Mental health and addiction problems among vulnerable populations and the impact of a supportive text message intervention in one vulnerable group

By

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ABSTRACT

Background

Mental health and addiction problems are prevalent among some groups such as the military, firefighters, the elderly, and residents who have experienced multiple disasters. Identifying the prevalence and predictors of mental health and addiction conditions is important for primary prevention and planning treatment programs for these populations.

Objectives

1.To identify the prevalence and correlates of post-traumatic stress disorder (PTSD), depressive disorders and suicidality among the military, firefighters, and the elderly.

2. To identify the prevalence and correlates of likely Major Depressive Disorder (MDD), low resilience and, likely cannabis and alcohol abuse in residents of Fort McMurray following the 2016 wildfires, the COVID-19 pandemic and the 2020 flooding.

3. To implement and evaluate the impact of supportive texting service (Text4Hope-Addiction) for subscribers experiencing addiction issues in Alberta, Canada during the COVID-19 pandemic.

Methods

This thesis includes three separate but related studies which utilizes distinct study designs, including a general and scoping review of literature, cross sectional population level study and a longitudinal cross sectional program evaluation study.

To address objective 1, a general literature review (for the elderly) and scoping literature review (for military and fire fighters) were performed using relevant search terms in MEDLINE, EMBASE, PsycINFO, CINAHL, and PubMed databases. The searches were conducted to describe the existing research literature on the prevalence of depression and correlation of death by suicide among the geriatric population and the prevalence and correlation of PTSD among military personnel and firefighters. The Covidence software was used in the management and screening of the data.

To address objective 2, a cross sectional survey was conducted among residents of Fort McMurray using an online questionnaire. The survey was designed to capture socio-demographic, trauma exposure, and clinical variables. Mental health outcome variables were captured using self-reported standardized assessment scales to assess depression, PTSD, anxiety, suicidality, and resilience. Respondents were also asked to self-report cannabis and alcohol abuse in the last year. Data were analyzed using SPSS version 25 and presented as descriptive statistics, Chi-square/Fisher's Exact tests, and binary regression analysis.

To address objective 3, a daily supportive text messaging service, Text4Hope-Addiction was implemented for three-month to support subscribers' dealing with mental health and addiction problems during the COVID-19 pandemic. To evaluate the service, online surveys were delivered to subscribers via text messages at baseline, six weeks, and endpoint, 12 weeks and contained validated self-report scales to assess the prevalence and severity of anxiety, depression, and cravings among subscribers. Likert scale satisfaction responses were also used to evaluate various aspects of the Text4Hope-Addiction program.

Results

For the general review, MDD prevalence in the elderly ranges from 5.37% to 56%. Mental illnesses and physical illnesses contributed to suicidality, and depression was found to highly correlate with suicidal behavior among the elderly.

Regarding the scoping review, PTSD prevalence ranges from 1.9% to 57% among the firefighters and 3.72% to 37.8% among military personnel. Demographic factors like age, job factors, physical and psychological factors predicted PTSD among the military and firefighters.

In the population level cross-sectional study, 186 out of 249 individuals who accessed the survey completed it, giving a response rate of 74.7%. Prevalence of likely MDD was 45%, low resilience- 37.4%, cannabis abuse- 14%, and alcohol abuse- 27.4% among Fort McMurray residents.

For the Text4Hope-Addiction support program evaluation, 110 subscribers completed the surveys at least at one time point. After three months of subscription to Text4Hope-Addiction service, the percentage reduction in mean scores on standardized scales from baseline to three-month was 33.4%, 30.2% and 21.2% for craving, depression, and anxiety symptoms, respectively. Subscribers agreed the daily supportive messages helped them cope with stress (89%), anxiety (81%) and depression (69%).

Conclusion

The military personnel, firefighters, the elderly, and people exposed to multiple are susceptible to mental health and addiction problems. Supportive text-based programs are accessible and easily scalable approaches to help close the psychological treatment gap for vulnerable populations.

Preface

This thesis consists of published work that obtained ethics approval and peer-reviewed articles. The preface outlines the articles and presents details of each. This thesis is an original work by Gloria Obuobi-Donkor. The research contributing to this thesis was conducted per the Declaration of Helsinki (Hong Kong Amendment), and Good Clinical Practice (Canadian Guidelines), and the University of Alberta Reviews and Ethics Board approved the study (Pro00066054) (Pro00086163). Informed consent was sought and obtained from all participants.

All the chapters of this thesis are made up of sections and subsections that have been published or submitted for publication. For conciseness of the reference list, all published and submitted articles are listed in a single reference list at the end of this thesis. Aside this modification, the component of this thesis is presented exactly as they are published or submitted for publication. Details of the articles included in the thesis are provided as well as work contributed by Gloria Obuobi-Donkor

3.1. Prevalence of Major Depressive Disorder and Correlates of Death by Suicide in Geriatric Population- A General Review of Literature.

Published as: **Obuobi-Donkor, G.,** Nkire, N., & Agyapong, V. I. (2021). Prevalence of major depressive disorder and correlates of thoughts of death, suicidal behaviour, and death by suicide in the geriatric population—A general review of literature. *Behavioral Sciences*, *11*(11), 142.

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Contribution: Gloria Obuobi-Donkor was responsible for the conceptualization of the paper, data search, writing the original draft, and editing. N. Nkire reviewed and edited the work. V. I.O. Agyapong was the supervisory author, and responsible for review, editing, and funding acquisition.

3.2. A Scoping Review on the Prevalence and Determinants of Post-Traumatic Stress Disorder among Military Personnel and Firefighters: Implications for Public Policy and Practice

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3.3. Evaluating the Prevalence and Predictors of Moderate to Severe Depression in Fort McMurray, Canada during the COVID- 19 Pandemic

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Contribution: Gloria Obuobi-Donkor drafted the initial manuscript and reviewing. E. Eboreime contributed to data collection. R. Shalaby conducted the data analysis. B. Agyapong reviewed the initial draft. F. Oluwasina reviewed and revised the initial draft manuscript. M. Adu reviewed the initial draft manuscript. E. Owusu reviewed the initial draft. W. Mao revised the initial draft manuscript. V.I.O. Agyapong conceived, designed, and supervised the work and funds acquisition. All authors contributed to study design and revised and approved the final draft of the manuscript.

3.4. Prevalence and Predictors of Low Resilience in Residents of Fort McMurray One Year After a Devastating Flood

Submitted to the Journal of Flood Risk Management as: **Gloria Obuobi-Donkor**, Reham Shalaby, Ejemai Eboreime, Belinda Agyapong, Hannah Pazderka, Medard Adu, Folajinmi Oluwasina, Ernest Owusu, Wanying Mao, Vincent I.O. Agyapong

Contribution: Gloria Obuobi-Donkor drafted the initial manuscript, revising, and reviewing. R. Shalaby conducted the data analysis. E. Eboreime contributed to data collection. B. Agyapong reviewed the initial draft. H. Pazderka reviewed and revised the initial draft manuscript. M. Adu reviewed the initial draft manuscript. F. Oluwasina reviewed and revised the initial draft manuscript. E. Owusu reviewed the initial draft. W. Mao revised the initial draft manuscript. V.I.O. Agyapong conceived, designed, and supervised the work and funds acquisition. All authors contributed to study design and revised and approved the final draft of the manuscript.

3.5. Prevalence and correlates of cannabis abuse among residents in the community of Fort McMurray, a city in Northern Alberta which had endured multiple natural disasters

Submitted to Frontiers in Psychiatry Addictive Disorders Journal as: **Gloria Obuobi-Donkor**, Ejemai Eboreime, Reham Shalaby, Belinda Agyapong, Vincent I.O. Agyapong.

Contribution: Gloria Obuobi-Donkor drafted the initial manuscript, Ejemai Eboreime contributed to data collection and reviewing, Reham Shalaby analyzed the data, Belinda Agyapong reviewed the initial manuscript, V.I.O Agyapong conceived, designed, and supervised the work. All authors contributed to data collection, study design, review, and approved the final draft of the manuscript.

3.6. Prevalence and predictors of alcohol abuse and association with symptoms of other mental health conditions in the residents of Fort McMurray after the 2016 wildfires, COVID-19 pandemic and 2020 flooding.

Submitted to Frontiers in Psychiatry Public Mental Health Journal as: **Gloria Obuobi-Donkor**, Reham Shalaby, Belinda Agyapong, Ejemai Eboreime, Vincent I.O. Agyapong

Contribution: Gloria Obuobi-Donkor drafted the initial manuscript, Ejemai Eboreime contributed to data collection and reviewing. Reham Shalaby analyzed the data. Belinda Agyapong reviewed the initial manuscript. V.I.O Agyapong conceived, designed, and supervised the work. All authors contributed to data collection, study design, review, and approved the final draft of the manuscript.

4.1. Text4Hope-Addiction Support Program: Three Months of Daily Supportive Text Messages reduces Craving and Improves Mental Health Outcomes

Submitted to JMRI Mental health as: **Gloria Obuobi-Donkor**, Reham Shalaby, Wesley Vuong, Belinda Agyapong, Marianne Hrabok, April Gusnowski, Shireen Surood, Andrew J. Greenshaw, Vincent Israel Opoku Agyapong

Contribution: Gloria Obuobi-Donkor drafted the initial manuscript, editing, and reviewing. R. Shalaby conducted data analysis, W. Vuong, and S. Surood participated in data collection, B. Agyapong, M. Hrabok, A. Gusnowski, Y. Zhang, C. Hilario, and A.J. Greenshaw reviewed and revised the initial draft of the manuscript. V.I.O. Agyapong conceived and designed the study and the Text4Hope-Addiction program All authors contributed to the study design, revised, and approved the final draft of the manuscript.

Dedication

This work is dedicated to my husband, companion, and counsellor (Nana Ofori Asante).

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LIST OF SYMBOLS

BDI: Beck Depression Inventory

BRS: Brief Resilience Scale

BSCS: Brief Substance Craving Scale

CI: Confidence Intervals

COVID-19: Coronavirus Disease 2019

DSM-IV: Diagnostic and Statistical Manual of Mental Disorders 4th Edition

DSM-5: Diagnostic and Statistical Manual of Mental Disorders 5th Edition

GAD: Generalized Anxiety Disorder

GAD-7: Generalized Anxiety Disorder-7 scale

GDP: Gross Domestic Product

GDS: Geriatric Depression Scale

ICD-9: International Classification of Diseases, Ninth Revision

MDD: Major Depressive Disorder

MH: Mental health

NFFF: The National Fallen Firefighters Foundation

OR: Odds ratio

PCL-5: PTSD Checklist for DSM-5

PHQ-9: Patient Health Questionnaire-9

PSP: Public Safety Personnel

PTSD: Post-traumatic Stress Disorder

REDCap: Research Electronic Data Capture

SD: Standard Deviation

SPSS: Statistical Package for Social Sciences

SUD: Substance Use Disorder

UK: United Kingdom

USA: United States of America

WHO: World Health Organization

CHAPTER 1. INTRODUCTION

The introduction consists of five sections.

1. Mental health burden
2. Vulnerable populations
3. Text intervention
4. Overall aims and objectives
5. Justification for the research

1.1. Mental Health Burden

Globally, mental health and substance use disorders have been recognized as public health concerns due to their high prevalence and their substantial contribution to disability [1]. Mental and substance use disorders significantly impact role functioning compared to most chronic physical health conditions [2, 3]. Worldwide, approximately 1 in 7 individuals experience mental and substance use disorders (SUD) [4]. Various studies have recorded varying prevalence of mental and substance use disorders. A survey conducted in twenty-eight countries concluded that mental illness is common in all the countries, with a twelve-month prevalence of 6.8% in 50% of the countries [5]. National Survey on Drug Use and Health reported that 21 per cent of individuals 18 or older had a mental illness in 2020 [6]. In Canada, about 10.1% of the population reported symptoms consistent with mental or substance use disorders [7]. Mental health burden affects every aspect of one's life, reduces productivity and utilizes a significant part of health care resources in most countries [8]. In Canada, about $51 billion in economic costs is spent annually on mental health illnesses [8].

While the general population encounters psychological illness, others within the community may be more vulnerable [9]. Military personnel, firefighters, the elderly, people exposed to traumas and those with mental health and substance use disorder are more susceptible to experiencing mental illness than the general population [10-13]. The principal reasons for focusing on these groups is that they represent a set of vulnerable populations whose multi-faceted mental health needs may be inadequately met due to barriers in mental healthcare delivery.

1.2. Vulnerable Populations

Numerous terms have been used to describe people who are susceptible to poor physical and psychological health including 'vulnerable population'[14]. After extensive research on those classified as "vulnerable", no clear consensus has been drawn on the exact constitution of vulnerability [15, 16]. However, literature has defined vulnerability as the ability to be wounded and, in a broader medical scope, prone to health challenges such as psychological health problems [14, 15]. The epidemiological concept of vulnerability is the probability of an individual getting sick at a particular time [14]. Other cohorts are vulnerable to experiencing mental illness due to the occupation, natural disasters experienced, age, and history of any mental health or addiction condition [12, 13, 17, 18].

1.2.1. Older adults

The World Health Organization (WHO) reports that persons 60 years and older constitute about one billion of the 2020 total world population, which is estimated to increase to 1.4 billion in 2030 [19]. The composition of ageing varies, and according to WHO, ageing results from biological damage of molecular and cellular damage with time [19]. It is widely known that the burden of both physical and mental disorders increases with ageing [20]. The vulnerability of older people to their health necessitated the WHO to release the first world report on ageing and health [21]. This reports on the entire life course of the aged and describes vital disorders that become rampant in the older age impacting functioning [22], rendering them vulnerable to other complications. When one advances in age, the quality of life will likely diminish, and reduced strength leads to a sense of worthlessness and anxiety [17]. In addition, other studies have linked old age vulnerability to the decreased sensory awareness and physical impairment, among other mental health impairments [23-25]. Although some older population may not experience mental health conditions, limited information is available to conclude that older people in this current century are experiencing healthier life than in previous centuries [26].

1.2.2. Military personnel and firefighters

Military personnel are one of the cohorts who may be vulnerable to mental health conditions [27]. They are exposed to traumatic events rendering them vulnerable to mental health conditions, including post-traumatic stress disorder (PTSD) and physical traumas [28, 29]. For example, the National Vietnam Veterans Readjustment Study estimated lifetime prevalence rates of PTSD among veterans at 30.9% and 26.9% for men and women, respectively [30]. Various studies have suggested occupational factors as predictive of vulnerability in experiencing PTSD, substance abuse, depression, and anxiety among the military personnel [28, 31-33].

Another public safety personnel (PSP) group vulnerable to experiencing psychological problems are firefighters [34]. Firefighters are usually the first to assist victims during traumatic events like natural disasters and fire outbreaks [35, 36] and are confronted with emotionally demanding and unpredictable situations [34, 37]. Literature has estimated the trauma they experience at 91.5% [38], while Tomaka et al. (2017) estimated the prevalence of PTSD in firefighters as 33% [39]. The traumatic events due to the nature of their job make them vulnerable to alcohol use disorders, PTSD, and mood disorders [39-42]. Other studies have reported that preexisting mental health illness contributes to their vulnerability to other mental conditions besides occupational susceptibility [43, 44].

1.2.3. Disaster victims

Disasters and pandemics are unexpected events that cause trauma and loss of properties and lives [45]. Irrespective of the loss, there are other health consequences [46]. An individual who experiences disasters such as flooding, wildfires, and pandemics are vulnerable to mental health illness [47]. Depression, PTSD, suicidality, substance use, anxiety, and low resilience are usually noticed among people who have experienced disaster [48, 49]. However, the most common psychopathology post-disaster is PTSD, and a diagnosis predicted on the experience of a traumatic event [47, 50, 51]. Undoubtedly, research has advanced on the mental health consequences of disasters [18, 49, 52, 53]. For example, a study conducted by Agyapong et al.(2022) reported that people who experience more than one trauma are at high risk of psychological conditions compared to those exposed to only one trauma [54]. The same research group revealed that participants who experienced coronavirus disease (COVID-19), flooding and wildfire were eleven

to eighteen times more likely to express anxiety and PTSD symptoms than participants who experienced only COVID-19 trauma [54]. Health burden after a disaster can be significant, with a PTSD prevalence of 10–40% among direct victims [47, 49-51].

1.2.4. Individuals with substance use disorders

Individuals who become dependent on substances usually abuse substances due to the initial positive effects and the belief they can control their usage [55]. The substances pleasurable effect diminishes, and this increases the individual's need to take more to have the same impact, leading to abuse or dependence [55].

The common substances people abuse include alcohol and cannabis [7, 56]. There is considerable evidence suggesting that ingesting substances produces adverse effects [57], which renders individuals vulnerable to other mental health illnesses, physical illnesses [58], and sometimes death [20]. Moreover, studies reported that most individuals who abuse substances meet the criteria for substance use disorders and other mood disorders [59-63].

Evidence suggests that most global preventable death results from problematic substance intake [64]. For example, in 2016, WHO estimated the alcohol-attributable deaths at 10.3% in both males and females [64], which could be prevented. Persons who use substances and have preexisting mental illness may be more vulnerable to a worse form of the condition. The substance may trigger or worsen mental health conditions among this vulnerable group [65].

1.3. Text Intervention

Globally, accessing mental health services is a challenge, and few health care workers are available [66]. Literature reports that approximately 70% of people with mental illness do not receive any treatment, and the condition is left untreated [67, 68]. Similarly, data from the National Comorbidity Survey reported that only about 40% of individuals with lifetime mental disorders and substance use disorders had received professional treatment [69]. Although there are several substance use disorder treatment services in many countries, many of these are private rather than public services and due to financial constraints, many individuals who abuse alcohol and other

drugs cannot access treatment programs [70]. In addition, the Mental Health and Addiction services across Canada identified long wait times, high cost of accessing mental health services, inadequate mental health service, stigma, and geographic and demographic inequities as barriers hindering individuals with addiction and mental health problems from accessing health services [71-73]. Adopting the use of text messages to deliver health interventions to vulnerable group has the potential of improving health. Most randomized controlled trials reviewing text messaging for both clinical and healthy behaviours reported a significant improvement in health after the text message interventions [74]. A study conducted in Fort McMurray reported that people who experienced wildfire showed a reduction in anxiety after six months of receiving supportive text messages [71]. In addition, a systematic review concluded that text messaging intervention positively affects the mental health of vulnerable individuals [75]. The high prevalence of mental health and substance use complications among vulnerable groups necessitates an exploration of the use of supportive text message interventions as a population-level program for these groups.

1.4. Overall Aims and Objectives

Overall, the aims of this project were to explore the prevalence and correlates of common mental health and addiction problems among vulnerable populations, and to investigate whether daily supportive messages are effective in mitigating anxiety, depression, and cravings among subscribers of Text4Hope-Addiction Support.

The specific objectives include:

- conduct literature reviews to identify the prevalence and correlates of post-traumatic stress disorder (PTSD), depressive disorders and suicidality among the military, firefighters, and the elderly.
- conduct a cross sectional survey to identify the prevalence and correlates of likely Major Depressive Disorder (MDD), low resilience and, likely cannabis and alcohol abuse in residents of Fort McMurray following the 2016 wildfires, the COVID-19 pandemic and the 2020 flooding

- implement and evaluate the impact of supportive texting service (Text4Hope-Addiction) for subscribers experiencing addiction issues in Alberta, Canada during the COVID-19 pandemic.

Details of the aims and specific objectives for each sub-study are included in the published or submitted articles that constitute subsequent chapters of this thesis.

1.5 Justification for the research

The high prevalence of mental health and substance use disorders, particularly among vulnerable populations requires an integrated approach to healthcare delivery. Despite ongoing efforts to address mental health and substance use problems at a population-level among the general public, vulnerable populations experiencing mental and addiction concerns continue to experience significance barriers to accessing services [76, 77]. There is therefore the need for ongoing research and advocacy to address the unmet mental health needs of vulnerable populations. Research pertaining to mental health and addiction burden in specific vulnerable population like the military, the elderly, disaster victims, and firefighters is parse; and the few studies conducted, have focused mainly on other vulnerable population like the poor and children [78, 79]. As well, few studies have specifically examined the impact of supportive text messaging programs to address mental health and addiction concern during the COVID-19 pandemic [80-82]. This study sought to expand the literature pool regarding vulnerable populations who are prone to mental health and substance abuse problems. It also seeks to provide evidence of effectiveness of supportive text message interventions in reducing the mental health and addiction burden of one vulnerable population. This study further provided suggestions for other supportive technology enabled services in healthcare delivery to address the mental health needs of vulnerable populations. Finally, the study provides the foundation for future research among other vulnerable population who have been neglected in the global context and usefulness of supportive text message intervention in reducing mental health conditions.

CHAPTER 2. METHODOLOGY

This chapter presents the methodology of this thesis by providing brief information on the various studies conducted and participants selected with the sampling rationale. Details of the various methodologies of each work included in this thesis are elaborated in subsequent chapters.

2.1. Reviews

A general review of the literature was performed using relevant search terms to determine both the prevalence and correlates of depression and death by suicide among the geriatric population. Databases (four) were searched; MEDLINE, PsycINFO, CINAHL, and PubMed. Studies were eligible when the elderly were defined as persons 60 years of age or older in relevant journals. Articles that specified the reason for death by suicide in the geriatric population were included.

A scoping review was conducted among military personnel and firefighters. This review was designed and conducted in adherence with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) statement [83] and followed Arksey and O'Malley's five-stage approach to scoping reviews [84]. A literature search was conducted in five databases, including PubMed, MEDLINE, PsycINFO, CINAHL, and EMBASE. Studies were eligible when they identified the prevalence of PTSD among firefighters, veterans, or military personnel. The Covidence software (https://www.covidence.org/) was used in data screening and management.

2.2. Observational Studies

An observational study is a type of study that usually examines participants in their natural state with no control over the participants. A cross-sectional study is one category of an observational study [85]. In order to estimate the prevalence of likely alcohol abuse and cannabis abuse, low resilience and likely MDD among residents of Fort McMurray, the cross-sectional approach was adopted, and the measurement for each person was done at one point. Through a quantitative cross-sectional survey design, data were collected using self-administered online questionnaires, which were programmed into the REDCap software. Data were collected from 24 April to 2 June 2021.

2.3. Text Evaluation

Text4Hope-Addiction Support program was implemented to help reduce craving and mental health symptoms among subscribers. Participants self-subscribed to the service by texting "Open2Change" to a short code number. Subscribers to the Text4Hope-Addiction Support program received daily supportive text messages crafted based on addiction counselling and cognitive behavioural therapy principles for three months. Participants completed an anonymous online questionnaire to assess cravings, anxiety, and depressive symptoms using the Brief Substance Craving Scale, Generalized Anxiety Disorder-7 Scale, and Patient Health Questionnaire-9 Scale at enrollment, six weeks, and three months. Data were collected at baseline (on subscription to the Text4Hope-Addiction Support program), at six weeks and after three months via online survey questionnaires programmed into REDCap software. Subscribers' satisfaction responses were used to assess various aspects of the Text4Hope-Addiction program. Data were collected between July 1, 2020, and November 23, 2021.

2.4. Outcome Measures for the Cross-Sectional and Program Evaluation Studies

- The Patient Health Questionnaire (PHQ-9) was used to measure the depressive symptoms of participants [86]. This tool is a nine-item measured on a four Likert scale with a score of 0-4 - normal, 5-9 mild, 10-14 moderate, 15-19 moderately severe, and 20-27 severe [86]. The scores were reclassified into two variables none to mild depression and moderate to severe depression. The reliability and validity of the tool have indicated it as having sound psychometric properties and the internal consistency of the PHQ-9 has been shown to be high [86].
- The Generalized Anxiety Disorder-7 (GAD-7) scale was used to assess the likelihood of anxiety symptoms. The seven self-reported items are rated on a four Likert scale; 0 (not at all) to 3 (nearly every day), with a score range of 0 to 21. A score of 10 or more was deemed to be likely anxiety, the higher the score, the more severe the anxiety symptoms. The score was recategorized into; low anxiety (less than 10) and moderate to high anxiety (score of 10 or more) [87]. The internal consistency and test–retest reliability of the GAD-7 was good and it also provided good criterion, construct, factorial, and procedural validity [88].
- The Post Traumatic Stress Disorder Checklist Civilian (PCL-C) was used to assess likely PTSD symptoms. This is a self-report rating scale for PTSD comprising 17 items. The level of

distress produced by each symptom is rated on a five Likert scale 1 (not at all) to 5 (extremely) and a score of 44 or more was classified as likely PTSD and score below 44 as unlikely PTSD [89]. The PCL-C demonstrated good internal consistency and retest reliability and favorable patterns of convergent and discriminant validity [90]. Studies suggest that the PCL-C demonstrated good internal consistency and retest reliability than alternative measures of PTSD [89, 90].

- The Brief Resilience Scale (BRS) was used to assess participants' ability to recover from stress. A score ranging from 1.00-to 2.99 indicates low resilience, while a score ranging from 3.00-to 5.00 indicates high to normal resilience [91]. Regarding reliability and validity literature shows that the BRS has good internal consistency, with Cronbach alphas ranging from 0.80 to 0.90 and test–retest reliability coefficients for a two-week interval were fair (0.61 to 0.69) [92].
- Participants were asked whether they had any suicidal ideation. This was achieved via the ninth question of the PHQ-9 scale; passive death wishes or thoughts of self-harm in the last two weeks.
- Craving score were measured using the Brief Substance Craving Scale (BSCS), a three-item self-reported on a five-point Likert scale instrument [93] used to assess craving for alcohol and other substances, was used to assess participants' intensity, frequency, and length of time craving. The BSCS consists of the following items: 1. “The INTENSITY of my craving, that is, how much I desired this drug in the past 24 hours”. 2. “The FREQUENCY of my craving, that is, how often I desired this drug in the past 24 hours”. 3. “The LENGTH of time I spent craving this drug during the past 24 hours”.
- Self-reported alcohol abuse among study participants in Fort McMurray was determined through the question; “have you abused alcohol in the past year?”
- Self-reported cannabis abuse among study participants in Fort McMurray was determined through the question; “have you abused cannabis in the past year?”
- Satisfaction of Text4Hope-Addiction was assessed using satisfaction questions adopted from those used to evaluate the Text4Mood, Text4Hope and Text4Support programs [81, 94-96]. Areas assessed include how participants coped with stress, anxiety and depression related to addiction, after receiving the daily supportive text messages for three months. Receptivity of the supportive messages for addiction and recommendation of other technology-based services for future use in the addiction support program were also assessed.

CHAPTER 3. COHORTS VULNERALE TO MENTAL HEALTH CONDITIONS

3.1. Prevalence of Major Depressive Disorder and Correlates of Death by Suicide in Geriatric Population- A General Review of Literature.

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ABSTRACT

Background

There has been an increase in deaths by suicide in old age in the last decade. Depression and suicide in the elderly, 60 years and above, is a major global public health concern. Determining the prevalence of depression, and correlates of death by suicide in the geriatric population, is an important first step toward addressing this public health concern. This literature review aims to determine the prevalence of major depressive disorders and the correlates of death by suicide in the geriatric population.

Methods

This general review of the literature was performed using relevant search terms to determine both the prevalence of depression and the correlates of death by suicide among the geriatric population. Databases such as MEDLINE, PsycINFO, CINAHL, and PubMed were searched. Relevant and current articles were extracted, reviewed, and analyzed. The elderly population was defined as individuals 60 years and above. Only full texts articles in English were reviewed.

Findings

The prevalence estimates of major depressive disorder in the elderly ranged from 5.37 to 56%. Adults aged 60 years and older have a high risk of depression that exposes them to suicide. Moreover, elderly women are more likely to experience depression than elderly men, but successful suicide is more common in men. Depression and other mental health conditions (schizophrenia, anxiety disorders) and perceived stress were found to be predictors of suicide in the elderly. Other predictors included physical illnesses such as malignancies, financial constraints, cuckoldry, and sexual dysfunction, and also social factors like living alone triggers depressive symptoms and increases suicidal risk in the elderly. Hanging was found to be the most common method of death by suicide for both sexes. While elderly women preferred poisoning, elderly men in Western countries preferred firearms. Differences in gender, the aging process and social issues were also contributing factors to methods used for suicide.

Conclusion

Depression and debilitating physical illnesses were identified as significant contributors to suicide risk in the elderly population, and emphasis should be placed on identifying these factors early and treating them. Recognizing and addressing factors that predict suicide in the elderly will help to improve the mental wellbeing of the elderly

INTRODUCTION

Old age is a period involving physical and functional disabilities as well as reduction of cognitive function, social life, loss of autonomy and independence [97]. As one advance in age, the quality of life may reduce with a decline in physical and cognitive abilities or infirmities. Chronic diseases and reduced strength lead to a sense of worthlessness and anxiety, ultimately resulting in depression [98]. The United Nations (UN) Population Division projects an increase of the geriatric population (60 years and above) from 800 million representing 11% of the general population, to 2 billion i.e. 22% of the population by the year 2050 [99]. In the year 2008, persons 65 years and over constituted 13.5% of the Ontario population; by 2036, that figure is expected to rise to approximately 23.2% [100]. It is estimated that the prevalence of mental health problems ranges

17% to 30% or higher, depending on the diagnoses included in the analysis [100]. The elderly population in Ghana accounted for 4.7 per cent of the total population in 2010, with the elderly population making up 56% women and 44% of men [101].

Globally, suicide rates in men and women have been reported as 25 per 100,000 persons and 6 per 100,000 persons among men and women, respectively, in the general population [102]. For example, a study in China suggests that the prevalence of suicide among Chinese older adults is on the rise compared to the prevalence estimates in Western countries [103]. A suicide mortality rate of 23 per 100,000, or 287,000 deaths, is reported annually in China [103]. A study of suicides among centenarians in seventeen countries revealed a suicide rate of 57 per 100,000 men and 6.8 per 100,000 women [102]. In Germany, the suicide rate in those over 90 years was 90.1 per 100,000 for men and 20.9 per 100,000 for women [102].

Globally, approximately every 40 seconds, a person dies by suicide somewhere in the world [98]. Suicide in elderly people is fatal than in young adults [104, 105]; therefore, more attention is needed among the geriatric population. The elderly population forms a significant proportion of the population. With the geriatric population inflating, suicides among the elderly pose a serious issue for global societies. Suicide is the conscious act of inflicting injury to self with the behavior and intention to die [106-108]. Suicide is a serious public health problem for the elderly [109]. However, the suicide rate among the elderly has not been as high as that among adolescents since the 1970s. The suicide rate among the elderly is still high, particularly in Western countries like Canada and the United States [110]. Other countries may record lower values of suicide in the elderly. Malaysia records 3.0 per 100,000 suicides among the elderly [111]; reasons may be related to religious practices [111]. Suicide, especially among men in Traditional culture in China, represents failure, which makes deliberate injuries being recorded as accidents to save one from shame [112]. It is estimated that 7000 elderly aged 60 years and above are involved in suicide yearly in the United States [113].

Persons 65 years and older represent 13% of the general population and account for 18% of deaths by suicide in the year 2000 [106]. In the year 2005, it was estimated that 575,000 persons visited the emergency departments in the US on account of self-injury [113]. Suicide accounted for close

to 1.5% of all deaths worldwide, bringing it into the top 20 leading causes of death in 2015 [108]. In the 2010 Global Burden of Disease, self-injury was ranked 17th at age 60–64years [114] among causes of death.

The self-destruction data in elders are very high, with a close-ratio of nearly 2:1 attempted and completed suicides respectively [115]. The American Association of Suicidology reported that, among the general population, there is one accomplished death in 25 suicide attempts with a 1:4 ratio among the elderly and 1:100-200 attempts among the youth [116]. These statistics are alarming, and makes it a health concern to the society and the healthcare sector, and calls for action to reduce the risk of such acts [100].

Depression seems to be a significant contributor to suicide, with about 800,000 people dying by suicide yearly [117]. According to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-V), depressive disorders include "disruptive mood dysregulation disorder, major depressive disorder, dysthymia, premenstrual dysphoric disorder, substance/medication-induced depressive disorder, depressive disorder due to another medical condition, other specified depressive disorder, and unspecified depressive disorder"[118].

Depression is characterized by the presence of sad, empty, or irritable moods [118]. Usually, the first sign of depression among the geriatric population is a lack of interest in usual activity [119]. In defining depression in both the elderly and younger populations, depressive symptoms, specific depressive illnesses or disorders, number and type of symptoms are considered [120].

Depression is more common in people over 65 years old than other emotional changes, accompanied by a high mortality rate and pathological comorbidity [10]. Currently, approximately 20% of women and 10% of men in the USA experience major depressive disorder [10]. A study conducted in Athens shows that, of the cohort of 300 elderly individuals studied, 84.3% showed symptoms of depression in the moderate and severe spectrum of the illness [10]. In a study of about 1,300 community adults 60 years or older, results from screened depressive symptomatology showed 27% reported depressive symptoms, 19% were diagnosed as suffering mild dysphoria, 4% symptomatic depression, 2% dysthymia, 1.2% a mixed depressive and anxiety syndrome, and 0.8% major depression [121].

Longitudinal analyses of the practice-randomized Prevention of Suicide in Primary Care Elderly: Collaborative Trial (PROSPECT) analyzed 1,226 elderly adults. Results showed 29% of patients with major depression and 11% with minor depression wished to die. Meanwhile, 7% with no depression also had suicidal thoughts [122]. Another study that studied persons 65 years or older recorded major depressive disorder prevalence around 1.3-4%, dysthymic disorder 2%, minor depressive disorder 4-13% and 8-16% of depressive symptoms [123].

The depressed elderly may fail to express their sadness, and they often tend to somatize their complaints [123] which makes diagnosing depression in the elderly challenging [124]. People's experiences as they age overlap between the vegetative symptoms of depression and that of comorbid physical illness making accurate diagnoses difficult [124] and leading to unnecessary treatment. To fully evaluate depression among the elderly, validated measures, such as the Patient Health Questionnaire 9 (PHQ-9) [86] and Beck's depression inventory (BDI) [125] can reflect diagnostic criteria [126]. Geriatric Depression Scale (GDS) is also one of the best screening tools for depression in the elderly who are healthy/ill or mild to moderately cognitively impaired [127, 128]. These tools indicate significant depression and assess for suicidal risk; the scores help provide adequate intervention for suicide. The elderly adults, peculiarly elderly white men, have high suicide rates. Hence, presence of suicidal thoughts should be carefully investigated [129]. Poor recognition of mental disorders and suicidal ideation among the elderly makes it challenging to get an appropriate solution. Determining the prevalence of major depressive disorder and the predictors of suicide in the geriatric population will support the health of the elderly and improve their quality of life.

To the best of our knowledge, this is the first review article to examine the prevalence and correlates of depression and suicide in the elderly as well as explore different methods adopted in elderly suicide. Epidemiological studies, whilst useful in this context, do not specifically explore all the different predictors of suicide or all the various methods used in suicide in the geriatric population. Thus, this general literature review was conducted to synthesize the data regarding depression and suicide as far as it related to the elderly population. Specifically, we aim to explore literature related to the prevalence of depression, demographic, social, and clinical correlate of suicide, and the methods commonly adopted in completed or attempted suicides among the geriatric population.

METHODS

A comprehensive review of studies and research on depression and death by suicide in the elderly was performed. We appraised suicidal attempts and ideation due to the close relationship of these terms in the geriatric population [130]. This general review of the literature was performed using relevant search terms to determine both the prevalence rates and correlates of depression and death by suicide among the geriatric population. Databases such as MEDLINE, PsycINFO, CINAHL and PubMed were searched. Relevant and current articles were extracted, reviewed, and analyzed. Articles were screened to find a group of articles that focused specifically on suicide in the elderly and depression in the same group. Editorial, opinion, theoretical, qualitative, and quantitative studies were included in this review.

