Bridging the Psychological Treatment Gap Using Peer Support and Supportive Text Messaging

by

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Abstract

Background: Most discharged psychiatric patients in Alberta are offered follow-up appointments with Alberta Health Services (AHS) Addiction and Mental Health (A&MH) community providers. It is typical to wait weeks or months for a follow-up appointment, resulting in a substantial psychological treatment gap. The significance of this treatment gap became more evident during the COVID-19 pandemic.

Objectives: **1)** Evaluate effectiveness of innovative peer support worker services (PSWs) and of supportive text messages (Text4Support) provided to the patients discharged from acute care, in Edmonton, Alberta.; **2)** Implement and evaluate effectiveness of a supportive texting service (Text4Hope) provided to the general public during the COVID-19 pandemic; **3)** Identify the prevalence of mental health conditions during this pandemic.

Methodology: Through a prospective, rater-blinded, four-arm controlled observational pilot trial, we examined the use of PSS and text messages (TxM) of Text4Support for post-discharged patients from acute psychiatric care. Patients (n=181) with mental health disorder were recruited and randomised to either (1) PSWs alone; (2) PSWs + TxM; (3) TxM alone; or (4) treatment as usual (TAU).

During the pandemic, we provided a three-month supportive TxM to the general public (Text4Hope) service to support and monitor mental health in Alberta. Validated self-report questionnaires were used to assess mental health conditions. Data were collected at baseline, program midpoint (6 weeks), and endpoint (12 weeks). Statistical analyses including descriptive, correlational, inferential statistics and longitudinal data analysis, using SPSS, and thematic analysis using NVivo software.

Results: Sixty-five patients completed assessments at each time point of the pilot study. Improved scores were reported for PSW+TxM compared with TAU condition on the total recovery assessment score and willingness to ask for help and personal confidence and hope domains, along with environment domain (physical safety and security) of WHO-QOL scale, and the functioning domain of CORE-OM scale. The PSW+TxM group consistently achieved better outcomes on CORE-OM recovery, clinical and reliable improvement. TxM and PSW+TxM arms significantly reduced prevalence of risk of self/other harm symptoms after six-month intervention.

After one-year of Text4Hope service, participants providing valid responses to baseline, six-week, and three-month surveys comprised groups of 9214, 4110 and 1286, respectively. Statistically significant reductions mid-point reductions were observed for likely prevalence and mean scores of moderate or high stress and likely anxiety but not likely depression. After 3 months of using Text4Hope, there were significant reductions of prevalence and mean score compared with baseline on: the GAD-7 by 22.7%, PHQ-9 by 10.3%, and PSS-10 scores by 5.7%. Similar reductions were reported after one year of the service, with the largest reduction in anxiety (32.9%).

By the time of exiting the service, 89.4% subscribers reported high satisfaction with Text4Hope, and 60.6-85.7% agreed that the service helped them in diverse ways. Messages were read and well-perceived by more than 90% of the subscribers.

Conclusions: Positive outcomes were reported after implementing PSW and TxM programs in terms of clinical and functional improvements, customer satisfaction; and effective surveillance methodology for tracing changes in mental health, during the COVID-19 pandemic. Free mobile-based services such as Text4Hope or Text4Support can overcome financial barriers, while

maintaining essential physical distancing required during pandemics, and providing means of support for those with no access to conventional mental health services. This work indicates the potential value of incorporating such interventions in routine service.

Preface

This thesis contains published work that was subject to prior ethics approval and is presented in the form of peer reviewed articles this preface lists those articles and provides details of them. This thesis is an original work by Reham Shalaby. The research comprising this thesis was conducted in accordance with the Declaration of Helsinki (Hong Kong Amendment) and Good Clinical Practice (Canadian Guidelines) and received ethics approval under protocols Pro00078427 and Pro00086163), operational approval from Alberta Health Services [AHS-(PRJ) #35293] and is registered with clinicaltrials.gov: NCT03404882. All participants provided informed consent prior to study inclusion.

Most chapters of this thesis included sections and subsections that were published/submitted/planned for submission. To avoid redundancy, the references from each of these published/ to be submitted papers are listed in a single refence list at the end of this thesis, apart from this change, the text of the papers are presented exactly as they are published.

Details of inclusion of these papers are provided below, together with the contribution to this work of Reham Shalaby

Chapter 1.2: This chapter has been published as: **Shalaby, R.** A. H., & Agyapong, V. I. O. (2020). Peer Support in Mental Health: Literature Review. *JMIR Ment Health, 7*(6), e15572. doi:10.2196/15572.

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Reham Shalaby participated in data collection, data analysis and writing the initial manuscript. VIOA conceived and designed the study, including Text4Support. RS and VIOA performed the data analysis and jointly drafted the initial manuscript with MH. RS, RMAE, and WV participated in the data collection. P Spurvey participated in the provision of peer support services, while M Knox and R Rathwell coordinated and supervised the peer support workers. All authors participated in the study design, reviewed and edited the initial draft of the manuscript, and approved the final draft of the manuscript.

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Routine Evaluation Measures for Patients Discharged from Acute Psychiatric Care: Four-Arm Peer and Text Messaging Support Controlled Observational Study. Int J Environ Res Public Health, 19(7). doi:10.3390/ijerph19073798.

Reham Shalaby participated in the data collection, performed the data analysis and drafted the initial manuscript. V Agyapong conceived and designed the study, including Text4Support and supervised the project execution. W Vuong participated in the data collection. P Spurvey participated in the provision of peer support services, while M Knox and R Rathwell coordinated and supervised PSWs. All authors participated in the study design, reviewed and edited the initial draft of the manuscript, and approved the final draft of the manuscript before submission.

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Reham Shalaby was responsible for data collection, data analysis, and manuscript composition, V Agyapong conceived and designed the study, including Text4Support. E Ebroeime assisted with data collection and data analysis. W Vuong participated in data collection. All authors participated in the study

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Reham Shalaby participated in study design, critically reviewed the article and contributed to the final draft of the article. V Agyapong conceived and designed the study, including the Text4Hope program, and performed data analysis. M Hrabok analyzed the data, drafted the initial article with VAgyapong and I Nwachukwu, and participated in study design. A Gusnowski, W Vuong, and S Surood participated in study design and in data collection. Reham Shalaby, D Li, and A Greenshaw critically reviewed the article and contributed to the final draft of the article. All authors participated in study design and reviewed and approved the final draft of the article.

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Reham Shalaby drafted the manuscript, performed the statistical analysis, participated in acquisition, analysis, interpretation of data, and critical revision of the manuscript for important intellectual content. Dr. Vincent Agyapong was responsible for concept and design, acquisition, analysis, or interpretation of data, critical revision of the manuscript for important intellectual content, Administrative, technical, or material support, and project supervision. Marianne Hrabok, Wesley Vuong, April Gusnowski, Shireen Surood, Andrew J. Greenshaw participated in acquisition, analysis, or interpretation of data, critical revision of the manuscript for important intellectual content,

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Table of Contents

List of tables

Table 4.3.5.1: Mean Scores and Prevalence Changes Reported in the Three Clinical Conditions, Moderate-to-High Stress, Likely Major Depressive Disorder (MDD), and Likely Generalized Anxiety Disorder (GAD), from Baseline to Three-Months

List of figures or illustrations

List of symbols

A&MH: Addiction and Mental Health

AHS: Alberta Health Services

ANOVA: One-factor analysis of variance

APC: Acute psychiatric care

ATP: Participants who completed the surveys at all time-points

BDI: Beck Depression Inventory

BOCS: Brief Obsessive-Compulsive Scale

CAD: Canadian

CAMH: Centre for Addiction and Mental Health

CBT: Cognitive behavioral therapy

CDC: The Centers for Disease Control and Prevention

CG: Control group

CI: Confidence intervals

CIHI: Canadian Institute for Health Information

CMH: Composite Mental Health

CoPE: Coping with Corona: Extended Psychosomatic care in Essen

CORE-OM: The CORE outcome measure

COREQ: Consolidated criteria for reporting qualitative research

COVID-19: Coronavirus Disease 2019

CPDI: COVID-19 Peritraumatic Distress Index

CROSS: Checklist for Reporting of Survey Studies

CRPD: Convention on the Rights of Persons with Disabilities

DASS: depression, anxiety, and stress scale

DSM-IV: Diagnostic and Statistical Manual of Mental Disorders IV

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

ED: Emergency department

EPSS: Edmonton peer support system

GAD: Generalized anxiety disorder

GAD-7: Generalized Anxiety Disorder-7

HCWs: Health care workers

i-CBT/iCBT: Internet-based cognitive behavioral therapy

IG: Intervention group

IPS: Intentional peer support

IVR: Interactive voice response

LMICs: Low- and middle-income countries

M: Mean

MANCOVA: Multivariate analysis of covariance

MDD: Major depressive disorder

MERS: Middle East respiratory syndrome

MERS-CoV: Middle East respiratory syndrome coronavirus

MH: Mental health

MHDS: Moderate to high depressive symptoms

NATP: Participants who did not complete the surveys at all time-points

OCD: Obsessive compulsive disorder

OR: Odds ratio

PCL-5: PTSD Checklist for DSM-5

PHQ-9: Patient Health Questionnaire-9

PPE: Personal protective equipment

PSS: Peer support service

PSS-10: Perceived Stress Scale-10

PSSs: Peer support services

PSWs: Peer support workers

PTSD: Post-traumatic stress disorder

PWDs: People with disabilities

QOL: Quality of life

RAS: Recovery assessment scale

RCI: Reliable change index

RCTs: Randomized controlled trials

RE-AIM: Reach, Effectiveness, Adoption, Implementation, and Maintenance

SAMHSA: The Substance Abuse and Mental Health Services Administration

SARS: Severe adult respiratory syndrome

SARS-CoV: Severe acute respiratory syndrome coronavirus

SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2

SD: Standard deviation

SEM: Standard error of the mean

SIAM: Suicide Intervention Assisted by Messages

SMI: Severe mental illness

SMS: Text message/short message service

SPSS: Statistical Package for Social Sciences

STAI: State-Trait Anxiety Inventory

SUD: substance use disorder

TAU: Treatment as usual

TIC: Trauma-informed care

TxM/TextM: Supportive text messages

UAU: Unhealthy alcohol users

UK: the United Kingdom

VHS: Video home system

WHO: World Health Organization

WHO-QOL: World Health Organization Quality of Life Brief instrument

YLDs: Years lived with disability

Chapter 1. Introduction

The introduction consists of three sections: 1) an overview on the treatment gap in mental health; 2) literature review on peer support services in mental health, and 3) a rapid review on the text messages in mental health field.

1.1.Overview on Treatment Gap in Mental Health

Mental health disorders are prevalent worldwide and represent a global health problem. Epidemiological studies have estimated the total number of people living with mental health disorders across the world at 792 million, and to more than one billion people when considering addiction; this represents more than one in ten people or may increase to one in five when considering people in conflict settings and civil wars [1-3]. In Canada, according to The Centre for Addition and Mental Health (CAMH), one in five Canadians in a given year will incur mental health illness or addiction problems; and by age 40, half of Canadians will have or have had experienced a mental illness [4]. Mental illness represents the leading cause of disability among Canadians, with a disease burden exceeding other physical health conditions, including cancers and infectious diseases [4].

In respect to mental health needs, the World Health Organization (WHO) and the World Bank have reported that at least half of the world's population cannot obtain essential health services [5]. While at least 10% of the total population may endure a mental health problem at any one time, only 1% of the global health workforce provides mental health care [6]. According to the WHO report in 2017, the estimated rate for mental health workers was at nine per 100,000 individuals, and significantly less in the low-income countries where it was below two per 100,000 individuals [7]. Regarding the total estimate of psychiatrists, low proportions were reported across the world, regardless of regional income level, albeit to a varying degree. While in high-income countries, there were only 11.9 psychiatrists per 100,000 people, the problem was more intense in low-income countries where the estimate was less than 0.1 psychiatrists per 100,000 people [7]. Furthermore, the same report demonstrated fewer pediatric psychiatrists, ranging from less than 0.1 to 1.19 per 100,000 population, depending on regional income.

Additionally, a high portion of mental health treatment in all countries (developed and less developed) is devoted to subthreshold cases, and this portion was inversely correlated with the prevalence of mental health conditions in different regions. For example, in countries with high prevalence of mental health disorders, estimates had the lowest proportion of treatment directed to

the subthreshold cases, and vice versa [8], suggesting the disproportion of the offered human and non-human resources when compared to individuals' needs and demands for mental health support.

The treatment gap is defined as *the number of people with a condition or disease who need treatment for it but who do not get it* [9]. It highlights the discrepancy between the proportion of people who need care and those who receive care [10]. The treatment gap is estimated at (30-50%) in high-income countries, and even higher in low- and middle-income countries (LMICs) (90%), where it may involve serious health conditions with an eminent risk of death [2, 8, 11, 12]. With more people affected by addiction or mental health disorders across the world, there has been increasing recognition of these conditions. Notwithstanding, support is limited and disproportionate to population needs [2, 13].

With respect to regions and ethnicities, the treatment gap in the Americas is estimated at 66%, when higher rates are reported in South and Latin America and among the Indigenous population in the USA [14]. In Canada, almost 18% (5.3 million) of Canadians reported their need for some mental health support, but just above half of this figure (10.1%, 3.1 million) reported their needs were fully met [15]. The rest (7.9%, 2.3 million) stated their needs were partially met or unmet altogether. When considering patients who do not have a regular health care provider, the percentage increases to 60.3% [15]. The need for counselling was reported as the most likely need to be fully unmet, while the need for medication was the most likely to be met [15]. This finding may highlight the dissatisfaction with the existing service and underscore the increasing demand for various therapeutic lines, including mental health counselling and not necessarily medication.

Regarding the treatment gap in the individual mental health conditions, a review reported that the highest estimate was with alcohol abuse at (78.1%), followed by other mental health conditions: (57.5%) for generalized anxiety disorder (GAD); (57.3%) for obsessive compulsive disorder (OCD); (56.3%) for depression; (56.0%) for dysthymia; (55.9%) for panic disorder; and (50.2%) for bipolar disorder; while the least reported treatment gap was (32.2%) for non-affective psychotic disorders [14].

Two mental health treatment gaps are highlighted in this dissertation: the gap that emerged during the coronavirus disease 2019 (COVID-19) pandemic and the gap existing after patients are discharged from psychiatric hospitals/acute care units.

Treatment gap During the COVID-19 Pandemic and Population Mental Health

As discussed above, accessibility to health care system has been a global challenge, with a limited number of health care workers, including psychiatrists and therapists. The ultimate number of people who reported having received mental health services and reported their needs having been met represents only a half, and in another report only a third of the overall population [15, 16]. During the COVID-19 pandemic, this problem was expected to escalate and become a global health issue. From previous similar experiences, such as severe adult respiratory syndrome (SARS), the risk of mental health disorders, including suicide, was increased and became persistent long-term [17]. With the prior existent shortcomings of the health care systems, a similar trajectory was expected to follow, particularly when the state of COVID-19 pandemic was declared.

In December 2019, an outbreak of pneumonia emerged in Wuhan, Hubei province, China and rapidly spread worldwide to become an international threat and public health emergency [18, 19]. A zoonotic RNA-virus known as SARS-CoV-2 was identified as the causative agent for the resultant disease, which was named by the World Health Organization as coronavirus disease 2019 (COVID-19) (WHO) [19, 20]. The pandemic status was declared thereafter by the WHO on March 11, 2020 [21]. By the second half of March 2020, most countries had reported cases of COVID-19 and by March 23, 2020, there were 332,930 COVID-19 confirmed cases globally, with 14,509 associated deaths, confirmed by the WHO [22].

The spread of the pandemic mandated strict health recommendations, precautions, and legislation to curb the virus spread [23]. These measures included physical distancing, quarantining and self-isolation, enhanced hand hygiene and disinfection protocols, travel restrictions, and closure of public schools and non-essential businesses [24]. The disruptions reached different sectors and workplaces, including the health care system. Prominent disruptions was reported particularly in schools and workplace mental health services when they were most needed, according to the Director General of the WHO [25].

The WHO conducted a survey from June to August 2020 to examine the change in provision of mental and substance use services due to COVID-19 [25]. According to the survey, the reported disruptions primarily affected vulnerable groups, including children and adolescents, women requiring antenatal or postnatal services, and seniors (60-72%). Regarding the type of service, the substance use disorder (SUD) treatment programs, and psychotherapy, including counselling services were among the highly-perceived disrupted services due to the pandemic (45 and 67%

respectively). Furthermore, more than a third of survey respondents reported disrupted emergency services, including serious physical and mental health conditions, while only three out of ten respondents reported disrupted access to their medications for mental, SUD, or for neurological condition [25].

This situation inadvertently produced far-reaching impacts on individuals' well-being, physical and mental health [26, 27]. Data from several countries supported such findings in different contexts. For example, in the USA, difficulty eating or sleeping, and increases in alcohol consumption or substance use were highly reported among adults, in the United Kingdom, a low level of physical health and more weight gain were reported, while in Latin America, people were more affected by emotional problems [28-30]. Additionally, depression or anxiety symptoms increased in the USA three- to four-fold during the COVID-19 pandemic compared to the reported data of early 2019 (before the declaration of the pandemic) [28, 31].

In Canada, a series of national surveys conducted by the CAMH reported that, in July 2021, about 19% of Canadians experienced moderate to severe anxiety, and felt depressed and lonely as a result of COVID-19 [32]. These figures were slightly lower than what was reported earlier in the pandemic (20-21%), however, binge-drinking remained at a higher level (26-27%), compared to other mental health conditions [32]. Furthermore, the likelihood to express passive death wishes and thoughts of self-harm notably increased since the beginning of the pandemic; and according to the Mental Health Commission of Canada, 10% of Canadians experienced thoughts or feelings of suicide [33], whereas 3.1% reported having these symptoms more than half the days, and 1.8% reported experiencing these symptoms nearly every day [34].

Although high levels of mental health burdens were reported worldwide, a subset of exposed populations was deemed more prone to be significantly afflicted by mental health burdens during the pandemic. This included marginalized people, such as persons of color or the financially disadvantaged; persons who are single, widowed, or divorced; persons who experienced isolation or quarantine during the pandemic; people with underlying chronic health conditions [27, 30, 35-37]. Regarding the age distribution, young people were believed to be more affected than older adults due to under- or unemployment associated with the economic drift since the beginning of COVID-19 pandemic [38]. With respect to gender, females were reported to be at a higher risk than males of experiencing mental health threats of depression and anxiety; this included older age groups, whereby anxiety was believed to risk their memory and cognitive functioning [37, 39].

Technology and Mental Health Support During the COVID-19 Pandemic

At this tough time of the evolving pandemic, it was warranted to protect and support individuals' mental health and well-being. The Centers for Disease Control and Prevention (CDC) provided five tips for healthy ways to cope with COVID-19 related stress: *Take breaks from watching, reading, or listening to news stories; Take care of your body; Make time to unwind; Connect with others; and Connect with your community- or faith-based organizations* [40].

The COVID-19 pandemic further reinforced the urgent need for transforming the mode of delivery of mental health services to remote, digitally-enabled services that cope with the new pandemic regulations and lifestyle [41] [30]. Some initiatives of psychological digital interventions have been adopted since the onset of COVID-19 worldwide. In China, *WeChat* is a free 24/7 online service (e.g., WeChat, Weibo, and TikTok) that provided psychological self-help intervention in the form of online cognitive behavioral therapy (CBT) for depression, anxiety, and insomnia, directed for certain populations such as medical staff, students or patients with COVID-19 [42].

In Germany, a service termed CoPE (Coping with Corona: Extended Psychosomatic care in Essen) provided telephone and videoconferencing calls with experts, web contents, and online interventions using different modules, such as mindfulness, psychoeducation, and cognitive behavioral skills training [43]. Similar initiatives took place in Singapore and South Korea; for example, an online psychotherapy was provided via Zoom to patients with psychiatric conditions; hotlines, leaflets, and psychological counselling were provided to people in quarantine; and a multidisciplinary team has collaborated virtually utilizing internal and external networks during the COVID-19 pandemic, to provide the necessary psychosocial support in Korea [44, 45].

Additionally, some digital interventions took place for health care workers, such as a digital support package provided on psychological well-being in the United Kingdom (UK) [46]. The e-package included evidence-based guidance, support, and signposting relating to psychological well-being for all UK health care employees. The package had over 50 000 hits within seven days of release; it was well-perceived; and 100% of the participants anticipated they would use it in the future. Similar initiatives, including local supportive services for staff (e.g., rest and recharge rooms) were introduced in Spain, Italy, and the USA [45].

Supportive mental health text messaging has shown itself to be a convenient mental health approach that could fulfil the pandemic mandates to deliver services remotely without physical contact. In addition, the service is cost-effective and accessible at a population level [47]. In Canada, almost 88% of residents own a smartphone [48]. Additionally, SMS text messaging is

embedded in 98% of mobile phones [49]. Texting is free to the majority of users, does not require technical skill to use, is included in most mobile plans and furthermore, cost-effective for providers [50]. Online services have expanded to incorporate mental health surveys with or without associated short supportive text messages using different online platforms. In the COVID-19 pandemic, these surveys were applied to measure the prevalence of the mental health symptoms and conditions among different populations, such as medical staff, students, and patients with COVID-19 [42, 51-54].

Although the WHO strongly recommended the use of technological mental health supports during the pandemic, other than some of the aforementioned initiatives, most of the services in the literature focused rather upon the surveillance of the mental health burden among different populations. Very few as mentioned above were directed to tackle health conditions. Moreover, most of the services aimed to support certain groups of population, such as those with a prior mental health condition, in isolation or quarantine, physicians and health care workers, while a dearth focused on the general public and their endangered well-being and mental safety. Thus, the need to provide a mental health support to the general public was warranted early in the pandemic and to comply with the enforced restrictions.

Treatment Gap for Patients Discharged from Hospitals

Hospital discharge and transitioning from acute mental health care to the community settings is described as vulnerable and challenging and poses a remarkable risk to the patients' well-being and mental health safety [55, 56]. Several challenges could confront the patients upon their discharge, such as medication management, poorly coordinated information that may result in duplication of services, clinical deterioration, and risk of self-harm [55]. The term 'revolving door' demonstrates how patients can repeatedly transition between hospitals and community care and end up with early readmission [55].

In Canada, while provincial health care spending has more than doubled in the past 15 years [57], the treatment gap has remained the same after hospital discharge and before receiving the first community health care service. Service users and researchers describe the discharge process as chaotic and stressful, where the discharge may be unnecessarily delayed due to the incoordination between service providers, incurring extra costs to the health care system and exposing patients to unnecessary hospital-related risks; or on the other hand, the discharge takes place prematurely with an ill-defined care plan, exposing patients to complications for recovery and increased risk of

readmission [55, 58]. The lack of routine follow-up and clear care plan provided to patients upon their hospital discharge could have a detrimental effect on their recovery, which is often associated with premature readmission and frequent visits to Emergency [59, 60].

Although the estimates of total discharges in Canada remained nearly stable (from 8,411 to 8,450) per 100,000 population [61], there has been a steady increase in mental health and addiction discharges, with prominently high figures for schizophrenia and psychotic disorders [62]. Emergency department (ED) visits and hospital readmission rates after hospital discharge ranged between 12 to 22% and 5 to 50%, respectively, depending on the age and mental health condition of the patient [63-67]. Furthermore, mounting evidence refers to invariably high estimates of self-harm and deaths that took place early post-discharge. As well, more than a third of suicides related to mental health discharges took place in the first month post-discharge [68, 69], and in another report, 55% were reported in the first week post-discharge [70]. About half of these patients died before having their first follow-up appointment [68, 69]. Thus, there has been an emphasis upon having the follow-up appointments early post-discharge; in the first seven days or more stringently within two-to-three days post-discharge due to the high risk of reported self-harm during this period [69].

Several factors, however, were more likely to drive the risk of readmission after discharge, such as having prior psychiatric hospitalizations, multiple comorbidities, unemployment, and psychotic disorder diagnosis [59, 71]. Nevertheless, the risk factors of suicide are relatively more complex and intermingled. Although some factors showed strong association with the suicide risk, including personal factors, such as sociodemographic, ethnic, and having personality disorder, prior mental health condition or previous suicide attempts and family and societal factors, such as stigma, taboo, lack of social support, and family history of suicide, the health care system has played a key role in suicide risk. The reported high rates of underdiagnosis of mental health disorders, growing lack of trust in and frustrations with the system/service, lack of support, and the *hostile* attitude of health care staff towards suicide attempters might decrease patients morale, with the result of losing hope, feeling stigmatized, and urged to repeat the suicide attempt [69, 72, 73].

As such, several factors have collectively resulted in the wide treatment gap emerging after discharge, which has exposed patients to challenges and unnecessary harms, including risking their own safety and lives. The lack of support after discharge, poor coordination, with unclear care plan

that ensures linking the patient to a health care provider soon after discharge were among the most common drivers.

Examples of Supportive Initiatives Provided to Patients after Hospital Discharge Aiming to Close the Treatment Gap

The recent movement of global mental health has highlighted the inequalities and inequities in mental health provision, whereby experts across the globe have participated in developing a related consensus statement to address the gap in mental health provision [10]. In 2008, the WHO declared an action plan to address and resolve the treatment gap that included two main initiatives, the Mental Health Gap-Action Program and the Mental Health Gap-Intervention Guide [74]. The aim was to scale up services for mental, neurological, and substance use disorders in the LMICs; where depression, suicide, schizophrenia and other psychotic disorders were among the priority conditions [74]. The aim was for mental health to be integrated into primary health care.

In Canada, mental health has not been formally integrated into primary care, except in a few organizations and provinces, such as Ontario, where an intersectoral mental health strategy was expanded in 2014 to better integrate primary care and mental health [75]. In Edmonton, Alberta, an initiative of seamless care transition policy was provided to patients who were not previously connected to Addiction and Mental Health (AMH) outpatient services [76]. The service reported a considerable reduction in wait time, a marked rise in the number of the new psychiatric assessments, with a modest reduction of the readmission rates.

In a recent systematic review on the interventions introduced to patients after their discharge, the authors reported 45 studies covering a wide spectrum of interventions [55]. They classified these interventions into either services that primarily dependent on personnel, such as peer support workers or pharmacist, and services that provide distinct approaches such as *Critical Time Intervention* (a service produced by workers under the clinician's supervision to patients with severe mental illness (SMI) after their discharge to prevent homelessness and ease the process of transition into the community; the service typically lasts for nine months post-discharge [77]) and *Transitional Discharge Model* (the peer support workers (PSWs) provide additional support to their peers following hospital discharge from psychiatric hospitals and while transitioning into the community; the service may vary in its length and the meeting frequency, and aims to facilitate discharge and reduce readmission rates [78, 79]).

Researchers suggested a number of key elements that need to be incorporated while the patient is still hospitalized to facilitate and improve the discharge process [56, 80]. This essentially depends on developing a health information system that stores patients' clinical, socio-cultural, and personal information in a single accessible place that eases the communication related to the patients' health condition. The information needs to be gathered at admission, which may involve the source of the referral and reason for admission in addition to the information needed about the assigned settings to which the patients will be discharged. The overall aim of all aforementioned services is to reduce readmission and suicide, improve well-being, and treatment adherence, and accelerate discharge [55].

While the initiatives supporting patients after hospital discharge have evolved, improved, and provided hope to the discharged patients, the reported effectiveness in terms of clinical and administrative outcomes are still inconsistent and yet to be conclusive. Therefore, there was an essential need to examine novel strategies that may include combined services that may enhance and potentiate the effect of each other, as follows.

Combined Service of the Peer Support Workers and Text Messages in the Field of Mental Health Aiming to Close the Treatment Gap after Hospital Discharge

Two mental health services have demonstrated efficacy and economic value in the field of mental health: peer support workers (PSWs) and supportive text messages (TxM). The development of the health care system over the past few decades was aligned with the cultivation of a paradigm shift [81-84]. The newly-adaptive model entails moving from the medical support model represented in a service provided with physicians/clinicians who prescribe medication to community-based care, represented with occupational therapists, mental health therapists, social workers as well as PSWs who provide allied lines of therapeutic management [81-84]. Peer support service has been demonstrated in various contexts, such as outpatient department, ED, hospital, or post-discharge [85-88]. While the outcome measures of the service provided by PSWs are usually mixed, there is a subtle agreement upon the reported improved mental health recovery, patients' community engagement, better adherence to medication and provided therapies, and better self-control, among others [85-88].

Similarly, digital technology has evolved wildly, invading several life sectors in the last few decades, including health care. It became possible to provide or screen for mental health services through remote channels that depend on available technologies, such as smart/cell phones or

computers [89-92]. Examples of these services are mental health apps, unguided/guided internet-based cognitive behavioural therapy (i-CBT) and supportive text messages [93-95]. These therapies are usually based upon the CBT principles and could be provided remotely with/without therapist involvement [94, 95]. Such platforms became largely available via online channels supporting people with depression [94, 96, 97], anxiety [91, 97], insomnia [51], addiction [98], post-traumatic stress disorder (PTSD) [99, 100], psychosis [47, 101], or comorbid conditions [102].

1.2. Peer Support in Mental Health: Literature Review

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In the context of the mental health gap referred to in section 1.1, this chapter will highlight and elaborate with further details upon the benefits and positive outcomes of the peer support services in the field of mental health along with their role in addressing the emerged gap. The section represents a published literature review.

Abstract

Background: A growing gap has emerged between people with mental illness and health care professionals, which in recent years has been successfully closed through the adoption of peer support services (PSSs). Peer support in mental health has been variously defined in the literature and is simply known as the help and support that people with lived experience of mental illness or a learning disability can give to one another. Although PSSs date back to several centuries, it is only in the last few decades that these services have formally evolved, grown, and become an integral part of the health care system. Debates around peer support in mental health have been raised frequently in the literature. Although many authors have emphasized the utmost importance of incorporating peer support into the health care system to instill hope; to improve engagement, quality of life, self-confidence, and integrity; and to reduce the burden on the health care system, other studies suggest that there are neutral effects from integrating PSSs into health care systems, with a probable waste of resources.

Objective: In this general review, we aimed to examine the literature, exploring the evolution, growth, types, function, generating tools, evaluation, challenges, and the effect of PSSs in the field of mental health and addiction. In addition, we aimed to describe PSSs in different, non-exhaustive contexts, as shown in the literature, that aims to draw attention to the proposed values of PSSs in such fields.

Methods: The review was conducted through a general search of the literature on MEDLINE, Google Scholar, EMBASE, Scopus, Chemical Abstracts, and PsycINFO. Search terms included peer support, peer support in mental health, social support, peer, family support, and integrated care.

Results: There is abundant literature defining and describing PSSs in different contexts as well as tracking their origins. Two main transformational concepts have been described, namely, intentional peer support and transformation from patients to peer support providers. The effects of PSSs are extensive and integrated into different fields, such as forensic PSSs, addiction, and mental health, and in different age groups and mental health condition severity. Satisfaction of and challenges to PSS integration have been clearly dependent on a number of factors and consequently impact the future prospect of this workforce.

Conclusions: There is an internationally growing trend to adopt PSSs within addiction and mental health services, and despite the ongoing challenges, large sections of the current literature support the inclusion of peer support workers in the mental health care workforce. The feasibility and maintenance of a robust PSS in health care would only be possible through collaborative efforts

and ongoing support and engagement from all health care practitioners, managers, and other stakeholders.

Introduction

Peer support services (PSSs) are novel interventions recently adopted in mental health systems worldwide. It is believed, however, that PSSs date back to more than three centuries to the moral treatment era [103], albeit on an informal basis. Diverse definitions and classifications for PSS have been provided in the literature [104-106], and numerous reports have praised and supported the service provided by peer support workers (PSWs) [107-110]. However, other literature suggests the neutral effects of PSS with weak associated evidence to support such services [111, 112]. The potential impact of PSWs on their peers [113-116] have received considerable attention in the literature.

PSSs have been introduced in different contexts, such as family PSWs [117-121], the forensic field [122, 123], and online PSSs. A considerable number of strategies were proposed to generate an effective PSS in the MH field amid a number of associated concerns and challenges [124-127].

Methods

This general review sheds light on PSWs' experiences, benefits, challenges, opportunities to expand access to quality addiction, and mental health care using PSSs. The review was conducted through a general search of the literature on MEDLINE, Google Scholar, EMBASE, Scopus, Chemical Abstracts, and PsycINFO. Search terms included peer support, peer support in mental health, social support, peer, family support, and integrated care. We began the review with an examination of the definitions, origins, and types of peer support contributions and within different clinical contexts, aiming at deepening the view to the diverse effects of such a workforce. We then continued with examining the transition from a patient role to a PSW role and their incorporation into mental health systems. Thereafter, we provided a conceptual framework for the effects of peer support and stigma in relation to PSWs. We concluded the review by examining the benefits and challenges associated with PSSs and provided a commentary on future directions for PSSs in mental health.

Results

Definitions

Peer support has diverse meanings in the literature. For example, it is a *system of giving and receiving help founded on key principles of respect, shared responsibility, and an agreement of*

what is helpful [128]. A *peer* is defined as *an equal*, someone with whom one shares demographic or social similarities, whereas *support* refers to "the kind of deeply felt empathy, encouragement, and assistance that people with shared experiences can offer one another within a reciprocal relationship" [105]. The Mental Health Foundation in the United Kingdom defined peer support in mental health as "the help and support that people with lived experience of a mental illness or a learning disability can give to one another" [129]. Peer employees were also defined as "individuals who fill designated unique peer positions as well as peers who are hired into traditional MH positions" [130]. In 1976, authors defined self-help groups as "voluntary small group structures for mutual aid in the accomplishment of a specific purpose...usually formed by peers who have come together for mutual assistance in satisfying a common need, overcoming a common handicap or life-disrupting problem, and bringing about desired social and/or personal change" [130]. Although the mutual relationship was sometimes overlooked and rather described as an asymmetric or nearly one-directional relationship [131], it is emphasized upon as 1 of the 4 main tasks for peer support accomplishments, which are mutuality, connection, worldwide, and moving toward rather than moving away [132].

Origin and Growth of Peer Support

Davidson et al [113] have expressed the paradigm that calls for new models of community-based practice, which turned away from case management and from conceptualizing old practices under new terms. In the 1990s, peer support was formally introduced as a service in community mental health care. However, there is evidence of its practice throughout history, including during the moral treatment era in France at the end of the 18th century [103]. Recently, peer support has been rapidly growing in many countries and could attract a considerable amount of research [124]. Although Lunatic Friends' Society is known as the earliest peer support group in mental health, which was founded in England in the middle of the 19th century [133], self-help groups were described as the oldest and most pervasive of peer support types [130]. Some peer-run groups also formed in Germany in the late 19th century, which protested on involuntary confinement laws. In addition to this, several individuals in the 18th and 19th centuries publicized their protests about their treatment in autobiographies and petitions [134]. The origin of peer support even reaches further back than the earliest asylums [135]. Some authors suggest that peer support is not based on psychiatric models and diagnostic criteria [105]; however, it is about "understanding another's

situation empathically through the shared experience of emotional and psychological pain" [136]. In the United States, the start of legitimacy for peer support was ignited in 2007 by considering the conditions under which PSSs could be reimbursed by Medicaid [137]. Although this reform was entailing a recovery model, which has been adopted by health care providers and stakeholders in many "English-speaking" countries, it was not the case in many other countries, in which this reform was yet to be well formulated [138].

