for reliability reasons (Edwards, 1997). Data collection occurred in two separate stages. The first stage included a visit to the selected participants' home to collect the basic information, including demographic data, knowledge and understanding of CVD risk factors, and their opinions on

cardiovascular-related problems (Edwards, 1997). The home interview also included two blood pressure readings that were taken before the interview and after the interview (Edwards, 1997). For the second stage of data collection, the respondents were asked to fast for a minimum of 8 hours and visit the clinic to provide anthropometric measurements (weight and height), a blood test, and further blood pressure readings (Edwards, 1997). All tests were completed by health care professionals, including qualified nurses (Edwards, 1997).

Study Participants

The sample size of the study consisted of 379 participants, which included 266 males and 113 females. Inclusion criteria: included people between the ages of 65-74 who have self-reported a previous heart attack. Exclude cases list wise was completed to deal with missing cases.

Study Outcomes

The primary outcome of our research question is the ratio between LDL/HDL-C. The primary outcome was obtained through a blood test, which measured the amount of cholesterol in the blood. The blood tests were completed at the clinic during stage two of data collection after the participants had fasted for at least 8 hours. These data collection methods are consistent with other studies, including Zitnanova et al. (2018), Després et al (2000), and Fernandez & Webb (2008), where fasting and blood tests were completed to assess LDL-C and HDL-C ratios. Further reasoning for the selected primary outcome is that cardiovascular research (e.g. Millán, 2009; Grover, 2003; Althaus, 1998; Després, 2000), conducted over the last 30 years has concluded that LDL/HDL-C ratio is the most optimal method in assessing cardiovascular risk and traditional methods are not as accurate and reliable.

Additional Data Collection

The list of additional variables includes self-reported previous heart attack, gender, age, and weight of participants. The self-reported previous heart attack variable was obtained through the survey question, “Has the individual ever had a heart attack?” with the answer options: Yes, No, Not Sure. The gender and age of the participants were obtained during the interview stage, where they were recorded by the interviewer. Weight was measured and recorded during the second stage when the participants arrived at the clinic. These variables were selected because previous research (i.g. Harris, 1998) has suggested that weight and gender are potential risk factors.

Statistical Analysis

The statistical assessments were completed using IBM SPSS Statistics 27. The significance level was selected to be 0.05 and because our data was not normally distributed using the Shapiro-Wilk test, the Mann-Whitney U test was used to compare between groups for particular variables. Spearman correlation coefficient was performed to determine relationships between LDL/HDL-C ratio and weight.

RESULTS

After filtering out missing data and unknown variables, 379 participants who had a history of previous heart attacks were selected. Among the participants, 266 were male and 113 were female. Each

participant's LDL-C level, HDL-C level and weight were collected. A ratio of LDL/ HDL-C was calculated and used as a risk indicator (Table 1).

Table 1. Descriptive statistics for LDL-C, HDL-C, LDL/HDL-C and Weight of selected male and female participants from Canadian Heart Health Database, 1986-1992 (CHHD 1986-1992) [N=379]

Variable	Number of Participants	Mean	Median	Range	
Low-Density Lipoprotein (LDL-C) (mmol/L)	379	3.59	3.54	5.66	
High- Density Lipoproteins (HDL-C) (mmol/L)	379	1.17	1.13	1.92	
LDL-C/HDL-C	Male [n=266]	3.36	3.24	5.62	p<0.001*
Weight (Kg)	Female [n=113]	3.10	2.93	5.21	
Weight (Kg)	Male [n=266]	80.69	79.00	69.00	p<0.001*
	Female [n=113]	70.18	69.00	70.00	

* (p-value < 0.05)

HDL-C, LDL-C, LDL-C/HDL-C and weight were inputted into the Shapiro-Wilk test to test the data's normality. The results showed that LDL is normal (p=0.062) and that LDL-C and LDL/HDL-C were not normally distributed (p<0.001, p=0.025). Since most of the data were not normally distributed, the Mann-Whitney U test was chosen to compare the groups. There was a statistically significant difference in weight between males and females since p<0.001. The p-value was also less than 0.001 in the LDL/HDL-C ratio between males and females, which is less than 0.05, so this was also statistically significant. The findings indicated that the potential heart attack risks of males and females were different.

Spearman's Rho was also performed to test the correlation between the ratio of LDL-C/HDL-C and weight. Since the correlation coefficient was 0.088, which is larger than 0.01, the ratio of LDL/HDL-C and weight is not statistically significant. A scatter graph was also made to see the correlation of the ratio of LDL-C over HDL-C and weight visual (Figure 1). Based on Figure 1, both male and female linear trends tended to be flat. The R squared from both male and female groups was less than 0.8, which indicates that there was no statistically significant difference between males and females.

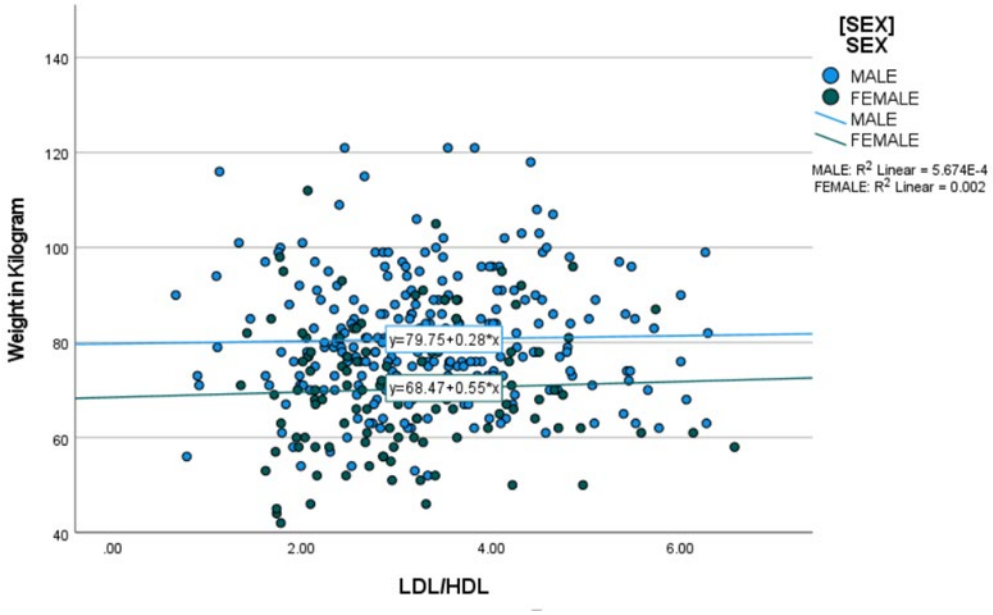

Figure 1. The Correlation Linearity Differences of the ratio of LDL/HDL-C over different weights between Male and Female (CHHD 1986-1992) [N=379]

To conclude, there was a statistically significant difference in the ratio of LDL-C to HDL-C between males and females and no statistically significant correlation between the ratio of LDL-C to HDL-C and different weights.

DISCUSSION

There are two research questions that have been researched and analyzed. The first one is whether there is a difference in the ratio of LDL-C to HDL-C in males (aged 65 to 74 years) who have had a previous heart attack compared to females (aged 65 to 74 years) who have had a previous heart attack. The second research question that has been analyzed is whether there is a difference in the ratio of LDL-C to HDL-C among males and females (65 to 74 years of age) who have had a previous heart attack and among different weight categories. Through the analysis of the results of this research paper, it can be suggested that there is indeed a difference in the ratio of LDL-C to HDL-C in males compared to females who have self-reported a previous heart attack. By using the Mann-Whitney U test to analyze the LDL/HDL-C ratio between men and women with a history of heart disease in the elderly, it was found that there is a significant difference in the potential risk of heart attack between

men and women. However, using Spearman's Rho it was determined that there is no significant correlation between LDL/HDL-C ratio and weight between genders.

The most advanced research explicates that a high LDL/HDL-C ratio is associated with CHD risk and that the LDL/HDL-C ratio is not affected by dietary cholesterol, so it is more dependable than LDL-C or HDL-C alone to predict the risk and severity of coronary heart disease (Fernandez, M., & Webb, D. 2008). This paper has the same position in that the LDL/HDL-C ratio is selected to measure the risks and varieties of CVD among elderly men and women. Previous heart health research has established that an increased risk of coronary heart disease is seen with increased age. Results of a study by Bots et al (2017) suggest that CHD mortality is lower in women than in men throughout adulthood, however, the magnitude of this difference varied by age (Bots et al., 2017). Similarly, this study depicts that the potential risk of coronary heart disease determined by the LDL/HDL-C ratio differs significantly between men and women as seen through the analysis of the results (Bots et al., 2017). The results of this research study are in line with previous research that has been conducted in the field and validates what is already known. The similarities between the results of this research paper and those conducted previously help to validate the previous research and solidifies the information that has been established prior.

Moreover, it has been known for a long time that obesity increases the risk of coronary heart disease as well as other risk factors such as hypertension, diabetes and many other heart-related diseases. Results of a study by Wannamethee et al. (2005) demonstrate that increased weight and obesity lead to an increased long-term risk of CVD and diabetes despite showing that weight loss has no associated reduction in the risk of CVD (Wannamethee et al., 2005). Since the limitations of the study by Wannamethee includes the fact that researchers focus on British men solely, neglecting women and those of other nationalities, a wider scope study is required in order to ascertain these findings (Wannamethee et al., 2005). Unexpectedly, the results of this current research paper depict otherwise. In this study, the correlation between the LDL/HDL-C ratio and weight is investigated and no significant correlation is found between the two. Differences in the results of this research paper, when compared to other studies, could be due to several other confounding variables that may have skewed the results in one way or another. These confounding variables may include lifestyle factors such as exercise and diet that may have impacted the correlation of LDL/HDL-C ratio with weight.

Our report has some limitations. Even though our paper examines the risk factors of heart disease through a one-time questionnaire, it is unable to monitor the effect of weight changes over a period of time on the LDL/HDL-C ratio between sexes. Such monitoring would be beneficial to more accurately assess the long-term impact of weight gain and obesity on cardiovascular health, specifically, its impact on the LDL/HDL-C ratio. This study did not find a statistically significant difference between body weight and LDL/HDL-C ratio. As mentioned above, this is contrary to previously conducted research. Other limitations to this study include the fact that it was only applied to a small age group of individuals of 65-74 years old. To accurately assess any possible associations or correlations between the LDL/HDL-C ratio and weight and its differences between different genders, a wider scope study incorporating various age groups would be beneficial. In addition, the

sample size of our data is only 379 individuals, making it a very small sample size that could not be generalized to the overall Canadian population.

This data lacks the results of lipids and insulin levels, and there is no more detailed classification of the population. It is impossible to comprehensively consider risk factors and eliminate interference to analyze the relationship between body weight and LDL/HDL-C ratio. Existing literature supplements the information lacking in this paper. A longitudinal cohort study analyzes the association between weight change and LDL-C and HDL-C levels (Norman et al., 2013). This result of previous research reveals that the race, gender and age of the participants will not affect the adverse changes in LDL-C and HDL-C levels caused by 10 years of weight gain (Norman et al., 2013). It is necessary and feasible to add accurately quantified risk factors related to weight change in the data of this study.

Despite having a few limitations, this study has many strengths as well. This study is unique because no previous research has investigated the same variables. This study not only investigates the association between the LDL/HDL-C ratio and CVD, but further goes beyond that to assess any differences in this ratio between elderly men and elderly women with varying weights. The findings of this study are very important as it further validates previously conducted research and adds a substantial amount of significant information to the field. Through the discovery that there is a difference in the LDL/HDL-C ratio between men and women who have self-reported a previous heart attack, further risk assessments can be made to discover the reasons behind these differences. In addition, more resources and healthcare initiatives could be implemented for the group that is more at risk to prevent or reduce the proportion of these individuals with CVD and reduce heart attacks among the population. This would aid in reducing the economic burden that CVD has on Canada as a country, and more broadly, across the globe by reducing CVD mortality and morbidity amongst a wider population. All in all, the results of this study demonstrate that there is a difference in the ratio of LDL-C to HDL-C in males compared to females who have self-reported a previous heart attack and that there is no significant correlation between LDL/HDL-C ratio and weight between genders.

REFERENCES

Ancelin, M. L., Ripoche, E., Dupuy, A. M., Samieri, C., Rouaud, O., Berr, C., Carrière, I., & Ritchie, K. (2014). Gender-specific associations between lipids and cognitive decline in the elderly. European neuropsychopharmacology: the journal of the European College of Neuropsychopharmacology, 24(7), 1056–1066. https://doi.org/10.1016/j.euroneuro.2014.02.003

Nair, C., Colburn, H., McLean, D., & Petrasovits, A. (1989). Cardiovascular disease in Canada. Health reports, 1(1), 1–22.

Norman, J. (2013). The impact of weight change on cardiovascular disease risk factors in young black and white adults: the CARDIA study. Int J Obes 27, 369–376 (2003). https://doi.org/10.1038/sj.ijo.0802243

Statistics Canada. (2017). Heart disease in Canada: Highlights from the Canadian Chronic Disease Surveillance System. Government of Canada. Retrieved from

https://www.canada.ca/en/public-health/services/publications/diseases-conditions/heart-disease-canada-fact-sheet.html

Després, J., Lemieux, I., Dagenais, G., Cantin, B., & Lamarche, B. (2000). HDL-cholesterol as a marker of coronary heart disease risk: The Québec cardiovascular study. Atherosclerosis, 153(2), 263-272. doi:10.1016/s0021-9150(00)00603-1

Harris, T. B., Savage, P. J., Tell, G. S., Haan, M., Kumanyika, S., & Lynch, J. C. (1997). Carrying the burden of cardiovascular risk in old age: associations of weight and weight change with prevalent cardiovascular disease, risk factors, and health status in the Cardiovascular Health Study. The American journal of clinical nutrition, 66(4), 837–844. https://doi.org/10.1093/ajcn/66.4.837

Lee, C. D., Jackson, A. S., & Blair, S. N. (1998). US weight guidelines: is it also important to consider cardiorespiratory fitness?. International journal of obesity and related metabolic disorders : journal of the International Association for the Study of Obesity, 22 Suppl 2, S2–S7.

Fernandez, M., & Webb, D. (2008). The LDL to HDL Cholesterol Ratio as a Valuable Tool to Evaluate Coronary Heart Disease Risk, Journal of the American College of Nutrition, 27:1, 1-5, DOI: 10.1080/07315724.2008.10719668

Hao, W., & Friedman, A. (2014). The LDL-HDL Profile Determines the Risk of Atherosclerosis: A Mathematical Model. PLoS ONE, 9(3). doi:10.1371/journal.pone.0090497

Castelli, W. P. (1984). Epidemiology of coronary heart disease: the Framingham study. The American journal of medicine, 76(2), 4-12.

Stamler, J., Vaccaro, O., Neaton, J. D., Wentworth, D., & Multiple Risk Factor Intervention Trial Research Group. (1993). Diabetes, other risk factors, and 12-yr cardiovascular mortality for men screened in the Multiple Risk Factor Intervention Trial. Diabetes care, 16(2), 434-444.

Bots, S., Peters, S., & Woodward, M. (2017, March 27). Sex differences in coronary heart disease and stroke mortality: A Global assessment of the effect of Ageing between 1980 and 2010. Retrieved April 09, 2021, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5435266/

Wannamethee, S., Shaper, A., & Walker, M. (2005, February 01). Overweight and obesitynand weight change in middle aged men: Impact on cardiovascular disease and ndiabetes. Retrieved April 09, 2021, from https://jech.bmj.com/content/59/2/134n

Edwards, A. C. (1997). Canadian Heart Health Database 1986-1992. Memorial university of Newfoundland, Canada.

Millán, J., Pintó, X., Muñoz, A., Zúñiga, M., Rubiés-Prat, J., Pallardo, L. F., ... & Pedro-Botet, J. (2009). Lipoprotein ratios: physiological significance and clinical usefulness in cardiovascular prevention. Vascular health and risk management, 5, 757.

Grover, S. A., Dorais, M., & Coupal, L. (2003). Improving the prediction of cardiovascular risk: interaction between LDL and HDL cholesterol. Epidemiology, 14(3), 315-320.

Althaus, B. U., Staub, J. J., LÈCHE, A. R. D., Oberhänsli, A., & Stähelin, H. B. (1988). LDL/HDL-changes in subclinical hypothyroidism: possible risk factors for coronary heart disease. Clinical endocrinology, 28(2), 157-163.

Correlation Between Low-Fat Diet, Weight and BMI in males and females aged 18-34; BMI associated with Low Fat Diet

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INTRODUCTION

High dietary fat intake is known as a cause of obesity, resulting in a worldwide effort to reduce daily dietary fat consumption (Pirozzo et al., 2003). Other diseases are also associated with a high dietary fat intake such as cardiovascular diseases (Hooper et al., 2001). Some studies concluded that there is a risk reduction by 9% in cardiovascular diseases with avoiding fat or modifying the intake of fat by consuming healthier fats (Hooper et al., 2001). There is also an increase in risk of all-cause mortality associated with high dietary fats such as saturated fat and trans fat (Guasch-Ferré et al., 2015). However, many fat-restricted fad diets are followed by people to achieve weight loss (Makris & Foster., 2005). Studies have shown that in order to lower BMI and weight, it would be beneficial to lower fat intake as well as exercise (Jakicic et al., 2001). Most people want to achieve weight loss without exercise and therefore turn to diet (Kendall et al., 1991). This research study aims to determine whether small choices, such as consciously choosing foods with lower-fat content at the grocery store, has an impact on overall weight and BMI.

Low Fat diet and BMI

BMI or Body Mass Index is the primary outcome analyzed in this research study. BMI was chosen because it is a more comprehensive measure of healthy body weight. BMI does not measure body fat directly but it is a useful means to categorize healthy body fat and is correlated with other more direct forms of measurements (All About Adult BMI., 2020). Numerous primary and clinical research studies in the literature observe the impacts that high and low-fat diets have on BMI. One such clinical study on rat models investigated the impact that cafeteria food, known to have very high fat in the U.S, would have on BMI (Buyukdere et al., 2019). The results showed that human cafeteria food led to significantly higher obesity in rats after just 12 weeks (Buyukdere et al., 2019). This study concluded that there is a clear link between dietary fats and BMI (Buyukdere et al., 2019). Another study conducted on humans investigated the consumption of dietary fat and its effect on BMI. A control diet consisting of relatively normal fat amounts was used as a reference to a low-fat diet. The results showed that weight loss and a reduction in BMI was seen in overweight individuals on a low fat diet (BMI > 30 Kg/m2) (Astrup., 2001). The study predicted and confirmed that people with a BMI of 30 or higher, with a 10% reduction of fat in diet, would lose about four kilograms (Astrup., 2001).

Low Fat Diet and Weight

Weight was chosen as a secondary outcome because it is commonly associated with fat intake (Hooper et al., 2015). A study done by the Look AHEAD Trial examined how dietary modifications, such as reducing dietary fat intake, impact weight loss in participants with diabetes. They found that in year one of following a strict low-fat diet, participants reported an average weight loss of 8.6% compared to initial body weight (Deedwania., 2010). As the years progressed, it was harder to lose more weight. In year four participants lost on average, 4.7% of initial body weight (Deedwania., 2010). This shows that

even when following a strict low-fat diet there's a threshold after which point the diet will not be as effective for weight loss.

Another study showed that obesity causes dieting behaviour in individuals and leads to restriction in fat intake (Seidell., 1998). However, while this may cause weight loss in people who are obese, it cannot be generalized to entire population. Another study done by Taylor et al., (1992) looked at people in rural communities who were more lean and had a higher energy intake but low fat intake. The study concluded that the low fat intake and increased energy expenditure led to a low prevalence of obesity in that community.