Inclusion and Exclusion

Studies were considered eligible when the elderly were defined as persons 60 years of age or older in relevant journals. This placed a cut-off for the age definition of the elderly due to the lower numbers of papers for people aged 70 and above. Articles that specified the reason for suicide in the geriatric populations were included in this review. To be included in our review, a study needed to report the correlation of the predictor of suicide or suicidal behavior in the geriatric population. Priority was given to outcomes directly related to suicide and measures of suicidality; secondary priority was given to depression. Only full texts in English were reviewed.

Articles were excluded if they did not focus on suicide in the elderly or if the article focused on suicide and depression in the general population instead of the geriatric population specifically. However, studies that did not specify the predictor of suicidality among the geriatric population were excluded, and articles that did not fall in our age category of elderly were excluded. Furthermore, editorial, opinion and theoretical articles were excluded from the review. Covidence software was used to (**https://www.covidence.org/** (accessed on 15 June 2021 @ Edmonton, Canada)) enhanced the screening and data extraction of the data collected.

Search Strategy

The search strategy included a combination of MeSH terms, keywords, and descriptors: (elderly OR aged OR older OR elder OR geriatric OR elderly people OR old people OR senior) AND (predictors OR indicators or factors OR determinants OR risk factors) AND (depression OR depressive disorder OR depressive symptoms OR major depressive disorder OR MDD OR mood disorder) AND (suicide OR suicidality OR suicidal OR suicidal ideation OR suicidal behaviors OR suicidal thoughts OR death) AND (prevalence or incidence OR epidemiology or frequency OR occurrence). The search included all articles indexed as of 15 June 2021. Duplicates and non-peer-reviewed articles were removed before the remaining abstracts were reviewed. The data were systematized into;

1. Prevalence of depression in the geriatric population.
2. Prevalence and predictors of thoughts of death by suicide, suicidal behaviors, and death by suicide in geriatric population.
3. Methods of suicide.

RESULTS

The flowchart in Figure 3.1 shows that 1340 studies were initially extracted from the identified databases using the Covidence software. Of these, 248 studies were automatically identified as duplicates and removed, leaving 1092 studies screened for eligibility. Further screening done using the inclusion/exclusion criteria, and a full-text review resulted in a final pool of twenty-four studies that were eligible for inclusion in this literature review.

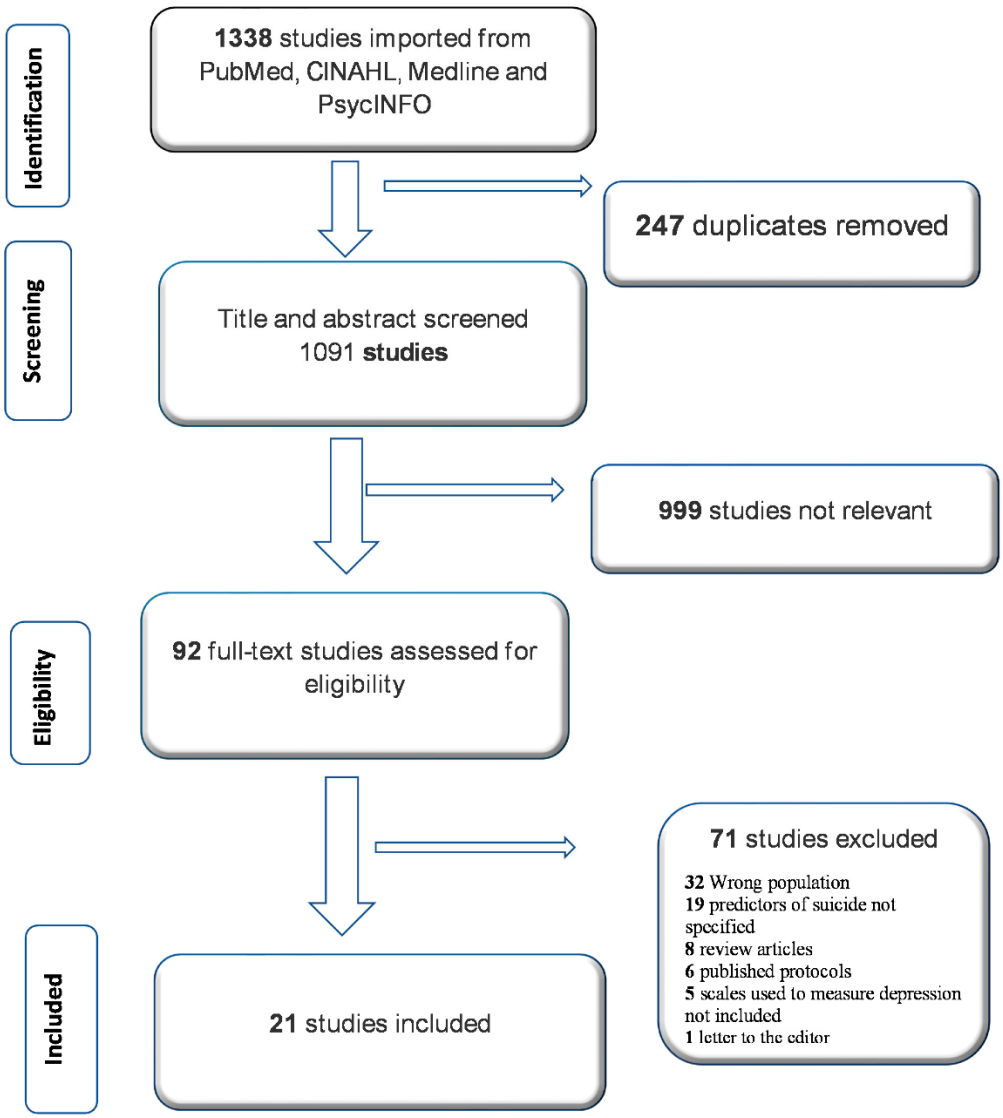

Figure 3.1. PRISMA flowchart of studies selection

The twenty-four studies included a total of 306,173 subjects, and the sample size ranged from 40 [101] to 203,668 [131]. Most studies (11) were published in the last five years, from 2016 to 2021, followed by nine studies from 2010 to 2016 and 4 studies in the year 2000- 2009. Most of the studies were conducted in Asia (48%), Europe 24%, North American studies had 20%, and 4% were conducted in Africa and Australia. Nine studies specified the methods used to commit suicide in the elderly, while other studies did not specify the approach adopted in suicide. About 70% of the studies identified mental illness (specifically depression) as the reason for suicide in the

geriatric population. Twenty-three studies (96%) defined elderly starting from 60 or 65years and above. Table 3.1 reports on the prevalence of depression in the elderly population, whilst Table 3.2 reports on the correlates of thoughts of death, suicidal behavior, and death by suicide in the elderly. Table 3.3 summarizes studies that report on the methods used by the elderly who die by suicide.

Table 3.1. Prevalence of Major Depressive disorder among the elderly

AUTHOR AND YEAR	COUNTRY	POPULATION	SAMPLE SIZE	SCALE USED	PREVALENCE OF MDD
Park J.H. et al. (2010)	Korea	65years and above	1118	Geriatric depression scale (GDS)-Korea	5.37%
Wongpakaran N. et al. (2012)	Thailand	63years -94years	113	Geriatric Depression scale	23.5%
Booniam S. et. al. (2020)	Thailand	Mean age 69.24years	803	DSM-IV AND Thai Geriatric Depression scale	18.64%
Padayachey U. et al. (2017)	South Africa	60 years and above	300	Geriatric Depression scale	40%
Shoib S. et al. (2020)	India	65years and above	200	Beck's Depression Inventory	56%
Wærn M. et al. (2002)	Scandinavia	65 years and above	100	DSM-IV	38%

Table 3.2. Correlates of thoughts of death, suicidal behavior, and death by suicide in the elderly

NAME OF AUTHOR AND YEAR	COUNTRY OF ORIGIN	STUDY DESIGN	TARGETED GROUP	SAMPLE SIZE	REASON FOR SUICIDE	FINDINGS
Crestani C. et al. (2019)	Italy	A retrospective study (autopsy/police report)	60 years and above	538	Mental illness	The highest risk of suicide is observed in the age between 70 and 79 years. Pathological factors were revealed in 427 cases. Mental illness was related significantly to suicidal risk.
Bogers I.C.H.M et al. (2013)	Netherlands	A prospective study	60 years and above	378	Depression and physical injury	Patients reporting thoughts of death but no suicidal ideation were older and more severely depressed, whereas patients with suicidal ideation were also more severely depressed but not older.
Rurup, M. L et al. (2011)	Netherlands	A longitudinal cohort study	58-98 years	1794	Psychiatric comorbidity; dysthymia and panic attack.	Of those who wish to die, 67% had depressive symptoms, and 20% suffered from a depressive disorder.
Altınöz A. E.et al.(2019)	Turkey	A retrospective study	65 years and above	978	Mental illness and financial difficulties.	The most common cause of suicide was a financial difficulty for men and marital conflict for women. The most frequent suicide method among older adults of both sexes was hanging. In all age groups,

						firearms use was more common among men and jumping from a high place was more common among women.
Conejero I. et al. (2018)	Korea	A prospective longitudinal study	60 years and above	1548	Physical illness	Independent relationship between physical health status and suicidal behavior in the elderly. High correlation with the history of suicide attempts in the elderly, and there is independence between depression factors and suicide.
Bogers I.C. et al. (2013)	Netherlands	A prospective multi-site naturalistic study	60 years and above	378	Depression	In depressed older persons, thoughts of death and suicide differ in relevant demographic, social, and clinical characteristics, suggesting that the risks and consequences of the two conditions differ.
Bickford D. et al. (2020)	San Francisco	A retrospective study	65 years and above	225	Perceived stress	Perceived stress was found to be a risk for suicidal activity in depressed older adults.
Booniam S. et al. (2020)	Thailand	A retrospective study	mean age of 69 years	803	Major Depressive Disorder (MDD)	MDD was the main predictor for suicidal ideation; however, agoraphobia and poor perceived social support increases suicide risk.

Razai D. et al. (2020)	Iran	A cross-sectional descriptive-analytic study	65 years and above	1,601	Physical mental illnesses	Successful suicides have been rising, from 3.7 in 2008 to 4.37 per 100,000 people in 2014.
Rossom B. C. et al. (2019)	US	Cross-sectional cohort study	65 years and above	203,668	Depression	Depression severity was by far the strongest predictor of suicidal ideation in older adult patients. Older patients with suicidal ideation should be screened for depression.
Shin K.M. et al. (2013)	Korea	A prospective study	60 years and above	1548	Anxiety, depression, and stroke	This study suggests that there is an independent relationship between physical health status and suicide behavior in the case of elders.
Shoib S. et al. (2020)	India	A cross-sectional study	65 years and above	200	Depression	Depression had a positive correlation with suicidal ideation. Hopelessness and suicidal intent had a more significant positive correlation.
Bergman L.T. et al. (2011)	Israel	A retrospective study	65 years and above	78	Physical illness	Suicidal patients scored higher in the vascular and respiratory section of the cumulative illness rating scale; higher rates of illness among suicidal elderly patients.
Liu B.P. et al. (2018)	China	A paired case controlled	60 years and above	190	Not living with a spouse,	The influence of negative life events increases the risk of suicide in the elderly.

					depressive symptoms	
Sun W. et al. (2010)	China	A cohort Study	65 years and above	56,088	Depression and physical illness	Depressive symptoms were associated with all-cause mortality in men and with suicide in both sexes.
Kaya A. et al. (2020)	Turkey	A retrospective study(autopsy)	60 years and above	17,942	Asphyxia, CNS injury and physical illness	In the summer, June and July, the suicides occurred more frequently in the 65–74 age subgroup.
Adinkrah M. et al. (2020)	Ghana	A descriptive study	60 years to 65 years	40	Lack of finance, indebtedness, cuckoldry, sexual dysfunction, grief, or marital breakdown.	Elderly persons who died by suicide were male, aged 60 to 65 years old, and of low income.
De Leo. D et al. (2013)	Australia	A case-control study	60 years and above	261	Psychiatric diagnosis, hopelessness, past suicidal attempts and living alone	Older adult suicides showed a significantly lower prevalence of psychiatric diagnoses (62%) when compared to middle-aged suicide cases (80%). In both age groups, subjects who died by suicide were significantly more likely to present a psychiatric diagnosis.

Chan H. L. et al. (2011)	Taiwan	A Cross-sectional Study	65 years and above	3,853	Physical illness and depressive symptoms	The point prevalence of elderly suicidal ideation was 6.1%. Female gender, age over 85 years, low level of education, single status, unemployment, no income, disability, current smoking, self-perceived bad to very bad health, depressive symptoms, various physical disorders and pain symptoms were strongly associated with suicide ideation.
Conwell Y et al. (2002)	Monroe (US)	A case-control study (psychological autopsies)	60 years and above	238	Depressive illness	Completed suicides had a more depressive illness, physical illness burden and functional limitations. They were more likely to be prescribed antidepressants, anxiolytic agents, and narcotic analgesics. Among depressed subjects, affective symptom severity and emotional dysfunction distinguished suicide completers.
Wærn M. et al (2002)	Scandinavia	A case-control study (psychological autopsies)	65 years and above	100	Depressive disorder	Ninety-seven percent of the suicide victims fulfilled the criteria for at least one DSM-IV axis I diagnosis, compared with 18% of the living comparison subjects. Recurrent major

						depressive disorder was a very strong risk factor for suicide, as was substance use disorder.
Turvey C. L. et al. (2002)	US	A longitudinal cohort study	66 years and above	14,456	Depressive symptoms, perceived health status, sleep quality, and absence of loved one	This study provided additional information about the context of late-life depression that also contributes to suicidal behavior: poor perceived health, poor sleep quality, and limited presence of a relative or friend to confide in.
Wongpakaran N. et al. (2012)	Thailand	A cross-sectional descriptive study	63years-94years	113	Major Depressive Disorder	23.5% met the criteria for current major depressive episodes and suicide risk was reported for one-third of the elderly.
Harwood, D., et al. (2001)	UK	A descriptive and case-control study	60years and above	154	Depression, personality disorder, and personality trait	Seventy-seven per cent of the suicide sample had a psychiatric disorder at the time of death, most often depression (63%).
Voaklander D C et al. (2008)	British Columbia	A case-control studies	66years and above	602	Lower socioeconomic status, depression and physical illness.	The annual rate of suicide is 13.2 per 100 000. Firearms were the most common mechanism (28%), followed by hanging/suffocation (25%), self-poisoning (21%), and jumping from height (7%). There

						was an elevated risk for those prescribed inappropriate benzodiazepines and those using strong narcotic pain killer.

Table 3.3. Summary of commonest methods used in suicide in the elderly.

AUTHOR AND YEAR	POPULATION	METHODS OF SUICIDE
Crestani C. et al. (2019)	60years and above	Hanging Fall from height firearm
Altınöz A. E. et al. (2019)	65years and above	Hanging Firearm Jump from height
Razai D. et al. (2020)	65years and above	Hanging Poisoning
Kim K.H et al. (2016)	65 years and above	Drug overdoses Pesticide or caustics
Rossom B. C. et al. (2019)	65years and above	Hanging
Shin K.M. et al. (2013)	65years and above	Hanging
Adinkrah M. et al. (2020)	60years to 65years	Hanging and firearm
Kaya A. et al. (2020)	65years and above	Hanging
Voaklander D C. et al. (2008)	66years and above	Medication overdose (benzodiazepine) Firearm

DISCUSSION

This review highlights the high prevalence of major depressive disorder in the elderly and other correlates [132-134]. This literature review included studies from 2000 to 2021, which reflects the time of modernization where more internet and online activities have been on the rise [135]. In many countries, migration of the younger generation to their respective nuclear families have left the geriatric population burdened and their mental health not adequately met [135]. The majority of the studies on depression and suicide in the elderly population were published between 2016 and 2021, which suggests there is an alarming health concern in this population. Annually, The

International Day of Older Persons on 1 October is observed to mark the need to give ear to the elderly well-being and other peculiar needs [136]. Table 3.1 suggests that the prevalence estimates of major depressive disorder in the elderly ranged from 5.37% [137] to 56% [133]. The review also indicates that depression is a major reason for suicide in the elderly [133, 138, 139]. Some studies reported a direct correlation between depression and death by suicide [140-143]. Other studies identified other mental health illnesses as the reason for suicide in the elderly [98, 144, 145] (Table 3.2).

Few of the studies did not report relationships between major depressive disorder and death by suicide [101, 146-148]. Other correlates of death by suicide in the elderly included; physical illnesses [148-150], low socioeconomic factors, living alone and loss of a loved one [147, 151]. One of the articles reviewed revealed that sexual dysfunction and cuckoldry contributed to depressive symptoms in the elderly, which predisposes them to suicidal ideation and even death by suicide [101].

Six articles used validated scales like GDS and Beck's inventory scale and the Diagnostic and Statistical Manual of Mental Disorders in diagnosing depression in the elderly [133, 137-139, 142, 143]. Nine articles identified the dominant methods used by the elderly to complete suicide [98, 101, 131, 144, 150-154].

DEMOGRAPHY AND SUICIDE

Gender differences must be taken into account when suicide is mentioned. Generally, suicide attempts are higher in females than in males [155], and same for the prevalence of anxiety and depression [156]. Females have a 1.5 to 3 higher prevalence of depression compared to males [118]. Elderly women and widowers have high rates of depression as well [123]. However, most countries have suicide rates of 2–3 times higher in males than in females, which could be due to a male preference for higher lethality methods and the reluctance of males to seek help [157].

The male to female suicide ratio in most Western countries is approximately 3:1, and on the contrary, many Asian countries have the reverse of this ratio[158]. A longitudinal study in the USA disclosed that male gender and higher-income projects lethal suicidal ideation [159].

Depressed elderly males are usually likely to report suicidal ideations [160]. Some researchers suggest that the ratio of suicide rate in men compared to women is higher [161]. Women have a high prevalence of suicidal attempts, while completed suicide is successful with men [150]. One significant rationale is the violent methods used by men for suicide. The use of violent methods for suicidal acts increases the likelihood of completed suicide. Gender and age have proven to be analytic risk factors in determining suicide methods [162].

Deaths by suicide are lower among young people, while suicides occurred more frequently in the elderly, 65–74 age group [157]. Epidemiologic and clinical studies using symptoms scales suggest the prevalence of both depression and suicide increase with age [132]. A retrospective study of autopsies and police reports of suicide from 1979 to 2015 realized that, by age, the most prevalent group for suicide was 60 and 69 years until 1990 had a paradigm shift for the highest to be 70 and 79years[98]. According to Crestani et al. (2019), data by gender from the study states that being married does not affect the risk of suicide by men [98].

Liu et al. (2018) researched suicide behaviors among the elderly and non-elderly. In the study, no significant differences in education level, religion, family history of suicide, nor pesticide storage in the household influence completed suicide [97]. Somewhat it differs in several sociodemographic and psychological factors. Elderly living without spouse, poor family economic status and poor social support were exposed to suicide [163, 164].
While other studies do not correlate educational level and depression or suicide, few studies did. A study in China suggested that lower educational status, poor living condition and reduce social interaction with family members pose a risk for lifetime Major Depressive disorder [165]. Interestingly, phone calls and visits of family members were found to be linked to major depressive disorders [165].

CORRELATES OF DEATH BY SUICIDE IN THE ELDERLY

A retrospective review of autopsy reports of individuals aged 60 and older who died by suicide in Turkey between 2005 and 2014 indicated that the majority of the suicides happens in the summer and specifically in June and July [152].

Psychiatric and physical illnesses [98, 145, 149, 150], functional impairment [129, 152] and social/economic factor [144, 153] may contribute to suicide in the elderly. Substance abuse and hospitalization for any physical health problems and diagnoses related to injuries have also predict suicide [159, 166].

MENTAL ILLNESS

Studies have shown that mental health problems strongly correlate with suicide in the elderly [98, 144]. Also, more than half of the studies (autopsies) showed that death by suicide among the elderly is preceded by some psychiatric disorder [140, 145]. In the general population, mental disorders are perceived as increasing vulnerability to suicidal behavior, attempted and completed suicides [167]. However, many researchers show psychiatric conditions, particularly depression as a factor that leads to elderly suicidal behavior [105] since the predominant mental health problem among the elderly is depression [168]. Other studies estimated that 95% of the elderly people who die by suicide had been diagnosed with some mental disorder prior to their death [142, 149, 169]. Due to these observations, regulatory agencies and professional organizations recommend that physicians routinely screen for depressive symptoms [170]. Other psychiatric comorbidities may contribute to suicide among the elderly. Schizophrenia, dementia, anxiety disorders, and personality disorders have proven to increase risk of suicide in elderly suicides but to a lesser degree [154, 171]. Perceived stress has also proven to be a vital direction that increases the risk of suicide among the elderly population diagnosed with major depressive disorder [172].

MAJOR DEPRESSIVE DISORDER

The diagnostic criteria for major depression in the DSM-5 include either sadness or anhedonia with a total of five or more symptoms over two weeks [118]. One important distinction between the DSM-5 and the DSM-IV is that it defined major depressive disorder with the inclusion of bereavement in the former and not in the latter [119, 173]. When the elderly are depressed, thinking may be impaired, making it difficult for a logical verdict [174].

In various studies, the definition of late-life depression is used for major depressive disorder, which occurs at age 60 and above for the first time [175, 176]. These studies indicate that

depression occurring in the elderly for the first time differs from the depression occurring at earlier ages. In terms of clinical presentation, prognosis, and response to treatment [177].
The literature shows that about 5% of major depressive disorder occurs in community-dwelling older adults, and 8 to 16% of older adults have clinically significant depressive symptoms [178]. This result agrees with previously reported findings of the elderly experiencing major depressive disorders [133, 137].

During a psychological autopsy study of completed suicide in late life, sixteen out of eighteen subjects were diagnosed with major depressive disorder [179], which contributed to their death. Furthermore, a postmortem from psychological autopsy to ascertain the reason behind the suicide act of the elderly proved that 71% to 95% were diagnosed with the mental health disorder before suicide [149, 180, 181]. A Case-control Study in four countries and one large urban area in central England established that 63% of 100 sample size of elders who died by suicide, suffered depression before the act [140].

Studies have shown that rates of major depressive disorder increase with medical morbidity. Five studies suggested psychiatric comorbidities correlate with suiciding in the elderly population[98, 144, 145] with a high rate of 37% after acute care hospitalizations [124]. Major depressive disorder has shown to be the commonest psychiatric diagnosis in elderly suicide victims, and it is also the main cause of suicide in the geriatric population [124, 182]. Other studies suggested that a feeling of hopelessness is also common symptomatology in elderly suicide victims [131, 133, 147, 163, 164].

Nonetheless, depression usually coexists with other medical health conditions and disabilities and can be provoked by diseases that affect the elderly such as diabetes mellitus, stroke, heart disease, Alzheimer's disease, Parkinson's disease, and arthritis [106, 164, 183, 184]. In Western and Asian countries, depression as a risk factor of suicidality among the elderly has been confirmed [101]. Elderly men and women experiencing major depression are likely to have suicidal ideation and are more likely to die by suicide [124].

An epidemiological study in an elderly community also reported mild dysphoria and severe depression among the elderly age group [121]. Paradoxically, mild forms of depressive symptoms reduce the quality of life and increase the sense of hopelessness, resulting in suicide in the elderly

and suicidal ideation [185]. A study of 969 people aged 75years and over revealed that 13.3% of the subjects had suicidal thoughts, notwithstanding, 26.7% had major depressive disorder while 50% were depressed [186].

The interpretation of these studies is akin; suicidal ideation and completion are correlated to major depressive disorder. The characteristic symptoms of elderly suicides with depression are less described; moreover, it aids in fishing out predictors of suicide [187]. A study by Conwell et al. (1996) reported that 76% of elderly suicide victims had psychopathology; 54% with major depression, and 11% with minor depression [124, 188].

There is complexity in the depressed elderly and other predictors in elderly people who have already been diagnosed with depression. Most comprehensive studies in elderly suicide have reported the prevalence of major depression and other mood disorders ranging from 60% to 90% during an exhaustive research [187]. Depression cannot be speculated as the sole predictor of suicidal behavior at the expense of other psychiatric comorbidities [145, 189].

Suicide is a complex event with multiple causes [115]. According to the literature, there are various predictors of suicide in old age [129, 190]. Before the elderly die by suicide, approximately 30% of this population express their desire to die to close contact [191]. It is quite unfortunate family/close contacts do not respond to this pressing need; hence professional assistance is not sought. Report has shown that approximately six million Americans 65 years or older are affected by depression, but only 10% of those affected receive treatment [184, 192].

PHYSICAL ILLNESS

The existence of serious illnesses is another precursor and a significant risk factor for suicide among the aged, especially cardiovascular conditions, with prevalence ranging from 34% to 94% [149, 193]. Cancer and liver conditions may cause depression in the elderly while medications to treat pain may be abused by some elderly [151]. Malignancies accompanied by severe pain in the elderly also have a high association with suicide [151]. Studies suggest that many elderly die by suicide because they feared they had cancer than actually dying by suicide due to cancer [194]. A

study by Brown et al. (1986) revealed that, among 44 terminally ill elderly patients, one out of four expresses a desire to die by suicide [195].

In a controlled psychological autopsy study of suicide in late life, eight victims(all men) believing they had cancer played a major role in the decision to end their lives [196]. Most of these numbers had diagnosable major affective disorders, but none had sort mental health care [196]. Although physical illness and functional impairment increase the risk of suicide in the elderly, their influence appears to be mediated by depression [141].

Whereas physical illness correlates directly to suicide in the elderly [148], Shin et al. (2020) also revealed that there is an independent relationship between physical health status and suicide behavior in the case of elders [154].

SOCIAL/ECONOMIC FACTOR

Sociopsychological autopsies among 122,044 dead elderly subjects reported that social factors promoted suicide in these elderly [179, 197], contributing to depressive symptoms [101, 163]. These include financial problems, poor occupation, relationship difficulties, family conflicts, social isolation, and loneliness [101, 115, 153]. Psychosocial stressors such as a spouse or loved one's death and traumatic mourning [105] may trigger a depressive episode, although transient reactions to major losses can resemble depression [101, 105, 164, 178]. In addition, the same researchers found that limited social interaction contributes to suicidal ideation and suicide in the geriatric population [198]. Making inadequate social interaction a major problem in the elderly [115].

A sense of interaction and socialization will minimize suicide in there elderly and is a protective factor, even when elderly are not faced with mental disorders [197]. Good social support therefore serves as a protective factor against suicide in the elderly [97].

Some authors distinguish between living alone and loneliness [147]. Interviews with the next of kin of the deceased elderly revealed that most elderly lived alone before their dead by suicide [147]. Living alone can be the decision of the elderly; on the contrary, loneliness may also occur despite living with people [115]. In a retirement community, hopelessness was found to be a predictor of suicide [199].

Somatic symptoms disorder is another risk factor for suicidal thoughts for older adults in the community [200], which may not be associated with depressed older adults[160].

SUBSTANCE USE

The rate of substance use disorders among older adults who die by suicide is minimal, with a prevalence range of 5% to 40% [159, 166]. However, these values should not be underrated. The toxicological screening was done at the time of death for 96 Honolulu older adults, and analysis revealed about 54% alcohol or possible habituating substance misuse on postmortem [201].
Although women are twice as likely as men to meet the criteria for major depression, they are one-fourth less likely than men to commit suicide [120]. Men who are depressed have a higher prevalence of comorbid alcohol and substance abuse than women [120, 202]

Studies have observed that depression in elderly suicide is usually without comorbid substance abuse or personality disorders compared to young adults [203]. Substance use without any comorbid affective disorder is unlikely among the elderly [188, 203]. A study to compare substance abuse without comorbid mood disorder in two age groups revealed 39% of the 16–30 age group and 8% in the 60–88 age group experience substance abuse without comorbid mood disorder [193]. Only substance abuse or other mental health problems in late life suggest that dual analysis may be a less essential risk component for elderly suicide than young adults [193].
An increase in alcohol consumption may awaken depressive symptoms and anxiety. Moreover, this may diminish social support and trigger suicide. Older men who continue to abuse alcohol in conjunction with stress from society may be fatal [203]. Alcoholism and late social support can be a trigger for completed suicide [203].

METHODS OF SUICIDE

A summary of some of the commonest methods used in suicide is seen in table 3.3. Studies have shown that preferred suicide methods differ by age and country [152]; irrespective of country-specific suicide patterns, hanging, pesticide suicide and firearm dominate [204]. All articles which researched the methods of suicide in this review reported hanging as the dominant method [98,

131, 154]. However, Altınöz A. E. et al.(2019) found that firearms are commonly used in men while jumping from a height was more common among women [144]. It is estimated in the USA that over 60% of the elderly who completed suicides use firearms, with white men engaging in this practice habitually [187].

A systematic review conducted in China revealed that pesticides are frequently used for suicide in rural areas among the general population [205]. Ingestion of agricultural chemicals or rat poison was the most common method (34.3–66.6%) [205]. Other methods include drowning in rivers or wells, jumping from heights, poisoning with other substances, traffic accidents, electrocution and carbon monoxide poisoning [206, 207]. In India, drowning, hanging, and poisoning are ranked the common methods of suicide(63%)[206, 208]. This finding contradicts Western countries, where firearms, hanging and drug ingestion are adopted in suicide, with the former being the commonest [209]. Despite the significance of depressive disorder in elderly suicide, most studies report considerably insufficient/inept use of antidepressants before death [151, 210].

A psychiatric assessment among 69 old adults in southern Sydney revealed 81% of the elderly 65 years and over attempted suicide with overdoses of medications like narcotic pain killer and diuretic use; benzodiazepine represents 64% of this group [151, 204]. Violent methods of suicide are less common with aging [194]. Methods such as firearm suicide and hanging are more frequent among men, while women choose poisoning or drowning, which are less violent and less lethal [204].

A study of 538 subjects aged 60 years on over showed that 32.52% hanged themselves as means of dying by suicide. Out of that number, 27.88% were men while 4.64% were females [98]. The same study revealed that fall from height was the second most common method used after the former, then drowning and firearm [98]. Kim et al. (2016) researched the suicide attempts in adults and the elderly population in Korea and emphasized that poisoning with pesticides and caustics was more common in the elderly while cutting/piercing was more common in the non-elderly. This concludes that most elderly suicide attempters prefer less-lethal methods [211]. Most of the older people stay alone, making elderly suicide occur at home. They are usually fragile and may be experiencing some physical impairments, making them unable to leave their homes where they choose to die by suicide [152].

PUBLIC POLICY AND PRACTICE IMPLICATIONS

Improved detection and early interventions are crucial in preventing suicidal attempts and completed suicides. Depression which is a vital predictor of suicide must be targeted and treated. Interpersonal psychotherapy and Cognitive-behavioral therapy can be effective, yet appointments are required [212]. Notwithstanding, internet- delivered cognitive behavioral therapy may be recommended [192]. Supportive text messages programs like "Text4Hope" have proven to reduce depression and suicidal ideation effectively [213].

The National Strategy for Suicide Prevention emphasized that detection and treatment of depression is an approach to prevent late-life suicide [214]. Policymakers and mental health professionals need to make a conscious effort to improve mental health services among the geriatric population, reduce the risk of suicide and improve the quality of elderly life.

Social interventions such as providing enjoyable activities and increasing interaction with peers should be encouraged. Although this can be difficult to accomplish due to the elderly's limited mobility and reluctance to participate, they need to be encouraged. The best treatment regimen should be provided for the elderly to treat psychological and physical illnesses to minimize suicide. Nonetheless, most patients with depression and other common mental disorders are treated in general medical settings. Evidence shows that treating depression in patients with physical illnesses positively affects psychological and physical health [215].

LIMITATIONS

The search strategy appraised only studies published in the English language. Although much effort was made to identify all relevant studies for this literature review, some relevant studies may be missing, especially those published in other languages. Notwithstanding the limitations of the study, this review provides insight into the prevalence of depression in the elderly, suicidality among the elderly and some intervention to curtail suicide in the geriatric population.

CONCLUSION AND FUTURE DIRECTIONS

The findings from this study provide an understanding of suicide among the elderly. Factors contributing to suicide in the elderly include physical, psychological, and social problems. This review has highlighted the predisposing factors for death by suicide, such as malignancy, medical comorbidities, mental health illnesses including major depressive disorder, and loneliness.

Depression was found to be the most dominating predictor of death by suicide among the elderly in most of the studies. Factors such as loss of a loved one, chronic pain, loneliness, financial constraints, and lack of interaction could trigger depression and suicidal thinking [101, 147, 164].

Older adults (60 years and above) who experience depression or other physical comorbidities are usually faced with difficulties and may have a feeling of hopelessness [147]. Geriatric depression is a complex disorder with multiple risk factors. There is a correlation between age, depression, suicidal ideation, and death by suicide. Any form of action taken by the elderly should be investigated, and appropriate interventions applied.

Other mental illnesses also contribute to suicide in the elderly but have a lower effect [141, 163]. Physical illness and functional impairment may increase the risk of suicide but is usually triggered by depression. Lack of social interaction is an independently associated risk factor for suicide in later life [141, 163].

The study also revealed that gender differences influence the method used in suicide. In the general population, men prefer violent methods of dying by suicide and elderly men often use firearm for suicide. Elderly women are often depressed than elderly men. While elderly women have more suicidal ideation, completed suicide in observed more in elderly men. However, Suicide rates are higher in later life than in any other age group [144, 183].

Government and policymakers can improve the mental health of the elderly to reduce suicidal risk. E-mental health services can be incorporated to improve geriatric mental health. Early detection of physical illnesses and effective social interaction is recommended to improve the mental health of the geriatric population.

3.2. A Scoping Review on the Prevalence and Determinants of Post-Traumatic Stress Disorder among Military Personnel and Firefighters: Implications for Public Policy and Practice

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Abstract

Background

Firefighters and military personnel are public safety personnel who protect the safety of individuals and their properties. They are usually exposed to traumatic events leaving them at risk of developing mental health conditions such as post-traumatic stress disorder (PTSD). Increasing concern has been raised regarding the mental health impacts, specifically PTSD, among military personnel and firefighters.

Objective

There is an increased exposure of firefighters and military personnel to traumatic events and the attendant risk of developing post-traumatic stress disorder. It is crucial to ascertain the level of PTSD amongst this cohort and determinants to formulate policies and practices that mitigate the risk and protect public safety personnel. This scoping review sought to determine the prevalence of PTSD among this cohort globally and to explore determinants of this mental health condition.

Methods

A literature search in databases including MEDLINE, CINAHL, PubMed, PsycINFO, and EMBASE was conducted electronically from May 2021 to 31 July 2021. Two reviewers independently assessed full-text articles according to the predefined inclusion criteria and screening process undertaken to identify studies for the review. Articles were screened with a third reviewer, resolving conflicts where necessary and further assessing them for eligibility. During

article selection, the PRISMA checklist was adopted, and with the Covidence software, a total of 32 articles were selected for the final examination. For the eligible studies, data extraction was conducted, information was collated and summarized, and the findings were reported. Original qualitative and quantitative data on the prevalence and predictors of PTSD among veterans, military, and firefighters were reported.

Results

The prevalence of PTSD ranged from 1.9% to 57% for firefighters and 5.37% to 37.8% for military personnel. Demographic factors, job factors, social support, injuries, physical and psychological factors, and individual traits were the main predictors of PTSD in this cohort.