Transformational Concepts in Peer Support Service

Intentional Peer Support: Informal to Formal Peer Support Evolution

Intentional peer support (IPS) is described as a philosophical descendant of the informal peer support of the ex-patients' movement in the 1970s [105]. It depends on a way of communication that immerses the provider into the recipient experience by stepping back from one's story and being eagerly open to others' stories [132]. In the field of psychiatry, trauma is blamed for playing a pivotal role in the experience, diagnosis, and treatment, and peer support is described as the logical environment for disseminating trauma-informed care (TIC) or service, which enables building relationships based on mutuality, shared power, and respect [139]. In the same context, trauma-informed peer support usually begins with the main question, "What happened to you?" instead of "What is wrong with you?" [132]. TIC is an explanatory model that identifies PSWs sharing lived experiences, ensuring safety and functioning as an advocate, and a liaison to patient management plans, where empowerment and intervention models are strongly emphasized upon [140, 141]. The shift from a traditional biomedical model to recovery-oriented practice is meant to perceive trauma as a coping mechanism rather than a pathology [140, 142]. This clearly entails training of all service providers for better acknowledgment and comfort in dealing with *trauma survivors*, with an understanding of trauma as an expectation rather than an exception [143]. Although the TIC concept has evolved over the years, it still lacks guidance, training, staff knowledge, and governmental support, which are necessary to ensure successful policy implementation [142]. The role of PSWs also extended to support those at risk of trauma events because of the nature of their work, including child protection workers, who are at risk of posttraumatic stress disorder or anxiety disorder [144]. Although IPS grew from the informal practices of grassroots-initiated peer support, it differs from earlier approaches because it is a theoretically based, manualized approach with clear goals and a fidelity tool for practitioners [116].

It instead focuses on the nature and purpose of the peer support relationship and its attention to skill building to purposefully engage in peer support relationships that promote mutual healing and growth [105]. Transitioning from informal to formal roles provides not only well-formulated expectations of the role but also a better chance to identify the potential conflict of the PSWs' mixed identity [145].

Research conducted on PSWs has been conceptualized throughout history [124]. Starting with feasibility studies, at the initial stage, it is followed by studies comparing peer staff with nonpeer staff and, finally, the studies that answer questions such as the following:

- Do interventions provided by peers differ from those provided by nonpeers?
- What makes peer support a unique form of service delivery?

If so, to the previous question, what are the active ingredients of these aspects of peer support, and what outcomes can they produce?

Studies that provide answers to the latter set of questions are expected to provide a deeper understanding of the philosophical underpinnings of the IPS concept for PSSs.

The Transformation from Patient to Peer Support Providers

The shift from being a service recipient to a service provider has been contributing as a driving force to restore fundamental human rights, especially among those with serious mental illnesses (SMIs) [124]. Telling the personal lived experience leads to a profound shift, from telling an "illness story" to a "recovery story" [106]. This involved an identity transformation from being perceived as a victim or a patient to a person fully engaged in life with various opportunities ahead [106]. This transition is seen as a gradual process and one that is supported by several other personal changes with expected challenges [146]. Moving a full circle to include PSWs as the service provider has been undertaken by mental health services to further exceed the transformational role, which was primarily the main aim of providing such a service [147]. A liminal identity was given for PSWs as laying between several roles, being service users, friends, and staff. Thus, the professionalism of the PSW role might not be a successful way to ensure individual well-being or to promote the peer support initiative [148]. Thus, successful transitioning from the patient to PSW role involves fundamental functional shifts achieved through overcoming multiple barriers at the personal, health system, societal levels.

Effects of Peer Support Service in Different Contexts

Trained PSWs or mentors can use communication behaviors useful to different client groups. Many studies showed the effectiveness and feasibility of applying for peer support as follows:

Severe or Serious Mental Illness

Generally, the evidence for peer support interventions for people with SMIs has been described as moderate to limited with mixed intervention effects [104, 149]. On the one hand, adding PSSs to intensive case management teams proved to improve *activation* in terms of knowledge, skills, confidence, and attitudes for managing health and treatment. Hence, patients become healthier, report better quality of life (QOL), engage in more health care practices, and report more treatment satisfaction [150, 151]. On the other hand, a systematic review of randomized controlled trials (RCTs) involving adults with SMIs, while showing some evidence of positive effects on measures of hope, recovery, and empowerment at and beyond the end of the PSS intervention in this review, did not show any positive effects on hospitalization, satisfaction, or overall symptoms [112]. Similarly, a Cochrane systematic review of PSSs for people with schizophrenia found inconclusive results, with a high risk of bias in most of the studies and insufficient data to support or refute the PSS for this group [152].

Addiction and Drug Users

In recent years, peer recovery support services have become an accepted part of the treatment for substance use disorders, providing a more extensive array of services that are typically associated with the mutual supportive intervention [153]. This is in contrast to the use of peer support for SMIs where evidence is still developing. The Substance Abuse and Mental Health Services Administration (SAMHSA) defined peer recovery support for substance use disorders as “a set of nonclinical, peer-based activities that engage, educate, and support individuals so that they can make life changes that are necessary to recover from substance use disorders” [153]. Despite the long-term nature of substance abuse, immersion in peer support groups and activities and active engagement in the community are considered the 2 critical predictors of recovery for more than half the dependent substance users [154].

A number of trials studied the peer support effect on drug users, especially in the emergency department [155, 156]. Another randomized trial found that a socially focused treatment can affect

change in the patient's social network and hence increase support for abstinence, for example, an increase of one nondrinking friend in the social network is translated into a 27% increase in the probability of reporting abstinence on 90% of days or more at all follow-up visits, which extended to 15 months [157].

Forensic Peer Support Service

The forensic peer system refers to the engagement of peer specialists who have histories of mental illness as well as criminal justice involvement and who are trained to help other patients sharing similar accounts [122]. As referred to by Davidson and Rowe [122], "Forensic Peer Specialists embody the potential for recovery for people who confront the dual stigmas associated with SMI and criminal justice system involvement."

They offer day-to-day support for those released early from jail by accompanying them to initial probation meetings or treatment appointments and referring them to potential employers and landlords, helping people to negotiate and minimize continuing criminal sanctions and training professional staff on engaging consumers with criminal justice history [122, 123]. PSWs with incarceration histories could successfully identify the liminal space in being supportive rather than providing support for the criminal offense, in contrast with the conventional methods that directly confront criminality [158]. In fact, having criminal history is the "critical component" for achieving recovery [158]. Multiple initiatives have been introduced to facilitate a reentry process for people recently released from incarceration, including Forensic Assertive Community Treatment, Assertive Community Treatment, Critical Time Intervention, and Women's Initiative Supporting Health Transitions Clinic, through diverse community support groups involving PSWs [159, 160].

Old Adults

A peer support program undertaken by older community volunteers was effective in improving general and physical health, social functioning, depression parameters, and social support satisfaction, especially in socially isolated, low-income older adults [161]. The Reclaiming Joy Peer Support intervention (a mental health intervention that pairs an older adult volunteer with a participant) has the potential for decreasing depression symptoms and improving QOL indicators

for both anxiety and depression [162]. Engaging the community in health research could be of a high value in acknowledging their own health needs [163].

Youth and Adolescents

Peer support programs are mostly needed for university students, where challenges with loneliness and isolation are well recognized [164]. Hence, a need emerged for training peers to support their peer adolescents with the prospective challenges at this age [165]. Trained peer support students without necessarily having a lived experience were also examined in England [166]. The study included university students measuring the acceptability and impact of the volunteer peer support program through 6 weekly sessions. Students with lower mental well-being were more likely to complete the course, and an improvement in mental well-being was recorded for those who attended more frequently. Overall, peers remain to be an essential source of support for young people experiencing mental health and substance use problems [167].

Medically and Socially Disadvantaged Subgroups

A peer-led, medical self-management program intervention has been beneficial for medically and socially disadvantaged subgroups [162]. The Reclaiming Joy Peer Support intervention has the potential for increasing QOL and reducing depression in low-income older adults who have physical health conditions [162]. Similarly, for those who are "hardly reached," it was indicated that the PSS provided is even more effective in these marginalized populations [168]. A Health and Recovery Peer program was delivered by mental health peer leaders for people with SMIs, resulting in an improvement in the physical health–related QOL parameters such as physical activity and medication adherence [151]. Peer-delivered and technology-supported interventions are feasible and acceptable and are associated with improvements in psychiatric, medical self-management skills, QOL, and empowerment of older adults with SMIs and or chronic health conditions [169, 170].

Persons With Disabilities

The United Nations' Convention on the Rights of Persons with Disabilities (CRPD) was adopted in 2007 and stated that "persons with disabilities should have equal recognition before the law and the right to exercise their legal capacity" [81, 171, 172]. Therefore, a positive emphasis upon the

supported decision making and the fight against discrimination is evident through the convention. Nevertheless, these initiatives have been perceived as incomplete considering many challenges such as the community social status and ongoing perceived stigma of people with disabilities (PWDs) [81, 173]. "Circle of support" is an elaborate example of an applicable peer support model for PWDs that has helped in decision making and facilitating communication [81, 174, 175]. This is clearly aligned with the paradigm shift from the biomedical to the socially supportive model of disability, which was provided by CRPD [81].

Peer Support for Families

Families may act either as sources of understanding and support or stigmatization through ignorance, prejudice, and discrimination, with subsequent negative impact [121]. In addition, the distress and burden associated with caring for a family member with mental illness are evident, where 29% to 60% endure significant psychological distress [119]. Family support can be financial or emotional; however, moral support was perceived as the substantial motivating factor for relatives who are ill [121]. In the last few decades, consistent and growing evidence that supports the inclusion of family members in the treatment and care of their misfortunate relatives has been developed. This has been mainly evident in the youth mental health system that urged the transformation change, which incorporates family members in the health care service provided to their youth [120, 176]. Many PSWs have been engaged in family psychoeducation as family peers or parent partners, especially for those with the first episode of psychosis [177]. Although familial education is crucial and needs to be provided through different scales [121], an extensive matching of PSWs and the caregivers has not been perceived as a necessity to create a successful volunteer mentoring relationship [178]. Multiple initiatives have taken place all over the world. In India, a program titled "Saathi" was established for family members of residential and outpatient mental health service users that had dual goals of offering information and developing a peer support mechanism for family members of people with different mental health conditions [121]. In Melbourne, Australia, "Families Helping Families" was developed, where family PSWs are positioned in the service assessment area and in the *inpatient unit* to ensure early involvement [120]. An impressive peer support guide for parents of children or youth with mental health problems is provided by the Canadian Mental Health Association, British Columbia Division

[117]. In Ontario, family matters programs are provided through provincial peer support programs [118].

The term “transforming mental health care” entails active involvement of families in orienting the mental health system towards recovery [179]. Family members are to have access to timely and accurate information that promotes learning, self-monitoring, and accountability [79]. The inclusion of family members as partners of the medical service is the new philosophy, with a subsequent shift from the concept of clinic-based practice to a community-based service approach [179].

Peer Support Service in Low- and Middle-Income Countries

Several initiatives took place in low- and middle-income countries, such as in rural Uganda, where a trained peer-led team provided 12 successful training sessions of perinatal service for a group of parents over a 6-month period, which resulted in better maternal well-being and child development, compared with another control group [180]. Similarly, successful community peer groups were conducted in rural India and Nepal, with high feasibility and effectiveness rates, and perceived as “potential alternative to health-worker-led interventions” [181-183]. In addition, adding counseling and social support groups entailing PSWs to the conventional medication treatment for patients with psychotic disorders was tried in a cohort study in Uganda; however, the results were not significantly different from those who received only medications [184]. This might be because of the underpowering of community services offered, compared with the robust medication regimens [185].

It is evident from the aforementioned information that there is mixed evidence on the effectiveness of PSW interventions in different contexts. For example, for patients with SMIs, systematic reviews suggest that there is some evidence of positive effects on measures of hope, recovery, and empowerment but no positive effects on hospitalization, satisfaction, or overall symptoms [112]. Similarly, for patients with addiction issues, although being involved in a peer network did not reduce social assistance for alcohol, they somewhat increased behavioral and attitudinal support for abstinence as well as involvement with Alcoholics Anonymous [157]. Furthermore, although many observational studies support the PSW role in the other contexts described above, there is a current dearth of literature involving RCTs and systematic reviews reporting on the effectiveness

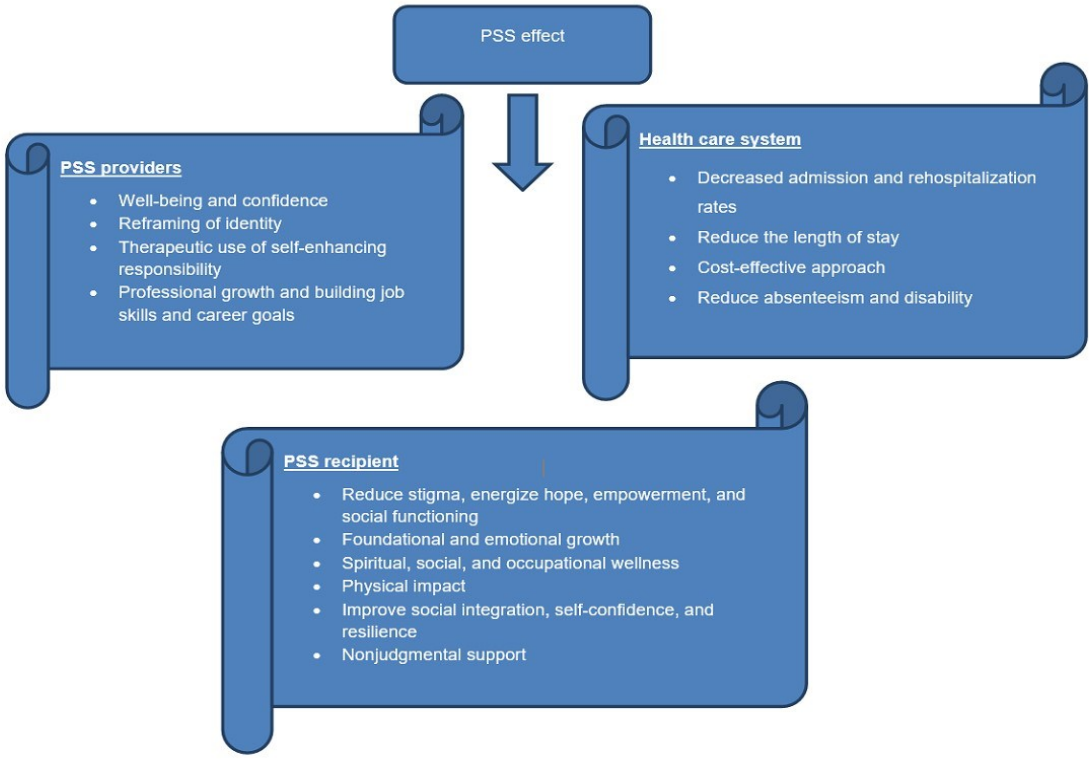
of PSWs in these specific contexts. Thus, there exist opportunities for conducting RCTs in the described contexts.

The Conceptual Framework for the Effects of Peer Support Service

The conceptual framework is based on empirical evidence, suggesting that the impact of PSWs reflects upon the recipients of such a service [4,76,86-90], the global health system [22,47,76,86,91,92], and the PSWs themselves [13,28,76,93], as shown in Figure 1.2.1. The framework has, therefore, been developed by authors through a general review of the literature that examines the effects of PSSs on patients, health care systems, and also PSWs themselves so as to provide evidence-based material supporting all possible effects of PSW roles.

Supportive social relationships can have a dual opposing effect on individuals' lives, either as a family member or as social and professional networks through sharing their disappointments and pains or their joy and successes [113]. Useful roles for PSSs are identified in many studies. For example, adding 3 peer specialists to a team of 10 intensive case managers provided better QOL with greater satisfaction [114], stigma reduction, and less health service utilization [186, 187]. The economic impact of PSSs has been extensively studied in the literature, concluding cost containment for the health care system in terms of reduction of readmission rates, emergency visits, and fewer hospital stays, which altogether substantially exceed the cost of running a peer support program [188]. Moreover, PSWs are looked at as providers of a service at a cheaper cost compared with other health care providers [189, 190]. For example, about US $23,000 is paid to PSWs in the United States compared with around US $100,000 for a nurse practitioner [96]. However, a PSS is not posited as a substitute for clinical services, rather it is perceived as an intrapersonal and social service that provides a dual role of effective service and with humanizing care and support [116, 128, 191]. This role extends to cover PSWs themselves, in terms of improved overall well-being and self-confidence, reframing identity, and enhancing responsibility either toward themselves or their peers [115, 192].

Figure 1.2.1. The conceptual framework for the impact of peer support workers in mental health. MH: mental health; PSS: peer support service; PSW:
peer support worker.



Although PSWs can play a variety of tasks, managers who hire them may want to ensure that improving patient activation is included in their range of duties [150]. In 2 concurrent studies, a significant increase in QOL satisfaction, reduction of rehospitalization rates, and reduction in the number of hospital days were recorded when adding PSSs to usual care [124, 193]. In another study engaging 31 peer providers in diverse mental health, agencies identified 5 broad domains of wellness, including foundational, emotional, growth and spiritual, social, and occupational wellness [106]. In a systematic literature review for people with SMIs, peer-navigator interventions and self-management were the most promising interventions [149]. PSWs' effects are diversified through sharing in different contexts. For example, positive impacts on the physical health of their peers have been recorded [151], Peer-based approaches have been used to deliver behavioral weight loss interventions [194]. For young students, structured peer support for depression may have benefits in improving students' mental well-being [166]. In the case of crisis houses, greater satisfaction was achieved through a provided informal PSS [195]. Robust studies, therefore, recommend implementing peer support programs [112, 120].

On the other hand, authors found that PSSs met moderate levels of evidence and that effectiveness varied across service types, for example, with “peers in existing clinical roles” was described as being less effective than the “peer staff added to traditional services” and “peer staff delivering structured curricula” [105]. Other reviews suggested that current evidence does not support recommendations or mandatory requirements from policy makers to offer programs for peer support [111, 112].

Peer Support Workers’ Satisfaction and Challenges

PSWs experience different problems alongside their diverse job roles, including low pay, stigma, unclear work roles, alienation, struggling with skill deficits, lack of training opportunities, emotional stress in helping others, and, on top of that, maintaining their personal physical and mental health wellness [196, 197]. Researchers found that PSWs experience discrimination and prejudice from nonpeer workers, in addition to the encountered difficulties of how to manage the transition from being a patient to a PSW. As a result, high attrition rates were noted among PSWs in mental health settings [198, 199]. Peer job satisfaction is strongly dependent on several factors [196, 200, 201]. Role clarity and psychological empowerment, organizational culture, and working partnership with peers were the most significant predictors of PSW job satisfaction, while professional prejudice was not perceived as a significant predictor [202, 203]. Other studies noted that the main problems were experiencing marginalization, lack of understanding, and a sense of exclusion [204-206]. Payment could also contribute to the amount of satisfaction of PSWs [177], as compensation helps through facilitation and engagement motivation [205]. Nevertheless, it seems that not the payment, which ranged from US $10 to US $20 per hour, but the lack of recognition and acknowledgment are the causes for job nonsatisfaction [200].

An interesting literature review grouped these challenges and barriers facing PSWs during fulfilling their assigned roles into 6 main categories: nature of the innovation, individual professional, service user, social context, organizational context, and economic and political contexts [207].

It is evident from the abovementioned information that the PSW role is challenged at multiple levels, including at the personal, societal, and organizational levels. These challenges have a direct bearing on PSW satisfaction, and the successful integration of the PSW role into the health care system depends to a great extent on how these challenges are overcome.

Novel Technology in Peer Support Service (Online and Telephone)

Online support groups are usually conducted through bulletin boards, emails, or live chatting software [130]. Online groups are familiar with people whose illnesses are similar to SMIs or affecting the body shape that have forced them to experience embarrassment and social stigmatization [125, 126]. Therefore, they split from the social contexts and redirect toward novel ways of help, such as PSWs and online support groups, and web-based communities provided a suitable medium for people with SMIs by following and learning from their peers on the web, which positively helped them to fight against stigma, instilling hope and gaining insight and empowerment for better health control [127]. Increasingly, social media grew as a target for individuals with SMIs, such as schizophrenia, schizoaffective disorder, or bipolar disorder, seeking advice and supporting each other [208-210]. For someone with SMIs, the decision to reach out and connect with others typically occurs at a time of increased instability or when facing significant life challenges [211]. In a qualitative study, popular social media, such as YouTube, appeared useful for allowing people with SMIs to feel less alone, find hope, support each other, and share personal experiences and coping strategies with day-to-day challenges of living with mental illness through listening and posting comments [210]. Mobile phone–based peer support was found to be a feasible and acceptable way to the youngsters during their pregnancy as well as in the postpartum period [212]. In addition, when coupled with frequent face-to-face meetings with PSWs and with "text for support," it could be of high value for patients with different mental illnesses [213]. Although online peer networks actively fight against discrimination and stigma, their accessibility to diverse patients' sectors regarding their income and ethnicity is still questionable [127].

Future of Peer Support Services

Potential new roles, such as community health workers, peer whole health coaches, peer wellness coaches, and peer navigators, have been suggested for such a workforce [177]. They are described as an "ill-defined potential new layer of professionals" [214]. Through an initiative undertaken by SAMHSA via its "Bringing Recovery Supports to Scale Technical Assistance Center Strategy," a successful identification of abilities and critical knowledge necessarily required for PSWs who provide help and support for those recovering from mental health and substance abuse was noted [177]. At present, peer support is seen as a growing paradigm in many countries, including the

United Kingdom, Canada, New Zealand, France, and the Netherlands [199, 215]. As an evolving culture, peer support has the opportunity to forge not just mental health system change but social change as well [139]. A novel peer support system termed "Edmonton peer support system" (EPSS) is currently being tested in a randomized controlled pilot trial [213]. In this study, investigators are evaluating the effectiveness of an innovative peer support program that incorporates leadership training, mentorship, recognition, and reward systems for PSWs, coupled with automated daily supportive text messaging, which has proven effectiveness in feasibility trials involving patients with depression and alcohol use [216, 217]. Previous studies have examined the effect of PSS in different contexts, including outpatient departments [218], emergency departments [155, 156], community MH clinics [219, 220], inpatient sites [221]. On the contrary, the EPSS study focuses on patients who have been discharged from acute care hospitals. These patients are being randomized into 1 of the 4 main groups: enrollment in a peer support system, enrollment in a peer support system plus automated daily supportive and reminder text messages, enrollment in automated daily supportive and reminder text messages alone, or treatment as usual follow-up care. The research team hypothesizes that patients who are assigned to a peer support system plus automated daily supportive and reminder text messages will show the best outcome.
Organizations may facilitate peer support through their values, actions, and oversight [215] and through a robust supervision system with available educational access, which could be the adequate path for creating a positive and risk-free environment for PSWs throughout their complex workloads [222]. On the other hand, ethics committees play essential roles in the inclusion of PSWs in applied research studies by avoiding repetition of the work of other trusted agencies and considering the ethical validity of consent procedures for peer support interventions [223].

Discussion

There is an internationally growing trend to adopt PSSs within addiction and mental health services, and despite the ongoing challenges, large sections of the current literature support the inclusion of the PSWs into the mental health care workforce. The literature suggests that the benefits of PSSs impact not only the recipients of mental health services but also extend to the PSWs and the whole health care system. Although the expected benefits of PSSs might be directly measured in terms of service utilization or patient improvement indicators, this could also extend to include wellness and empowerment for PSWs, who may still be fragile, vulnerable, and in need of ongoing acknowledgment and recognition. Thus, the potential for PSSs to be embedded into

routine care and the opportunities for the development of innovative models of care for addiction and mental health patients such as the EPSS, which incorporates PSSs and supportive text messaging [213], are evidently a high valued priority. However, the feasibility and maintenance of a robust PSS in health care would only be possible through collaborative efforts and ongoing support and engagement from all health care practitioners, managers, and other stakeholders.

This literature review has several limitations. First, the review is not a systematic review or meta-analysis, and as such, there were no well-defined inclusion or exclusion criteria of studies, which potentially could lead to the exclusion of some essential related studies. Second, the search was conducted in English publications only. Consequently, there is a high probability of missing critical related publications published in non-English languages. Finally, as the review depended mainly on the available literature from the aforementioned sources, which showed marked variability in their design and covered diverse ideas under the central theme, the different weights for each idea throughout the review could be noted.

1.3. Text Messages in the Field of Mental Health: Rapid Review of the Reviews

Shalaby, R., Adu, M. K., El Gindi, H. M., & Agyapong, V. I. O. (2022). Text Messages in the Field of Mental Health: Rapid Review of the Reviews. *Front Psychiatry, 13*. doi:10.3389/fpsyt.2022.921982. Available at: Frontiers | Text Messages in the Field of Mental Health: Rapid Review of the Reviews | Psychiatry (frontiersin.org)

This section will highlight and elaborate with further details upon the benefits and positive outcomes of the supportive text messaging in the field of mental health along with their role in addressing the emerged gap. The section demonstrates a rapid review of the reviews hold upon the text messages in mental health field, regarding their applications, usability, and benefits.

Abstract

Background: While mental health problems constitute a worldwide concern contributing to the global rates of morbidity and mortality, conventional mental healthcare services do not meet the current needs. Text messages (TM) represent a live model that incorporates technology into health services, spanning a large number of health conditions and playing different roles that may support the current healthcare system.

Objective: To examine the TM services in the field of mental health, regarding their effectiveness, feasibility, acceptability, and economic evaluation in different contexts of mental health diagnoses and during critical times, when provided to individuals with mental health symptoms/disorders.

Methods: This rapid review was conducted through an online search in PubMed, Embase, PsycINFO, and Medline databases. The review targeted the review studies which examined online or mobile addiction and mental health services, utilizing TM services. The search was run from the inception up to September 30, 2021.

Results: Sixty review articles met the inclusion criteria and were included in this review. All reviews were published over the last decade. The results showed that people of a young age were fairly represented, and most reviews were run over substance use disorders (SUD), including Alcohol. Most reviews examined the effectiveness outcomes of the texting service, while to a lesser extent the acceptability and feasibility, among others. Texting services were reported as effective in psychotic disorders and SUD. However, the results related to depression and anxiety were mixed. Most reviews reported a considerably high risk of bias among their included studies. High satisfaction and acceptability of the texting services were reported for patients with various mental health conditions, including those with severe mental illness.

Conclusions: This rapid review highlighted the applications, usability, benefits, and satisfaction with the TM in the field of mental health. For a higher quality of evidence, future studies should consider TM interventions in the contexts with mixed results or a dearth of literature, and during critical times, such as the COVID-19 pandemic. Policy- and decision-makers, therefore, need to further support text-based services with guided investments in interventions that were evidenced to be accepted, economic and feasible.

Introduction

Mental health problems constitute a global concern and contribute significantly to the global rates of morbidity and mortality [224, 225]. Mental health care services, however, do not meet current needs. Globally, about two-thirds of patients with mental illness never seek treatment [226]. Similarly, in Europe, less than one-third of patients with psychiatric illnesses receive any treatment [227]; in the USA, more than half of adults with mental illness do not receive treatment for their mental health conditions [228]; and in Canada, more than 40% of Canadians who reported that they need help for mental health, reported their needs were partially met or fully unmet [229].

Although the World Health Organization (WHO) reported the availability of mental health services, such as medications [226], several other limitations have contributed to the aforementioned trends. For example, the system barriers represented in the lack of mental health professionals, including therapists in the remote and rural communities, in addition to the costly and resource-intensive nature of the conventional services [226, 228-231]. Furthermore, the stigma and discrimination barriers related to the patients' own beliefs or to the social and professional circles surrounding them have significantly contributed to the limited accessibility to the mental health services [226, 228-231].

A large body of literature, therefore, suggested the high impact and effectiveness of the remotely delivered services that could be as effective in managing mental health conditions as compared to face-to-face services [229, 232]. Skills acquired through self-directed learning from online resources and different technological platforms have been embraced as potential solutions to cross the gap between evidence-based therapies and community practice [233]. Such services have been widely adopted in the healthcare system worldwide, and several technical terms becoming commonly used, such as telehealth or telepsychiatry, mHealth, eHealth, Internet interventions, mobile-based interventions, and user-led support [234-238].

Text messages represent a live model for incorporating technology into the health care system, spanning over a large scale of mental health conditions and through different roles. The majority of the current literature reports significant outcomes of these services within different contexts. For example, texting services are commonly used as a reminder of medical appointments [239]or to encourage adherence to prescribed medications [240]. Texting or talking on the phone was a preferred mode of communication among adolescents compared to the face-to-face physicians'

evaluation; more convenience with reduced anxiety and effective communication were among the reported reasons [241]. Therefore, the growing spread of such wireless services in the health care system became more reasonable.

Texting service programs, such as Text2quit and Quit4baby, have been provided to people in the field of smoking, addiction, and well-being during their vulnerability with considerable success. Text2quit is a smoking cessation text messaging program provided primarily for adults, while Quit4baby is a smoking cessation text messaging program for pregnant smokers that was adapted from Text2quit [242, 243]. Like Text2quit, Quit4baby was based on the Social Cognitive Theory with messages aimed at improving self-efficacy for quitting. Participants received 1 to 5 text messages every day, with the highest dose of text messages sent on and around their quit date [243]. Quit4baby was designed to serve as a potential adjunct service for Text4baby, an existing national texting program in the USA, provided for pregnant women that provides perinatal health information, and has enrolled almost 1,000,000 users since its launch in 2010 [243, 244]. Text4baby is a theory-based mobile health program in which text messages are delivered to pregnant women and new mothers to improve their beliefs and behaviors of health care, and improve health status and clinical outcomes [245, 246]. The mothers receive free text messages three times per week with interactive components and user feedback [244]. Favorable responses to these programs have been reported. Participants to Text2quit and Quit4baby praised the content and the skills taught that helped them with positive ideas on quitting, to the extent that they may recommend it to a friend. Among reported outcomes for Text4baby, the positive belief changes among pregnant and new mothers concerned perinatal vitamin use, visiting a health care provider, and the risk of alcohol during pregnancy.

Text4Mood and Text4Support represent two other mobile text messaging programs to help people with mood disorders and other mental health conditions, including alcohol use disorder, respectively [94, 217, 247, 248]. Through Text4Mood service, subscribers were patients seeking psychological or counseling services for depression and anxiety who received one daily text message for six consecutive months [94]. The messages were written by cognitive behavior therapists and counselors in partnership with mental health patients. Text4Support service, on the other hand, was delivered to patients with diverse mental health background. A bank of messages was generated and included different text message programs tailored for the following eight mental health domains: depression, anxiety, psychotic disorders, substance use disorders, bipolar disorder,

adjustment disorders, attention-deficit or hyperactivity disorder, and general well-being [249]. The subscribers received a single daily message for six consecutive months, which were based on cognitive behavioral therapy principles, and patients were enrolled to receive an assigned message bank based on their primary diagnosis.

The results were promising as the services reported improved depression symptoms on the BDI-II scores, the sense of better symptom control, and high satisfaction on several domains. Clinically, the service reported significant higher days to first drink in patients who received daily supportive text messages for 6 months, compared to those who did not.

The current availability of mobile phones has significantly contributed to the wide use of text message services [47, 231]. Seven billion people, representing 95% of the population worldwide, live in an area covered by a mobile-cellular network [231]. In Canada, the number of mobile internet users is 33.7 million in 2021 [250], representing around 90% of the population (88.1%). Additionally, by 2019, mobile technology expanded rapidly and the global penetration rate was 96%, with more than 8 billion mobile phone subscriptions worldwide, along with the global widespread wireless network [251].

During crises times, such as COVID-19 pandemic, restrictions and limited activities were enforced in many jurisdictions. Self-isolation, quarantine, and physical distance rules became the new normal during this hard time that added to the distress associated with the pandemic and further widened of the gap, especially for people with underlying mental health conditions. Such limitations, while aimed to protect the public from communicable diseases, may trigger mental health problems and ultimately mental illness [252]. Texting services may help to close the emergent treatment gaps and support the public health against mental falls during the COVID-19 pandemic [253].

Despite the reported benefits of texting services in the field of mental health, it is still not clear if such effects are generalized to all mental health symptoms or conditions, and whether they are available to individuals across different age groups. In addition, the evidence regarding the cost-effectiveness of these services may need to be further explored, to understand the economic values of these programs.

Therefore, this study aimed to illustrate the role of remote delivery means, particularly text messaging programs, in the field of mental health. The literature was examined to report the service regarding their supportive, preventive and screening roles when provided to the patients with

mental health disorders, caregivers, or the general public with mental health symptoms. Additionally, we explored the effectiveness, feasibility, acceptability, and economic evaluation of texting services in different contexts of mental health diagnoses or during critical times.

Methodology

This rapid review was conducted through a systematic search in PubMed, Embase, PsycINFO, and Medline databases. The review examined the available study reviews which were run in the field of addiction and mental health and reported upon the utilization or application of text messaging programs, from the inception of the database until the 30th of September 2021. Review of the reviews represents a comprehensive and systematic approach of analysis that could help in examining online interventions, such as texting programs. Additionally, such reviews could reliably reflect various outcomes along the desired ones, which may help in enriching the topic and supporting the results.

The search strategy was run in the electronic databases with the use of Covidence software [254]. Three reviewers/authors (RS, MA, HE) helped in reviewing the articles, and independently screened titles and abstracts and reviewed all full-text articles meeting the inclusion criteria. For each article, two reviewers were needed to independently screen the titles and abstracts of identified citations, as well as for the full text review. Discrepancies were discussed among the authors and the fourth author (VA) resolved the conflicts.

Search Terms

The following terms were used for article extraction: Systematic review, scoping review, meta-analysis, review, analysis and; online, text, internet, message, web-based, mobile, cell phone, SMS, digital health, mobile, web, mHealth, eHealth and; depression, anxiety, mental, bipolar, psychosis, PTSD, schizophrenia, substance use disorder, alcohol, drugs.

Selection Criteria

Inclusion Criteria:

Type of the Study: Systematic review, scoping review, meta-analysis, literature review, review. Quantitative and qualitative reviews were included.

Intervention: Text messaging service (text message or SMS), including web and phone services. Texting services were included if they were the main intervention under study or when the technology used included text messages and controlled for in the analysis and results.

The Mental Health Conditions/Symptoms: Common mental health conditions, including depression, bipolar disorder, psychosis, anxiety, eating disorder, suicide (ideation/attempts), PTSD, panic disorder, substance use disorder (SUD; including different substances, alcoholism, or smoking).

Participants: patients with mental and non-mental health conditions, caregivers, and the general public.

Aim of the Used Text Service: Therapeutic, prevention, screening for or monitoring of mental health condition(s).

The Aim/Objective of the Study Reviews: To assess the efficacy, effectiveness, economic evaluation, adherence to the used technology, feasibility, recipients' satisfaction, usability, and health care providers acceptability (as a primary or secondary outcome)

Publications are to be in the English language.