While there has been extensive research on how foods with high-fat content affect outcomes such as BMI and weight (Bray & Popkin, 1998; Wang et al., 2008), and on how strict low-fat diets can improve BMI and weight (Bray et al., 2004; Kahleova et al., 2019) there are knowledge gaps and limitations associated with studying diet and BMI. This research attempts to look at individuals that make a conscious decision to avoid foods that have a high fat content. This is different from following a strict low fat diet as there is less pressure on the individual to follow through that diet every day. Participants in this study include all individuals that decide to avoid high dietary fats, not just those that follow fad diets. Therefore, this analysis would aid in filling a gap in literature by analyzing a more realistic population that are health conscious but do not have the time or resources to stick with a certain diet. In beginning to understand how the decision to avoid high fat impact indicators of obesity like BMI and weight, it is possible to discover a new, more achievable method of weight-loss or weight control for males and females. Hence, the main objective of this analysis, to look at the correlation in BMI (primary outcome) and weight (secondary outcome) between males and females aged 18-34 years who choose foods with a lower fat content, against those who do not make that choice.

MATERIALS AND METHODS

Study Design and Database

We conducted an observational cross-sectional study to quantitatively examine our research question. Our sample was derived from the Canadian Community Health Survey (CCHS) 2017-2018 Annual Component (Health Statistics Division 2018). Statistics Canada has replicated this survey since 2001. It is a single data source for health surveillance and public health research to improve health outcomes. We downloaded the January 2017 to December 2018 microdata file which contained questions related to the health status, health care uses and health determinants of Canadians. Statistics Canada collected the data using computer assisted interviews which include telephone interviews (25%) and in-person (75%) interviews with the chosen participants. The automated system recorded the most important information and generated a report (Health Statistics Division, 2018).

Statistics Canada chose adults aged 18 and over using the Area frame (Health Statistics Division, 2018). Canadians were selected based on the area of their private dwelling and health region. This ensured that the data was fairly represented. To generalize the data for the public, 3% of respondents were omitted since they were part of foster care, Aboriginal reserves, Canadian Forces or living in certain health regions (Health Statistics Division, 2018).

Study Participants

We excluded participants under age of 18 and over 34 to fit the research question. We chose this range because Statistics Canada classifies BMI in age groups of 18 to 34 (McDiarmid, 2019). Participants who had missing values for BMI and weight were also excluded. 1569 participants were excluded as they did not respond to the survey question: "Do you choose certain foods because of the lower fat content?" The dataset which initially consisted of 20,559 participants was narrowed down to 2700 males and females.

Study Outcomes

We assessed the association of choosing foods with lower fat content with BMI (primary outcome) and weight (secondary outcome). Even though the BMI scale is criticized for being inaccurate, outdated and oversimplified for calculating an individual's body fat, we chose it because it provides an estimate of the population's health and body fatness (Zierle-Ghosh & Jan, 2020). It is a clinically significant measure and universally used by researchers in correlational studies to measure the relative body fat of a population (Zierle-Ghosh & Jan, 2020). BMI was readily calculated in the database using the self-reported weight in kilograms divided by their self-reported height in meters. We used adjusted BMI which omitted outliers below 14.23 and above 56.72. It was expressed as a continuous variable in kg/m^2. Weight was the secondary self-reported outcome which was expressed as a continuous variable in kilograms. On its own, it does not predict an individual's health so it is important to use it for secondary analysis (Zierle-Ghosh & Jan, 2020). It was used to further interpret the results. Participants were asked, "Do you choose certain foods because of the lower fat content?" If they answered "Yes (or sometimes)" then we assumed that they consciously make efforts to choose foods with lower fat.

Additional Data Collection

To study our demographic, we assessed additional variables including age (in years) and sex. Participants were asked, "What is your age?" Statistics Canada grouped the ages in the following categories: 18-19; 20-24; 25-29 and 30-34 to keep the identities confidential. We chose 18-34 as the range because adult BMI categories do not vary significantly by age (Centers for Disease Control and Prevention, 2020). We stratified the participants by sex. The question asked, "Is [participant's name] male or female?" There was no missing data for age or sex.

Statistical Analysis

We performed statistical analysis on SPSS Version 25. Descriptive statistics were used to summarize 2700 cases (Table 1). We presented the frequencies and percent for choosing foods with lower fat content, sex and age groups as n(%). We performed tests for normality on BMI and weight which were continuous variables (Table 1). Since they were not normally distributed, we presented them as median and range using *median(IQR). Mann-Whitney U tests were performed to examine between group differences on these outcomes (Table 1). A significance level of $p<0.05$ suggested that the medians between choosing low fat foods and not choosing low fat foods were significantly different for BMI and weight. To address the sex differences, we repeated the test separately for 1307 males and 1393 females. We presented between group differences graphically for both sexes, and males and females separately (Table 1; Figure 1).

To further determine the association, BMI was cross-tabulated with choosing foods with lower fat content (Table 2). We used cut-points to convert BMI, which was a continuous variable, into an ordinal variable based on the standard BMI classification system used by the CDC (Centers for Disease Control and Prevention, 2020). A series of four dummy variables were created: underweight/low (≤18.50 kg/m^2); healthy/normal (18.51-24.99 kg/m^2); overweight/high (24-29.99 kg/m^2); and obese (≥30 kg/m^2). We performed 4x2 Pearson Chi-square tests with $p<0.05$ significance and recorded the observed counts (Table 2). We repeated the same for males and females separately. Weight was a continuous variable which cannot be converted into an ordinal variable. Weight alone is an inaccurate indicator of body fat and cannot be categorized. So Chi-square analysis was not conducted on weight and choosing low fat foods.

RESULTS

The dataset consisted of 20,559 participants which was narrowed down to 2700 participants. Participants under age 18 and over age 34 were excluded. 1569 cases were deleted because there were missing values for BMI or weight. 17859 participants who did not respond to the independent variable were excluded. There were 1307 males and 1393 females that met inclusion criteria (Table 1).

Table 1: Descriptive characteristics of study population [N=2700]

Characteristics		Choosing Low Fat Foods (%)	Not Choosing Low Fat Foods (%)	Total (%)	P Value
Choosing Low Fat		1307(48.4)	1393(51.6)	2700 (100)	
Sex	Male	607(46.4)	749(53.8)	1356(50.2)	
	Females	700(53.6)	644(46.2)	1344(49.8)	
Age (years)	18-19	103(7.9)	126(9)	229(8.5)	-
	20-24	296(22.6)	318(22.8)	614(22.7)	
	25-29	401(30.7)	456(32.7)	857(31.7)	
	30-34	507(38.8)	493(35.4)	1000(37.1)	
BMI (kg/m^2)	Total	25.05(6.1)*	24.45(6.1)*	24.92(6.1)*	0.003[a]
	Males	26.22(5.6)*	24.97(5.8)*	-	<0.001[a]
	Females	23.97(5.8)*	23.70(6.3)*	-	0.252[a]
Weight (kg)	Total	72(24.8)*	72(23.0)*	72(23.2)*	0.789[a]
	Males	81.00(20.3)*	78.75(18.0)*	-	<0.001[a]
	Females	63.00(15.8)*	62.05(18.0)*	-	0.309[a]

Data values are presented as n(%) of participants unless otherwise noted. * median(IQR); BMI, Body Mass Index. Data with "a" represents significance from the Mann-Whitney U test.

Between groups analysis for the primary outcome, using Mann-Whitney U tests, showed that the median BMI was significantly higher for participants who chose foods with lower fat content, at 25.05 kg/m^2, compared to 24.45 kg/m^2, p=0.003 (Figure 1A). Further analysis revealed median BMI was only significantly higher for males who chose low fat foods (26.22 kg/m^2 yes, 24.97 kg/m^2 no), p<0.001 (Figure 1C) and not females (Figure 1E). Between groups analysis for the secondary outcome showed that median weight did not differ between those who chose low fat foods and those who did not for the entire study population (Figure 1B). Further analysis showed weight was significantly higher for males who chose foods with lower fat content, p<0.01 (Figure 1D), but not for females (Figure 1F).

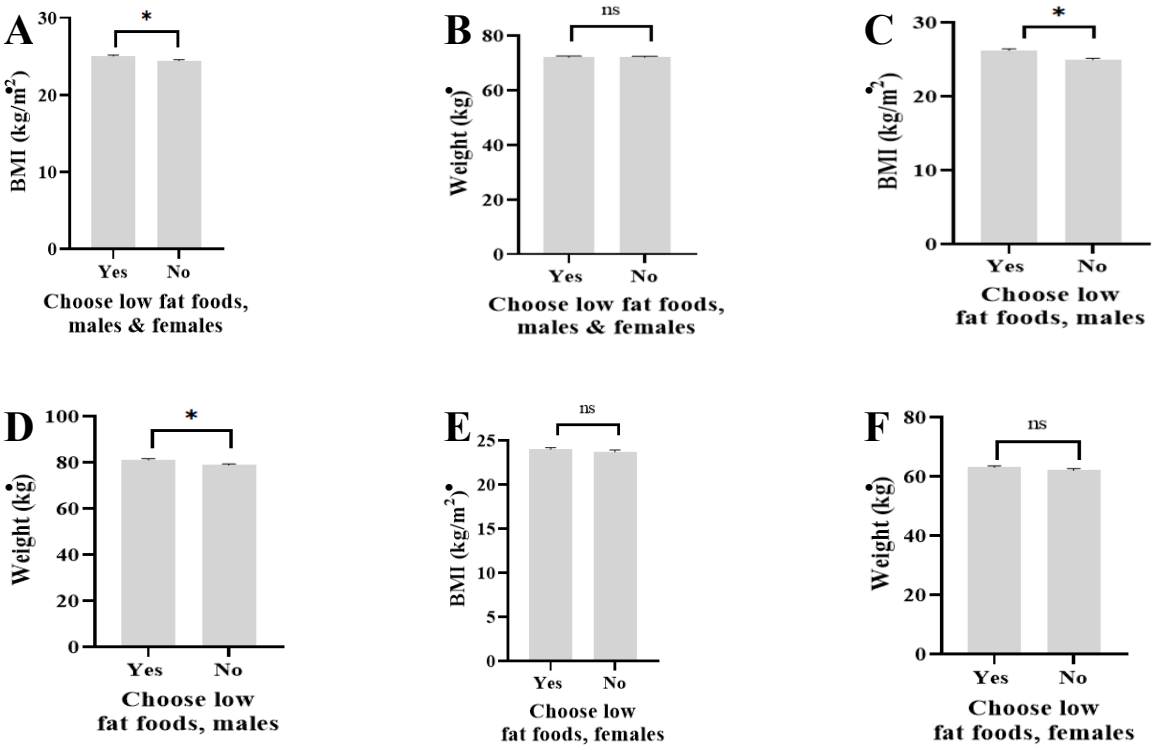

Figure 1. Between groups analysis for choosing low fat foods. Data represents median ± SE. '*' represents significance, 'ns' represents not significant. Total (n=1307, yes; n=1393, no) (A) Body mass index (BMI), p =0.003 and (B) Weight, p=0.789. Males (n=607, yes; n=749, no)(C) Body mass index (BMI), p<0.001 and (D) Weight, p<0.001. Females (n=700, yes; n=644, no) (E) Body mass index (BMI), p=0.252 and (F) Weight, p=0.309.

Chi-square test results showed a strong association between choosing low fat foods and BMI, p=0.001 (Table 2). More respondents who chose low fat foods had high BMI (24.00-29.99 kg/m^2), n=414 and obese BMI (≥30 kg/m^2), n=243 than those who did not (Table 2). Most respondents who did not choose low fat foods had normal BMI (18.51-24.99 kg/m^2), n= 742 (Table 2). Low BMI results were excluded from analysis because they did not meet minimum expected count. Association was strong for males, p<0.001 but not for females, p = 0.089 (Table 2). More males who chose low fat foods had obese BMI,

n=127 (Table 2). There were an equal number of male participants with high BMI that chose low fat foods (n=241) and did not choose low fat foods (n=242) as shown in Table 2.

Table 2: Pearson chi-square test comparing BMI categories (kg/m^2) with choosing foods with lower fat content on participants aged 18-34 [N=2700], men [N=1356] and women [N=1344].

		Choose Low Fat Foods			X^2		P Value
		Yes	No	Total			
BMI (kg/m^2)	Low BMI (≤18.50)	11	33	44	17.199		0.001
	Males	3	13	16			
	Females	8	20	28			
	Normal BMI (18.51-24.99)	639	742	1381			
	Males	236	378	614	Males	24.994	<0.001
	Females	403	364	767			
	High BMI (25-29.99)	414	393	807			
	Males	241	242	483			
	Females	173	151	324	Females	6.515	0.089
	Obese BMI (≥30)	243	225	468			
	Males	127	116	243			
	Females	116	109	225			
Total		1307	1393	2700	-		

Expected count: 21.3 for both males and females; 7.16 for males; 13.42 for females

DISCUSSION

Median BMI was found to be significantly higher for participants who chose low fat foods compared to those who did not. This could suggest that individuals who already fall into overweight or obese categories of BMI are aware of this fact, and are attempting to make choices in their everyday life to change their body weight. Chi-square analysis also showed a statistically significant association between BMI and choosing low fat foods for all participants. It was observed that most participants with high BMI choose foods that had lower fat content. Most participants with normal or underweight BMI did not choose foods with lower fat content. This was reflected in another study that showed weight loss and a reduction in BMI in overweight individuals (BMI > 30 kg/m^2) (Astrup., 2001). This study looked at normal weight individuals (control) and overweight individuals to study the effects of a low fat diet on obesity. This was similar to our analysis on low fat diet and BMI. Astrup (2001) also looked at physical activity which was not considered in our analysis and is important for studying weight loss. This study had limitations regarding the validity of diet recorded by the participants, which made it difficult to analyze overweight individuals and their weight loss (Astrup., 2001). Our research adds to the literature as further evidence that overweight adults are more likely to make healthier food choices.

When comparing individuals that chose low fat foods and weight, there was no significant difference between groups. This falls in line with the understanding that weight is not an accurate indicator of overweight or obese conditions (Zierle-Ghosh & Jan, 2020). Muscle and bone mass are also included in weight measures so adiposity is not accurately reflected in weight (National Institute of Diabetes and Digestive and Kidney Diseases, 2018). Differences in weight loss would only start to show in data if a strict diet consisting of low fat foods is followed for a certain period of time or if other factors such as physical activity, habits and culture lead to weight loss (National Institute of Diabetes and Digestive and Kidney Diseases, 2018).

Another reason why weight was not correlated with low fat foods could be because we conducted a cross-sectional analysis and were not able to analyze the weight-related changes over time. The study population in other studies follow strict diets over a period of time. A longitudinal study by Hession et al., (2008) showed that weight loss was observed after six months of following through with a low fat or low carb/high protein diet. This study looked at intervention groups that follow a strict diet which is different from our analysis on individuals that choose low fat foods but do not follow a strict diet. A limitation in Hession et al. (2008) was that the RCT design for diet could cause weight loss and also lead to a return in weight gain. Since weight fluctuates in participants, the significance of the results was questionable (Hession et al., 2008). Our research presents insignificant results which adds to the literature that weight loss depends on other confounding factors (i.e., physical activity, fluctuations) and makes it harder to find a significant correlation between weight and low fat foods.

Further analysis on sex differences showed that there was a significant difference in BMI and weight in choosing low fat foods for males, whereas in females, neither BMI nor weight was significantly different in choosing low fat foods. Chi-square showed that more men who had an underweight or normal BMI did not choose low fat foods. More men that were obese chose low fat foods. Equal number of men who had a high BMI chose or did not choose low fat foods. Our results are supported by an analysis

done by Gough (2007) on men and their knowledge on lifestyle and health. This study showed that most men were not as knowledgeable with dieting and health compared to women (Gough., 2007). While this analysis was conducted on men in the UK who grew up in a different environment, it could still be relevant to our analysis that found most men with normal or high BMI did not choose low fat foods. Our analysis also shows that Canadian men exhibit similarities to UK men with regards to diet. Another study also reported that men are more likely to eat high calorie foods and less fruits and vegetables compared to women (Baker & Wardle., 2003). While this study was done on older adults, men and women, it still shows that men are less aware of nutritional value in foods compared to women (Baker & Wardle., 2003), which adds to the analysis by Gough (2007), surrounding men and their dietary patterns.

These results also contradict numerous research that has reported that men are less likely to favor "healthier" meal choices (Beardsworth, 2002). Other literature also stated that there are more women (34%) than men (28%) in the United States that are obese and want to lose weight (Hession et al., 2008). We saw that men with obese BMI were open to making healthy food choices, although this was not seen in men with high BMI so this may suggest a shift in attitudes for health choices in males. Median BMI and weight were both significantly different for males but not females, which may have occurred due to the 'flat-slope syndrome' that leads to a tendency for underweight females to overreport and overweight females to underreport their weight due to social perceptions of ideal body size as seen in a study by Larson (2000). Though this effect may be decreasing due to body positivity movements, as seen in a more recent study by Davies et al., (2020).

There are many limitations to this research project. The first being our primary outcome was BMI. At times BMI is not considered an accurate predictor of healthy body weight. Latest research shows that BMI does not consider other factors such cholesterol, blood sugar, heart rate, etc that may also contribute to weight (Adab, Pallan and Whincup, 2018). BMI only gives a yes or no answer as to whether an individual is of normal weight without any context or justification. When performing the chi-square test, low BMI values did not meet minimum expected count and had to be excluded as well.

A limitation with this analysis is that we did not adjust for the daily physical activity of individuals. Studies show that physical activity is important in regulating BMI (Liu et al., 2018). We do not know if the individuals who chose a low fat diet in our analysis were also exercising in our study, which could affect weight-related outcomes. The questionnaire was self-reported, so there may have been some self-reported bias. Individuals may have over-reported positive behaviours, such as consciously choosing low-fat foods (Larson., 2000). Another limitation is sampling error because our data does not represent the entire population in Canada. This data is not transferable to other populations, especially in other countries, because the ability to make specific food choices depends on the availability of food and financial constraints. Sampling error is an inevitable limitation that cannot be avoided in any research study.

Chi-square analysis for a 4x2 contingency table in this study gave an overall significance value which made it difficult to analyze and obtain significant differences within the four categorical variables. Mann-Whitney U tests are more susceptible to type 1 error which makes the significance values

obtained in this analysis less accurate. Since these tests do not provide regression analysis, it is difficult to determine the direction of the relationship between BMI and low fat foods

This research is important as it is known that BMI and consumption of food high in fats are positively related (Maskarinec et al., 2000) and understanding consumption habits of different weight groups would facilitate ways to change those habits. Future research into how peoples' daily food choices of other food groups, especially carbohydrates, are related to BMI may offer more insight into individuals' consumption habits especially with methods such as daily meal diaries. Expanding on our research by doing regression analysis and modelling with normally distributed data may also expand current understanding. This research may inform public health policy and campaigns to encourage healthy food choices among younger people.