Conclusion

This information is vital for developing and implementing prevention and intervention strategies for PTSD in military personnel and firefighters. Recognizing and addressing factors that predict PTSD will help to improve mental wellbeing and increase productivity. More peer-reviewed studies are needed on the prevalence of PTSD amongst these cohorts.

INTRODUCTION

Post-traumatic stress disorder (PTSD) is a mental disorder commonly reported among military personnel and firefighters [29]. This condition is usually chronic and may affect all aspects of life. Firefighters and military personnel fall into the category of public safety personnel (PSP) [216] due to their job description. They face many traumatic situations due to the nature of their work, and in the process of saving lives and property, they may sustain injuries and endanger their own lives [37]. This is amplified for military personnel deployed to war zones, who are exposed to a range of traumatic events, such as exposure to explosives [217]. Firefighters are usually the first point of call-in domestic emergencies, such as fires, and are known as first responders. They save people's lives, confront injuries and death associated with natural and artificial disasters, at times under the threat of personal injury, and prevent death or attempt to limit the damage. These

potentially traumatic events are essential and set firefighters apart from other first responders, and they pose a significant psychological burden in this field of work [218-220].

PTSD can coexist with other conditions. In addition to PTSD, firefighters and military personnel are significantly at risk of experiencing other mental health conditions such as depression and anxiety due to the nature of their job [217, 221, 222]. The Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5), defined a traumatic event as experiencing, witnessing, or being confronted with at least one occasion of severe injury, threatened death, or sexual violence. The prevalence of PTSD may be influenced by occupation and the nature and severity of continuous exposure to traumatic events [223]. PTSD rates are very high among PSPs, including firefighters and military personnel [216]. This ranges from one-third to more than one-half of those exposed to potentially traumatic events [222]. The National Fallen Firefighters Foundation (NFFF) of the US shows that due to the diversity of the job description of other first responders, traumatic events differ, as does exposure to PTSD [224]. The prevalence of PTSD in combat veterans is estimated to be between 10% and 15%, with lifetime prevalence estimates ranging from 12% to 30% [225]. A critical review by Richardson et al. (2010) in the US and UK revealed that the point prevalence rate of PTSD for military personnel ranges from 2% to 17% [226]; the US military personnel returning from Afghanistan or Iraq recorded a higher prevalence of PTSD as compared to the UK military personnel returning from Afghanistan or Iraq [227].

Globally, it is estimated that 10% to 35% of first responders, including firefighters, experience mental disorders [223, 228]. A meta-analysis examining mental disorders among ambulance personnel found estimated prevalence rates of 11% for PTSD, 15% for depression, 15% for anxiety, and 27% for general psychological distress [229]. The study showed that PTSD is common among PSPs [229]. A study by Durham, McCammon, and Allison (1985) revealed 80% of rescue, firefighter, medical, and police personnel who treated victims of an apartment building explosion reported at least one symptom of PTSD [230, 231]. The prevalence figures of PTSD in these groups were found to vary widely from 0% [232] to 46% [233]. Prevalence rates of PTSD symptoms of firefighters have ranged from 6.5% to 37% [234]. The significant variance in the prevalence rates of PTSD symptoms may be explained in the research population that is examined. When examining firefighters, military personnel, police, and paramedics specifically; PSPs in general;

or a mixture of the individual professions, the sample sizes and selection of PTSD measures influence the results.

Researchers exploring the prevalence of PTSD in military personnel and firefighters have examined specific predictors and risk factors to better understand the values; amongst the commonly studied variables are gender, previous psychiatric history, and age [234, 235]. The National Vietnam veterans Readjustment Study (NVVRS) selected 3016 American veterans as representative of personnel who serviced in the armed forces during the Vietnam period. The estimated lifetime prevalence rates of PTSD among these veterans were 30.9% and 26.9% for men and women, respectively [30].

The World Health Organization (WHO) completed an epidemiological study among 200,000 respondents in 27 countries [223]. The first 17 countries completed the World Mental Health Surveys. The results estimated lifetime PTSD prevalence ranges, from a low of 0.3% in China to 6.1% in New Zealand [30]. The PTSD rates found in the rescue teams ranged from 5% to 32% [236], with firefighters having a 21% rate [236]. However, the prevalence rates of PTSD for firefighters in the USA ranged from 8% to 22% [234, 237]. The Canadian Community Health Survey of 2012 suggested a prevalence rate of PTSD of 1.7% among the Canadian population and 17% among firefighters [216], while male firefighters recorded a 20% rate of PTSD [44, 238]. A study conducted among 677 individuals experiencing different types of traumas in Los Angeles revealed that 31% met the criteria for PTSD [239]. Notwithstanding, a meta-analysis reported a 7% prevalence of PTSD among firefighters [218]. A study on the mental health of firefighters in 16 provinces in China found 11% of firefighters' mental well-being was poorly catered for, with 5% not cared for at all. Firefighters and military personnel experiencing PTSD may experience decreased productivity, increased risk of suicide, and poor social interactions [240]. Canada lost about 1.3% of its Gross Domestic Product (GDP) due to reduced labor output among workers with PTSD [216].

PTSD may co-occur with other mental illnesses or manifest symptoms similar to other mental illnesses. This may cause it to be misdiagnosed, resulting in the risk of appropriate and adequate treatment not being administered [240]. Determining the prevalence and determinants of PTSD among military personnel and firefighters will support the health and improve the quality of life in

this cohort. To the best of our knowledge, this is the first scoping review article to examine the prevalence and determinants of PTSD in military personnel and firefighters. Epidemiological studies, whilst useful in this context, do not specifically explore all the different determinants of PTSD, nor the prevalence of PTSD in this population. Thus, this scoping review was conducted to synthesize the data on PTSD regarding its relation to military personnel and firefighters. Specifically, we aimed to explore the literature related to the prevalence and determinants of PTSD among these PSPs.

METHODS

This review was designed and conducted in adherence with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) statement [241]. This scoping review followed Arksey and O'Malley's five-stage approach to scoping reviews [84].

A literature search was conducted in five databases, including PubMed, MEDLINE, PsycINFO, CINAHL, and EMBASE. A comprehensive review was completed, including articles from January 1985 to August 2021. Two reviewers independently assessed full-text articles according to the predefined inclusion criteria and screening process undertaken to identify studies for the review. Articles were screened with a third reviewer, resolving conflicts where necessary and further assessing them for eligibility. Relevant and current articles were extracted, reviewed, and analyzed. Articles were screened with an overall goal of finding a group of articles that focused explicitly on PTSD among firefighters and military personnel. Qualitative and quantitative studies were included in this review. Furthermore, editorial, opinion, and theoretical articles were excluded from this review. All included papers were published in peer-reviewed journals.

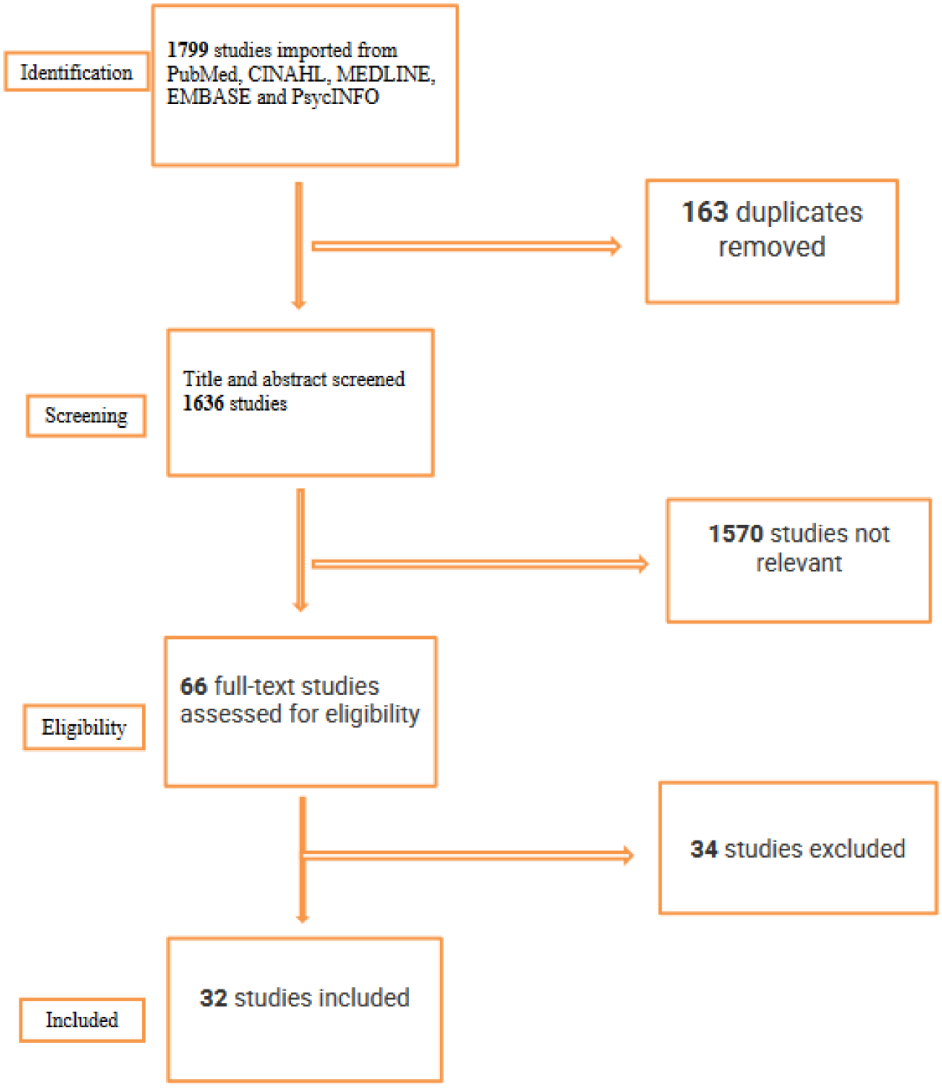
Inclusion and Exclusion Criteria

Studies were considered eligible when they identified the prevalence of PTSD among firefighters, veterans, or military personnel from relevant journals. All articles were published in the English language.

We excluded articles if they did not focus on PTSD among firefighters or military personnel or did not identify the predictors of PTSD and its prevalence. Grey literature was not scoped, as some authors indicate that searching grey literature requires large investments of time, yields very little relevant material, and is not often considered appropriate by researchers [83]. In addition, only full texts in English were reviewed.

The search strategy embraced a combination of MeSH terms, keywords, and descriptors including (PTSD OR post-traumatic stress disorder OR traumatic stress disorder OR stress disorder), (firefighters OR firemen OR fire fighters OR fire service OR firefighting), (military OR veterans OR soldiers OR armed forces), (predictors OR risk factors OR causes OR predisposition OR determinants OR cause), and (prevalence OR incidence OR epidemiology OR frequency OR occurrence OR statistics). The characteristics and results reported in each included article are described and the information is summarized in detail in the PRISMA flow diagram (Figure 3.2.1).

Figure 3.2.1. PRISMA flow chart of study inclusion process



RESULTS

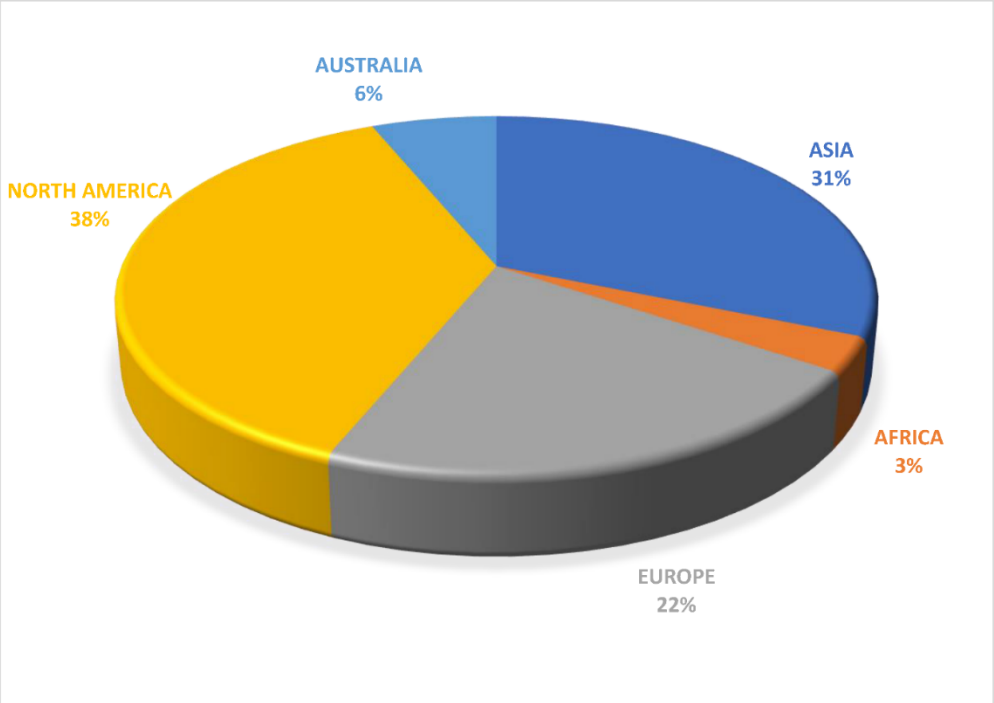
Characteristics of Studies

The search strategy identified a total of 1799 studies from the electronic databases searched using Covidence software (Covidence.org: Melbourne, VIC, Australia). The Covidence software automatically screened and removed 163 studies as duplicates. The remaining items (1636) were screened against the eligibility criteria set by the authors based on the title and abstract only, yielding 66 remaining records for full-text screening. Thirty-four studies were excluded in the full

text screening phase, leaving a final pool of 32 studies that were eligible for inclusion in this scoping review.

The thirty-two studies included a total of 306,173 subjects. This scoping review included studies from 2005 to 2021. The majority of studies (75%) were published in the last ten years (2011 to 2021), 25% were from 2005 to 2010, and seven studies were from 2005–2009. Most of the studies were conducted in North America (38%), Asia (31%), and Europe (22%), while African and Australian studies represented 3% and 6%, respectively (Figure 3.2.2). In total, 50% of the studies examined firefighters, while the other 50% examined military personnel.

Figure 3.2.2. Summary of continents selected for the review.



The samples of these studies mainly consisted of firefighters and military veterans and soldiers. The sample sizes ranged from $n = 43$ [242] to $n = 31{,}534$ [243]. The PTSD Checklist, Civilian Version (PCL) [90] is a 17-item self-report measure of PTSD symptoms. The items assess the individual's experience of PTSD symptoms over the past month. The PCL has two versions: the PCL-M (reexperiencing symptoms explicitly written for military) and the PCL-C (reexperiencing symptoms written generically to apply to any traumatic event) [90]. The PCL-M version that

measures PTSD symptom severity comprises 17 self-report items rated from 1 to 5 points on a Likert-type scale [244]. A cut off starting from 50 or higher and the presence of the symptoms suggest a moderate or high level per the DSM-IV algorithm for diagnosing PTSD, which is commonly used to screen for PTSD [245].

Other studies have used the Impact of Event Scale-Revised (IES-R) Korea version, comprising 22 items in Korean for self-reported PTSD symptoms experienced in the past seven days related to a specific stressor. The symptoms include intrusion, numbing, avoidance, and hyperarousal. Total scores range from 0 to 88, with PTSD positivity being indicated by a score of 18 or higher [32, 246]. Similarly, other authors adopted the German Version of the Post-Traumatic Symptom Scale, with values above 12.5 being associated with a suspected diagnosis of PTSD [247]. The Japanese version of the IES-R comprised 22 items, with scores of 25 or more indicating PTSD [248]. One of the articles used in this review assessed PTSD with the SRIP, a Dutch-validated and reliable self-administered questionnaire [249]. This questionnaire consists of 22 questions, with higher score indicating more PTSD symptoms (range 22–88) [249].

PTSD in DSM-V is categorized under Trauma- and Stressor-Related Disorders, a group focused on behavioral symptoms, including four distinct diagnostic clusters instead of three; “re-experiencing, avoidance, negative cognitions and mood, and arousal” [250]. On the other hand, the DSM-IV criteria classify PTSD as an anxiety disorder. DSM-5 requires one re-experiencing, one avoidance, two cognition- and mood-related, and two arousal- and reactivity-related symptoms out of 20 qualifying symptoms. Moreover, researchers adopting either DSM-IV or DSM-V need to consider symptoms lasting at least one month and impaired functioning. To use ICD-10 criteria, individuals must exhibit one re-experiencing symptom, one avoidance symptom, and one feeling of continued threat symptom out of 17 qualifying symptoms [250]. The majority of the studies used in this scoping review adopted a pre-existing PTSD checklist either based on DSM IV, DSM V, or ICD 10/11.Table 3.2.1 and Table 3.2.2 outline the factors examined by each of the 32 included studies. The prevalence rates of PTSD among firefighters ranged from 1.9% [251] to 57% [252], while for military personnel the rates ranged from 3.72% [253] to 37.8% [244]. The study instruments used to measure the level of PTSD and its predictors also varied. Relevant and detailed methodological information was extracted and summarized from the various studies and is presented in Table 3.2.1 and Table 3.2.2.

Table 3.2.1. Summary of studies with prevalence and predictors of PTSD among Military Personnel.

Author and Year	Country	Study Design	Size	Occupation	Prevalence of PTSD and Measure	Predictors
Grieger T.A. et al. (2006) [31]	US	Cross-sectional and longitudinal	243	Soldiers	28.4% (1, 4, 7 months) PTSD Checklist, Civilian Version	Physical problem Severity Combat exposure Deployment length
Jakupcak M. et al. (2008) [244]	US	Retrospective	108	Veterans deployed to Iraq/Afghanistan	37.8% PTSD Checklist, Military Version	Poor health function Combat and chemical exposure
Tracie S.M. et al. (2013) [254]	US	Cohort	238	National Guard soldiers	12.60% DSM-IV-TR	Combat exposure Life and family stress during deployment Post-deployment social support
Connell M.A. et al. (2013) [255]	South Africa	A cross-sectional and descriptive study	1527	Veterans	33% Impact of Event Scale—Revised	Exposed to combat during the border war
Forbes D. et al. (2016) [256]	Australia	Retrospective study	1025	Veteran peacekeepers deployed on one or more of seven UN-	16.8% World Mental Health Survey Initiative version	Age at the time of deployment was Traumatic life events exposure

				sanctioned interventions between 1989 and early 2002.	of the World Health Organization's Composite International Diagnostic Interview, Version 3.0 (CIDI)	In terms of overall life experiences, the most common PTEs were Transport accidents physical assaults and the sudden unexpected death of someone close
Zamorski M. et al. (2016) [257]	Canada	Longitudinal	2002 and 2013 (n = 5155 and 6996, respectively)	Armed forces	DSM-IV 5.3%	Traumatic exposure
Wang H. et al. (2011) [258]	China	Retrospective	1056	Military	6.53% Davidson Trauma Scale Earthquake Experiences Scale	Traumatic exposure/earthquake experience not having received psychological counseling regular drinking
Liu B. et al. (2016) [259]	China	Cohort study	303	Veterans	29.0% The Post-Traumatic Stress Checklist—	Combat exposure Social support Family-disclosure norms

					Civilian Version	
Sandweiss D.A. et al. (2011) [260]	USA	Cohort	22,630	Military personnel deployed to Iraq and Afghanistan	8.10% DSM-IV	Self-reported preinjury Psychiatric status
Hu Y. et al. (2020) [261]	USA	Cross-sectional	1042	Veteran	7.1% PTSD Checklist	Current Depression Current insomnia Concussion Low social support
Iversen A.C. et al. (2008) [253]	UK	Cross-sectional	4762	Military personnel deployed to Iraq	3.72% PTSD Checklist	Deployed to a 'forward' area Low morale and poor social support within the unit and non-receipt of a home-coming brief (psychoeducation)
Macera C.A. et al. (2014) [243]	USA	Cohort	31,534	Military personnel deployed to Afghanistan or Iraq	5.38% DSM-IV	Combat exposure or other deployment-related characteristics
Rona R.J. et al. (2012) [262]	UK	Longitudinal Cohort study	6292	Military personnel Iraq	3.90% PTSD Checklist, Civilian Version (PCL-C)	Higher educational qualification Feeling unsupported on return from deployment Deployed not with parent unit Multiple physical symptoms

						Perception of poor or fair health Older age and Perception of risk to self
Macgregor A.J. et al. (2013) [263]	USA	Cohort	1777	Military personnel	25.15% ICD-9	Previous mental health diagnosis within 1 year of deployment Previous Battle injury
Van Liempt S. et al. (2013) [249]	Dutch	Prospective longitudinal cohort	453	Military personnel deployed to Afghanistan	6.6% Self-Rating Inventory for PTSD (SRIP)	Existence of pre-deployment nightmares is associated with an increased risk for the development of PTSD
Stevelink S.M.A. et al. (2018) [264]	UK	Cohort study	10,272	Military personnel	6.2% PTSD Checklist (PCL-C)	Deployment to Iraq or Afghanistan and a combat role during deployment were associated with significantly worse mental health outcomes and alcohol misuse in ex-regular personnel but not in currently serving regular personnel.

PTDS—Post Traumatic Stress Disorder, DSM—Diagnostic and Statistical Manual of Mental Disorders, ICD—International Classification of Diseases

Table 3.2.2. Summary of studies with prevalence and predictors of PTSD among Firefighters.

Author and Year	Country/Religion	Study Design	Size	Occupation	Prevalence of PTSD and Measure	Predictors
Del Ben K.S. et al. (2006) [234]	US	Cohort	131	Firefighters	8% PTSD Checklist Impact of Event Scale	Previous psychological treatment Age at which one started work Miscellaneous Calls Response of horror following the firefighter's Single Worst Event
Na K.S. et al. (2017) [265]	Korea	Cross-sectional	507	Firefighter	27.4% Impact Event Scale-Revised Korean Version	Age Duration of service Marriage Depression
Alghamdi M. et al. (2016) [252]	Saudi Arabia	Randomized, controlled	200	Firefighters	57% Screen for Post-traumatic Stress Symptoms (SPTSS)DMS-IV	Anxiety Depression Passive coping strategies
Heinrichs M. et al. (2005) [242]	Germany	Prospective Follow-Up Study	43	Male firefighters	At 24-month follow-up, 16.3% met the criteria for PTSD and 18.6% subsyndromal PTSD according	Preexisting high levels of hostility Low levels of self-efficacy Personality traits

					to the PTSD Symptom Scale	
Jo I. et al. (2018) [266]	South Korea	Retrospective	109	Firefighters	Full PTSD criteria was 2.7% and partial PTSD was 2.7%, Thus, 5.4% of the participants were in high risk of PTSD. Impact of Event Scale-Revised-Korean version	Burnout
Armstrong D. et al. (2014) [267]	Australia	Cross-Sectional Study	218	Firefighters	23% Impact of Events Scale-Revised (IES-R)	Organizational stress Traumatic events Job stress Cognitive coping
Saijo Y. et al. (2012) [268]	Japan	Cross-sectional	1621	Firefighters	9.7% Japanese version of the Impact of Events Scale-Revised (IES-R)	Depression Job stress Social support
Langtry J. et al. (2021) [269]	UK Ireland	Cross-sectional	1300	Firefighters	Complex PTSD criteria were met by 18.23% and PTSD criteria were met by 5.62% of the sample	Experiencing higher levels of service-related trauma significantly increased the risk for both PTSD and CPTSD, and non-

					International Trauma Questionnaire ICD-11 criteria	work-related trauma uniquely predicted CPTSD but not PTSD.
Chung I. S. et al. (2015) [32]	Korea	Cross-sectional	185 male firefighters	Firefighters	35.1% Impact Event Scale-Revised Korean Version (IESR-K)	Job duration Age Masculinity-femininity (Personality) Social introversion (Personality) Job stress
Meyer E.C. et al. (2012) [38]	USA	Cross-sectional	142	Firefighters	6.4% The PTSD Checklist-Civilian	Lower education Low Social Support Higher Occupational Stress
Noor N. et al. (2019) [44]	USA	Retrospective	75 female and 2564 male	Firefighters	Twenty per cent of the women and 12% of men reported relatively high levels (≥39) of PTSD symptoms. The PTSD Checklist—Civilian Version	Depression Having seen mental health professional General stress
Shi J. et al. (2021) [251]	China	Cross-sectional	261	Firefighters	1.9% PTSD Checklist for DSM-5	Perceive stress Social support Rank (Soldiers and sergeants)

Soravia L.M. et al. (2020) [247]	Switzerland	Cross-sectional	239	Firefighters	8% German Version of the Post Traumatic Symptom Scale (PTSS-10)	Female sex Previously experienced work-unrelated trauma Work-related trauma Years on the job Dysfunctional coping strategies Problem-focused coping strategies and self-efficacy
Soo J. et al. (2011) [270]	USA	Longitudinal	11,006	Exposed World Trade Center—Firefighters	7.4% PTSD Checklist	Concurrent conditions and behaviors, such as Respiratory symptoms, exercise, and alcohol use also play important roles in contributing to PTSD symptoms.
Sun X. et al. (2020) [271]	China	Cross-sectional	409	Firefighters	4.89% PTSD checklist for DSM-5	Firefighters whose majors were Information Communication and Equipment Safety reported higher levels of depression and PTSD
Chen Y.S. et al.	Taiwan	Two-stage survey	410	Firefighters	10.5% PTSD Checklist	Mental status

(2007) [272]						Psychosocial stressors, or perceived physical condition

PTDS—Post Traumatic Stress Disorder, DSM—Diagnostic and Statistical Manual of Mental Disorders, ICD—International Classification of Diseases.

PREDICTORS FOR PTSD

Demographics Factors

The relationship between demographics and PTSD has been examined in some studies. For example, the age at which one starts work as a firefighter, as well as the age of the military personnel at the time of deployment to war, affects the development of PTSD [32, 234, 256, 262]. Furthermore, marital status [272] and female sex [247] among these cohorts have been found to influence the occurrence of PTSD. Some studies showed that educational level influences PTSD, while other studies found conflicting results, for example for military personnel deployed to Iraq with higher academic qualifications [262] and for firefighters whose majors in education were information communication and equipment safety [271]. On the contrary, Meyer et al. (2012) explained that lower educational status might expose firefighters to an increased risk of developing PTSD [38].

Organization Factors

The hierarchy of rank in service is associated with PTSD, with soldiers and sergeants demonstrating higher levels of PTSD than officers. The duration of service was also associated with PTSD; the longer one stays in service, the more exposed one is to experiencing PTSD [31, 32, 247, 269]. Some studies examined organizational or job stress as a contributor to experiencing PTSD in both firefighters and military personnel [267, 268]. Higher occupational stress [38] and burnout [266] were significant factors related to work-related PTSD. Exposure to traumatic events at work or due to one's job description [234, 256-258, 269] and the exposure of military personnel

deployed to other countries during combat [31, 243, 244, 253-255, 259, 264] were the most significant predictors in these studies. Moreover, Soravia et al. (2021) suggested that even previously experienced work-unrelated trauma can predispose firefighters to PTSD [247]. Another study showed an association between injuries received prior to being employed in the profession [260, 263] and PTSD.

Comorbidity

The development of PTSD cannot be mentioned without psychological disorders being mentioned, since these play a vital role in the development of PTSD [218]. Some studies revealed that pre-existing mental health conditions such as anxiety disorder [252] and depression [44, 268] , among other mental health comorbidities, can predict PTSD among firefighters [234, 251, 272] and military personnel [260, 263]. However, other studies have suggested that physical illnesses also contribute to PTSD among these groups [31, 272]. Poor health function [244] and concurrent conditions and behaviors, such as respiratory symptoms, exercise, and alcohol use, also play important roles in contributing to PTSD symptoms [270]. Specifically, pre-deployment nightmares among military personnel are associated with an increased risk of developing PTSD [249].

Social Support

Social support is a significant predictor of the development of PTSD [218]. Psychosocial stressors in the life of military personnel and firefighters have been shown to increase the risk for incurring PTSD. Tracie et al. (2013) explains that life and family stress during the deployment of military personnel [254, 259] and lower social support [38, 251, 259] are triggers for PTSD, while post-deployment social support is a protective factor [254]. Iversen et al. (2008) found low morale and non-receipt of a homecoming brief (psychoeducation) to be triggers for PTSD [253]. Passive coping [252] and dysfunctional cognitive coping strategies [247, 267] are associated with PTSD.

Personality

Individual personality characteristics may predict PTSD. Chung et al. (2015) showed a significant association between masculinity–femininity personality and social introversion with PTSD among firefighters [32]. Heinrichs et al. (2005) suggested that the combination of a pre-existing condition,

increased hostility, and low levels of self-efficacy are strong predictors of the development of PTSD symptoms in the high-risk population of firefighters [242].

DISCUSSION

Firefighters and military personnel are considered to work in hazardous and stressful occupations. They may be exposed to both direct and indirect stressors, such as risking one's own life when entering a burning building, combat, and wars, and witnessing the suffering of others. PTSD prevalence rates reaching 57% for firefighters and 37.8% for military personnel have been described in these groups [244, 253].

The studies included in this review were acceptable in quality. The studies revealed that the varying factor increases the risk of developing PTSD among firefighters and military personnel. Based on this review, we identified that traumatic events, occupational factors, social support, physical and psychological factors, and individual traits were the main predictors of PTSD.

To our knowledge, this is the first scoping review study focusing on predictors of PTSD among firefighters and military personnel and estimating the PTSD prevalence in these populations. When the nature and intensity of duty-related exposures are considered, among other factors, the risk of developing PTSD is apparent. These studies found that prevalence rates of PTSD in this cohort exceeded those of the general population [273]. This suggests a need for targeted efforts to mitigate the risk of developing PTSD amongst firefighter and military personnel, either by addressing individual characteristics that predispose individuals to the risk, screening those going into these professions for vulnerability factors, or reducing the impacts of trauma exposure on the psyche.

Prevalence of PTSD among Military Personnel and Firefighters

Prevalence can be described as the proportion of individuals in a society with a particular disorder at a specific time. Prevalence estimates are governed by various factors of the disease, the duration of the condition, demographic characteristics, and others [30].

Prevalence is dynamic and may vary with population, place, and time [30]. Various studies have attempted to estimate the prevalence rates of PTSD among firefighters and military personnel. Prevalence estimates for PTSD rates among military personnel ranged from 2% to 17% [226]. A study among professional firefighters in Germany approximated the PTSD rate at 18.2% [274]. On the contrary, our present scoping review found high figures for both military personnel and firefighters.

Previous studies conducted after the conclusion of hostilities and conflicts in Iraq and Afghanistan have broadened the understanding of PTSD among military personnel after deployment [275]. Richardson et al. (2010) estimated the point prevalence during this time as ranging from 4% to 17% [226], while the US military recorded the highest prevalent rate during the study [226, 244]. Jakupcak et al. (2008) found the prevalence rate of PTSD for US veterans deployed to Iraq or Afghanistan after a retrospective study to be 37.8%. In reverse, a rate of 3.72% was recorded in a cross-sectional study of 4762 UK military personnel deployed to Iraq [244].

Similarly, firefighters' prevalence rates for PTSD symptoms also vary from 6.5% to 37% [218, 219, 252, 276]. The sample size used to study the firefighters may influence the prevalence rate [37, 218], along with the research participants, whether other cohorts were investigated in addition to a different cohort [252], and the scales adopted in measuring PTSD [277]. Some scales may depict incomplete measures of PTSD symptoms compared to the DSM [278].

Finally, the exact prevalence estimates of PTSD in military and firefighter populations are not known. Therefore, it is not necessary to bother with the precise prevalence rates [275] for these populations. The big challenge is ensuring that PTSD is acknowledged swiftly and that reliable pathways to evidence-based care are available [275].

Predictors of PTSD among Military Personnel and Firefighters

Demographic Factors

Sociodemographic variables may contribute to PTSD among firefighters and military personnel. Previous studies have distinguished certain demographic predictors that increase the occurrence of PTSD, viz. gender, age, educational status, marital status, and socioeconomic status [234, 256, 279]. Specifically, the impacts of younger age during traumatic events and exposure to PTSD are difficult to predict. Moreover, there are conflicting effects on the generation and processes of traumatic stress reactions [280, 281].

Our review of three studies examined age as a risk factor for PTSD in both military personnel and firefighters [32, 234, 256]. A previous study suggested that having a younger age at the time of trauma is primarily unrelated to PTSD [282]. Forbes et al. (2016) also suggested that age at the time of deployment of the military personnel was related to experiencing PTSD [256]. The same research group revealed that military personnel who were older at deployment are more likely to have current PTSD [256]. On the contrary, other studies have shown that younger personnel were about four times more likely to experience PTSD than the older age group, with a steadily decreasing age effect [283]. Firefighters advanced in age may have been more exposed to traumatic events than younger ones [32].

Over the past 20 years, the number of males serving in the military and the fire service has outnumbered the number of females [284, 285]. In 2018, females made up about 8% of the fire service [284]. The number of females has increased over twenty years now, and this number is estimated to increase further [282]. Consequently, this projected increase in the female gender puts females at a high risk of experiencing mental illnesses, including PTSD [282, 285]. A cross-sectional study in Switzerland suggested that female firefighters are at risk of PTSD [247], while additional factors may contribute. However, a concrete reason may be that women in the military are inadequately prepared [286]. On the other hand, female fighters experience physical, emotional, and occupational stressors [287] with higher rates of depression, which predisposes them to PTSD. Surprisingly, only one article [247] that met the criteria for inclusion in this scoping review examined relations between female gender and PTSD. Despite the studies included, conclusions cannot be made on gender and PTSD among firefighters and military personnel. A meta-analysis involving 32 articles revealed that military personnel with higher education levels might adopt

better coping strategies than those with lower educational levels [282]. Similarly, Meyer et al. (2012) suggested that firefighters with lower educational levels risk PTSD [38]. Notwithstanding, these findings differed from Rona et al. (2012), who found that the higher educational level of the military personnel, the more they are exposed to PTSD [262].

In other studies, demographic characteristics such as employment status have been shown to affect PTSD. Regarding the lifetime prevalence of PTSD, being employed has been shown to reduce the occurrence of PTSD by half compared to the unemployed [283]. Likewise, unemployed individuals after military training are more likely to exhibit PTSD symptoms [282]. Individuals with single marital status are at risk of PTSD. One article showed that being single as a firefighter put individuals at risk of PTSD compared to being married, since they may have reduced emotional and social support [252].

Job Factors

Job and organizational stress [31, 244, 268], burnout [266], length of service [32, 247], rank in service [251], and traumatic events [254-256, 267] were found to be associated with increased risk of PTSD among military personnel and firefighters. Within organizations, it is said that non-experts are at risk of PTSD symptoms [288]. Soravia et al. (2020) studied first responders and the risk of developing PTSD, with the findings showing that length of service is related to PTSD symptoms [247]. Higher job rank levels (soldiers and sergeants) among firefighters showed a significant association with PTSD [251]. An explanation may be that as one advances in their career, more experience is acquired, and more traumatic events are encountered, exposing one to PTSD.