Exclusion Criteria

1) Digital or online interventions that did not include text messaging services or included them but did not control for this condition while reporting the results.

2) Non-review papers.

3) Non-mental health reviews, such as general health care services.

4) Any other mental health conditions, other than those referred to in the inclusion criteria.

5) Protocols, comments, or theses.

6) Publications reporting psychological impacts of social network sites (e.g., Facebook).

7) Aim of the text messages was to: improve mental health literacy, knowledge, information about psychological conditions, relieve stigma, surveillance, training, appointment reminders, or adherence to the medications as a standalone outcome.

Data Extraction

For eligible trials, the following data were extracted using a data extraction form:

Author name and year of publication; duration covered within the review; technology used and the details of the comparative group; targeted mental health condition(s); the aim of the review; the number of the studies included in each review; type of the included population (demographic characteristics); reported bias (e.g., selection, reporting, and publication); and the main findings/results.

Results

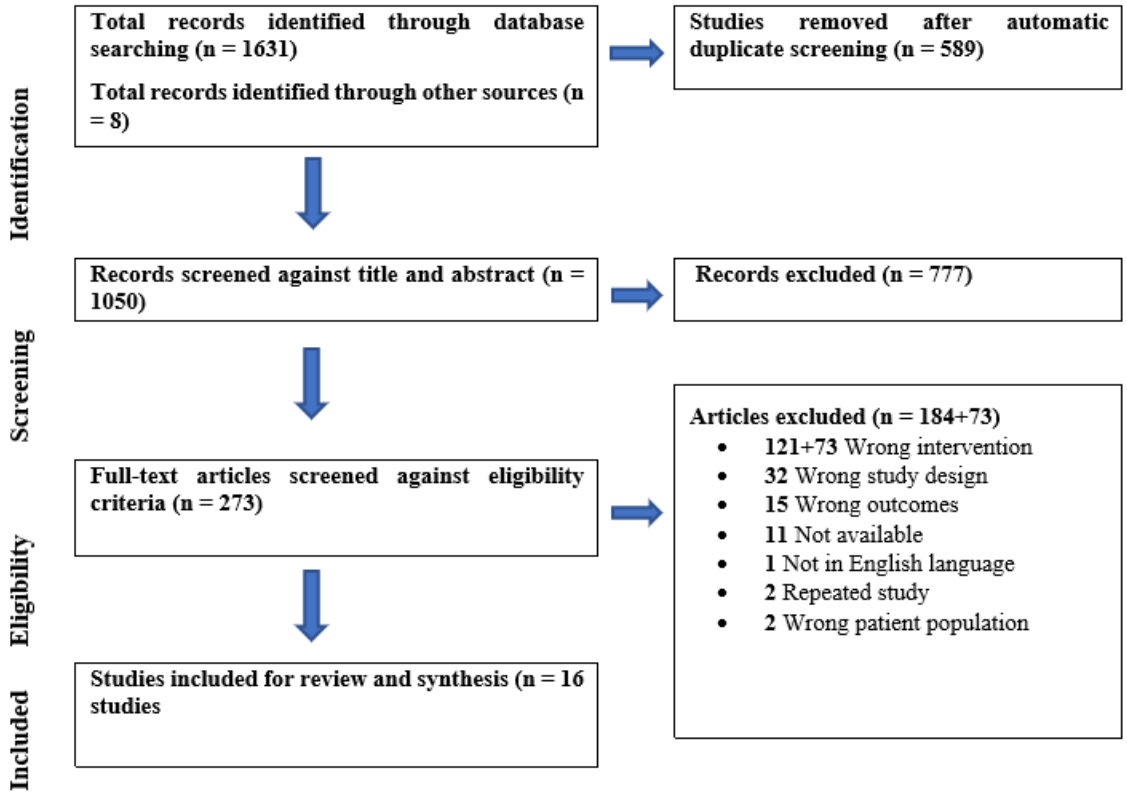
Search Results

Through the search strategy in the electronic databases and the use of Covidence software, 1,631 articles were identified. Another eight studies were recruited manually from Google Scholar and gray Literature, yielding a total of 1,639 articles eligible for primary screening. After the removal of duplicated records, 1,050 studies were screened for title and abstract; out of them, 273 articles were eligible for full-text review. After careful review, 257 studies were excluded; the primary reason was for the wrong intervention in which the studies used different technology, such as mental health apps, iCBT, or digital technology not including texting services or did not control for texting services while reporting the results. Finally, only 16 review articles met the inclusion criteria and were included in this review Figure 1.3.1.

Overview of the Included Reviews

Most of the included reviews were systematic reviews (n = 14, 87.5%); of those, five reviews were followed by meta-analysis. The rest were scoping reviews (n = 2, 12.5%). Publishing of the reviews started in 2014 and continued to 2021. Half of these (n = 8.50%) were published in the last 3 years (2019–2021). The reviews spanned the period starting from the inception of the database and ending in 2020. Refer to Table1.3.1.

Figure 1.3.1: PRISMA flowchart of study inclusion process



Targeted conditions: Various mental health conditions and addiction disorders were covered in the reviews under study. Just below half of the reviews (n = 7, 44%) targeted the condition of SUD, including substance, alcohol or smoking [255-261]. The rest included other mental health conditions: depression (n = 2, 12.5%) [231, 262], psychosis (n =2, 12.5%) [47, 237], depression, suicidal ideation or anxiety (n = 1, 6%) [263] or any mental health disorder (n = 4, 25%) [241, 264-266].

The Intervention

More than half the review studies (9/16, 56%) focused primarily on texting-based services, while seven studies examined different online interventions that included texting services (Hutton et al. review [256], which examined text messages, apps on smartphone devices, iPad and internet delivered treatment; Alvarez Jimenez et al. review [237], which included internet or mobile-based interventions;; Berry et al. review [266], which examined Online or mobile phone interventions;

Song et al. review [259], which examined mHealth, interactive voice response (IVR) or app; Boland et al. review [258], included mobile phone (text or apps)and internet services; Fowler et al. review [260], which included Mobile technology-based interventions, such as SMS, texts or apps; and Dwyer et al. review [263], which included E-mental health approaches involving text-based, real-time communication with a qualified human therapist and the predictive power of language use patterns).

Aim of the reviews: Most reviews aimed to assess text messaging services or mHealth interventions (controlling for text message outcomes) regarding their effectiveness (n = 10) [231, 255-263], acceptability, feasibility, usability, barriers, safety and benefits (n = 4) [47, 237, 264, 266]; adherence (to medications or the intervention) or engagement (n = 3) [47, 261, 265]; general characteristics of the service and other outcomes (n = 3) [241, 259, 263], with reported overlapped outcomes.

Number of articles/participants included in the reviews: The total number of articles included in each review ranged from (n = 7) in two reviews [231, 265] to (n = 70, [263]). The number of participants included in each review was not always reported. Only Cox, Allida et al. 2021 [231] reported having 1918 participants for their seven studies; and Senanayake, Wickramasinghe et al. 2019 [262] reported 945 participants for their nine studies.

Participants' characteristics: The included reviews targeted different populations; for example, four studies targeted young people, adolescents, or young adults spanning from 12 - 39 years [241, 255-257]. Two studies [231, 259] targeted adult populations 18 years and older, and one study [262] targeted both adults and adolescents. One study [258] targeted vulnerable and socioeconomically disadvantaged populations, including homeless persons, mental health patients or prisoners, juvenile delinquency, or Indigenous /Maori /Inuit /North American Indian). The rest of the studies (n = 8) did not report/include any specific demographic characteristics for the participants [47, 237, 259, 261, 263-266]

Risk of bias assessment: Only six studies (40%) of the included reviews reported the assessment of bias among the studied articles. The Cochrane Collaboration risk of bias tool was commonly used to assess the quality and risk of bias. The results varied but overall, seem to be at a high risk of bias; for example, Alvarez-Jimenez, Alcazar-Corcoles et al. [237] demonstrated that only two studies (one RCT and one uncontrolled study) out of ten (20%) mostly met the assigned quality

criteria, while no study included blind assessors to study design or purpose. Boland, Stockings et al. [258] reported that only one study (1/13, 8%) was methodologically rigorous, while the rest were between moderately (8/13, 62%) and poorly rigorous (4/13, 31%). Similarly, Cox, Allida et al. [231] reported the quality of evidence of the effectiveness of text messaging among their reviewed studies was very low. The authors attributed the low quality to a high risk of selection and performance bias, heterogeneity, and the reported wide confidence intervals.

On the other hand, Senanayake, Wickramasinghe et al. [262] excluded the probability of high risk of bias among their review studies, but they did not exclude the risk of publication bias that may be expected when negative results were not published.

Table 1.3.1: Summary of studies using Web-based interventions for the mental health disorders

Author (Year)	**Duration**	**Type of review**	**Technology used/ mental health condition**	**Aim of the review study**	**Number of the studies / participants' (characteristics)**	**Bias assessment**	**Outcome/results ± effect size**
(Mason et al. 2015)	2000 - 2013	Meta analysis	Text message-based intervention programs /SUD	To examine the effectiveness of text message interventions for tobacco and alcohol cessation within adolescent and young adult populations	14 articles / adolescents and/or young adults ages 12 to 29	-	- Text interventions have a positive effect on reducing substance use behaviours (Effect size = 0.25). - In general, text interventions have a positive effect on reducing substance use behaviours. - Results are discussed in the context of prevention opportunities and recommendations for future text messaging intervention research.
(Hutton et al. 2020)	2005 - January 2017	Systematic review of the literature	mHealth interventions delivered via website or mobile technology (including text messages, apps on smartphone devices, iPad and internet delivered treatment) / alcohol consumption.	To examine current evidence on the effectiveness of mHealth technology use in reducing harmful alcohol-related behaviours among young people without known alcohol addiction.	18 articles / young people (12-26 y) without known alcohol addiction, alcohol dependency, or a pre-existing condition related to alcohol.	-	- The length of interventions, time carried out and follow-up was variable, with the shortest intervention being 2 to 3 h and the longest being 1year. - Ten studies reported some effectiveness related to interventions with nine reporting a reduction in alcohol consumption. - SMS messaging had the greatest efficacy among the interventions reviewed in this population. - Use of mHealth, particularly text messaging (SMS), was found to be an acceptable, affordable and effective way to deliver messages about reducing alcohol consumption to young people.
(Alvarez-Jimenez et al. 2014)	From inception to August 2013.	Systematic review	User-led, internet or mobile-based interventions / psychosis	To systematically compile and analyze the current evidence on the acceptability, feasibility, safety and benefits of internet and mobile-based interventions for people suffering from psychosis	12 articles / No specific demographic characteristics. Participants should be diagnosed with	- Cochrane Collaboration 'risk of bias' tool. - Only one study reported adequate randomization procedures, blinding of study-group assignments and had sufficient	- Interventions included: web-based psychoeducation; web-based psycho-education plus moderated forums for patients and supporters; integrated web-based therapy, social networking and peer and expert moderation; web-based CBT; personalized advice - 74–86% of patients used the web-based interventions efficiently; 75 – 92% perceived them as positive and useful, and

					schizophrenia -spectrum disorders using either DSM or ICD criteria.	statistical power to detect moderate effects. - For uncontrolled studies, only 3 measured acceptability and completion of the intervention against a priori criteria. - No study included assessors blind to study purpose and/or methodology.	70 – 86% completed or were engaged with the interventions over the follow-up. - Preliminary evidence indicated that online and mobile-based interventions show promise in improving positive psychotic symptoms, hospital admissions, socialization, social connectedness, depression and medication adherence. **Regarding mobile interventions only:** - There is an associated increased number of social contacts, decreased hallucination severity, improved medication adherence, and useful medium to monitor early warning signs of relapse and possibly prevent hospital admissions in real-time ecological momentary assessments. - A tailored SMS-based intervention showed encouraging results in improving social contacts and hallucination severity. - Conversely, no significant improvements were detected in psychotic symptoms, depression and independent living skills, fostering functional outcomes through validated measures at follow-up.
(Bastola et al. 2020)	From 2010 to 2018	Meta-analysis of RCTs and pre-post studies	Mobile phone-based text messaging/SMS / Alcohol abuse and alcoholism	To analyze the effectiveness of mobile phone-based text messages as a preventive intervention for youth and younger adult populations' problem drinking.	44 articles / College students and younger adults (<39 years).	Cochrane "Risk of Bias" tool was used. No results were reported.	- Forest plot analysis showed reduction in binge drinking episodes in the control group without the intervention (OR = 2.45 [1.32–.53], $I^2 = 59\%$, $\chi^2 = 14.64$), suggesting that mobile phone-based text messaging was not effective in lowering binge drinking, with possibilities of opposite effect. - Forest plot analysis on the effect of short-term interventions using mobile phone-based text messaging on the mean drinks per occasion favoured neither group (standard mean difference = 0.28 [−0.02 to 0.58], $I^2 = 28\%$, $\chi^2 = 4.19$), also suggesting that the text message had negligible impact on the experimental group. - Similarly, the effect of text messaging on the reduction in average standard glasses per week favoured neither group (standard mean difference = −0.05 (−0.15 to 0.05), $I^2 = 0\%$,

							$\chi^2 = 2.88$), further suggesting that the text messages had a negligible impact. - Forest plot analysis on the effect of long-term interventions favoured the control groups over the experimental groups (OR = 7.24 [2.71–19.31], $I^2 = 76\%$, $\chi^2 = 12.41$).
(Berrouiguet et al. 2016)	In May 2015	Systematic review of RCTs, non-RCTs and protocols	mobile phone and web-based text messaging. (Text messages could be delivered to a patient by the caregiver or vice versa). / Mental health conditions, including SUD, depression, anxiety, bipolar disorder, and schizophrenia.	To review the literature regarding the use of mobile phone text messaging in mental health care; SMS was used to promote mental health, including any type of preventive or monitoring strategy	36 articles / No special characteristics were reported.	-	- Text messaging was used in a wide range of mental health situations, notably substance abuse (31%), schizophrenia (22%), and affective disorders (17%). - Four ways were identified in which text messages were used: reminders (14%), information (17%), supportive messages (42%), and self-monitoring procedures (42%). Applications were sometimes combined. - Growing interest in text messaging since 2006 was reported and text messages have been proposed as a health care tool in a wide spectrum of psychiatric disorders including substance abuse, schizophrenia, affective disorders, and suicide prevention. - Most papers described pilot studies, while some randomized clinical trials (RCTs). - Overall, a positive attitude toward text messages was reported. - RCTs reported improved treatment adherence and symptom surveillance. Other positive points included an increase in appointment attendance and in satisfaction with management and health care services.
(Boland et al. 2018)	From January 1980 to May 2016	Systematic review and Meta-analysis	Technology-based smoking cessation interventions (eg, mobile phone (text or apps), internet, etc.), excluding telephone counselling or	To assess the methodological quality and effectiveness of technology-based smoking cessation interventions in disadvantaged groups.	13 studies / Disadvantaged groups (vulnerable populations or socioeconomic status or homeless persons or	- Cochrane Collaboration risk of bias tool was used. - Only one study scored six or more “low risk” items and was deemed to be methodologically rigorous.	- Most utilized were websites (n = 5) or computer programs (n = 5), and seven additionally offered nicotine replacement therapy. - Technology-based interventions increased the odds of smoking cessation for disadvantaged groups at 1 month (odds ratio [OR] 1.70, 95% confidence interval [CI] 1.10, 2.63), 3 months (OR 1.30, 95% CI 1.07, 1.59), 6 months (OR 1.29, 95% CI 1.03,

			VHS video), or conventional mass media campaigns / Smoking		mental health patients or prisoners or juvenile delinquency or Indigenous/Maori/Inuit/north American Indian)	- Eight studies deemed to be moderately rigorous. - Four studies deemed to be poor on measures of methodological rigour. - The majority of studies were at low risk of bias for sequence generation, incomplete outcome data, selective reporting - Approximately half of the studies were at low risk of bias for allocation concealment. - None of the studies clearly reported blinding of participants and personnel, - Three studies were deemed high risk of bias for incomplete outcome data; three studies were considered high risk for selective reporting; and two studies were considered high risk for other bias including uneven sample sizes and significant differences in baseline characteristics per condition.	1.62), and 18 months post-intervention (OR 1.83, 95% CI 1.11, 3.01). - Regarding mobile text-messaging intervention alone (only one study), a significant effect was reported after one month of the intervention, with higher odds of smoking cessation among intervention groups (OR 2.81, 95% CI 1.58, 4.99). - Mobile phone text-messaging, computer- and website-delivered quit support showed promise at increasing quit rates among Indigenous, psychiatric and inpatient substance use disorder patients.
(Cox, Allida,	from 1992 to 18 Septe	System atic review and	- Text messaging interventions were defined as one or more text	- To quantify the effects of text messaging	7 studies with 1918 participants /	- Cochrane risk of bias tool for RCTs was used	- Borderline statistically significant reduction in depressive symptom scores between the text messaging intervention and control groups favoring intervention.

and Hackett 2021)	mber 2018	Meta-analyssi	messages with health-related content sent to a personal mobile device. - The comparator had to be usual care or an attention control - One-way and two-way text messaging trials were included. - Trials of smartphone applications were excluded. / Depression.	interventions to reduce depressive symptoms - Identify variables that might influence the effectiveness of the intervention.	Adults aged ⩾18 years and were identified by a healthcare provider, to minimize volunteer bias. No exclusions were made on the basis of any reported medical condition among the participants.	- The overall rating of the quality of evidence of the effectiveness of text messaging was very low - The evidence from the trials was downgraded in quality due to a high risk of selection and performance bias, heterogeneity and very wide CIs. - Publication bias was not assessed due to the small number of included trials	- Statistically significant reductions were shown in important subgroups, such as in those using the Beck Depression Inventory (BDI) or 9-item Patient Health Questionnaire (PHQ-9) questionnaires; where text message content was targeted at mental well-being, mood improvement and cognitive behavioural therapy information; and when the message frequency was ⩾2 times per week. - Text messaging has potential to reduce depressive symptoms, however more research is required before recommendations can be made about the routine use of text messaging for the management of depressive symptoms.
(D'Arcey et al. 2020)	From January 2000 to March 2019	Systematic review	Text message / Psychosis	- To examine the clinical engagement and feasibility of SMS text messaging services in the treatment of psychosis.	15 studies / Demographic restrictions were not applied	-	- Most studies demonstrated the positive effects of SMS text messaging on dimensions of engagement such as medication adherence, clinic attendance, and therapeutic alliance. - Particular subgroups expressed better adherence, such as patients with low baseline adherence and those living independently. - Regarding feasibility outcome: five studies examined aspects of feasibility, usability, and user satisfaction. Studies reported a good endorsement of interest (59%), wanting to continue using the intervention (47% - 64%), moderate-to-high ratings of effectiveness (41% - 87%), satisfaction (70% - 90%), and ease of use (80% - 98%); and only a small proportion endorsed harm associated with the intervention (13%).

							- Overall, SMS text messaging is a low-cost, practical method of improving engagement in the treatment of psychosis, although efficacy may vary by symptomology and personal characteristics.
(Senanayake et al. 2019)	Between 2012 and 2019	A systematic review and meta-analysis of RCTs	Text messaging / Depression	To evaluate the effectiveness of text messaging interventions for the management of depression.	9 studies (945 patients: 764 adults and 181 adolescents)	Low risk of bias was expected (RCTs used), however publication bias may be expected where negative results may have not been published	- Five studies used text messaging as the only intervention, while the remaining combined text messaging with other treatment modalities such as behavioural activation or CBT. - A meta-analysis was conducted on seven selected RCTs (845 patients: 664 adults and 181 adolescents). The standardized mean reduction in depression due to text messaging interventions was 0.23 (95% confidence interval: –0.02 to 0.48). - There was evidence of heterogeneity in treatment effect between studies.
(Song, Qian, and Yu 2019)	From December 2016 to March 2017	Systematic review of RCTs	Mobile phone technologies (e.g., SMS, mHealth, interactive voice response (IVR) or app) / Unhealthy alcohol use (UHU)	- To synthesize and understand the research evidence about the efficacy of mHealth interventions on various health outcomes for consumer self-control of UAU. - To identify the core components to achieve these outcomes.	19 studies / No specific characteristics were reported	-	- 63% of mHealth interventions brought significant positive outcomes in improving participants' health as measured by behavioural (n=11), physiological (n=1), and cognitive indicators (n=1), while no significant health outcome was reported in 32% of the studies. - A significant negative outcome was reported for the male participants in the intervention arm in one study (1/19, 5%), but no change was found for the female participants. - In total, five core components reported in the mHealth interventions for consumer self-control of UAU were context, theoretical base, delivery mode, content, and implementation procedure. However, sound evidence is yet to be generated about the role of each component for mHealth success. - Over half of the SMS- and IVR-enabled interventions were effective in reducing alcohol use or increasing readiness to change UAU in eight out of 12 studies (67%) and two out of two studies (100%), respectively. In contrast, app-enabled

							interventions were only successful in reducing alcohol use in two out of five studies (40%). - The health outcomes were similar regardless of types of UAU, deployment setting, with or without nonmobile cointervention, and with or without theory.
(Tofighi et al. 2017)	Not mentioned	Systematic review of the literature	Mobile phone messages (TM) / Drugs and alcohol dependence	- To clarify the effects of TM intervention design characteristics (frequency, personalization, user-generated content, interactivity and privacy measures), patient engagement with the interventions, clinical outcomes, and potential adverse events.	11 articles / No specific characteristics were reported	-	- Most studies demonstrated improved clinical outcomes, medication adherence and engagement with peer support groups. - TM interventions also intervened on multiple therapeutic targets, such as appointment attendance, motivation, self-efficacy, relapse prevention, and social support. - Suggestions for future research, including intervention design features, clinician contact, privacy measures, and integration of behaviour change theories - TM interventions offer a feasible platform to address a range of substances (i.e., alcohol, methamphetamine, heroin, and alcohol), and there is increasing evidence supporting further larger-scale studies.
(Fowler, Holt, and Joshi 2016)	From January 2004 to December 2015	Systematic review of the literature of RCTs	Mobile technology-based interventions (e.g., SMS, texts or apps) / Harmful use of alcohol (alcohol-dependent and nondependent)	- To summarize the current literature and determine the efficacy of mobile technology-based interventions among adult users of alcohol interventions.	8 studies / At least 18 years of age and reported using alcohol.	-	- Most of the studies found positive effects of the intervention, even though the interventions themselves varied in design, length, dosage, and target population, and were pilot or preliminary in nature. - positive effects of the intervention on several parameters included behavioural outcomes, such as a reduced average number of risky drinking days and heavy drinking days; marginally greater cumulative abstinence duration as well as a trend towards lower units of alcohol per drinking day; and a reduction in the number of drinks per drinking day, in addition to the cognitive outcomes, including increase in goal-setting willingness to reduce binge drinking days and readiness to change from beginning to follow-up.

							- Findings from this review highlight the promising, yet preliminary, evidence for the efficacy of mobile technology-based interventions, and in particular SMS interventions, among dependent and nondependent adult users of alcohol.
(Watson, Simpson, and Hughes 2016)	From January 1999 to October 2015.	Systematic review	Text messages (TM) / Mental health disorders or SUD	To characterize the impact of TM interventions on medication adherence or mental health related outcomes (such as psychiatric symptoms and social functioning) in people with mental health disorders including substance use.	7 studies / ≥18 years	-	- Three studies evaluated TM in patients with schizophrenia or schizoaffective disorder, two studies for chronic alcohol dependence, and two for mood disorders. - Six studies were RCTs, and one was a prospective pilot study with pre- post intervention design. - TM frequency ranged from once weekly to twelve per day. - The effect of TM on medication adherence was measured in five studies: one study reporting significant improvements in the text messaging intervention group. - The effect of TM on mental health related outcomes showed significant improvements, in (71%) of the studies. on a variety of psychiatric and social functioning assessments, such as depression inventory measures. - The Brief Psychiatric Rating Scale (BPRS) and Brief Symptom Inventory (BSI) showed significant improvement, when combining text messaging and telephone contact. - Improvements in scores measuring quality of life (using the EuroQol Scale for Health-Related Quality of Life) was reported. - Patient satisfaction was assessed in one study, where patients reported greater satisfaction with the quality of care.
(MacDougall et al. 2021)	From 2013 to 2020	Scoping review	SMS text messaging-based interventions / Mental health and addiction care	- To map and categorize gaps around the use of SMS text messaging-based interventions. - To identify the outcomes measured to	31 studies with less than 100 participants in each trial / Children or Adolescents < 18 years	-	- Intervention engagement was the most common type of outcome measured (18/31), followed by changes in cognitions (16/31); and acceptability (16/31). - Interventions were typically delivered in less than 12 weeks. - Adolescents received 1-3 messages per week.

				determine effectiveness and engagement. - To identify technological and clinical design features of these interventions. - To identify the barriers and facilitators.			- 35% (11/31) of studies specifically indicated the intervention was for substance use or problem drinking, and 32% (10/31) focused on adolescents with depression. - Bidirectional messaging was involved in 65% (20/31) of the studies. - Limited descriptions of implementation features (eg, cost, policy implications, technology performance) were reported.
(Dwyer et al. 2021)	Up to November 2020	Scoping review	E-mental health approaches involving text-based, real-time communication with a qualified human therapist and the predictive power of language use patterns. / Depression, suicidal ideation or anxiety	- To map the research that has explored text-based e-mental health counselling services and studies that have used language use patterns to predict mental health status. - To capture existing and emerging research within the field.	70 studies / No specific characteristics were reported	-	-Text-based counselling is effective in treating psychological distress and depression. -It may be effective for treating substance abuse, reducing high-risk behaviours, and improving the subjective experiences of individuals with attention deficit hyperactivity disorder and/or autism. -When patients with depression are comfortable with online communication, the anonymity of the online therapeutic relationship may be more appealing, and online therapy is an acceptable and helpful alternative to face-to-face services. -There is converging evidence that text-based communications that have been analyzed using computational linguistic techniques can be used to predict progress accurately during treatment and identify individuals at risk of serious mental health conditions and suicide. -Modern computational linguistic tools and techniques allow analyses that may help predict progress during treatment and may ultimately identify individuals at risk.
(Berry et al. 2016)	From 2005 to 2015	Systematic review	Online or mobile phone interventions / Severe mental illness (SMI): Psychosis, bipolar disorder,	- To explore whether interventions delivered online and via mobile phones are hypothetically or	49 studies / No specific characteristics were reported	-	-The hypothetical acceptability of online and mobile phone-delivered interventions for SMI was relatively low, while actual acceptability tended to be high. -Hypothetical acceptability was higher for interventions delivered via text message than by email.

			or personality disorder.	actually acceptable for people with SMI. - Investigate whether participant and intervention-related factors influence acceptability. - Identify common participant views about acceptability from qualitative studies.			-Most studies that assessed the impact of demographic characteristics on acceptability reported no significant relationships between the two. -Actual acceptability was higher when participants were provided remote online support. -Common qualitative factors relating to acceptability were safety and privacy concerns, the importance of an engaging and appealing delivery format, the inclusion of peer support, computer and mobile phone literacy, technical issues, and concerns about the impact of psychological state on intervention use.

SAD: social anxiety disorder; **DSM-5:** Diagnostic and Statistical Manual of Mental Disorders, fifth edition; **MI:** motivational interviewing; **VHS**: Video home system

Outcome results

Regarding the effectiveness of text messages in mental health conditions, of the 16 included reviews, the majority indicated that the intervention was effective either on self-reported or clinical parameters. The effect size of the intervention was reported only in one review [255]. The rest of the reviews reported the effect of the intervention based on the included studies, referring to different effects reported within specific demographic subgroups or according to the duration of the service. Other outcomes were also reported. Table 1.3.1 summarizes the outcome results.

The reviews under study were classified according to the targeted clinical condition and their outcome, as follows:

SUD, including alcohol and smoking cessation: Seven studies examined the effect of text messages in people with diagnosis/risk of SUD. Six of the reviews reported the positive effect of text messaging services, while only one review [257] reported negative outcomes as follows:

1. Mason, Ola et al. [255] reported positive results of texting services in their meta-analysis when used as a preventive tool for SUD in adolescents. The authors reported that some studies had a medium effect size (.54), but overall and when including all studies, the effect size was small.

2. Hutton, Prichard et al. [256] examined the effect of mHealth interventions, including text messages, on reducing the harmful alcohol related behaviours among young people. The authors reported that the service was effective in reducing alcohol consumption in 50% of their studies, mostly in studies that included text messages. Additionally, they found that young people liked personalized messaging that helped in an effective way to convey mHealth services.

3. Song, Qian et al. [259] examined the effect of mobile phone technologies, including SMS, on unhealthy alcohol users (UAU). The authors depicted that more than half (63%) of these interventions produced positive outcomes. In respect to SMS interventions alone, a similar percentage was reported (eight out of 12 studies: 67%).

4. Tofighi, Nicholson et al. [261] systematically assessed the effect of mobile texts on people with drugs and alcohol dependence. In this systematic review, the authors reported that

most studies demonstrated improved clinical outcomes in terms of reduced alcohol, methamphetamine, and opioid use, and relapse prevention.

In respect to other outcomes, the authors reported improved medication adherence, engagement with peer support groups, clinic follow-up, appointment attendance, motivation, and social support. Regarding feasibility, the authors reported that text messaging interventions are feasible platforms for addressing a range of substances, such as alcohol, heroin, methamphetamine, and alcohol.

5. Fowler, Holt et al. [260] examined the efficacy of mobile-based interventions on reducing the harmful effects of alcohol among adult alcohol users (dependent or non-dependent). In their review, the majority of the studies assessed text messages as a primary intervention (6 out of 8 studies: 75%). The authors reported promising results, given that most studies found positive effects of the intervention on several parameters, including behavioural and cognitive outcomes.

6. Boland, Stockings et al. [258] ran a meta-analysis to examine the effectiveness of the technology-based services (phone and internet) in the context of cessation of smoking among disadvantaged vulnerable populations. The meta-analysis concluded a positive effect in favour of the intervention; where people in the intervention group were at least 1.29 times more likely to quit smoking. Regarding the mobile text-messaging intervention alone, the results were promising, where a statistically significant effect was reported after one month of the intervention. On the long-term analysis, although high odds were reported on three- and six-month follow-up among those who received text-based intervention, the effect was not statistically significant.

7. Similar to Mason, Ola et al. [255] review (14 studies), the review of Bastola, Locatis et al. [257] (19 studies) examined the text messages effect on young adults regarding alcoholism/abuse. Unlike Mason et al.'s results, Bastola et al. concluded in this meta-analysis that text message-based interventions might not be effective in decreasing alcohol intake in the younger populations in the short term. Moreover, a possible opposite effect was reported in the long term.

Psychosis: Two reviews assessed a mobile-based intervention [237] and text message services [47] in patients with psychosis. The reviews concluded positive results related to the efficacy, engagement, and feasibility of the intervention, as follows:

1. Alvarez-Jimenez, Alcazar-Corcoles et al. [237] indicated that both the online and mobile-based interventions may show promise in improving positive psychotic symptoms among patients with schizophrenia-spectrum disorders. Moreover, mobile-based interventions may provide a useful tool to monitor early relapse signs, therefore, may prevent hospital admissions. Tailored text-based interventions were found to be particularly associated with improved symptomatology in terms of reduced hallucination severity and improved sociability but not functional outcomes.

2. D'Arcey, Collaton et al. 2020 [47] reported data on text message (SMS) studied the engagement and feasibility of text messages in psychosis. The authors concluded that text messages can leverage patients' engagement in terms of medication adherence, clinic attendance, and therapeutic alliance. In terms of the measured parameters of feasibility and acceptability, overall, the service was feasible in terms of cost and practicality and was well perceived as reported by more than half of the study participants. Overall, text messages were concluded to be safe, easy to use, and positively received.

Depression or anxiety symptoms: Three mental health reviews focused on depression condition/symptoms alone or in association with anxiety and suicidal symptoms. The results were not conclusive. 'Threshold' significance level results were reported in one review [231] and in another review when the service was accompanied with other e-services [263]. The third study reported borderline significant results, however, after careful review of the data the results seem to be not statistically significant [262], as follows:

1. In the meta-analysis of Cox, Allida et al. [231], the authors demonstrated the effect of texting services on depressive symptoms among adults. The authors concluded a significant effect of text messages in reducing depressive symptom scores, however, due to the substantial heterogeneity (high inconsistency in results), the effect was described as "*borderline"*.

2. A similar meta-analysis of seven studies was run by Senanayake, Wickramasinghe et al. 2019 [262] aimed to examine the effect of the treatment delivered via text messages on depression. The meta-analysis reported a borderline statistically-significant reduction due to text messaging (standardized mean difference of –0.23 (95% CI: –0.48 to 0.02, p = 0.07).
3. Dwyer, de Almeida Neto et al. [263] review was the only study that examined text messages in combination with other e-services. The authors reported a beneficial role of e-mental health approaches on depression, suicidal ideation or anxiety, particularly when patients with depression are comfortable with online communication. In respect to text-based communications, the use of computational linguistic and modern techniques was found to help to predict progress during treatment and may ultimately identify individuals at risk.

Other measured outcomes/mental health conditions: Four reviews reported on the effect of texting services on different mental health conditions. Overall, the reported outcome was promising in terms of the effectiveness, satisfaction, feasibility, and acceptability of the texting service in mental health conditions, such as alcohol disorder, PTSD, SMI, suicide attempts, and anorexia/bulimia.

1. Berrouiguet, Baca-García et al. [264] studied the effect of text messages on different mental health conditions, including SUD. The review demonstrated various outcomes of the text messages in different mental health conditions, including SUD, schizophrenia, PTSD, suicide attempts, and anorexia/bulimia. The authors concluded that text messages may be helpful in diverse ways, additionally, they allow for inexpensive and instantaneous communication between patients and clinicians. Nevertheless, the authors reported that these interventions are at a crucial stage in their development as they present a promising opportunity for innovation; however, the risk of intrusiveness into a patient's personal space through these interventions may need to be carefully assessed.

2. Watson, Simpson et al. [265] examined the effect of text messaging on mental health-related outcomes among the adult population. The authors concluded that most studies showed high satisfaction along the significant improvements in a variety of psychiatric and social functioning assessments related to mental health conditions, such as psychotic and

alcohol disorders. However, regarding adherence to medications, the results were not promising. Collectively, the authors reported that these studies suggest text messaging is a promising tool to support the management of patients with mental illness.

3. MacDougall, Jerrott et al. [241] scoping review examined the literature for text-based services in mental health among children and adolescents. The authors reported data related to the nature, frequency, and targeted assessments of text-based services. Compared to Watson, Simpson et al.'s [265] systematic review on adult populations, a smaller number and frequency of text messages were provided to the younger population, with a similar representation of the targeted clinical conditions, i.e., depression and SUD/alcohol. The authors additionally reported a high representation of engagement as a measurement outcome for the majority of the studies. This finding could not be compared to other reviews, as none reported the outcome measures in their studies.

4. Berry, Lobban et al. [266] systematically examined the acceptability of remotely delivered services in severe mental illness conditions. The authors concluded that there is a high *actual* acceptability of the online and mobile-based health services, while the text-based services, particularly, got a higher theoretical acceptability compared to emails or phone checking. Safety and privacy were among the concerns that were reported to be related to the acceptability of such interventions.