REFERENCES

Adab, P., Pallan, M., & Whincup, P. H. (2018). Is BMI the best measure of obesity? BMJ, 360, k1274. https://doi.org/10.1136/bmj.k1274

Astrup, A. (2001). The role of dietary fat in the prevention and treatment of obesity. Efficacy and safety of low-fat diets. International Journal of Obesity, 25(1), S46–S50. https://doi.org/10.1038/sj.ijo.0801698

Baker, A. H., & Wardle, J. (2003). Sex differences in fruit and vegetable intake in older adults. Appetite, 40(3), 269–275. https://doi.org/10.1016/s0195-6663(03)00014-x

Beardsworth, A., Bryman, A., Keil, T., Goode, J., Haslam, C., & Lancashire, E. (2002). Women, men and food: The significance of gender for nutritional attitudes and choices. British Food Journal, 104(7), 470–491. https://doi.org/10.1108/00070700210418767

Bray, G A, & Popkin, B. M. (1998). Dietary fat intake does affect obesity! The American Journal of Clinical Nutrition, 68(6), 1157–1173. https://doi.org/10.1093/ajcn/68.6.1157

Bray, George A., Paeratakul, S., & Popkin, B. M. (2004). Dietary fat and obesity: A review of animal, clinical and epidemiological studies. Physiology & Behavior, 83(4), 549–555. https://doi.org/10.1016/j.physbeh.2004.08.039

Buyukdere, Y., Gulec, A., & Akyol, A. (2019). Cafeteria diet increased adiposity in comparison to high fat diet in young male rats. PeerJ, 7, e6656. https://doi.org/10.7717/peerj.6656

Centers for Disease Control and Prevention. (2020, September 17). All About Adult BMI. Centers for Disease Control and Prevention. https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html

Davies, A., Wellard-Cole, L., Rangan, A., & Allman-Farinelli, M. (2020). Validity of self-reported weight and height for BMI classification: A cross-sectional study among young adults. Nutrition, 71, 110622. https://doi.org/10.1016/j.nut.2019.110622

Deedwania, P. C. (2010). Risk of Diabetes and Cardiovascular Disease: Best to Return Back to the Basics: Comment on "Long-term Effects of a Lifestyle Intervention on Weight and Cardiovascular Risk Factors in Individuals With Type 2 Diabetes Mellitus." Archives of Internal Medicine, 170(17), 1575–1577. https://doi.org/10.1001/archinternmed.2010.333

Gough, B. (2007). 'Real men don't diet': An analysis of contemporary newspaper representations of men, food and health. Social Science & Medicine, 64(2), 326–337. https://doi.org/10.1016/j.socscimed.2006.09.011

Guasch-Ferré, M., Babio, N., Martínez-González, M. A., Corella, D., Ros, E., Martín-Peláez, S., … Salas-Salvadó, J. (2015). Dietary fat intake and risk of cardiovascular disease and all-cause mortality in a population at high risk of cardiovascular disease. The American Journal of Clinical Nutrition, 102(6), 1563–1573. https://doi.org/10.3945/ajcn.115.116046

Health Statistics Division (Ed.). (2018). Canadian Community Health Survey, 2017-2018: Annual Component. Retrieved April 05, 2021, from https://search2.odesi.ca/#/details?uri=%2Fodesi%2Fcchs-82M0013-E-2017-2018-Annual-component.xml

Hession, M., Rolland, C., Kulkarni, U., Wise, A., & Broom, J. (2009). Systematic review of randomized controlled trials of low-carbohydrate vs. low-fat/low-calorie diets in the management of obesity and its comorbidities. Obesity Reviews, 10(1), 36–50. https://doi.org/10.1111/j.1467-789x.2008.00518.x

Hooper, L., Summerbell, C., Thompson, R., Capps, N., & Riemersma, R. (2001). Dietary fat intake and prevention of cardiovascular disease: Systematic review. BMJ, 322(7289), 757–763. https://doi.org/10.1136/bmj.322.7289.757

Jakicic, J. M., Clark, K., Coleman, E., Donnelly, J. E., Foreyt, J., Melanson, E., Volek, J., & Volpe, S. L. (2001). Appropriate intervention strategies for weight loss and prevention of weight regain for adults. Medicine & Science in Sports & Exercise, 33(12), 2145–2156. https://doi.org/10.1097/00005768-200112000-00026

Kahleova, H., Hlozkova, A., Fleeman, R., Fletcher, K., Holubkov, R., & Barnard, N. D. (2019). Fat Quantity and Quality, as Part of a Low-Fat, Vegan Diet, Are Associated with Changes in Body Composition, Insulin Resistance, and Insulin Secretion. A 16-Week Randomized Controlled Trial. Nutrients, 11(3), 615. https://doi.org/10.3390/nu11030615

Larson, M. R. (2000). Social desirability and self-reported weight and height. International Journal of Obesity, 24(5), 663–665. https://doi.org/10.1038/sj.ijo.0801233

Liu, F., Wang, W., Ma, J., Sa, R., & Zhuang, G. (2018). Different associations of sufficient and vigorous physical activity with BMI in Northwest China. Scientific Reports, 8(1), 13120. https://doi.org/10.1038/s41598-018-31227-6

Makris, A., & Foster, G. D. (2011). Dietary Approaches to the Treatment of Obesity. Psychiatric Clinics, 34(4), 813–827. https://doi.org/10.1016/j.psc.2011.08.004

Maskarinec, G., Novotny, R., & Tasaki, K. (2000). Dietary Patterns Are Associated with Body Mass Index in Multiethnic Women. The Journal of Nutrition, 130(12), 3068–3072. https://doi.org/10.1093/jn/130.12.3068

McDiarmid, C. (2019, June 25). Overweight and obese adults, 2018. Overweight and Obese Adults, 2018. https://www150.statcan.gc.ca/n1/pub/82-625-x/2019001/article/00005-eng.htm

Pirozzo, S., Summerbell, C., Cameron, C., & Glasziou, P. (2003). Should we recommend low-fat diets for obesity? Obesity Reviews, 4(2), 83–90. https://doi.org/10.1046/j.1467-789X.2003.00099.x

Taylor, R., Badcock, J., King, H., Pargeter, K., Zimmet, P., Fred, T., Lund, M., Ringrose, H., Bach, F., & Wang, R. L. (1992). Dietary intake, exercise, obesity and noncommunicable disease in rural and urban populations of three Pacific Island countries. Journal of the American College of Nutrition, 11(3), 283–293. https://doi.org/10.1080/07315724.1992.10718229

Wang, W. C., Worsley, A., & Cunningham, E. G. (2008). Social ideological influences on reported food consumption and BMI. International Journal of Behavioral Nutrition and Physical Activity, 5(1), 20. https://doi.org/10.1186/1479-5868-5-20

Zierle-Ghosh, A., & Jan, A. (2021). Physiology, Body Mass Index. In StatPearls. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK535456/

Cross-sectional Study: Single Parent Households do not have Significant Effects on Exercise and Diet in School-aged Boys

Authors: Khadija Imtiaz Ahmed, Jamie Bennett, Hannah D'Andrea, Farjad Khan

INTRODUCTION

Physical inactivity is the fourth leading cause of global mortality (Lee et al., 2012). Physical activity (PA) rapidly declines following adolescence, often positively correlated with the rise in childhood obesity rates of 38% (van Jaarsveld, & Gulliford, 2015). Sufficient evidence exists for the effectiveness of exercise in the treatment and prevention of mental illnesses (Chekroud et al., 2018) and physical health (Gutin & Owens, 1999), but research is lacking in understanding why children's activity levels vary. Social support has become a beacon for varying PA levels, ranging from encouragement to transportation, but lacks specificity with age and sex of the child (Sallis, 1999). It is possible that the lack of social support given to children living in separated parental homes causes them to engage in less vigorous physical activity.

Living with a single parent, or in multiple homes, negatively impacts children's physical activity levels. In 11-16-year-old children, living with a single parent is linked with children having less moderate to vigorous physical activity (MVPA) (Langøy et al, 2019). 11-year-old boys who live in multiple homes participate in less MVPA during the weekend than those who only live in one home (Solomon-Moore et al, 2019). We predict that our study will also show differences in MVPA between children living with one parent as compared to both.

In most Western countries, like Canada, children and adolescents eat far less than the recommended amount of fruits and vegetables (Krebs-Smith, 1996). This difference seems to be more pronounced for children in single parent homes. 11-16-year-old children who live only with their mother consume fewer vegetables and more carbonated beverages (Fismen et al, 2020). Divorce is one reason that children may live with a single parent. In children, divorce predicts higher BMI and less structured feeding practices, which promote eating for reasons besides hunger (Yannakoulia et al, 2008). According to Mauskopf et al (2015), children of divorced parents have less frequent breakfast consumption, and also consume sugarier beverages. They note that a stable family environment positively influences healthy eating habits in children, which may be why children of divorced parents seem to lack these habits. We hypothesize that less frequent breakfast and vegetable consumption, as well as less structured feeding practices, likely predict lower fruit consumption.

There are currently no studies that examine both the hours of MVPA performed and the amount of fruits consumed each week in children living with one or both parents. Although there is substantial evidence that single parent households decrease children's physical activity levels and healthy eating habits, our research is the first to examine both of these variables together. Our research will allow for an age- and gender-specific analysis, looking at Canadian school-aged boys.

Our data was obtained from a study conducted in 1997, titled 'Health Behaviour in School-Aged Children'. We focused on boys living with one or both parents as our independent variable, while observing hours of vigorous exercise where individuals were sweating and out of breath, and quantity of fruit consumed as our dependent variables. This allowed us to formulate our research question: Does living with both parents increase the hours of exercise performed and the quantity of fruit eaten each week for boys aged 11-15, compared to those living with a single parent, and is there a correlation between exercise and fruit consumption?

MATERIALS AND METHODS

Study Design and Database

The study design is observational and cross-sectional. The data was collected by researchers from Queen's University in association with the World Health Organization (WHO) (Public Health Agency of Canada, 2020). This study is the Canadian component of a cross-national survey known as the Health Behaviour in School-Aged Children (HBSC) study, in which over 40 different countries are involved. This survey is conducted every 4 years. The data in this study are collected via self-report surveys of 11-15-year-old children. These surveys are administered in schools. The WHO chose to study health behaviours in this age group because many physical and emotional changes happen during this time, and children start making important decisions about their lives and developing a sense of self. The HBSC study allows for a greater understanding of children's health behaviours at this age.

Study Participants

We included boys aged 11-15 in our database. We excluded girls from our dataset as we were specifically focusing on the results within a specific demographic in order to limit gender differences. Although the dataset states that only children aged 11-15 were included in the study, there were some participants that fell outside of this range. Since the majority of participants were 11-15 years of age, we excluded the few that were outside of this range to not misrepresent the data. We also excluded participants who did not live with either of their parents.

Study Outcomes

The primary analysis in our research question is if there is a difference in exercise performance between school-aged boys who live with both parents as compared to those who live with a single parent. The secondary analysis is if there is a difference in fruit consumption between these groups. Our tertiary analysis is determining the correlation between exercise performance and fruit consumed. To ask about fruit consumption per week, the researchers asked "How often do you eat fruit?" and the participants chose between the following options: "never," "rarely," "weekly not daily," "once a day," and "more than daily". To ask about the hours of exercise performed per week, the researchers asked the children "Outside school hours: in your free time, how many hours a week do you usually exercise so that you get out of breath or sweat?" The participants chose one of the following options: "none," "½ hour," "1 hour," "2-3 hours," "4-6 hours," and "7 hours or more". To ask about the children's living arrangement, the researchers asked "Which of these people live at your home? If your mother and father live in different places, answer for the home where you live most of the time." The participants chose between "live with mother," "live with father," "live with stepmother,"

and “live with stepfather”. Participants could choose multiple answers in order to accurately report their living situation. We used the answers to this question to determine whether participants were living with one or both parents. The options that the participants were given for these questions were clear and minimized confusion, as the researchers explained MVPA in a way that the participants would easily understand, and also specified that if the participants’ parents lived in different homes, to answer for the home they mostly live in. Fismen et al (2020) used the same methods to ask about fruit consumption and living situation in participants. Additionally, Langøy et al (2019) asked the same questions about children’s living situations, and explained MVPA the same way to the children. Thus, these methods are reliable and reproducible. One key difference between these studies is that participants of Langøy et al’s study included exercise at school in their weekly exercise performance times, while ours did not. It is important to study the outcomes of physical activity and fruit consumption because, as stated, they are both key components of a healthy lifestyle.

Additional Data Collection

We used the variables “sex” and “agey” to filter our dataset to focus only on boys aged 11-15. The “LwM”, “LwF”, “LwSM”, and “LwSF” variables were used to determine whether our subjects were living with one or both parents, and exclude individuals who were living with neither of their parents or step-parents.

Statistical Analysis

To answer our research question we used Chi-Squared tests and Spearman’s rho analysis. The statistical analyses were conducted using the software SPSS Statistics. Chi-Squared tests were used to answer our primary and secondary analysis- whether living with both parents increases hours of exercise performed and amount of fruit consumed in boys aged 11-15. A Chi-Squared result of 0.05 or below indicates that there is a difference between proportions in the table. The tertiary analysis of whether exercise and fruit consumption are correlated was answered using Spearman’s rho analysis. A spearman’s rho value between 0.10-0.29 indicates a small correlation, 0.30-0.49 indicates a medium correlation, and 0.50-1.00 indicates a large correlation between the variables. A p-value 0.05 or below indicates that the correlation is significant. Missing data was excluded from the statistical analysis.

RESULTS

The present study aimed to determine if living with both parents increased the hours of exercise performed and fruit consumed for boys aged 11-15, compared to those living with a single parent, and if there exists a correlation between exercise and fruit consumption. The study included boys aged 11-15 retrieved from the HBSC database. The original database of 11,272 participants was filtered in order to exclude girls and any other outliers, allowing for the inclusion of 4,359 individuals (Table 1).

Table 1. Exercise and Fruit Consumption Characteristics of Boys Aged 11-15 Who Live With One Parent VS Boys Who Live With Both Parents (N = 4707)

Characteristics	Boys living with Single Parent (n = 641)	Boys living with Both Parents (n = 3718)
Exercise performed each week, hours		
0	63 (9.8)	290 (7.8)
0.5	71 (11.1)	387 (10.4)
1	82 (12.8)	444 (11.9)
2-3	145 (22.6)	882 (23.7)
4-6	114 (17.8)	829 (22.3)
7+	159 (24.8)	859 (23.1)
Missing	7 (1.1)	27 (0.7)
How often fruit eaten each week		
Never	14 (2.2)	49 (1.3)
Rarely	55 (8.6)	292 (7.9)
Weekly not daily	188 (29.3)	982 (26.4)
Once a day	219 (34.2)	1370 (36.8)
More than daily	162 (25.3)	1007 (27.2)
Missing	3 (0.5)	18 (0.5)

Data is presented as number (%) of subjects unless otherwise noted

Table 2. Chi-Squared analysis of boys aged 11-15 living with single or both parents and how many hours of exercise performed each week (p > 0.05)

		Hours a week exercise								
		0	0.5	1	2-3	4-6	7+	Total	χ^2	P
Participants living with single or both parents	Single	63	71	82	145	114	159	634	9.460	0.092*
	Both	290	387	444	882	829	859	3691		
Total		353	458	526	1027	943	1018	4325		

The primary aim of the present study examined if there is a difference in exercise performance between school-aged boys who live with both parents as compared to those who live with a single parent. The Chi-Squared analysis for "LiveWith" and "ExerciseHrs" variables was 0.092 (Table 2). The p-value observed did not show a significant difference between exercise performance in boys who live with both compared to single parental household structures.

Table 3. Chi-Squared analysis of boys aged 11-15 living with single or both parents and how often fruit is consumed (p > 0.05)

		How often eat fruit							
		Never	Rarely	Week-ly not daily	Once a day	More than daily	Total	χ^2	P
Participants living with single or both parents	Single	14	55	188	219	162	638	6.682	0.154*
	Both	49	292	982	1370	1007	3700		
Total		63	347	1170	1589	1169	4338		

The secondary aim of the present study examined if there is a difference in fruit consumption between these groups. The Chi-Squared analysis for "LiveWith" and "Fruit" variables was 0.154 (Table 3). The p-value observed did not show a significant difference between fruit consumption in boys who live with both compared to single parental household structures.

The tertiary analysis of the present study aimed to determine if there is a correlation between exercise performance and fruit consumed. The bar graphs (Figures 1 & 2) compare the variables visually and quantitatively. The number of participants included living with single and both parents. A left-skewed uptrend is observed in both graphs with the increase of fruit consumption and exercise.

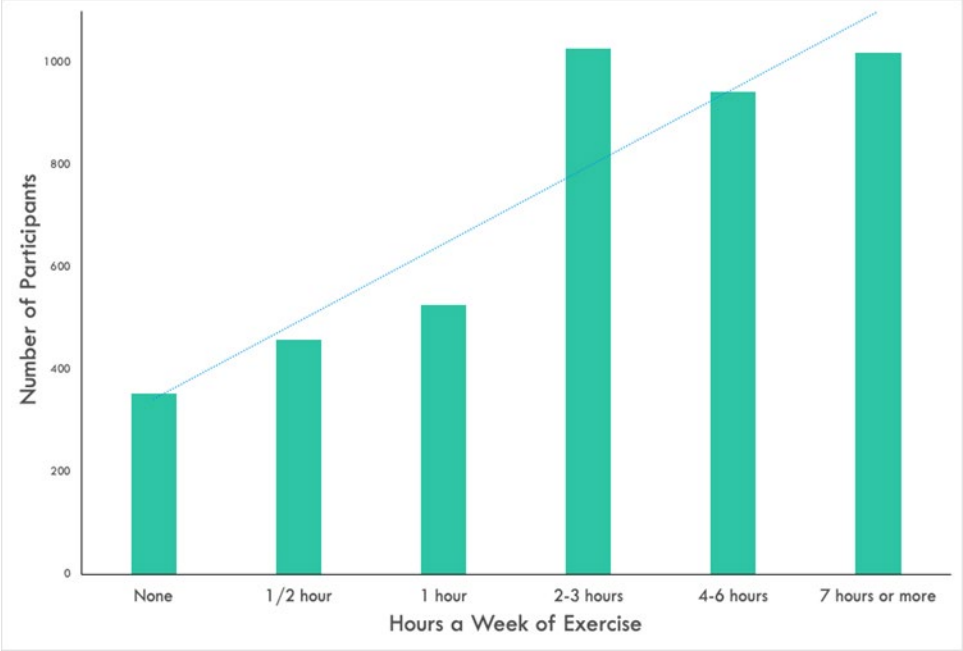

Figure 1. Health Behaviour in School-Aged Children (HBSC) study results for the number of participants on hours of exercise per week. For boys aged 11-15 living with single and both parents.

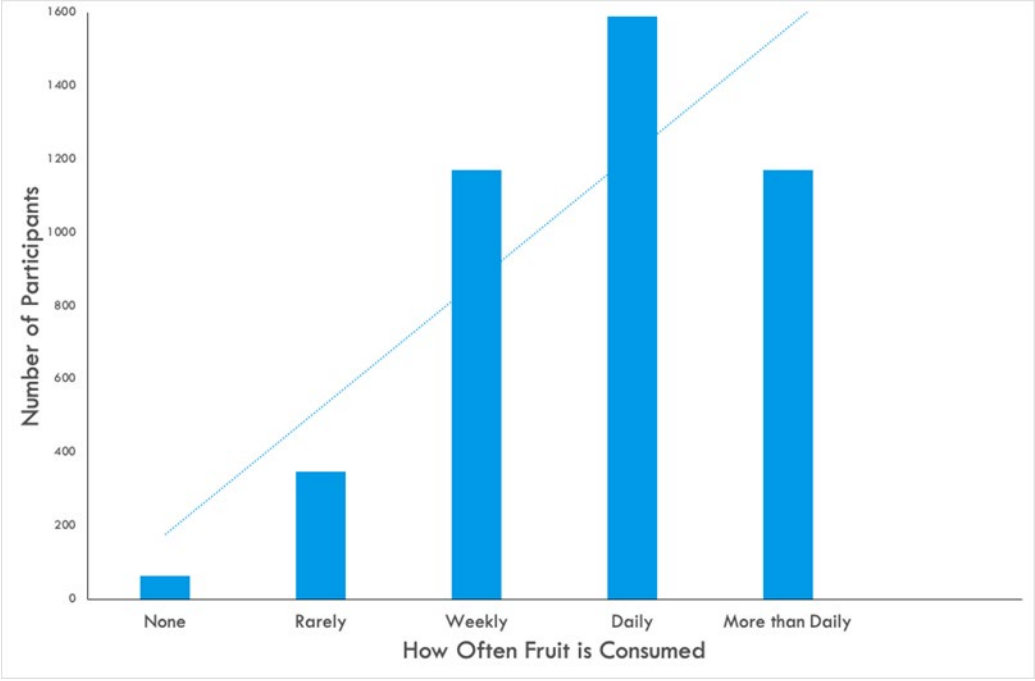

Figure 2. Health Behaviour in School-Aged Children (HBSC) study results for the number of participants on how often they consume fruit during the week. For boys aged 11-15 living with single and both parents.