Exposure to traumatic events is the most prevalent factor for developing PTSD among military personnel and firefighters. Deployment to war and combat zones makes military personnel vulnerable compared to those not deployed to war zones [243]. Another study showed that being deployed to a ‘forward’ area during combat makes the individual more at risk compared to colleagues not at the front [253]. Furthermore, combat roles during deployment to Iraq or Afghanistan were associated with significantly acute mental health outcomes [264]. A cross-sectional study among various rescue teams with a cohort of 239 firefighters showed that work-

related trauma was a predictor of PTSD [247]. Military personnel discharge weapons or witness injury and death during deployment [282]. These memories of trauma and intense fear increase their risk of PTSD [255]. Stevelink et al. (2018) studied 10,272 military personnel deployed to Iraq or Afghanistan and concluded that military personnel in combat roles developed worse mental health outcomes [264]. Among firefighters who experience elevated levels of job-related trauma, there are significantly higher risks of PTSD and chronic PTSD [269], while non-work-related trauma significantly predicted only chronic PTSD but not PTSD [269]. The category and intensity of the traumatic events may likely be the risk factors correlated with the differences in PTSD in firefighting [234]. These findings are consistent with Trickey et al. (2012), suggesting that the intensity of the trauma is associated with the likelihood of PTSD [289]. Despite the complexity of the traumatic exposure, estimating the conceptual factors is tricky [289]. Studies among firefighters suggest that higher organizational stress increases PTSD [32, 38]. Nonetheless, occupational stress is not only associated with PTSD, but also with depression and alcohol abuse [290]. Continuous exposure to traumatic events has been shown to negatively affect one's psychological health, with increased flashbacks and irritability [291]. In our study, few articles supported perceived stress and general stress as predictors of PTSD among firefighters and military personnel [44, 251]. Burnout has been recorded as a factor for PTSD. In a study in South Korea, burnout was shown to correlate with PTSD among firefighters [266]. Another study categorically showed that the emotional exhaustion of burnout is directly linked to PTSD [277], while countermeasures were proven as protective factors for PTSD [277]. On the flip side, a greater number of years in service is linked to burnout and the risk of PTSD [290].

Social Support

Social support is defined as information an individual receives in the form of believing they are loved and cared, for while feeling esteemed and affiliated with a network of social and mutual obligations [218]. Tracie et al. (2013) explained that general life stress and family stress during deployment of military personnel increase the likelihood of PTSD [254]. Firefighters and military personnel are exposed to a high degree of stress at work. Therefore, they require support from their family and friends to reduce the impact of this stress on them. According to a study by Rona et al. (2012), social support is a significant predictor for PTSD, as it plays a mediating role between

traumatic events and other mental health conditions [262]. Furthermore, among the military personnel, low morale and poor social support within the unit and non-receipt of a homecoming brief, i.e., psychoeducation [253], augment the development of PTSD. Another study supports these findings. The literature shows that UK military personnel deployed to Iraq may have PTSD due to feeling unsupported on return from deployment [38, 262]. This supports previous findings indicating that perceived social support is likewise a predictor of PTSD symptoms among professional firefighters and military personnel exposed to various traumatic events [244, 248, 250, 255]. The findings from previous studies suggest that good social support acts as a buffer against the adverse outcome of traumatic stressors among PSPs [230]. Overall, high social support will positively affect self-reliance and self-security and serve as a protective factor [282].

Psychological and Physical Disorders

Few studies have ascertained the relationship between psychological and physical illness as a risk factor for PTSD among firefighters and military personnel, in which traumatic exposure takes the lead. However, it is difficult to ascertain the effects of mental and physical health on the occurrence of PTSD. Notwithstanding, some studies have revealed that some psychological and physical conditions predispose military personnel or firefighters to PTSD [31, 244, 252, 263, 272], such as depression and anxiety. Likewise, a longitudinal study among rescue personnel showed that workers exposed to traumatic events had significantly higher depression levels than less-exposed workers [292]. Nightmares before deployment have also been associated with an increased risk of PTSD among military personnel [249]. A study showed that anxiety and depression comorbidities are usually noticed among firefighters and military personnel diagnosed with PTSD who had concurrent psychological conditions [43, 293]. These findings show PTSD as consistently coexisting with other mental health conditions [294]. Wang et al. (2011) examined 1056 Chinese military personnel who assisted in an earthquake rescue operation and concluded that personnel who have not received psychological counseling and who habitually abuse alcohol are at risk of PTSD [258]. Additionally, other studies have shown that having a diagnosis from a mental health professional [44], previous history of psychological treatment, and non-receipt of any psychological counseling [258]increases the risk of developing PTSD. Soo et al. (2013) linked

those concurrent conditions and behaviors, such as respiratory symptoms, exercise, and alcohol use, to PTSD symptoms [270].

Injuries

Few studies have illustrated a relationship between PTSD and physical injury. Ozer et al. (2003) revealed that psychological processes during the traumatic event are the most significant predictors of PTSD [295]. A study examining injury and PTSD among US military personnel showed that injuries sustained during battel were actively associated with PTSD compared to non-battle injuries [263]. Sandweiss et al. (2011) added that irrespective of the severity of injury sustained, self-reported preinjury was significantly associated with PTSD [260]. Occupational injuries result in physical disabilities and psychological disturbance, worrying injury memories, impairment of contextual memory, emotional disorders, and PTSD [296]. A study to determine the effects of occupational trauma on individuals' psychological ability revealed that among those who had an injury at work, 12% had PTSD. In comparison, 11% had subsyndromal PTSD after six months of follow-up assessment [297].

Other Factors

The coping strategy has been identified as another important risk factor for developing PTSD among firefighters and military personnel. A longitudinal study among firefighters provided in-depth knowledge of coping behaviors to aid function after traumatic events [234]. Different coping styles are associated with PTSD. For example, females who are very sensitive to threats are less likely to use effective coping strategies [282]. Passive coping strategies [252], problem- and emotion-focused coping, and mixed focused coping [298] were found to relate to experiencing PTSD among military personnel and firefighters. Sattler et al. (2014) demonstrated that disengagement coping [299] and self-blame coping were associated with PTSD [38]. Some personality traits of individuals who experience repeated traumatic exposure may predict PTSD [32]. Chung et al. (2015) found that masculinity–femininity and social introversion traits expose one to PTSD [32]. Another study examined certain personality traits, which revealed that

neuroticism was linked to PTSD [300]. A neurotic individual is sensitive to the stressor, and their responses are fast and intense, yet slow to return to a normal state [300].

Trajectory of PTSD among Military Personnel and Firefighters

The trajectories for PTSD symptoms among people exposed to traumatic events are complex [301]. PTSD is categorized in the DSM and ICD as an anxiety disorder and one of neurotic, stress-related, and somatoform disorders [275]. The first criterion to be met in both systems is that the individual experiences a severe stressor, primarily a severe threat to life or physical integrity, i.e., the individual experiences or witnesses a traumatic event, such as combat, a natural disaster, fires, or a violent personal assault.

Furthermore, both the DSM and ICD require evidence of experiencing the trauma in the form of intrusive thoughts, nightmares, or dissociative flashbacks, resulting in severe stress via these reminders. More often than not, these are usually symptoms of traumatic stress and a focus of interest [275]. The re-experiencing symptoms may be the distinctive trademark of traumatic stress, manifesting as either poor prognosis, chronic PTSD, or disabling PTSD [302]. Finally, PTSD diagnosis requires a cluster of intrusion, avoidance, and arousal symptoms. Significantly, this condition in the past and present members of the military and firefighters is linked to infirmity, poor quality of life, and increased physical health problems [303, 304]. Studies have shown that about 80% of individuals with PTSD meet the criteria for other mental health conditions such as substance use disorder or anxiety [305, 306]. Paradoxically, these comorbidities may just be a result of inadequate symptom specification at diagnosis [307]. A study by Kessler et al. (1995) revealed that about one-third of individuals who experience an episode of PTSD never recover, even after many years [306]. Regarding the course, PTSD in military personnel and firefighters, both in active service and as veterans, becomes chronic to the condition [308]. For example, a prospective longitudinal study of 214 veterans from 1982 in Lebanon showed that the rate of PTSD was reduced three years after war but then increased 17 years after war [308]. The delayed onset of PTSD is one debatable trajectory of the condition. Usually, PTSD occurs at any age, beginning after the first year of life, with symptoms initiating within the first three months after exposure to the trauma [222]. Delayed PTSD is when the disorder surfaces at least six months after the traumatic exposure [222, 275]. Andrews et al. (2007) showed that the delayed onset of PTSD is

seldom seen in civilian populations but may be more common in veterans [309]. Consequently, a longitudinal study among firefighters revealed that delayed onset during follow-up was linked to functional impairment [310].

Implications for Public Policy and Practice and Future Directions

This study reveals that the prevalence rates of PTSD among military personnel and firefighters are high compared to reported rates in the general population. Early interventions are vital in preventing PTSD among firefighters and military personnel. This study also highlights vital predictors of PTSD among military personnel and firefighters. PSPs require adaptation skills and trauma management at work to reduce the occurrence of PTSD and increase productivity. Health policy directors and managers need to integrate interventions that mitigate vulnerability factors in PSP and increase their resilience as a way of preventing PTSD in members of the military and firefighters. Leaders in these cohort and the community can also provide continuous support to reduce stress and PTSD [282]. Additionally, psychological interventions have been proven to reduce PTSD. While interpersonal psychotherapy and cognitive–behavioral therapy can be effective, long waiting times are expected [212]. Despite the increase in PTSD among military personnel and firefighters, most individuals do not seek help from health professionals nor report symptoms [273]. The percentage of PSPs receiving treatment for mental health illness is estimated to be significantly lower due to stigma associated with mental illness and privacy loss [273]. Notwithstanding, internet-delivered cognitive behavioral therapy may be recommended [192], and supportive text messages programs such as “Text4PTSI” and “Text4Wellbeing” can reduce mental health problems, with the former specifically reducing PTSD among first responders [311]. Various randomized controlled clinical trials have proven that supportive messaging mitigates depression, anxiety, and stress, and may mitigate PTSD [17, 71, 82, 94, 312].

Governments and policymakers need to make a conscious effort to improve mental health services among PSPs to improve their quality of life. These findings will help health professionals understand the various predictors and provide the best treatment regimen for individuals with comorbid physical and mental illnesses to reduce the risk of PTSD. Future research should focus

on interventions aimed at preventing and reducing PTSD among military personnel and firefighters. Further research is also needed to examine how identified predictors interact and provide strategies to protect these cohorts and reduce the prevalence of PTSD.

Limitations

The authors of this scoping review acknowledge several limitations. Firstly, in this scoping review, we only searched English language databases. Much effort was made to identify all relevant studies for this review considering our eligibility criteria. However, we may have left out some relevant studies, especially those published in other languages. In addition, the various studies included in this review used different screening measures and international diagnostic classifications for the determination of PTSD, which could potentially lead to variations in prevalence estimates. Finally, there was no assessment of risk of bias for the included studies, which is a limitation. Notwithstanding the limitations of the study, this scoping review provides an insightful overview of the prevalence and predictors of PTSD among military personnel and firefighters.

Conclusion

This review has identified a wide range of risk factors associated with PTSD among firefighters and military personnel. As clearly illustrated, exposure to traumatic events is just one of several possible predictors. Job stress, physical and psychological comorbidities, demographics characteristics, personality traits, and social support systems similarly predict PTSD among military personnel and firefighters.

This scoping review adds to the literature implicating multiple factors in predicting PTSD among military personnel and firefighters. The present study highlights an overall prevalence of PTSD. Social interventions and effective support from the family and friends of these PSPs are needed to reduce psychological stress. Governments and policymakers should be mindful of these factors and should try to improve the mental health of these PSPs. Proactively identifying military personnel and firefighters with risk factors for developing PTSD and offering then support and

treatment can reduce future psychopathology and minimize the risk of PTSD. E-mental health services such as daily supportive text messaging can be incorporated to reduce the risk of PTSD [313-317].

3.3. Evaluating the Prevalence and Predictors of Moderate to Severe Depression in Fort McMurray, Canada during the COVID- 19 Pandemic

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ABSTRACT

Background

The Coronavirus disease (COVID-19) pandemic has produced adverse health consequences, including mental health consequences. Studies indicate that residents of Fort McMurray, a community which has experienced trauma from flooding and wildfires in the past, may be more vulnerable to the mental health effects of the pandemic.

Objective

This study aimed to examine the prevalence and predictors of likely Major Depressive Disorder (MDD) among residents of Fort McMurray during the COVID-19 pandemic.

Methods

A cross-sectional approach was adopted utilizing an online survey questionnaire to gather sociodemographic data, COVID-19 related data, and clinical information, including likely MDD using the Patient Health Questionnaire (PHQ-9) scale, from the residents of Fort McMurray between the period of April 24 to June 2, 2021.

Results

Overall, 186 individuals completed the survey out of 249 residents who accessed the online survey, yielding a completion rate of 74.7%. The prevalence of likely MDD among respondents was 45%. Respondents willing to receive mental health counselling were five times more likely to experience MDD during the COVID-19 pandemic (OR= 5.48; 95% CI: 1.95 – 15.40). Respondents with a history of depression were nearly five folds more likely to report MDD during the era of

the pandemic than residents without a history of depression (OR= 4.64; 95% CI: 1.49 – 14.44). Similarly, respondents with a history of taking hypnotics (sleeping tablets) were nearly six-fold more likely to express MDD than respondents with no history of receiving sleeping tablets (OR= 5.72; 95% CI: 1.08 – 30.30). Finally, respondents who reported receiving only partial support from the employer had three times higher odds of having likely MDD than those who received absolute support from the employer (OR= 3.50; 95% CI: 1.24 – 9.82).

Conclusion

In addition to the effect of the pandemic and other measures taken to curb the psychopathological impact of the pandemic, policymakers need to implement policies to manage individuals with preexisting mental health conditions and provide strong employer support.

INTRODUCTION

Since the World Health Organization (WHO) announced the Coronavirus disease (COVID-19) as a public health emergency of international concern on January 30, 2020, the infection has become one of the significant threats to global public health [318]. COVID-19 has taken millions of lives globally; as of March 22, 2022, 470,839,745 people had been confirmed positive for COVID-19 globally, with an estimated 6,092,933 deaths [319]. In Canada, 3,397,593 people had been confirmed positive of COVID-19 as of the same date, with 37,169 deaths [319].

The emergence of the pandemic has been associated with mental health and socioeconomic consequences and the rate of likely depression symptoms increased among individuals [320]. For example, a study in Italy conducted by Fiorillo et al.(2020) revealed that out of the 20,720 participants studied, 2,555 reported severely or extremely severe depression symptoms during isolation due to the COVID-19 pandemic [321]. Some depression symptoms include nearly every day experiencing diminished ability to think or concentrate, fatigue, insomnia, or hypersomnia [118]. Individuals affected by the virus experience stigma that adversely affects their psychological wellbeing. The widespread fear caused by the COVID-19 pandemic, and the stringent measures to control it, are potential mental health stressors [322]. Traceable to COVID-19, authorities

worldwide implemented policies to curtail the disease. Such implementations include lockdowns, vaccines, quarantine, and isolation measures, which adversely affect the mental health of most individuals [321, 323, 324]. Researchers have documented the mental health effect on individuals in times of crisis. A cross-sectional study in South Asia recorded a higher prevalence of depression among 82.4% of the respondents examined due to the pandemic [325].

Another cross-sectional study conducted in India during the COVID-19 pandemic revealed a prevalence rate of 25% of moderate to extremely severe depression [326]. Similarly, a study conducted in Canada showed one week prevalence rate for self-reported moderate to high stress, Generalized Anxiety Disorder (GAD), and likely MDD as 84.9%, 46.7%, and 41.4%, respectively [327]. Furthermore, another study conducted in Alberta during the pandemic reported a prevalence of 44.0% of likely MDD among respondents [328].

The increasing infection rate and traumatic death of individuals took a toll on health workers and patients. Healthcare workers are psychologically affected by the pandemic as well. For example, research conducted in China to compare medical workers with the general population during the pandemic revealed that 23.13% of medical workers in China reported depression symptoms since the pandemic [329]. Likewise, a meta-analysis showed a 45% pooled prevalence of depression among COVID-19 patients [330]. Similarly, in Canada, a study to assess the impact of COVID-19 among nurses showed a 5% increase in anxiety and depression from 10% to 15% pre-pandemic and early stages of the pandemic, respectively [331]. These studies demonstrate the pandemic's psychological impact; and the need to treat any mental health condition that emerges, considering that untreated depression can be complicated with suicidal ideation, social dysfunction, and severe cognitive impairment [17, 332].

Previous studies have shown that various factors can contribute to adverse mental health during the pandemic and other traumatic events. These predictors include sociodemographic characteristics, preexisting mental health diagnoses (e.g., depression), and social support, including governmental and family and friends, support received during the pandemic [333, 334]. Furthermore, preexisting physical illness [335], living in urban areas [336], individuals with the confirmed or suspected COVID-19 infection together with their family or friends, occupational exposure risks [337] and weak immune system are some determinants of mental health illnesses [320].

Although various studies make contributions during the pandemic, important questions remain regarding the factors influencing moderate to severe depression symptoms amid the pandemic in Fort McMurray. The study aims to report depression symptoms among residents of Fort McMurray and identify risk factors for moderate to severe depression among residents of Fort McMurray during the COVID-19 pandemic. Further, given that the Fort McMurray community has experienced previous natural disasters in the past five years, our study uniquely throws light on how the ongoing pandemic may have affected the mental health of residents of a vulnerable community.

METHODOLOGY

Study setting

Fort McMurray is in the Northern part of Alberta, Canada. The municipality has a population of 111,687 as of 2018 [338]. Residents of Fort McMurray have experienced a series of traumatic events in recent times, such as the 2016 wildfire that destroyed homes and forced many residents out of their homes [339], and the 2020 flooding [340]. These traumatic events affected the mental health of the residents. A study by Agyapong et al.(2018) shows a one-month prevalence rate for likely MDD, GAD and Post Traumatic Stress Disorder (PTSD) as 19.8%, 12.8% and 14.8%, respectively, six months after the Fort McMurray wildfire [339, 341, 342]. The COVID -19 potentially adds an extra psychological burden on residents of Fort McMurray. Following the pandemic, Albertans (including residents of Fort McMurray) received support from the Government and other entities. Such support includes, but has not been limited to, food, medical supply, and financial support [343].

Study design

This study was a cross-sectional survey conducted between April 24 and June 2, 2021. Multistage sampling approach was used. The first stage was a convenience sampling of intermediaries through which respondents could most easily be reached at Fort McMurray. These intermediaries include

the government, schools, occupational and community platforms. The questionnaires were distributed randomly via email to residents of Fort McMurray via these intermediaries. Data were collected using online questionnaires administered via REDCap [344]. This approach was necessitated by the COVID-19 pandemic restrictions and was approved by the ethics committee.

Outcomes and Measures

The survey measured likely MDD among residents using the Patient Health Questionnaire (PHQ-9), which scores each of the nine DSM-IV criteria as "0" (not at all) to "3" (nearly every day) [86]. The PHQ-9 scale categorizes depression based on scores into none-minimal (0-4 points), mild (5-9 points), moderate (10-14 points), moderately severe (15-19 points), and severe (20-27 points). The scores were recategorized into a binary variable: a) none to mild depression and b) moderate to severe depression. The scale used to assess depression symptoms was self-reported, hence, the likely depression symptoms.

The justification for this was based on the recommendations for active management. Typically, some form of active management of depression is recommended for patients scoring above 10 points, whereas no active treatment is recommended for patients with none to mild depression [86]. The reliability and validity of the tool have indicated it as having sound psychometric properties and the internal consistency of the PHQ-9 has been shown to be high [86]. In addition, the survey contained questions related to respondents' mental health and medication history, as well as exposure to COVID-19 pandemic news. Data were also collected on the support received from family and friends, employers, the Government of Alberta, and Canada during the pandemic.

Statistical Analysis

Data were analyzed using SPSS Version 25 [345]. Demographic, clinical, and other variables were described, and sex analysis was conducted. Cross-tabular analyses using the Chi-square test explored relationships, categorical predictors, and the likelihood that respondents self-reported MDD during the COVID-19 pandemic.

Multivariate binary logistic regression analysis was examined to determine predictor variables for respondents to self-report moderate to severe symptoms of depression during the COVID-19 pandemic, controlling for the other variables. From the bivariate analysis, variables which were statistically significant or approaching significance ($p \leq 0.1$) with the likelihood of respondents to self-report moderate to severe depression were included in the regression model. The multivariate logistic regression analysis was run after correlational analysis was performed to exclude any strong intercorrelations (Spearman's correlation coefficient of 0.7 to 1.0 or −0.7 to −1.0) among predictor variables. Odds ratios (OR) and confidence intervals (C.I) were reported. There was no imputation for missing data, and the data analyzed and reported reflect the number of responses for each question.

Ethical considerations

Participants were provided with information about the survey, and informed consent was implied by completing the survey questionnaires. The University of Alberta Health Research Ethics Committee approved this study (Pro00066054).

RESULTS

Two hundred and forty-nine individuals accessed the online survey link, out of which 186 completed the survey, giving a response rate of 74.7%. Descriptive characteristics of the sample of respondents (N = 186) were examined against the sex at birth of the participants (Table 3.3.1). As shown in Table 3.3.1, most respondents 98 (52.7%) were above 40 years of age; 175 (94.1%) were employed; 132 (71.0%) were married or partnered; 58 (31.2%) reported history of depression while 90 (48.4%) reported having no mental health diagnosis; 59 (31.7%) were on antidepressants; 120 (64.5%) reported not receiving psychotropic medications; 72 (38.7%) reported receiving mental health counselling in the past, and 98 (52.7%) said they would like to receive mental health counselling. With reference to COVID-19 related variables, 160 (92%) of respondents reported having been fearful about contracting the virus; 168 (96.6%) were afraid about their close friends

or family members contracting the Coronavirus; 124 (72.1%) reported having close friends or family members who have been sick from the coronavirus disease; 104 (60.1%) had to self-isolate or self-quarantine due to COVID-19 symptoms, recent travel, or being in contact with someone who may have COVID-19; 77 (44.3%) watched television images of sick and dead people caused by Coronavirus, on a daily basis; 101 (58%) of respondent daily read newspaper and internet articles related to the pandemic; 153 (87.9%) reported not losing their job due to the COVID-19 pandemic; Concerning social support received since the COVID-19 pandemic declared, respondents who received absolute support from family and friends were 76 (43.9%), those who reported no support from the Government of Canada were 92 (54.4%); while 107 (62.9%) reported no support from the Government of Alberta. Similarly, 78 (45.3%) of respondents reported receiving absolute support from the employer. The prevalence of moderate to severe depression was 45.0% during the COVID-19 pandemic in Fort McMurray.

Table 3.3.1. Descriptive Characteristics of the Sample by Gender at Birth

Variables	**Male** **n (%)**	**Female** **n (%)**	**Overall** **n (%)**
Age categories			
≤25years	4 (14.8)	9(5.7)	13 (7.0)
<26-40years	5(18.5)	70(44.0)	75 (40.3)
>40years	18(66.7)	80(50.3)	98(52.7)
Employment status			
Employed	24 (88.9)	151(95.0)	175 (94.1)
Unemployed	3 (11.1)	8(5.0)	11 (5.9)
Marital Status			
Married/partnered	17(63.0)	115(72.3)	132(71.0)

Divorced/Separated	1(3.7)	17(10.7)	18(9.7)
Single	9(33.3)	27(17.0)	36(19.4)
Mental health diagnosis			
Depression			
Bipolar Disorder	6(22.2)	52(32.7)	58(31.2)
Anxiety	1(3.7)	5(3.1)	6(3.2)
Schizophrenia	9(33.3)	69(43.4)	78(41.9)
Personality Disorder	0 (0.0)	0 (0.0)	0 (0.0)
Other diagnoses	0 (0.0)	2 (1.3)	2(1.1)
No mental health diagnosis	5(18.5)	12(7.5)	17(9.1)
	15(55.6)	75(47.2)	90(48.4)
History of psychotropic medications			
Antidepressants	7 (25.8)	52(32.7)	59 (31.7)
Antipsychotics	3 (11.1)	1 (0.6)	4 (2.2)
Benzodiazepines	0 (0.0)	4(2.5)	4 (2.2)
Mood stabilizers	3(11.1)	9 (5.7)	12 (6.5)
Sleeping tablets	4(14.8)	17(10.7)	21 (11.3)
Other	1(3.7)	2 (1.3)	3 (1.6)
Not on medication	18(66.7)	102(64.2)	120 (64.5)
Mental Health counselling in the past year			
No	18 (66.7)	96 (60.4)	114 (61.3)

Yes	9(33.3)	63(39.6)	72(38.7)
Willingness to receive mental health counselling			
No	18 (66.7)	70(44.0)	88(47.3)
Yes	9(33.3)	89(56.0)	98 (52.7)
Fearful about contracting the coronavirus	7(29.2)	7(4.7)	14(8.0)
No	17(70.8)	143(95.3)	160(92.0)
Yes			
Fearful about close friends or family members contracting the coronavirus	2(8.3)	4(2.7)	6(3.4)
No	22(91.7)	146(97.3)	168(96.6)
Yes			
Close friends or family members sick from the coronavirus disease			
No	3(13.0)	45(30.2)	48(27.9)
Yes	20(87.0)	104(69.8)	124(72.1)
Self-isolate or self-quarantine due to COVID-19 symptoms, recent travel, or in contact with someone who may have COVID-19.	12(50.0)	57(38.3)	69(39.9)
No	12(50.0)	92(61.7)	104(60.1)

Yes			
Frequency watching television images of sick and dead people caused by a coronavirus			
Daily	12(50.0)	65(43.3)	77(44.3)
Less than daily	10(41.7)	64(42.7)	74(42.5)
Not at all	2(8.3)	21(14.0)	23(13.2)
Frequency reading newspaper and internet articles related to the pandemic			
Daily	14(58.3)	87(58.0)	101(58.0)
Less than daily	9(37.5)	60(40.0)	69(39.7)
Not at all	1(4.2)	3(2.0)	4(2.3)
Lost your job due to the COVID-19			
No	22(91.7)	131(87.3)	153(87.9)
Yes	2(8.3)	19(12.7)	21(12.1)
Received sufficient support from family and friends since the COVID-19			
Absolute support	10(41.7)	66(44.3)	76(43.9)
Some support	10(41.7)	45(30.2)	55(31.8)
Limited support	1(4.2)	25(16.8)	26(15.0)
No support	3(12.5)	13(8.7)	16(9.2)

Received sufficient support from Government of Canada since the COVID-19			
Absolute support	3(13.0)	19(13.0)	22(13.0)
Some support	3(13.0)	24(16.4)	27(16.0)
Limited support	3(13.0)	25(17.1)	28(16.6)
No support	14(60.9)	78(53.4)	92(54.4)
Received sufficient support from Government of Alberta since the COVID-19			
Absolute support	3(13.0)	13(8.8)	16(9.4)
Some support	3(13.0)	22(15.0)	25(14.7)
Limited support	1(4.3)	21(14.3)	22(12.9)
No support	16(69.6)	91(61.9)	107(62.9)
Received sufficient support from Employer since the COVID-19			
Absolute support	9(37.5)	69(46.6)	78(45.3)
Some support	7(29.2)	39(26.4)	46(26.7)
Limited support	3(12.5)	21(14.2)	24(14.0)
No support	5(20.8)	19(12.8)	24(14.0)
At most Mild Depression	14(60.9)	79(54.1)	93(55.0)
Moderate to Severe depression	9(31.9)	67(45.9)	76(45.0)

The bivariable analysis in Table 3.3.2 included thirty-two variables: demographic, clinical and COVID-related association with the likelihood of MDD. The chi-squared or Fisher exact test showed a significant ($p \leq 0.05$) association between the likelihood of MDD and sixteen variables: employment status; history of depression; history of anxiety diagnosis; history of any mental health diagnosis; history of antidepressant medications; history of Benzodiazepine medications; history of Sleeping tablets, history of receiving any psychotropic medications; receiving mental health counselling; willingness to receiving mental health counselling; lost job due to COVID-19 pandemic; fearful of close friends or family members contracting COVID-19; receiving support from family or friends; receiving support from the Government of Alberta; receiving support from the employer since the COVID-19 pandemic declared. Those who received support from the Government of Canada showed a near significant ($0.1<p<0.05$) association with likely MDD.

Table 3.3.2. Chi-square test of association between demographic, clinical, and COVID-19 characteristics and potential MDD.

Variables	**At most Mild Depression**	**Moderate to Severe Depression**	**Chi-square/ Fisher Exact**	**P-value**
Demographic characteristics				
Gender				
Male	14(60.9%)	9(39.1%)	0.367	0.654
Female	79(54.1%)	67(45.9%)		
Age categories				
≤25	4(44.4%)	5(55.6%)	1.014	0.596
26-40	36(52.2%)	33(47.8%)		
>40	53(58.2%)	38(41.8%)		

Employment status				
Employed	92(57.9%)	67(42.1%)	8.709	0.004
Unemployed	1(10.0%)	9(90.0%)		
Place of employment				
School boards	49(64.5%)	27(35.5%)	4.301	0.507
Healthcare industry	4(44.4%)	5(55.6%)		
Keyano college	10(50.0%)	10(50.0%)		
Oil Sands industry	6(50.0%)	6(50.0%)		
Municipal or Government Agency	8(66.7%)	4(33.3%)		
Other	14(48.3%)	15(51.7%)		
Marital status				
Married/Partnered/cohabiting	70(56.9%)	53(43.1%)	0.646	0.737
Divorced/Separated/ Widowed	8(50.0%)	8(50.0%)		
Single	15(50.0%)	15(50.0%)		
Clinical characteristics				
History of Depression from a health professional				
Yes	16(29.6%)	38(70.4%)	20.688	0.000
No	77(67.0%)	38(33.0%)		

History of Bipolar Disorder from a health professional? Yes No	3(50.0%) 90(55.2%)	3(50.0%) 73(44.8%)	0.064	1.000
History of Anxiety from a health professional? Yes No	27(38.0%) 66(67.3%)	44(62.0%) 32(32.7%)	14.301	.000
History of Alcohol Abuse Yes No	2(66.7%) 91(54.8%)	1(33.3%) 75(45.2%)	0.167	1.000
History of Drug Abuse Yes No	1(50.0%) 92(55.1%)	1(50.0%) 75(44.9%)	0.021	1.000
History of Personality Disorder Yes No	1(100.0%) 92(54.8%)	0(0.00%) 76(45.2%)	0.822	1.000

No history of mental health diagnosis Yes No	 36(41.4%) 57(69.5%)	 51(58.6%) 25(30.5%)	 13.501	 .000
Other mental health diagnosis Yes No	 8(50%) 85(55.6%)	 8(50%) 68(44.4%)	 0.181	 .793
History of Antipsychotics medications Yes No	 2(50.0%) 91(55.2%)	 2(50.0%) 74(44.8%)	 0.42	 1.000
History of Benzodiazepines Yes No	 0(0.0%) 93(56.4%)	 4(100.0%) 72(43.6%)	 5.013	 .039
History of Mood Stabilizers Yes No	 5(45.5%) 88(55.7%)	 6(54.5%) 70(44.3%)	 0.436	 .545
History of Antidepressants				

Yes No	22(40.7%) 71(61.7%)	32(59.3%) 44(38.3%)	6.547	.013
History of Sleeping Tablets Yes No	3(15.8%) 90(60.0%)	16(84.2%) 60(40.0%)	13.319	.000
History of other medications Yes No	3(100.0%) 90(54.2%)	0(0.0%) 76(45.8%)	2.496	.253
No history of mental health medication Yes No	25(41.0%) 68(63.0%)	36(59.0%) 40(37.0%)	7.610	.007
Respondents received mental health counselling in the past year Yes No	27(42.2%) 66(62.9%)	37(57.8%) 39(37.1%)	6.865	.011

Respondents would like to receive mental health counselling Yes No	33(37.1%) 60(75.0%)	56(62.9%) 20(25.0 %)	24.481	.000
COVID-19 related characteristics				
Fearful of contracting the coronavirus during the pandemic Yes No	83(53.5%) 10(71.4%)	72(46.5%) 4(28.6%)	1.659	.265
Fearful of their close friends or family members contracting the coronavirus during the pandemic Yes No	87(53.4%) 6(100.0%)	76(46.6%) 0(0.0%)	5.084	.033
Friends or family members sick from the coronavirus disease				

Yes	66(55.5%)	53(44.5)	.157	.733
No	25(52.1%)	23(47.9%)		
Self-isolate/self-quarantine due to COVID-19 symptoms, recent travel, or because you were in contact with someone who may have COVID-19				
Yes	54(52.9%)	48(47.1%)	.347	.635
No	38(57.6%)	28(42.4%)		
Frequency watching television images of sick and dead people caused by coronavirus				
Daily	41(55.4%)	33(44.6%)	1.004	.606
Less than daily	42(57.5%)	31(42.5%)		
Did not watch	10(45.5%)	12(54.5%)		
Frequency reading newspaper and internet articles				

related to the pandemic				
Daily	53(54.1%)	45(45.9%)	.154	.908
Less than daily	38(56.7%)	29(43.3%)		
Did not read	2(50.0%)	2(50.0%)		
Lost your job due to the COVID-19				
Yes	6(30.0%)	14(70.0%)	5.743	.019
No	87(58.4%)	62(41.6%)		
Support from family and friends since the COVID-19 pandemic declared				
Absolute support	52(69.3%)	23(30.7%)	12.945	.004
Some support	25(48.1%)	27(51.9%)		
Limited support	9(34.6%)	17(65.4%)		
No support	6(40.0%)	9(60.0%)		
Support from the Government of Canada since the				

COVID-19 pandemic declared				
Absolute support	16(72.7%)	6(27.3%)	6.243	.099
Some support	17(68.0%)	8(32.0%)		
Limited support	13(46.4%)	15(53.6%)		
No support	45(50.0%)	45(50.0%)		
Support from the Government of Alberta since the COVID-19 pandemic declared				
Absolute support	13(81.3%)	3(18.8%)	11.483	.008
Some support	16(69.6%)	7(30.4%)		
Limited support	7(31.8%)	15(68.2%)		
No support	55(52.4%)	50(47.6%)		
Support from the employer since the COVID-19 pandemic declared				
Absolute support	54(69.2%)	24(30.8%)	14.530	.002
Some support	19(43.2%)	25(56.8%)		

Limited support	12(52.2%)	11(47.8%)		
No support	7(30.4%)	16(69.6%)		

Multivariate Binary Logistic regression results

From Chi square analysis, there were fifteen variables that showed significance and one showed nearing significance. After running correlation analysis, we had eleven variables eligible for the regression model, after excluding variables that showed a high correlation (collinearity) with other variables and variables that showed low variability.

Table 3.3.3 represents the multivariate logistic regression model to ascertain the association between independent (clinical and COVID-19 related) variables and the MDD variable among respondents in Fort McMurray.

The entire model containing all predictors was statistically significant; X^2 (df=17; n=164) = 72.26, $p < .001$, indicating that the model was able to distinguish between respondents who have moderate to severe depression and those who are at most have a mild depression during the COVID-19 pandemic at Fort McMurray. The model explained the variance between 35.6% (Cox and Snell R^2) to 47.6% (Nagelkerke R^2). According to the goodness-of-fit statistic using Hosmer-Lemeshow goodness-of-fit test, the model was adequately fit (Chi^2= 7.15; p = 0.52). The model correctly classified 76.8% of cases.

As shown in Table 3.3.3, only four independent variables made a unique statistically significant contribution to the model (history of depression, history of taking sleeping tablets, willingness to receive mental health counselling and support from the employer).

The strongest association was found among respondents willing to receive mental health counselling. These respondents had five times greater odds of having likely MDD during the pandemic than those who did not require mental health counselling (OR=5.48; 95%CI: 1.95-15.40). Similarly, respondents who had MDD in the past were nearly five times the likelihood of having

likely MDD (OR=4.64; 95% CI: 1.49 -14.44) than respondents with no history of MDD from a health professional. Again, respondent who received partial support from the employer had more than three folds higher odds than those who received absolute support (OR=3.495; 95% C.I 1.244-9.818). Finally, respondents who were currently taking sleeping tablets had nearly six-fold greater odds of having likely MDD during the pandemic when compared to respondents who were not taking sleeping tablets (OR=5.72; 95% CI: 1.08 -30.30).