Discussion

Principle Findings

Our rapid review closely examined and summarized the results of 16 published reviews on the use of text-based services in the field of mental health. The reviews included in this review were mostly systematic reviews with a considerable number of meta-analysis reviews. The studies were collated between 2014 and 2021, with a majority in the latest three years. SUD including alcohol and smoking was the most targeted condition reviewed. This suggests that there are more reviews applied in the addiction field compared to other mental health conditions. Regarding the aim of the reviews, the effectiveness outcomes of the texting service, either as self-reported or clinically

measured, represented the most assessed aim and outcome of the reviews under study (10 out of 16 studies; 63%). People of a young age were considerably represented, and the included reviews mostly reported a high risk of bias.

With respect to smoking text-based interventions, only one review reported on smoking cessation interventions via text messages [258]. The review included only one study that assessed the texting service to quit smoking [267]. The study showed promising results related to the intervention in young people in New Zealand. This study may pave the way to introduce further research based on evidence to support quitting smoking via supportive texting services, especially since this research was done 16 years ago and may need to be updated.

In terms of the effectiveness of the text-based services in different mental health conditions, the results are promising, particularly in psychotic disorders and SUD, including alcohol and smoking. The results related to depression ± anxiety, however, were not fully conclusive. In some studies, for example, although the effectiveness of the texting service was reported to be statistically significant, it was borderline. Additionally, the heterogeneity of the studies included in this review was generally high, thus may limit a definitive conclusion. Nevertheless, in respect to one review [231], when considering only the studies with depression as the primary outcome, which represented a majority (five out of seven studies; 71%), the sensitivity analysis reported a statistically-significant reduction in depressive symptoms with a low heterogeneity in the intervention group compared to the control group at the end of treatment (SMD, −0.30; 95% CI, −0.53 to −0.08; $I2$ = 23%). Similar results were obtained while considering trials using standard depression rating scales. The agreement was, therefore, hard to reach, particularly when looking at the meta-analysis run by Senanayake et al. on seven selected RCTs [262]. The authors reported a borderline statistically-significant reduction in depression after the use of text messages, with evidence of heterogeneity, although the reported result does not read the same (standardized mean difference of –0.23 (95% CI: –0.48 to 0.02, $p = 0.07$), which means that the noted change may be at maximum approaching significant. For a higher quality of evidence, studies, including reviews may need to be more homogeneous and methodologically rigorous.

Specific Findings and Comparisons

The results related to SUD may need to be interpreted cautiously, given that one review [257] reported different findings (negative) related to alcohol disorders in college students and younger adults. In this review, the authors provided a meta-analysis of 44 articles and reported odds ratios and confidence intervals for the calculated neutral to the negative effect of texting services on the study cohort. This different outcome may be explained by the specific demographic characteristics of the study cohort, as well as the clinical condition under study, particularly when the rest of the reviews, except for one study [256], examined the intervention in the adult population or did not specify the age group. Additionally, the rest of the reviews examined the SUD as a complex group rather than alcohol disorder alone as seen with Bastola et al. [257], concluding that these results may represent only the young people who have alcohol disorder. Nevertheless, Hutton, Prichard et al. [256] examined texting service in a similar cohort and mental health condition, and produced relatively positive outcomes. However, the authors reported that reduced alcohol consumption was reported only in half of their studies, and the review did not conclude that mHealth technology can definitively influence behavior change.

Regarding feasibility and acceptability, the present review reports promising results related to text messaging programs as being feasible and acceptable by the majority of the service recipients. Online supportive services were more preferred than non-support services, albeit authors reported that it is still too early to conclude that [266]. A cautious approach was recommended by Berrouiguet, Baca-García et al. [264] when providing technology services, as it may carry the risk of invading the personal bubbles of patients with mental health problems. This is consistent with the reported factors that affect the acceptability of the remote health service, including safety and privacy concerns, in addition to the format of delivery and mobile technical issues [266]. Similarly, D'Arcey, Collaton et al. [47] pointed out the selective effectiveness of text-based services based on baseline social characteristics. For example, patients with low baseline adherence and those who live independently reported higher effectiveness, when compared to people with high baseline adherence and those who live within a socially-supportive community. Other influences that may improve the acceptability or effectiveness were reported as receiving tailored text messages, targeted content with CBT-based information, text messages with goal-setting, and the length of registration time [231, 256]. There was also a reference to the various models or frameworks applied with the included interventional texts. For example, MacDougall, Jerrott et al. [241] found

that the social cognitive theory was the most frequently cited followed by cognitive behavioral therapy, while to a lesser extent the health belief model and normalization process theory.

Regarding the mode of delivery, given the nature of the study reviews, there was a blend of modes including both manual and automatic delivery of the messages [265], while Mason, Ola et al. [255] reported that while the majority of messages were delivered automatically, this finding was not consistently reported.

Date related to differences based on gender and to the number of messages were also reported; the high frequency of at least twice messages per week was associated with positive outcomes [231]. On the other hand, a significant negative outcome was reported for male participants in the intervention arm in one study of one review [259] (one out of 19 studies, 5%), however, no change was noticed in the female participants. Variable receptivity seems built upon several socio-demographic or intervention-related factors that may, therefore, significantly influence the outcome and effectiveness of the provided service.

Digital technology, particularly text-based services, carries the promise to improve the access and quality of mental health services. Prior literature and the current report indicate high interest and acceptance of these services by the target population [241, 266]. Text-based services via mobile phones offer a convenient, cost-effective for both the provider and recipient, and the service represents an accessible means of implementing population-level interventions thanks to high mobile phone ownership, ranging from 82% to 94%, and in Canada, almost 90% of residents own a smartphone and SMS text messaging is embedded in 98% of mobile phones [47, 49, 241]. The mobile health services, therefore, became widely spread, albeit texting-based interventions are still at a lower level than mobile health apps (45% vs 54%) [268].

COVID-19 and Digital Technology

During the COVID-19 pandemic, while the need for digital health support was urged, overall, the present review did not find any review that covers specifically text messages intervention in mental health during the pandemic. In a rapid systematic review, however, the authors examined all

available mental health services provided during the pandemic[269]. The authors reported that such services were provided by different bodies, such as governments or academic agencies. The type of services included counseling, supervision, and psychoeducation through e-platforms, such as hotline, WeChat, online self-help psychological interventions, including CBT for depression, anxiety, and insomnia [269].

This review [269] highlighted the services provided during the pandemic, particularly the remotely delivered supports that aimed to fulfil the imposed requirements of physical distancing, and therefore were necessary to close the treatment gap emerged during the pandemic. The review illustrated the digital services, such as Videoconferencing, online programs, smartphone apps, text messaging, and e-mails have been useful communication methods for the delivery of mental health services. the authors referred to one project that has included texting services, Text4Hope [270]. In Canada, a support text message (Text4Hope) program was launched to combat the psychological impact of COVID-19. The program provided three months of free supportive text messages for the general public in Alberta, Canada [270]. Other digital and supportive services, referred to in the same review, were provided in Germany, for example, a 'Coping with Corona: Extended Psychosomatic care in Essen' (CoPE) provided psychological support for distressed individuals through four main steps: initial contact, triage and diagnosis, support via tele or video-conference, and aftercare [43]. In Singapore, online psychotherapy and counseling were provided through videoconferencing platforms to psychiatric patients and the general public with distress related to COVID-19 [271].

Text messages in mental health may have their own limitations as reported in the reviews under study. This may be attributed either to the lack of research in this area or to the nature of the intervention. For example, the Alvarez et al. review [237] indicated that there was no reported support or enough data fostering functional outcomes while using online or mobile-based interventions. Similarly, coupling the text message intervention with another assistant service, such as interactive voice recognition, smartphone applications, and remote online support was suggested in the literature to support text services. However, the latter view was not supported much in the literature, given the paucity of direct comparisons against text message-only interventions. Moreover, when comparing unguided online services to guided services in study

reviews, the results were usually mixed, reporting that it seems early to support this conclusion [261, 266, 272, 273].

This rapid review has several limitations. While the authors carefully examined the literature, the included studies may not represent an exhaustive list of the literature. This may be due to the nature of the search which was run on specific databases (not all), the limited search terms used, restricted inclusion criteria, and the inclusion of the English-only studies. Additionally, we did not report results for meta-analysis due to the variability of the reviews and the lack of consistent reporting of effect sizes. Therefore, the conclusions reported in this review can be viewed as future recommendations for research and policy to tailor accordingly their planned future research work. Additionally, the focus of the present research was to examine the literature specifically in regards to the texting services in mental health, thus the reviews that covered supportive mental health services provided during the COVID-19 pandemic without a particular lens on texting services were not part of this review [269]. Finally, as a review of the reviews, there was a blend of supportive mental health services that were provided via texting messages, including treatment delivery, treatment support, or supportive texts, which did not specify the purpose, or the types of text services aimed to examine. The blend of remotely delivered services was also part of this review, however we solicited the data related to the texting-based service, aiming to provide a comprehensive review related to this particular intervention.

To conclude, this general review carefully examined the published reviews and provided useful information regarding the online mental health support using text-based services. The results in general were promising with evidenced impacts and reported satisfaction and acceptability of texting services in various mental health conditions, including severe mental illness. The reports related to the feasibility of these programs were positive. One study reported on cost-effectiveness, but no further cost analyses were run. Some mixed outcomes were reported in relation to some diagnoses and were attributed to the large heterogeneity and sometimes to the lack of high-quality studies. This review suggested potential areas for further research, particularly as study reviews, in different contexts, including smoking cessation, cost analyses, and to some extent reviews that carefully examine the effect of texting services in management of affective disorders. Future

studies should consider SMS text messaging interventions in different contexts and during critical times, such as the COVID-19 pandemic. Texting-based services have become more convenient and appealing interventions that can fulfill the essential physical distance requirements enforced during the pandemic. As such, these remotely delivered services are capable to close the treatment gap, which has exponentially increased during the pandemic. Policy- and decision-makers, therefore, need to further support text-based services through rigorous research methodologies and with guided investments in such interventions that proved to be acceptable, cost-effective, and feasible.

Chapter 2: Overall aims and detailed protocols of the two completed studies

2.1 Overall Aims and Objectives

This section outlines very briefly the aims and objectives of the two completed overall research studies:

The aim of the first overall study Closing treatment gap for patients discharged from mental health acute care units by using peer support and supportive text messaging was to examine the effectiveness of supportive text messages and peer support mental health services provided for patients who were recently discharged from acute care units. We sought to explore their role in closing the treatment gap, and improving the patients' overall clinical outcomes, using validated and reliable clinical measure scales. Within that study, over time, comparative measures were analyzed across four treatment arms and we focused on aspects of the patients' recovery, changes in psychological measures and quality of life of patients. Patient satisfaction and acceptance of the technology or approach used was assessed using a mixed-methods (qualitative and quantitative data measures) approach.

The second overall study sought to close the treatment gap of mental health care for the general population and assess the prevalence of common mental health conditions during the COVID-19 pandemic. In this context, we examined the prevalence and the predictors of mental health symptoms during the COVID-19 pandemic with respect to: generalized anxiety disorder (GAD); major depressive disorder (MDD); obsessive compulsive disorder (OCD); post-traumatic stress disorder (PTSD); suicidal thoughts; and sleep disorder symptoms. The approach was to look at differences based on socio-demographic features and also consider vulnerable groups. Important variables included age, relationship status, ethnicity condition, and health care workers, including nurses, physicians, and other healthcare workers. Likely prevalence estimates were derived from surveys conducted in the context of theText4Hope supportive text messaging program. Effectiveness and acceptability of the Text4Hope service were measured over the intervention period or in a comparative analysis, by assessing: effectiveness of Text4Hope in mitigating stress, anxiety, and depression after six weeks (mid-point) of exposure to Text4Hope, in the first-week program cohort. We also measured effectiveness of Text4Hope in mitigating stress, anxiety,

depression, sleep disorder, and suicidal thoughts among text4Hope subscribers, compared to a control population.

The research reports from this study focused on several outcomes of the Text4Hope intervention in terms of user experience and satisfaction, based on the gender of the participants. These also include: effectiveness in mitigating stress, anxiety, and depression after three months (end of service) and one year after launching the service.

The methodological details are provided in the following sections with respect to the published protocols for the two overall studies included in this thesis, including the latest adapted amendments and changes.

2.2 Study (1) protocol: Closing treatment gap for patients discharged from mental health acute care units by using peer support and supportive text messaging

For this research work, I did not participate in the preparation, writing, or publishing the protocol of this work (2018). This first project "closing the treatment gap after hospital discharge" as with the next project "Health systems response to a text message program during COVOD-19 pandemic" is comprehensively described in the following overarching protocol paper. For this reason, I provide the reference for this work for the convenience of the reader, as follows:

Urichuk, L., Hrabok, M., Hay, K., Spurvey, P., Sosdjan, D., Knox, M., . . . Agyapong, V. I. O. (2018). Enhancing peer support experience for patients discharged from acute psychiatric care: protocol for a randomised controlled pilot trial. BMJ Open, 8(8), e022433. doi:10.1136/bmjopen-2018-022433

Note: The study was registered with ClinicalTrials.gov (trial registration: NCT03404882). Due to logistic factors, detailed in the following chapters, the study was changed from a randomized controlled trial to a controlled observational trial. the amendments to the study protocol are reflected in the revised registered trial protocol at ClinicalTrials.gov.

2.3 Study (2) protocol: Closing the Psychological Treatment Gap During the COVID-19 Pandemic with a Supportive Text Messaging Program: Protocol for Implementation and Evaluation

Agyapong, V. I. O., Hrabok, M., Vuong, W., Gusnowski, A., **Shalaby, R.,** Mrklas, K., . . . Greenshaw, A. J. (2020). Closing the Psychological Treatment Gap During the COVID-19 Pandemic with a Supportive Text Messaging Program: Protocol for Implementation and Evaluation. JMIR Res Protoc, 9(6), e19292. doi:10.2196/19292. Available at https://www.ncbi.nlm.nih.gov/pubmed/32501805

The protocol was amended, and information provided here is related to the updated version in relation to the current study.

Abstract

Background

Coronavirus disease (COVID-19) has spread globally with far-reaching, significant, and unprecedented impacts on health and everyday life. Threats to mental health, psychological safety, and well-being are now emerging, increasing the impact of this virus on world health. Providing support for these challenges is difficult because of the high number of people requiring support in the context of a need to maintain physical distancing. This protocol describes the use of SMS text messaging (Text4Hope) as a convenient, cost-effective, and accessible population-level mental health intervention. This program is evidence-based, with prior research supporting good outcomes and high user satisfaction.

Objective

The project goal is to implement a program of daily supportive SMS text messaging (Text4Hope) to reduce distress related to the COVID-19 crisis, initially among Canadians. The prevalence of stress, anxiety, and depressive symptoms; the demographic correlates of the same; and the outcomes of the Text4Hope intervention in mitigating distress will be evaluated.

Methods

Self-administered anonymous online questionnaires will be used to assess stress (Perceived Stress Scale), anxiety (Generalized Anxiety Disorder-7 scale [GAD-7]), depressive symptoms suicidal ideation, sleep disorder symptoms (Patient Health Questionnaire-9 [PHQ-9]), post-traumatic stress disorder (PTSD) (PTSD Checklist for DSM-5 [PCL-5]), and of obsessive-compulsive disorder (OCD) symptoms (the Brief Obsessive-Compulsive Scale [BOCS]). Data will be collected at baseline (onset of SMS text messaging), the program midpoint (6 weeks), and the program endpoint (12 weeks).

Results

Data analysis will include parametric and nonparametric techniques, focusing on primary outcomes (i.e., stress, anxiety, and depressive symptoms) and metrics of use, including the number of subscribers and user satisfaction.

Conclusions

This COVID-19 project will provide key information regarding prevalence rates of stress, anxiety, and depressive symptoms during the pandemic; demographic correlates of distress; and outcome data related to this scalable population-level intervention. Information from this study will be

valuable for practitioners and useful for informing policy and decision making regarding psychological interventions during the pandemic.

Introduction

Background

Coronavirus disease (COVID-19), a severe acute respiratory syndrome caused by the SARS-CoV-2 virus (severe acute respiratory syndrome coronavirus 2; officially identified in January 2020 in Wuhan, China), is now a global pandemic with far-reaching, significant, and unprecedented impacts on human health and everyday life. The World Health Organization declared the COVID-19 outbreak a Public Health Emergency of International Concern [274] on January 30, 2020, with many countries globally struggling to adapt to its impact. The closing of schools and small and large businesses, extremely high unemployment rates, and the effects of quarantine are further stressors facing the global population due to COVID-19 [275].

Threats to mental health, psychological safety, and well-being are now emerging, increasing the impact of this virus on world health [276, 277]. Over half of survey respondents in China rated the psychological impact of COVID-19 as moderate or severe, with 29% reporting significant anxiety symptoms and 17% reporting significant depressive symptoms [278]; these symptoms persisted after 4 weeks of the COVID-19 epidemic [279]. A number of factors may correlate with psychological impact, including female gender, student status, specific physical symptoms (eg, myalgia, dizziness, and coryza), and poor self-rated health status. A recent rapid review of 24 published studies on pandemics reported negative psychological effects, including posttraumatic stress symptoms, confusion, and anger [280]. Stressors included longer quarantine duration, infection fears, frustration, boredom, inadequate supplies, inadequate information, financial loss, and stigma.

In a study focused on health care workers (HCWs), over half had significant symptoms of depression, approximately 45% showed significant anxiety symptoms, and one-third experienced sleep disturbance and insomnia [281]. Correlates of symptomatology were related to exposure (eg, working in Wuhan, working on the front line) and demographic factors, including gender and occupation (eg, female, nurse). Although an important and inevitable public health measure during a highly infectious disease outbreak, quarantine is associated with a number of negative psychological and social effects (eg, posttraumatic stress, anger, fear, financial loss, and stigma) [280], and may serve as an additional risk factor. The literature describing the psychological impact of natural disasters suggests that a subset of people exposed to natural disasters struggle with clinically significant mental health conditions, including anxiety, depression, and substance use

disorders [282-284]. Several risk factors were identified for the development of psychological conditions after disasters. In addition to the demographic factors described above, these include degree of exposure [285-289], gender [290-293], social stressors (eg, unemployment status [290] or low socioeconomic status [291]), as well as pre-existing mental health conditions [291, 294, 295].

Even at this early stage of the global pandemic, there is evidence of significant psychological effects among the general population, which may be more pronounced in certain groups (eg, female, socially stressed, frontline worker, pre-existing psychological disorder) [296, 297]. Providing support for these challenges is difficult because of the high number of people requiring support in the context of a need to maintain physical distancing.

Mobile health technology offers a unique and innovative solution in this context. Specifically, this tool offers a convenient, cost-effective, and accessible means for implementing population-level interventions. Almost 90% of Canadians own a smartphone [298], and SMS text messaging is free to end users, does not require technical skill for use, and does not require expensive data plans. Text messages are also cost-effective to providers, costing cents per message to deliver.

Supportive text messages are associated with positive outcomes, including the reduction of depressive symptoms, increased abstinence duration in alcohol use disorder, and high user satisfaction, as reported in previous research. For example, in randomized controlled trials (RCT), patients with depression that received supportive text messages showed symptom reduction on a standardized self-report when compared to a similar patient group that did not receive text messages (with large effect sizes: Cohen *d*=0.85, Cohen *d*=0.67) [94, 217]. In another RCT, to evaluate the effectiveness of an addiction-related supportive SMS text messaging mobile intervention in improving treatment outcomes for patients with alcohol use disorder, small to moderate effects were found for the cumulative abstinence duration. In addition, the intervention group's mean time to first day to drink was over twice the length of that of the control group (60 versus 26 days, respectively) [94]. In two user satisfaction surveys, over 80% of subscribers reported that a supportive SMS text messaging program improved their mental health [94, 299]. Subscribers reported text messages made them feel more hopeful about managing issues (82%), in charge of managing depression and anxiety (77%,), and connected to a support system (75%); in addition, such messages improved their overall mental wellbeing (83%) [94].

Objective

This protocol describes the implementation of the Text4Hope program (a low-cost, evidence-based, supportive SMS text messaging service) in Canada. The objective of the project is to implement a self-subscribing daily supportive text message program (Text4Hope) to close the psychological treatment gap and reduce anxiety and stress related to the COVID-19 crisis among Canadians. Our research questions include the following: (1) What are the prevalence rates of stress, anxiety, obsessive compulsive, and depressive symptoms in Canada related to the COVID-19 crisis? (2) What are the demographic correlates of stress, anxiety, obsessive compulsive, and depressive symptoms? (3) Will the Text4Hope program help reduce stress, anxiety, and depressive symptoms among Canadians experiencing psychological distress as a result of the COVID-19 crisis?

Methods

Evaluation Methodology and Measurement Plan

In the Text4Hope program, individuals self-subscribe to receive daily supportive text messages for 3 months by texting "COVID19HOPE" to 393939. The messages are aligned with a cognitive behavioral framework, with content written by mental health therapists as well as our research team members (authors MH and VIOA). The following is an example of the messages sent: "When bad things happen that we can't control, we often focus on the things we can't change. Focus on what you can control; what you can do to help yourself (or someone else) today" [300]. The messages are preprogrammed into an online software that delivers messages at 9 AM each morning. At the onset of the first message, respondents are welcomed to the service and are invited to complete an online baseline survey capturing demographic information; COVID-19–related self-isolation/quarantine information; and responses on the Generalized Anxiety Disorder-7 (GAD-7) scale [301], Perceived Stress Scale [302], the Patient Health Questionnaire-9 (PHQ-9) [303]; in addition, the PTSD Checklist for DSM-5 (PCL-5) Part 3 [304]; and the two items on the Brief Obsessive-Compulsive Scale (BOCS) were added to the follow-up surveys [305].

Survey questions were programmed into SelectSurvey.net, an online survey tool operated by the Alberta Health Services Evaluation Services Team. No incentives are offered to respondents. Participation in the program is entirely voluntary, and completion of the survey was not a prerequisite requirement to receive supportive text messages. Subscribers may opt out at any time

by texting “STOP” to 393939. Survey responses will be stored within our regional health system (Alberta Health Services) Select Survey account, and data will be exported, stored, and maintained by the Research and Evaluation team within our health region. The supportive SMS text messaging project subscriber recruitment plan was based on the success of a Text4Mood program in Alberta that was launched in response to the Fort McMurray wildfire disaster in 2016. Text4Hope has been the subject of a wide-exposure communications campaign (TV, radio, internet, and print media), including the local provincial mental health foundation, the single provincial government health care provider Alberta Health Services (AHS). Additionally, Text4Hope was the subject of a specific COVID-19 mental health support media release by the Provincial Chief Medical Officer [306]. Ethics approval has been granted by the University of Alberta Health Research Ethics Board (Pro00086163).

Sample Size Considerations

Based on previous experience using the technology, (ie, >10,000 recipients within 6 months), we expect about 300,000 Canadians to subscribe to the Text4Hope program over the next 6 months. Based on a response rate of 21.7% for our prior Text4Mood survey [94], we anticipate around 20,000 responses to the Text4Hope surveys per 100,000 subscribers.

Outcome Measures

The primary outcome is changed scores at 6 and 12 weeks from baseline on the Perceived Stress, GAD-7, PHQ-9 scales, the PCL-5 Part 3 scale, and the two items on the Brief Obsessive-Compulsive Scale (BOCS). The secondary outcomes are the following: (1) changes in prevalence rates for perceived stress, anxiety, depression, suicidal ideation, sleep disorder symptoms, PTSD, and OCD from the early phase of the COVID-19 pandemic to a later phase, as measured with the Perceived Stress, GAD-7, and PHQ-9 scales, PCL-5, and BOCS, respectively; (2) the interaction between primary outcomes and the demographic characteristics of subscribers as well as the date of subscription to Text4Hope relative to the phase of the pandemic in Alberta; and (3) subscriber satisfaction/experience.

Proposed Timeline and Milestones

The first stage involved the creation and review of the supportive text messages (targeting stress and anxiety-related concerns to COVID-19), and the programming of the messages into the software. This stage was completed on March 20, 2020. The second stage involved the launch of the Text4Hope program, which occurred on March 23, 2020. The remainder of the project will be focused on data analysis and reporting.

Hypotheses

Our hypotheses, based on previous research, are as follows: (1) High rates of stress, anxiety, and depression will be reported, affecting one-third to half of the general population; the 1-week prevalence rates for these disorders will increase as the pandemic continues, compared to rates in the early phase. (2) Specific risk factors will be found for the experience of distress during the pandemic, such as female gender, risk of exposure, and social determinants of health (eg, employment, housing). (3) The intervention will result in a 25% or greater reduction in perceived stress, anxiety, and depressive symptoms (as measured by the Perceived Stress, GAD-7, and PHQ-9 scales) at 6 and 12 weeks from baseline. (4) At least 80% of subscribers will express satisfaction with the Text4Hope program and perceive the daily supportive text messages as contributing to their overall mental well-being.

Results

Project evaluation will proceed using the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) Framework [307] and the Alberta Quality Matrix for Health [308]. Specifically, dimensions considered will include the following: acceptability (subscriber satisfaction/experience), accessibility (ease of subscription to and utilization of the Text4Hope program), appropriateness (numbers of residents subscribing to the program), and effectiveness (6- and 12-week changes in the Perceived Stress, GAD-7, and PHQ-9 scales). It may also be possible to examine efficiency (cost avoidance and efficiencies through reduced need for face-to-face counselling) and safety (self-reports of decreased crisis and urgent service calls, and decreased emergency medical services utilization rates).

We will evaluate the efficacy of Text4Hope with the reductions of perceived stress, anxiety, and depression at 6 weeks and 12 weeks. Data analysis will include the standard use of parametric and nonparametric techniques (eg, within-subject general linear models), including multiple

comparison Type 1 error corrections. Power analysis with effect sizes based on Agyapong group research publications [94, 217, 299, 309, 310] indicates a sufficient effect size for the expected Text4Hope program subscriber sample size.

Discussion

The impact of the COVID-19 global pandemic on health, way of life, and psychological safety and wellbeing is difficult to overstate. The psychological impact on the general population, both during and after the crisis, requires the use of innovative techniques that can serve the high number of people requiring support, while respecting the need to maintain physical distancing.

The current protocol describes the use of mobile health technology as a convenient, cost-effective, and accessible means for implementing a population-level psychological intervention during the pandemic. This program is empirically supported by previous research results, showing good outcomes as well as high user satisfaction [94, 217]. This project will evaluate outcomes with standardized, empirically validated questionnaires, and will also provide key information regarding prevalence rates of stress, anxiety, and depression in the Canadian population during the COVID-19 pandemic; demographic correlates of this distress; and outcome data related to a scalable population-level intervention. Information from this study will thus be critical for practitioners, as well as useful for informing policy and decision-making regarding psychological interventions during the COVID-19 pandemic. If Text4Hope is effective for the Canadian population, we will explore scale-up and national implementation, and will disseminate this program for adaptation for potential global use through the APEC Digital Hub for Mental Health [311].

Limitations of this protocol include a lack of baseline data on stress, anxiety, and depression levels before self-isolation measures were implemented in Alberta; this was unavoidable as our study was initiated shortly after quarantine and self-isolation measures were introduced. Nonresponse bias may also affect the expected results, as program subscribers are a sample of the population, not the entire population of the province. Nonrespondents may differ in a systematic way compared to respondents. For example, they may differ in their baseline level of mental wellness, be more (or less) affected by the pandemic or have limitations in literacy or English fluency. In view of the limitations noted above, any prevalence estimates must be interpreted with caution, and compared to the conventional baseline of subsequent conventional prevalence estimates. The authors also

note that this protocol does not include a control group and this raises the question of specificity concerning hypothesis 3, which concerns reductions in perceived stress, anxiety, and depressive symptoms. Previous RCT work from this group has demonstrated the efficacy of supportive SMS text messaging in intervention groups, compared to control groups that did not receive supportive text messages; instead, the control group received the same survey requests as the intervention group in addition to a single text message every 2 weeks, thanking them for participating in the study [217, 310]. Given the intention to provide support to the catchment population of this study and the prior evidence for efficacy, it would be unethical to include a control group in the current protocol. Nevertheless, prior studies did include subscriber satisfaction surveys, as does this protocol, and that measure will provide evidence for engagement of the subscribers with the program (simply put, if subscribers ignored the text messages, it is highly unlikely that there would be positive satisfaction survey results). In the current health implementation context of this protocol, the comparison of changes in outcome measures in relation to comparison with effect sizes from our prior work (together with an assessment of the degree of correspondence of subscriber satisfaction survey responses to changes in our outcome measures) will be a good indicator of subscriber engagement in the absence of a control condition. Despite these limitations and possible bias factors, our protocol will provide useful data about the mental health characteristics of individuals in the early stages of the COVID-19 pandemic. We expect that our results will represent an important initial source of information for government and health care planners in determining the nature and quality of services required to address mental health challenges arising during this pandemic, as well as future pandemics that employ self-isolation or quarantine measures. Specifically, planning for and implementing virtual care programs, including supportive SMS text messages, may be a fruitful approach to supporting isolated or quarantined individuals. In addition, we expect the supportive SMS text messaging intervention to have a positive effect on mental well-being and we will be able to measure this well within the expected sample size.

Chapter 3. The effectiveness of and satisfaction with supportive text messages and peer support mental health services for patients discharged from acute care units

This chapter will provide the results and discussion related to the first study: closing treatment gap for patients discharged from mental health acute care units by using peer support and supportive text messaging.

As articulated in aims and objectives (Chapter 2), for this study area, we assessed peer support service and text messages support for patients discharged from acute psychiatric care units in Edmonton, regarding the effectiveness of the services, using validated scales, along with the measurement of participants' acceptability and satisfaction with the received text service.

The following two sections describe our findings in relation to our published/in submission papers.

3.1 Effectiveness of peer support and text message services using the recovery assessment scale (RAS), Clinical Outcome Routine Evaluation Measures (CORE-OM), and World Health Organization-Quality of Life-BREF (WHOQOL-BREF) scales at all follow-up time points

This section demonstrates the studies hold to examine the effectiveness of the two interventions through comparing the baseline to six-week, three-month, and six-month measurements, among the intervention groups, using recovery assessment scale (RAS), Clinical Outcome Routine Evaluation Measures (CORE-OM), and World Health Organization-Quality of Life-BREF (WHOQOL-BREF) scales. This will be demonstrated in the following three subsections.

3.1.1 Recovery Following Peer and Text Messaging Support After Discharge from Acute Psychiatric Care in Edmonton, Alberta: Controlled Observational Study

Shalaby, R., Hrabok, M., Spurvey, P., Abou El-Magd, R. M., Knox, M., Rude, R., . . . Agyapong, V. I. O. (2021). Recovery Following Peer and Text Messaging Support After Discharge From Acute Psychiatric Care in Edmonton, Alberta: Controlled Observational Study. JMIR Form Res, 5(9), e27137. doi:10.2196/27137. Available at: https://www.ncbi.nlm.nih.gov/pubmed/34477565

Abstract

Background: Peer support is an emotional, social, and practical help provided by nonprofessionals to assist others in sustaining health behaviors. Peer support is valued in recovery-oriented models of mental health and is becoming increasingly implemented at the organizational level. Text messaging is a relatively low-cost, high-impact, and easily scalable program that uses existing technology, is devoid of geographic barriers, and is easily accessible to end users.

Objective: This study aims to evaluate the effectiveness of an innovative peer support system plus a supportive text messaging program on the recovery of discharged patients from acute psychiatric care.

Methods: This prospective, rater blinded, controlled observational study included 181 patients who were discharged from acute psychiatric care. Patients were randomized to one of four conditions: treatment as usual (follow-up care), daily supportive text messages only, peer support only, or peer support plus daily supportive text messages. A standardized self-report measure of recovery (Recovery Assessment Scale [RAS]) was completed at baseline, 6 weeks, 3 months, and 6 months. Descriptive analysis, one-way analysis of variance, and repeated measures multivariate analysis of covariance were used to examine the changes in the RAS among the study groups and over the follow-up time points.

Results: A total of 65 patients completed the assessments at each time point. For the overall sample, higher scores were found for the peer support plus text message condition compared with the text message only and treatment as usual condition on several scales (i.e., willingness to ask for help and personal confidence and hope) and total score on the RAS, after 6 months of intervention.

Conclusions: Peer support plus supportive text messaging seems to result in improved recovery compared with other interventions. It may be advisable to incorporate the two interventions as part of routine practice for patients with psychiatric disorders upon hospital discharge.

Introduction

Background

Peer support is emotional, social, and practical help provided by nonprofessionals to assist others in sustaining health behaviors [168]. The supporters share a similar condition as patients, successfully manage their conditions, and have received training to provide support [312]. Peer support may include activities such as advocacy, connecting resources, and experiential sharing [313]. Peer support is consistent with the recovery paradigm in mental health [314], and the purported mechanisms through which it functions [312] include knowledge sharing, modeling adaptive coping strategies, social comparison, and enhancing social support. Moreover, peer support systems can serve as an entry point into the health care system for *hardly reached* individuals and can provide support for those who would otherwise not engage in treatment [168]. Peer support may also offer benefits to peer supporters by enhancing feelings of competence and meaning [312]

Peer support is valued in recovery-oriented models [314] of mental health and is becoming increasingly implemented organizationally [315, 316]. A review reported positive outcomes, including lower inpatient service use, better relationships with providers, and increased engagement [104]. However, a rigorous evaluation of randomized controlled trials (RCTs) [317] of peer support studies reported that outcomes were mixed and often nonsignificant. In their review, the authors noted a high degree of bias and methodological limitations in the studies, including inconsistent training for peer support workers (PSWs), lack of randomization of patients, and lack of blinding of outcome assessors, and concluded that "peer support programmes should be implemented within the context of high-quality research projects wherever possible."

The existing literature suggests that peer support is valuable, but a more rigorous methodology to evaluate peer support program outcomes is needed. This study used an RCT design to evaluate a peer support model, which incorporates, as an innovative adjunct intervention, daily supportive text messages (TxM), provision of consistent training to PSWs, adopting blindness of the assessor, and randomization of the allocated patients.

Text messaging is a relatively low-cost, high-impact, and easily scalable program that uses existing technology, is devoid of geographic barriers, and is easily accessible to end users. Several RCTs

have shown significant decreases in symptomatology in psychiatric conditions after the implementation of text messaging [217, 318], and high rates of satisfaction among end users [248]. During the COVID-19 pandemic, supportive text messaging has been effective in decreasing symptomatology at the general population level [253]. Incorporating such services as a standard for patients upon their discharge from acute care may significantly improve the clinical and nonclinical outcomes for these patients and the health care system.

Study Aim

The overall aim of this project is to evaluate the effectiveness of innovative peer support and supportive text messaging systems as either stand-alone or combined interventions in addition to the usual treatment for patients discharged from acute care.

Methods

Study Design

Although the initial intention was to conduct an RCT [213], subject recruitment and treatment arm allocation issues necessitated an early planned transition to a controlled observational study, as described in the following sections. Participants were recruited from June 2019 to February 2020 and were randomized into one of four conditions: (1) PSW only, (2) TxM only, (3) PSW plus TxM condition (PSW+TxM), and (4) treatment as usual (TAU). Written consent was obtained and no incentives were provided.