Table 4. Spearman's rho analysis for the two variables of exercise performed and fruit consumed per week.

			Hours a week exercise	How often eat fruit
Spearman's rho	Hours a week exercise	Correlation coefficient	1.000	0.162 *
		P		<0.001 *
		Number of participants	4325	4307
	How often eat fruit	Correlation coefficient	0.162	1.000
		P	<0.001	
		Number of participants	4307	4338

The trends were further analyzed with The Spearman's rho analysis and a value of 0.162, with a p-value <0.001 was observed. A value of 0.162 indicated a significant small positive correlation between exercise and fruit consumption.

DISCUSSION

Previous studies have suggested that living situations among adolescent children can be considered a determinant of exercise quality and amount (Solomon-Moore et al., 2019). The aim of the present study was to examine the effects of living situations on adolescent boys aged 11-15 exercise, as well as fruit consumed. We also aimed to determine if there is a significant correlation between exercise performed and fruit consumption. Statistical analyses revealed that there does not exist a statistical difference between adolescent boys living with both parents compared to a single parent in regards to exercise amount and fruit consumption. Though, the analyses did reveal a statistical small positive correlation between exercise and fruit consumption, where increases in exercise performed correlates to increases in fruit consumption.

These results, yet surprising, could be indicative of other variables not accounted for in the dataset. Haines et al. (2013) found that healthy habits at home can result in increased fruit and vegetable consumption and exercise. Comparatively, healthy habits at home may be successfully implemented in single parent households, and may be a stronger determinant of fruit consumption and exercise than the household structure itself. Similar to previous research, the present study reveals a significant

small positive correlation between exercise and fruit consumption, and could be due to transferable effects of behaviour. Transferability of exercise onto fruit consumption has been previously described by Jayawardene et al. (2016), where changing one voluntary behaviour can ultimately change another, even though it was not primarily targeted for. Overall, the results seen in this study provide insight into the complexity of exercise amount and fruit consumption seen within adolescence, while highlighting that household structure may not be the only variable that impacts this.

By manipulation of the Canadian cross-national HBSC, the present study was able to determine associations across a magnitude of variables including gender, age, family structure, exercise, and fruit consumption. Revision of the dataset still ellotted for a large participant group allowing for a more accurate determination of mean values, ability to identify outliers that may skew the data, and allow for the provision of a margin of error. The dataset used in the present study has the potential to offer insight into the gender identity of parental structures, for example living with a single step-mother, which is an aspect that similar studies (Solomon-Moore et al., 2019) were unable to provide. The consideration of gender identity of the parental structures will allow for associations to be made across gender patterns within families and the relation to childhood exercise and fruit consumption.
Despite the ability to obtain large amounts of data while maintaining a low cost and participant burden, this study is limited by the subjective measurements within the dataset, as all of the data was obtained via a questionnaire. The ability to recall and answer the questions subjectively may influence the reliability and validity of the study. Alternate approaches in order to obtain data, specifically regarding exercise quality and amount, could be more accurately determined using an accelerometer (Solomon-Moore et al., 2019). This study provides insight into a very specific group, being adolescent boys aged 11-15 within Canada, and could potentially limit the results to this demographic. Further research should investigate the influence of parental family structures and its association between exercise and fruit consumption across larger demographics, accounting for cultural and gender differences. Increasing amounts of evidence has suggested that there may exist alternative variables associated with physical activity. Previously, Bagley et al. (2006) used cross-sectional evidence to uncover the association between siblings and physical activity, where having siblings has a strong positive correlation with amounts of exercise. Variables, like the amount of siblings, should be considered in future studies in order to ensure accuracy of the results.

Physical exercise has been described for years as a preventative and therapeutic outlook for physical and mental health within children, adolescents, and adults. It has been suggested that exercise and lifestyle choices adopted in teenage years may set a lifelong pattern into adulthood, further promoting the idea of early life physical activity (Hallal et al., 2006). By updating Canadian obesity maps, Gotay et al. (2013) quantified and visualized the geological demographic of obesity across the country. Their results showed that obesity is a growing problem within Canada and stressed the importance of action within Canada's public, health professionals, and decision-makers. This demonstrated rise in obesity could be due to increased leisure time, decreased fruit and vegetable consumption, and decreased exercise uptake. In order to ensure the health of the country's future generations, changes in lifestyle patterns and overall obesity rates should be targeted towards the critical developmental years experienced during adolescence.

The number of single-parent households has rapidly increased, thought to be due to the increasing growing rate of divorce (Porter & Chatelain, 1981). There does exist an alarming amount of problems within single-parent households, including, but not limited to: single-parent financial responsibility, isolation and lack of emotional support, and confirmation from another adult figure (Cunningham & Brown, 1984). These parental struggles may amount to serious physical and mental issues within the children of this environment. Programs and support must be put in place within single-parent households in order to ensure that the children receive adequate care regarding exercise and nutrition. The US Department of Agriculture implemented a salad bar program as a lunch option within the Los Angeles elementary school district, demonstrating a significant increase in the amounts of fruit and vegetable consumption by elementary-school children, specifically those in low-income households (Slusser et al., 2007). Programs, such as those previously described, may be required in Canada in order to meet the needs of growing divorce rates.

REFERENCES

Bagley, S., Salmon, J. O., & Crawford, D. (2006). Family structure and children's television viewing and physical activity. Medicine and Science in Sports and Exercise, 38(5), 910-918.

Chekroud, S. R., Gueorguieva, R., Zheutlin, A. B., Paulus, M., Krumholz, H. M., Krystal, J. H., & Chekroud, A. M. (2018). Association between physical exercise and mental health in 1· 2 million individuals in the USA between 2011 and 2015: a cross-sectional study. The Lancet Psychiatry, 5(9), 739-746.

Cunningham, N. J., & Brown, J. H. (1984). A parent group training program for single parents. Journal for Specialists in Group Work, 9(3), 145-150.

Fismen, A. S., Smith, O., Samdal, O., Helleve, A., & Haug, E. (2020). Associations between family structure and adolescents' food habits. Public health nutrition, 1–8. Advance online publication.

Gotay, C. C., Katzmarzyk, P. T., Janssen, I., Dawson, M. Y., Aminoltejari, K., & Bartley, N. L. (2013). Updating the Canadian obesity maps: an epidemic in progress. Canadian journal of public health, 104(1), e64-e68.

Gutin, B., & Owens, S. (1999). Role of exercise intervention in improving body fat distribution and risk profile in children. American Journal of Human Biology: The Official Journal of the Human Biology Association, 11(2), 237-247.

Hallal, P. C., Victora, C. G., Azevedo, M. R., & Wells, J. C. (2006). Adolescent physical activity and health. Sports medicine, 36(12), 1019-1030.

Haines, J., McDonald, J., O'Brien, A., Sherry, B., Bottino, C. J., Schmidt, M. E., & Taveras, E. M. (2013). Healthy habits, happy homes: randomized trial to improve household routines for obesity prevention among preschool-aged children. JAMA pediatrics, 167(11), 1072-1079.

Jayawardene, W. P., Torabi, M. R., & Lohrmann, D. K. (2016). Exercise in young adulthood with simultaneous and future changes in fruit and vegetable intake. Journal of the American College of Nutrition, 35(1), 59-67.

Krebs-Smith, S. M., Cook, D. A., Subar, A. F., Cleveland, L., Friday, J., & Kahle, L. L. (1996). Fruit and vegetable intakes of children and adolescents in the United States. Archives of pediatrics & adolescent medicine, 150(1), 81-86.

Langøy, A., Smith, O., Wold, B., Samdal, O., & Haug, E. M. (2019). Associations between family structure and young people's physical activity and screen time behaviors. BMC public health, 19(1), 433.

Lee, I. M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., Katzmarzyk, P. T., & Lancet (2012). Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. The lancet, 380(9838), 219-229.

Mauskopf, S. S., O'Leary, A. K., Banihashemi, A., Weiner, M., & Cookston, J. T. (2015). Divorce and eating behaviors: a 5-day within-subject study of preadolescent obesity risk. Childhood Obesity, 11(2), 122-129.

Porter, B. R., & Chatelain, R. S. (1981). Family life education for single parent families. Family Relations, 517-525.

Public Health Agency of Canada. (2020, November 19). Health Behaviour in School-Aged Children. Canada.ca. https://www.canada.ca/en/public-health/services/health-promotion/childhood-adolescence/programs-initiatives/school-health/health-behaviour-school-aged-children.html.

Sallis, J. F., Prochaska, J. J., Taylor, W. C., Hill, J. O., & Geraci, J. C. (1999). Correlates of physical activity in a national sample of girls and boys in grades 4 through 12. Health psychology, 18(4), 410.

Slusser, W. M., Cumberland, W. G., Browdy, B. L., Lange, L., & Neumann, C. (2007). A school salad bar increases frequency of fruit and vegetable consumption among children living in low-income households. Public health nutrition, 10(12), 1490-1496.

Solomon-Moore, E., Salway, R., Emm-Collison, L. G., Sebire, S. J., Thompson, J. L., & Jago, R. (2019). A Longitudinal Study of the Associations of Family Structure with Physical Activity across the Week in Boys and Girls. International journal of environmental research and public health, 16(20), 4050.

van Jaarsveld, C. H., & Gulliford, M. C. (2015). Childhood obesity trends from primary care electronic health records in England between 1994 and 2013: population-based cohort study. Archives of disease in childhood, 100(3), 214-219.

Yannakoulia, M., Papanikolaou, K., Hatzopoulou, I., Efstathiou, E., Papoutsakis, C., & Dedoussis, G. V. (2008). Association between family divorce and children's BMI and meal patterns: the GENDAI Study. Obesity, 16(6), 1382-1387.

Single Status as a Protective Factor Against Illicit Drug Use in BC: An Observational Cross-Sectional Study

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INTRODUCTION

Illicit drug use is associated with significant disturbances to interpersonal relationships, as well as increased risk of exposure to violence, criminal activity, economic insecurity, and health problems (UNODC, 1995). As such, it is important to gain an understanding of the factors that contribute to the onset and continuation of illicit drug use in order to identify vulnerable populations and effectively create and target harm reduction strategies. Up until the 1990s, studies pertaining to drug addiction have almost exclusively been conducted on men, with the results being generalized to the female population. Thus, our general knowledge of the risk factors and social determinants associated with female drug addiction has been comparatively insufficient.

Given that a growing body of research is indicating that women are more susceptible than men to illicit drug use and abuse (Lynch & Carroll, 1999; Elflein, 2018), it is important to understand the potential triggers that may lead to illicit drug use among women. Not only are women more prone than men to mood and anxiety disorders (WHO, 2021), but women are more likely to be diagnosed with a substance use disorder that is secondary to a mental health disorder (Zilberman et al., 2003). This is in contrast to men who are more commonly diagnosed with a substance use disorder that is considered a primary diagnosis (Zilberman et al., 2003). This highlights the importance of determining the psychosocial factors that may play a role in the onset and development of substance use disorders among women.

Among the psychosocial factors that may contribute to illicit drug use, marital status has been identified as having a significant effect on the onset of illicit substance use (Edwards et al., 2018). Marital disunion (e.g., divorce, separation, and widowhood) is a significant life stressor that could make women more susceptible to both mental health and substance abuse issues. Additionally, within Canada, there exist significant between-province differences in the prevalence of problematic substance abuse (Veldhuizen et al., 2007). The Canadian Centre for Justice Statistics has identified British Columbia (BC) as having the highest rates of drug offences, and Newfoundland and Labrador (NL) as having the lowest (Tremblay, 1999). In BC, a leading cause of premature mortality is illicit drug overdose, with cocaine being present in over 50% of deaths associated with illicit drug use between 2001 and 2005 (Marshall et al., 2012). There are a multitude of reasons why such drug-associated trends exist and investigating the differences in martial disunion factors between provinces will help to further contextualize/ elucidate environmental conditions which are predictive of deleterious drug usage.

Many studies have been conducted regarding the association between drug use and relationship status in countries other than Canada. We will be specifically studying two provinces within Canada which have never been previously studied or directly compared in this regard. Recently, data has been

collected regarding female relationship status in Canada, as well as these participants' drug usage, allowing for an analysis to be made using modern statistical techniques. This collection of data will be used to determine if there is any correlation between drug use and marital status. Studies have demonstrated the effects that stress and one's living situation has on the onset of drug use (Boardman et al., 2001). Data pertaining to the relationship between inter-provincial discrepancies in divorce rates and illicit drug use is lacking, and we aim to fill that gap. In this study we will be looking at illicit drug use as our primary outcome. By choosing BC and NL—the two provinces with the greatest differential rates of illicit drug use—we will be able to compare marital disunion factors between the two provinces. In doing so, we will be able to demonstrate the effects of marital status on cocaine, heroin, and ecstasy use in females >15 years of age, living in British Columbia or Newfoundland.

It is known that significant life stressors may lead to illicit drug use, so we expect the results of this study to show that those who are included in the martial disunion category will be more likely to partake in illicit drug use. We believe this trend will exist in both BC and NL. Although NL has the lowest illicit drug use rates in Canada, we still expect to find similar proportional drug use between marital status and illicit drug use.

MATERIALS AND METHODS

Study Design and Database

Using the website "Odesi", we were able to search for the database that best suited us. The database that we used was the Canadian Addiction Survey (CAS), 2004. This database collected data from 784 volunteers spanning across multiple Canadian provinces. CAS 2004 was a collaborative effort in which the initiative was sponsored by Health Canada. Our study cross-sectional study design, using a subset of the data within this database. Other studies have used this database to conduct research on drinking and driving, such as the study conducted by Beirness and Davis in 2007. There were a number of ways in which the dataset could have been used, and they chose to focus on alcohol consumption. The goals of the CAS (2004) looked to:

1. Determine the frequency, prevalence, and incidence of alcohol and drug use in people aged 15 and older living in Canada.
2. Understand the context of why people use drugs and the potential negatives associated with drug addiction.
3. Identify the risk associated with using drugs amongst the general population
4. Assess the public's knowledge, opinions, views and thoughts regarding current policies and policies that are thought to be emerging in recent years.

Study Participants

The participants that we chose to include were females aged 15 and older. To narrow down our criteria even further, we used females who, at the time of study, were living in BC or NL. Since our research question revolved around females, the males in the CAS were excluded. Females living in provinces outside of BC and NL were also excluded. The issue of missing data (failure to report, refusing to answer, etc) was resolved by relegating the statistical analysis to only participants which answered all

relevant questions. This selection criterion reduced the amount of possible candidates, but increased the accuracy, allowing for a more reliable conclusion. Additionally, we excluded individuals who did not respond to questions pertaining to cocaine, heroin, and ecstasy use. Lastly, we excluded individuals who did not classify their marital status to create our final subset of data. This final usable database included females over the age of 15 years who were either single, committed, widowed, separated, or divorced, living in BC or NL.

Study Outcomes

Looking at our research question, the outcome that we found to be important was whether marital status was a determining factor that led to increased illicit drug use in females. In a study conducted by Bracken et al, 2013 they looked at young adolescents to see if certain youth are more prone to using harder drugs than others. In the Canadian Addiction Survey, 2004 the participants were asked a number of questions for varying substances that can cause addiction. Knowing that contemporary research has a deficit on female addiction with stronger drugs such as cocaine, heroin and ecstasy we knew that this was the area which would see benefits from more precise investigation, allowing our research question to have increased utility. Other than our primary outcome, an additional study outcome that was to be examined is seeing whether living in one province over the other makes a difference in illicit drug addiction. The Canadian Centre for Justice Statistics identified British Columbia (BC) as having the highest rates of drug use, while Newfoundland and Labrador (NL) on the other hand had the lowest (Tremblay, 1999).

Additional Data Collection

Other than the original variables used, we also created new variables. For the addiction portion of our research question we created the variables Cocaine_use, Heroin_use and Ecstacy_use. Participants who answered “yes, more than once” were given a value of 1 (yes) for the new variable. Participants who answered “no” and “yes, just once” were given a value of 2 (no) for the new variable, emphasizing that they are not regular drug users. We then created a “super variable” called All_drugs. It was created by combining the data of variables: heroin_use, ecstasy_use, cocaine_use). A value of 1 (yes) for any of the three variables translated to a value of 1 (yes) for the all_drugs variable. A value of 2 (no) for any of the three drug variables translated to a 2 (no) for the all_drugs variable. Finally, the marital status variable was recoded into 3 different binary variables that we named Committed, Disunion, and Single. Participants who were recorded as “married” or “living common law,” were categorized as “yes” for the variable ‘Committed.’ Participants who were “widowed,” “separated,” or “divorced,” were translated as responding “yes” to the Disunion variable. Participants who responded “single” were grouped as answering “yes” for the ‘Single’ variable.

Statistical Analysis

To answer our research question, there were two statistical analyses that were run. Using the SPSS software, one of the tests that was conducted was the Chi-Square test. We did this test because we have categorical variables and want to determine if there is a meaningful association between them. Our methods for applying the Chi-Square test was to create 9 2x2 tables for each province investigated. These results were then summarized in a 3x3 table. The Chi-Square test significant p-value tells the reader if there is a relationship between the compared categorical variables. In the case

of the research question, it would tell us, to what degree illicit drug use and marital status are related to each other. After that, we used the Spearman's rho to create another table where the correlation coefficient was determined between all the drugs (heroin, cocaine and ecstasy combined) and whether or not they were used in the last 12 months depending on one's relationship status. A high correlation coefficient tells us that we can be confident that the results were not obtained by chance, and that there is a significant relationship. Together, both the Chi-Square test and the Spearman's rho allow for us to more concisely say that our conclusions are statistically supported.

RESULTS

Table 1. Survey Results of Females in Newfoundland and British Columbia (N=2383) from Canadian Addiction Survey, 2004.

Question	Response	NL (n=624)	BC (n=1759)
Ever used or tried heroin			
	Yes, just once	1.1	1.3
	More than once	6.3	8.8
	No	11.4	12.1
	DK	13.8	11.0
	Refused	0.2	0.1
	Total	32.7	33.3
	Missing	67.3	66.7
	Total	100.0	100.0
Ever use or tried cocaine			
	Yes, just once	1.0	4.1
	More than once	0.8	8.9
	No	98.1	86.8
	DK	0.0	0.1
	Refused	0.2	0.2
	Total	100.0	100.0
Used or tried ecstasy			
	Yes, just once	0.5	1.7
	More than once	0.6	3.1
	No	98.7	94.7
	DK	0.0	0.2
	Refused	0.2	0.2
	Total	100.0	100.0
Current marital status			
	Married	54.8	45.1
	Living common law	6.7	7.6
	Widowed	7.1	9.2
	Separated	2.6	4.8
	Divorced	7.4	9.0
	Single	20.2	23.3
	DK	0.5	0.2
	Refused	0.8	0.7
	Total	100.0	100.0

Note: Data presented as number (%) of participants unless otherwise noted.

Results from the Chi-Square analyses conducted using data from our NL participants (Table 2A) demonstrate a significant relationship between a single status and ecstasy use (p=0.035). The Chi-Square analyses conducted using data from our BC participants (Table 2B) reveal a significant relationship between committed status and ecstasy use (p<0.001); single status and cocaine use (p<0.001); and single status and ecstasy use (p<0.001). Results for all other variables were insignificant. Results from the Spearman's rho correlation analysis for BC and NL (Table 3) demonstrate a significant relationship between single status and overall illicit drug use (cocaine, heroin, and ecstasy use, combined) in BC only.