The logistic regression model results show that job loss, support from family and friends, and support from the government during the pandemic had no statistically significant association with the likelihood for respondents to present with likely MDD.

Table 3.3.3. Multivariate logistic regression model for respondents' likelihood to present with Moderate to Severe MDD.

Variables		Coefficient	Standard Error	Wald statistic	P-value	Odds Ratio	95%C.I.for Odds Ratio	
							Lower	Upper
Unemployed		2.290	1.369	2.800	0.094	9.876	0.675	144.421
COVID-19 Related variables								
Lost job due to the COVID-19 pandemic		1.277	.794	2.591	.107	3.587	.757	16.996
Support from family and friends	Absolute Support			1.531	.675			
	Some support	.142	.501	.080	.777	1.152	.431	3.077

since the COVID-19 pandemic	Limited Support	-.001	.688	.000	.998	.999	.259	3.848
	No Support	.892	.775	1.325	.250	2.440	.534	11.145
Support from the Government of Alberta since the COVID-19 pandemic	Absolute Support			4.713	.194			
	Some Support	.038	.987	.002	.969	1.039	.150	7.195
	Limited Support	1.660	.995	2.783	.095	5.260	.748	36.980
	No Support	.578	.874	.437	.508	1.783	.321	9.891
Support from your employer since the COVID-19 pandemic	Absolute Support			5.836	.120			
	Partial Support	1.251	.527	5.638	**.018**	3.495	1.244	9.818
	Limited Support	.519	.633	.673	.412	1.680	.486	5.808
	No Support	.114	.721	.025	.874	1.121	.273	4.610
Clinical Covariates								
History of Depression		1.535	.579	7.036	**.008**	4.643	1.493	14.435

History of Anxiety	.712	.546	1.699	.192	2.039	.699	5.948
History of taking Sleeping Tablets	1.743	.851	4.193	**.041**	5.715	1.078	30.304
Not on any medication for mental health concerns	-.712	.623	1.306	.253	.491	.145	1.663
Received mental health counselling in the past year	-.839	.571	2.161	.142	.432	.141	1.323
Willingness to receive mental health counselling	1.701	.527	10.395	**.001**	5.478	1.948	15.403

DISCUSSION

The prevalence of likely MDD among our respondents was 45%. Our findings agree with other studies showing an increase in depression symptoms following the pandemic. A national survey conducted in Canada to ascertain depression before and during COVID-19 in 2021 showed an increase from 4% to 10% respectively since the onset of COVID-19 [346]. Prevalence varies in population, sample size, place, time, and even the type of traumatic event [30]. For example, six months after the 2018 wildfire in Fort McMurray, the prevalence of MDD was 19.8% among residents [339] and 24.8% eighteen months after the same traumatic event [347]. These rates are lower than the prevalence of MDD during the pandemic recorded at 45% in this study.

Similarly, various studies have recorded higher rates of MDD during the COVID-19 pandemic, which is consistent with our research. For example, a study in British Columbia, Canada, showed a prevalence of 15% during the pandemic [331].

Our study did not find a significant association between receiving support from family and friends and the presence and severity of depression. This finding is counterintuitive given that empathy and support of loved ones are expected to allay potential fears and distress in times of crisis, as demonstrated in existing research. For example, a study conducted in China showed that family support is a protective factor for developing mental health conditions and improves psychological health during the COVID-19 pandemic [348]. Similarly, Liu et al. (2020) found that family support reduces stress on individuals during the pandemic and increases resilience to health problems like depression [349]. However, given that over 50% of the respondents in our study have a history of mental health conditions and may be receiving support from family and friends, there is the possibility of a responder bias dissociating the existing support from support received during the pandemic.

Some governmental bodies have supported people since the emergence of the pandemic. The Government of Alberta supported residents with financial assistance and encouraged working remotely to curtail the spread and protect the health of individuals [343]. An evidenced-based study in the United States indicated that Governmental aid mitigates psychological stress and reduces depression [350]. The Government of Canada provided health tips to deal with depression during the pandemic and emergency financial aid, which reduced stress [351]. Government support did not significantly impact respondents' likelihood of moderate to severe depression. However, individuals may have received benefits directly from the employer or received Governmental support indirectly through the employer; thereby, the individual does not appreciate a direct positive impact of the Governmental support.

Further, losing jobs during the pandemic had no statistically significant association with the presence or severity of depression symptoms. Being employed or obtaining a job provides individuals with confidence, improves self-esteem, and brings control with life and emotions [352]. Notwithstanding, this finding contrasts with previous studies that associate job loss with a high risk of developing poor mental health during disasters [353]. For example, a survey conducted among 723 participants to establish the relationship between job loss and mental health during the pandemic revealed that participants who lost their job had increased incidence and severity of depression symptoms [352]. Given the meagre unemployment rate (6%), the low incidence of job loss during the pandemic (12%), and the associated wide confidence interval, this lack of

association should be interpreted with caution. However, studies involving a larger sample size may clarify this finding.

Covariates and potential effect modifiers

Covariates and potential effect modifiers in this study include pre-existing diagnoses of depression, the willingness to receive mental health counselling and a history of taking hypnotics (sleeping tablets).

Our study revealed that respondents with a history of depression were nearly five more likely to report MDD during the COVID-19 pandemic. Our result is consistent with other studies, which showed that participants who had a pre-existing diagnosis of depression from a health professional were more likely to exhibit depression symptomatology [53, 321, 347, 354]. For example, results from the COMET collaborative network showed that people with pre-existing mental health conditions have a greater risk of experiencing severe depression symptoms ($p < 0.0001$) [321]. This may be explained that people who have a well-established diagnosis of mental health conditions may be in a poorer position to deal with the stress during a crisis like COVID-19 than those without pre-existing mental health problems. A prior diagnosis of depression supports the idea that existing mental health diagnosis exposes one to further mental health trauma and suggests that an individual with a diagnosis of depression may be more prone to developing severe conditions when faced with crises.

Respondents willing to receive mental health counselling were five times more likely to express depression symptoms. This could be explained that the individuals with mental health conditions will desire to receive mental health counselling to cope with their conditions and vice versa. This agrees with other literature. Studies examining traumatic events and mental health have shown that respondents willing to receive mental health counselling are at risk of expressing mental health symptoms like depression [347] while other studies stipulated that counselling after a traumatic experience may not be advantageous to the individual [355], especially when it is a single session of counselling [356], mental health counselling in the pandemic era was proved to help reduce depression symptoms [357].

Respondents with a history of taking sleeping tablets were almost six times more likely to express depression symptoms. This is concerning a study by the Holmquist research group, which shows that most respondents with insomnia and depression symptoms resort to sleeping tablets [358]. A survey by Tsuno and Ritchie (2005) to examine the relationship between sleep disturbance and depression revealed that excessive use of sleeping tablets could explain the pathophysiology of depression symptoms [359]. This study is also consistent with our research which suggested that respondents on sleeping tablets are likely to express depression symptoms. Again, individuals with sleep disturbance usually use are more likely to become dependent on hypnotics, which may be associated with depression symptoms. Most studies have established a relationship between sleep deprivation, sleeping tablets (example, triazolam) and experiencing depression symptoms [360, 361]. Furthermore, a survey conducted in clinical aspect to ascertain sleep disturbance and likely depression explained that 25 of the 33-sample population receiving sleeping tablets expressed depression symptomatology [360].

Policy implications and future directions

Psychological first aid can be a choice of intervention during or after traumatic events. This enhances adaptive coping reduces acute stress and depression symptoms [45]. Governmental and employer support can improve resilience and further prevent depression symptoms. Hence the Government of Canada and Alberta, together with employers, should give adequate support to citizens. Furthermore, policies can adopt novel electronic and mobile health options which are economical and effective to minimize mental health illnesses. A study by Agyapong et al. (2021) concluded that daily supportive text messaging could reduce the psychological distress in the wave of COVID-19 [82, 213, 333]. The same research team revealed that after three months subscribing to the Text4Hope program, subscribers reported a 10.3% reduction in moderate to high depression symptoms compared to baseline data [82]. The study period enabled the researchers to assess the mental health impact of residents of Fort McMurray since the pandemic was at its peak. Treating pre-existing mental health conditions and providing effective counselling can reduce further psychological stress and improve resilience. Further studies are needed to ascertain other variables that may contribute to moderate to severe depression symptoms in the era of COVID-19 and other

traumatic events. In-depth research is needed into the association between sleeping tablets and likely depression symptoms during pandemics.

Limitations of this study

Our study has some limitations which need to be considered when interpreting our findings. First, we relied on online convenience sampling methods since the pandemic did not allow for a more systematic approach to data collection. Thus, our findings may not represent the general population of Fort McMurray. However, our sample may be considered to reflect the residents of Fort McMurray who were accessible during the pandemic through the government and institutional intermediary channels used. Further, the MDD measurement scale (PHQ-9) used in the study was self-reported by residents, thus should not be interpreted as an objective clinical diagnosis of MDD or its severity. The PHQ-9 is however considered an excellent screening tool for depression disorders in primary care [362]. Finally, due to the large number of variables and the lack of correction for multiple testing in our regression model, our study outcome may be prone to type 1 error. On the other hand, routine use of corrections methods such as Bonferroni correction have been criticized as deleterious to sound statistical judgment and reducing the chance of a type I error at the expense of a type II error [363]. Notwithstanding these limitations, the current results add to other COVID-19 studies and limited literature on predictors and estimate likely MDD during the pandemic.

CONCLUSION

The study establishes the prevalence and associated factors of MDD symptomatology among residents of Fort McMurray during the pandemic. The study results suggest a history of pre-existing diagnosis of depression, willingness to receive mental health counselling, receiving some support from the employer and taking sleeping tablets contribute to likely depression symptoms. Policymakers need to mitigate the threat of the pandemic and incorporate effective and accessible supportive messaging to prevent and reduce moderate to severe symptoms of depression among Fort McMurray residents and improve quality of life.

3.4. Prevalence and Predictors of Low Resilience in Residents of Fort McMurray One Year After a Devastating Flood

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ABSTRACT

Background

In April 2020, parts of Fort McMurray were affected by severe floods. The flooding caused the loss of properties and evacuation of some residents. Resilience after natural disasters is becoming an increasingly important area of research.

Objective

This study explores the prevalence and sociodemographic and clinical correlations of low resilience a year after the 2020 floods in Fort McMurray.

Method

Data collection was accomplished one year after the flood, from April 24 to June 2, 2021, using an online survey. Data were analyzed with SPSS version 25 using the chi-squared test and binary logistic regression analysis.

Results

The prevalence of low resilience was 37.4%. Respondents under 25 years were nearly 26 times more likely to show low resilience (OR= 26.32; 95% CI 2.60-250) than respondents 40 years and above. Responders with a history of depression (OR=3.88 95%CI: 1.34-11.24) and a history of anxiety (OR= 4.72; CI 95% 1.51-14.71) were nearly four to five times more likely to show low resilience than those without a history. Similarly, respondents willing to receive mental health

counselling (OR=7.46 95%CI: 2.65-21.27) were 7.5 times more likely to show low resilience. Participants residing in the same house after the flood were almost 11 times more likely to show low resilience (OR=10.53; 95% CI 2.34-47.62) than those who relocated.

Conclusion

Findings emphasize clinical and sociodemographic variables predicting low resilience after the flood. Further studies are needed to explore measures to promote resilience among flood victims in affected communities.

INTRODUCTION

Natural disasters are large-scale events that are often unexpected and among other things cause trauma and the destruction of property [47, 364]. The Fort McMurray 2020 flooding had a wide-range impact on residents. Hundreds to thousands of homes, businesses, and properties were destroyed, necessitating a large evacuation of residents in the affected vicinity.

The flood forced about 15,000 people to be evacuated between April 26 and May 2, 2020, due to the devastating flood and caused about $228 million in losses. The provincial Government called the disaster a once-in-a-century event [340].

Exposure to natural disasters is relatively common, and the individual who is exposed may battle with mental health conditions like post-traumatic stress disorder (PTSD), substance use disorders, and depression [45, 339]. In Canada, exposure to natural disasters is fairly common, with about 12.4 million Canadians experiencing a disaster in their lifetime, and 73% of this population report a significant disruption of work and home life [53, 339].

Natural disaster affects public safety, physical and mental health of an individual [339, 365], as well as one's resiliency [366]. Many sociodemographic and clinical factors have been identified as predictors of the likelihood of longer-term mental health impacts of disasters like flooding [347]. These include individual resiliency, the severity of the disaster, healthy or maladaptive coping

skills, degree of victim involvement, history of mental health, and age [339, 342, 347]. On the spectrum of age, children are considered more vulnerable and experience lower resilience to natural disasters [50, 367], than adults. Studies have explored the effects of flooding on common mental disorders from high or middle-income countries, and results revealed significant increases in depression, anxiety, and psychological distress among adults who experience flooding [45, 50, 339]. A survey conducted by Greene et al. (2015) showed that flooding was actively correlated with poor mental health and resiliency and strongly associated with lower psychological distress [365]. While some studies associate mental health repercussions to post disasters [45], few suggest that people adjust well during a disaster like flooding [50]. For example, in post-disaster situations, community social capital networks provide direct aid, information, financial resources, and emotional and psychological support. Individuals who benefit from this support are shown to exhibit high to moderate resilience [50, 368].

The ability to continue functioning after a traumatic event is usually a characteristic of successful adaptation and coping [45, 369]. As research advances, attention is now drawn to individual resilience after a traumatic event [370]. The definition of resilience is usually based on two key concepts: adversity and positive adaptation [370, 371]. Psychologists define resilience as the process of adapting well (bouncing back) in the face of adversity, trauma, tragedy, threats, or significant sources of stress [372].

Disasters affect victims' functioning at both physical and psychological levels [373]; flooding is not exempt. Along with losing physical possessions, disaster survivors are likely to develop some form of instability due to the stressors of a disaster, and resilience is compromised [373, 374]. A study in Carlisle, after the flooding, shows several people reported suffering from anxiety and stress in different forms, which reduce resilience [375].

Previous studies did not compare the effects of flooding and factors contributing to low resilience. However, while the number of studies of the impact of natural disasters on mental health is on the rise, more research is needed to determine the predictors of low resilience to improve quality and achieve high to moderate resilience. This study aims to assess the sociodemographic and clinical predictors of low resilience during the Fort McMurray flooding in 2020. To our knowledge, it will be the first study that examines the sociodemographic and clinical characteristics rather than flood exposure variables related to low resilience in residents of Fort McMurray one year after a devastating flood.

METHODS

Study Setting

Fort McMurray is located in the Northern Alberta Regional Municipality of Wood Buffalo, Alberta, Canada and in the middle of the Athabasca oil sands, surrounded by boreal forest. The Municipality population has changed significantly over the past two decades - increasing from 51,406 people in 2000 to 111,687 people in 2018 [376].

A large proportion of the inhabitants of Fort McMurray are employed in the nearby oil sands. Accordingly, the largest population cohort in Fort McMurray is the 30-34 age group, which accounts for 12.3% of the total population. The next largest population cohorts are the 35-39 and 25-29 age groups [340]. Overall, there are more males (54.9%) than females (45.1%) in the population [376].

On April 26, 2020, the Regional Municipality of Wood Buffalo (RMWB) declared a State of Local Emergency (SOLE) due to high water levels and flooding along the Athabasca and Clearwater Rivers. More than 13,000 people were evacuated. The flood was the first large disaster in Canada during the COVID-19 pandemic [340]. After the population of Alberta went into lockdown and people were told to remain at home unless they were obtaining vital services, a large group of residents were forced out of their homes. Due to enforced social isolation, this was both complicated and stressful.

Study Design and Institutional Review Board Approval

A cross-sectional survey was used in this study of data amassed between April 24 and June 2, 2021. Quantitative data was collected via REDCap [344] using online questionnaires. They were distributed via email and randomly sent to residents of Fort McMurray to fill out online. This was made possible by Government, school, occupational, and community platforms. An anticipated sample size of 249 was predetermined, with 186 responses to the survey with no gross incompletion, giving a response rate of 74.7%. Prospective participants were provided with information about the survey, and consent was obtained from those agreeing to participate. Study approval was granted by the University of Alberta Health Research Ethics Committee (Pro00066054).

Data Collection and Outcome Measure

Fort McMurray residents were offered the opportunity to complete the survey forms online at their convenience. Respondents' demographic characteristics, clinical background, flood exposure experience and various supports received were gathered using a data collection form designed for this purpose.

Selected predictive factors included in the data collection form were chosen based on a literature review of the factors which have been previously investigated with the mental health effects (depression and anxiety), resilience, and other natural disasters [339, 377, 378]. These variables included age, employment, relationship status, housing status, where residents lived before the flood, respondents lived after the flood, and properties destroyed. Other variables included whether respondents watched devastating damages caused by the flood on media and whether they were fearful for their lives and those of their family and friends during the flood. Clinical variables included the history of mental health problems and previous use of psychotropic medication. Finally, variables assessing the level of support received during the flood, insurance companies, the Red Cross, and the Government of Alberta, whether residents received counselling after the flood, and whether they would like mental health counselling.

The brief resilience scale (BRS) was created to assess the ability to bounce back or recover from stress [92]. A mean score ranging from 1.00-2.99 indicates low resilience, a score from 3.00-4.30 shows normal resilience, while 4.31-5.00 indicates high resilience [91]. Two categories were thus generated 1.00-2.99 suggesting low resilience and 3.00-5.00: normal to high resilience. Regarding reliability and validity literature shows that the BRS has good internal consistency, with Cronbach alphas ranging from 0.80 to 0.90 and test–retest reliability coefficients for a two-week interval were fair (0.61 to 0.69) [92].

Statistical Analysis

Data were analyzed using SPSS Version 25 [345]. Results of descriptive analysis were presented as absolute numbers and percentages according to gender for all the demographic, clinical and flood related variables. Univariate analysis with chi-squared tests was used to ascertain the

relationship between each predictor and the likelihood that respondents had high to normal and low resilience. Univariate analysis with Chi Square test was used to access the presence of significant associations between the predictor variables and low resilience. A two tailed p-value of ≤ 0.05 was deemed significant on univariate analysis. Predictors with significant or near significant relationship with low resilience on univariate analysis were entered into a logistic regression model. Correlation analysis was initially performed to exclude variables that correlated with other variables (Spearman's correlation coefficient of 0.7 to 1.0 or − 0.7 to − 1.0). Odds ratios from the binary logistic regression analysis were studied to ascertain the association between each of the variables in the model and the likelihood of respondents presenting with low resilience, controlling for the other variables in the model. There was no data imputation for missing data.

RESULTS

Overall, 249 residents accessed the online survey out of which 186 completed giving a response rate of 74.7%.

Descriptive Sample Characteristics

From Table 3.4.1, the predominant age was 26 years or older (93%), females (67%), employed (91%; of which 50% was school board staff), and married, partnered, or cohabiting (71%). Most participants resided in Fort McMurray during the flood (95%) and 82% in the flood areas. Most respondents (78%) owned their house. Notwithstanding, most responders (89%) reported no significant property loss due to the flood, while 12.9% reported some minor extent of the damage. In terms of media exposure, most respondents reported daily exposure to television images (67%) and newspaper/internet (76%) coverage of the flood and its effects, and 29.3% feared for their lives or their family members' lives.

Regarding clinical history, almost half of the participants reported the absence of a mental health condition before the flooding (48%). Some participants (39%) have sought mental health counselling in the past, while 53% reported they would like to receive mental health counselling. The flood did not impact most participants; therefore, they did not receive any support from the

Red Cross (79%), the Government of Alberta (79%), and insurers (84%). However, the majority reported receiving absolute support from family and friends (44%). Table 3.4.1 also shows that the prevalence of low resilience among our respondents was 37.4%.

Table 3.4.1. Descriptive Characteristics of the Sample by Gender at Birth

Variables	**Male** **n (%)**	**Female** **n (%)**	**Total** **n (%)**
Age(years)			
≤25	4 (14.8)	9 (5.7)	13 (7.0)
26-40	5 (18.5)	70 (44.0)	75 (40.3)
>40	18 (66.7)	80 (50.3)	98 (52.7)
Employment status			
Employed	24 (88.9)	151 (95)	175 (94.1)
Unemployed	3 (11.1)	8 (5.0)	11 (5.9)
Place of employment			
School boards	8 (33.3)	79 (52.7)	87 (50.0)
Healthcare industry	0 (0.0)	10 (6.7)	10 (5.7)
Keyano College	1 (4.2)	19 (12.7)	20 (11.5)
Oil sands industry	6 (25.0)	7 (4.7)	13 (7.5)
Municipal or government agency	5 (20.8)	8 (5.3)	13 (7.5)
Other	4 (16.7%)	27 (18.0)	31 (17.8)
Marital status			
Married/partnered/cohabiting	17 (63.0)	115 (72.3)	132 (71.0)

Divorced/separated/widowed	1 (3.7)	17 (10.7)	18 (9.7)
Single	9 (33.3)	27 (17.0)	36 (19.4)
Did respondents reside in Fort McMurray during the 2020 flood?			
Yes	25 (92.6)	151 (95.0)	176 (94.6)
No	2 (7.4)	8 (5.0)	10 (5.4)
Affected residence during the 2020 flood			
No flooding areas	20 (80.0)	125 (82.8)	145 (82.4)
Flooding areas	5 (20.0)	26 (17.2)	31 (17.6)
Homeownership prior to 2020 Fort McMurray flooding?			
Own home	17 (63.0)	124 (78.0)	141 (75.8)
Renting	10 (37.0)	35 (22.0)	45 (24.2)
Current homeownership			
Own home	18 (66.7)	127 (79.9)	145 (78.0)
Renting	9 (33.3)	32 (20.1)	41 (22.0)
History of mental health diagnosis from a health professional	6 (22.2)	52 (32.7)	58 (31.2)
Depression	1 (3.7)	5 (3.1)	6 (3.2)
Bipolar Disorder	9 (33.3)	69 (43.4)	78 (41.9)
Anxiety	0 (0.0)	0 (0.0)	0 (0.0)
Schizophrenia	0 (0.0)	2 (1.3)	2 (1.1)

Personality Disorder Other No mental health diagnosis	5 (18.5) 15 (55.6)	12 (7.5) 75 (47.2)	17 (9.1) 90 (48.4)
History of psychotropic medications Not on psychotropic medication	9 (33.3)	57 (35.8)	66 (35.5)
Respondents received MH counselling in the past year	9 (33.3)	63 (39.6)	72 (38.7)
Respondents would like to receive MH counselling	9 (33.3)	89 (56.0)	98 (52.7)
Where did respondents live just prior to the 2020 Fort McMurray flooding? Fort McMurray Other areas	22 (91.7) 2 (8.3)	145 (96.7) 5 (3.3)	167 (96.0) 7 (4.0)
Respondents witnessed the flooding of homes or structures in Fort McMurray?	20 (83.3)	111 (74.0)	131 (75.3)
Respondents who were fearful for their life or the lives of their friends or family during the flooding?	5 (20.8)	46 (30.7)	51 (29.3)
During the 2020 Fort McMurray flooding, how frequently did respondents watch television images about the devastation caused by the floods? Daily Less than daily Not at all	15 (62.5) 6 (25.0) 3 (12.5)	101 (67.3) 31 (20.7) 18 (12.0)	116 (66.7) 37 (21.3) 21 (12.1)

During the 2020 Fort McMurray flooding how frequently did you read newspaper and internet articles related to the devastation caused by flooding?			
Daily	15 (62.5)	117 (78.5)	132 (76.3)
Less than daily	8 (33.3)	27 (18.1)	35 (20.2)
Not at all	1 (4.2)	5 (3.4)	6 (3.5)
Property loss because of the floods in Fort McMurray:			
The house was completely destroyed	0 (0.0)	0 (0.0)	0 (0.0)
The house suffered substantial damage	1 (3.7)	8 (5.0)	9 (4.8)
The house suffered slight damage	1 (3.7)	4 (2.5)	5 (2.7)
The car was completely destroyed	1 (3.7)	3 (1.9)	4 (2.2)
The business was completely destroyed	0 (0.0)	6 (3.8)	6 (3.2)
No loss	24 (88.9)	141 (88.7)	165 (88.7)
Live in the same house you lived in before the floods			
Yes	18 (75.0)	129 (86.6)	147 (85.0)
No; I live in a different house even though my previous home was not destroyed by the flood	5 (20.8)	17 (11.4)	22 (12.7)
No; I live in a different house because my previous home was destroyed by the flood	1 (4.2)	3 (2.0)	4 (2.3)
Received sufficient support from family and friends during and after the floods			

Yes, absolute support			
Yes, some support	10 (43.5)	64 (44.4)	74 (44.3)
Yes, but only limited support	3 (13.0)	23 (16.0)	26 (15.6)
Not at all	2 (8.7)	15 (10.4)	17 (10.2)
	8 (34.8)	42 (29.2)	50 (29.9)
Received sufficient support from Red Cross			
Yes, absolute support	2 (8.3)	11 (7.5)	13 (7.6)
Yes, some support	2 (8.3)	4 (2.7)	6 (3.5)
Yes, but only limited support	0 (0.0)	7 (4.8)	7 (4.1)
Not at all	2 (8.3)	8 (5.4)	10 (5.8)
Not Applicable as I was not impacted by the floods	18 (75.0)	117 (79.6)	135 (78.9)
Received sufficient support from the Government of Alberta			
Yes, absolute support	2 (8.3)	9 (6.1)	11 (6.4)
Yes, some support	2 (8.3)	5 (3.4)	7 (4.1)
Yes, but only limited support	0 (0.0)	6 (4.1)	6 (3.5)
Not at all	2 (8.3)	10 (6.8)	12 (7.0)
Not Applicable as I was not impacted by the floods	18 (75.0)	117 (79.6)	135 (78.9)

Received sufficient support from insurers			
Yes, absolute support	0 (0.0)	5 (3.4)	5 (2.9)
Yes, some support	1 (4.2)	4 (2.7)	5 (2.9)
Yes, but only limited support	1 (4.2)	6 (4.1)	7 (4.1)
Not at all	1 (4.2)	10 (6.8)	11 (6.4)
Not Applicable as I was not impacted by the floods	21 (87.5)	122 (83.0)	143 (83.6)
Resilience			
Low resilience	6(25)	58(39.5)	64(37.4)
High resilience	18(75)	89(60.5)	107(62.6)

Chi-square/Fisher's Exact test of association between predictor variables and resilience

Chi-square analysis (see **Table 3.4.2**) shows significant associations ($p < 0.05$) between resilience and age, employment status, history of mental health diagnosis- depression or anxiety, on any medication for mental health concerns, receiving antidepressants, receiving mental health counselling in the past, and willingness to receive mental health counselling.

Table 3.4.2 Chi-Square Analysis/ Fisher's Exact test* of association between variables and resilience

Variables	Low resilience	High to normal resilience	Chi-square/fisher's Exact test* value	p- value
Age (years)				
≤25	7(77.8%)	2(22.2%)	8.098	**.015**
26-40	28(40.6%)	41(59.4%)		
>40	29(31.2%)	64(68.8%)		
Employment status				
Employed	56(34.8%)	105(65.2%)	8.220	**0.006**
Unemployed	8(80.0%)	2(20.0%)		
Place of employment				
School boards	27(34.6%)	51(65.4%)	3.454*	.642
Healthcare industry	3(33.3%)	6(66.7%)		
Keyano college	6(30.0%)	14(70.0%)		
Oil Sands industry	5(41.7%)	7(58.3%)		
Municipal or Government Agency	2(16.7%)	10(83.3%)		
Other	13(44.8%)	16(55.2%)		
Relationship status				
Married/Partnered/Cohabiting	45(36.3%)	79(63.7%)	1.121	.634
Divorced/Separated/Widowed	5(31.3%)	11(68.8%)		
Single	14(45.2%)	17(54.8%)		

Housing status Own home Renting	54(39.7%) 10(28.6%)	82(60.3%) 25(71.4%)	1.474	.247
History of Depression Yes No	34(63.0%) 30(25.6%)	20(37.0%) 87(74.4%)	21.976	**.000**
History of Bipolar Disorder Yes No	2(33.3%) 62(37.6%)	4(66.7%) 103(62.4%)	.044	1.000
History of Anxiety Yes No	41(56.9%) 23(23.2%)	31(43.1%) 76(76.8%)	20.229	**.000**
History of Personality Disorder Yes No	0(0.0%) 64(37.6%)	1(100%) 106(62.4%)	.602	1.000
No history of mental health diagnosis Yes (received MH Dx) No	46(51.7%) 18(22.0%)	43(48.3%) 64(78.0%)	16.112	**.000**
Received Antidepressants before the flood Yes	30(55.6%)	24(44.4%)	11.076	**.001**

No	34(29.1%)	83(70.9%)		
Received Antipsychotics before the flood Yes No	2(50.0%) 62(37.1%)	2(50.0%) 105(62.9%)	.276	.631
No medication for mental health concerns Yes No	32(52.5%) 32(29.1%)	29(47.5%) 78(70.9%)	9.150	**.003**
Receive MH counseling in the past Yes No	33(50.8%) 31(29.2%)	32(49.2%) 75(70.8%)	7.971	**.006**
Would like MH counseling Yes No	49(55.1%) 15(18.3%)	40(44.9%) 67(81.7%)	24.630	**.000**
Residing in McMurray during 2020 flood No Yes	5 (71.4%) 59 (36.0%)	2 (28.6%) 105 (64.0%)	3.603	.104

Residing area during the 2020 flood				
No flooding area	49 (36.6%)	85 (63.4%)	.111	.838
Flooding area	10 (33.3%)	20 (66.7%)		
Residence prior to 2020 McMurray flood				
In Fort McMurray	60 (36.6%)	104 (63.4%)	1.211	.427
Other	4 (57.1%)	3 (42.9%)		
Witness flooding of homes				
No	15 (35.7%)	27 (64.3%)	.070	.856
Yes	49 (38.0%)	80 (62.0%)		
Fearful of life and lives of family and friends during flood				
No	41 (33.9%)	80 (66.1%)	2.218	.165
Yes	23 (46.0%)	27 (54.0%)		
Frequency watching TV of the flood				
Daily	44 (38.6%)	70 (61.4%)	.328	.863
< Daily	12 (33.3%)	24 (66.7%)		
Never	8 (38.1%)	13 (61.9%)		

Frequency reading newspapers about the flood				
Daily	49 (37.7%)	81 (62.3%)	.470	.813
< Daily	12 (35.3%)	22 (64.7%)		
Never	3 (50.0%)	3 (50.0%)		
Lose property due to the flood				
No loss	57 (38.0%)	93 (62.0%)	.171	.679
Yes loss	7 (33.3%)	14 (66.7%)		
Live in the same house prior to the flood				
Yes	58 (40.3%)	86 (59.7%)	4.430*	.095
No (although home not destroyed by flood)	4 (18.2%)	18 (81.8%)		
No (home destroyed by flood)	2 (50.0%)	2 (50.0%)		
Family and friends support during/after the flood				
Absolute support	22 (30.1%)	51 (69.9%)	6.117	.107
Some support	8 (30.8%)	18 (69.2%)		
Limited support	9 (52.9%)	8 (47.1%)		
Not at all	23 (47.9%)	25 (52.1%)		

Support from Red Cross during/after the flood				
Absolute support	3 (23.1%)	10 (76.9%)	7.500*	.098
Some support	5 (83.3%)	1 (16.7%)		
Limited support	1 (14.3%)	6 (85.7%)		
Not at all	4 (40.0%)	6 (60.0%)		
N/A	50 (37.9%)	82 (62.1%)		
Support from the Government of Alberta during/after the flood				
Absolute support	1 (9.1%)	10 (90.9%)	7.681*	.088
Some support	5 (71.4%)	2 (28.6%)		
Limited support	3 (50.0%)	3 (50.0%)		
Not at all	4 (33.3%)	8 (66.7%)		
N/A	4 (33.3%)	8 (66.7%)		
Support from insurers during/after the flood				
Absolute support	1 (20.0%)	4 (80.0%)	1.927*	.789
Some support	3 (60.0%)	2 (40.0%)		
Limited support	2 (28.6%)	5 (71.4%)		
Not at all	4 (36.4%)	7 (63.6%)		
N/A	53 (37.5%)	87 (62.1%)		

*Fisher's exact test was used when the number of counts in any cell was less than 5.

Logistic regression analysis of predictors of low resilience

Nine of the variables in Table 3.4.2 with significant p values ($p < 0.05$) or p-values that were trending or approaching significance p values ($0.05 \leq p \leq 0.1$) were entered into the logistic regression model. However, because the variables "support from Red Cross after the flood" and "receiving antidepressants before the flood" were highly correlated ($r \geq 0.7$) with other variables, they were not included in the model. The entire model, including all nine predictors, was statistically significant, X^2 (14, N =168) = 77.54, $p < 0.001$, which suggested that the model could distinguish between respondents who reported low resilience and those reporting high to moderate resilience. The model explained between 37% (Cox and Snell R^2) to 50.4% (Nagelkerke R^2) of the variance and correctly classified 76.2% of all cases.

As illustrated in Table 3.4.3, six of the independent variables (age, history of depression, history of anxiety, desire to receive mental health counselling, place of residence before the flood, and support from the Government of Alberta) made unique statistically significant contributions to the model. The strongest predictor of low resilience was participants who would like to receive mental health counselling (Wald =14.42), (OR= 7.46; 95% CI 2.65-21.28). Results suggest that respondents who would like to receive mental health counselling were about 7.5 times more likely to show low resilience than those who would not want to receive mental health counselling.
Participants diagnosed with depression were nearly four times more likely to have low resilience than those without a historical diagnosis of depression (OR= 3.88; 95% CI 1.34-11.24). Similarly, those with a history of anxiety are 4.7 times more likely to show low resilience after the flood (OR= 4.72; CI 95% 1.51-14.71) than the respondent with no history of anxiety.

Age was statistically significant. Respondents 25 years and below were about 18.5 times more likely to show low resilience than respondents between the ages of 26 and 40 (OR= 18.52; 95% CI 1.76 - 200). Moreover, respondents under 25 years were nearly 26 times more likely to show low resilience than respondents 40 years and above (OR= 26.32; 95% CI 2.60-250)
Participants who are still residing in the same house as before the flood are 10.5 times more likely to show low resilience than those who have relocated, although their relocation is not due to the flood (OR=10.53; 95% CI 2.34-47.62).

Finally, participants who received some support from the Government of Alberta (OR= 208.343; 95% CI 3.284 - 13218.663) were more likely to express low resilience than those who received absolute support from the Government of Alberta, and similarly, participants who did not receive any Governmental support were more likely to express low resilience than those who received absolute support (OR= 67.688; 95% CI 1.723-2659.09).