Initial randomization was performed by an independent statistician using the block randomization method. The generated codes were sent securely to the study coordinator to assign the recruited patients across the four arms of the study treatment groups. Participants were asked at the beginning of the interview to not reveal their treatment allocation to the researcher who would facilitate the follow-up assessments. The study database was updated by the study coordinator upon recruitment. Randomization codes were kept secured on a password-protected computer. To further maintain the blindness, the researcher conducting follow-up assessments was not granted access to the database that contained the randomization code.

The study was approved by the Health Ethics Research Board of the University of Alberta (reference number Pro00078427) and operational approval from Alberta Health Services, the regional health authority. Written informed consent was obtained from all the patients. The study was registered with ClinicalTrials.gov (trial registration: NCT03404882). In relation to the design change to a controlled observational study, the amendments to the study [213] are now reflected in a revised registered trial protocol for NCT03404882.

Study Locations

The study was conducted at 5 acute psychiatric care units in Edmonton, Alberta, Canada. Patients were invited to participate in the study before their discharge.

Participants

Patients

The inclusion criteria were as follows: mental health condition (mood or psychotic disorder), imminent discharge from acute care, 18 to 65 years of age, able to provide written consent, and a mobile handset capable of receiving text messages. The exclusion criteria were as follows: inability to read the text messages from a mobile device, an addiction disorder without a mental health diagnosis, receiving PSW service before the study, or inability to commit to a sixth-month follow-up of the study.

Peer Support Workers

PSWs in this study were employed by Alberta Health Services Edmonton Zone Addiction and Mental Health Services after receiving 2 weeks of formal training. The PSW training program was designed by Cusick [319]. In alignment with the literature [178] and covered 13 domains: recovery and peer support; the history of recovery movement; worldview and culture; self-determination; trauma-informed care; boundaries and limits; communication and connection; the social determinants of health; impact of prejudice, discrimination, and stigma; grief and loss; crisis and recovery; goal planning; and self-care. In alignment with the literature [178], matching PSWs with our patients with respect to their baseline mental health conditions was not a criterion for assigning candidate patients to a PSW.

Demographic Characteristics of PSWs

A total of 8 dedicated PSWs were enrolled in this study (1 male and 7 females). They are employed by Alberta Health Services and occupy different positions in different health care settings within the Addiction and Mental Health portfolio. As described earlier, PSWs were not matched to our patients based on their mental health conditions, and so the mental health diagnosis of the PSWs in this study was not ascertained.

Treatment Interventions

In the PSW-only condition, a PSW met physically or virtually with the patients up to eight times over a 6-month period to offer mental health support. In the TxM-only condition, TxM were received without additional PSW intervention. In the PSW+TxM condition, participants were offered PSW services along with daily TxM. In the control arm, conventional follow-up appointments with community providers were offered but neither PSW nor TxM were provided.

1. Peer support service: patients in the PSW-only and PSW+TxM arms of the study were assigned PSWs who visited them (one to one) at the hospitals to introduce themselves and build rapport before patients were discharged into the community. PSWs visited the participants up to eight times over a 6-month period (mean 3 visits, SD 2.5). They offered the opportunity for interactive phone calls and/or texts between themselves and patients for 6 months. Phone calls or virtual meetings were offered to replace face-to-face meetings during the COVID-19 pandemic. Patients continued to receive usual community clinic or program treatments.

2. Text4Support: this is a daily supportive text message service conceived and designed by a group of psychiatrists, psychologists, mental health therapists, and patients based on cognitive behavioral therapy principles [320]. A bank of messages was generated and included different text message programs tailored for the following eight mental health domains: depression, anxiety, psychotic disorders, substance use disorders, bipolar disorder, adjustment disorders, attention-deficit or hyperactivity disorder, and general well-being. About 80% of the messages in all eight message banks had similar general well-being content: the remaining 20% targeted diagnosis-specific symptoms. Patients were enrolled by the research team to receive an assigned message bank based on their primary diagnosis by linking their phone number to the message bank through a web-based application (software). Patients in the automated TxM-only and PSW+TxM arms of this

study received automated messages at 12 noon Mountain Time. Examples of these messages include the following:

- Notice the good things going on in your life right now. Often, we do not notice the good but taking a moment to do so can uplift you. (General well-being)
- When we are anxious, our thoughts often focus on future "danger." Shift your attention to the present. What is happening right now? (Anxiety)
- Self-monitoring helps you identify and distinguish between normal changes in mood and mood swings that are problematic. (Bipolar disorder)
- Try talking quietly back to voices. Tell them they are wrong. Using the vocal part of the brain can reduce the intensity of voices. (Psychosis)

Outcomes

Participants completed measures at baseline, 6 weeks, 3 months, and 6 months. The primary outcome measure for this study was recovery, as assessed by the Recovery Assessment Scale (RAS [321]), a standardized instrument with strong psychometric properties, including high internal consistency (α=.93), test-retest reliability (r=0.88), and concurrent validity [322]. Furthermore, the scale seems sensitive to change over time [323]. This 24-item scale provides self-reported recovery ratings on a 5-point Likert scale (strongly disagree=1, disagree=2, not sure=3, agree=4, and strongly agree=5). The RAS subscales include five factors: (1) *personal confidence and hope* (response range 9-45); (2) *willingness to ask for help* (response range 4-20); (3) *goal and success orientation* (response range 3-15); (4) *reliance on others* (response range 5-25); and (5) *no domination by symptoms* (response 3-15). The Cronbach α coefficients for the five subscales range from 0.74 to 0.87, and the total score is positively associated with quality of life and empowerment, whereas it is inversely associated with symptoms [324]. Total scores (raw scores) were calculated for the composite RAS and for each of the five subscales and were used in the analysis of this study [323, 325-327].

Sample Size

Consistent with the idea that this was a pilot study without an empirically established effect size available to aid in power and sample size calculations, the targeted sample size of 180 participants was based on existing operational resources [328].

Data Analysis

The analysis was conducted using SPSS version 20 (IBM Corp, 2011) [329]. Initially, we aimed to use intention-to-treat analysis, whereby patient data were analyzed according to their original assigned groups, regardless of the time spent in the study. However, after randomization and due to clinical logistic reasons, a significant number of patients did not receive access to the PSW service in the two intervention arms of the PSW. As stated earlier, a strategic decision was made to adapt the protocol to a controlled observational study and to change the analysis approach to as-treated, rather than intention-to-treat, to maximize the investigational value of the study without compromising or biasing outcomes.

Baseline data, including sociodemographic (age group, gender, ethnicity, education level, employment status, and relationship) and clinical characteristics (primary diagnosis and RAS five factors), were analyzed to assess between-group differences across the four arms of the study (PSW-only condition, TxM-only condition, PSW plus TxM condition, and TAU condition). The analysis was conducted using chi-square and one-factor analysis of variance (ANOVA) for categorical and continuous variables, respectively.

Age categories were generated in accordance with the quartile distribution of the age-in-years variable. RAS factors were analyzed to assess cluster differences among the four study arms across the four periods of the study, using mean and SD. A one-factor ANOVA followed by Tukey post hoc test was performed to assess the statistical differences between the study arms and corresponding mean scores on each RAS factor for all the participants who completed the follow-up assessment at any designated follow-up time point. Welch F and Games-Howell post hoc tests were performed when there was evidence of a violation of the homogeneity of variance assumption. For participants who completed assessments at all the four time points, a repeated measures multivariate analysis of covariance (MANCOVA) was used to assess the impact of the four arms of the study on participants' scores of the RAS five factors across the three time points

(6 weeks, 3 months, and 6 months follow-up), while controlling for baseline scores. With regard to MANCOVA post hoc analysis, Bonferroni corrections were used to control for multiple comparison error rate changes for post hoc pairwise analyses.

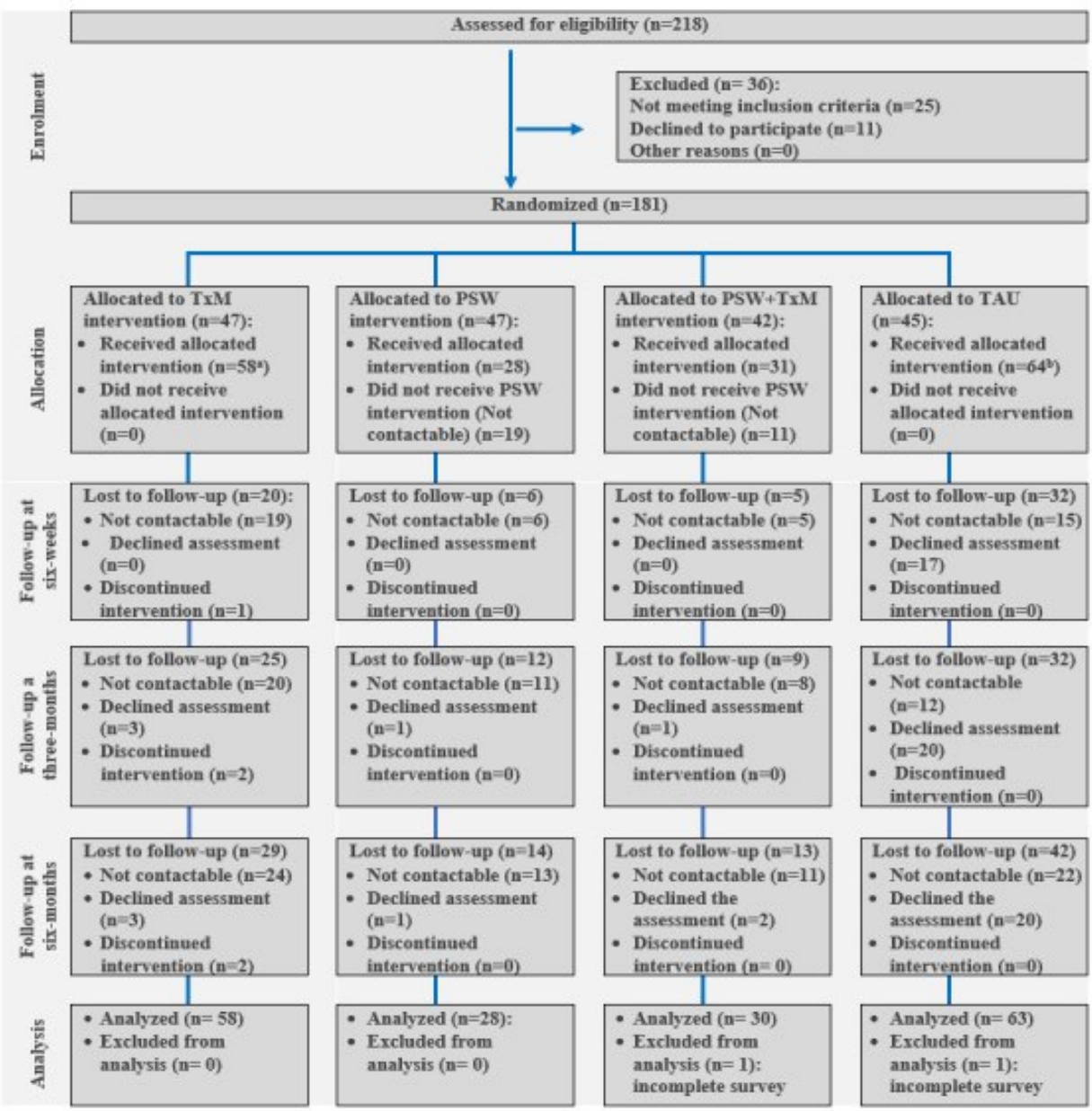
CIs and *P* values were used in reporting. Cases with missing values of more than one individual response per factor were excluded from the analysis. The two-tailed α-level criterion for statistical significance was set at $P \leq .05$.

Results

Participant Flowchart

The study flowchart is presented in Figure 3.1.1.1. A total of 181 patients were recruited and randomized into four study arms (n=43-47 per condition). At 6 weeks, 64.6% (117/181) of patients responded to the RAS survey, whereas 56.9% (103/181) of patients responded at 3 months, and 45.9% (83/181) of patients responded to the 6-month survey, yielding an aggregate time point response range between 45.9% and 64.6%.

Figure 3.1.1.1: Study flow chart.



Some patients were randomized to receive the PSW intervention with or without TxM support but did not receive PSW interventions for several reasons, including subsequent noninterest in receiving visits from PSWs and failure of PSWs to contact (Figure 3.1.1.1). Some of these participants continued to receive only TxM support or only TAU but attended follow-up assessments. Given the relatively small sample size of our study and the overarching objective of assessing the actual effects of the interventions, we adapted our study analysis plan to simply assess outcome data with regard to either the TAU or TxM support-only groups, reflecting the service they actually received.

Participant Characteristics

In terms of demographic and clinical characteristics (Table 3.1.1.1), the overall gender balance was fairly even with 56.9% (103/181) identifying as female, 27.1% (49/181) in the range of 50-65 years of age, 69.1% (125/181) identifying as White, 55.9% (100/179) achieved a postsecondary education level, 69.4% (125/180) are unemployed, 50.8% (84/179) are single, and 50.8% (92/181) were admitted for depression and/or anxiety.

Table 3.1.1.1: Demographic and clinical characteristics of study participants in the study arms.

Demographic and clinical variables	**TxM[a] only, n (%)**	**PSW[b] only, n (%)**	**PSW+TxM, n (%)**	**TAU[c], n (%)**	**Total, n (%)**	**Chi-square (*df*)**	***P* value**
Gender						6.8 (3)	.08
Male	18 (31)	14 (50)	18 (58.1)	28 (43.8)	78 (43.1)		
Female	40 (69)	14 (50)	13 (41.9)	36 (56.2)	103 (56.9)		
Age groups (years)						10.9 (9)	.28
18-30	17 (29.3)	9 (32.1)	8 (25.8)	14 (21.9)	48 (26.5)		
31-40	9 (15.5)	6 (21.4)	6 (19.4)	19 (29.7)	40 (22.1)		
41-50	11 (19)	10 (35.7)	8 (25.8)	15 (23.4)	44 (24.3)		
50-65	21 (36.2)	3 (10.7)	9 (29.0)	16 (25.0)	49 (27.1)		
Ethnicity						5.3 (6)	.51
Indigenous	5 (8.6)	4 (14.3)	4 (12.9)	12 (18.8)	25 (13.8)		
White	46 (79.3)	18 (64.3)	20 (64.5)	41 (64.1)	125 (69.1)		
Other	7 (12.1)	6 (21.4)	7 (22.6)	11 (17.2)	31 (17.1)		
Educational level						4.8 (6)	.58
Less than high school	6 (10.3)	7 (25)	5 (16.1)	11 (17.7)	29 (16.2)		

High school degree or equivalent	19 (32.8)	7 (25)	6 (19.4)	18 (29.0)	50 (27.9)		
Above high school education	33 (56.9)	14 (50)	20 (64.5)	33 (53.2)	100 (55.9)		
Employment status						2.7 (3)	.45
Employed	16 (27.6)	7 (25)	8 (25.8)	24 (38.1)	55 (30.6)		
Unemployed	42 (72.4)	21 (75)	23 (74.2)	39 (61.9)	125 (69.4)		
Relationship						5.1 (6)	.53
Married, common law, or in relationships	11 (19)	11 (39.3)	10 (33.3)	16 (25.4)	48 (26.8)		
Single	30 (51.7)	12 (42.9)	12 (40.0)	30 (47.6)	84 (46.9)		
Divorced, separated, or widowed	17 (29.3)	5 (17.9)	8 (26.7)	17 (27.0)	47 (26.3)		
Admitting diagnosis						6.6 (6)	.37
Depression and/or anxiety	27 (46.6)	14 (50)	16 (51.6)	35 (54.7)	92 (50.8)		
Bipolar disorder	21 (36.2)	10 (35.7)	10 (32.3)	12 (18.8)	53 (29.3)		
Psychotic disorder	10 (17.2)	4 (14.3)	5 (16.1)	17 (26.6)	36 (19.9)		

[a]TxM: supportive text messages.
[b]PSW: peer support worker.
[c]TAU: treatment as usual.

Chi-square and ANOVA results indicated that participants in the four treatment arms did not significantly differ in terms of sociodemographic and clinical parameters at baseline (χ^2_3=2.7 to χ^2_3=6.8, P=.08 to P=.91; $F_{3,175}$=0.39-1.60, P=.19 to P=.76).

Study Outcome

For the overall sample (with variable N for each time point as shown in Table 3.1.1.2), ANOVA revealed a statistically significant difference between- and within-groups for scores of *personal confidence and hope* factor at the 3-month follow-up ($F_{3,99}$=3.35; *P*=.02); *willingness to ask for help* factor at the 6-month follow-up ($F_{3,79}$=3.89; *P*=.01); and total recovery score at the 6-month follow-up. Tukey post hoc tests revealed a significantly higher mean of the *personal confidence and hope* factor at 3 months in the PSW+TxM arm than in the TxM-only arm (mean difference 5.09, 95% CI 0.41-9.77; *P*=.03) and TAU arm (mean difference 5.09, 95% CI 0.38-9.8; *P*=.03). In addition, a significantly higher mean for *willingness to ask for help* was detected for the PSW+TxM arm than for the TxM-only arm (mean difference 1.87, 95% CI 0.22-3.51; *P*=.02). Similarly, for the total recovery score, the PSW+TxM arm had a significantly higher mean than the TxM-only condition (mean difference 11.78, 95% CI 3.08-20.48; *P*<.01).

Table 3.1.1.2: Mean and SD of the Recovery Assessment Scale total score and factor scores by study condition for patients who completed assessments at any of the four time points.

RAS[a] score and time	TxM[b] only		PSW[c] only			PSW+TxM		TAU[d]
	Patients, n (%)	Value, mean (SD)	Patients, n (%)	Value, mean (SD)	Patients, n (%)	Value, mean (SD)	Patients, n (%)	Value, mean (SD)
Personal confidence and hope								
Baseline (n=179)	58 (32.4)	33.4 (6.67)	28 (15.6)	34.5 (7.23)	30 (16.8)	35.6 (8.69)	63 (35.2)	32.1 (8.46)
6 weeks (n=117)	37 (31.6)	32.6 (5.91)	22 (18.8)	33.6 (5.53)	26 (22.2)	35.6 (6.26)	32 (27.4)	32.0 (6.5)
3 months (n=103)	33 (32)	31.1 (5.81)	16 (15.5)	32.4 (6.57)	22 (21.4)	31.1 (7.57)	32 (31.1)	31.1 (7.57)
6 months (n=83)	29 (34.9)	31.5 (6.37)	14 (16.9)	34.0 (5.82)	18 (21.7)	35.9 (3.65)	22 (26.5)	32.3 (6.83)
Goal and success								

Baseline (n=179)	58 (32.4)	16.5 (2.72)	28 (15.6)	16.7 (3.22)	30 (16.8)	17.0 (3.12)	63 (35.2)	15.8 (3.13)
6 weeks (n=117)	37 (31.6)	15.6 (2.44)	22 (18.8)	15.4 (3.0)	26 (22.2)	17.0 (2.43)	32 (27.4)	15.2 (3.21)
3 months (n=103)	33 (32)	15.0 (3.27)	16 (15.5)	14.9 (2.73)	22 (21.4)	16.6 (2.48)	32 (31.1)	14.8 (3.4)
6 months (n=83)	29 (34.9)	15.0 (3.24)	14 (16.9)	15.6 (2.95)	18 (21.7)	17.1 (2.4)	22 (26.5)	15.5 (2.7)
Willingness to ask for help								
Baseline (n=179)	58 (32.4)	11.5 (2.54)	28 (15.6)	11.8 (2.7)	30 (16.8)	12.8 (2.08)	63 (35.2)	11.8 (2.85)
6 weeks (n=117)	37 (31.6)	11.2 (2.52)	22 (18.8)	11.5 (1.92)	26 (22.2)	12.4 (1.65)	32 (27.4)	11.8 (1.83)
3 months (n=103)	33 (32)	11.3 (2.27)	16 (15.5)	12.0 (2.16)	22 (21.4)	12.4 (2.08)	32 (31.1)	11.9 (2.74)
6 months (n=83)	29 (34.9)	11.0 (2.6)	14 (16.9)	12.7 (1.68)	18 (21.7)	12.8 (1.79)	22 (26.5)	11.7 (1.75)
Reliance on others								
Baseline (n=179)	58 (32.4)	20.3 (3.72)	28 (15.6)	21.5 (3.29)	30 (16.8)	21.3 (2.71)	63 (35.2)	20.4 (3.39)
6 weeks (n=117)	37 (31.6)	19.4 (3.51)	22 (18.8)	20.0 (2.77)	26 (22.2)	20.7 (2.17)	32 (27.4)	19.5 (3.65)
3 months (n=103)	33 (32)	19.7 (2.88)	16 (15.5)	20.5 (2.78)	22 (21.4)	21.6 (2.32)	32 (31.1)	20.3 (3.13)
6 months (n=83)	29 (34.9)	19.5 (2.89)	14 (16.9)	21.0 (2.86)	18 (21.7)	21.2 (2.71)	22 (26.5)	20.5 (3.23)
No domination by symptoms								
Baseline (n=179)	58 (32.4)	9.2 (3.12)	28 (15.6)	9.7 (3.44)	30 (16.8)	9.9 (3.8)	63 (35.2)	9.3 (3.36)
6 weeks (n=117)	37 (31.6)	9.5 (2.45)	22 (18.8)	9.2 (2.74)	26 (22.2)	10.1 (2.41)	32 (27.4)	9.8 (2.92)
3 months (n=103)	33 (32)	9.5 (3.04)	16 (15.5)	9.1 (3.2)	22 (21.4)	10.2 (2.92)	32 (31.1)	9.2 (3.5)

6 months (n=83)	29 (34.9)	9.3 (3.19)	14 (16.9)	10.7 (2.09)	18 (21.7)	11.0 (2.17)	22 (26.5)	9.3 (3.14)
RAS total								
Baseline (n=179)	58 (32.4)	90.9 (14.16)	28 (15.6)	94.2 (17.01)	30 (16.8)	96.0 (17.5)	63 (35.2)	89.4 (17.83)
6 weeks (n=117)	37 (31.6)	88.2 (11.6)	22 (18.8)	89.6 (13.46)	26 (22.2)	95.9 (12.86)	32 (27.4)	88.2 (14.09)
3 months (n=103)	33 (32)	86.6 (12.25)	16 (15.5)	88.9 (13.69)	22 (21.4)	97.0 (12.73)	32 (31.1)	87.3 (17.73)
6 months (n=83)	29 (34.9)	86.3 (13.88)	14 (16.9)	94.1 (13.33)	18 (21.7)	98.1 (8.48)	22 (26.5)	89.3 (15.03)

[a]RAS: Recovery Assessment Scale.
[b]TxM: supportive text messages.
[c]PSW: peer support worker.
[d]TAU: treatment as usual.

For patients who completed the RAS (n=65) at all four time points (Table 3.1.13; PSW: n=13; TxM: n=19; PSW+TxM: n=12; TAU: n=19), we performed repeated measures MANCOVA, with treatment intervention as the independent variable, RAS score and subscores as the dependent variables, and baseline scores as covariates. With sphericity accepted, tests of within-subject effects indicated that neither time ($F_{10,47}$=1.47; P=.18; ηp2=0.24) nor the interaction of time and PSW ($F_{10,47}$=1.20; P=.31; ηp2=0.20), time and TxM ($F_{10,47}$=.48; P=.89; ηp2=0.09), or time and PSW+TxM ($F_{10,47}$=1.24; P=.29; ηp2=0.21) significantly predicted RAS subscores and total scores. However, tests of between-subject effects indicated that the interaction between PSW and TxM was predictive of differences in scores on only the goal and success subscale ($F_{1,63}$=4.37; P=.04; ηp2=0.072) and reliance on other subscales ($F_{1,63}$=6.24; P=.02; ηp2=0.10).

Table 3.1.1.3: Mean and SD of the Recovery Assessment Scale total score and factor scores by study condition for patients who completed assessments at all four time points.

RAS[a] score and time	TxM[b] only (n=19), mean (SD)	PSW[c] only (n=13), mean (SD)	PSW+TxM (n=13), mean (SD)	TAU[d] (n=20), mean (SD)
Personal confidence and hope				
Baseline	35.00 (6.63)	35.77 (7.50)	34.69 (10.37)	32.1 (8.23)
6 weeks	32.32 (6.19)	33.08 (5.55)	35.15 (6.31)	32.00 (6.16)

3 months	32.32 (5.14)	32.31 (7.32)	35.77 (5.34)	31.35 (7.37)
6 months	33.11 (6.04)	33.92 (6.05)	35.77 (3.59)	32.30 (6.87)
Goal and success				
Baseline	16.47 (2.93)	16.85 (3.41)	16.54 (4.18)	15.8 (2.82)
6 weeks	15.26 (2.81)	14.85 (3.26)	16.85 (2.44)	15.55 (3.33)
3 months	15.32 (3.76)	14.77 (2.77)	16.54 (2.33)	14.70 (3.20)
6 months	15.11 (3.40)	15.62 (3.07)	17.38 (2.47)	15.80 (2.97)
Willingness to ask for help				
Baseline	10.79 (3.46)	12.23 (3.35)	13.08 (1.80)	11.4 (3.10)
6 weeks	11.11 (2.71)	11.69 (2.06)	12.92 (1.38)	11.95 (1.93)
3 months	11.21 (2.72)	12.23 (2.24)	12.23 (1.92)	11.80 (2.57)
6 months	11.16 (2.65)	12.77 (1.74)	12.92 (1.98)	11.65 (1.76)
Reliance on others				
Baseline	20.3 (3.30)	22.08 (3.17)	21.77 (.59)	20.25 (3.13)
6 weeks	19.74 (3.35)	20.31 (2.66)	21.15 (1.99)	20.15 (3.18)
3 months	19.42 (3.19)	20.77 (3.00)	21.92 (2.02)	20.55 (2.76)
6 months	19.6 (3.25)	21.8 (2.96)	21.85 (1.95)	20.60 (2.74)
No domination by symptoms				
Baseline	10.95 (3.26)	10.46 (3.07)	9.38 (3.86)	9.90 (2.73)
6 weeks	9.53 (2.86)	9.23 (2.95)	9.62 (2.36)	10.05 (3.02)
3 months	10.74 (2.54)	9.54 (3.31)	9.62 (2.82)	9.45 (3.38)
6 months	10.47 (3.10)	10.54 (2.07)	11.00 (2.12)	9.45 (3.20)
RAS total				
Baseline	93.84 (15.32)	97.38 (16.98)	95.46 (20.20)	89.45 (15.46)
6 weeks	87.95 (12.35)	89.15 (13.74)	95.69 (12.45)	89.70 (14.19)
3 months	89.00 (12.83)	89.62 (15.03)	96.08 (12.05)	87.85 (17.01)
6 months	89.47 (14.59)	93.92 (13.86)	98.92 (8.37)	89.55 (14.45)

[a]RAS: Recovery Assessment Scale.
[b]TxM: supportive text messages.
[c]PSW: peer support worker.
[d]TAU: treatment as usual.

Discussion

Principal Findings

To our knowledge, this is the first study to evaluate the effects of an innovative peer support program that incorporates supportive text messaging on recovery outcomes in patients discharged from acute psychiatric care under optimum controlled observational study conditions. An ongoing RCT in the United Kingdom is examining the effects of peer worker support for patients discharged from acute care in comparison with patients receiving TAU [330]; however, that study did not include a supportive eHealth component such as the text messaging support included in our controlled observational study.

Despite the relatively small sample size in our study, patients in the PSW+TxM group had notably higher recovery scores compared with those receiving either TxM-only or TAU. The study measures that were included provide potentially important information regarding the mechanisms of change enacted by peer support. For example, although the mechanism of change in peer support is unclear, our results suggest that peer support may influence personal confidence and hope as well as enhance the ability of patients to ask for help.

It is notable in this study that most patients who refused to complete the follow-up assessment were in the TAU group (n=20), compared with the other groups (maximum for other groups=3). This may be explained by a lack of interest. When patients receive no actual intervention, they become less motivated to provide feedback related to the research under study. Dropout figures were the highest among the patients who were assigned to the PSW service [331]. Some patients stated that they preferred to *control* their path of recovery after hospital discharge. Others were not suitable candidates for this service during this initial vulnerable postdischarge period, as assessed by the PSW; many PSW-allocated patients proved hard to reach, and in such cases, PSW follow-up is usually terminated or at least significantly interrupted [331].

A recent systematic review explored different interventions, including peer support, to improve the successful transition for discharge from acute mental health inpatient care to the community [55]. In one Australian study, 38 patients achieved recovery and wellness (particularly clinical and functional recovery) after receiving peer support for 6-8 weeks, which is consistent with our results [332]. In another Australian study, 49 patients receiving peer support, as supportive packages for 8-12 hours for 1-2 weeks, reported that the intervention solidified their recovery and improved their self-confidence [333]. In contrast, in a UK study, in which 23 patients received peer support for 4 weeks and 23 were in the TAU group, there was no evidence of a significant difference

between the two groups regarding hopefulness [331]. Unlike the three studies reviewed in the systematic review [55], our study findings indicate the relative impact of combined delivery of PSW+TxM compared with peer support alone, which may explain the discrepancy noted with the UK study [331].

Other studies have provided peer support to discharged patients either alone or alongside other interventions, such as environmental support or brief intervention (eg, interactive behavior change technology). However, those studies assessed outcomes other than patient recovery or reported mixed findings [87, 334]. The positive effect of the combined delivery of PSW+TxM observed in our study included TxM provided to the patients that were tailored according to their diagnosis. Previous studies have reported positive benefits of receiving daily TxM in the context of mental health and addiction. For example, patients with depression alone or comorbid with alcohol use disorder reported the effectiveness of texting service on symptom recovery in terms of better management of depression and anxiety and perceived better overall mental well-being [94]. In addition, a longer time to first drink was reported after receiving TxM for 3 months and was maintained for up to 6 months [216, 248]. Multiple advantages have been reported when using texting services in patients with psychotic disorders, including better medication adherence, improved clinical and functional symptoms, effective symptom monitoring, and high acceptability by end users [335-337].

Studies examining the effect of a supportive texting service for patients discharged from acute care are rare. A recent systematic review focusing on web- and mobile phone–based texting in mental health [338] reported some studies that offered texting services to patients on hospital or emergency discharge with different mental health conditions, including alcohol use disorder, bulimia nervosa, and suicide. Each of these studies reported positive outcomes, including decreased binge drinking, reduced remission rates, and achieved feasibility and acceptability by patients who attempted suicide. In contrast, our study did not produce more favorable recovery outcomes for patients who received only TxM along with TAU. This contrasts with previous findings that patients with major depressive disorder who received daily TxM in addition to usual treatment had significantly fewer depressive symptoms and improved quality of life compared with TAU [217, 318]. It is interesting to note that those previous RCTs used the Beck Inventory Score changes at 3 months from baseline as the outcome measure, while this study assessed

recovery outcomes using the RAS. The fact that patients in our study received text messages once daily, whereas patients in two previous RCTs [217, 318] received twice daily text messages may also be related to differences in these study outcomes.

A growing body of evidence supports the paradigm of integration of health care services through multidisciplinary intervention or support. This appears to have a particularly high potential impact when patients are facing multiple and complex needs that can progress to severe forms of mental illness [339, 340].

The results of this controlled observational pilot study have the potential to signal an important direction for future studies to incorporate these integration goals into peer support programs.

Study Limitations

Our study had several important limitations. For instance, only the RAS recovery outcome measure is reported in this study, and it is important to examine the effects of peer support and daily supportive text messaging on multiple outcomes, including quality of life, symptomatology, and health care use and functional outcomes, such as employment [213]. In addition, the RAS is a self-report outcome questionnaire and is therefore subject to social desirability and another weakness in this study. For future studies, it will be important to maximize adherence to self-reporting across the time points assessed. This can be achieved via incentives linked to completion.

Importantly, high dropout and/or nonservice provision rates for PSW among the study participants undermined the initial RCT design, thereby reducing the robustness of the study results. Consequently, to be able to access the actual impact of the interventions, we adopted a controlled observational study with a *to-treat analysis* rather than the original RCT plus an *intention-to-treat analysis*.

Although this study provided important preliminary information regarding the outcomes of peer support programs for patients discharged from acute care, the overall study sample and the individual group sizes were relatively small. Small sample sizes reduce study power and the sensitivity of studies to detect differences between treatment groups. A multicenter study with large sample sizes will be needed to validate the results of this study and to determine the actual effect size of the various interventions forming a part of this controlled observational study.

3.1.2 Clinical Outcome Routine Evaluation Measures for Patients Discharged from Acute Psychiatric Care: Four-Arm Peer and Text Messaging Support Controlled Observational Study

Shalaby, R., Spurvey, P., Knox, M., Rathwell, R., Vuong, W., Surood, S., . . . Agyapong, V. I. O. (2022). Clinical Outcomes in Routine Evaluation Measures for Patients Discharged from Acute Psychiatric Care: Four-Arm Peer and Text Messaging Support Controlled Observational Study. Int J Environ Res Public Health, 19(7). doi:10.3390/ijerph19073798. Available at: https://www.mdpi.com/1660-4601/19/7/3798/htm

Abstract

Background: Peer support workers (PSW) and text messaging services (TxM) are supportive health services that are frequently examined in the field of mental health. Both interventions have positive outcomes, with TxM demonstrating clinical and economic effectiveness and PSW showing its utility within the recovery-oriented model.

Objective: To evaluate the effectiveness of PSW and TxM in reducing psychological distress of recently discharged patients receiving psychiatric care.

Methods: This is a prospective, rater-blinded, pilot-controlled observational study consisting of 181 patients discharged from acute psychiatric care. Patients were randomized into one of four conditions: daily supportive text messages only, peer support only, peer support plus daily text messages, or treatment as usual. Clinical Outcomes in Routine Evaluation—Outcome Measure (CORE-OM), a standardized measure of mental distress, was administered at four time points: baseline, six weeks, three months, and six months. MANCOVA was used to assess the impact of the interventions on participants' scores on four CORE-OM subscales across the three follow-up time points. Recovery, clinical change, and reliable change in CORE-OM all-item analysis were examined across the four groups, and the prevalence of risk symptoms was measured.

Results: A total of 63 patients completed assessments at each time point. The interaction between PSW and TxM was predictive of differences in scores on the CORE-OM functioning subscale with a medium effect size ($F1,63 = 4.19$; $p = 0.045$; $\eta p2 = 0.07$). The PSW + TxM group consistently achieved higher rates of recovery and clinical and reliable improvement compared to the other study groups. Additionally, the text message group and the PSW + TxM group significantly reduced the prevalence of risk of self/other harm symptoms after six months of intervention, with 27.59% ($X2 (1) = 4.42$, $p = 0.04$) and 50% ($X2 (1) = 9.03$, $p < 0.01$) prevalence reduction, respectively.

Conclusions: The combination of peer support and supportive text messaging is an impactful intervention with positive clinical outcomes for acute care patients. Adding the two interventions into routine psychiatric care for patients after discharge is highly recommended.