Table 2A. Yates continuity Correction for Newfoundland

	Heroin	Cocaine	Ecstasy
Committed	χ^2= 0.004 df = 1 Sig = 0.947	χ^2= 2.134 df = 1 Sig = 0.144	χ^2= 0.992 df = 1 Sig = 0.319
Disunion	χ^2= 1.227 df = 1 Sig =0.268	χ^2= 0.622 df = 1 Sig =0.430	χ^2= 0.054 df = 1 Sig =0.815
Single	χ^2= 0.006 df = 1 Sig = 0.940	χ^2= 0.299 df = 1 Sig = 0.585	χ^2= 4.459 df = 1 Sig = 0.035*

Note: Using a Chi-Square analysis, and reporting the results from the Yates continuity correction, we reported the results from two by two contingency tables from the respective groups in Newfoundland. Reporting is in a binary of YES or NO. Data retrieved from 2004 CAS-E addictions survey. *p<0.05.

Table 2B. Yates Continuity Correction for British Columbia

	Heroin	Cocaine	Ecstasy
Committed	χ^2=1.447 df = 1 Sig = 0.229	χ^2= 3.157 df = 1 Sig = 0.076	χ^2= 12.433 df = 1 Sig = <0.001*
Disunion	χ^2= 2.516 df = 1 Sig =0.113	χ^2= 1.616 df = 1 Sig =0.204	χ^2= 2.893 df = 1 Sig =0.089
Single	χ^2= 0.007 df = 1 Sig = 0.933	χ^2= 11.969 df = 1 Sig = <0.001*	χ^2= 36.030 df = 1 Sig = <0.001*

Note: Using a Chi-Square analysis, and reporting the results from the Yates continuity correction, we reported the results from two by two contingency tables from the respective groups in British Columbia. Reportings are in a binary of YES or NO. Data retrieved from 2004 CAS-E addictions survey. *p<0.05.

Table 3. Spearman rho correlation for British Columbia and Newfoundland

	All drug in BC	All drug in NF
Committed	Correlation Coefficient = 0.045 Sig (2 tailed) = 0.060	Correlation Coefficient = -0.068 Sig (2 tailed) =0.092
Disunion	Correlation Coefficient = 0.041 Sig (2 tailed) = 0.088	Correlation Coefficient = 0.020 Sig (2 tailed) =0.610
Single	Correlation Coefficient = -0.094 Sig (2 tailed) = <0.001*	Correlation Coefficient = 0.056 Sig (2 tailed) = 1.59

Note: Results from the Spearman Rho analysis between all drug, being heroin, cocaine, ecstasy, and respective relationship status in British Columbia (BC) and Newfoundland (NL). Reportings are in a binary of YES or NO. Data retrieved from 2004 CAS-E addictions survey. *p<0.01.

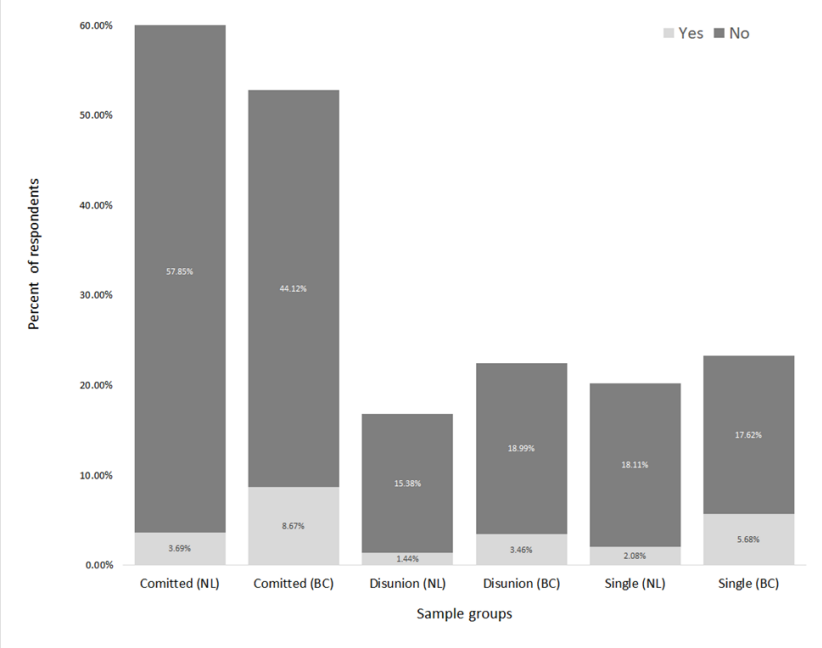

Figure 1. The percentage of self-reported drug-usage in British Columbia (BC) and Newfoundland (NL) in the 2004 Cas-E survey. Here, a response of “no” corresponds to “no” drug use and “Just once", and “yes” corresponds to using at least one of the three drugs in the All-Drug supervariable, and not shown is all other responses ("DK", "Refused", and “Missing”). In all cases, a reporting of "no" occurred at a higher frequency compared to "yes", indicating drug use is still relegated to a small proportion of the population, regardless of marital status. N(NL) = 624 N(BC)=1759.

DISCUSSION

Our initial hypothesis was that marital disunion would be a risk factor for overall drug use among females >15 years of age, and that this trend would exist in both British Columbia and Newfoundland. However, in our study, we found that marital disunion did not predict illicit drug use in either province, and actually it was single status that was differentially predictive of illicit drug use in BC and NL. Within BC, single status decreases the probability that an individual will participate in illicit drug use (cocaine, heroin, and ecstasy), whereas in NL, single status increases the probability that an individual will use specifically ecstasy. Additionally, a committed status in BC increases the probability that an individual will use ecstasy. Results for heroin and cocaine use, as well as overall drug use in NL, did not reach statistical significance when tested against marital status.

This was the first study to directly compare inter-provincial predictors of illicit drug use within Canada. Interestingly, the results of this study generally contradict what is currently known about the relationship between marital status and drug use. Previous studies tend to report that divorced individuals are more likely to abuse substances, including illicit drugs like cocaine and heroin (Cranford, 2014; Karimian et al., 2017; Edwards et al., 2018). Divorce is a major life stressor, so we predicted that results from our study would be similar to that of others. However, we found that marital disunion did not predict illicit drug use in either province. Since our study collapsed widowhood, divorce, and separation into one status we called “marital disunion”, it is possible that we covered up significant findings related to specific statuses within marital disunion and their corresponding probabilities of illicit drug use. Perhaps trends do indeed exist within specifically divorced individuals living in BC and NF with regard to illicit drug use, but clustering divorce with widowhood and separation would have confounded these results.

Additionally, the consensus in the literature is that being in a committed relationship is a protective factor against drug use (Chen & Kandel, 1998; Jang et al., 2018), however we found that a committed status in BC increases the probability that an individual will use ecstasy. Of note, committed status was not predictive of overall illicit drug use in either province. The reasons for this seemingly contradictory result could relate to the fact that women use ecstasy primarily to enhance sexual enjoyment (Kostick, 2018). A committed relationship usually provides a consistent sexual partner, and so this could explain why women in a committed relationship are more likely to use ecstasy.

The data from this study suggest that single status is predictive of illicit drug use in BC and NL. Evidence that consistently corroborates this across Canada would provide reason to shift the focus from divorced to single status individuals when it comes to relationship status as a predictor for drug use. Many studies exist which examine the relationship between divorce and drug-related implications, but far fewer examine single status. Divorce is typically associated with high levels of stress, but this is typically an acute response and may not be as stable an indicator of illicit substance use. While divorce has been demonstrated to be a risk factor for the onset of drug abuse in a Swedish National sample (Edwards et al., 2018), our study indicates that single status is protective against lifetime illicit drug use in BC. This substantially adds to the field of substance abuse, as data from this study can be extrapolated to provide evidence for single status as a protective factor against high levels of lifetime drug use as well as various drug-related outcomes.

This study has some limitations, the first being the fact that we looked at lifetime drug use. This means that illicit drug use would not be as closely related to the marital status the participants noted at the time of study as, say, illicit drug use in the past year. To explicate this, if the questionnaire asks a married individual who has refrained from illicit drug use since her marriage if she has used illicit drugs more than once in their lifetime, then this individual could be grouped into the "yes" category as well as the "committed" one. But in reality, her marital status is acting as a protective factor against illicit drug use, and so in these likely scenarios we have unwittingly confounded the results of our study. The second limitation of note pertains to how we dealt with missing data. We had quite a bit of missing data that was not even across all variables, and the reasons for this could be relevant to our study. However, we decided to exclude this data from our analysis and instead analyze only the data that was directly relevant to our research question. Lastly, the data collected by the Canadian Addiction Survey could have been influenced by reporting bias due to the nature of self-reports, however the anonymity of the survey makes this less likely.

In terms of future directions and implications of our study, it would be helpful to look more specifically at relationship statuses instead of collapsing them into super-variables like we did with "marital disunion". With more time and a more specific survey, it would be good to look into all of the categories that we collapsed into marital disunion. As well, looking into illicit drug use within the past year would be a good idea because this would relate more closely to the marital status of participants and would create a database that contains information that more closely relates to our research question. Another implication that we did not consider beforehand is that single status may include reduced access to illicit drug use due to the smaller social network or decreased relationship stressors. We believe that conducting a study solely based on BC would create a better understanding of how relationship status relates to illicit drug use. Using a more recent database with questions specifically related to this subject would allow for a similar study to be conducted with more precise results.

REFERENCES

Beirness, D.J., Davis, C.G. (2007). Driving after drinking in Canada: findings from the Canadian Addiction Survey. Can J Public Health. 98(6):476-80. doi: 10.1007/BF03405442.

Boardman, J. D., Finch, B. K., Ellison, C. G., Williams, D. R., & Jackson, J. S. (2001). Neighborhood disadvantage, stress, and drug use among adults. Journal of Health and Social Behavior, 42(2), 151. doi:10.2307/3090175

Bracken, B. K., Rodolico, J., & Hill, K. P. (2013). Sex, age, and progression of drug use in adolescents admitted for substance use disorder treatment in the northeastern united states: Comparison with a national survey. Substance Abuse, 34(3), 263-272. doi:10.1080/08897077.2013.770424

Chen, K., & Kandel, D. B. (1998). Predictors of cessation of marijuana use: an event history analysis. Drug and alcohol dependence, 50(2), 109-121.

Cranford J. A. (2014). DSM-IV alcohol dependence and marital dissolution: evidence from the National Epidemiologic Survey on Alcohol and Related Conditions. Journal of studies on alcohol and drugs, 75(3), 520–529. https://doi.org/10.15288/jsad.2014.75.520

Edwards, A. C., Larsson Lönn, S., Sundquist, J., Kendler, K. S., & Sundquist, K. (2018). Associations between divorce and onset of drug abuse in a Swedish national sample. American journal of epidemiology, 187(5), 1010-1018.

Elflein, J. (2018, November 23). Lifetime illegal drug use Canada by gender 2017. Statistica. Retrieved February 10, 2021, from https://www.statista.com/statistics/812289/lifetime-illegal-drug-use-canada-by-gender/

Jang, B. J., Schuler, M. S., Evans-Polce, R. J., & Patrick, M. E. (2018). Marital Status as a Partial Mediator of the Associations Between Young Adult Substance Use and Subsequent Substance Use Disorder: Application of Causal Inference Methods. Journal of studies on alcohol and drugs, 79(4), 567–577.

Karimian, M., Motevalian, A., Damghanian, M., Rahimi-Movaghar, A., Sharifi, V., Amin-Esmaeili, M., & Hajebi, A. (2017). Explaining socioeconomic inequalities in illicit drug use disorders in Iran. Medical journal of the Islamic Republic of Iran, 31, 108. https://doi.org/10.14196/mjiri.31.108

Kostick, K. M., & Schensul, J. J. (2018). The role of Ecstasy (MDMA) in managing intimacy and conflict in stable relationships. Culture, health & sexuality, 20(10), 1071–1086. https://doi.org/10.1080/13691058.2018.1475682

Lynch, W. J., & Carroll, M. E. (1999). Sex differences in the acquisition of intravenously self-administered cocaine and heroin in rats. Psychopharmacology, 144(1), 77–82. https://doi.org/10.1007/s002130050979

Marshall, B. D. L., Milloy, M.-J., Wood, E., Galea, S., & Kerr, T. (2012). Temporal and Geographic Shifts in Urban and Nonurban Cocaine-Related Fatal Overdoses in British Columbia, Canada. Annals of Epidemiology, 22(3), 198–206. https://doi.org/10.1016/j.annepidem.2011.12.004

Tremblay, S. (1999). Illicit drugs and crime in Canada. Canadian Centre for Justice Statistics, Catalogue no. 85-002, Vol. 19, No. 1. Retrieved February 10, 2021, from https://www150.statcan.gc.ca/n1/en/pub/85-002-x/85-002-x1999001-eng.pdf?st=IJS5D0-s

United Nations Office on Drugs and Crime (UNODC) (1995). THE SOCIAL IMPACT OF DRUG ABUSE. United Nations International Drug Control Programme. Retrieved February 10, 2021, from: https://www.unodc.org/pdf/technical_series_1995-03-01_1.pdf

Veldhuizen, S., Urbanoski, K., & Cairney, J. (2007). Geographical variation in the prevalence of problematic substance use in Canada. The Canadian Journal of Psychiatry, 52(7), 426-433. doi:10.1177/070674370705200704

World Health Organization (WHO) (2021). Gender and women's mental health. Mental Health and Substance Abuse. Retrieved February 10, 2021, from https://www.who.int/teams/ mental-health-and-substance-use/gender-and-women-s-mental-health

Zilberman, M. L., Tavares, H., Blume, S. B., & el-Guebaly, N. (2003). Substance use disorders: sex differences and psychiatric comorbidities. Canadian journal of psychiatry. Revue canadienne de psychiatrie, 48(1), 5–13. https://doi.org/10.1177/070674370304800103

COVID-19's Impact on Mental Health: A Cross-Sectional Study

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INTRODUCTION

A new type of coronavirus began spreading in late 2019, the coronavirus "Severe Acute Respiratory Syndrome-related Coronavirus type 2" (SARS-CoV-2) has caused serious acute atypical respiratory diseases first in Wuhan, Hubei Province, China, and now it has become an outbreak globally. Today, we genuinely refer to this disease as COVID-19 (Yuki et al., 2020).

In Canada, all travelers arriving in the country are under an emergency order, which is the Quarantine act. Under this act, all arriving travellers must go to their home, hotel or suitable places, where they self-isolate for 14 days. The goal of this action is to slow down the spreading of COVID-19 (Travel restrictions in Canada, 2021). Other actions include closure of schools, universities and businesses (Here's what's allowed and not allowed, 2020).

As displayed in a study by Panchal et al (2021), when comparing feelings of decreased mental health, and increased anxiety and depression symptoms in June to January 2019, prior to the pandemic, to January 2021, living in the pandemic, there is a clear correlation between decreased mental health scores and life with COVID-19. These results indicate that the COVID-19 pandemic has significantly impacted the health and well-being of adults in the past year (Panchal et al., 2021).
However, these actions also directly affected many people's well being, both physically and mentally.

Many people indicated that the stresses over coronavirus have worsening their sleeping schedule, eating habits and have increased their alcohol consumption. Mentally, since the pandemic, the anxiety and/or depressive disorder rate for young adults has increased rapidly (Panchal et al., 2021). Many studies in the US indicated that financial concerns and job insecurity have also become a stressor, and has directly increased in adult's depression and anxiety cases (Wilson et al., 2020).

The COVID-19 pandemic has drastically impacted the lives of individuals worldwide, in terms of finances, mental health, and overall well-being. While investigating the changes caused by COVID-19, the main focus included asking the question: Is there a difference between the mental health scores of individuals living in dense areas, defined as populations equal to or greater than 499,999 residents, compared to individuals living in less dense areas, defined as populations less than 499,999 residents, from age 15 to 24 in Ontario? The participants of the study are the groups of young adults, ages 15 to 24 in Ontario, Canada, from high and low density areas. The intervention involves determining if there is a difference in mental health scores, and the comparison relies on comparing the difference in mental health scores of high versus low density populations. The outcomes include evaluating the mental health scores.

The secondary research question also researched is: Is there a difference between the financial obligations scores of individuals found in a higher density area in comparison with less dense areas

from age 15 to 24 in Ontario? Here, the participants are the young adults ages 15 to 24 living in Ontario, the intervention is the differences in financial obligations of the participants, the comparison lies within individuals living in higher versus lower density communities, and the outcomes involve the financial obligation scores of the participants.

The main aim of this observational study is to measure how the reduction of physical contact, isolation, and the COVID-19 pandemic overall decreases mental health and well-being status, while comparing populations less than or greater than 499,999. Numerous variables were observed in this study, including the primary variable; individual's perceived mental health, and secondary; the community size and metropolitan influence zone. The control group in this observational study is the individual's aged 15 to 24 living in less dense areas, with population sizes of 499,999 residents or less.

MATERIALS AND METHODS

Study Design and Database

The study design we performed is cross sectional, observational where the participants can choose to respond to the survey online. The survey was anonymous and found on Statistics Canada website and data was collected through crowdsourcing.

In the original data, there were 43 variables listed. For our analysis, we shrank it to 5 (Age group, Province of Residence, Density500k, Perceived Mental Health, and COVID-19 impacts ability to meet financial obligations or essential needs.) The variable called 'age group' was a categorical variable. A participant could not choose a certain year, instead they had to pick an age range (ex. 15-24. 25-29 years old). We filtered for age and only assessed individuals between the ages of 15-24 which in this dataset is one category of 'age group.' Next, we filtered for the Province of Residence and therefore only examined individuals living in Ontario. The p-value we used for our study is 0.05.

Our independent variable was "Density 500k." It has 2 categories. One category was population ≥499,999 which was labeled as 'denser areas.' The second category was population <499,999 which was labeled as 'less dense areas.' All of the participants which had missing data for the variables we analysed were excluded. This included the dataset labelled as: valid skip, don't know, refusal, not stated, and missing.

Study Outcomes

For the primary research outcome, the dependent variable was 'Perceived Mental Health.' This variable is used to look at mental health scores of participants. It is an ordinal variable. This variable had 9 categories. We excluded 5 categories ranging from values 5-9 (in SPSS) which all labeled missing data. After exclusion, we were left with 5 categories. 0 is 'Poor,' 1 is 'Fair,' 2 is 'Good,' 3 is 'Very Good,' and 4 is 'Excellent.' In our research question, we looked at differences in 'mental health scores' when comparing people living in denser versus less dense regions. Also, we examined whether there was a correlation between denser areas (≥499,999) compared to less dense areas (<499,999) in their mental health scores.

For our secondary outcome, our dependent variable was 'COVID-19 impacts ability to meet financial obligations or essential needs.' This is also an ordinal variable. This variable had 9 categories (1-9), but we excluded the categories ranging from 6-9 (missing data). For our analysis, we only looked at 5 categories. 1 is 'Major Impact,' 2 is 'Moderate Impact,' 3 is 'Minor Impact,' 4 is 'No Impact,' and 5 is 'Too soon to tell.' We wanted to see whether there were differences and correlations in financial obligation scores in individuals living in less dense versus denser areas.

Study Participants

One of the reasons we wanted to look at specifically mental health scores and financial obligation scores in the younger people in Ontario was because of lack of research locally. Studies in the past looked at mental health scores nationally (Robillard et al., 2020) but little research has been done locally looking at the role of density and how that plays into affecting mental health scores. We wanted to analyse how density played a role.

The variable 'Density500k' was created by transforming another variable in SPSS. We took the variable "Community Size and Metropolitan Zones" which had 6 categories and condensed it into 2 categories. This variable talks about the different community sizes and the population within. The 6 categories initially included people ranging from 1,500,000+ to 1. We condensed this variable into 2 categories labeled 'dense' and 'less dense' regions.