Table 3.4.3 Chi-square test of association between demographic and clinical antecedents and the likelihood of low resilience

Variables		Coefficient	Standard Error	Wald statistic	P value	Odds Ratio	95% C.I.for Odds Ratio	
							Lower	Upper
AGE (YEARS)	≤25			7.805	**.020**			
	26-40	-2.924	1.203	5.911	**.015**	.054	.005	.567
	≥40	-3.277	1.183	7.671	**.006**	.038	.004	.384
Employment status		-1.609	1.186	1.840	.175	.200	.020	2.046
Depression (No)		-1.355	.540	6.282	**.012**	.258	.089	.744
Anxiety (No)		-1.552	.581	7.140	**.008**	.212	.068	.661
Not on any medication for mental health concerns		.327	.599	.298	.585	1.387	.429	4.487
Received mental health counselling in the past year		1.039	.558	3.466	.063	2.827	.947	8.445
Would like to receive mental health counselling		-2.010	.529	14.421	**.000**	.134	.047	.378
Residing in the same house before the flood	Yes			9.458	**.009**			
	No, although not due to flooding	-2.358	.769	9.401	**.002**	.095	.021	.427
	No, due to flooding	.141	1.325	.011	.915	1.151	.086	15.439
	Absolute			7.402	.116			

Receiving Support from the Government of Alberta during and after the floods	Some support	5.339	2.117	6.358	**.012**	208.343	3.284	13218.663
	Limited support	3.028	1.862	2.643	.104	20.651	.537	794.475
	No support	4.215	1.873	5.065	**.024**	67.688	1.723	2659.091
	Not applicable	3.278	1.687	3.776	.052	26.526	.972	723.931

DISCUSSION

This study is the first to examine the sociodemographic and clinical variables that impacted resilience one year after the 2020 Fort McMurray flooding. Prevalence of low resilience among our respondents was 37.4%.

Residents with low resilience were more likely to be young, stay in rental or other accommodation, relocate to a different home, have pre-existing mental health conditions, seek mental health counselling, and receive support. Out of the variables examined, the significant predictors of low resilience include age, relocation after the flood, a pre-existing anxiety disorder, pre-existing depressive disorder, level of perceived support from the Government of Alberta, and whether one wants to receive counselling.

There was an association between low resilience and the presence of these variables, ranging from nearly a fourfold (history of depression) to an almost twenty-six-fold (age; 40 years and older) less likely to experience low resilience. The rates of low resilience were 77.8% and 40.6% for those ages 25 and younger and for those ages 26 to 40 years ($p = 0.015$), respectively. The more one ages and experienced traumatic events such as natural disasters, the more they are resilient than younger people who have not experienced these events [45]. Another study also suggest that older

individuals may cope better under highly adverse circumstances because of higher resilience and more prosperous life experience [379]. Moreover, younger people exhibit acute psychological impairments and are considered more vulnerable, with minimal resiliency outcomes than older adults, following natural disasters [50, 380].

Previous studies have suggested that increased social support protects against mental health effects and increases resilience post-natural disasters [366]. Low levels of social support are also associated with post-disaster psychological symptoms and mental health disorders [50]. A longitudinal evaluation in a rural community in northern China after an earthquake revealed that the sample that received more support showed a general improvement in post-disaster wellbeing from 3 to 9 months post-disaster [362]. Similarly, in our study, individuals who received some support from the Government of Alberta were protective of low resilience. Introducing societal interventions will promote resilience in a large population of individuals physically and emotionally [366, 381].

Similarly, a study reported that lower social support post-disaster was associated with higher psychological distress implying low resilience [339, 382] and communal coping is protective against the mental health effects of the trauma associated with natural disasters [383]. A meta-analysis of risk factors associated with depression in 31 natural disasters publications established that social support (ORs = 0.95 for adults and 0.21 for children) may protect against mental-health-related stress and maximize resilience [384]. Interestingly, our study has revealed that support from the Government was a protective factor against low resilience after flooding in the logistic regression model.

Numerous studies have found that pre-existing mental health illness increases psychopathology and reduces resilience after natural disasters [367]. Published literature indicate that an existing mental health diagnosis of an anxiety disorder reduces resilience post-disaster and makes respondents prone to other mental health illnesses, like post-traumatic conditions [339, 342, 366]. One study that examined the association between resilience and various socio-contextual factors revealed that depression predicts low resilience in trauma-exposed individuals [379]. The history of anxiety was a risk factor of low resilience 18 months after the Fort McMurray wildfire [347].

Our findings are also consistent with other mental health studies regarding other disasters, which have reported predictors of low resilience related to pre-existing mental health conditions and exposure-related variables [242, 382, 385, 386].
Furthermore, our study showed an association between the increased likelihood of low resilience and the desire to receive counselling after the flood. This may stipulate those individuals experiencing low resilience were more likely to seek counselling services. On the contrary, some studies suggest that counselling after a traumatic event may not benefit the individual [355]. When a single session occurs, interventions may not contribute to long-term resilience [356]. The most conservative explanation for this finding is that adults who are distressed (lowest resilience) are most likely to be seeking mental health counselling.

Participants who do not reside in the same house as they did prior to the flood are about eleven-fold less likely to show low resilience although relocation was not due to the flood compared to those staying at the same home. This result is in relation to a study by Najarian et al. (2001), which revealed that women who relocated after the earthquake at Gumri had significantly higher depression scores and low resilience than women who stayed in the earthquake city [387]. Likely, remaining at the disaster site is usually associated with high to normal resilience, quicker recovery, and healing [388]. This finding suggests that those who move out of the disaster zone do so because they might not have the resilience to overcome any psychological disturbance. On the contrary, children who relocated after an earthquake and children who remained at the earthquake zone had no significant reduction in behavioral difficulties, depression, and post-traumatic disorders [389]. Despite the frequency of post-disaster relocation and evidence of its effect on psychological well being, there is a relative scarcity of studies; hence, further research is needed in that area.

Restoring devastated communities may be difficult when the majority of the residents who have low resilience are suffering from other mental health comorbidities [390]. Effective tools must be developed to identify vulnerable individuals in need of accessing mental health resources. However, it is essential to study resilience post-disaster and screen residents for depression and anxiety, among other mental health conditions since their existence predicts low resilience. Making this perhaps the most critical factor influencing the effectiveness of emergency preparedness, response, and recovery is good governance [391]. This has led some researchers to

recommend that healthcare systems, government bodies, and policymakers put supportive measures post-disaster to increase resilience and reduce mental health effects [50].

LIMITATIONS OF THIS STUDY

Our study has some limitations which need to be considered when interpreting our findings. Firstly, we relied on online convenience sampling methods, as the circumstances of the pandemic did not allow for a more systematic approach to data gathering at the population level. Second, the sample of respondents was not fully representative of the community since data was obtained from a few of Fort McMurray residents, with a total number of residents of about 111,687. Thirdly, we did not try to equate the genders in absolute numbers. It certainly would have been better to have an equal number of males and females, but the nature of this type of research is restrictive in that sense. Lastly, most residents at the disaster zone do not return to the former house post-disaster, thereby decreasing the sample's population [341]. It can be explained that most residents severely affected might have chosen not to return to the town within the year when this study was conducted, perhaps permanently. This is likely due to the recent economic downturn in the oil industry, coupled with the COVID-19 global pandemic and the relative isolation of this small town. Notwithstanding these limitations, the current results add to other natural disaster studies and suggest that clinical variables and sociodemographic affect resiliency rather than flood exposure variables.

CONCLUSION

The results of the study suggest clinical characteristics grossly contribute to low resilience after a natural disaster. Risk factors reduce resilience, specifically, younger age, a pre-existing anxiety disorder, and pre-existing depression contributes to low resilience after the flood. Other factors that predispose flood victims to low resilience include relocation and a perceived lack of governmental support. Our findings are broadly in accord with the natural disaster and flood-related literature. Further studies are needed to unravel other clinical variables that may contribute

to low resilience in flood victims. In-depth research is needed into the association between support from a government body, relocation, and resilience.

Psychological first aid has become the choice of post-disaster intervention to provide safety and necessities for victims' post-disaster. This promotes adaptive coping, reduces acute stress, and increases resilience [45]. In addition, policy implications and post-disaster interventions must be developed to help mitigate future psychopathology and provide overall mental health resilience. Novel electronic and mobile health options which are economical and effective such as daily supportive text messaging, can reduce the psychological distress after traumatic events like flood and improve the resilience of the residents [71, 82, 94, 312, 315, 392]. This study adds to the growing body of literature suggesting that mental health promotion is of key importance in the aftermath of natural disasters.

3.5. Prevalence and correlates of cannabis abuse among residents in the community of Fort McMurray, a city in Northern Alberta which had endured multiple natural disasters

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ABSTRACT

Background

Cannabis is one of the widely used drugs for relaxation and may be abuse among users. Researchers have given attention to cannabis use among the general population while vulnerable populations who have experience multiple traumas may be at risk of cannabis abuse. Other factors may influence cannabis abuse among people exposed to traumas.

Objective

The study aims to determine the prevalence and correlates of self-reported cannabis abuse among residents of Fort McMurray, a city in Northern Alberta, Canada.

Methods

A cross-sectional survey was conducted using an online questionnaire. Sociodemographic data, trauma exposure, and clinical characteristics were collected to identify the possible risk factor of cannabis abuse. Data were analyzed with SPSS version 25 using a chi-square test and binary logistic regression analysis. Correlation analysis was also performed to ascertain likely cannabis abuse and the association with other mental health conditions.

Results

Overall, participants who completed the survey were one hundred and eighty-sixed out of the two hundred and forty-nine residents who accessed the online survey, giving a response rate of 74.7%. The prevalence of self-reported cannabis abuse among participants was 14%. Most of the

participants were females (159, 85.5%), more than forty years of age (98, 52.7%), employed (175, 94.1%), owned their house (145, 78.0%), and 103 (60.6%) reported being exposed to at least a trauma (COVID-19, flooding, or wildfire). Regarding regression analysis results, participants living in a rented accommodation were nearly four times more likely to abuse cannabis (OR= 3.86; 95% CI: 1.34–11.14) than those owning their houses. Similarly, male participants were more than six folds more likely to abuse cannabis than the female gender (OR= 6.25; 95% CI: 1.89 – 20), and participants in a relationship were six times more likely to abuse cannabis than participants not in a relationship (OR= 6.33; 95% CI: 1.67–24.39). The study also found significant association of depressive symptoms ($X^2 = 4.561$; $p = 0.033$) and anxiety symptoms ($X^2 = 4.700$; $p = 0.030$) with likely cannabis abuse.

Conclusion

Demographic factors significantly predicted likely cannabis abuse in the Fort McMurray population, and cannabis abuse significantly correlated with presence of moderate to high anxiety and depression symptoms. It is essential to mobilized resources to support vulnerable communities and manage cannabis abuse.

INTRODUCTION

Globally, cannabis is a habitually used psychoactive substance [393] and one of the most extensively used recreational drugs in Canada [56]. According to the United Nations Office on Drugs and Crime, in 2019, the annual prevalence of cannabis use was 3.86% globally [394]. Since the legalization of cannabis in Canada in 2018, the usage has increased by about 2% among people 15 years and older from 14.9% to 16.8% in 2019 [56, 395]. Similarly, statistics from the National Survey on Drug Use and Health recorded the prevalence of cannabis use at 17.9% in 2020 [6]. In a systematic review and meta-analysis, the prevalence of cannabis use disorder and cannabis abuse among people who use cannabis was recorded at 22% and 13% respectively [396].

This suggests that as the overall prevalence increases, the risk for cannabis use disorder increases [6, 397, 398]. Cannabis misuse can negatively affect one's mental health, especially for those with comorbid anxiety or depressive disorders and is associated with suicidal ideation [7]. Furthermore, individuals with mental illnesses like depressive and anxiety disorders and post- traumatic stress disorder are more prone to problematic cannabis use than the general population [57].

Experiencing mental health disorders is likely to cause a surge in the abuse of cannabis [399]. The US saw an increase in the prevalence of cannabis use among people with depression from 2005 to 2017 [400]. Clinical practice and epidemiological studies have also proven that a history of depressive disorder predisposes an individual to cannabis use [401, 402] which may lead to abuse and later worsen their conditions [400, 403]. For example, a study among 728,691 people reported that individuals experiencing depression are 18.8% as likely to abuse cannabis as the rest of the population [400].

In the United States, major depressive disorder is one of the commonest psychological illnesses, with an estimated lifetime prevalence of 17% [404]. This history of depressive disorder increases the prevalence of cannabis use among patients with major depressive disorder. The literature on why individuals with mental health history abuse cannabis are limited and it is also unknown whether there is likely cannabis abuse among those with various history of mental health conditions [400].

Numerous explanations have been reported why cannabis abuse may be more eminent among people with mental health conditions than those without. For example, Gruber et al. (1996) suggested that cannabis possesses antidepressant effects; thereby, the depressive patient uses it to reduce depressive symptoms [405]. Other research suggests that individuals may use cannabis to induce sleep among those with PTSD [406] and reduce anxiety symptoms [407]. Notwithstanding, other clinical associations and sociodemographic predictors remain unclear, and further research is needed to explore these factors. Other demographic parameters may be attributed to the use of cannabis. For example, a comparative study conducted by Van Etten and Anthony revealed that the male gender has the potential to venture into drug usage and desire to explore substances when the opportunity arises [408]. On the contrary, the same research group found that females will instead progress, and abuse cannabis once exposed to the substance [408]. Marital status has also become a predisposing factor to cannabis use. A critical review among adults in the 21st century

revealed that being unmarried increases the individual's chances of using cannabis [409]. The neighborhoods and housing status may influence cannabis use. For example, a survey among the youth suggests that there is a 30% likelihood that deteriorating neighborhoods expose the youth to cannabis [410]. Similarly, homeless youth and those living in critical housing situations usually use cannabis [411].

Other studies have focused on the exposure to traumatic events and the usage of substances (e.g., cannabis) leading to substance abuse [339, 347, 412]. Fort McMurray residents have been exposed to various traumatic events including wildfire, flooding and the recent global pandemic which may lead to cannabis usage [49, 52, 54, 413]. A study by Agyapong et al. (2018) reported that participants in a cross-sectional study were more likely to abuse substances after the wildfire in Fort McMurray [339]. Other studies have also examined the association between substance use among individuals who have experienced traumatic events [414, 415]. However, these reasons would not explain why there may be an increase in likely cannabis abuse among people in Fort McMurray at this time. Further research is needed to establish the correlation between cannabis use and other mental health conditions, even though few studies have found significant associations between problematic drug use and likely mental health conditions (PTSD, depression and anxiety) [347]. Irrespective of the contributions made by various studies, important questions remain regarding the factors influencing likely cannabis abuse among a vulnerable population who have experienced multiple traumas. To bridge the gaps in knowledge, we sought to assess the risk and identify the predictors of cannabis abuse and the association between mental health conditions and likely cannabis abuse among residents of Fort McMurray, where residents have experienced multiple traumas.

METHODOLOGY

Study Setting

Fort McMurray is the urban service area of the Regional Municipality of Wood Buffalo in Northern Alberta, Canada. Following the 2021 census, the population of Fort McMurray was 106,059 [416]. The population consists of 52.6% males and females 47.4% in the municipality [416]. The municipality is dominated by the youth, with 42.4% between the ages of 20 and 44.

Residents of Fort McMurray have experienced a series of traumatic events in recent times, such as the global pandemic (COVID-19) [417], the 2016 wildfire that destroyed homes and evacuated many residents [339], and the 2020 flooding [340] that threatened lives and properties.

Study Design and Institutional Review Board Approval

The study was a cross-sectional survey design, with quantitative data collected through self-administered online questionnaires with the REDCap software [36]. Data were collected between April 24 and June 2, 2021. Participants provided consent when they clicked on the survey link and submitted responses. This study was conducted per the University of Alberta Reviews and Ethics Board (Pro00066054).

Outcome and measures

The primary outcome measure was to assess the likely cannabis abuse among participants, through a self-reported question; have you abused cannabis in the past year.

Other variables of mental health conditions in the study were measured, depressive symptoms, resilience, PTSD, anxiety symptoms, and suicidal ideation.

The Patient Health Questionnaire (PHQ-9) was used to measure the depressive symptoms of participants [86]. The nine-item were measured on a four Likert scale. The PHQ-9 scale categorizes depression based on scores into none-minimal (0-4 points), mild (5-9 points), moderate (10-14 points), moderately severe (15-19 points), and severe (20-27 points) [86]. The scores were further categorized into two categories: none to mild depression and moderate to severe depression. The reliability and validity of the tool have good psychometric properties, and the internal consistency of the PHQ-9 has been shown to be high [86].

The brief Resilience Scale (BRS) was used to assess participants' resilience or the ability to recover from stress. A score ranging from 1.00-to 2.99 indicates low resilience, while a score ranging from 3.00 to 5.00 indicates high to normal resilience [91]. Regarding reliability and validity literature shows that the BRS has good internal consistency, with Cronbach alphas ranging from 0.80 to 0.90, and test–retest reliability coefficients for a two-week interval were fair (0.61 to 0.69).

The Post Traumatic Stress Disorder Checklist Civilian (PCL-C) was used to assess likely PTSD symptoms. The level of distress produced by each symptom is rated on a five Likert scale from 1(not at all) to 5 (extremely) and a score of 44 or more was classified as likely PTSD and a score below 44 as unlikely PTSD [89]. The PCL-C demonstrated good internal consistency and retest reliability and favorable patterns of convergent and discriminant validity [90].

The Generalized Anxiety Disorder-7 (GAD-7) scale measured participants' likelihood of anxiety symptoms. The self-reported tool consists of seven items rated on a four Likert scale. The score was recategorized into a binary; low anxiety (score less than 10) and moderate to high anxiety (score of 10 or more). A more severe symptom means a higher score (0 to 21) [87]. The internal consistency and test–retest reliability of the GAD-7 was good, and it also provided good criterion, construct, factorial, and procedural validity [88].

The survey included a question on likely suicidal ideation (the ninth question of the PHQ-9 scale) which asked whether participants had passive death wishes/thoughts of self-harm in the last two weeks. In addition, the survey contained questions related to participants' mental health and medication history, as well as exposure to multiple traumas, i.e., COVID-19, wildfires, and flooding.

Data Collection and Statistical Analysis

All participants were requested to complete questions related to demographic, clinical and multiple trauma exposures (COVID-19, flooding, or wildfire). The survey questions distributed were programmed into REDCap, an online survey program. Participants were offered to fill out the online survey forms at their convenience.

Demographic variables included gender, age, employment status, and housing status. Clinical variables included the history of mental health diagnosis and previous psychotropic medication use, mental health counseling history, and willingness to receive mental health counseling.

Finally, the data collection form was chosen based on a literature review of some predictive factors included in survey questions, including variables to assess the likelihood of other mental health conditions; PTSD, anxiety, depression, suicidal ideation, and resilience [57, 418, 419].

The data were analyzed using SPSS Version 25 [345]. Demographic, clinical, and multiple trauma exposure variables were examined against relationship status. Demographic characteristics were presented as raw numbers and percentages.

We were interested in examining the different clinical factors that may, at length, lead to the outcome of likely cannabis abuse. Cross-tabular analyses using the Chi-square test explored the association between demographic, clinical, and trauma variables and the likelihood of cannabis abuse.

A logistic regression model was performed, including the variables which were statistically significant or nearly significant ($p \leq 0.1$) to the likelihood of participants abusing cannabis, derived from the Chi-square analysis. Correlational analysis was performed initially to exclude variables which were highly corelated with other variables (Spearman's correlation coefficient of 0.7 to 1.0 or − 0.7 to − 1.0) before running the regression model. Odds ratios (OR) and confidence intervals (C.I) obtained from the binary logistic regression analysis were appraised for the likelihood of participants abusing cannabis while controlling for the other variables in the model.

We performed a chi square test to ascertain the association between the likely cannabis abuse and the likelihood of other mental health conditions. There was no data imputation for missing data. The data analyzed and reported reflect the number of responses to each question.

RESULTS

An online survey link was distributed to 249 residents of Fort McMurray; out of this number, a total of 186 completed the questionnaires with no gross incompletion giving a response rate of 74.7%.

Descriptive Sample Characteristics

Table 3.5.1 illustrates the demographic profile of the participants and their clinical characteristics examined against relationship status. The prevalence of likely cannabis abuse was 14.0%. The majority were females 159 (85.5%), above the age of forty years 98 (52.7%), employed, 175 (94.1%), and owed their houses 145 (78.0%). Regarding clinical variables, 78 (41.9%) reported having a history of anxiety diagnosis from a health professional, while 58 (31.2%) reported a history of depression. Again, 59 (31.7%) of the participants were on antidepressants, 21 (11.3%)

on sleeping tablets, 72 (38.7%) reported receiving mental health counselling in the past year, and 98 (52.7%) of the participants were willing to receive mental health counselling. Participants, 103 (60.6%) reported experiencing COVID-19 and either Wildfire or flooding traumas.

Table 3.5.1: Demographic profile, clinical characteristics and trauma experienced by the study population

Variables	**In a relationship n (%)**	**Not in a relationship n (%)**	**Total n (%)**
Gender			
Male	17 (12.9)	10 (18.5)	27 (14.5)
Female	115 (87.1)	44 (81.5)	159 (85.5)
Age categories			
≤40y	62 (47.0)	26 (48.1)	88 (47.3)
>40y	70 (53.0)	28 (51.9)	98 (52.7)
Employment status			
Employed	125 (94.7)	50 (92.6)	175 (94.1)
Unemployed	7 (5.3)	4 (07.4)	11 (5.9)
Housing status			
Own home	113 (85.6)	32 (59.3)	145 (78.0)
Renting	19 (14.4)	22 (40.7)	41 (22.0)
History of mental health diagnosis from a health professional?			
Depression	37 (28.0)	21 (38.9)	58 (31.2)
Anxiety	54 (40.9)	24 (44.4)	78 (41.9)
History of psychotropic medications			
Antidepressants	34 (25.8)	25 (46.3)	59 (31.7)
Sleeping tablets	12 (9.1)	9 (16.7)	21 (11.3)
Respondents received MH counselling in the past year	48 (36.4)	24 (44.4)	72 (38.7)

Respondents would like to receive MH counselling	66 (50.0)	32 (59.3)	98 (52.7)
Multiple traumas COVID-19 trauma only COVID-19 and either Wildfire or flooding traumas COVID-19, Flooding and Wildfire traumas	 13 (10.7%) 78 (63.9%) 31 (25.4%)	 6 (12.5%) 25 (52.1%) 17 (35.4%)	 19 (11.2) 103 (60.6) 48 (28.2)
No cannabis abuse **Cannabis abuse**	110 (83.3%) 22 (16.7%)	50 (92.6%) 4 (7.4%)	160 (86.0%) 26 (14.0%)

MH: Mental health

Associations between Sociodemographic, Clinical, and trauma exposure variables and likely cannabis abuse.

Table 3.5.2 represents the results of the Chi-square analysis. Specifically, seven of the variables were identified via Chi-square analysis with significant p values ($p \leq 0.05$) or p-value trending significance ($0.1<p<0.05$). The bivariable analysis in Table 3.5.2 illustrates statistically significant associations ($p \leq 0.05$) between gender, housing status, history of depression diagnosis, history of mental health counselling, willingness to receive mental health counselling, and the likelihood of abusing cannabis. In contrast, relationship status and history of antidepressants showed a p-value near significance ($0.1<p<0.05$).

Participants who were males, in a relationship, renting accommodation, had a history of depression, received antidepressants, and received mental health counselling in the past, and those who were willing to receive mental health counselling were more likely to abuse cannabis compared to the following respectively: participants who were females, those who were not in a relationship, staying in their own house, had no history of depression, nor were on antidepressants, no history of receiving mental health counselling and not willing to receive mental health counselling.

Table 3.5.2: Chi-square test of association between cannabis abuse, demographic, clinical and trauma-related variables

Variables	No cannabis abuse	Cannabis abuse	Chi-square	P-value	Effect size
Gender					
Male	19(70.4%)	8(29.6%)	6.434	**0.011**	0.186
Female	141(88.7%)	18(11.3%)			
Age categories					
≤40y	76(86.4%)	12(13.6%)	0.016	0.999	0.009
>40y	84(85.7%)	14(14.3%)			
Employment status					
Employed	152(86.9%)	23(13.1%)	1.718	0.367	0.096
Unemployed	8(72.7%)	3(27.3%)			
Relationship status					
In a relationship	110(83.3%)	22(16.7%)	2.732	0.098	0.121
Not in a relationship	50(92.6%)	4(7.4%)			
Housing status					
Own home	129(89.0%)	16(11.0%)	4.741	**0.029**	0.160
Renting	31(75.6%)	10(24.4%)			
History of Depression from a health professional	45(77.6%)	13(22.4%)	4.987	**0.026**	0.164
Yes	115(89.8%)	13(10.2%)			
No					
History of Anxiety from a health professional	65(83.3%)	13(16.7%)	0.369	0.369	0.066
Yes	95(88.0%)	13(12.0%)			
No					
History of Antidepressant medications	47(79.7%)	12(20.3%)	2.907	0.088	0.125

Yes No	113(89.0%)	14(11.0%)			
History of Sleeping tablets medications Yes No	16(76.2%) 144(87.3%)	5(23.8%) 21(12.7%)	1.903	0.168	0.101
Respondents received MH counselling in the past year Yes No	57(79.2%) 103(90.4%)	15(20.8%) 11(9.6%)	4.591	**0.032**	0.157
Respondents would like to receive MH counselling Yes No	79(80.6%) 81(92.0%)	19(19.4%) 7(8.0%)	5.040	**0.025**	0.165
Multiple traumas COVID-19 trauma only COVID-19 and either Wildfire or flooding traumas COVID-19, Flooding and Wildfire traumas	17(89.5%) 89(86.4%) 41(85.4%)	2(10.5%) 14(13.6%) 7(14.6%)	0.192	0.908	0.034

Multivariate Binary Logistic regression results

Seven of the variables identified via Chi-square analysis, as shown in table 3.5.2, with significant p values ($p < 0.05$) or p-values approaching significance ($0.05 \leq p \leq 0.1$), were illegible for the logistic regression analysis. However, the variables "history of antidepressant medications" was highly correlated ($r \geq 0.7$) with "History of depression", hence, not included in the model. As presented in Table 3.5.3, the logistic regression model showed the association between independent (demographic and clinical) variables and cannabis abuse among respondents in Fort McMurray. The entire model containing all the six predictors was statistically significant; X^2 (6,

N=186) = 28.36, $p < .001$, suggesting that the model was able to differentiate between participants who are addicted to cannabis and those who are not addicted to cannabis. The model explained between 14.1% (Cox and Snell R^2) and 25.5% (Nagelkerke R^2) of the variance in the likelihood that participants will present with symptoms of cannabis addiction and correctly classified 86.0% of cases. According to the goodness-of-fit statistic using Hosmer-Lemeshow goodness-of-fit test, the model was adequately fit ($X^2 = 5.80$; $p = 0.56$).

Only three of the six predictors made unique contributions to the model (gender, relationship status and housing status). The strongest association (Wald= 9.05) was found among the female gender (OR=0.158; 95% CI: 0.047-0.526). This suggests that males are six times more likely to abuse cannabis than females. Similarly, participants in a relationship are more than six times more likely to abuse cannabis than participants not in a relationship (OR=0.158; 95% CI: 0.041-0.598). Finally, participants renting accommodation are approximately four times as likely to abuse cannabis (OR=3.859; 95% CI: 1.337-11.137).

Table 3.5.3: Multivariable logistic regression model for participants' likelihood of abusing cannabis

Variable	**Coefficient**	**Standard Error**	**Wald**	**P-Value**	**Odds Ratio**	**95% C.I for Odds Ratio**	
						Lower	Upper
Gender (female)	-1.846	.614	9.045	**.003**	.158	.047	.526
Relationship status (not in a relationship)	-1.848	.681	7.377	**.007**	.158	.041	.598
Housing status (renting)	1.351	.541	6.238	**.013**	3.859	1.337	11.137
History of Depression	.870	.532	2.671	.102	2.387	.841	6.777

Received Mental health counselling in the past	.238	.578	.170	.680	1.269	.409	3.939
Would like to receive mental health counselling	1.085	.643	2.842	.092	2.959	.838	10.443

C.I.: confidence interval

Associations Between Likely cannabis abuse and other mental health conditions

Table 3.5.4 shows an association between the likely cannabis abuse and other mental health conditions. The results suggest a significant association between likely moderate to severe depression and cannabis abuse. 14(18.4%) of the moderate to severe depression participants are likely to abuse cannabis, compared to 7(7.5%) of those with at most mild depression. Similarly, participants with likely moderate to high anxiety 13(18.3%) were more likely to abuse cannabis, compared to participants with low anxiety 7(7.3%).

Table 3.5.4: Association between the likely cannabis abuse and other mental health conditions

Variables	**No cannabis abuse**	**Cannabis abuse**	**Chi-square/ Fisher's Exact**	**P-value**	**Effect size**
Likely depression					
At Most Mild Depression	86(92.5%)	7(7.5%)	4.561	**0.033**	0.164
Moderate to Severe Depression	62(81.6%)	14(18.4%)			
Likely suicidal ideations					
Have not had passive death wishes/thoughts of self-harm in the last two weeks	125(89.3%)	15(10.7%)	2.197	0.138	0.114
	23(79.3%)	6(20.7%)			

Have had passive death wishes/thoughts of self-harm in the last two weeks					
Likely anxiety					
Low anxiety	89(92.7%)	7(7.3%)	4.700	**0.030**	0.168
Moderate-to-high anxiety	58(81.7%)	13(18.3%)			
Likely PTSD					
Unlikely PTSD	89(89.9%)	10(10.1%)	1.023	0.312	0.079
Likely PTSD	55(84.6%)	10(15.4%)			
Resilience					
High to normal resilience	93(86.9%)	14(13.1%)	0.012	0.912	0.008
Low resilience	56(87.5%)	8(12.5%)			

DISCUSSION

The prevalence of self-reported cannabis abuse among residents of Fort McMurray was 14%. After adjusting for confounders, gender, relationship status, and housing status were significantly associated with self-reported cannabis abuse among the study sample. Further, self-reported cannabis abuse was significantly associated with moderate to severe depression and moderate to high anxiety symptoms. Other literature has recorded a varying prevalence of cannabis abuse [56, 398, 420]. The variation in prevalence may be attributed to many factors, including the country where cannabis use is legalized. For example, Canada saw an increase in cannabis use since it was legalized and recorded the prevalence of cannabis use at 16.8% in 2019 compared to 14.6% in 2018. However, a national survey in South Africa recorded 5.0% non-daily and 2.8% daily cannabis use [420]. However, improper, and continuous use of cannabis use has been associated with other substance use disorders [56]. Nonetheless, the majority notice occasional use of

cannabis as unremarkable but literature has found that as overall prevalence increases, the risk for cannabis use disorder increases [398].

This study indicates gender as a predictor of likely cannabis abuse, with the prevalence of self-reported cannabis abuse among the male gender being 30% compared to 11% among females. This finding is consistent with several studies which report that males are more likely to use cannabis [7, 56, 420]. However, this prevalence of self-reported cannabis abuse is much higher than those reported in previous studies across Canada which reported a prevalence of 1.9% in males and 0.7% in females [7]. Males are noted to take an adventure in using cannabis more than females [408], which may account for the increased prevalence of self-reported cannabis abuse in this study which showed that males are six times more likely to use cannabis. On the contrary, another study suggests that females are more likely to abuse cannabis than males once exposed to its use [19]. These disparities may be due to genetic variations and social norms [421, 422].

This study also shows a correlation between relationship status and self-reported cannabis abuse. Participants in a relationship are six times more likely to self-report cannabis abuse compared to participants who were not in a relationship. The literature differs on the association between relationship status and cannabis use. One study reported that participants who are not in a relationship have increased stress and may resort to problematic cannabis use [409]. A 20-year longitudinal study of cannabis use reported that adult roles and not being married was significantly associated with cannabis use [423]. Homish et al. (2007) concluded that unmarried people who use cannabis might strongly predict cannabis use in their relationship [424].

This study showed that participants living in rented houses were almost four times more likely to self-report cannabis abuse than those owning their homes. On the contrary, several studies have reported the state of homelessness and substance use. For example, a report on substance usage and homelessness in Canada disclosed that 27.6% of male respondents' substance use is due to housing loss [425]. Sekharan (2015) also reported that homeless youth and people living in critical housing situations usually use cannabis [411]. Whereas studies associate homelessness with the use of cannabis and its abuse, this study did not collect data specific to homelessness. Thus, we are unable to hypothesize the reason for our findings conclusively. Future research is required to ascertain the relationship between housing status and self-reported cannabis abuse.

Our study found an association between cannabis abuse and other mental health conditions. People experiencing mental illnesses like schizophrenia, anxiety disorders, post-traumatic stress disorder, and depression usually indulge in problematic cannabis use, perceiving that cannabis use is innocuous [57]. Comparably, individuals with a history of anxiety or depression may use cannabis to soothe pain or aversive sensations [426]. Continuous use of cannabis to manage negative effects associated with mental disorders results in the abuse of the substance [426]. More than 18% of the participants in this study reported likely moderate to severe depression symptoms, and self-reported cannabis abuse was positively correlated with presence of moderate to high depression symptoms. The findings from this study are consistent with results from other studies. For example, a study in the United States estimated that cannabis use among people with depression is double the rate of those who are not depressed [400]. Major depressive disorder also recorded 19% higher odds in the likelihood of cannabis use in a study conducted by Marmet et al. (2021) [427]. Similarly, a study to examine risk factors of substance abuse among the youth reported that depressed youths had high odds of abusing cannabis [62]. It has also been argued that young people may exhibit suicidal ideations and depressive symptoms when using cannabis [428].

The proportion of participants who reported moderate to severe anxiety symptoms in this study was similar to those who reported moderate to high depression symptoms (18.4%). Anxiety disorder, like other mood disorders, makes an individual vulnerable to the use of cannabis. A meta-analysis concluded that the use of cannabis might cause the onset of affective disorders, including anxiety [401]. Predictably, continued use of cannabis is related to elevated prevalence of anxiety disorders and vice versa [429].

Consistent with various literature [406, 415, 428, 430], this study found no significant association between self-reported cannabis abuse and suicidal ideation, PTSD, or low resilience [406, 415, 428, 430]. Despite evidence supporting that individual with PTSD use cannabis to mitigate their symptoms [406, 430]. Exposure to disasters is relatively common, and individuals may experience at least a trauma in their lifetime; others may develop mental health illnesses like PTSD, substance use disorders, and depression [45, 339] as a result of the trauma. Exposure to traumatic events is usually accompanied by increased cannabis use and abuse [431]. Approximately 60.6% of the participants in this study reported experiencing COVID-19 and either wildfire, or flooding. However, this study's traumatic exposure was not significantly associated with self-reported

cannabis abuse, which contrasts with the previous study [431]. Some studies have compared age and the impact of trauma on substance abuse. Younger individuals experience acute psychological impairments when exposed to traumatic events and are hence more vulnerable than adults to abuse cannabis [50, 380]. Yet, this study did not find younger age predictors for cannabis abuse during traumatic exposures. Although studies have shown the effects of traumatic experiences on mental health conditions such as cannabis use disorder, not all people subject to the trauma will develop psychological complications [432].

LIMITATION

Limitations are often unavoidable, especially for studies involving traumatic conditions; therefore, the study's limitations are worth mentioning. Primarily, the sample size for the study was not fully representative of the municipality, given that males are about 5.2% more than females in the municipality and more than 85% of our participants were female, even though they embrace about 47% of the Fort McMurray population. Also, the response rate for the study was computed by using participants who assessed the survey link as the denominator instead of the number who received the survey link, perhaps the overestimation of the response rate. Finally, the scales used to measure likely mental health conditions in the study were self-reported by participants and were not supported by objectivity and detailed clinical assessment. Notwithstanding these limitations, this study is one of the few to examine predictors of likely cannabis abuse. It adds to the literature by documenting potential predictive factors for cannabis abuse and the association with mental health symptoms among a population that has experienced multiple traumas.