Background

Psychological distress is often reported by patients who are discharged from a clinical setting [341-346]. Patients with mental health disorders are particularly vulnerable, including for suicidality or homicidal propensity [68, 345, 347]. The Clinical Outcomes in Routine Evaluation-Outcome Measure (CORE-OM) is a well-recognized and validated tool that measures psychological distress and can be administered at several time points to detect changes in mental health parameters [348, 349]. The instrument is designed to provide a feasible outcome measure accepted by researchers and practitioners and is sensitive to a wide range of intensities of psychological distress [349, 350]. CORE-OM validity is supported by results of frequent trials and feedback received from practitioners [349].

A lack of routine follow-up care provided after clients are discharged from acute care units may lead to detrimental effects, including readmission and frequent emergency visits [59, 60]. An estimated 12 - 22% of discharges from mental health hospitalizations may result in subsequent Emergency department (ED) visits and 5 - 50% may result in hospital readmission, depending on age and mental health conditions [63-67]. Several factors, including prior psychiatric hospitalization, multiple comorbidities, unemployment, and psychosis are identified as likely primary drivers of readmission within four years after hospital discharge [59, 71].

Available peer support and texting services are interventions that can be easily integrated into health services, given that each intervention has a proven track record of clinical effectiveness and economic value in mental health settings [104, 124, 310, 316, 351]. Improved mood status, sense of control of depression, and improved alcohol-use profile are associated with the use of supportive text messages for three or six months [94, 299, 310]. Similarly, lower rates of readmission within a supported, recovery-oriented model were observed with peer support services [156, 316, 334].

Providing these services to recently-discharged patients may help to alleviate potential health distress and close the treatment gap experienced by many after discharge, especially during the period preceding their first follow-up appointment with a health care provider that may only come weeks or months post-discharge [213].

Monitoring changes in patients' psychological parameters over time is of key importance for assessing the success and effectiveness of mental health services [348, 352]. Roe et al. emphasized on the importance of assessing patient outcome measures, with active engagement of the patients and service users who can participate in the selection and prioritization of the used measures [353]. Additionally, the available prevalent technology, such as apps can facilitate this involvement, which carry the promise for allowed easily collecting, analyzing and presenting ecologically valid patient dependent outcome measures [353]. Recent research has found that person-centered and self-directed care approaches, among others, may allow individuals to exercise better control over their own care with benefits over usual care. These benefits are represented in rates of adherence and self-management as well as in medical and mental health outcomes, resulting in reduced inpatient and emergency room use, improved cost-effectiveness, service satisfaction, and quality of life [354]. These benefits may intensify when interventions become comprehensive, intensive, and integrated into routine care [354].

In this context, we undertook the current study to assess the effectiveness of supportive text messaging and peer support worker (PSW) services, using the CORE-OM as a window on the intensity of psychological distress in patients discharged from acute care psychiatric units.

Study objectives: This study aimed to assess changes in overall CORE-OM and subscale scores among the supportive text messaging and peer-support treatment conditions compared to usual care across the four study time points.

Methods

Participants and study design were described in detail in a previous report [249]. A brief summary follows.

Study Design

This controlled observational study was designed as a four-parallel-arm study with randomized services provided [213]. Although the initial intention was to conduct a randomized controlled trial (RCT), subject recruitment and treatment arm allocation issues necessitated an early planned transition to a controlled observational study, as described in the following sections. Participants were randomized into one of four conditions: (1) PSW only; (2) TxM only; (3) PSW plus TxM condition (PSW+TxM); and (4) treatment as usual (TAU), with 1, 1, 1, 1 allocation. Recruitment

was run from June 2019 to February 2020 from acute care units in Edmonton, Canada. A study flow chart is given in Figure 3.1.11. Researchers running follow-up assessment were blinded, and participants were allocated to treatment groups by computer-driven block randomization.

The study received ethics approval from the Health Ethics Research Board of the University of Alberta (reference number Pro00078427) and operational approval from Alberta Health Services. All participants provided written informed consent. The study is registered with ClinicalTrials.gov (trial registration: NCT03404882). Amendments to the study protocol [213] have been revised and registered (trial registration: NCT03404882).

Some patients who were randomized to receive the PSW intervention with or without TxM support did not receive PSW interventions for some reasons, such as subsequent noninterest in receiving visits from PSW, hospital readmission, and failure to reach out, despite several attempts being made to connect these patients with a PSW (Figure 1). Some of these participants continued to receive only TxM support or otherwise did not receive any service (acting like TAU group) and attended the follow-up assessment sessions related to the scale under study. Given the relatively small sample size of our study and the overarching objective of assessing the actual effects of the interventions, we adapted our study analysis plan to simply assess outcome data with regard to either TAU or TxM support-only groups to reflect the service the patients had actually received.

Patients

The inclusion criteria were: (1) mental health condition (mood or psychotic disorder); (2) imminent discharge from acute care; (3) 18-65 years of age; (4) able to provide written consent; and (5) a mobile handset capable of receiving text messages. The exclusion criteria were: (1) inability to read text messages from a mobile device; (2) an addiction disorder without a mental health diagnosis; (3) receiving PSW service before the study; or (4) inability to commit to a sixth-month follow-up of the study.

Treatment Interventions

In the PSW-only condition, a PSW met physically or virtually with the patients up to eight times over a six-month period to offer mental health support. In the TxM-only condition, only daily TxM were received. In the PSW+TxM condition, participants received both PSW services and daily

TxM. In the control arm (i.e., TAU), only conventional follow-up appointments with community providers were offered.

Text4Support is a daily supportive text message service conceived and designed on cognitive behavioural therapy principles [249]. A bank of messages was generated and included messages for the following eight mental health conditions: depression, anxiety, psychotic disorders, substance use disorders, bipolar disorder, adjustment disorders, attention-deficit or hyperactivity disorder, and general well-being. Examples of the messages are provided in another publication [249].

Outcome:

For this study, the primary outcome measure was psychological distress as assessed by CORE-OM scale.

CORE-OM:

The CORE-OM is a 34-item self-report questionnaire designed for use as a baseline and outcome measure in psychological therapies. It consists of four main domains/items:

1) subjective well-being (4 items, e.g., such as "I have felt overwhelmed by my problems").
2) problems/symptoms (12 items, e.g,. "I have had difficulty getting to sleep or staying asleep").
3) functioning (12 items, e.g., "I have been able to do most things I needed to").
4) risk to self or others (6 items, e.g., "I have threatened or intimidated another person) [349, 355].

Each item is rated on a Likert scale of five responses ranging from 0 to 4 (0 = not at all, 4 = always or most of the time). The lower the score, the better the psychological condition [356].

Three types of changes are usually studied with CORE-OM:

1) **Clinical change:** From the literature, clinical and non-clinical conditions usually relate to people who are waiting for therapy versus those who are not [357]. The cut-off score used is 10 and the change between the two populations is called 'clinical change' [357, 358].

2) **Reliable change:** The reliable change index (RCI) is used to assess pre-post change, and 0.50 (clinical score of 5) is the cutoff score [349], i.e., clinical score changes greater than 5 are significant.

   Reliable improvement indicates a positive reliable change, i.e., clients achieving a lowering of severity level by at least 5, [357] [349] [359]. Clients whose score changes are below +5 or -5 are deemed to have no reliable change, while clients with score increases of more than 5 were deemed to have deteriorated [349] [359].

3) **Recovery:** Recovered is defined by two change conditions (clinical and reliable, as above), when baseline CORE-OM scores move from above the clinical range (equal to or greater than 10.0) to the non-clinical range, and are reliably improved (change in score by ≥5) [359] [357].

Only clients with valid pre and post CORE-OM scores and who scored above the predetermined cut-off point on the CORE-OM measure (≥10) at baseline are included in assessing recovery [359].

Regarding CORE-OM psychometric properties, the scale demonstrated good internal and test-retest reliability (0.75-0.95); the scale shows a good convergent validation against a battery of existing measures and clinician ratings of risk, and good sensitivity to change [360].

Sample Size

Since this is a pilot study, no sample size calculation was completed. A sample size of 180 participants was chosen for the study based on the availability of existing operational resources. [328].

Analysis

1. **Baseline data analysis:**

   Analysis was conducted using SPSS Version 25 (IBM Corp, 2011) [361]. Sociodemographic and clinical characteristics and baseline CORE-OM domains were analyzed based on the study dropouts (patients who were dropped out from the PSW service; n=30) and non-dropouts (the rest of the participants; n=151), using Chi square ($\chi 2$) and t-tests for categorical and continuous variables, respectively. Welch's t-test was applied when equal variances were not assumed [362]. The aim was to generalize the data based on hypothetical absence of significant differences between the two groups.

2. **Outcome Analysis:**
    - **Non-risk domains:** As the risk domain will be analyzed separately, the three other domains (subjective well-being, problems/symptoms, functioning) were analyzed to assess cluster differences among the four study arms across the four time points using means (M) and standard deviations (SD). To assess the impact of the study arms on the three non-risk CORE-OM domains, a repeated measure multivariate analysis of covariance (MANCOVA) was used for patients completing all time points (PSW: n = 13; TxM: n = 19; PSW + TxM: n = 13; TAU: n = 20). We controlled for baseline scores when analyzing across fol-low-up timepoints (i.e., six-weeks, three-months, and six-months). We ran the analysis, with the treatment intervention (TxM yes/no and PSW yes/no) as the independent variable, mean scores of CORE-OM domains as the dependent variables while controlling for baseline scores as covariates. With regard to MANCOVA post-hoc analysis, Bonferroni corrections were used to control for multiple comparison error rate changes for post-hoc pairwise analyses.
    - **All-item analysis:** For CORE-OM all-item (the total score of the scale), the change parameters discussed above, including CORE-OM recovery, reliable change, clinical change, and the change in prevalence were measured. For this analysis, we compared the baseline data to six-month data only to examine the overall change from the beginning to the end of the intervention for the four study groups. Data were reported as proportions and percentages.
    - **Risk domain:** As the score of the Risk domain correlates poorly with the non-risk items [363], a separate analysis for Risk score examined prevalence and the associated change at the end of the study across the four groups, using Chi^2 analysis. A patient was deemed at risk when scoring ≥1 on the Risk subscale.

According to the instrument manual, the CORE-OM is not limited to a particular diagnosis [364], thus the tool was applied to the case mix of our study with different baseline diagnoses. We presented results in frequencies and percentages, and a corrected two-tailed significance value of 0.05 was set as the criterion for statistical significance. Individual responses were deemed incomplete when no response was received for more than three questions (10% missing of all

items); i.e., 31 questions were the minimum accepted response, with prorating the reported items to compute the means for the total scores [360].

Results

There were 181 patient participants randomized into the four arms of the study. At six weeks, 117 patients responded to the CORE-OM survey, yielding a 64.64% response rate, while 103 patients responded to the survey at three months, yielding a 56.90% response rate, and 83 patients responded to the six-month survey, yielding a 45.86% response rate.

For demographic and clinical characteristics (Table 3.1.2.1), most participants were identified as female (56.9%), 25 to 34 years of age (28%), Caucasian (69.1%), post-secondary education level (55.9%), unemployed (69.4%), single (46.9%), and admitted for depression and/or anxiety (51.1%).

Chi-square analysis indicated that participants did not differ significantly from their socio-demographic characters, based on the dropout condition (Chi-square ranged between 0.26 and 4.66, p=.10 to .77).

In respect to CORE-OM domains, the mean scores were above 1 (equivalent to above 10 on the clinical scoring) for all domains and items; t-test indicated no significant differences in baseline CORE-OM scores between dropout and non-dropout participants (t value ranged between 0.02 to 1.75, p=12 to p= 98), Table 3.1.2.1.

Missing data: One participant provided fewer than 31 CORE-OM responses, and was excluded from the analysis, while five participants provided missing responses (≤ 2), and were included in the analysis, yielding a total of 180 eligible patients for CORE-OM scale analysis.

Table 3.1.2.1: Comparison between dropout and non-dropout participants regarding baseline demographic and clinical characteristics and baseline CORE-OM domain scores

Baseline characteristics n (%)	**Non-dropout** N= 151	**Dropout** N= 30	**χ^2 / t value**	**P**
Age (years)	41.37	41.19	t(179)=0.07	.94
Sex recorded at birth			χ^2(1)= 0.70	.40

Male	63 (80.8)	15 (19.2)		
Female	88 (85.4)	15 (14.6)		
Ethnicity				
Indigenous	18 (72.0)	7 (28.0)	$\chi^2(2) = 4.66$	.10
European/Caucasian	104 (83.2)	21 (16.8)		
Other	29 (93.5)	2 (6.5)		
Educational Level				
Less than high school	26 (89.7)	3 (10.3)	$\chi^2(2) = 2.96$	.23
High school degree or equivalent	38 (76.0)	12 (24.0)		
Above high school education	85 (85.0)	15 (15.0)		
Employment Status				
Employed	47 (85.5)	8 (14.5)	$\chi^2(1) = 0.26$	.61
Unemployed	103 (82.4)	22 (17.6)		
Relationship				
Married/Common law/ or in relationships	42 (87.5)	6 (12.5)	$\chi^2(2) = 0.94$	.62
Single	68 (81.0)	16 (19.0)		
Divorced/Separated/Widowed	39 (83.0)	8 (17.0)		
Admitting Diagnosis				
Depression/Anxiety	75 (81.5)	17 (18.5)	$\chi^2(2) = 0.51$	.77
Bipolar disorder	45 (84.9)	8 (15.1)		
Psychotic disorder	31 (86.1)	5 (13.9)		
CORE-OM domains (mean score, SD)	N=150	N= 30		
Subjective well-being Domain	1.71 (1.02)	1.83 (1.10)	t(178)=0.58	.56
Problem/Symptom Domain	1.75 (.94)	1.75 (1.09)	t(178)=0.02	.98
Functioning Domain	1.38 (0.71)	1.66 (0.91)	t(36.42)=1.57	.12
Risk Domain	0.53 (0.68)	0.57 (0.66)	t(178)=0.29	.77
All items	1.40 (0.73)	1.52 (0.88)	t(37.45)=0.68	.50
Non-risk items	1.59 (0.78)	1.72 (0.97)	t(36.90)=0.71	.48

SD: Standard deviation

(Table 3.1.2.2) presents the mean and standard deviation of CORE-OM clinical scores by study condition for the overall patient sample (A) and for those who completed assessments at each time point and at the four-time points (B). None of the four groups achieved a non-clinical level (<10) on the mean scores of CORE-OM domains at either six weeks or three months. The combined

group (PSW + TxM) was the only group that consistently reached a non-clinical level after six months of intervention on all non-risk scale domains. The combined group also improved with respect to reliable change (≥ 5 points difference) on all non-risk domains.

Table 3.1.2.2: Clinical scores of CORE-OM items across the study conditions

A. Mean and Standard Deviation of CORE-OM clinical score by study conditions for patients who completed the assessments at any of the four time points.									
		Baseline		Six weeks		Three months		Six months	
TxM only		N= 58		N= 37		N= 33		N= 29	
PSW only		N= 28		N= 22		N= 16		N= 14	
PSW + TxM		N= 30		N= 26		N= 22		N= 17	
TAU		N= 64		N= 32		N= 32		N= 22	
		Clinical Mean	SD	Clinical Mean	SD	Clinical Mean	SD	Clinical Mean	SD
Well-being	TxM only	18	10.14	16	10.24	17	10.63	19	11.78
	PSW only	16	11.10	17	11.27	19	10.99	13	9.65
	PSW + TxM	14	10.39	13	10.81	13	10.40	9.7	8.66
	TAU	19	9.85	17	11.38	18	11.10	15	10.62
Problem/ symptom	TxM only	17	10.42	17	8.48	17	8.04	17	10.84
	PSW only	17	8.73	15	9.58	15	9.55	11	7.97
	PSW + TxM	17	8.50	13	7.03	13	7.79	9.5	5.59
	TAU	19	9.92	15	9.11	16	11.23	14	9.77
Functioning	TxM only	15	7.61	13	8.08	15	7.78	15	9.01
	PSW only	13	7.52	14	7.18	15	6.58	11	6.38
	PSW + TxM	13	6.16	11	7.52	12	6.49	8	7.32
	TAU	15	7.86	13	8.14	13	9.00	12	7.85
Risk	TxM only	6	6.83	3	5.73	3	5.29	3	6.34
	PSW only	5	6.78	5	6.16	4	6.37	2	5.80
	PSW + TxM	4	5.77	3	5.08	1	1.72	1	2.06
	TAU	6	7.22	3	4.58	4	5.21	3	5.44

All items	TxM only	14	7.87	13	7.16	14	6.83	14	8.72
	PSW only	13	7.50	13	7.29	14	6.71	9.6	6.52
	PSW + TxM	13	6.65	11	6.17	10	6.22	8	5.35
	TAU	15	7.71	12	7.68	13	8.83	11	7.44
Non-risk items	TxM only	16	8.45	15	7.76	16	7.57	16	9.68
	PSW only	15	8.05	15	7.98	16	7.39	11	6.99
	PSW + TxM	15	7.25	12	7.01	12	7.32	9.1	6.36
	TAU	17	8.34	14	8.60	15	9.78	13	8.30

B. Mean and Standard Deviation of CORE-OM clinical scores by study conditions for patients who completed assessments at the four-time points.

			Baseline		Six weeks		Three months		Six months	
		N	Clinical Mean	SD	Clinical Mean	SD	Clinical Mean	SD	Clinical Mean	SD
Well-being	TxM only	19	14	9.06	16	10.98	15	10.18	15	11.36
	PSW only	13	14	11.16	18	11.34	18	12.08	13	9.92
	PSW + TxM	13	14	10.29	14	9.80	13	11.01	9	9.08
	TAU	20	19	10.90	17	12.08	18	11.61	15	10.98
Problem/ symptom	TxM only	19	13	11.14	17	9.64	15	8.32	14	10.72
	PSW only	13	15	8.67	17	8.70	14	10.10	11	8.30
	PSW + TxM	13	16	7.43	15	6.76	13	7.30	9	5.80
	TAU	20	18	10.94	15	9.71	15	11.64	13	10.09
Functioning	TxM only	19	12	7.27	13	8.97	13	8.11	13	8.77
	PSW only	13	11	8.84	14	5.96	15	7.21	11	6.47
	PSW + TxM	13	14	4.25	11	7.12	11	6.26	8	7.26
	TAU	20	14	7.95	13	8.98	13	9.60	12	7.97

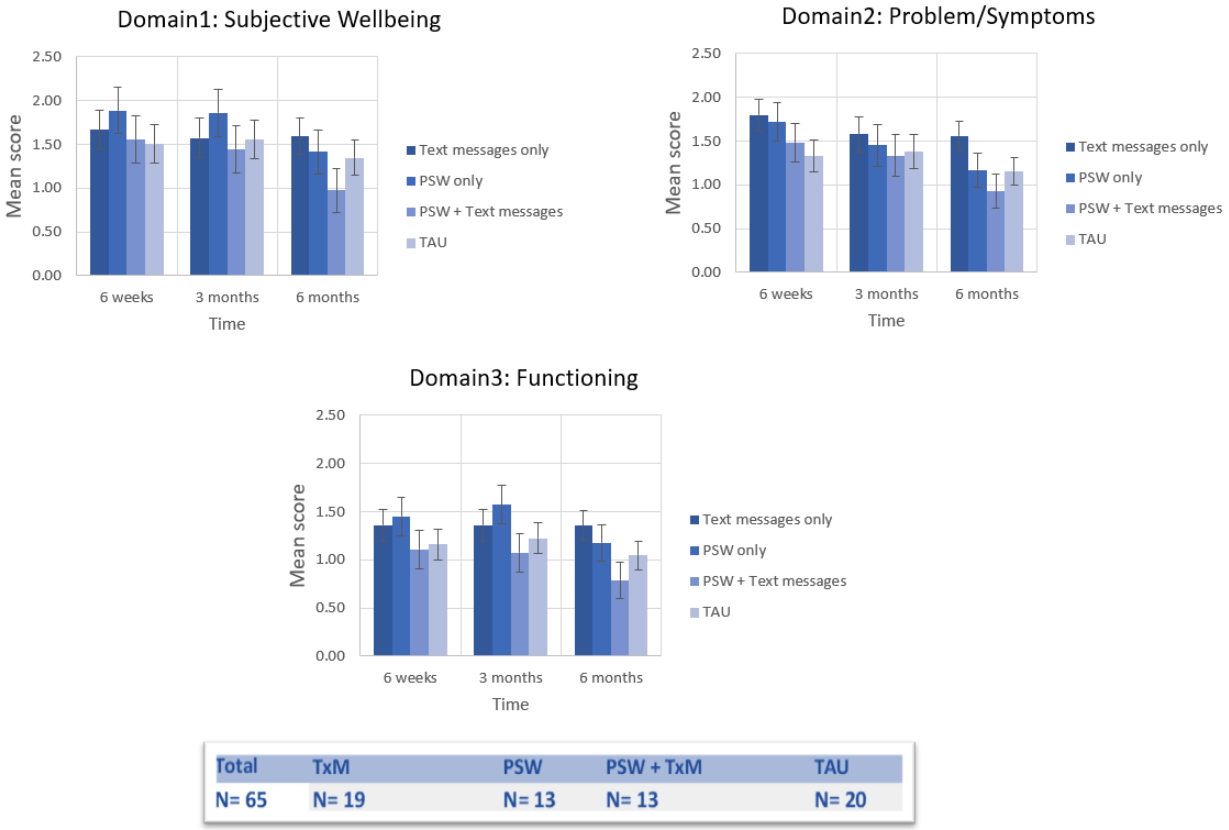
Risk	TxM only	19	4	5.93	3	6.65	1	4.06	2	5.97
	PSW only	13	4	7.25	4	4.21	3	6.37	2	6.00
	PSW + TxM	13	4	3.94	2	3.49	1	1.58	0	0.47
	TAU	20	7	8.50	3	3.79	4	5.40	3	5.69
All items	TxM only	19	11	7.84	13	8.20	12	6.95	12	8.55
	PSW only	13	12	7.96	14	5.99	13	7.23	10	6.74
	PSW + TxM	13	13	5.27	11	5.61	10	6.10	7	5.36
	TAU	20	15	8.72	12	8.34	13	9.36	11	7.73
Non-risk items	TxM only	19	12	8.40	15	8.74	14	7.85	13	9.38
	PSW only	13	13	8.58	16	6.87	15	7.96	11	7.22
	PSW + TxM	13	15	5.89	13	6.45	12	7.23	9	6.44
	TAU	20	16	9.11	14	9.48	15	10.34	13	8.58

Clinical mean: mean x 10; **W**: Subjective well-being domain; **P**: Problems/symptoms domain; **F**: Functioning domain; **R**: Risk domain

Non-risk Domains:

Figure 3.1.2.1 demonstrates the distribution of CORE-OM domains, over the six months of the study, after controlling for domains' baseline scores. MANCOVA analysis was run for participants who completed the survey at all time points (n= 65). With sphericity accepted for repeated measures MANCOVA analysis, tests of within-subject effects indicated no significant effect on CORE sub scores by time ($F_{6,53}$=1.99; P=.84; ηp2=.18), interaction of time and PSW ($F_{6,53}$=.62; P=.72; ηp2=.07), interaction of time and TxM ($F_{86,53}$=0.17; P=.99; ηp2=.02) or interaction of time and PSW+TxM ($F_{6,53}$=0.36; P=.90; ηp2=.04). By contrast, tests of between-subject effects indicated that the interaction between PSW and TxM had a significant effect on the scores of CORE functioning domain ($F_{1,58}$=4.22; P=.045; ηp2=.07) with medium effect size. Figure 3.1.2.1

Figure 3.1.2.1: CORE-OM non-risk domain distribution over the six-month study period after controlling for baseline scores (adjusted means with standard error of the mean (SEM))



Total	TxM	PSW	PSW + TxM	TAU
N= 65	N= 19	N= 13	N= 13	N= 20

All-item Analysis:

Regarding baseline and six months data only, 82 patients completed both baseline and six-months surveys, (TxM= 29 (35%), PSW= 14 (17%), PSW + TxM=17 (21%), and TAU= 22 (27%). With respect to the change from baseline to six months, the participants who showed clinical significance for All-items score at baseline (i.e., scored above the clinical cut-off score (≥10.0)) (49, 59.8%) were deemed eligible for the analysis of the clinical change and recovery parameters. Table 3.1.2.3 illustrates the change parameters from baseline to six months of the CORE-OM All-items domain across the four arms of the study.

Table 3.1.2.3: The change parameters of CORE-OM All-items across the four study arms from baseline to six months

Study groups	Prevalence n/N (%)				
	Reliable change (Total=82)			Clinical change (Improvement) (Total= 49)	Recovery (Total= 49)
	Improvement	No change	deterioration		
TxM	7/29 (24.1%)	15/29 (51.7)	7/29 (24.1)	3/18 (16.7%)	3/18 (16.7%)
PSW	5/14 (35.7%)	7/14 (50.0)	2/14 (14.3)	2/6 (33.3%)	2/6 (33.3%)
TxM+PSW	10/17 (58.8%)	7/17 (41.2)	0/17 (0)	5/11 (45.5%)	5/11 (45.5%)
TAU	9/22 (40.9%)	12/22 (54.5)	1/22 (4.5)	5/14 (35.7%)	4/14 (28.6%)

From Table 3.1.2.3, the following results were reported:

1) Reliable improvement: Overall, 31/82 (37.8%) on the All-items score met the criteria for a reliable improvement at six months. The TxM+PSW group scored highest (58.8%).
2) Clinical change: out of the eligible participants, 15/49 (30.6%) on the All-items score met the criteria for clinical change at six months. The TxM+PSW group scored highest (45.5%).
3) Recovery: out of the eligible participants, 14/49 (28.6%) met the criteria for recovery (reliable and clinically significant change) on the All-items score. Of them, 5/11 (45.5%) were from the TxM+PSW group.

It is worthwhile to mention that TAU group has also achieved a considerable improvement on the reliable improvement (41%) and clinical change parameters (36%), holding the second rank after the combined group (TxM+PSW).

Risk Sub-score Prevalence Analysis:

Table 3.1.2.4 demonstrates the prevalence of risk across the four arms of the study. The highest baseline prevalence of risk was found among the TxM+PSW group at 72.2%. After six months, the highest change (improvement) was reported for the TxM+PSW group, at 50% reduction in prevalence (X^2 (1) = 9.03, p<0.01), followed by the TxM group, at 27.59% (X^2 (1) = 4.42, p=.04).

Table 3.1.2.4: Prevalence change of risk scores across the four study arms from baseline to six months

Condition	Prevalence, n/total responses (%)		Change in prevalence rate (sixth month from baseline) %	χ^2 (df)	*P* value
	Baseline	Sixth month			
TxM	18/29 (62.07)	10/29 (34.48)	–27.59	4.42 (1)	.04*
PSW	7/14 (50.00)	4/14 (28.57)	–21.43	1.35 (1)	.25
TxM+PSW	13/18 (72.2)	4/18 (22.2)	–50.00	9.03 (1)	<.01*
TAU	14/22 (63.64)	12/22 (54.55)	-9.09	0.38 (1)	.54

*$p \leq .05$

Discussion

This study aimed to measure changes in psychological distress among patients with mental health disorders who were recently discharged from acute care units in Edmonton, Canada. The CORE-OM was employed to measure changes over six months of exposure to TxM and PSW interventions through a controlled observational design that included four study arms: TxM only, PSW only, TxM+PSW, and TAU. The TxM+PSW group showed a better improvement and clinical change on CORE-OM domains than the other groups.

Generally, there was no significant difference between dropouts and the rest of the participants in the study regarding sociodemographic and clinical characteristics or baseline CORE-OM scale domains. This may improve the potential generalizability of our data. Compared to the number of patients who completed CORE-OM at baseline, the number who completed pre and post data at the three follow-up periods was relatively small (65/181= 35.91%). Similar or lower results were reported previously, particularly in studies that examined reliable responses over several time points [357, 359, 365]. Our data yielded no significant differences in the CORE-OM total or sub-scores across the study arms at baseline in terms of sociodemographic and clinical characteristics. A balanced representation was noted in biological sex distribution, which is a quite unique finding as females usually constitute a majority in similar studies [359, 365]. The majority of participants were Caucasian, with post-secondary education level, unemployed, and single.

Depression and/or anxiety disorder represented the most prevalent conditions in our study. Major depressive disorder (MDD) is the most common mental health condition, constituting a major public health problem. In 2019, it was estimated that 322 million people suffered from MDD, and

it has been recognized as the single largest global contributor to nonfatal health loss, with the equivalent of over 50 million work years lost to that disability [366].

Scale Outcome Across the Intervention Groups

The TxM + PSW group was the only group to achieve clinical improvement in all the CORE-OM subscores at the end of the intervention period. When we ran the analysis over the six-month period and controlled for baseline scores, combined services showed a significant association, namely with the change in the functional domain, with a medium effect size. Other studies have reported a medium to high effect size of similar interventions, such as different psychological therapies delivered in psychiatric routine care in Sweden [365]; short-term counselling in Ireland [359]; and person-centred care in primary care settings [367]. The comparison here, however, might not be similar given the effect sizes in the literature were reported in a pre–post research design rather than in a controlled observational model as in our study.

In our study, TxM+PSW group was the major contributor to the recovery (45.5%). This concurs with results of other studies examining similar services in the field of mental health, such as providing counselling by a therapist (46.9%); the primary care Increasing Access to Psychological Therapy Service (50.8%). Considering the effects of diverse mental health therapies, reported recovery rates range from 19 to 65% [359] [368].

In this context, the proportion of the three change measures (reliable improvement, clinical change, and recovery) from baseline to six months were highest in the combined group. Peer support service combined with TxM resulted in a synergistic effect on all measures compared to either service alone or the TAU group. Recovery in our study was similar to that observed in a Swedish study, where around half of the participants reported a significant change after receiving psychiatric services [365]. This is consistent with the effectiveness of the combined service in our study.

Our provided service included TxM, which is known to produce successful outcomes in terms of improved clinical condition and clinical measures in patients with MDD [369], eating disorder [370], anxiety disorder [94], schizophrenia related symptoms [371] or psychiatric comorbidities [372] [217]. Such web-based services have been used widely during the COVID-19 pandemic to monitor symptoms related to infection, to direct the public to the available service channels [373]

or to support mental well-being and ameliorate pandemic-related psychological distress (as in the case of the Text4Hope service) [95]. With Text4Hope, the authors provided a daily supportive text message for the public for three consecutive months. The service was effective in reducing measures of depression, anxiety, stress, and self-harm [253] [374].

The combined service in our study included PSW. Peer support has been defined as "the help and support that people with lived experience of a mental illness or a learning disability can give to one another" [375]. The service has proven a success in the field of mental health, with reported consequent growth in sense of empowerment, recovery, goal orientation, and self-confidence [151, 154, 187, 316, 376]. There is an evidence-based consensus on the benefits of PSW, particularly for improved well-being [166, 215, 376]. In addition, PSW integrates positive economic impacts regarding recently-discharged patients in terms of reducing length of stay and readmission rate [333, 334, 377, 378].

Although our study did not show a significant effect of the interventions with the problem/symptom subscale, the combined intervention was effective in improving functioning after six months of the study. Given that the physical health and life expectancy of patients with mental illness is often poorer than the general population [379], it is notable that patients who received the PSW service were increasingly reporting better physical health, reduced distress, and better functioning [161, 380]. Fortunately, a number of initiatives, such as HARP and Reclaiming Joy, emphasize achieving better quality of life and functioning in marginalized populations and patients with severe mental illness [151, 162, 168]. In an RCT, PSW were incorporated into a transitional discharge model along with inpatient and community staff support [381]. and the results were promising in terms of improved functionality, quality of life, and readmission rate. This again highlights synergistic effects that may result from a combined service approach in the mental health field, with expected improvement in patients' quality of life, functioning, and hence overall productivity.

Risk Score

Our study showed a significant reduction of risk prevalence after six months in two main arms, TxM and TxM+PSW, which resulted in up to 50% reduction in prevalence. In a comparative study, the authors measured the risk score before and after the introduction of a counselling program to university students [357]. Reported results were promising, with a 22% reduction in the prevalence of the risk. In another study, people who received daily supportive texting messages for three

months (Text4Hope) were less likely to report thoughts of self-harm and suicidal ideation during the COVID-19 pandemic compared to another group that was yet to receive the texts (odds ratio= .59) [374]. This clearly highlights the potential impact of the intervention in reducing the risk of self-harm or other harm among those who were recently discharged from acute psychiatric care.

Our study is not without limitations. Firstly, the sample size was relatively small, particularly after dividing into four study arms. This indicates a need for replication with a larger study. Secondly, COVID-19 hit during our data collection time, so mental well-being and the provided responses of our participants may have been impacted. Thirdly, our measures were self-reported by the participants and not supported by clinical judgement or professional mental health assessment. Finally, the high dropout and/or nonservice provision rates for PSW among the study participants undermined the initial RCT design, forcing us to adopt a controlled observational study with a to-treat analysis rather than the original RCT-based intention-to-treat analysis.

While it was beyond the scope of this study, based on the results of this research, the application of novel interventions seems to be feasible as well as effective. The clinical and economic implications of incorporating PSW and TxM support into routine mental healthcare system could lead to reductions in the rates of readmission and frequent emergency visits. Currently, we have a procedure in place that examines the cost-effectiveness of this initiative moving forward. In this context, the research team has just launched a new research project that involves patients discharged from all acute care units in three of the five health care zones in Alberta [382]. This new mega study aims to examine the feasibility along with the economic impact of incorporating PSW and TxM as part of the routine health services provided to the majority of patients who are discharged from acute psychiatric care in Alberta.

Conclusions

Our study demonstrated that the provision of peer support service plus supportive text messages for six months synergistically contributes to better recovery, increased functioning, and reduction of risk symptoms for patients recently discharged from acute mental health units. Large studies with a rigorous methodology and RCT design are encouraged for future validation of our results.

3.1.3 Quality of Life Assessment after Peer and Text Message Support for Patients Discharged from Psychiatric Care: A Controlled Observational Study

This paper is in preparation for submission to a peer reviewed journal

Introduction

Following discharge from acute psychiatric care (APC), barriers to accessing community mental health support may be detrimental to patient recovery [55]. Post-discharge supports, including peer support services (i.e., pairing a patient with a trained peer with lived experience of mental illness) and texting-based services) can improve patient QoL [383] [384]. We explore the impact of these modalities of service on QoL for patients discharged from APC. We hypothesize that post-discharge supports improve patient QoL, and that participants who did not complete the surveys at all time-points (NATP) will have lower baseline QoL domain scores compared to those who completed the surveys at all time-points (ATP).

METHODS

In this controlled observational study, adult psychiatric participants discharged from hospital were randomized into four conditions: peer support workers (PSW) only, supportive text messages (TxM) only, PSW plus TxM condition (PSW+TxM), and treatment as usual (TAU) [213]. The study had University of Alberta Health Ethics Research Board approval (Pro00078427).