Some demographic variables in this dataset were used as filters. We filtered the variable 'Province of Residence,' so we only included people living in Ontario for our analysis. We also filtered the variable 'Age group.' The age group in the original database looked between the ages of 15-65+. We only analysed participants from '15-24' which was the 1st category in the 'age group' variable.

Statistical Analysis

We used SPSS as the software for analysis. Our 2 dependent and 1 independent variables were all categorical variables so we could not use tests for normality as we did not have any continuous variables. To test for differences between groups, we used the chi-squared test and to test for correlation between the groups, we used the Spearman's rho correlation.

RESULTS

Demographic characteristics of the sample, as well as perceived mental health scores and concerns about the impact of COVID-19 are reported in Table 1. Of the 45 989 participants in the entire database of Canadian residents, 1 109 were included in this study which focused on those of age 15-24 years-old who reside within Ontario. Out of these 1 109 participants, 27.3% (n = 303) were male and 72.7% (n = 806) were female. Since the perceived mental health and concerns about financial impact are both categorical variables, a chi-squared test was conducted to test between group differences. The results of the chi-squared test for perceived mental health and concerns about financial impact are 0.420 and 0.003 respectively. A Spearman's rho correlation was conducted to indicate the strength and direction of the relationship between both variables in each study. The correlation coefficient for perceived mental health scores is -0.034, and the p-value is 0.260. This is not statistically significant.

The correlation coefficient for concern about financial impact is -0.092, this correlation is significant at the 0.01 level (2-tailed). The p-value for concern about financial impact is 0.002. This is statistically significant.

Table 1. Descriptive characteristics and concerns related to COVID-19 of Ontario-based study population, 15-24 years of age, by community size. (n=1109)

Variable	Community size >499 999 (n=795)	Community Size <499 999 (n=314)	P Value
Gender			
Male	234 (29.4)	69 (22.0)	
Female	561 (70.6)	245 (78.0)	
Perceived mental health			
Excellent	36 (4.5)	15 (4.8)	0.260
Very good	158 (19.9)	62 (19.7)	
Good	257 (32.4)	87 (27.7)	
Fair	263 (33.1)	107 (34.1)	
Poor	80 (10.1)	43 (13.7)	
Concern about impact on ability to meet financial obligations or essential needs			
Too soon to tell	92 (11.6)	28 (8.9)	0.002
No impact	265 (33.3)	73 (23.3)	
Minor impact	154 (19.4)	76 (24.3)	
Moderate Impact	163 (20.5)	84 (26.8)	
Major impact	121 (15.2)	52 (16.6)	

Data are presented as number (%) of individuals, unless otherwise stated.
SOURCE: Statistics Canada, 2020.

The comparison of the perceived mental health scores between dense and less dense community sizes are represented in Figure 1. In the current study, 33.1% (n = 263) of those living in dense communities reported their mental health as fair. Similarly, 34.1% (n = 107) of those living in less dense communities reported their mental health as fair. There is no statistically significant difference (.260) between the two community sizes in any proportion.

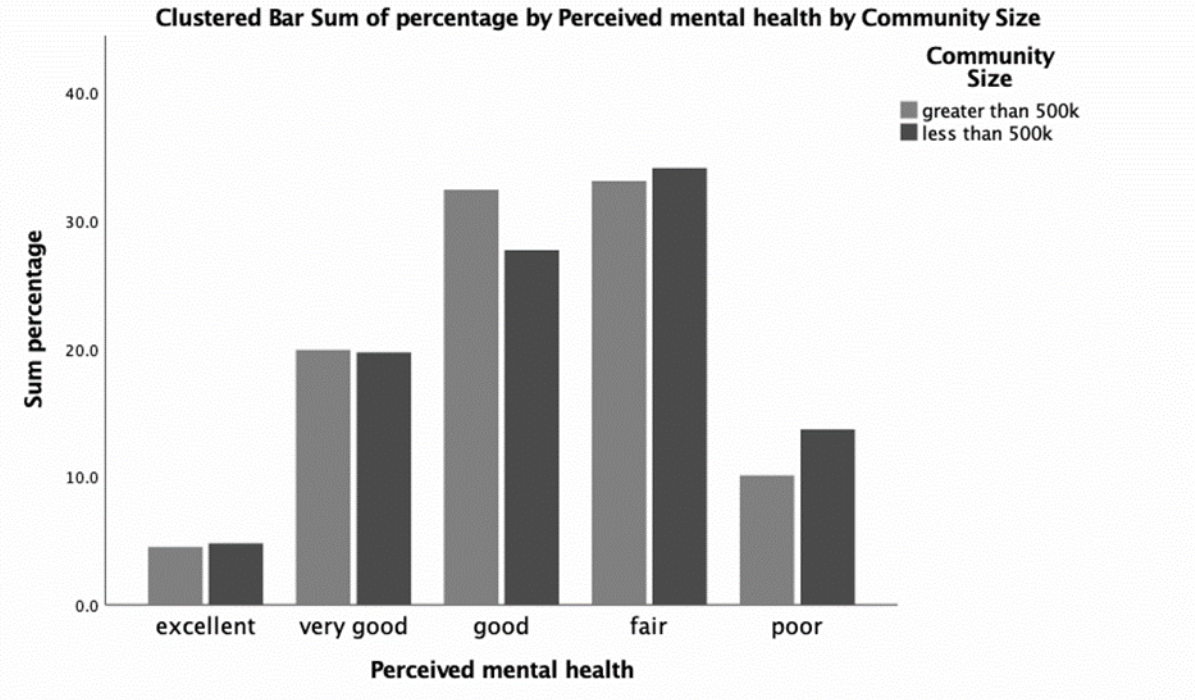

Figure 1. Comparison of perceived mental health scores in dense vs less densely populated communities of 15-24 year olds residing in Ontario (n=1109)

The comparison of the impact of COVID-19 on ability to meet financial obligations or essential needs in differing community sizes are represented in Figure 2. Out of those who live in a dense community, 55.1% (n = 438) reported that COVID-19 would have a minor, moderate, or major impact on their ability to meet financial obligations or essential needs. From the participants who live in a less dense community, 57.7% (n = 212) reported that COVID-19 would have a minor, moderate, or major impact on their ability to meet financial obligations or essential needs. There is a statistically significant difference (.002) between financial concerns in less densely populated communities compared to densely populated communities.

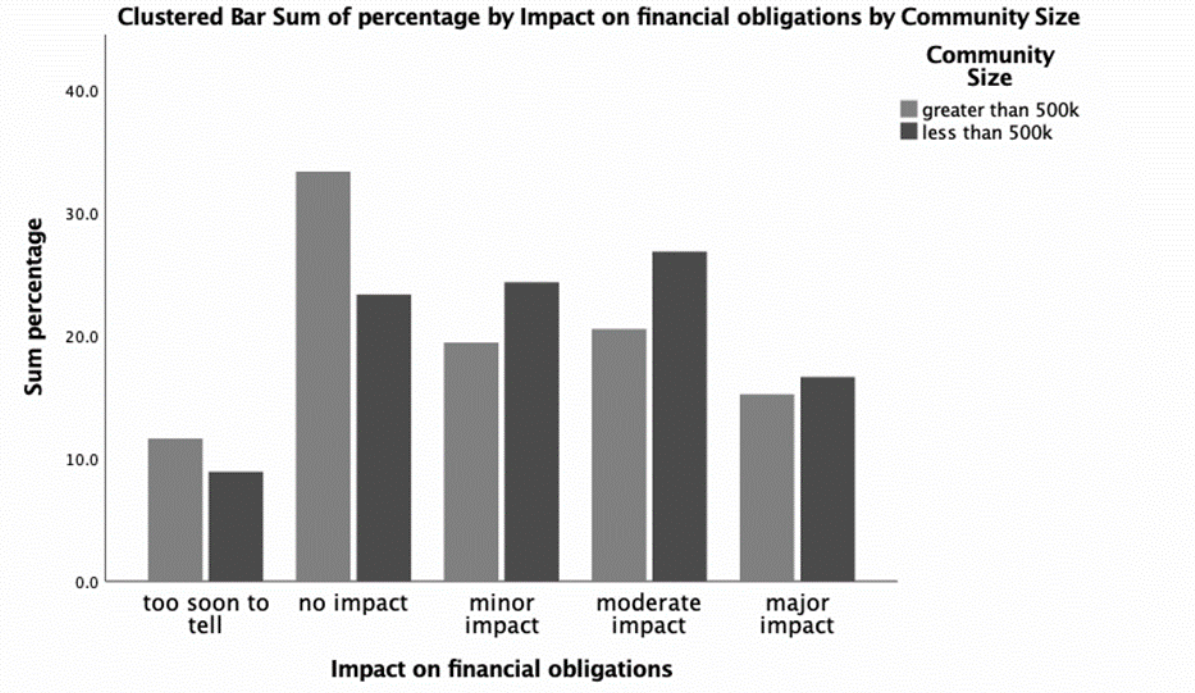

Figure 2. Comparison of impact on ability to meet financial obligations or essential needs in dense vs less densely populated communities of 15-24 year olds residing in Ontario (n=1109)

DISCUSSION

In this study, we first examined the mental health score differences among young adults in Ontario, who live in population dense areas and less densely populated areas. Secondly, we compared the financial obligations score among the same groups. As mentioned above, we performed Chi-Squared tests and Spearman's rho correlations because our variables were all categorical variables. Nevertheless, we could not perform tests for normality because we did not have any continuous variables. As a result, there were no significant differences in terms of the mental health score, but significant differences were found in the financial obligation scores. The results of this study have contributed more information to the impacts of the reduction of physical contact, isolation, and the overall impact of COVID-19 on individuals' mental health on a local scale.

When comparing our study to previous research, we found that online surveys were mostly used for collecting data on mental health status, and data were mostly collected from the beginning of the pandemic (Robillard et al., 2020). The reason is that online surveys are easily accessible and acceptable for most individuals to complete. Also, within the first two months experiencing the pandemic, many individuals have already shown a worsen in their mental health status. According to the data from Statistics Canada of the beginning of the pandemic, 46% of Canadian adults rated their mental health has worsened from very good, excellent to fair, poor, and moreover 52% of people have rated their mental health "bad" (Findlay & Arim, 2020). In line with previous studies, the current study also showed an decrease in canadian's mental health status. However, previous studies were mostly focused on

how COVID-19 has affected Canada nationally, but this current research has looked at the impacts on local, provincial scale, and regarding how the population density may also play a role regarding people's mental health status.

Limitations

The participants measured in order to conduct the study were individuals ages 15-24. This is a limited range, and as a result, may result in bias within the results obtained. Participants aged 15-24 are categorized as youth, or young adults, and the COVID-19 pandemic impacts different age groups uniquely. There are additional external factors that impact young adults throughout the pandemic, for instance the economic and financial pressures that come as a result (Jia et al., 2020). This group of individuals is far more likely to lose their job, and experience financial stress. Additionally, individuals in this age range are far more likely to be employed in essential work, which increases the risk of contracting the virus and in turn, mental health may be more likely to decrease (Jia et al., 2020). Furthermore, this age group likely includes students, who are now experiencing a completely different learning style and education, which may result in increased stress levels and worse mental health status (Jia et al., 2020).

Another limitation includes the amount of people living within a household. As the participants are ages 15-24, the majority of these individuals will be living with family members or roommates. Living with others may increase social interactions throughout the day, leading to improvements in mental health. Living with others can decrease feelings of loneliness, and family or friends are able to provide social support. The financial stress could also be more focused on the parents of these young adults, especially when living in a household with a large number of people. Supporting and caring for more children is more expensive, and while young adults may aid family financially, they are most likely working less hours, if at all, elevating the stress in the household.

A final important limitation of the study is where the participants were drawn from in the study. Communities and neighbourhoods with higher density have larger populations, and as a result, more participants may have been selected from more densely populated locations, creating a bias. The participants were twice as likely to be living in dense areas than less dense areas, and therefore more responses were generated from these areas. As there was not an equal participation between the high and low density populations, results can be skewed towards the higher density area individuals.

Conclusion

To conclude the research and results generated in the study, the statistical analyses conducted reveal that there is no statistically significant difference between the mental health scores of individuals ages 15 to 24 in Ontario living in denser areas, meaning populations equal to or greater than 499,999, in comparison with individuals living in less dense areas, meaning populations less than 499,999. There was a statistically significant difference between the financial obligations scores of individuals found in a higher density area in comparison with less dense areas from age 15 to 24 in Ontario. In order to obtain these results, the chi-squared test was used, as well as Spearman's rho test, to determine correlation between the groups. In order to improve accuracy in future research and studies, aiding the government in creating more accurate health benefits and plans, in order to reduce overall stress

of citizens, and help alleviate financial burdens. Focusing on the long term impacts of COVID-19, specifically mental health, will provide more information on how individuals are impacted during and post pandemic. Finally, there are additional stressors and factors that may have impacted mental health throughout the pandemic, outside of COVID-19. Therefore, not all decreases in mental health can be attributed to COVID-19.

REFERENCES

Findlay, L., & Arim, R. (2020). This article examines the self-perceived mental and physical health of Canadians during the COVID-19 pandemic and reports differences between women and men and for different age groups. Canadians report lower self-perceived mental health during the COVID-19 pandemic. https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00003-eng.htm.

Here's what's allowed and not allowed under Ontario's provincewide lockdown | CBC News. CBCnews. (2020). https://www.cbc.ca/news/canada/toronto/ontario-shutdown-details-pdf-1.5850224.

Jia, R., et al. (2020). Young people, mental health and COVID-19 infection: the canaries we put in the coal mine. Public Health, 189, 75-30. Doi:https://doi.org/10.1016/j.puhe.2020.10.018

Panchal, N., Kamal, R., Cox, C., & Garfield, R. (2021). The Implications of COVID-19 for Mental Health and Substance Use. KFF. https://www.kff.org/coronavirus-COVID-19/issue-brief/the-implications-of-COVID-19-for-mental-health-and-substance-use/.

Robillard, R., Saad, M., Edwards, J., Solomonova, E., Pennestri, M.-H., Daros, A., … Kendzerska, T. (2020). Social, financial and psychological stress during an emerging pandemic: observations from a population survey in the acute phase of COVID-19. BMJ Open. https://bmjopen.bmj.com/content/10/12/e043805.

Travel restrictions in Canada. Mandatory isolation or quarantine – Travel restrictions in Canada – Travel.gc.ca. (2021). https://travel.gc.ca/travel-COVID/travel-restrictions/isolation.

Wilson, J. M., Lee, J., Fitzgerald, H. N., Oosterhoff, B., Sevi, B., & Shook, N. J. (2020). Job Insecurity and Financial Concern During the COVID-19 Pandemic Are Associated With Worse Mental Health. Journal of occupational and environmental medicine, 62(9), 686–691. https://doi.org/10.1097/JOM.0000000000001962

Yuki, K., Fujiogi, M., & Koutsogiannaki, S. (2020). COVID-19 pathophysiology: A review. Clinical Immunology. https://www.sciencedirect.com/science/article/abs/pii/S152166162030262X.

Checking the Validity of COVID-19 Information is Associated with Increased Anxiety Levels in Canadians Aged 15 years and Older: An Observational Study

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INTRODUCTION

In January of 2020, the World Health Organization declared a health emergency as the novel coronavirus (SARS-CoV-2) began spreading globally. Individuals with the virus develop an acute respiratory infectious disease, termed COVID-19. The symptoms mainly manifest as fever, dry cough, and fatigue. This can be accompanied by upper respiratory and digestive tract symptoms, where more severe cases are life-threatening (Allen et al., 2020). In an attempt to curb the spread of this virus, the Canadian government has taken stringent measures, including social distancing, mandatory mask-wearing in public spaces, and entering several lengthy lockdown periods (Public Health Agency of Canada, 2021).

The onset of the COVID-19 pandemic was accompanied by increased anxiety levels among the general population (Salari et al., 2020). This finding is not novel or unique to the COVID-19 pandemic. Past studies have investigated changes in mental health during pandemics. They have demonstrated that the news of outbreaks and corresponding government regulations are associated with increased anxiety levels. For example, researchers found that there was a combination of pandemic concerns contributing to increased anxiety levels among college students during the H1N1 (swine flu) pandemic, where concerns receiving more media coverage were the greatest contributors to anxiety (Wheaton et al., 2012).

A study on the 2003 SARS outbreak suggested that media outlets in Hong Kong increased public anxiety by inflating the risks of the virus, reporting inaccurate infection rates, and commonly referring to the virus as the "killer virus" (Cheng, 2004). This type of reporting is not uncommon, as distressing stories are more likely to make headlines and receive more coverage. This presents a biased and unrealistic view of the event and skews the general public's perception towards a more negative and threatening perspective. This increases perceptions of risk, feelings of fear, and anxiety (Sanderson et al., 2020). This is especially concerning given that media consumption in the past few decades has increased dramatically (Watson, 2020).

Xie et al. (2011) have provided support for the role of perception in increasing anxiety. This study suggested that subjective factors, such as people's perceptions of the health crisis, were significant predictors of anxiety levels during the 2011 SARS epidemic. Specifically, this included people's perception of the risk, as well as believing they lacked knowledge about the crisis. A primary strategy to combat the inaccurate perception of threat is to use cognitive reappraisal (Sanderson et al., 2020). Here, the goal is to evaluate the evidence of the situation and develop an appropriate risk perception. Previous research has identified that pandemics are associated with increased anxiety. More specifically, media and online platforms create perceptions of the pandemic that increase anxiety. However, the current literature does not investigate whether individuals attempted to reduce their

anxiety-inducing perceptions, such as by checking multiple sources or checking the accuracy of online information. Our study investigates whether checking the accuracy of COVID-19 information is associated with generalized anxiety severity scores (as measured by the GAD-7 scale) in Canadians aged 15 and older, compared to Canadians in the same age group with no exposure to COVID-19 information. Additionally, the individual's level of concern regarding the impacts of COVID-19 was assessed as a secondary outcome. Further, as a secondary research question, we investigate whether suspecting false COVID-19 information is related to generalized anxiety severity scores and COVID-19 concern scores, as compared to those who do not suspect false information.

MATERIALS AND METHODS

Study Design and Database

We conducted an observational, cross-sectional study using data from the online questionnaire "Canadian Perspective Survey Series (CPSS) 4: Information Sources Consulted During the Pandemic" from Statistics Canada. This survey collected data about the source and quality of COVID-19 information accessed, and the impacts of COVID-19 on the physical and mental health, and social and employment circumstances of participants from July 20, 2020 to July 26, 2020. Participants were randomly invited to complete the survey via email.

Study Participants

The target population of the "CPSS4: Information Sources Consulted During the Pandemic" was Canadian residents aged 15 years or older from all Canadian provinces. This excluded full-time members of the Canadian Armed Forces as well as those living on reserves and other Aboriginal settlements, institutionalized, or residing in extremely remote areas with very low population density. Our study only included participants who responded to all questions regarding checking the validity of COVID-19 information, suspecting false COVID-19 information, and their mental health. All missing data in these questions was deleted.

Study Outcomes

Our primary outcome measured the severity of generalized anxiety using the generalized anxiety disorder-7 (GAD-7) scale, which measures self-reported anxiety (Plummer et al., 2016). Respondents chose one of the following options to answer 7 questions regarding their anxiety symptoms over the past 2 weeks: "not at all", "several days", "more than half the days", "nearly every day", and we awarded scores from 0-4, respectively. We calculated cumulative scores with a maximum of 21 points, and grouped respondents based on their severity of their anxiety as follows: 0-9 = "low severity", and 10-21 = "high severity". This cut-off point is also the threshold to meet criteria for GAD according to the GAD-7 scale (Löwe et al., 2008).