CONCLUSION

This research highlights potential predictors of likely cannabis abuse among populations who have experienced multiple traumas. These factors include gender, relationship status and housing status. However, the data found no significant association between exposure to trauma and self-reported cannabis abuse. The presence of PTSD symptoms was not associated with self-reported cannabis abuse. However, the presence of moderate to high anxiety and depression symptoms correlated with self-reported cannabis abuse. Further studies are needed in a larger sample to explore the

demographic and clinical factors that impact cannabis abuse among populations who have experienced multiple traumas. There is also a need for research into innovative treatment options for individuals presenting with mental health symptoms post-natural disasters to minimize cannabis abuse. Low-cost interventions such as supportive text messaging have been proven effective for supporting the mental health and addiction-related variables among patients [81, 313, 315, 316, 433] and the public [71, 213, 434, 435] and are geographic location-independent. They can reach thousands of individuals simultaneously with ongoing mental health support post-natural disasters. Finally, policymakers need to mobilize the resources that examine how to create buffer conditions against cannabis abuse.

3.6. Prevalence and predictors of alcohol abuse and association with symptoms of other mental health conditions in the residents of Fort McMurray after the 2016 wildfires, COVID-19 pandemic, and 2020 flooding.

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Background

Individuals usually consume alcohol for varied reasons, which progresses to abuse. Several factors may contribute to alcohol abuse, and people exposed to multiple traumas like flooding, COVID-19, and wildfire may be more vulnerable to abusing alcohol. Individuals with pre-existing mental health conditions may also be susceptible to alcohol abuse.

Objective

The study aims to determine the prevalence and predictors of self-reported alcohol abuse among residents of Fort McMurray, Alberta, Canada, and whether self-reported alcohol abuse correlates with common mental health conditions.

Methods

A quantitative cross-sectional survey was adopted. Data were collected using an online questionnaire. Sociodemographic data, trauma exposure, and clinical characteristics were collected to identify the predictors of alcohol abuse. The SPSS version 25 was used to analyze the data using descriptive statistics, chi square, and logistic regression analysis. Correlation analysis was also performed to determine the association between self-respect alcohol abuse and other mental health conditions.

Results

Two hundred and forty-nine individuals accessed the online survey link, out of which 186 completed the survey, yielding a response rate of 74.7%. Most participants were females (159, 85.5%), and 103 (60.6%) reported exposed to COVID-19 and either wildfire or flooding traumas. The prevalence of self-reported alcohol abuse among our respondents was 27.4%. Participants who would like to receive mental health counselling were three times more likely to self-report alcohol abuse than those who did not express the desire to receive mental health counselling (OR=3.017; 95% CI: 1.349-6.750). The study also found significant association between self-reported alcohol abuse and self-rated moderate to high depression symptoms ($X^2 = 4.783$; $p = 0.033$), moderate to high anxiety symptoms ($X^2 = 4.102$; $p = 0.047$) and suicidal ideations or thoughts of self-harm ($X^2 = 13.536$; $p = 0.001$).

Conclusion

The desire to receive mental health counselling predicted self-reported alcohol abuse among residents of Fort McMurray, and self-reported alcohol abuse correlates with suicidal ideations, moderate to severe anxiety and depression symptoms. Hence, measures to reduce mental disorders such as depression and anxiety may help reduce alcohol abuse and associated mental health burden in vulnerable populations.

INTRODUCTION

Alcohol is a psychoactive substance that is globally used, and the adverse effect it has on the individual has been known since the documentation of histories [64, 436]. In most parts of the world, adults consume alcohol occasionally [437], common substance people usually abuse in all age groups [7]. Among people aged twelve or older in 2019, 50.8 percent reported drinking alcohol in the past month [6, 64]. In the Western Pacific Region, approximately 2.3 billion people (53.8%) consumed alcohol in 2016 [437]. However, as the consumption of alcohol increases, the risk for alcohol use disorder increases [6, 438].

Problematic alcohol use is associated with mental and physical health risks [64] and is the leading cause of preventable death worldwide [439]. The world health organization (WHO) estimated the alcohol-attributable deaths in 2016 at 10.3% in both males and females [64]. Similarly, alcohol contributed to 14,826 deaths in Canada, representing 22% of all substance use attributable deaths [440]. Epidemiological studies have recorded varying prevalence of alcohol abuse. The National Epidemiologic Survey on Alcohol and Related Conditions recorded a 17.8% twelve-month prevalence of alcohol abuse [441], and the Lebanese Epidemiologic Survey on Alcohol recorded 6.2% [442]. These epidemiological studies on alcohol are essential to derive vital information on the causes of alcohol abuse. Therefore, current research is critical in enlightening the public health system on the need for adequate alcohol abuse preventive measures [442].

Most studies have focused on the general population's social and economic etiology of alcohol abuse [443-446], and there is a lack of literature on alcohol abuse among vulnerable populations who have experienced multiple traumas. Aside from social causes of alcohol abuse, mental health conditions have been associated with alcohol abuse [447, 448]. The US National Comorbidity Survey recorded that half of the individuals with a lifetime of a substance use disorder, including alcohol abuse, experience at least one-lifetime mental illness [59, 60], such as anxiety and depressive disorders [61, 62]. These mental disorders often lead to increased severity of alcohol consumption and abuse [449].

Suicidal ideation has seen a surge among alcohol abusers and is portrayed as an adverse effect on the individual who abuses it [450-455]. Exposure to trauma can predispose one to posttraumatic stress disorder (PTSD) [12]. Likewise, people with PTSD may seek alcohol use to reduce adverse symptoms of the condition [456, 457].

It is presently unknown what the prevalence of self-reported alcohol abuse is in residents of communities impacted by multiple natural disasters. It is also unknown what the predictors and correlation are for alcohol abuse among residents of communities affected by various natural disasters. Thus, this study aims to estimate the prevalence and correlation of likely alcohol abuse among residents of Fort McMurray who have experienced multiple traumas.

METHODOLOGY

Study Setting

Fort McMurray is situated in Northern Alberta, Canada. The municipality has a population of 106,059 according to the 2020 statistics [416]. The municipality consist of 52.6% females and 47.4% males [416] and is dominated by the youth; 42.4% (20 and 44 years). Residents of Fort McMurray have experienced multiple traumas such as the global coronavirus pandemic (COVID-19) [417], the 2016 wildfire [339], and the 2020 flooding [340].

Study Design and Institutional Review Board Approval

This study used a quantitative cross-sectional survey design. Data were collected using self-administered online questionnaires through the REDCap software. Participants provided consent by assessing the survey link and submitting their responses. The University of Alberta Reviews and Ethics Board approved the study (Pro00066054).

Outcome measure

The primary outcome measure was the prevalence of self-reported alcohol abuse among participants, and this was measured through the question; have you abused alcohol in the past year. Secondary outcomes include demographic, clinical, and trauma-related predictors of self-reported alcohol abuse, and the association of self-reported alcohol abuse with mental health parameters, including moderate to severe depression moderate to high anxiety, likely PTSD, low resilience, and suicidal ideation. The Patient Health Questionnaire (PHQ-9) was used to measure the depressive symptoms of participants [86]. This tool is a nine-item measured on a four Likert scale with a score of 0-4 - normal, 5-9 mild, 10-14 moderate, 15-19 moderately severe, and 20-27 severe [86]. The scores were reclassified into two variables: none to mild depression and moderate to severe depression. The reliability and validity of the tool have indicated it to have good psychometric properties, and the internal consistency of the PHQ-9 high [86].

The Generalized Anxiety Disorder-7 (GAD-7) scale was used to assess participants' likelihood of anxiety symptoms. The seven self-reported items on a four Likert scale. The score was recategorized into; low anxiety (less than 10) and moderate to high anxiety (score of 10 or more) [87]. The internal consistency and test-retest reliability of the GAD-7 was good, and it also provided good criterion, construct, factorial, and procedural validity [88].

The Post Traumatic Stress Disorder Checklist Civilian (PCL-C) was used to assess likely PTSD symptoms. The PTSD checklist consists of 17-item as stated by the Diagnostic and Statistical Manual (DSM-IV). The level of distress produced by each symptom is rated on a five Likert scale from 1 (not at all) to 5 (extremely) and a score of 44 or more was classified as likely PTSD and score below 44 as unlikely PTSD [89]. Studies suggests that the PCL-C has good internal consistency and retest reliability than alternative measures of PTSD [89, 90].

The brief Resilience Scale (BRS) was used to assess participants' ability to recover from stress. A score ranging from 1.00-to 2.99 indicates low resilience, while a score ranging from 3.00-to 5.00 indicates high to normal resilience [91]. Regarding reliability and validity literature shows that the BRS has good internal consistency, with Cronbach alphas ranging from 0.80 to 0.90, and test-retest reliability coefficients for a two-week interval were fair (0.61 to 0.69).

Participants were asked whether they had any suicidal ideation. This was achieved via the ninth question of the PHQ-9 scale; passive death wishes or thoughts of self-harm in the last two weeks**.** Other questions related to participants' mental health, medication history, and exposure to multiple traumas, i.e., COVID-19, wildfires, and flooding.

Data Collection and Statistical Analysis

An online survey program (REDCap) distributed the survey links and participants completed the survey related to demographic, clinical and multiple trauma exposures [344]. Data were collected between April 24 and June 2, 2021. Demographic variables included gender, age, employment status, and housing status. Clinical variables included the history of mental health diagnosis and psychotropic medication, history of mental health counselling, and willingness to receive mental health counselling. Questions were asked to assess the likelihood of PTSD, anxiety, depression, suicidal ideation, resilience, and the type of trauma experienced. The Statistical Package for Social

Sciences (SPSS) version 25 (IBM Corp 2011) was used to analyze the data [345]. Demographic, clinical, and multiple trauma exposure variables were examined and shown as raw numbers and percentages. Data were analyzed using cross-tabulations and logistic regression analysis. The different baseline clinical factors that predict likely alcohol abuse were examined. The Chi-square test explored the association between each predictor variable and the likelihood of alcohol abuse. The logistic regression model included variables with a statistically significant or near significant ($p \leq 0.1$) to the likelihood of participants abusing alcohol. Correlational analysis removed any strong correlation (Spearman's correlation coefficient of 0.7 to 1.0 or − 0.7 to − 1.0) from the regression model. Odds ratios (OR) and confidence intervals (C.I) obtained from the binary logistic regression analysis were analyzed for the likelihood of participants abusing alcohol and controlling for the other variables. No data imputation for missing data.

RESULTS

Descriptive Sample Characteristics

Sample characteristics are listed in Table 3.6.1**.** Two hundred and forty-nine individuals accessed the online survey link and one hundred and eighty-six completed the survey, giving a response rate of 74.7%. The sample was predominantly females 159 (85.5%), above 40 years 98 (52.7%), employed 175 (94.1%), own their house 145 (78.0%) and in a relationship 132 (71.0%). In relation to clinical history, 58 (31.2%) reported a history of depressive symptoms, 78 (41.9%) had a history of anxiety symptoms, 59 (31.7%) were on antidepressants, and 21 (11.3%) were on sleeping tablets. Participants who had received mental health counselling in the past were 72 (38.7%), and the majority would like to receive mental health counselling, 98 (52.7%). Most participants had experienced at least two traumatic events; COVID-19 and either Wildfire or flooding traumas. The minority of the participants self-reported alcohol use 51 (27.4%).

Table 3.6.1. Descriptive Characteristics of the Sample.

Variables	Total
Gender	
Male	27 (14.5%)
Female	159 (85.5%)
Age categories	
≤40y	88 (47.3%)
>40y	98 (52.7%)
Employment status	
Employed	175 (94.1%)
Unemployed	11 (5.9%)
Housing status	
Own home	145 (78.0%)
Renting	41 (22.0%)
Relationship status	
In a relationship	132(71.0%)
Not in a relationship	54(29.0%)
History of mental health diagnosis from a health professional?	
Depression	58 (31.2%)
Anxiety	78 (41.9%)
History of psychotropic medications	
Antidepressants	59 (31.7%)
Sleeping tablets	21 (11.3%)
Respondents received MH counselling in the past year	72 (38.7%)
Respondents would like to receive MH counselling	98 (52.7%)

Multiple traumas	
COVID-19 trauma only	19 (11.2%)
COVID-19 and either Wildfire or flooding traumas	103 (60.6%)
COVID-19, Flooding and Wildfire traumas	48 (28.2%)
No alcohol abuse	135(72.6%)
Alcohol abuse	51(27.4%)

Associations between Sociodemographic, Clinical, and trauma exposure variables and marijuana use.

The results of the Chi-square analyses are illustrated in Table 3.6.2. Primarily, six variables were identified via Chi-square analysis with significant p values ($p \leq 0.05$) or p-value approaching significance ($0.1<p<0.05$). The bivariate analysis describes significant associations ($p \leq 0.05$) between housing status, history of depression, history of antidepressants, history of mental health counselling, willingness to receive mental health counselling, and the likelihood of alcohol abuse. However, employment status, housing status, history of depression, and mental health counselling demonstrated a near-significant p-value ($0.1<p<0.05$).

Unemployed participants, renting accommodation, had a history of depression, received antidepressants, and were willing to receive mental health counselling were more likely to abuse marijuana compared to the following respectively: participants who were employed, owned their house, had no history of depression, not on antidepressants, no history of mental health counselling, nor willing to receive mental health counselling.

Table 3.6.2. Chi-square test of association between alcohol abuse, demographic, clinical and trauma-related variables

Variables	No alcohol abuse	Alcohol abuse	Chi-square	p-value
Gender				
Male	19(70.4%)	8(29.6%)	0.078	0.817
Female	116(73.0%)	43(27.0%)		
Age categories				
≤40y	65(73.9%)	23(26.1%)	0.138	0.744
>40y	70(71.4%)	28(28.6%)		
Employment status				
Employed	130(74.3%)	45(25.7%)	4.323	**0.073**
Unemployed	5(45.5%)	6(54.5%)		
Relationship status				
In a relationship	100(75.8%)	32(24.2%)	2.306	0.149
Not in a relationship	35(64.8%)	19(35.2%)		
Housing status				
Own home	110(75.9%)	35(24.1%)	3.559	**0.074**
Renting	25(61.0%)	16(39.0%)		
History of Depression				
Yes	37(63.8%)	21(36.2%)	3.270	**0.078**
No	98(76.6%)	30(23.4%)		
History of Antidepressants				
Yes	37(62.7%)	22(37.3%)	4.229	**0.052**
No	98(77.2%)	29(22.8%)		

History of Sleeping tablets				
Yes	13(61.9%)	8(38.1%)	1.356	0.299
No	122(73.9%)	43(26.1%)		
Respondents received MH counselling in the past year				
Yes	47(65.3%)	25(34.7%)	3.148	**0.092**
No	88(77.2%)	26(22.8%)		
Respondents would like to receive MH counselling				
Yes	61(62.2%)	37(37.8%)	11.119	**0.001**
No	74(84.1%)	14(15.9%)		
Multiple traumas				
COVID-19 trauma only	16(84.2%)	3(15.8%)		
COVID-19 and either Wildfire or flooding traumas	78(75.7%)	25(24.3%)	3.343	0.184
COVID-19, Flooding and Wildfire traumas	31(64.6%)	17(35.4%)		

Multivariate Binary Logistic regression results

Six of the variables identified by the Chi-square analysis, as shown in table 3.6.3, with significant p values ($p < 0.05$) or p-values trending significance ($0.05 \leq p \leq 0.1$), were eligible to be entered into the logistic regression model. However, the variables "history of depression" was highly correlated ($r \geq 0.7$) with other variables, hence, not included in the model. The entire model containing all the five predictors was statistically significant; X^2 (5, N=186) = 18.47, p =.002, suggesting that the model was able to differentiate between participants who are addicted to marijuana and those who are not addicted to marijuana. The model explained between 9.5% (Cox and Snell R^2) and 13.7% (Nagelkerke R^2) of the variance in the likelihood that participants will present with symptoms of alcohol abuse and correctly classified 72.6% of cases. According to the goodness-of-fit statistic using Hosmer-Lemeshow goodness-of-fit test, the model was adequately fit ($Chi^2 = 1.20$; $p = 0.97$). However, only one predictor variables were found to have associated with likely alcohol abuse; participants willing to receive mental health counselling. This suggests that participants who would like to receive mental health counselling were three times more likely to abuse alcohol than those who do not want to receive mental health counselling (OR=3.017; 95% CI: 1.349-6.750).

Table 3.6.3: Multivariable logistic regression model for participants' likelihood of abusing alcohol

VARIABLE	Coefficient	Standard Error	Wald	P value	Odd's ratio	95% C.I.for Odd's ratio (OR)	
						Lower	Upper
Employment status (unemployed)	1.154	.670	2.961	.085	3.170	.852	11.796

Housing status (renting)	.580	.394	2.166	.141	1.786	.825	3.865
History of antidepressants	.511	.387	1.748	.186	1.668	.781	3.559
Mental health counselling in the past year	-.245	.423	.336	.562	.783	.342	1.792
Willing to receive mental health counselling	1.104	.411	7.229	.007	3.017	1.349	6.750

Associations Between alcohol use and other mental health conditions

Table 3.6.4 shows an association between alcohol use and current mental health conditions. The results suggest a significant association between likely moderate to severe depression and alcohol use (p=0.033). This indicates that 25 (32.9%) of the participants who self-reported alcohol abuse also presented moderate to severe depressive symptoms, 15 (51.7%) had had passive death wishes/thoughts of self-harm in the last two weeks, and 23 (32.4%) reported moderate to high anxiety symptoms. Similarly, most participants 21 (32.3%), who self-reported alcohol abuse also presented with likely PTSD.

Table 3.6.4. Associations Between alcohol use and other mental health conditions

Variables	No alcohol use/abuse	Alcohol use/abuse	Chi-square	P-value	Effect size
Depression					
At Most Mild Depression	76(81.7%)	17(18.3%)	4.783	0.033	0.168
Moderate to Severe Depression	51(67.1%)	25(32.9%)			
Suicidal ideation/thought of self-harm present					
No	113(80.7%)	27(19.3%)	13.536	0.001	0.283
Yes	14(48.3%)	15(51.7%)			
Anxiety					
Low anxiety	78(81.3%)	18(18.8%)	4.102	0.047	0.157
Moderate-to-high anxiety	48(67.6%)	23(32.4%)			
PTSD					
PTSD Unlikely	79(79.8%)	20(20.2%)	3.067	0.098	0.137
PTSD Likely	44(67.7%)	21(32.3%)			
Resilience					
High to normal resilience	83(77.6%)	24(22.4%)	1.121	0.363	0.081
Low resilience	45(70.3%)	19(29.7%)			

DISCUSSION

The prevalence of likely alcohol abuse among our respondents was 27.4%, much higher than the prevalence reported in a report from Canada which showed that annually 6.4% of Canadians meet the criteria for alcohol abuse [7].

Our findings, however, are consistent with other studies that have recorded a high prevalence of alcohol use [6, 437]. As the overall prevalence of substances increases, the risk of abuse and disorders increases [6, 396, 397]. Globally in 2016, about 2.3 billion recorded consuming alcohol, with a majority of 53.8% drinking in the Western Pacific Region [437]. Similarly, the 2019 National Survey on Drug Use and Health in the US recorded that 55.0% of individuals 12 years and older used alcohol in the past month [6]. Although there is a varying rate, the fact remains that many people consume alcohol leading to alcohol abuse. Contingent on the harmful effects of alcohol abuse on individuals and the community, it continues to constitute a substantial public health problem [458].

Counselling on alcohol is among the efficient and economical clinical preventive services [459], helping to reduce the quantity of alcohol consumed [460] and improve quality of life. Participants in this study who were willing to receive mental health counselling were three times more likely to abuse alcohol than those who did not need counselling (OR=3.017; 95%CI: 1.349-6.750). Individuals with mental health conditions usually desire to receive counselling to manage their health conditions, and the desire to accept mental health counselling indicates a psychological need [52, 413]. Our results demonstrate the need for screening for problematic alcohol use among individuals seeking mental health counselling. Individuals who screen positive could be offered additional counselling and support, including enrollment in an addiction text-based counselling service which has demonstrated effectiveness in motivating and aiding recovery and relapse prevention [72].

Other studies conducted during traumatic events found respondents willing to receive counselling may predict psychological conditions. For example, individuals impacted by wildfires in Fort McMurray who were willingness to accept counselling services were more likely to have a psychopathy [347]. One study suggested that people may not benefit from the single section counselling [355], especially after traumatic events. Counselling services must be made available on an ongoing basis for residents of communities impacted by natural disasters.

Association between self-reported alcohol abuse and the presence of moderate to high anxiety symptoms showed a significant association. More than 32% of the participants who presented with

moderate to high anxiety symptoms also self-reported alcohol abuse in the past year. Past studies have documented the relationship between alcohol use and anxiety symptoms, and most have debated which one precedes the other; anxiety or alcohol [461]. The myth surrounding alcohol use suggests that if little quantity of alcohol is effective in hoisting mood and eliminating anxiety symptoms, then more doses would be even more efficacious [461]. Research has reported that a diagnosis of anxiety disorder promotes alcohol abuse [462, 463]. Comparably a critical review by Cox et al. (1990) pointed out that 10-20% of patients with anxiety disorder abuse alcohol, and most of the patients testified that the anxiety problems preceded alcohol abuse [464]. Literature showed that anxiety symptoms could foster the pathological use of alcohol [463] which other researchers term a self-medication hypothesis [465]. Other pharmacological and physiological studies have explained that the impact of alcohol on the individual reduces the unpleasant symptoms of anxiety; hence, individuals progress to abuse alcohol [407, 464, 466]. A study in Minnesota reported that approximately 55% of patients undergoing treatment for problematic alcohol use met diagnostic criteria for an anxiety disorder [462].

On the contrary, a critical review reported that anxiety symptoms are more likely to be the adverse effect of problematic alcohol use than be a predictor [461], even though not all people with alcohol problems meet the diagnostic criteria for anxiety disorders [467]. Literature has it that alcohol use and anxiety tend to occur in the same individual hence, comorbidity. However, controversies still surround this association [463].

Our study found an association between self-reported alcohol abuse and moderate to severe depressive symptoms. Approximately 33% of the participants who presented with moderate to severe depression symptoms also self-reported abuse of alcohol. This result is consistent with other studies that found an association between alcohol abuse and depressive symptoms [53, 452, 468, 469]. Depressive disorder is a common psychiatric disorder associated with alcohol abuse, with approximately one-third of patients with depression symptoms meeting the criteria for alcohol use disorder [452, 468, 470]. An analysis from a national survey among those with depressive disorders revealed that about 14% had an alcohol use disorder [471, 472], suggesting a critical indicator to seek adequate treatment. Researchers have strived to expound the correlation between alcohol abuse and depressive symptoms in diverse ways. For example, pharmacological and

laboratory studies suggest that alcohol reduces depression symptoms and improves adverse effects of depression [469, 473], leading to people with depression abusing alcohol. On the other hand, there are debates about whether depression symptoms precede alcohol abuse or vice versa. Literature suggests that individuals experiencing depression self-medicate and abuse alcohol which explains why depression symptoms usually precede alcohol abuse [474]. It is, therefore, not always the case that individuals with alcohol use disorder develop depression symptoms, but depression usually predicts alcohol abuse [475, 476].

Alcohol abuse and suicide are intimately related in a complex phenomenon. In the current study, 51.7% of participants with passive death wishes or thoughts of self-harm also self-reported alcohol abuse. Our study focused on the suicidal risk, not completed suicide, and this finding agrees with other literature focused on suicidal behaviours, ideation, or attempted suicide [446] than completed suicide [477, 478]. Previous research has established that alcohol abuse predisposes individuals to suicidal thoughts [450-454]. Further, most adolescents who abuse alcohol also report suicidal thoughts [479, 480]. Conversely, other studies have shown that individuals with suicidal thoughts abuse alcohol [481, 482]. For example, a global health survey in 2016 revealed that individuals with suicidal risk were significantly associated with alcohol abuse (OR 3.3, 95% CI 1.8-6.1) [455]. Notwithstanding, literature has suggested that externalizing traits may reflect an underlying vulnerability that promotes suicidal thoughts and predispose an individual to alcohol abuse [483-485].

LIMITATION

Limitations are often unavoidable, and caution is needed in interpreting the results. First, the sample size for the study was not fully representative of Fort McMurray (e.g., 85% of our participants were female, even though they consist of 47.4% of the Fort McMurray population) [416]. Second, the response rate for the study was determined by participants who assessed the survey link instead of the number of participants who received the survey link, which may have led to the overestimation of the response rate. Finally, alcohol abuse and the mental health conditions in the study were self-reported by participants as opposed to formal diagnostic screening, and so are not diagnostic. Notwithstanding these limitations, the study adds to the few

studies to examine the association between self-reported alcohol abuse and other mental health symptoms. The study has also established the predictive factors for self-reported alcohol abuse among a population that has experienced multiple traumas.

CONCLUSION

The study highlights a potential predictor of self-reported alcohol abuse among residents of Fort McMurray and the association between self-reported alcohol abuse and other mental health symptoms among a population who has encountered multiple traumas. Factors such as exposure to trauma and demographic and baseline clinical characteristics did not predict self-reported alcohol abuse in this study population. Again, there was a correlation between self-reported alcohol abuse and the presence of moderate to severe depression and anxiety symptoms, and suicidal thoughts. Further studies are needed in a larger sample to investigate the demographic and clinical factors that impact alcohol abuse among populations who have experienced multiple traumas. The critical factor in recovery includes the availability of mental health support. Therefore, it is crucial to research innovative treatment modalities for individuals experiencing mental health symptoms to minimize alcohol abuse. Policymakers and healthcare practitioners may adopt effective and economic interventions like supportive text messaging, which has proven effective in supporting mental health symptoms and problematic drinking among patients in randomized controlled trials and general population irrespective of geographical location, and with high satisfaction rates [71, 82, 213, 315, 433, 486-488].

CHAPTER 4. IMPACT OF SUPPORTIVE TEXT MESSAGE INTERVENTION

4.1. Text4Hope-Addiction Support Program: Three Months of Daily Supportive Text Messages reduces Craving and Improves Mental Health Outcomes

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ABSTRACT

Background

Drug misuse is complex, and various treatment modalities are emerging. Mental health conditions like anxiety and depression co-exist with substance use and are often undiagnosed and undertreated. Providing supportive text messages to individuals with substance use disorder offers the prospect of managing and improving symptoms of drug misuse and associated comorbidities.

Objectives

This study aimed to evaluate the impact of the daily supportive text message program (Text4Hope-Addiction Support) in mitigating cravings and mental health symptoms in subscribers and to quantify user satisfaction with the Text4Hope-Addiction Support program.

Methods

Subscribers to the Text4Hope-Addiction Support program received daily supportive text messages crafted based on addiction counselling and cognitive behavioural therapy principles for three months. Participants completed an anonymous online questionnaire to assess cravings, anxiety, and depressive symptoms using the Brief Substance Craving Scale, Generalized Anxiety Disorder-7 Scale, and Patient Health Questionnaire-9 Scale at enrollment (baseline), after six weeks and three months. Likert scale satisfaction responses were used to assess various aspects of the Text4Hope-Addiction program.

Results

Four hundred and eight people subscribed to the program and 110 subscribers completed the surveys at least at one time point. There were significant differences between mean baseline and three-month BSCS scores (-2.17, 95% CI of -0.62 to -3.72), PHQ-9 scores (-5.08, 95% CI of -1.65 to -8.51), and the GAD-7 scores (-3.02, 95% CI of -0.48 to -5.56). Participants who received the supportive text messages reported a reduced desire to use drugs, a long time before usage (reduced craving frequency) reflected in respective changes from a baseline score of 41.1% and 32.5%. About 89% of participants agreed that supportive text messages (Text4Hope-Addiction) helped them cope with addiction-related stress; 81% reported that messages assisted them in dealing with anxiety. Overall, 69% agreed it helped them cope with depression related to addiction, 85% felt connected to a support system, 77% were hopeful of the ability to manage addiction issues, and 73% felt their overall mental wellbeing was improved. Most participants agreed that the interventions were positive, affirmative, and succinct. Furthermore, 88% always read the messages, 83% took positive or beneficial action after reading and no participant took a negative action after reading the messages. Also, most participants agreed to recommend other diverse technology-based services as an adjunctive treatment for their mental and physical health.

Conclusion

Subscribers of Text4Hope addiction support experienced improved mental health and addiction symptoms. Addiction care practitioners and policymakers could implement supportive text-based strategies to complement conventional treatments for addiction, given that mobile devices are widely used.

INTRODUCTION

Substance misuse and abuse, and their comorbid mental health conditions are a disabling global health concern associated with costly treatment modalities. The World Economic Forum projected that about US $16 trillion would be lost globally due to substance misuse and mental health conditions in the next 20 years [20], with inadequate treatment options for substance use disorders [20, 489]. The lifetime prevalence of substance use disorder in Canada is estimated at 21.6% [490],

and $40 billion was spent on treating substance use and misuse in 2002 [435, 491]. Similarly, in the US, the annual national bill for substance use disorder and its related effects is over $740 billion and approximately 900,000 people die of alcohol abuse [63, 492, 493]. Addiction services can be advantageous in reducing complications of a substance use disorder, but there are barriers to assessing these services. An examination of the rationale for delay and failure in the treatment of mental disorders revealed that the proportion of people with substance use disorders who seek treatment in the year of disorder onset ranged from 0.9 to 18.6% and is estimated to increase to between 19.8 and 86.1% over 50 years [494]. Although the severity of the illness is associated with early health service utilization, a study among 84,850 respondents recorded a maximum of forty-six patients received any care in the previous year [489]. Stigma, geographical location, and distribution of the services contribute to low numbers of people obtaining mental health services [495]. Mental Health and Addiction services across Canada have long wait times, high cost of assessing mental health services, inadequate mental health service, stigma, and geographic and demographic inequities as barriers hindering individuals with substance use disorders from accessing health services [73].

Due to the coronavirus disease (COVID-19) and associated policies to curb the virus spread, many face-to-face addiction services were closed or modified their operational hours, leaving a substantial gap in additional treatments in many jurisdictions [496]. The pandemic thus reduced support that was available for patients with substance use disorder. The isolation felt by these individuals also increased the stress, anxiety, and depression many patients with substance use disorder experienced, which could further worsen their substance abuse [497, 498].

Providing healthcare services through technology during the pandemic was encouraged to reduce the risk of virus transmission and promote provision of effective treatments [499]. Smartphones, computers, and care delivery via video conferencing have been utilized more in the pandemic era with reduced physical contact [500, 501], and text messaging was also popular during the pandemic [71, 82, 312, 333, 392, 434]. Contingent on the few psychologists, limited health care services, and high demand for mental health interventions, text messaging as a telehealth intervention has repeatedly been suggested to be beneficial in delivering individualized cognitive behavioural therapy to individuals with mental health and addiction disorders [502, 503]. Mobile

phone penetration is increasing worldwide, which has increased their utilization in the health sector in managing health conditions, including substance use disorder [504]. In a study of patients with substance use disorder, about eighty-three percent possessed a mobile phone and eighty-six percent were willing to receive their treatment and other interventions via mobile phone [505].

In a review of mobile phone text messaging in clinical and healthy behaviour interventions, ten out of sixteen randomized controlled trials reported a significant improvement in text message interventions compared to usual care [74]. Furthermore, a meta-analysis revealed that web- and computer-based intervention is effective and promising in reducing the stress associated with mental disorders [503]. On the contrary, low motivation related to people with substance use disorder may contribute to non-adherence to this intervention [435, 506]. Additionally, a systematic review to characterize the impact of text messaging intervention on people with mental disorders and substance use reported a significant improvement in addiction symptomatology and social function [75]. In a randomized controlled trial in Dublin, Ireland, patients with major depressive disorder and comorbid alcohol use disorder reported there was more significant cumulative abstinence duration in the intervention group who received twice-daily supportive text messages compared to the control group who received only the usual care [72, 313, 316]. In this study, 83% of the patients self-reported that the supportive text messages improved their mental health and were a source of motivation for recovery and preventing relapse [72, 488]. Similarly, analysis from a randomized control trial in Grande Prairie in Alberta, Canada showed a longer cumulative abstinence duration among patients with alcohol use disorder who received text messages than those who received usual follow-up care after being discharged from a residential treatment program [433].

To the best of our knowledge, no current studies have yet assessed the impact of supportive text messages for addiction support on cravings, anxiety, depression, and recovery during the pandemic. The present study's goal is to assess the impact of Text4Hope-Addiction program on subscribers. The specific objective of this study is to assess the impact of the Text4Hope Addiction Support program in reducing cravings, anxiety, and depression symptoms in subscribers.

METHODOLOGY

Study design

This was a longitudinal cross-sectional program evaluation with data collected at baseline (on subscription to the Text4Hope-Addiction Support program), at six weeks and after three months via online survey questionnaires programmed into REDCap software [344].

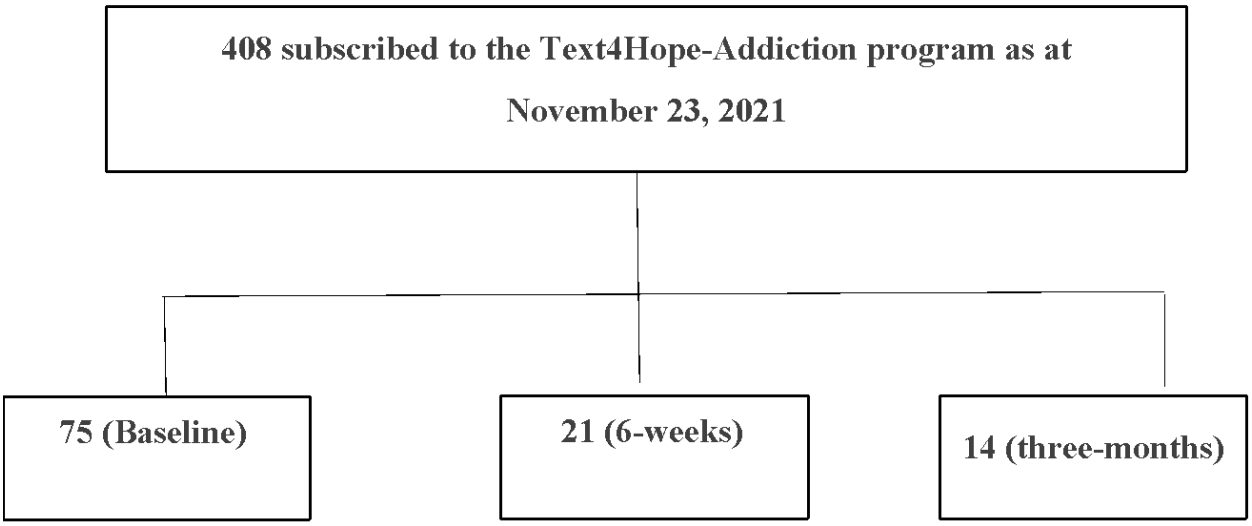
Institutional Review Board

This study received ethics approval from the University of Alberta Health Research Ethics Board (Pro00086163). Consent was implied if subscribers completed and returned the survey responses.

Data collection

On enrollment in the Text4Hope-Addiction program, subscribers received a welcome message which included the link to the baseline online survey questionnaire, which captured demographic information (age, gender, employment status, relationship status, ethnicity, and educational level); COVID-19–related; self-isolation or quarantine information; and responses on the Brief Substance Craving Scale (BSCS) [93], Generalized Anxiety Disorder-7 (GAD-7) scale [88], and the Patient Health Questionnaire-9 (PHQ-9) [86]. The data were collected between July 1, 2020, and November 23, 2021. At six weeks (program midpoint) and three months (program endpoint), individuals received survey links that collected demographic and clinical information similar to those gathered at baseline. Subscribers entered the cell phone number with which they received messages into each survey which was used to link baseline responses to follow-up responses. The survey took a maximum of ten minutes to complete, and no incentives were provided to subscribers. Furthermore, participation in the program was not based on survey participation. Figure 4.1.1 illustrates the subscriber flowchart and the number of subscribers who completed the surveys at each time.