Participants completed surveys at baseline, six weeks, three months, and six months (from June 2019 – September 2020). Surveys included demographic and perceived well-being questions and the short version of the World Health Organization Quality of Life (WHOQOL-BREF, 26 items on a 5-point Likert scale) [385]. The four domains are *Physical Health* (Domain1), *Psychological Health* (Domain2), *Social Relationships* (Domain3), and *Environment* (Domain4). The WHOQOL-BREF has good discriminant and content validity, and test-retest reliability. Higher scores indicate higher perceived QoL [385, 386]

SPSS Version 25 (IBM Corp), descriptive statistics, chi-square (χ^2), and One-Way ANOVA were used to examine baseline data across study groups. Repeated measures MANCOVA was used to

assess the impact of the four study groups' WHOQOL-BREF domain scores, overall quality of life, and perceived general health across three time-points while controlling for baseline scores. Mean domain scores were transformed on a scale (0 - 100) to enable comparisons between domains. Means and standard deviations (SD) were reported. Cases with missing values > 20% were excluded from analyses.

RESULTS

181 individuals were recruited; only 67 participants completed the surveys at all time-points (ATP group). Descriptive and inferential comparisons between the ATP and NATP groups are illustrated in Table 3.1.3.1.

The comparisons in Table 3.1.3.1 revealed higher mean scores reported for ATP at Domain3, *Social Relationships* (m=44.76±26.83; t(176)=2.59, P=.01) and Domain4, *Environment,* (m=65.24±17.51; t_{176}=2.37, P=.02) compared to NATP (m=44.76±26.83) and (m=58.67±18.16), respectively. For other baseline parameters, chi-square and independent t-tests indicated no significant differences between ATP compared to NATP (χ_1^2=0.07 to χ_2^2=5.56, P=.06 to P=.79; t_{176} =0.60, p= .55 to t_{179}=1.78, p= .08).

Table 3.1.3.1: comparison of the baseline characteristics between participants who did not complete all timepoint surveys (NATP) and participants who completed all four timepoint surveys (ATP)

Baseline characteristics n (%)	**NATP** N= 113	**ATP** N= 67	**χ^2 / t value**	**P**
Age (years)	40.1	43.5	t(179)=1.78	.08
Sex recorded at birth Male Female	 50 (43.9) 64 (56.1)	 28 (41.8) 39 (58.2)	χ^2(1)= 0.07	.88
Ethnicity Indigenous European/Caucasian Other	 16 (14.0) 81 (71.1) 17 (14.9)	 9 (13.4) 44 (65.7) 14 (20.9)	χ^2(2) =1.07	.61
Educational Level Less than high school	 23 (20.5)	 6 (9.0)	χ^2(2) =5.56	.06

High school degree or equivalent Above high school education	33 (29.5) 56 (50.0)	17 (25.4) 44 (65.7)		
Employment Status Employed Unemployed	 29 (25.7) 84 (74.3)	 26 (38.8) 41 (61.2)	$\chi^2(1) = 3.42$	.06
Relationship Married/Common Law/ or in relationships Single Divorced/Separated/Widowed	 25 (22.1) 59 (52.2) 29 (25.7)	23 (34.8) 25 (37.9) 18 (27.3)	$\chi^2(2) = 4.38$	.11
Admitting Diagnosis Depression/Anxiety Bipolar disorder Psychotic disorder	 56 (49.1) 33 (28.9) 25 (21.9)	 36 (53.7) 20 (29.9) 11 (16.4)	$\chi^2(2) = 0.83$	.68
RAS domains (mean score, SD)				
Overall Quality of Life	3.21	3.09	t(176)=0.64	.52
General health satisfaction	2.93	2.97	t(176)=0.21	.83
Domain1: Physical Health	53.03	56.63	t(176)=1.12	.26
Domain2: Psychological Health	49.69	51.96	t(176)=0.60	.55
Domain3: Social relationships	44.76	55.22	t(176)=2.59	.01*
Domain4: Environment	58.67	65.24	t(176)=2.37	.02*

*p≤ .05

Table 3.1.3.2 and Figure 3.1.3.1 shows the mean scores of each study arm for WHOQOL-BREF domains and the two general questions for ATP participants across the four time points of the study. Except for Domain3, *Social Relationships,* ($F_{3,63}$=2.88, P=.04 (post-hoc analyses were not significant)), chi-square and One-Way ANOVA indicated no significant differences among baseline parameters for the four study groups (χ^2_3 1.16 to χ^2_3 = .70, P=.25 to P=.94; $F_{3,63}$=0.20-1.51, P=.22 to P=.90).

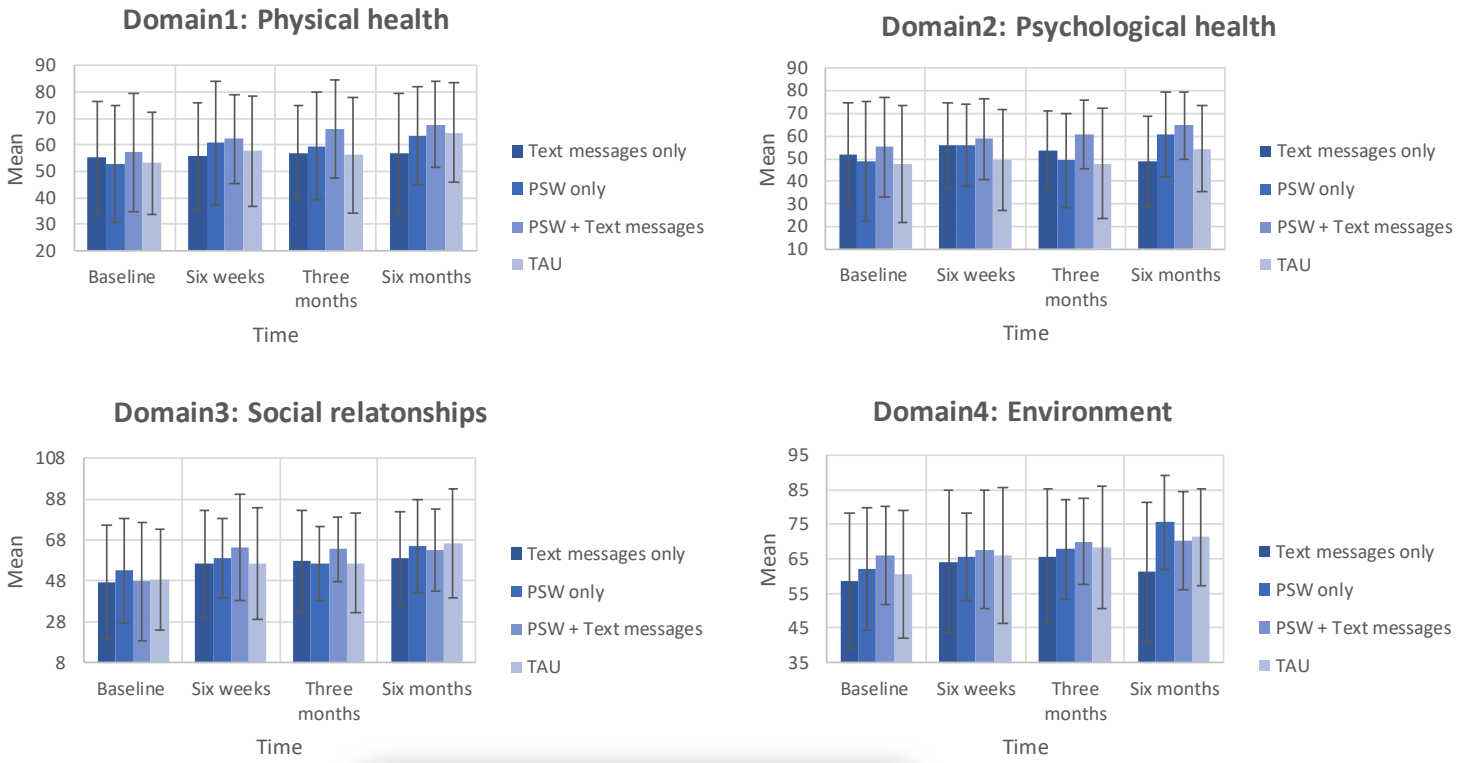
Table 3.1.3.2: WHO QOL-BREF Scale domain transformed scores (0-100) by study condition at baseline, 6th week, 3rd month, and 6th month follow-up for patients who completed the WHO QOL-Bref at all four time-points (mean and SD)

Scale		**TxM only n= 19**		**PSW only n= 13**		**PSW + TxM n= 14**		**TAU n= 21**		**Total n= 67**	
RAS Score	**Time**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
Overall Quality of Life	Baseline	3.11	1.29	3.15	1.463	3.14	1.29	3.00	.95	3.09	1.20
	6 W	3.89	0.99	3.85	.899	3.57	1.16	3.57	1.21	3.72	1.07
	3 M	3.79	1.03	3.77	.927	3.71	1.20	3.62	1.12	3.72	1.06
	6 M	3.74	1.10	3.85	.899	4.21	0.58	3.76	.89	3.87	0.90
General Health satisfaction	Baseline	3.16	1.30	3.08	1.441	2.93	1.39	2.76	1.30	2.97	1.33
	6 W	3.11	1.33	3.08	.862	3.43	1.02	3.38	1.20	3.25	1.13
	3 M	3.16	1.02	3.08	1.320	3.50	1.02	3.05	1.24	3.18	1.14
	6 M	3.47	1.17	3.38	1.044	3.71	0.83	3.90	0.89	3.64	1.00
Domain 1: Physical Health (0-100)	Baseline	60.00	26.38	55.15	24.67	55.43	21.71	55.29	17.59	56.63	22.17
	6 W	57.05	24.04	59.08	22.60	64.50	14.63	60.00	19.37	59.93	20.33
	3 M	58.89	20.17	59.85	22.14	65.43	21.91	53.57	21.57	58.78	21.30
	6 M	62.32	22.31	65.00	18.56	67.93	16.06	64.48	19.42	64.69	19.17
Domain 2: Psychological Health (0-100)	Baseline	59.21	18.83	50.08	26.34	52.86	25.59	45.95	23.99	51.96	23.53
	6 W	56.74	18.55	51.54	18.44	55.86	12.50	49.81	23.10	53.37	18.91
	3 M	56.63	18.75	49.00	22.95	60.93	13.57	49.19	24.64	53.72	20.89
	6 M	55.16	18.92	60.15	19.09	66.21	9.02	54.24	19.50	58.15	17.81
Domain 3: Social Relationships (0-100)	Baseline	63.53	26.06	63.46	25.14	42.00	20.37	51.43	23.34	55.22	24.94
	6 W	62.16	27.90	55.31	16.91	61.71	23.80	58.71	29.82	59.66	25.53
	3 M	60.16	28.53	57.08	16.32	59.43	8.90	57.76	26.40	58.66	22.33
	6 M	62.11	24.08	64.85	23.86	64.64	17.31	66.43	27.21	64.52	23.41
Domain 4: Environment (0-100)	Baseline	64.95	17.79	66.00	20.89	68.07	13.04	63.14	18.55	65.24	17.51
	6 W	62.26	24.01	65.46	11.26	74.71	13.57	70.05	18.50	67.93	18.49
	3 M	67.21	22.78	68.46	15.59	71.14	11.16	70.00	16.97	69.15	17.31
	6 M	63.58	21.77	76.15	14.08	72.36	14.14	70.90	14.17	70.15	16.92

M: mean, SD: Standard deviation

Figure 3.1.3.1: WHO-QOL domain distribution across the four time periods (means with standard error of the mean (SEM))

Figure 2: Error bar graph illustrates means and standard deviations

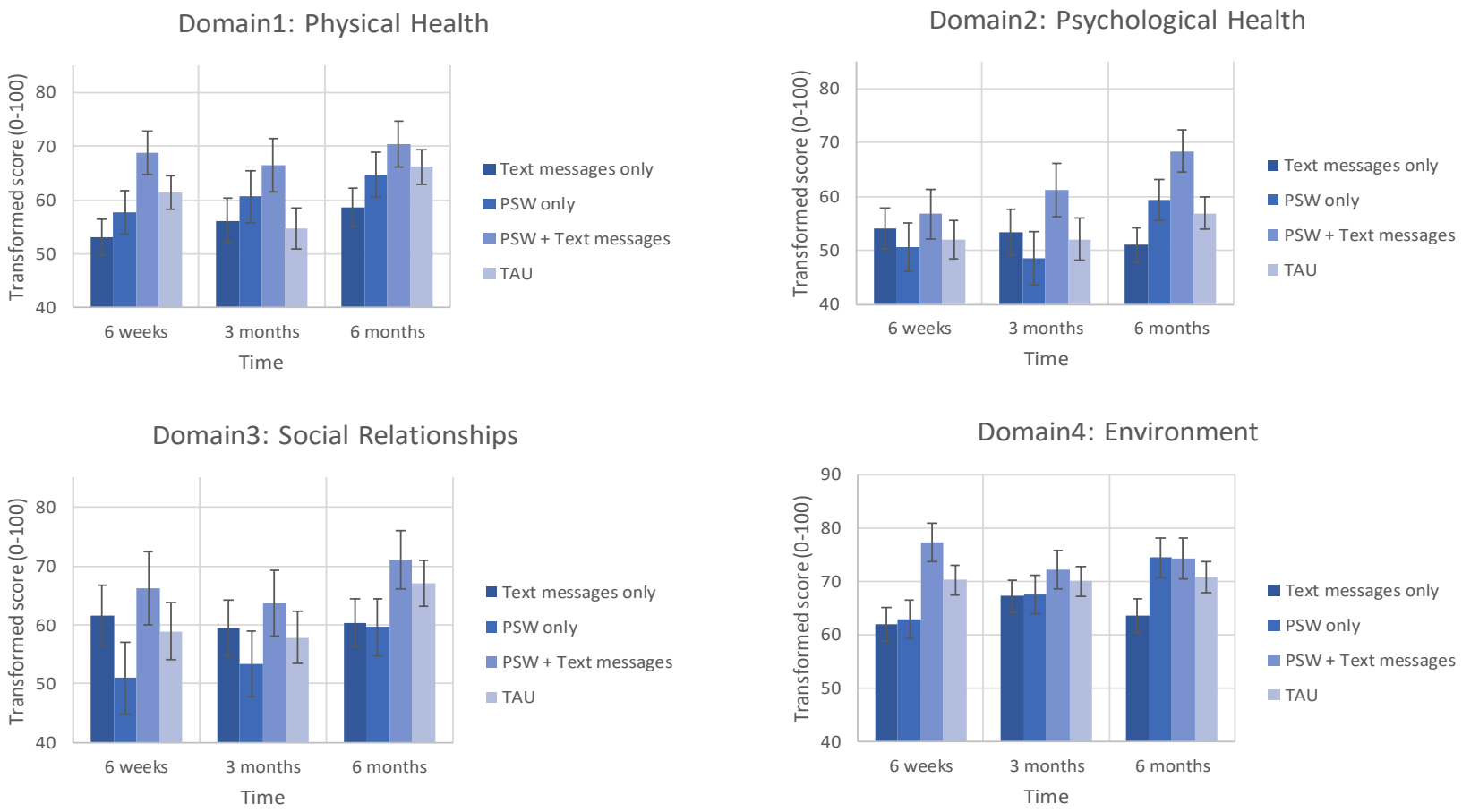


Total number of cases

	Text messag	PSW only	PSW + Text n	TAU
Baseline	N= 56	N= 28	N= 31	N= 63
Six weeks	N= 38	N= 22	N= 26	N= 33
Three month	N= 33	N= 16	N= 22	N= 32
Six months	N= 29	N= 14	N= 18	N= 22

Across the four time points, repeated measures MANCOVA run for ATP participants indicated that neither time (Wilks Lambda = .77, F(8, 52)=1.93, P=.08, ηp_2=.23) nor the intervention group factors (PSW and TxM) (Wilks Lambda = .92, $F_{4,56}$=1.24, P=.30, ηp_2=.08) alone predicted WHOQOL-BREF scale domain scores. although their interaction was a significant predictor (Wilks Lambda = .71, F(8, 52)=2.71, P=.01, ηp2=.29). Post-hoc analysis revealed this interaction was only significant for Domain4 (Environment) (F_2= 3.86, P=.02, ηp2=.06) Figure 3.1.3.2. The interaction between PSW and TxM was predictive of differences in scores on the *Environment* domain4 (F(1)= 4.43, P=0.04, ηp2=.07). Neither interaction between time and interventions nor interventions alone predicted overall QoL or general health satisfaction.

Figure 3.1.3.2: WHO-QOL domain distribution over six-month study period after controlling for baseline scores (adjusted means with standard error of the mean (SEM))



Total	Text messages only	PSW only	PSW + Text messages	TAU
N= 67	N= 19	N= 14	N= 13	N= 21

Discussion

Our study examined the effects of PSW and TxM on QoL on patients discharged from APC. The increase in mean scores from baseline to six months was explained by the interaction between time and intervention. In relation to the hypothesis that support services would improve QoL scores, only Domain 4 had significant changes. Domain 4 entails physical safety and security, financial resources, home environment, health and social care, physical environment, acquiring new information, and participation in leisure activities [385]. Simpson et al. reported similar findings, examining PSW effects on discharged patients [331], with no changes in QoL parameters, with higher QoL in the TAU group. Additionally, as we hypothesized, our NATP group exhibited worse baseline scores for QoL but only in two domains relative to ATP scores. There are some study limitations including low sample size, particularly for participants who completed all time points. The modest effect of the two interventions on QoL may warrant a wide-scale study to confirm this effect. Additionally, the finding that the NATP group had low baseline scores on two QoL domains may need to be further examined against other clinical and health utilization parameters to support better engagement in follow up study questionnaires as well as health services.

3.2 Patients' expectations and experiences with a mental health supportive text messaging program: a mixed-methods evaluation

Shalaby, R., Vuong, W., Eboreime, E., Surood, S., Greenshaw, A. J., & Agyapong, V. I. O. (2022). Patients' Expectations and Experiences With a Mental Health–Focused Supportive Text Messaging Program: Mixed Methods Evaluation. JMIR Formative Research, 6(1). doi:10.2196/33438. Available at: Patients' Expectations and Experiences With a Mental Health-Focused Supportive Text Messaging Program: Mixed Methods Evaluation - PubMed (nih.gov)

This section demonstrates the assessed patients' satisfaction with and acceptability of the received supportive text messages after hospital discharge. This work is published.

ABSTRACT

Background: Web-based services are economic and easily scalable means of support that use existing technology. Text4Support is a supportive complementary texting service that supports people with different mental health conditions after they are discharged from inpatient psychiatric care.

Objective: We aimed to assess user satisfaction with the Text4Support service for a better understanding of subscribers' experiences.

Methods: This is a mixed-method study using secondary data of a pilot observational controlled trial. The trial included 181 patients discharged from acute psychiatric care and distributed into four randomized groups. Out of the four study groups in the initial study, two groups who received supportive text messages (89 patients), either alone or alongside peer support worker (PSW), were included. Thematic and descriptive analyses were used. Differences in feedback based on sex at birth and primary diagnosis was determined through univariate analysis.

Results: Out of 89 participants, 39 completed the follow-up survey yielding a response rate of 40.4%. The principal findings were that Text4Support was well-perceived with a high satisfaction rate either regarding the feedback of the messages or their perceived impact. Meanwhile, there was no statistically significant difference between satisfactory items based on subscriber's sex at birth or primary diagnosis. The initial patients' expectations were either neutral or positive in relation to the expected nature and/or the impact of the received messages upon their mental wellbeing. Additionally, the subscribers were satisfied with the frequency of the messages as provided once daily for six consecutive months. The participants recommended more personalized messages and/or mutual interaction with healthcare personnel.

Conclusions: Text4Support was generally well perceived by patients after their hospital discharge, regardless of their sex at birth or mental health diagnosis. Further personalization and interactive platforms were recommended that may need to be considered when designing similar future services.

Introduction

Recently, there has been rapid adoption of virtual and web-based services in healthcare systems. These services are often highly accessible, remotely delivered, cost-effective, and easy to use [94, 299, 387]. These characteristics make virtual and web-based services appealing and attractive to both healthcare providers and patients.

Wireless and mobile technologies needed to deliver virtual and web-based services have been rapidly expanding. In 2019, there were over 8 billion mobile phone subscriptions and more than 4 billion wireless internet users worldwide [15]. Given this vast reach, the use of these technologies may be beneficial in the area of community mental health where accessibility concerns, service gaps, and high cost of services are often reported [251].

With mobile technologies, text messaging services are increasingly used to serve non-traditional healthcare service functions across different health concerns. For instance, texting services have been used as medical appointment reminders [239] and help encourage patients to adhere to medication use [240]. There are about 400 mobile apps and service programs (e.g., Text2Quit and Quit4Baby) aimed at helping adults and pregnant women with smoking cessation and improving health beliefs and attitudes for new mothers [242, 243, 245, 246]. Similarly, Text4Mood and Text4Hope are examples of mobile text services for mental health. Both programs aimed to help support individuals living with mood disorders and to provide mental health support to the general public during the COVID-19 pandemic, respectively [94, 253].

Text4Support is a service offered by Alberta Health Services, the health authority in the province of Alberta, Canada. This complimentary service began in 2018 to support people living with different mental health conditions [213]. Psychiatrists, psychologists, and mental health therapists developed the cognitive behavioral therapy (CBT) based text message content. CBT focuses on helping individuals manage concerns, primarily by targeting negative beliefs and coping behavior [388].

The purpose of this initiative was to assess user satisfaction and better understand subscribers' experience with Text4Support. Assessment of user satisfaction can lead to better client retention and clinical outcomes [389]. A recent study reported that a 7.2% reduction in the frequency of reporting "at least good overall satisfaction" was associated with a 1% increase in hospital bed occupancy [389]. Similarly, texting and web-based services are widely accepted by individuals

who perceive these services as supportive and acceptable [299, 390]. Overall, examining patients' expectations and experience can help to allocate resources and positive expectations are highly linked to the patient's clinical outcome [391, 392].

A recent evaluation of Text4Support indicates the program is effective and accepted by individuals seeking access to outpatient mental health services in the Edmonton Zone. A large proportion of these subscribers reported frequent reading of the messages (98%) and the majority agreed that the text messages were on topic, to the point, supportive, and positive after six months of receiving the service [247]. In similar research, authors reported higher satisfaction with the texting service among females, who reported improved coping with different stresses related to COVID-19 pandemic along their quality of life, compared to their male counterpart [387]. Additionally, the literature reported high satisfaction related to different mental health conditions, such as psychotic disorder and depression [247, 299, 387]. However, such results based on sex at birth or diagnosis were not significant on all of the assessed items. There is also a dearth of research focusing on satisfaction and acceptability among patients, based on their diagnosis, and in a comparative fashion. This study examines such differences, aiming to provide an additional layer of evidence to the field.

This paper focuses on the experience of inpatients enrolled into Text4Support after their discharge from the mental health units in Edmonton, Alberta. Subscribers were patients with different mental health disorders who received the messages on a daily basis for a six-month period.

Methods

Research goals

(1) To explore and evaluate the experiences of the patients who were recently discharged from the acute care mental health units, regarding the supportive text message service (Text4Support), which they received daily for six-month period.
(2) To explore any difference in satisfaction based on sex at birth or the primary diagnosis of the subscribers

Study design

This was a mixed-methods study with data gathered using patients' key informant interviews and an online survey. The quantitative and qualitative methods were guided by the Checklist for Reporting of Survey Studies (CROSS) [393] and the Consolidated criteria for reporting qualitative research (COREQ) [394], respectively.

Setting and study participants

Data were collected from the subscribers who joined the Text4Support program as part of a controlled observational clinical trial [213] and who received daily supportive text messages for six weeks, using their mobile number for registration. The detailed recruitment process is described elsewhere [249], and would highlight that briefly in here.

The study was conducted at 5 acute psychiatric care units in Edmonton, Alberta, Canada. Patients were invited to participate in the study, from June 2019 to February 2020, before their hospital discharge. The patients' selection criteria were hospitalized patients and imminent to be discharged; 18 to 65 years; having mental health condition other than substance use disorder (mood or psychotic disorder); able to provide written consent; and having mobile handset capable of receiving text messages.

The research team applied a random allocation thereafter to assign the patients into four study arms: (1) peer support worker (PSW) only, (2) Text message (TxM) only, (3) PSW plus TxM condition (PSW+TxM), and (4) treatment as usual (TAU).

For the purpose of this study, we focused upon the two study arms who received TxM service (TxM only and PSW+TxM). The patients received the daily text messages for six months, and the current study will examine the mid-point experience after six weeks of receiving the TxM.

Text4Support background and data collection

Text4Support is a texting mental health service conceived and designed by group of psychiatrists, psychologists, mental health therapists based on the concepts of CBT [320].

- A bank of messages was generated and included eight different streams of messages tailored for the following mental health conditions: depression, anxiety, psychotic

disorders, bipolar disorder, general wellbeing, anxiety, substance use, personality disorder, and adjustment disorder. About 80% of the messages shared a similar content and 20% of the messages were mental health condition specific.

- Consenting participants provided the research team with their mobile number. This number was added to a texting delivery platform so that clients receive daily messages catered to their primary mental health concern.
- Patients received the automated messages with a content aligned with their current areas of diagnosis/concern, every day at 12 noon (Mountain time) for six months.
- A mid-point online satisfaction survey was sent to the patients, six weeks after enrolment in the service

Examples of the messages:

General supportive messages

(1) Think of your recovery as an opportunity to find new solutions in your life.
(2) Remember that the past is gone and what you do is what really matters for depression.

Depression messages

(1) Monitor your mood from on scale from 1-10 with 1 being lowest and 10 highest. Make a note of activities that improve your mood.
(2) When you notice a change in your mood, ask yourself what went through your mind. Did you notice a thought or an image?

Anxiety messages

(1) When you notice an increase in anxiety, pay attention to what triggered it - an interaction, a situation, a memory, a thought, etc.
(2) Make a list of what you're avoiding. Rate how anxious each thing makes you. Do what makes you least anxious and work your way up.

Quantitative data: The (mid-point) satisfaction survey included an adopted version of the Text4Mood user satisfaction survey [94]. The survey takes 5-10 minutes to complete and receiving supportive text messages was not contingent on survey completion.

The survey questions were formulated based on the objectives of the study and the available evidence from peer reviewed literature [94]. The survey consisted of predominately Likert scale responses evaluating sociodemographic and clinical characteristics; subscribers' response to and perceptions of the supportive text messages; and the impact of the program on the subscribers' mental wellbeing. Data collection took place between August 2019 and February 2020. The instrument was not validated but was adopted from surveys used in previous text messaging programs [94, 247, 387]. Participants entered their phone numbers as their unique study identification number, which prevented multiple participation to the study.

Qualitative data: Seven out of 15 randomly selected participants who belonged to the text messaging group and contacted via text messages accepted to participate in a key informant interview via telephone (Table 3.2.1). The interviews lasted between 30 to 45 minutes and were conducted by EE with experience in qualitative research. The interviews were recorded and subsequently transcribed verbatim. The interview questions (Appendix 3.2.1) explored expectations, experiences, anticipated receptivity, and the impact of the daily supportive text messages received for six weeks, from the perspective of the patients who were recently discharged from acute care mental health units in Edmonton hospitals, Alberta, Canada. Data collection took place between August and October 2020.

Table 3.2.1: Demographic and clinical characteristics of the respondents to the qualitative assessment

Participant	Age	Sex	Mental health condition/ diagnoses
P1	37	Female	Depression/Anxiety Disorder
P2	57	Female	Depression/Anxiety Disorder

P3	62	Female	Bipolar Disorder
P4	42	Female	Depression/Anxiety Disorder
P5	57	Male	Bipolar Disorder
P6	47	Female	Bipolar Disorder
P7	52	Male	Depression/Anxiety Disorder

Data analysis

Quantitative data:

Data were analyzed using SPSS Statistics for Windows, version 26 (IBM Corporation) [329]. Demographic characteristics were summarized as raw numbers and percentages. Likert scale satisfaction responses to various aspects of Text4Support service were summarized as frequency counts of response categories and percentages.

We were interested in studying the feedback and satisfaction of the different participants' groups. Thus, we examined each of the 25 questions in the satisfaction survey against participants' sex at birth and admitting diagnosis, using Chi square analysis and Fisher's Exact test with a two-tailed probability for significance, $p \leq 0.05$. There was no imputation for missing data, and the results were based on completed survey responses.

Qualitative data:

Participants' answers to the interview questions were transcribed and analyzed thematically using NVivo 12. Both inductive and deductive approaches were used in the analysis. First, structural coding was used to generate initial codes in line with the specific research questions. Thereafter, pattern coding, which allows identification of explanatory or inferential codes, was applied to the initial codes to identify patterns or emerging themes and subthemes across the dataset. Each individual theme and subtheme were further examined for 'fit' against the collated extracts for each theme, subtheme, and the overall dataset. The final sets of themes and subthemes were reported alongside their verbatim quotes. Due to the nature of the patients' ill health, repeat

interviews, feedback on transcripts and analysis by participants were not sort so as to minimize risk of psychological distress.

Results

I- Quantitative data:

Out of 89 patients allocated into the texting service, we received complete surveys from 36 participants, yielding a response rate of 40.4%.

Table 3.2.2 displays subscribers' demographic characteristics, indicating that most respondents were female (27, 75.0%), aged between 50 and 65 years (10, 27.8%); European or Caucasian (32, 88.9%); reported the completion of post-secondary education (27, 77.1%); were unemployed (15, 41.7%); and were divorced, separated, or widowed (14, 38.9%). The majority had depression and/or anxiety (22, 61.1%).

Table 3.2.2: Demographic and clinical characteristics of study participants.

Characteristic	**n**	**%**	**Total**
Sex at birth			
Male	9	25	36
Female	27	75	
Age groups			
18-24	4	11.1	
25-34	6	16.7	36
35-44	9	25.0	
45-54	7	19.4	
55-64	10	27.8	
Ethnicity			
Indigenous	1	2.8	
White	32	88.9	36
Asian	3	8.3	
Educational Level			
Less than high school	3	8.6	35
High school degree or equivalent	5	14.3	

Above high school education	27	77.1	
Employment Status			
Employed	13	36.1	36
Unemployed	15	41.7	
Other	8	22.2	
Relationship			
Married/Common Law/In a relationship	9	25.0	
Single	13	36.1	36
Divorced/Separated/Widowed	14	38.9	
Admitting Diagnosis			
Depression/Anxiety	22	61.1	36
Bipolar disorder	12	33.3	
Psychotic disorder	2	5.6	

Table 3.2.3 illustrates subscribers' opinions about Text4Support messages after receiving 6 weeks of daily text messages. The data indicate that the majority of respondents always or mostly found the text messages positive (34, 94.5%), affirmative (34. 97.2%), and clear (34, 97.2%). Likewise, more than 80% of respondents indicated that the messages were always or often relevant (30, 88.2%).

Most participants reported that they feel supported when receiving the texts (30, 83.3%); always read the messages (31, 86.1%); and always understand them (28, 87.5%). Generally, most participants were satisfied with the text messages (28, 82.4%), and indicated their preference to receive the text messages once per day (21, 61.8%).

Table 3.2.3: Participants' feedback about Text4Support at six-weeks post-intervention.

Feedback	**n**	**%**
When you received the daily messages, how do they make you feel?		
Supported	30	83.3
Indifferent	4	11.1

Annoyed	2	5.6
How often did you read the messages?		
Always	31	86.1
Mostly	4	11.1
Rarely	1	2.8
How often did you understand the messages?		
Always	28	87.5
Mostly	4	12.5
Rarely	0	0.0
Did you find the Text4Support messages to be positive?		
Always	19	52.8
Mostly	15	41.7
Sometimes	2	5.6
Did you find the Text4Support messages to be supportive?		
Always	22	62.9
Mostly	12	34.3
Sometimes	1	2.9
Did you find the Text4Support messages to be clear?		
Always	23	65.7
Mostly	11	31.4
Sometimes	1	2.9
Did you find the Text4Support messages to be relevant?		
Always	12	35.3
Mostly	18	52.9
Sometimes	4	11.8
How satisfied were you with the frequency of the text messages?		
Satisfied	28	82.4
Neither satisfied nor dissatisfied	5	14.7
Dissatisfied	1	2.9
Ideally, how often would you prefer to receive supportive text messages?		
Once daily	21	61.8

Twice daily	9	26.5
Once every other day	1	2.9
Once weekly	3	8.8

Table 3.2.4 data show that slightly more than three in four respondents indicated that they either read and reflected on the text messages or took positive or beneficial actions after reading the messages (26, 77.4%). No subscribers indicated that they read the messages and took a negative or harmful action. Additionally, the Table 3.2.4 shows the subscribers' level of agreement regarding the benefits of Text4Support and the perceived impact of the messages after receiving daily messages for 6 weeks. The results indicate that four in five respondents reported that the text messages helped them feel connected to a support system (28, 80.0%).

About two-thirds of respondents agreed that the daily text messages helped them cope with stress (22, 62.9%) and loneliness (23, 65.7%); helped them remember their goals (25, 71.4%); feel hopeful that they can manage issues in their life (22, 64.7%); feel like they know how to stay on track when life or everyday stressors come up (23, 65.7%); feel like they are making a change (25, 71.4%) and are making better choices (23, 65.7%); improved the overall mental wellbeing (24, 68.6%); and enhanced their quality of life (22, 62.9%).

Around half of the respondents were in agreement with the questions related to the mood, such as the daily texts helping to monitor my mood (21, 58.3%); know where to get help for depression or anxiety (16, 47.1%); and feel that they could be in charge of managing depression or anxiety (18, 51.4%).

Twenty respondents (57.1%) reported that the daily Text4Support messages helped them feel like they can bounce back upon making a mistake and only 12 respondents (35.3%) reported that the messages helped them to manage suicidal thoughts.

Table 3.2.4: Perceived impact of receiving daily messages for 6 weeks.

Perceived impact of daily messages from Text4Support	**n**	**%**

When you received the texts, what happened next?		
Read text and took a positive or beneficial action	8	23.5
Read text and reflected on the messages	18	52.9
Read the text and took no action	7	20.6
Read text and took a negative or harmful action	0	0.0
Did not read the text	1	2.9
The daily messages from Text4Support helps me to cope with stress.		
Agree	22	62.9
Neutral	10	28.6
Disagree	3	8.6
The daily messages from Text4Support helps me to cope with loneliness.		
Agree	23	65.7
Neutral	6	17.1
Disagree	6	17.1
The daily messages from Text4Support helps me to manage suicidal thoughts.		
Agree	12	35.3
Neutral	16	47.1
Disagree	6	17.6
The daily messages from Text4Support helps me to monitor my mood.		
Agree	21	58.3
Neutral	10	27.8
Disagree	5	13.9
The daily messages from Text4Support helps me to remember my goals.		
Agree	25	71.4
Neutral	6	17.1
Disagree	4	11.4
The daily messages from Text4Support helps me feel connected to a support system.		
Agree	28	80.0
Neutral	5	14.3

Disagree	2	5.7
The daily messages from Text4Support helps me feel hopeful I can manage issues in my life.		
Agree	22	64.7
Neutral	9	26.5
Disagree	3	8.8
The daily messages from Text4Support helps me know where to get help for depression or anxiety.		
Agree	16	47.1
Neutral	12	35.3
Disagree	6	17.6
The daily messages from Text4Support helps me feel that I could be the one in charge of managing depression or anxiety.		
Agree	18	51.4
Neutral	13	37.1
Disagree	4	11.4
The daily messages from Text4Support helps me feel like I know how to stay on track when life or everyday stressors come up.		
Agree	23	65.7
Neutral	7	20.0
Disagree	5	14.3
The daily messages from Text4Support helps me feel like I am making a change.		
Agree	25	71.4
Neutral	6	17.1
Disagree	4	11.4
The daily messages from Text4Support help me feel like I can bounce back if I make a mistake.		
Agree	20	57.1
Neutral	10	28.6
Disagree	5	14.3
The daily messages from Text4Support help me make better choices.		
Agree	23	65.7

Neutral	7	20.0
Disagree	5	14.3
The daily messages from Text4Support help me improve my overall mental wellbeing.		
Agree	24	68.6
Neutral	5	14.3
Disagree	6	17.1
The daily messages from Text4Support help me enhance my quality of life.		
Agree	22	62.9
Neutral	9	25.7
Disagree	4	11.4

The results of Chi-square and Fisher Exact tests did not show significant difference in reporting any of the questions related to the satisfaction with Text4Support service, based on the respondents' sex at birth or admitting diagnosis.