As a secondary outcome, we measured the respondent's severity of concern about the impacts of COVID-19 using the self-developed questionnaire in the "CPSS4: Information Sources Consulted During the Pandemic". This assessed the respondent's levels of concern regarding the impacts of COVID-19 on: "my own health", "member of the household's health", "vulnerable people's health", "Canadian population's health", "world population's health", "overloading the health system", "civil

disorder", "maintaining social ties", "ability to cooperate and support one another during the crisis", "ability to cooperate and support one another after the crisis", "family stress and confinement", and "violence in your home". Response options included: 1 = "not at all", 2 = "somewhat", 3 = "very", and 4 = "extremely". We calculated cumulative scores with a maximum of 48 points and categorized the respondents as follows: 0–24 = "minimal concern", and 25–48 = "high concern".

Additional Data Collection

To get a closer look at the factors influencing our study outcomes, we carefully analyzed additional background information. We included descriptive statistics to describe the study population's age, sex, employment, and perceived mental health. These were reported as frequency and percent. These variables are used to get deeper insight and reasoning for results.

Statistical Analysis

For the frequency of checking the accuracy of COVID-19 information, we combined the following response options "always" and "often", "sometimes", and "rarely" and "never" into high-, medium-, and low-frequency groups, respectively. We then used chi-square tests of independence to report the proportion of participants in these groups falling into the categories of severity of generalized anxiety (primary outcome), and concern about the impacts of COVID-19 (secondary outcome). We also conducted Spearman rank order correlation analyses to determine the correlation between the frequency of checking the accuracy of COVID-19 information and cumulative severity of generalized anxiety scores, or cumulative COVID-19 impact concern scores.

Based on the level of suspecting false COVID-19 information, we combined the response options "multiple times a day" and "once a day" into a "high frequency" group, and "at least once a week" and "rarely" into a low-frequency group. We conducted the same analyses as described above, except the frequency of suspicion of false COVID-19 information was used instead of the frequency of checking the accuracy of COVID-19 information.

Since the chi-square test does not disclose exactly where differences exist for variables with more than 2 categories, we conducted paired comparisons for all groups. Each frequency of validation of COVID-19 information was individually compared against each of the other groups. For example, the high-frequency group of checking the accuracy of COVID-19 information was compared to medium-, then to low-, then to no exposure-groups, and so on. This was repeated for the frequency of suspicion of false COVID-19 information. The chi-square test generated proportions for the two categories based on the severity of generalized anxiety (high, low) and the severity of concerns about the impacts of COVID-19 (high, low).

All statistical analyses were conducted using Statistical Package for the Social Sciences (SPSS) (version 27), with p-values < 0.05 indicating statistical significance. For the Spearman's rank order correlation analysis, correlation coefficients between 0.10–0.29, 0.30–0.49, and 0.50–1.00 were considered to be small, medium, and large correlations, respectively.

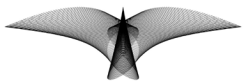
RESULTS

Table 1. Participant characteristics of the study population [N=3369]

Characteristics	Total Sample (N=3369)	High Frequency (N=1869)	Medium Frequency (N=778)	Low Frequency (N=608)	No Exposure (N=114)
Age					
15 to 34 years old	626 (18.6)	325 (17.4)	174 (22.4)	94 (15.5)	33 (28.9)
35 to 54 years old	1212 (36.0)	713 (38.1)	250 (32.1)	209 (34.4)	40 (35.1)
55 to 74 years old	1340 (39.8)	731 (39.1)	311 (40.0)	261 (42.9)	37 (32.5)
75 years and older	191 (5.7)	100 (5.4)	43 (5.5)	44 (7.2)	4 (3.5)
Sex					
Male	1568 (46.5)	875 (46.8)	343 (44.1)	291 (47.9)	59 (51.8)
Female	1801 (53.5)	994 (53.2)	435 (55.9)	317 (52.1)	55 (48.2)
Employment					
Part-time or more	1805 (53.6)	1005 (53.8)	417 (53.6)	322 (53)	61 (53.5)
Absent not due to COVID-19	247 (7.3)	142 (7.6)	52 (6.7)	44 (7.2)	9 (7.9)
Absent due to COVID-19	73 (2.2)	51 (2.7)	14 (1.8)	7 (1.2)	1 (0.9)
Not employed	1244 (36.9)	671 (35.9)	295 (37.9)	235 (38.7)	43 (37.7)
Perceived Mental Health					
Poor	438 (13.0)	230 (12.3)	120 (15.4)	75 (12.3)	13 (11.4)
Good	2928 (86.9)	1638 (87.6)	657 (84.4)	533 (87.7)	100 (87.7)

Values are stated as number (%) for all participants.

Our study examined a total of 3369 participants. All were included in the analyses that involved the frequency of validation of COVID-19 information. Only the 3255 participants that were exposed to COVID-19 information were included in the analyses that involved the frequency of suspecting false



information. There were a total of 849 missing cases. Table 1 shows the participant's characteristics. A total of 53.6% (1805/3369) of participants reported working part-time or more, and 36.9% (1244/3369) being unemployed. For perceived mental health, 86.9% (2928/3369) reported having good mental health.

Primary Analysis Examining the Frequency of Validation of COVID-19 Information

The chi-square results showed that the majority of the participants were at low risk of experiencing high generalized anxiety with statistically significant differences across all groups with a p-value of 0.015 (Table 2). Participants who experienced higher levels of concern of COVID-19 impacts were more likely to frequently validate COVID-19 information and were categorized into the high frequency (58.6%, 1096/1869) and medium frequency (50.9%, 396/778) groups (Table 2). Individuals who experienced low concern about the COVID-19 impacts were more likely to be categorized as infrequently validating COVID-19 information (58.1%, 353/608) or have had no exposure to COVID-19 information (81.6%, 93/114). Statistically significant differences were observed among all groups in regards to their level of concern of COVID-19 impacts with a p-value <0.001.

Spearman's rank order correlation analysis indicated that as frequency of validation of or suspicion of false COVID-19 information increased, the severity of generalized anxiety also increased. This association had a correlation coefficient of 0.070 with a p-value < 0.001, and 0.194 and a p-value < 0.001, respectively.

Table 2. Chi-Square for Frequency of Validating the Accuracy of COVID-19 Information.

	Frequency of validation of COVID-19 information						
Measures of anxiety	High frequency (N=1869)	Medium frequency (N=778)	Low frequency (N=608)	No exposure (N=114)	χ^2	df	p-value
Severity of Generalized Anxiety							
Low	1636 (87.5)	701 (90.1)	558 (91.8)	104 (91.2)	10.45	3	0.015*
High	233 (12.5)	77 (9.9)	50 (8.2)	10 (8.8)			
Severity of Concern About the Impacts of COVID-19							
Low	773 (41.4)	382 (49.1)	353 (58.1)	93 (81.6)	109.33	3	<0.001*
High	1096 (58.6)	396 (50.9)	255 (41.9)	21 (18.4)			

Values are stated as number (%) for all participants unless otherwise stated. *p-value < 0.05

Secondary Analysis Examining Frequency of Suspicion of False COVID-19 Information

The chi-square results showed that the majority of the participants were at low risk of experiencing high generalized anxiety across all groups with a statistically significant p-value <0.001 (Table 3). Individuals in the high and low frequency groups were more likely to experience high concerns regarding the impacts of COVID-19 at 58.2% (712/1224) and 51.4% (965/1879), respectively. Participants who never suspected false information were more likely to have low concerns about the impacts of COVID-19 at 53.9% (82/152). These results were statistically significant with a p-value < 0.001.

Spearman's rank order correlation analysis indicated that as frequency of validation of or suspicion of false COVID-19 information increased, the severity of generalized anxiety also increased. This association had a correlation coefficient of 0.118 with a p-value < 0.001, and 0.069 and a p-value < 0.001, respectively.

Table 3. Chi-Square Analysis for Frequency of Suspecting False COVID-19 Information

	Frequency of suspicion of false COVID-19 information					
Measures of anxiety	High frequency (N=1224)	Low frequency (N=1879)	Never (N=152)	χ^2	df	p-value
Severity of Generalized Anxiety						
Low	1046 (85.5)	1707 (90.8)	142 (93.4)	25.13	2	< 0.001*
High	178 (14.5)	172 (9.2)	10 (6.6)			
Severity of Concern About the Impacts of COVID-19						
Low	512 (41.8)	914 (48.6)	82 (53.9)	17.55	2	<0.001*
High	712 (58.2)	965 (51.4)	70 (46.1)			

Values are stated as number (%) for all participants unless otherwise stated. *p-value < 0.05

Ancillary Analysis Examining Paired Chi-Square Comparisons Among All Groups

Paired analyses comparing the frequency of validation of COVID-19 information and the severity of generalized anxiety (primary outcome) revealed a statistically significant difference between the high and low frequency groups with a X2 value of 7.74 and p-value of 0.005. Paired comparisons between the frequency of validation of COVID-19 information and the severity of concern about the impacts of COVID-19 (secondary outcome) showed statistically significant differences across all groups with a p-value < 0.001.

Paired comparisons between the frequency of suspicion of false COVID-19 information and the primary outcome showed a statistically significant difference between the high and low frequency

groups with a X2 value of 20.972 and p-value < 0.001. Paired analyses comparing the frequency of suspicion of false COVID-19 information and the secondary outcome also showed statistically significant differences between the same groups with a X2 value of 13.578 and p-value < 0.001.

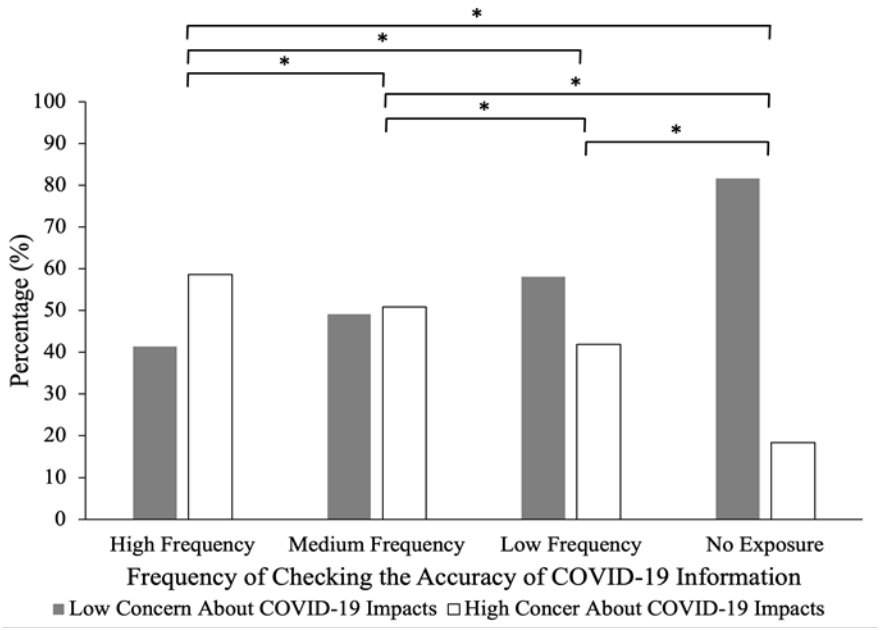


Figure 1. Percent distribution of the severity of concerns about the impacts of COVID-19 according to the frequency of validation of COVID-19 information. Data are presented as percent as calculated from the chi-square test of independence. *p-value < 0.05

DISCUSSION

Main Findings

Our study found that regardless of the frequency of checking accuracy of or suspecting false information, individuals were not likely to experience high severity of generalized anxiety. Thereby, most did not meet the criteria for GAD – as measured by the GAD-7 scale. We also found that the two groups that tend to have higher anxiety and COVID-related concerns included the group validating COVID-19 information in high frequency and the group suspecting false COVID information in high frequency.

Since the start of the COVID-19 pandemic, the number of people suffering from GAD has risen substantially. A study by Dozois et al. (2020) found that as many as 20% of participants experienced anxiety, although the sample size was small (Dozois, 2020). When comparing this study to our results, it is worth noting that as the frequency of checking and suspecting increased, the percentage of people experiencing high anxiety also increased, reaching similar percentages to those found by Dozois et al. (2020). Our control groups were less likely to experience high anxiety, with percentages being much closer to the typical population, which is 8.7% (Statistics Canada, 2012), than to the

pandemic proportions. This suggests that people's handling and response to online pandemic information could be a contributing factor in the increased anxiety levels observed during the pandemic. This is supported by a study by Singh et al. (2020), which found that the longer people spend searching for online COVID-19 information, the higher their anxiety levels and GAD-7 scores.

Given that our Spearman rank order correlation analyses only yielded small correlations, it is also important to take into consideration other factors that could have affected the increased levels of anxiety observed during the pandemic. For instance, an influencing factor could be a lack of meaningful interactions. A study by Koshar et al. (2020) found that physical contact such as hugging can alleviate people's anxiety. Due to the safety measures implemented to prevent the spread of COVID-19 (e.g., physical distancing), these practices were highly reduced, which could be associated with an increase in anxiety levels. Similarly, a study by Wilson et al. (2020) found that job insecurity arising from COVID-19 is associated with greater anxiety symptoms. As well, Elton-Marshall et al. (2020) found that risk factors such as having someone close working in a job at high risk of COVID-19 increased the likelihood of experiencing anxiety. Further, they found that those with multiple risk exposures were more likely to experience anxiety, suggesting a cumulative effect (Schneiderman et al., 2005). Since we only considered factors involving sources of COVID-19 information, this could be the reason we found a small correlation with our primary and secondary outcomes.

A study by Lee et al. (2020) found that exposure to COVID-19 misinformation was associated with misinformation belief, which was related to increased anxiety symptoms. This contradicts the results we found in our study, which suggest that high suspicion of false COVID-19 information is associated with higher levels of anxiety. However, in our study, we cannot assume that those who more frequently suspected false information then checked the accuracy of COVID-19 information. This would lead to misinformation belief, and subsequently, increased anxiety.

Strengths & Limitations

A limitation to consider when interpreting the results of our study includes the measures of anxiety used. The severity of generalized anxiety measured by the questionnaire is an indicator of anxiety, however is not specifically related to the pandemic. This is because the questionnaire does not gather information on how anxiety changed compared to pre-pandemic levels. However, our study still manages to assess pandemic-related anxiety using the measure of severity of concerns about the impacts of COVID-19 as a secondary outcome, in which high concerns correspond to more anxiety related to the pandemic. The questionnaire is also limited in that it does not report whether people that suspected false information also followed up on checking the validity of information. Never checking for the correct information may possibly contribute to increased anxiety experienced by this group, relative to the low frequency group, because their questions are left unanswered.

An assumption in our study is that the quantity of checking the accuracy of information predicts the quality of the check, which is not necessarily accurate. For instance, two given individuals might both frequently check the accuracy of their information, however, one individual might have only checked the credibility of the author, whereas the other individual the credibility of the author, verified the date of the information, and consulted other sources.

While the Spearman rank order correlation test is able to determine the correlation between two variables, it is unable to determine a causal relationship. As such, our study cannot distinguish the direction of the association between variables. In other words, whether suspecting or checking for false information affects anxiety levels, or vice versa.

Implications

The findings in our study highlight the need to restrict the spread of false information on social media during pandemics. Government and public health initiatives can use this research to develop strategies for allowing social media users to know exactly which online information is true and false, and overall feel more secure in their pandemic knowledge. Currently, most social media platforms automatically link any posts related to COVID-19 to government websites (Geeng et. al., 2020) but more platforms should additionally flag false information posts. This research also points to the need for campaigns that educate the public on how to discern credible sources of online information. This may help people feel more secure in their knowledge on the pandemic, have more trust in the accuracy of online information, and experience less pandemic-related anxiety overall.

Next Steps

Our study suggested that a higher frequency of validation of COVID-19 information is associated with increased anxiety and concerns regarding the pandemic. Future research should investigate whether there is a causal relationship between the frequency of validating information and pandemic-related anxiety (e.g., whether checking the validity of online information directly eases pandemic-related anxiety). Although we found that checking and suspecting false information is associated with higher anxiety, this correlation was weak. That said, future research should investigate other factors that could contribute to anxiety. For example, those who never suspected false COVID-19 information also tended to be over the age of 55, unemployed, and perceived themselves as having good mental health. These factors may have played a role in pandemic-related anxiety and should be further explored in relation to pandemic information. For example, perhaps these individuals had better coping strategies to deal with stress, which better equipped them to deal with the stressors brought by the COVID-19 pandemic.

Conclusion

There is an overall increase in anxiety during pandemics resulting from the natural uncertainties of the situation—uncertainties that are further fueled by inaccurate online information.

REFERENCES

Allen, W. E., Altae-Tran, H., Briggs, J., Jin, X., McGee, G., Shi, A., Raghavan, R., Kamariza, M., Nova, N., Pereta, A., Danford, C., Kamel, A., Gothe, P., Milam, E., Aurambault, J., Primke, T., Li, W., Inkenbrandt, J., Huynh, T., & Chen, E. (2020). Population-scale longitudinal mapping of COVID-19 symptoms, behaviour and testing. Nature Human Behaviour. https://doi.org/10.1038/s41562-020-00944-2

Cheng, C. (2004). To be paranoid is the standard? Panic responses to SARS outbreak in the

Hong Kong special administrative region. Asian Perspective, 28(1), 67-98. Retrieved February 13, 2021, from http://www.jstor.org/stable/42704444

Dozois, D. J. A. (2020). Anxiety and depression in Canada during the COVID-19 pandemic: A national survey. Canadian Psychology/Psychologie Canadienne. https://doi.org/10.1037/cap0000251

Elton-Marshall, T., Wells, S., Jankowicz, D., Nigatu, Y. T., Wickens, C. M., Rehm, J., & Hamilton, H. A. (2021). Multiple COVID-19 Risk Factors Increase the Likelihood of Experiencing Anxiety Symptoms in Canada. The Canadian Journal of Psychiatry, 66(1), 56–58. https://doi.org/10.1177/0706743720949356

Geeng, C., Francisco, T., West, J., & Roesner, F. (2020). Social Media COVID-19 Misinformation Interventions Viewed Positively, But Have Limited Impact. arXiv preprint arXiv:2012.11055.

Koshar, P., & Knowles, M. L. (2020). Do Hugs and Their Constituent Components Reduce Self-Reported Anxiety, Stress, and Negative Affect? Psi Chi Journal of Psychological Research, 25(2), 181–191. https://doi.org/10.24839/2325-7342.jn25.2.181

Lee, J. J., Kang, K. A., Wang, M. P., Zhao, S. Z., Wong, J. Y. H., O'Connor, S., ... & Shin, S. (2020). Associations between COVID-19 misinformation exposure and belief with COVID-19 knowledge and preventive behaviors: cross-sectional online study. Journal of medical Internet research, 22(11), e22205.

Löwe, B., Decker, O., Müller, S., Brähler, E., Schellberg, D., Herzog, W., & Herzberg, P. Y. (2008). Validation and Standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the General Population. Medical Care, 46(3), 266–274. https://doi.org/10.1097/MLR.0b013e318160d093

Plummer, F., Manea, L., Trepel, D., & McMillan, D. (2016). Screening for anxiety disorders with the GAD-7 and GAD-2: A systematic review and diagnostic metaanalysis. General Hospital Psychiatry, 39, 24–31. https://doi.org/10.1016/j.genhosppsych.2015.11.005

Public Health Agency of Canada. (2021). Coronavirus disease (COVID-19): Prevention and risks. Canada.ca. Retrieved from:https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks.html

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., Rasoulpoor, S., & Khaledi-Paveh, B. (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: A systematic review and meta-analysis. Globalization and Health, 16(1), 1–11. https://doi.org/10.1186/s12992-020-00589-w

Sanderson, W. C., Arunagiri, V., Funk, A. P., Ginsburg, K. L., Krychiw, J. K., Limowski, A. R.,

Olesnycky, O.S., & Stout, Z. (2020). The nature and treatment of pandemic-related psychological distress. Journal of Contemporary Psychotherapy, 50(4), 251-263. doi:10.1007/s10879-020-09463-7

Schneiderman, N., Ironson, G., & Siegel, S. D. (2005). Stress and health: psychological, behavioral, and biological determinants. Annual review of clinical psychology, 1.