Figure 4.1.1. Subscription flowchart.



Outcome Measures

The primary outcome of interest was to examine the change in craving score measured from baseline to the three-month follow-up. The BSCS, a three-item self-reported on a five-point Likert scale instrument [93] used to assess craving for alcohol and other substances, was used to determine participants' intensity, frequency, and length of time cravings. The BSCS consist of the following items: 1. "The INTENSITY of my craving, that is, how much I desired this drug in the past 24 hours". 2. "The FREQUENCY of my craving, that is, how often I desired this drug in the past 24 hours". 3. "The LENGTH of time I spent craving this drug during the past 24 hours". Each item was rated on a scale from 0 to 4, and the total of the three items was calculated [507].

Secondary outcomes of the study included a change in depression and anxiety scores from baseline at three months follow-ups and included measures related to participants' satisfaction.

Anxiety symptoms were measured using the GAD-7 [87]. This is a 7-item screening tool that assesses the severity of likely Generalized Anxiety Disorder. The 7-item inventory asks

participants to self-report how frequently they experience common anxiety symptomatology over the past month. Ratings are made on a 4-point Likert from 0 (not at all) to 3 (nearly every day), with a score range of 0 to 21, and a score of 10 or more was deemed to have likely anxiety; the higher the score, the more severe the anxiety symptoms [87]. The scores were recategorized into two (score less than 10 means low anxiety and moderate-to-high anxiety ≥ 10).

The nine-question item PHQ-9, a 9-item validated tool used to measure the severity of depression in general medical and mental health practice [86] was used to assess depression symptoms in study participants. The questions are scored between 0 (not at all) and 3 (nearly every day). Higher scores on the scale denote more elevated levels of depression [86]. The scale provides a total score (0-27). The PHQ-9 scale categorizes depression based on scores into none-minimal (0-4 points), mild (5-9 points), moderate (10-14 points), moderately severe (15-19 points), and severe (20-27 points) [86]. The scores were recategorized into none to mild depression and moderate to severe depression. The reliability and validity of the tool have indicated it to have good psychometric properties, and the internal consistency of the PHQ-9 is high [86].

The survey contained questions related to participants' satisfaction or Text4Hope-Addiction experience employing the user satisfaction survey in a similar program (Text4Mood program) [94]. This satisfaction scale assessed people's interest in text messaging and related technological services for health care delivery. Participants were further asked questions about their satisfaction with the text addiction program. These questions were categorized into three:

- Perception of how participants coped with stress, anxiety, and depression related to addiction, after receiving daily supportive text messages for three months. The questions were measured on a three Likert scale; Agree, Neutral, and Disagree.
- Receptivity of the supportive messages for addiction. These questions were also measured on a three Likert scale; Always, Often and Sometimes.
- Recommendation of other technology-based services for future use in the addiction support program. participants chose from a three Likert scale; Agree, Neutral and Disagree

Text4Hope-Addiction Support Intervention

Participants self-subscribed to the service by texting "Open2Change" to a short code number. Participants then received unidirectional daily supportive text messages for three months. The supportive messages were delivered by a computer program at 8:00 MST each day. The ninety messages built into the program aligned with an addiction counselling and cognitive behavioural therapy framework and were designed to help clients manage cravings, reduce stress and anxiety, minimize depressive symptomology, and improve overall mental health wellbeing. The messages were written by a clinical psychologist, psychiatrists, and service users and revised by a multidisciplinary team that included an addiction counsellor, a psychiatrist, a mental health therapist, and a service user. An example of a text message is, "*Addiction is often cue-based. Identify people, places, and things that trigger the desire to use the drug and avoid them*" [435].

Statistical analysis

Data were analyzed utilizing SPSS Version 25 [345]. Demographic, clinical, COVID-19- related variables and other variables were examined against the sex at birth variable, employing Chi-square or Fisher Exact test. Similarly, cross-tabular analyses explored the association of sex at birth with the primary outcome measures, using categorical variables for the likelihood that respondents self-report measures including craving, anxiety, and depressive symptoms during the COVID-19 pandemic. We planned to use a paired sample t-test to evaluate change from baseline to six- and three-months scores on primary outcome measures. However, given that most subscribers completed the surveys at only one-time point, we modified the analysis as follows.

An independent sample t-test was conducted initially to examine the difference in mean scores of baseline clinical variables between participants who completed only the baseline survey and those who completed both the baseline and follow-up surveys. This was to determine how similar or dissimilar the baseline clinical characteristics between the two groups were. Only four subscribers completed the surveys at baseline and six weeks or three months and were excluded from subsequent analysis. Next, the three months scores on the BSCS (Craving intensity, Craving frequency, and Length of Time Craving Drug), PHQ-9, and GAD-7 for subscribers who did not complete baseline surveys were examined against baseline scores for subscribers who did not complete either the six week or three months surveys, using an independent sample t-test. When

the homogeneity of variance assumption was violated, Welch's t-test was used instead of the independent sample t-test. For participants with missing responses for the three-month time-point, missing data were imputed using the Last Observations Carried Forward (LOCF), i.e., their six-week responses [508].

Satisfaction data were presented as a continuous variable measured on a 10-point Likert scale (1=very dissatisfied; 5=neutral; 10=very satisfied). The data were reported as means and standard deviations (SD). Additional questions related to satisfaction were presented as categorical variables and reported as frequency and percentages across all the study participants. Data were presented using two-tailed tests, with $p<0.05$ as the criterion for significance.

RESULTS

Out of the four hundred and eight (408) individuals who subscribed to the Text4Hope-Addiction program, seventy-five (75) participants completed the baseline surveys, giving a response rate of 18.4% for the baseline survey. Out of the 408 individuals who subscribed to the program, 97 did not complete the program, yielding a program completion rate of 76%. As illustrated in figure 4.1.1, twenty-one participants completed the six weeks survey while fourteen completed the three months survey.

Overall, 33 (30%) males and 77 (70%) females completed at least one survey. For the overall sample, 40 (37.0%) were between the ages of 31 and 39 years, 84 (76.4%) were Caucasian, and 65 (70.7%) had postsecondary education. Also, 49 (53.3%) were unemployed, 47 (51.1%) were in a relationship, 47 (51.1%) were renting an apartment, and 66 (60.0%) did not quarantine or self-isolate due to COVID-19. As illustrated in table 4.4.1, the Chi-square analysis showed no significant difference in participants' sociodemographic characteristics based on sex at birth for the total study sample.

Table 4.1.1: Distribution of demographic characteristics and isolation conditions based on sex at the birth of the participants

Variable	**Male n (%)**	**Female n (%)**	**Total n (%)**	**Chi^2 /Fisher Exact**	***P*- value**
Age					
≤30y	7 (21.9)	23 (30.3)	30 (27.8)	1.61	.45
31-39y	11 (34.4)	29 (38.2)	40 (37.0)		
≥40y	14 (43.8)	24 (31.6)	38 (35.2)		
Ethnicity					
Caucasian	29 (87.9)	55 (71.4)	84 (76.4)	4.77	*.09*
Indigenous	4 (12.1)	14 (18.2)	18 (16.4)		
Other	0 (0.0)	8 (10.4)	8 (7.3)		
Education level					
< High school diploma	4 (14.8)	11 (16.9)	15 (16.3)	*	.56
High school diploma	5 (18.5)	7 (10.8)	12 (13.0)		
Postsecondary education	18 (66.7)	47 (72.3)	65 (70.7)		
Employment status					
Employed	14 (51.9)	29 (44.6)	43 (46.7)	0.40	.53
Unemployed	13 (48.1)	36 (55.4)	49 (53.3)		
Relationship status					
In a relationship	14 (51.9)	33 (50.8)	47 (51.1)	.01	.99

Not in a relationship	13 (48.1)	32 (49.2)	45 (48.9)		
Housing status					
Own a home	11 (40.7)	19 (29.2)	30 (32.6)	1.16	.56
Living with family	4 (14.8)	11 (16.9)	15 (16.3)		
Renting	12 (44.4)	35 (53.8)	47 (51.1)		
Isolation (quarantine)					
No	23 (69.7)	43 (55.8)	66 (60.0)	1.85	.17
Yes	10 (30.3)	34 (44.2)	44 (40.0)		

*Fisher's Exact test was applied

Table 4.1.2 illustrates the distribution of clinical and drug-related variables based on the sex at birth of the participants in the study. Overall, 45 (60.0%) participants reported they had neither received treatment for drug/alcohol in detox nor accessed residential programs. Twelve participants (16%) reported they had overdosed on a recreational drug in the past year, 71 (64.5%) had no addiction counsellor, and 22 (62.9%) reported that they had never accessed emergency or crisis services for mental health-related concerns since the start of the COVID-19 pandemic. In addition, 85 (77.3%) of the participants reported they did not participate in any Narcotics/Alcoholics Anonymous either in-person, via zoom or online during the pandemic. regarding substance use, 51 (46.4%) participants indicated they were on marijuana.

Regarding the self-rated clinical scales, most participants (52, 80.0%) presented moderate to severe depression, while 46 (70.8%) presented moderate to severe anxiety. Craving intensity was either considerable or extreme in 42 (59.1%) participants. In comparison, 52 (73.2%) reported they crave substances at least several times a day, and 48 (67.6%) reported they crave drugs for at least a short time.

Table 4.1.2: Distribution of clinical and drug-related variables based on sex at birth of the participants

Variables	Male n (%)	Female n (%)	Total n (%)	Chi-square/ Fisher's exact	*P*-value
Drug or Alcohol Treatment or Detox Program					
Yes	11 (50.0)	19 (35.8)	30 (40.0)	1.30	.26
No	11 (50.0)	34 (64.2)	45 (60.0)		
Residential Treatment Program					
Yes	12 (54.5)	18 (34.0)	30 (40.0)	2.74	.10
No	10 (45.5)	35 (66.0)	45 (60.0)		
Past year overdose (recreational drug)					
Yes	4 (18.2)	8 (15.1)	12 (16.0)	0.11	.74
No	18 (81.8)	45 (84.9)	63 (84.0)		
Have Addiction Counsellor					
Yes	12 (36.4)	27 (35.1)	39 (35.5)	0.02	.90
No	21 (63.6)	50 (64.9)	71 (64.5)		
Since the first confirmed case of COVID-19 in Alberta, how often have you accessed emergency or crisis services for mental health related concerns?	8 (72.7)	14 (58.3)	22 (62.9)		.77

Not at all Once More than once	1 (9.1) 2 (18.2)	4 (16.7) 6 (25.0)	5 (14.3) 8 (22.9)	0.63	
In-person AA or NA Meeting					
Yes	5 (15.2)	11 (14.3)	16 (14.5)	0.01	.91
No	28 (84.8)	66 (85.7)	94 (85.5)		
Zoom AA or NA Meeting					
Yes	7 (21.2)	11 (14.3)	18 (16.4)	0.81	.37
No	26 (78.8)	66 (85.7)	92 (83.6)		
Online AA or NA Meeting					
Yes	5 (15.2)	5 (6.5)	10 (9.1)	2.10	.15
No	28 (84.8)	72 (93.5)	100 (90.9)		
Participated in AA or NA Meeting					
Yes	9 (27.3)	16 (20.8)	25 (22.7)	0.56	.46
No	24 (72.7)	61 (79.2)	85 (77.3)		
On psychotropic medications					
Downers or sedatives	2 (6.1)	6 (7.8)	8 (7.3)	0.10	.75
Benzos	3 (9.1)	8 (10.4)	11 (10.0)	0.04	.84
Hallucinogens	4 (12.1)	7 (9.1)	11 (10.0)	0.24	.63
Alcohol	10 (30.3)	40 (51.9)	50 (45.5)	4.37	.04
Solvents or inhalants	0 (0.0.)	2 (2.6)	2 (1.8)	0.87	.35
Heroin or other opiates	1 (3.0)	4 (5.2)	5 (4.5)	*	.99

Marijuana	11 (33.3)	40 (51.9)	51 (46.4)	3.22	.07
GHB	2 (6.1)	4 (5.2)	6 (5.5)	0.03	.86
Anabolic steroids	0 (0.0)	1 (1.3)	1 (0.9)	*	.99
stimulants	15 (45.5)	27 (35.1)	42 (38.2)	1.06	.30
PHQ-9 scale baseline					
At Most Mild Depression	5 (26.3)	8 (17.4)	13 (20.0)	0.67	.50
Moderate-to-Severe Depression	14 (73.7)	38 (82.6)	52 (80.0)		
GAD-7 baseline					
None to Mild Anxiety	7 (36.8)	12 (26.1)	19 (29.2)	0.75	.39
Moderate to Severe Anxiety	12 (63.2)	34 (73.9)	46 (70.8)		
Craving intensity baseline					
None at all	7 (33.3)	5 (10.0)	12 (16.9)	*	.19
Slight	2 (9.5)	6 (12.0)	8 (11.3)		
Moderate	3 (14.3)	6 (12.0)	9 (12.7)		
Considerable	7 (33.3)	22 (44.0)	29 (40.8)		
Extreme	2 (9.5)	11 (22.0)	13 (18.3)		
Craving Frequency baseline					
Never	2 (9.5)	7 (14.0)	9 (12.7)	*	.32
Almost never	6 (28.6)	4 (8.0)	10 (14.1)		
Several times	7 (33.3)	21 (42.0)	28 (39.4)		
Regularly	3 (14.3)	8 (16.0)	11 (15.5)		
Almost constantly	3 (14.3)	10 (20.0)	13 (18.3)		

Length of Time Craving Drug baseline					
None at all	5 (23.8)	8 (16.0)	13 (18.3)	*	.58
Very short	4 (19.0)	6 (12.0)	10 (14.1)		
Short	3 (14.3)	12 (24.0)	15 (21.1)		
Somewhat long	8 (38.1)	17 (34.0)	25 (35.2)		
Very long	1 (4.8)	7 (14.0)	8 (11.3)		

*Fisher's Exact test was applied

As illustrated in table 4.1.3, only four participants completed the baseline and the six-week or the three-month surveys. There was no statistically significant difference between the baseline mean scores for PHQ-9, GAD-7, and BSCS for participants who completed both baseline and either the six-week or the three months surveys and participants who completed only the baseline surveys.

Table 4.1.3: Comparison of baseline mean scores of PHQ-9, GAD-7, and BSCS between participants who completed both baseline and three months surveys and those who completed only baseline surveys

Measure	**Scores**				**t value**	**p value**
	N	**Completed subscribers, mean (SD)**	N	**Non-completed subscribers, mean (SD)**		
PHQ-9	4	17.25 (7.85)	61	16.85 (7.32)	.11	.91
GAD-7	4	11.50 (8.23)	61	13.80 (6.53)	.67	.50

Craving intensity	4	2.50 (1.00)	67	2.31 (1.38)	.27	.79
Craving Frequency	4	2.25 (.50)	67	2.12 (1.27)	.20	.84
Length of Time Craving Drug	4	2.06 (1.32)	67	2.25 (.96)	.28	.78
Total Craving Score	4	7.00(1.83)	64	6.49(3.62)	.28	.78

SD- Standard Deviation

An independent-sample t-test was conducted to compare the BSCS scores, PHQ-9, and GAD-7 scores for respondents who completed only baseline surveys and those who completed only either the six weeks or three months surveys (Table 4.1.4).

There was a significant difference in the craving intensity between the baseline (M=2.31, SD=1.38) and the three months follow-up scores (M=1.36, SD=1.16), t (93) =3.21, p<.01. Craving frequency was also significantly different between the baseline score (M=2.12, SD=1.27), and the three months scores (M=1.43, SD=0.96), t (93) =2.58, p=.01. There was a trend to finding a significant difference in mean baseline score (M=2.06, SD=1.32) and three months scores (M=1.54, SD=1.17) t (93) =1.82, p=.07 for the length of Time Craving Drug. Finally, total craving scores at baseline (M=6.49, SD=3.62) were significantly lower than the three months follow-ups scores (M=4.32, SD=3.04), t (93) =2.79, p=.01, with a change score of 33.4%.

There was also a significant difference in depression scores between baseline (M=16.83, SD=7.32) and the three months follow-ups scores (M=11.74, SD=6.21), t (82) =2.95, p<.01. The change between the baseline and the three-month scores was 30.2% in favor of the three-month scores.

Similarly, the GAD was significantly lower for participants after receiving supportive text messages for three months (M=10.78, SD=4.58) compared to participants who recorded only baseline scores (M=13.80, SD=6.53), t (82) =2.38, p=.02. The change between the baseline and the three-month scores was 21.9% in favor of the three-month scores.

Table 4.1.4: Changes in baseline mean scores of BSCS, GAD-7, and PHQ-9 after the supportive text message intervention (Text4Hope-Addiction).

Measure	Scores					Mean difference (95% CI)	*P* value	*t* value	Effect size (Hedges' g)
	n	Baseline score, mean (SD)	n	3-month score, mean (SD)	Change from baseline, %				
PHQ-9	61	16.82 (7.32)	23	11.74 (6.21)	30.2	-5.08 (-1.65 to -8.51)	**<.01**	2.95	0.72
GAD-7	61	13.80 (6.53)	23	10.87 (4.58)	21.9	-3.02 (-0.48 to -5.56)	**.02**	2.38*	0.48
Craving intensity	67	2.31 (1.38)	28	1.36 (1.16)	41.1	-0.95 (-0.37 to -1.55)	**<.01**	3.21	0.72
Craving Frequency	67	2.12 (1.27)	28	1.43 (0.96)	32.5	-.69 (-0.16 to -1.22)	**.01**	2.58	0.58
Length of Time Craving Drug	67	2.06 (1.32)	28	1.54 (1.17)	25.2	-0.52 (-0.05 to -1.10)	.07	1.82	0.41
Total Craving Score	67	6.49 (3.62)	28	4.32 (3.04)	33.4	-2.17 (-0.62 to -3.72)	**.01**	2.79	0.63

*Welch's t-test was run.

SD- Standard Deviation

Program Satisfaction Measures

Participants rated the supportive text messaging program on a scale of 1-10. One (1) represents very dissatisfied, five (5) represents neutral, while ten (10) represents very satisfied. The overall mean score for satisfaction was 8.71 (SD = 1.33). About 10 (41.7%) participants were very satisfied with the service.

Table 4.1.5 reports participants' perceptions about the text message addiction program after three months of receiving the text message intervention. Overall, 19 (73.1%) participants found the text messages positive and affirmative, while 17 (65.4%) established that the messages were relevant and succinct. The majority of participants 21 (87.5%) reported that they always read the text messages, and 9 (37.5%) participants reported that they at least sometimes returned to read the messages. Overall, 20 (83.3%) participants reported they took positive or beneficial action after reading the text messages. None of the participants reported reading the messages and taking negative action.

Table 4.1.5: Participants' feedback after three months of intervention

Feedback	**Values, n (%)**
The Text4Hope text messages were positive.	
Always	19(73.1)
Often	7(6.4)
The Text4Hope-Addiction text messages were affirmative.	
Always	19(73.1)
Often	7(26.9)
The Text4Hope-Addiction text messages were succinct.	
Always	17(65.4)
Often	8(30.8)
Sometimes	1(3.8)
The Text4Hope-Addiction text messages were relevant.	
Always	17(65.4)
Often	8(30.8)

Sometimes	1(3.8)
Frequency reading the Text4Hope-Addiction text messages.	
Always	21(87.5)
Often	3(12.5)
Action taken after reading text messages.	
Read the text and take a positive or beneficial action	20(83.3)
Read the text and took no action	3(12.5)
Other	1(4.2)
Return to read Text4Hope-Addiction text messages.	
Always	5(20.8)
Often	8(33.3)
Sometimes	9(37.5)
Rarely	2(8.3)

Table 4.1.6 shows that 23 (88.5%) of the participants agreed that the supportive text messages helped them cope with stress, whilst 21 (80.8%) and 18 (69.2%) agreed that the messages helped them cope with anxiety and depression related to their addiction, respectively. In addition, 16 (61.5%) participants reported that the messages helped them cope with addiction-related loneliness. Overall, 22 (84.6%) of participants agreed that they felt connected to a support system, 20 (76.9%) were hopeful they could manage issues related to addiction, and 19 (73.1%) of the participants agreed the text intervention helped improve their mental wellbeing. In comparison, 17 (65.4%) agreed that the text messages helped enhance their quality of life.

Table 4.1.6: Participants' opinion on the Text4Hope-Addiction after 12 weeks of intervention

Opinion	Values, n (%)
The daily messages from Text4Hope-Addiction have helped me to cope with stress related my addiction.	
Agree	23(88.5)
Neutral	2(7.7)
Disagree	1(3.8)
The daily messages from Text4Hope-Addiction have helped me to cope with anxiety related my addiction.	21(80.8)
Agree	5(19)
Neutral	
The daily messages from Text4Hope-Addiction have helped me to cope with depression related to my addiction.	
Agree	18(69.2)
Neutral	7(26.9)
Disagree	1(3.8)
The daily messages from Text4Hope-Addiction have helped me to cope with loneliness related to my addiction.	
Agree	16(61.5)
Neutral	7(26.9)
Disagree	

	3(11.5)
The daily messages from Text4Hope-Addiction have helped me feel connected to a support system. Agree Neutral Disagree	 22(84.6) 2(7.7) 2(7.7)
The daily messages from Text4Hope have helped me feel hopeful I can manage issues related to my addiction. Agree Neutral Disagree	 20(76.9) 3(11.5) 3(11.5)
The daily messages from Text4Hope have helped me improve my overall mental wellbeing. Agree Neutral	 19(73.1) 7(26.9)
The daily messages from Text4Hope have helped me enhance my quality of life. Agree Neutral Disagree	 17(65.4) 7(26.9) 2(7.7)

Table 4.1.7 illustrates participants' level of agreement with various technology-based services as a component of their health care services to facilitate counselling for addiction, stress, anxiety, and depression. Overall, 86.7% of participants agreed to recommend web counselling for addiction, stress, anxiety, and depression, 80% agreed to recommend telephone counselling for addiction, and 85.7% agreed to recommend telephone counselling for stress, anxiety, and depression. Overall, 14 participants (93.3%) agreed to recommend text messaging as means to support addiction, while 86.7% agreed to recommend text messaging for stress, anxiety, and depression counselling. In addition, 10 (67%) participants recommended email messaging to support addiction, while 11 (73.3%) participants agreed to recommend email massaging and support for stress, anxiety, and depression. Finally, 12 (80.0%) participants agreed to recommend video and telephone conferencing for physical health care, and 13 (86.7%) participants agreed to recommend consultation via telephone conferencing for mental health care.

Table 4.1.7: Participants' recommendations on counselling for addiction, stress, anxiety, and depression

Recommendations	Values, n (%)
Recommend web-based counselling for addiction	
Agree	13(86.7)
Disagree	2(13.3)
Recommend web-based counselling for stress, anxiety, and depression	
Agree	13(86.7)
Disagree	2(13.3)
Recommend telephone counselling for addiction	
Agree	12(80.0)

Neutral Disagree	2(13.3) 1(6.7)
Recommend telephone counselling for stress, anxiety, and depression Agree Neutral	 12(85.7) 2(14.3)
Recommend text messaging for addiction support Agree Neutral	 14(93.3) 1(6.7)
Recommend text messaging for stress, anxiety, and depression Agree Neutral	 13(86.7) 2(13.3)
Recommend email messaging for addiction support Agree Neutral Disagree	 10(66.7) 2(13.3) 3(20.0)
Recommend email messaging and support for stress, anxiety, and depression Agree Disagree Neutral	 11(73.3) 2(13.3) 2(13.3)

Recommend consultation via video conferencing for mental health care	
Agree	13(86.7)
Neutral	1(6.7)
Disagree	1(6.7)
Recommend consultation via video conferencing for physical health care	
Agree	12(80.0)
Neutral	1(6.7)
Disagree	2(13.3)
Recommend consultation via telephone conferencing for mental health care	
Agree	13(86.7)
Neutral	1(6.7)
Disagree	1(6.7)
Recommend consultation via telephone conferencing for physical health care	
Agree	12(80.0)
Neutral	2(13.3)
Disagree	2(13.3)

DISCUSSION

This study examines the impact of the Text4Hope-Addiction Support program on substance misuse, mental health, and participants' satisfaction after they received the text intervention for twelve weeks. Our study recorded that 73.2% of subscribers reported cravings for drugs at least several times a day, 71.8 % had moderate to extreme intensity for craving, and for 46.5%, the length of time craving drugs was at least somewhat long. The prevalence of moderate to severe depression and anxiety symptoms were 80% and 70.8% respectively. There was a significant improvement in BSCS, PHQ-9 scores, and GAD-7 scores from baseline to three months after the intervention. There was a 33.4% difference in the mean total craving score from baseline. Similarly, mean depression and anxiety symptoms scores saw 30.2% and 21.9% changes (improvement) from baseline to three months. Overall service satisfaction with the Text4Hope-Addiction Support program was high.

Various reports have indicated that the treatment for substance misuse is geared toward improving relapse and preventing acute episodes [509]. A more innovative, cost-effective, technology-enabled and easily scalable intervention such as daily supportive text messaging is needed to curb the typically chronic condition of substance misuse [510]. Most participants in this study were female, constituting 70% of the total sample. This finding may indicate that women are more likely to seek technology enabled mental health and additional treatments as observed in other supportive text messaging programs [94, 434]. However, it is important to note that sex at birth does not represent the gender identity of participants and may not necessarily affect the responses provided by participants [511].

The craving intensity yielded the greatest (41.1%) difference from mean scores at baseline and three months. Our study is consistent with results of Mason et al. (2014) who studied students' readiness to reduce alcohol consumption. The finding from that survey showed that craving intensity for alcohol reduced after a month of delivering supportive text messages and there was high participants' willingness to minimize alcohol intake [512]. This study found a significant reduction in the frequency of craving from baseline to six weeks. 95%CI 0.16-1.22). Our finding is consistent with data from a randomized trial among young adults to assess text-message interventions after hospital discharge. After three months of delivering text message intervention,

participants who received the text message intervention had reduced craving frequency compared to baseline [513].

This study did not find a significant difference between baseline and three-month participants' length of time craving the drug. However, given that participants in this study reported improvement in craving intensity and frequency, it is possible that participants were biased toward reducing the length of time for which they crave drugs. Moreover, the short follow-up time may not have given participants time to explore how long they may stay away from the drug in the absence of intervention. On the contrary, a pilot study reported that after providing supportive text messages to participants with substance misuse, respondents reported that the length of time using drugs had significantly reduced in the past month compared to responders who did not receive the intervention [514]. Also, in a randomized controlled trial for depression and comorbid alcohol use disorder, it was reported that after three months of supportive text messaging, patients reported higher days of first alcohol intake than the control group [433, 488]. Suggesting that supportive text messages can reduce alcohol or drug intake and increase days of abstinence.

Participants had a 30.2% lower mean depression symptom score in participant at baseline compared to the three-month, and this difference was statistically significant. This finding agrees with other studies that revealed a 24%-50% improvement in depressive symptomatology for patients with Major Depressive Disorder who received twice-daily supportive text messages as part of the randomized controlled trial (RCT) [315, 316]. In addition, a study to assess the community attitude to text messages through an online community survey reported that most participants with depression and anxiety symptoms expressed interest in receiving care through their mobile phones [515]. Since substance use disorders often co-exist with other mental health disorders like depression, interventions used to treat addiction may positively impact treating depression symptoms. One study found that addiction treatment for cocaine and alcohol user led to decreased levels of depression reported by participants [516]. Thus, treatment of substance misuse may improve levels of depression in patients with depression and comorbid substance use disorder.

Clinical practice and research report that anxiety is usually associated with substance use disorder, and their treatment and maintenance are interlaced in this comorbidity [517]. Therefore, treatment for anxiety may reduce drug abuse and vice versa. In our study, there was a reduction of anxiety symptoms with about 21.9% change from baseline, attributed to the intervention delivered. A similar study showed that anxiety disorders were more strongly related to substance dependence (odds ratio = 3.0-6.0) [517]. This study suggests that employing other adjunctive treatments to target substance use in individuals can be beneficial in minimizing anxiety symptoms.

Participants were very satisfied with the addiction support program yielding a mean score of 8.71 on a 10-point scale. This result is consistent with other programs, which reported an overall satisfaction of 95% [94] and slightly higher than that reported in the study by Shalaby et al., (2021) recording mean overall participant satisfaction of 8.55 [434]. Participants' satisfaction with the program indicates that the program is helpful and should be recommended to treat addiction and other related symptoms.

A higher number of participants self-reported the ability to cope with stress related to addiction. This result is consistent with other literature, which found that 77.2% of subscribers were able to cope with stress after receiving supportive text messaging [94]. Previous literature has shown that participants were positive about the daily supportive text messages [94, 96]. Similarly, this result agrees with our study; participants agreed that messages were positive, affirmative, succinct, and relevant. A survey among young cannabis users concluded that respondents were motivated to reduce their cannabis use after the introduction of supportive text messages and reported that the service was generally positive and impacted their mental health positively [518]. The supportive text messages have helped people abstain from alcohol and minimize relapse rates [72].

About 85% of participants in this study reported that supportive text messages make them feel connected to a support system. Eighty-one percent felt connected to a support system, while 75% felt part of a clinical team (perception data). Other data recorded similar results [81, 94, 96, 434, 487].

All the participants reported that they always or often read the text messages, which is higher than in other studies. In a survey by Agyapong et al. (2013), 84% reported reading the messages [72]. Similarly, more than three-thirds of the participants returned to read the messages. This is also

consistent with a cross-sectional study reporting that 33% of the sample returned to read the messages more than once [434]. It is also likely that the content of the text messages, which mental health professionals crafted, contributed to participants revisiting the messages to help them improve their addictive symptoms. Higher numbers may be due to the advantages of text programs. Text messages allow people to choose when or how often to read them and also offered individuals the flexibility to opt in and out at their convenience [519]. Most participants in this study reported that the daily supportive text messages improved their overall mental health. This was similar to the 83% of participants with alcohol use disorder and comorbid depression in another study who felt this way [72].

There is a crucial demand to develop evidence-based mental health policies that will provide for the health needs of individuals, and most prefer to receive such services remotely [520]. Most of the study participants (93.3%) agreed to recommend text messaging as an intervention to support an addiction. Almost three-quarters of the participants agreed to recommend text messaging, email, telephone, or video conferencing to provide extra support for addiction, stress, anxiety, or depression. Other studies support our findings. A randomized controlled trial to explore the perception of students on various interventions for alcohol showed that the majority of participants expressed satisfaction and agreed to recommend text messaging or email intervention to reduce alcohol consumption [511]. Most participants in this study also reported they would recommend telephone or text messages as the preferred means of receiving addiction treatment. These forms of counselling have an advantage over face-to-face counselling as they are convenient and provide privacy [518] and can aid healthcare delivery during pandemics in which one needs to isolate and social distance to minimize the risk of infection in the acute phase. For example, 63% of the participants in this study had never assessed mental health services since the onset of the pandemic.

Limitations

This study has several limitations, and findings should be put in context when interpreting the results. First there were low response rates for baseline and follow-up survey (six weeks and three months), and only four participants completed the baseline survey and any follow-up survey. Thus, the results presented in the study may not accurately reflect actual changes in scores from baseline

to three months for participants. Moreover, only fourteen participants completed the three-month surveys.[81, 521]. For twenty-one of the participants, the survey responses for the outcome measures at three months were imputed from their six-week survey responses. It is therefore likely that for participants for whom there was data imputation the six weeks outcome data may not accurately reflect their clinical outcomes at three months. Furthermore, the supportive text messages were delivered for three months, with outcome measures evaluated at the endpoint of three months. Thus, the long-term impact of this intervention cannot be determined from this study. In addition, the study participants may not represent individuals with addiction and may not be generalizable to a clinical sample of patients with addiction. In addition, although the BSCS, a three items scale has adequate reliability, inter-item consistency and face validity, the brevity and narrow focus of the dimensions assessed diminish the construct and concurrent validity of this scale [507].

Finally, participants' feedback and perception of their ability to cope with stress, anxiety and depression associated with drug addiction were self-reported and not assessed clinically, although standardized screening scales were used. Notwithstanding these limitations, the findings from this study denote that supportive text messages are promising and have the potential to reduce craving symptoms, depression, and anxiety in drug addiction.

Conclusion

The study's findings suggest that craving, anxiety, and depression symptoms were high among subscribers of Text4Hope Addiction support during the pandemic, and supportive text message intervention could help curtail craving, depression and anxiety symptoms experienced by individuals with drug addiction. Clinicians and policymakers may find it beneficial to incorporate supportive text messages to supplement addiction treatment to improve client outcomes. Further studies are needed to investigate other impacts of text message intervention for drug addiction.

CHAPTER 5: OVERALL STUDY CONCLUSIONS AND IMPLICATIONS FOR POLICY AND PRACTICE

This research study suggests that military personnel, firefighters, the elderly, and disaster victims have higher prevalence of mental health conditions compared to the general population. The research also highlights several important demographic, clinical and trauma related correlates for mental health and addiction problems among these vulnerable populations. The research further suggests that a daily supportive text messaging intervention program may be effective in reducing the mental health and addiction treatment gap in these vulnerable populations.

From the general review, it was established that depression was the most significant predictor of death by suicide among the elderly 60 years and above, with a prevalence of depressive disorder ranging from 5.37 to 56%. This alarming rate indicates the need for intervention to improve the mental health of the elderly and reduce suicidal risk. Factors such as loss of a loved one, chronic pain, loneliness, financial constraints, and lack of interaction were found to trigger depression and suicidal thoughts in the elderly population [101, 147, 164]. Early detection of physical illnesses and effective social interaction is recommended to improve mental health and minimize suicidal ideation among the geriatric population.

From the scoping review, it was established that military personnel and firefighters are particularly vulnerable to mental health symptoms, with a prevalence of PTSD ranging from 1.9% to 57% for firefighters and 5.37% to 37.8% for military personnel. Age at which the individual joins the service, marital status, occupational factors like shift hours and the encounter of trauma during work were some of the factors predictive of PTSD. Physical injuries sustained at work and social support are also correlated to PTSD and contributed to the vulnerability of the military and firefighters' mental health symptoms. Recognizing and addressing factors that predict PTSD and other mental health illnesses will help to improve mental well-being and increase productivity among the military and firefighters.

The cross-sectional studies reported that the mental health burden was generally high among residents of Fort McMurray after the wildfire, flooding and during the COVID-19 pandemic. There was a high prevalence of depression, self-reported substance abuse, and low resilience, among

other psychopathologies. Factors like a history of mental health illnesses, mental health counselling, inadequate support after the disaster, and exposure to multiple traumas increased the vulnerability of residents to experiencing mental health illnesses.

For the Text4Hope Addiction Support program evaluation, subscribers reported significant satisfaction with the daily supportive text message service. Improvements were observed from baseline to three months in prevalence and mean scores recorded on self-reported clinical measures. This suggests that supportive text-based interventions are helpful and can be broadly extended to other populations vulnerable to mental health symptoms. To this effect, the research team has explored a national scale-up and implementation of the Text4Hope programs in different languages, as well as other supportive text interventions like the Text4Healthy ageing program for the elderly [522] and Text4PTSI and Text4Wellbeing for first responders [311]. These interventions are in operation to manage mental health symptoms among vulnerable populations in the community. Policymakers and healthcare practitioners could adopt these effective and economic interventions. Decision-makers may consider implementing text-based intervention strategies to complement conventional treatments for addiction and mental health symptoms among vulnerable populations.

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