Singh P, Cumberland W. G., Ugarte D, Bruckner T, Young S. D. (2020). Association Between Generalized Anxiety Disorder Scores and Online Activity Among US Adults During the COVID-19 Pandemic: Cross-Sectional Analysis. Journal of Medical Internet Research, 22(9):e21490. doi: 10.2196/21490

Watson, A. (2020). Time spent with media in Canada 2018 - 2020, by medium. Statistica. Retrieved from: https://www.statista.com/statistics/431478/time-spent-media-canada-media/#statisticContainer

Watterson, R. A., Williams, J. V. A., Lavorato, D. H., & Patten, S. B. (2016). Descriptive Epidemiology of Generalized Anxiety Disorder in Canada. The Canadian Journal of Psychiatry, 62(1), 24–29. https://doi.org/10.1177/0706743716645304

Wheaton, M. G., Abramowitz, J. S., Berman, N. C., Fabricant, L. E., & Olatunji, B. O. (2012). Psychological predictors of anxiety in response to the H1N1 (swine flu) pandemic. Cognitive Therapy and Research, 36(3), 210–218. https://doi.org/10.1007/s10608-011-9353-3

Wilson, J. M., Lee, J., Fitzgerald, H. N., Oosterhoff, B., Sevi, B., & Shook, N. J. (2020). Job insecurity and financial concern during the COVID-19 pandemic are associated with worse mental health. Journal of occupational and environmental medicine, 62(9), 686-691.

Xie, X., Stone, E., Zheng, R., & Zhang, R. (2011). The 'typhoon eye effect': Determinants of distress during the sars epidemic. Journal of Risk Research, 14(9), 1091-1107. doi:10.1080/13669877.2011.571790

Cross-sectional study: Consumption above the Modified Canadian Guideline for Low-Risk Drinking Associated with Self-Reported Incidence of Back Pain

Author: Ahmad Al-Amad

INTRODUCTION

Lower back pain is one of the top three global contributors to years lived with a disability (James et al., 2018). The causes of lower back pain are varied; it is a symptom more than a disease. In most cases the cause is unknown (Hartvigsen et al., 2018). The incidence of lower back pain has been reported to be between 0.024% to 7.0%, while the prevalence was reported to be between 1.4% to 15.6% (Fatoye et al., 2019). A large meta-analysis involving 33 cohorts found that patients with acute to moderate lower back pain experienced pain for up to 6 weeks. Lower levels of pain were noted even at the 12-month mark (Costa et al., 2012). Lower back pain is also associated with negative mental affects such as: depression, reduced self-efficacy, anxiety and catastrophizing (Hartvigsen et al., 2018).

A study conducted by Meints et al. (2001) found that cases involving chronic lower back pain were associated with increased levels of catastrophizing. Catastrophizing or pain catastrophizing is associated with an elevated painful experience. It is a psychologically exaggerated negative state of mind (Sullivan et al., 2001). Pain catastrophizing, as a variable has been found to be a greater predictor of alcohol seeking more so than other factors such as pain intensity, depression, demographics or other measures of alcohol use. (Neito et al., 2021) The sample involved heavy drinkers with a criteria of 14+/7+ drinks a week for men and women, respectively. The criteria used by (Neito et al.,) for heavy drinkers were close to the upper weekly drinking limit of 15 (men)/10 (women) drinks a week by the Canadian Guidelines for Low-Risk Drinking (CGLRD) (Butt et al., 2011). Alcohol is a drug with known analgesic properties. In a large review and meta-analysis covering 18 lab-controlled experiments, it was found that analgesic effects of large to moderate effects were observed for self reported ratings of pain intensity at 2-3 drinks (women) and 3-4 (men) (Thompson et al., 2017). In another study, it was found that regular alcohol consumption as a behaviour, was found in 31.9% of American cases involving lower back pain (Yang & Haldeman, 2018). The negative effects of regular alcohol consumption are well attested. In 2014, alcohol related injuries cost Canadians $4.2 billion in healthcare costs (Stockwell et al., 2014)

Places to Grow—Growth Plan for the Greater Golden Horseshoe (GGH), is a government economic plan which aims to foster growth in the surrounding geographic areas occurring on the Western shores of Lake Ontario (Ministry of Public Infrastructure Renewal, 2006). No data or financial assessment was found to account for the medical burden relating incidences of lower back pain and self-treatment with alcohol. The Canadian Community Health Survey, 2015-2016 Annual Component (CCHS-2015-2016), conducted by Statistics Canada – Health division, included weekly alcohol consumption and status of back injury as part of the questionnaire. Currently, the relation between alcohol consumption above the CGLRD and low back pain is not known for the GGH. The physical harm of alcohol over consumption is medically well known. From a financial standpoint, alcohol over

consumption was found to account for 1% of the Ontario Health Insurance Plan (OHIP) 89.3 billion dollars attributed to health behaviour risk factors between the 2004 and 2013 (Manuel et al., 2019).

In this observational study, data from the CCHS-2015-2016 was used to investigate the relation between alcohol use within the recommended guidelines for low-risk drinking and cases of self reported back pain. These two variables were chosen since they represented the next best viable options in place of data pertaining to lower back pain, and pain catastrophizing. A modified version of the CGLRD set to 12 drinks a week for both men and women was utilized. This study aims to investigate the question: do self-reported cases of back pain in respondents residing in the GGH between the ages of 20 to 64 have an association or relationship to drinking levels above the modified CGLRD compared to respondents of the same age bracket that do not report having back pain?

MATERIALS AND METHODS

Study Design and Database

This study utilized a database based on a cross-sectional survey conducted by the Canadian Community Health Survey (CCHS) between 2015-2016. This database was freely obtained using the Odesi webservice. CCHS is a joint effort between Health Canada and Statistics Canada. The primary aim of this survey is to provide data for health surveillance and population health research covering all 10 provinces and 3 territories. The CCHS 2015-2016 was conducted using Computer-Assisted Interviewing (CAI) to provide a consistent logical flow of questions to the respondent. 80% of completed cases were conducted over the telephone while the remaining 20% were conducted during in person interviews. Although the CCHS survey for 2017-2018 was available on Odesi, it was not used in this study since the question: “do you have back problems, excluding scoliosis, fibromyalgia and arthritis?” was not asked.

Study Participants

The inclusion criteria utilized in this study consisted of individuals within the 20 to 64-year-old age bracket. Participants residing outside the 14 Health Regions of the GGH were excluded from this study. Participants which did not report any average number of alcoholic beverages consumed per week were also excluded.

Study Outcomes

The variable Weekly Alcohol Consumption was generated by the survey conductors using the CAI logical process. Participants were first asked if they have ever consumed an alcoholic beverage in their lifetimes. If the response was positive, the next question inquired if they consumed an alcoholic beverage during the last 12 months. If this question yielded a positive response from the participant, they were asked about the number of drinks consumed per day for a period covering the last 7 days prior to the interview. The number of drinks per day were summed to create the variable Weekly Alcohol Consumption.

The variable relating to back pain was asked in a context which excluded scoliosis, fibromyalgia and arthritis. The structuring of this question was relevant to this study since these 3 pathologies are also

sources of back pain. These three pathologies were investigated using three separate questions which preceded the back pain question and asked about once more during the question relating to back pain status. This confirms their exclusion lends credence to the strength of the CAI led approach to questioning.

Additional Data Collection

The *Places to Grow Act, 2005, ONTARIO REGULATION 416/05* was used in this study as the reference to defining the GGH. This definition was applied to *Map 7 Ontario, Health Units – Southern Ontario Health Regions, 2015*. This allowed the proper selection of relevant survey participants based on geographic health region residency.

The weekly alcohol consumption variable was not used directly in this study. It was used to categorize participants into one of two categories depending on whether weekly alcohol consumption was within or above the (CGLRD). Since the CGLRD recommends a maximum of 10 drinks per week for women and 15 for men, this study utilized 12 drinks per week as the upper limit of the *modified* CGLRD (MCGLRD).

Statistical Analysis

This study did not utilize any continuous data, as a result, testing was limited to using the Chi square test for independence. The exposure variable relating to the presence of back problems was placed in the row portion of the Chi square test for independence while the outcome variable relating to the modified CGLRD was placed in the column portion. Table I in the results section is organized alphabetically by variable name. IBM's SPSS statistical software version 27.0.1.0 64-bit edition was utilized for this study with a 0.05 p value for significance.

RESULTS

After applying the inclusion and exclusion criteria to the original dataset, the number of respondents decreased from 109,659 to 5,202. Of this represented sample, 979 (18.8%) people reported having back pain while 4,223 (81.2%) did not. The median age of study respondents was the 45-49 age bracket. The Chi Square Test of Independence (Fig. 1) for a 2x2 with Yates' Correction for Continuity had an Asymptotic Significance (2-sided) p value of <0.001. Figure 1. is provided as a means of visual assessment of the representation of the 14 health Regions covered in this study.

Table 1. Descriptive Characteristics of Study Population Covering the Greater Golden Horseshoe Region Divided by Incidence of Back Pain [N=5202]

Variable	Has Back Pain	No Back Pain
Age		
20–24	38 (9.5)	364 (90.5)
25–29	64 (12.3)	458 (87.7)
30–34	86 (14.7)	498 (85.3)
35–39	80 (15.5)	436 (84.50
40–44	110 (19.3)	460 (80.7)
45–49	113 (18.2)	507 (81.8)
50–54	171 (25.2)	507 (74.8)
55–59	158 (23.8)	505 (76.2)
60–64	159 (24.6)	488 (75.4)
Alcohol Consumption		
Within MCGLRD	790 (17.8)	3647 (82.2)
Above MCGLRD	189 (24.7)	576 (75.3)
Health Region		
Brant County	46 (18.1)	208 (81.9)
Durham Regional	87 (21.1)	326 (78.9)
Haldimand-Norfolk	53 (26.0)	151 (74.0)
Haliburton, Kawartha, Pine Ridge District	58 (28.0)	149 (72.0)
Halton Regional	72 (16.9)	353 (83.1)
City of Hamilton	65 (19.8)	264 (80.2)
Niagara Regional Area	66 (20.6)	254 (79.4)
Peel Regional	86 (18.9)	369 (81.1)
Peterborough County-City	40 (16.6)	201 (83.4)
Simcoe Muskoka District	95 (24.3)	296 (75.7)
Waterloo	77 (18.1)	348(81.9)
Wellington-Dufferin-Guelph	55 (16.9)	270 (83.1)
York Regional	85 (16.1)	443 (83.9)
City of Toronto	94 (13.7)	591 (86.3)
Sex		
Male	519 (18.8)	2236 (81.2)
Female	460 (18.8)	1987 (81.2)

Data are reported as a count with frequency percent of their respective rows in brackets.

Table 2. Chi Square Test of Independence between Back Pain and Drinking Level

		Within MCGLRD	Above MCGLRD	Count
Has back problems (excluding scoliosis, fibromyalgia and arthritis)	Yes	790	189	979
	No	3647	576	4223
Total		4437	765	5202

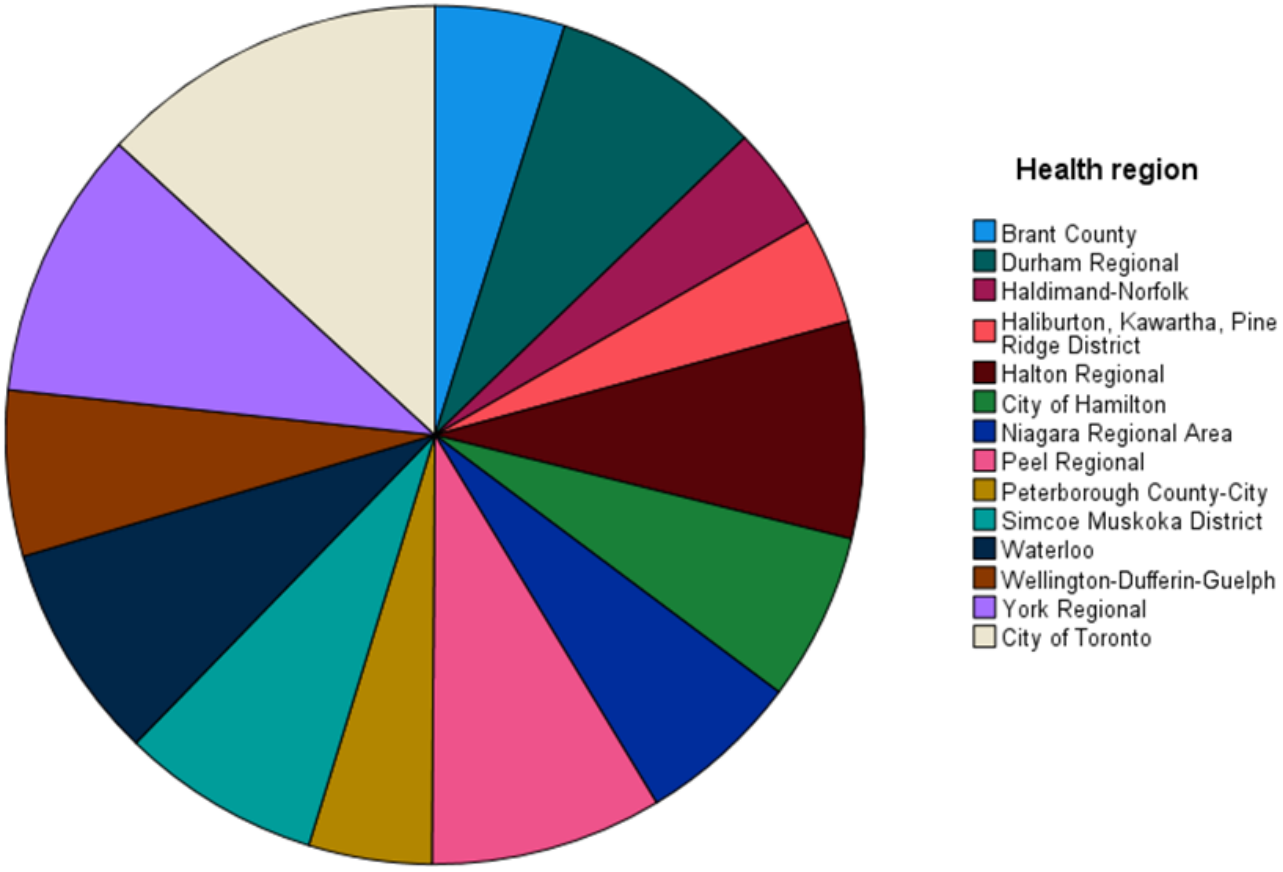


Figure 1. Proportions of Greater Golden Horseshoe Health Regions represented in this study

DISCUSSION

The Chi square test for independence result is significant and suggests that the (H0) of equality should be rejected. In other words, there is an association or relationship between incidences of self-reported back pain and alcohol consumption above the MCGLRD in survey subjects between the ages of 20 to 64 when compared to subjects that did not report back pain.

The GGH had a 7.2% less prevalence rate of drinking above the MCGLRD than was reported by Yang & Haldeman (2018) for Americans reporting back pain. The proportion that reported back pain in this study was 3.2% higher than the upper limit reported by Fatoye et al., (2019).

Assessing alcohol consumption based on interview answers is a valid means of data generation. A study based on the American National Alcohol Survey for the year 2000 found that 90% of respondents reported the same answers two months after being interviewed with the most variability occurring in those who drank seldom (Midanik & Greenfield, 2003).

The main weakness of this study was the two variables used. The question relating to back pain was used as a stand in variable for more direct approaches such as directly asking: do you have back pain? How long have you suffered from back pain? This could be followed by inquiring if it is upper or lower back pain. Secondly, The MCGLRD was a compromise between the CGLORDs recommendation of 15 drinks a week for men and 10 for women. This metric underestimates the real harm to women while overestimating the harm to men.

Although the study did not directly investigate notions of pain catastrophizing, future studies can extrapolate this from the relationship found between back pain in the GGH and consuming alcohol above the MCGLRD for possible psychological, or analgesic effects. This warrants interest for public policy and programming aiming to reduce expenditure on the negative psychological and physical results of prolonged alcohol use. Advice relating to alcohol consumption can be given at the point of care to back pain sufferers in the GGH. It is also possible to allocate some funding destined for alcohol related expenditures to rehabilitation programs and pain management strategies for back pain sufferers.

REFERENCES

Butt, P., Beirness, D., Gliksman, L., Paradis, C., & Stockwell, T. (2011). Alcohol and health in Canada: a summary of evidence and guidelines for low-risk drinking. Ottawa, ON: Canadian Centre on Substance Abuse.

Costa, L. D. C. M., Maher, C. G., Hancock, M. J., McAuley, J. H., Herbert, R. D., & Costa, L. O. (2012). The prognosis of acute and persistent low-back pain: a meta-analysis. Cmaj, 184(11), E613-E624.

Fatoye, F., Gebrye, T., & Odeyemi, I. (2019). Real-world incidence and prevalence of low back pain using routinely collected data. Rheumatology international, 39(4), 619-626.

Hartvigsen, J., Hancock, M. J., Kongsted, A., Louw, Q., Ferreira, M. L., Genevay, S., ... & Woolf, A. (2018). What low back pain is and why we need to pay attention. The Lancet, 391(10137), 2356-2367.

James, S. L., Abate, D., Abate, K. H., Abay, S. M., Abbafati, C., Abbasi, N., ... & Briggs, A. M. (2018). Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet, 392(10159), 1789-1858.

Stockwell, T., Dorocicz, J., & MacDonald, S. (2014). Canadian Substance Use Costs and Harm Scientific Working Group. Canadian substance use costs and harms: 2007–2014. Ottawa (ON): Canadian Centre on Substance Use and Addiction; 2018. High Medium Low 17. Holmes J, Meng Y, Meier PS, et al. Effects of minimum unit pricing for alcohol on different income and socioeconomic groups: a modelling study. Lancet, 383(9929), 1655-64.

Sullivan, M. J., Thorn, B., Haythornthwaite, J. A., Keefe, F., Martin, M., Bradley, L. A., & Lefebvre, J. C. (2001). Theoretical perspectives on the relation between catastrophizing and pain. The Clinical journal of pain, 17(1), 52-64.

Thompson, T., Oram, C., Correll, C. U., Tsermentseli, S., & Stubbs, B. (2017). Analgesic effects of alcohol: a systematic review and meta-analysis of controlled experimental studies in healthy participants. The Journal of Pain, 18(5), 499-510.

Manuel, D. G., Bennett, C., Perez, R., Wilton, A. S., Dass, A. R., Laporte, A., & Henry, D. A. (2019). Burden of health behaviours and socioeconomic position on health care expenditure in Ontario [version 2; peer review: 2 approved].

Ministry of Public Infrastructure Renewal. (2006). Places to Grow—Growth Plan for the Greater Golden Horseshoe.

Meints, S. M., Mawla, I., Napadow, V., Kong, J., Gerber, J., Chan, S. T., ... & Edwards, R. R. (2019). The relationship between catastrophizing and altered pain sensitivity in patients with chronic low back pain. Pain, 160(4), 833.

Midanik, L. T., & Greenfield, T. K. (2003). Telephone versus in-person interviews for alcohol use: results of the 2000 National Alcohol Survey. Drug and alcohol dependence, 72(3), 209-214.

Nieto, S. J., Green, R., Grodin, E. N., Cahill, C. M., & Ray, L. A. (2021). Pain catastrophizing predicts alcohol craving in heavy drinkers independent of pain intensity. Drug and alcohol dependence, 218, 108368.

Yang, H., & Haldeman, S. (2018). Behavior-related factors associated with low back pain in the US adult population. Spine, 43(1), 28-34.