II- Qualitative data:

This aspect of the study was guided by the phenomenological methodological orientation. Thus, we explored how the study candidates make sense of experience with the Text4Support and transform this experience into a worldview [395]. The study candidates were asked about their own experience regarding the text messages they received daily for six months. The outcome results were grouped into two main themes and further three subthemes under each theme (Figure 3.2.1).

Figure 3.2.1: Summative illustration of themes and sub-themes

1) Patients' initial expectations of the program

Prior to subscription to the Text4Support program, the expectations of the program differed among study participants. Whereas some respondents expressed neutrality, not knowing what to expect or whether the program would have any impact on their mental health, others had a positive expectation of their experiences and the impact on their mental health.

"I didn't really know what kind of [supportive] messages they were going to send."- P1

"When I heard about [the Text4Support program], I thought, oh, that'll be good."- P4

One respondent commented that they had expected some form of interactive component to the messaging program.

"Maybe it's something good because somebody is going to check in with you every day or whatever."- P4

2) Patients' experiences with the program

Patients reported varying experiences with the Text4Support program. While the program was perceived positively, some respondents were unsure of the impact of the program on their mental health. The reported experiences are categorized into three sub-themes: timing and frequency of the messages, message personalization, and usefulness of the messages.

(a) Timing and frequency of the text messages

Generally, participants expressed satisfaction with the timing of the supportive text messages, received daily at 12:00 noon. For some employed respondents, such timing aligned with the 'lunch break' and was perceived as a good opportunity to read and reflect upon the messages.

"Well, because [the messages] were [sent] at noon. That was good because you're usually on lunch break or starting your lunch break, so you don't get interrupted at work."-P6

The frequency of the messages was satisfactory to the patients. The regular and consistent nature of the messages seemed to have improved the perception and impact of the program on the mental health of the patients.

"I think that daily message was fine. I think any more would be overwhelming." -P1

"In the beginning [the supportive messages] seemed kind of boilerplate, like it wasn't really something that I could specifically use in my life, [but] as [the program] went on and I got these almost daily messages of techniques and kind of messages of support, I found it very comforting."-P5

(b) Message personalization

Patients expressed their experiences and concerns about the personalization of the supportive text messages. Whereas some patients reported that some of the messages were personally applicable to them, some patients expressed their desire for a more tailored or even interactive program such that it would speak specifically to the patients' mental health condition or to their particular needs. An interactive program, from the patients' perspective, would involve or simulate 'real' persons communicating back and forth with them.

"Some of them [text messages] were very detailed and yes, they applied to me."-P2

"They were very generic and very short and very like non-personal. Um, so that part I thought was useless…if you could have a real person doing it, I know they don't have all day to sit and text you back and forth, but if you had the option to respond, like say they texted, something that was meaningful to your experience or your situation, and then you could interact."-P4

(c) Usefulness of text messages

Patients were very positive about the usefulness and impact of the text messages on their mental health. One patient commented that using text messaging as a medium was advantageous such that they could get the chance to refer and reflect back on the past text messages stored on their phones.

"if I was having like a day where my anxiety was worse, sometimes the message would be—give me a chance to sit and have time to reflect and be present in that. Um, it also just gave me a chance to think outside of my perception of what I'm experiencing and that too."- P1

"Some of [the messages] lifted your spirits or give you direction. They were positive." -P6

Not all patients thought that the messages were helpful. Some commented that the program did not meet their initial expectations. This resulted from the generalized format of some messages. Some believed that more tailored and personalized messages would have been more effective.

"… I think it varies amongst people and their diagnosis [for which] the messages were being sent. Some were maybe applicable to me, some.., maybe not. So, and this also depends on the perception of the person receiving it."- P1

"I was expecting something different other than, well, I got all the text messages, motivational text messages, but I don't know. I don't know if it helped me or not."- P6

Discussion

This study sought to understand the experiences of recently discharged acute care patients with mental health concerns and selected to be Text4Support subscribers. There were two key goals: 1) examine the general experience of Text4Support subscribers, 2) explore the satisfaction differences based on sex at birth and diagnoses.

The principal findings of the study were that Text4Support was well perceived; there was a high satisfaction with the messages and the perceived impact of the messages. However, sex at birth and primary diagnosis did not statistically affect satisfaction. Majority of respondents identified as females, had a high education level, were unemployed, separated or divorced, and of Caucasian ethnicity. These demographic characteristics are common among research respondents who willingly provide feedback and are similar to other texting services [94, 247, 387].

Aligning with previous literature, Text4Support had high satisfaction [94, 247]. Over 80% of subscribers were satisfied and agreed that messages were positive, affirmative, clear, and relevant. Additionally, subscribers felt the messages helped them cope with stress, feel connected to a support system, remember goals, feel hopeful managing life issues, stay on track when life or everyday stressors came up; feel like changes were being made, make better choices. Subscribers also reported improved mental wellbeing and enhanced their quality of life. In the same context, a systematic review of clinical outcomes from mobile phone and web-based text messaging interventions reported that the texting services are praised and well-perceived in the mental health field, adding that texting services have successfully expanded to provide support to diverse psychiatric disorders and during times of crisis [247, 338].

The current study is different from previous Text4Support papers [247]. The study population involves psychiatric patients who are recently discharged from hospital while previous studies examine individuals who are accessing outpatient services and are of lower severity of mental health concerns.

The period lapsing between hospital discharge and the first meeting with a healthcare provider is perceived as critical and detrimental, that the lack of routine post-discharge follow-up care provided can lead to early readmission and frequent emergency visits [55, 59, 60]. Providing help after discharge through supplementary services, such as supportive text messages may help to keep

these patients connected with the healthcare system, especially when the patients are satisfied with the service, and further prevent the undesired outcomes. In general, the satisfaction results were consistent with the literature, whereby most texting services report a high satisfaction, a better sense of life control, physical health, and increased productivity [335, 396], and seemingly regardless of the setting or type of the patient.

Our findings indicate that approximately half of the respondents agreed that daily texts helped them monitor their mood, know where to get help for depression or anxiety, and felt that they could be in charge of managing depression or anxiety. This is a lower proportion than what was reported by Agyapong et al. [94] from subscribers of the Text4Hope program. Lower numbers of people (compared to Text4Hope) are agreeing with 1) text helping monitor mood, 2) where to get help, and 3) feeling in charge of managing depression or anxiety. This may be explained by the different type of service, while Text4Support were supposed to cater to specific types of mental health concerns (thus their population is more complex and have a mental health concern), Text4Hope was a supportive mental health service provided at a crisis time (COVID-19) and the subscribers were members of the general population. Additionally, the COVID-19 pandemic hit at the time of our data collection. This may have imposed excessive psychological burdens, such as stress, anxiety, depression, sleep disorder, and post-traumatic stress disorder symptoms, particularly among those who have underlying mental health conditions [297, 397, 398].

One third of clients self-reported that Text4Support helped them manage suicidal thoughts. In France, an RCT applying Suicide Intervention Assisted by Messages (SIAM), a supportive text messaging service, was designed to keep communication and support for people during the crisis time of suicide [399]. Initial study results revealed that the intervention was promising as it could maintain communication with patients following discharge from emergency department, encourage them to contact healthcare services during crises times, and ultimately prevent repeated suicide attempts. This may reflect a critical role of texting services such as Text4Support in keeping lines of communication and providing positive guidance to the subscribers during such times of vulnerability. Further research may identify the types of patients who could most benefit from the service during times of crisis.

Regarding the results of the secondary outcome, the relationship of satisfaction to sex at birth or to the primary diagnosis of the participants was not significant. From the literature, satisfaction based on respondents' sex at birth or gender usually produces mixed results, while females are more inclined to report to such surveys with positive satisfaction, other research indicated that males also report high rates of satisfaction [397]. In the same context, patients with different mental health conditions, such as psychotic disorder, depression, anxiety, and comorbid alcohol use often report a high satisfaction with mobile mental health services that make them feel in charge of managing their own mental health symptoms [247, 299, 335]. To be better understood, these findings may need to be replicated on a larger sample size and upon successive timepoints to capture such differences based on sex at birth and admitting diagnosis and to track any possible change that evolve over time.

Patients' expectations versus experience

Our results suggests that the initial patients' expectations were either neutral or positive in relation to the expected nature and/or the impact of the incoming text messages on their overall mental health. Additionally, the subscribers were satisfied with the frequency of the messages as was provided once daily, for six consecutive months. Subscribers also recommended and hoped for more personalized messages and/or mutual interaction with healthcare personnel. Future services should consider having ways clients can personalize their text messages. The medium of text messages was perceived as helpful because they could revisit messages anytime since they were stored on their cell phones.

The literature indicates that that majority of the patients often expect clinical improvement after a healthcare intervention, regardless of the service they receive, while a very few may expect no change or even being worse [392]. It was also reported that patients usually build their expectations in relation to the cost and design / customization of the mental health apps, while to a lesser extent, they put an emphasis upon the transparency of these apps [400]. Given that Text4Support was a free service for the end-users; this may have made it more appealing to complement existing healthcare services, as the combined services are usually preferred by patients in the mental health field [247, 392].

Subscribers were satisfied with the frequency of text messages at once per day; similar results were obtained from the Text4Mood service [94]. Receiving more frequent messages may be *overwhelming,* according to one of our subscribers, however, on the other side around a quarter of the participants (26%) reported that they prefer the messages to be received twice daily. This discrepancy may highlight the need for more individualized service that can address the one's preferences in the received service. Our participants additionally expressed their satisfaction with receiving the messages at noon time, which can align with the lunch breaks, that provide them with some time to read and reflect on messages.

Some study participants mentioned that having the text messages saved on the cell phone helped enhance and secure the sense of being able to return to the messages anytime. Additionally, many liked that they could forward the messages to a friend who may benefit from the service. This finding is in line with those of a similar texting service that found over 60% of subscribers reported that they returned to messages at least sometimes [387].

Study subscribers emphasized the importance of individualizing and tailoring text messages. Furthermore, clients recommended the service to be more interactive, which may be more engaging and supportive. It is usually declared that synchronous programs, where a therapist is involved can achieve better clinical outcomes and satisfaction among the subscribers [401]. These services, however, incur extra costs to the healthcare system (e.g., hiring a clinician or a therapist). Furthermore, the therapists may not be available or accessible to support such services, thus cost-benefit analysis is usually approached under such circumstances. Other options were also available, such as use of trained volunteers or conversational AI systems. A recent study applied a two-way interactive texting services for patients with chronic medical conditions and their families [402]. The authors developed a hybrid texting app, using design thinking approach that let the computer convey bulk messages to the patients and the healthcare workers address them and reply with tailored answers either immediately or within 2 days, according to the urgency.

Generally, asynchronous web-based and text-based services have been accepted by an increasing number of individuals, who usually report high satisfaction, easy use, and better control over life activities (85%), while above 90% report increased life productivity after receiving the messages [335, 403]. Additionally, telephone services are frequently associated with a lower attrition rate, compared to face-to-face services, which is likely due to the higher accessibility and the lack of

geographical barriers [404]. This is also important for those who are hesitant to seek medical attention and may be encouraged to join web-based services [404]. This could help keep these patients in contact with the healthcare system.

This study has a number of limitations. First, the small sample size may skew the results and may warrant a larger study that evaluates the service among a larger cohort. in addition, the small sample size means that the study was underpowered which might affect our ability to detect any differences in satisfaction based on biological sex and primary diagnosis. Second, the messages were partially tailored to the primary diagnosis of the patients (only 20% of the messages); this ratio may need to be increased in future services, thus fully meeting the patients' requests for text messages that were personalized to their condition. Third, the results were obtained from two different patient groups, those who received TxM solely and those who received in adjunction PSW; therefore, while it is not highly expected, the PSW may have affected the satisfaction level with the TxM as an outcome of the study. Fourth, we did not compare the quantitative to qualitative responses among the respondents. Lastly, although the questionnaire used in the study was designed based on relevant literature, it was not a validated instrument.

Overall, satisfaction with texting mental health services is well accepted because texting is convenient, low cost, and remotely delivered [387]. According to a systematic review examined 27 studies used mobile apps and SMS messaging, authors reported the usability and feasibility along satisfaction with mobile health services are highly rated by their users [405]. In accord with this finding, we conclude that Text4Support was well perceived by the patients who have received the service for six months after their discharge from the acute care units. The patients recommended some modifications to the service, including further personalization and interactive services, which may be considered in the design of similar future services.

Chapter 4. Closing the treatment gap of mental health care for the general population during the COVID-19 pandemic

This chapter will provide the results and discussion related to the second study: Health System and Community Response to a Text Message (Text4Hope) Program Supporting Mental Health in Alberta during the COVID-19 pandemic.
As articulated in aims and objectives (Chapter 2), for the second study area, we assessed a supportive text message service provided for the general public during the COVID-19 pandemic.

In this area, we assessed the overall prevalence and the predictors of mental health symptoms (section 4.1), and in relation to specific socio-demographic and vulnerable groups (section 4.2), during the COVID-19 pandemic. Additionally, we examined the effectiveness and acceptability of the Text4Hope service over the intervention period and in a comparative analysis to a quasi-non-interventional group (section 4.3).

The Text4Hope program was launched in Alberta during the first phase of the COVID-19 pandemic. On March 23, 2020, the Government of Alberta endorsed the service and encouraged residents of Alberta to subscribe to the program to receive mental health support. By the close of the first week of the service, ending March 30, there were 32,805 individuals subscribed to the service. Data related to this project was collected sequentially, as follows. Data related to the prevalence of different mental health conditions was gathered in the first week of the service (March 23, 2020- March 30, 2020), while data related to the sociodemographic determinants were gathered from the first six-weeks response data (March 23 to May 4, 2020). For the three months outcomes, including PTSD symptoms, the data was collected between 18 June and 19 August 2020. Data related to the first year of the service was provided from March 2020 - March 2021.

The following sections describe our findings in relation to our published/in submission papers.

4.1 Prevalence of mental health symptoms during the COVID-19 pandemic

This section will focus upon the prevalence of the symptoms of the common mental health conditions during the COVID-19 pandemic, including, anxiety, depression, post-traumatic stress disorder, sleep, suicidal thoughts, and obsessive-compulsive disorder.

The following sub-sections describe our findings in relation to our published papers.

4.1.1 Mental Health Outreach via Supportive Text Messages during the COVID-19 Pandemic: One-week Prevalence and Correlates of Anxiety Symptoms

Hrabok, M., Nwachukwu, I., Gusnowski, A., **Shalaby, R.,** Vuong, W., Surood, S., . . . Agyapong, V. I. O. (2021). Mental Health Outreach via Supportive Text Messages during the COVID-19 Pandemic: One-week Prevalence and Correlates of Anxiety Symptoms. Can J Psychiatry, 66(1), 59-61. doi:10.1177/0706743720969384.

Available at https://www.ncbi.nlm.nih.gov/pubmed/33131318

Introduction

Coronavirus disease 2019 (COVID-19) was first reported in December 2019 in China and spread internationally, with significant, unprecedented impacts. In addition to impacts on physical health, threats to psychological health are evident, with around 30% [278] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7874378/ - bibr1-0706743720969384 to 50% [281] of respondents reporting significant anxiety. Research suggests psychological effects of COVID-19 may be more pronounced in certain groups (e.g., female, socially stressed, frontline worker, preexisting psychological disorder) [278]. In this study, we report an estimate of 1-week prevalence rates of anxiety symptoms and correlates in 6,041 individuals in Canada. These data were collected in the context of a baseline survey completed as part of a supportive texting program (Text4Hope) [406], an intervention designed to offer mental health support at a general population level in an expedient, cost-effective, and evidence-based manner [94, 216].

Method

Residents of Canada (primarily Alberta residents) were offered the ability to self-subscribe to supportive text messaging. Messages were aligned with a cognitive behavioral therapy framework, with content collaboratively developed by experts and those with lived experience. At first message, respondents were invited to complete an online survey to capture demographic information and baseline scores on the Generalized Anxiety Disorder 7-item (GAD-7) Scale [94]. This project received ethics approval from the University of Alberta Human Ethics Review Board (Pro00086163). The Text4Hope program was launched in Alberta on March 23, 2020, and data were captured in the first week, ending March 30, 2020, with the data from 32,805 subscribers analyzed and presented in this study. Data were analyzed using the Statistical Package for Social Science Version 26, including descriptive statistics, χ^2 tests, and logistic regression.

Results

The response rate was 18.4% (6,041 of 32,805 individuals). Most respondents were Alberta residents (94%), over 40 years of age (52.0%), Caucasian (82.3%), completed postsecondary education (85.6%), were employed (72.2%), married (71.6%), and owned their home (66.6%). Nearly half (46.7%) reported moderate to severe anxiety.

Univariate analyses indicated that respondents who identified as gender diverse, were aged 25 years or less, Indigenous, had less than high school education, were unemployed, single, and those living with family had a higher likelihood of presenting with moderate to high anxiety compared to respondents with other characteristics within the same demographic group.

The full logistic regression model (see Table 4.1.1.1) containing all significant predictors was significant, $N = 6{,}041$, χ^2 (21) = 380.60, $P < 0.01$, and explained between 8.6% (Cox and Snell R^2) and 11.5% (Nagelkerke R^2) of the variance. This logistic model correctly classified 63.4% of all cases. Five of 7 independent variables (age category, ethnicity, education, employment, and housing status) made unique statistically significant contributions to the model. Age of the respondents made the biggest unique statistical contribution to the model, with a Wald score of 159.9.

Table 4.1.1.1: Logistic Regression Predicting Likelihood of Moderate to High Anxiety.

Predictor	***B***	***SE***	**Wald**	***df***	***P* Value**	**Odds Ratio**	**95% CI for Odds Ratio**	
							Lower	**Upper**
Gender								
Male			5.27	2	0.07			
Female	0.22	0.10	4.93	1	0.03	1.24	1.03	1.51
Other gender	0.42	0.40	1.10	1	0.29	1.51	0.70	3.29
Age (years)								
≤25			159.9		<.001			
26 to 40	−0.34	0.15	5.41	3	.02	1.41	1.05	1.89
41 to 60	−1.18	0.15	58.26		<.001	3.23	2.38	4.35
>60	−1.61	0.22	54.34		<.001	5.00	3.23	7.69
Ethnicity								
Caucasian			19.52	3	<.001			
Indigenous (First Nations, Métis, and Inuit)	−0.21	0.18	1.45	1	.23	1.23	1.1	1.75
Asian	−0.62	0.17	13.78	1	<.001	1.85	1.33	2.56
Other	−0.31	0.12	6.33	1	.01	1.27	1.06	1.72
Education								

Less than high school diploma			13.43	3	<.001			
High school diploma	0.01	0.22	0.00	1	.96	1.10	0.65	1.56
Postsecondary education	−0.28	0.20	1.95	1	.16	0.76	0.51	1.12
Other education	0.88	0.51	2.97	1	.09	2.40	0.89	6.51
Employment status								
Employed			19.1	3	<.001			
Unemployed	0.32	0.10	9.73	1	<.001	1.37	1.13	1.67
Retired	−0.29	0.17	2.90	1	.09	0.75	0.53	1.05
Student	−0.26	0.16	2.54	1	.11	0.77	0.56	1.06
Relationship status								
Married/common law/partnered					.06			
Separated/divorced	0.06	0.13	8.95	4	.61	1.07	0.83	1.36
Widowed	−0.1	0.29	0.26	1	.73	0.91	0.92	1.59
Single	−0.03	0.09	0.12	1	.76	0.97	0.81	1.16
Other	−1.49	8.42	0.10	1	<.001	4.35	1.61	12.5
Housing status								
Own home			12.08	3	<.00			
Living with family	0.06	0.15	0.15	1	.70	1.06	0.79	1.43
Renting	0.21	0.09	6.13	1	.01	1.24	1.05	1.46
Other	0.04	0.41	6.53	1	.01	2.82	1.27	6.25
Constant	0.71	0.25	7.72	1	.01	2.02		

Odds ratios suggested that those who were 26 to 40 years, 41 to 60 years, and those above 60 years of age were about 1.4, 3.2, and 5.0 times less likely to report significant anxiety symptoms compared to respondents who were 25 years or less, controlling for all other demographic factors. Odds ratios for other groups were as follows, in the direction of greater levels of anxiety: female (1.24) compared to male, renting or undefined accommodation (2.8 and 1.24, respectively) compared to living in own home, or unemployed (1.37) compared to employed. Conversely, the following demographic characteristics were associated with less anxiety: Asian and “other”

ethnicity (1.85 and 1.26, respectively) compared to Caucasian and “other” relationship status (4.3) compared to married.

Discussion

One-week prevalence rate estimates of anxiety symptoms during COVID-19 are high in subscribers of the Text4Hope program in Canada, with nearly half reporting moderate to severe anxiety, consistent with previous research [281]. This is especially striking, given that most respondents reported having the benefit of protective social factors including postsecondary education, employment, and home ownership, indicating the widespread effect of the pandemic on the health of the general population despite protective social determinants of health. We also reported a number of sociodemographic correlates of anxiety symptoms, with these results indicating that there are higher risk groups within the general population that represent an important focus for interventions during times of crisis.

In terms of limitations to our study, we did not have prevalence data on anxiety symptoms in the period immediately prior to the COVID-19 crisis. Consequently, we are unable to determine specifically what proportion of anxiety in our study may be attributable to the COVID-19 pandemic. Second, we used a screening instrument, not a diagnostic interview, to estimate anxiety levels. Thus, it is unclear what proportion of the sample was experiencing anxiety symptoms reflective of a transient state related to the pandemic versus clinically significant anxiety disorders. Third, our anxiety estimates may overestimate the anxiety levels of the general population because we sampled those who self-subscribed to a texting intervention; thus, the respondents may have been experiencing higher levels of anxiety than a random sample of participants.

4.1.2 Prevalence and Demographic Correlates of Major Depressive Disorder Symptoms in Alberta during the COVID-19 Pandemic

Introduction

In December 2019, an outbreak of pneumonia emerged in Wuhan, Hubei province, China [18]. Shortly after, it spread beyond China to become an international threat and global health emergency [19]. A zoonotic RNA-virus known as SARS-CoV-2 was identified as the causative agent for the resultant disease named coronavirus disease (COVID-19) by the World Health Organization (WHO) [19] [20]. By the second half of March 2020, most countries reported cases of COVID-19 and by March 23, 2020 (the date of data collection) 332,930 cases were confirmed globally, with 14,509 associated deaths confirmed by the WHO [22].

The COVID-19 pandemic resulted in strict health recommendations, precautions, and the modification and creation of laws [23]. These measures included physical distancing, enhanced hand hygiene and disinfection protocols, self-isolation and quarantining, travel restrictions, and the closure of public schools and non-essential businesses [24].

Major depressive disorder (MDD) is a well-known health concern and public health problem. Its multi-year global prevalence exceeds 4.4%, resulting in an estimated 322 million people living with MDD [366]. Depression alone is perceived as the single largest contributor to non-fatal health loss, with an estimate of over 50 million years lost with disability by 2019 across the globe [366].

The COVID-19 pandemic raised serious concerns regarding the psychological well-being of Canadians, and particularly the mental health of Alberta residents, where economic pressures are high [407] and people are yet to recover from another recent natural disaster. In 2016, Alberta endured a major wildfire in and around Fort McMurray, acquiring the name of “The Beast” that devoured several thousand kilometers of land, damaged more than 2,000 buildings, forced the evacuation of thousands, and was the most expensive natural disaster endured by Canada in pre-COVID-19 history [408]. The Fort McMurray disaster left many Albertans traumatized, with higher rates of moderate to severe depressive symptoms for as long as 18 months following the crisis that was quite prominent in young adolescents [409] and people with a previous history of depression [408].

The COVID-19 pandemic is expected to follow a similar trajectory and result in psychological stresses that might generate or aggravate several underlying depressive symptoms among the

general public. These include loss of pleasure in usual activities, feeling blue or gloomy, and a loss of a sense of meaning in life [410] [289]. Fear of contracting infection, anxiety [411] [309], isolation, grief, and loss are also common experiences [412]. In previous large-scale pandemics, high prevalence gave rise to stigmatization of individuals who were infected, had contact with those affected with a communicable disease or who had returned from affected places [411] [412] [413]. Loss of jobs, small business closures, and travel restrictions exacerbate psychological stress, and, in association with these factors, there is greater insecurity due to financial uncertainty [412] [414]. Arising from this challenging context, it is clear that threats to psychological well-being and depressive symptoms may be increasingly prevalent during the global COVID-19 pandemic.

In a naturalistic clinical trial to combat mental health consequences and to support and better understand the depressive symptoms of Albertans during the COVID-19 pandemic, we launched a novel technology-based program known as Text4Hope in partnership with our regional health services provider, Alberta Health Services (AHS).

Text4Hope was designed to monitor and help individuals maintain mental health wellness and promote psychological resilience through online texting services that promote healthy coping mechanisms and help to alleviate the associated stress, anxiety, and depressive symptoms among subscribers during the COVID-19 pandemic [415].

Similar platforms with mobile-based supportive texting have proven to be effective interventions for mental health disorders, such as MDD [318], and alcohol use disorder [216] [217]. Mobile-health interventions are scalable, convenient, and relatively inexpensive. In addition, they can strengthen the sense of self-control and connection individuals feel with the health care system, improving treatment adherence and facilitating geographically-independent monitoring of chronic conditions [94] [338].

The aim of our study was to assess and quantify the prevalence of the likely MDD among people living in Alberta during the early phase of the COVID-19 pandemic in Canada, using a web-based screening survey via the Text4Hope platform.

Materials and Methods

Study Design and Ethics Approval

This study is an online cross-sectional (prevalence) survey with quantitative methodology. Data were derived from categorical responses on a wide-scale survey questionnaire. Ethics approval has been granted by the University of Alberta Health Research Ethics Board (Pro00086163).

Study Participants and Data Collection

A self-administered questionnaire capturing sociodemographic data and baseline scores on the Patient Health Questionnaire-9 (PHQ-9) scale [416] was administered over a one-week period, starting at 4 pm on March 23, 2020 and ending by 4 pm on March 30, 2020. The questionnaire was delivered as part of a wide-scale baseline survey used at the launch of Text4Hope.

Text4Hope is a mobile-based program introduced by AHS to Alberta and Canadian residents, in partnership with the University of Alberta and other health organizations during the COVID-19 pandemic [415]. Self-subscription to the program occurred through cell phones, by texting "COVID19Hope" to a short code number in order to receive daily supportive text messages at no cost to the recipient over a three-month period. Messages were designed using a cognitive behavioural therapy (CBT) framework by AHS psychiatrists and mental health therapists including authors of the study (VA, MH).

The first welcome message includes a voluntary survey to gather demographic, clinical, COVID-19, and self-isolation related data. No incentives were offered and receiving text messages was not dependent on completing the survey. Survey questions were programmed into Select Survey, an online survey tool.

Study Measure

The PHQ-9 is a 9-item validated instrument (associated with a Cronbach's alpha of 0.89) which is used to diagnose and measure the severity of depression in general medical and mental health settings. Each of the 9 questionnaire items is scored between 0 (not at all) to 3 (nearly every day). Higher scores on the scale indicate higher levels of depression (24). The PHQ-9 demonstrated good convergent validity with related constructs with an adequate internal consistency [417].

Statistical Analysis

Almost all collected sociodemographic variables were categorical and included: gender, age categories, ethnicity, education level, relationship status, employment status, and housing status. Age was a continuous variable, where descriptive analysis was also provided. For the purpose of analysis, responses for some variables were pooled into fewer categories to better address the data set (e.g., employment status was initially gathered as 15 responses that were further collapsed into four main categories (Employed, Unemployed, Retired, and Student).

The PHQ-9 provided a total score (0-27) and a five-category variable (minimal depression, mild depression, moderate depression, moderately severe depression, and severe depression). This was later collapsed into two categories; "at most mild depression" (score: 1-9) and "moderate to severe depression" (score: 10-27) for the purpose of analysis.

Descriptive and inferential analyses were processed using the IBM Statistical Package for Social Sciences (SPSS) for Windows, version 26[418]. Sociodemographic response data were plotted against respondents' age categories (i.e., 25 years or less, 26-40 years, 41-60 years, and above 60 years) and are represented as frequencies and percentages (Table 4.1.2.1). We examined the statistical association between each sociodemographic variable and the PHQ-9 categorical variable through univariate analysis with chi-square (Table 4.1.2.2). A logistic regression was run using the socio-demographic variables that showed significant associations in the chi-square model. Spearman correlation coefficients calculated prior to performing the logistic regression, and $r_s \geq 0.7$, suggested multicollinearity existed among the independent variables. Prediction of the likelihood to develop moderate to severe depressive symptoms (PHQ-9 variable) among respondents was reported using odds ratio (OR) and confidence interval measures for each independent variable, controlling for other variables in the model (Table 4.1.2.3). Likelihood to develop MDD was measured as an overall percentage and a range over the survey time-period.

We presented results in frequencies and percentages, and a two-tailed significance value of 0.05 was set as the criterion for statistical significance. Individual responses were deemed incomplete when > 60% of responses were missing and were excluded from the analysis. We ran pairwise deletion analysis for the other missing responses with no imputation.

Results

Overall, 6041 individuals completed the baseline questionnaire out of 32805 who had subscribed in the first week to Text4Hope, yielding an 18.4% response rate. Likelihood to develop MDD in the first week of the survey was 41.3%, starting at 39.7% at the first day of the study, and reaching up to 47.2% towards the end of the survey.

Descriptive frequencies of the sociodemographic data identified by different age group categories are illustrated in Table 4.1.2.1. Respondent age ranged from (11 – 80) years, median age was 41 years and interquartile range was (32 – 52) years.

Table 4.1.2.1: Age Distribution of Demographic, Clinical, and Other Characteristics of Respondents.

Variables	Overall N (%)	≥25 y N (%)	26-40 y N (%)	41-60 y N (%)	> 60 y N (%)
Gender					
Male	720 (12.3)	74 (10.3)	247 (34.3)	308 (42.8)	91 (12.6)
Female	5091 (86.9)	550 (10.8)	1905 (37.4)	2213 (43.5)	423 (8.3)
Gender Diverse	49 (0.8)	15 (30.6)	21 (42.9)	11 (22.4)	2 (4.1)
Ethnicity					
Caucasian	4825 (82.6)	464 (9.6)	1745 (36.2)	2152 (44.6)	464 (9.6)
Indigenous	198 (3.4)	28 (14.1)	90 (45.5)	72 (36.4)	8 (4.0)
Asian	293 (5.0)	58 (19.8)	137 (46.8)	93 (31.7)	5 (1.7)
Other	528 (9.0)	87 (16.5)	194 (36.7)	211 (40.0)	36 (6.8)
Education					
Less than High School Diploma	212 (3.6)	123 (58.0)	46 (21.7)	31 (14.6)	12 (5.7)
High School Diploma	564 (9.6)	116 (20.6)	176 (31.2)	213 (37.8)	59 (10.5)
Post-Secondary Education	5028 (85.8)	395 (7.9)	1929 (38.4)	2265 (45)	439 (8.7)
Other Education	54 (0.9)	5 (9.3)	18 (33.3)	26 (48.1)	5 (9.3)
Employment status					
Employed	3658 (72.3)	161 (4.4)	1564 (42.8)	1793 (49.0)	140 (3.8)
Unemployed	696 (13.7)	130 (18.7)	262 (37.6)	272 (39.1)	32 (4.6)
Retired	390 (7.7)	0 (0.0)	0 (0.0)	102 (26.2)	288 (73.8)
Students	318 (6.3)	231 (72.6)	72 (22.6)	15 (4.7)	0 (0.0)
Relationship status					
Married/Cohabiting/Partnered	4212 (71.9)	334 (7.9)	1657 (39.3)	1891 (44.9)	330 (7.8)
Separated/Divorced	430 (7.3)	6 (1.4)	85 (19.8)	264 (61.4)	75 (17.4)
Widowed	89 (1.5)	0 (0.0)	4 (4.5)	38 (42.7)	47 (52.8)
Single	1073 (18.3)	289 (26.9)	408 (38.0)	321 (29.9)	55 (5.1)
Other	52 (0.9)	8 (15.4)	17 (32.7)	18 (34.6)	9 (17.3)
Housing status					
Own Home	3843 (66.7)	68 (1.8)	1294 (33.7)	2053 (53.4)	428 (11.1)
Living with Family	542 (9.4)	349 (64.4)	137 (25.3)	47 (8.7)	9 (1.7)
Renting	1320 (22.9)	205 (15.5)	693 (52.5)	366 (27.7)	56 (4.2)
Other	56 (1.0)	7 (12.5)	16 (28.6)	29 (51.8)	4 (7.1)
Total N (%)		640 (10.9%)	2174 (37)	2539 (43.3)	517 (8.8)

Univariate Analysis

The association between all sociodemographic variables and the likelihood of moderate to high depressive symptoms (MHDS) is illustrated in Table 4.1.2.2.

Except for ethnicity, all demographic characteristics showed significant association ($p \leq 0.05$) with the likelihood of MHDS. For example, over 60% of the respondents reported likely MHDS in the following subgroups: under 26 years, less than high school diploma, and dwelling with family.

Table 4.1.2.2: Chi-Squared Test of Association Between the Demographic Antecedents and Likely MDD.

Variables	Likely MDD number (%)	P-value
Gender		
Male	228 (37.3)	
Female	1874 (41.8)	**.012**
Gender Diverse	27 (56.2)	
Age (Years)		
≤25	351 (63.5)	
26 - 40	916 (48.6)	**.000**
41- 60	734 (33.5)	
> 60	104 (23.0)	
Ethnicity		
Caucasian	1760 (41.0)	
Indigenous	84 (47.2)	.293
Asian	89 (39.6)	
Other	191 (43.3)	
Education		
Less than High School Diploma	113 (64.2)	
High School Diploma	248 (51.2)	**.000**
Post-Secondary Education	1749 (39.3)	
Other Education	19 (45.2)	
Employment status		
Employed	1255 (39.3)	
Unemployed	368 (60.5)	**.000**
Retired	77 (21.6)	
Students	158 (55.1)	

Relationship status		
Married/Cohabiting/Partnered	1390 (37.5)	
Separated/Divorced	192 (49.2)	**.000**
Widowed	31 (36.9)	
Single	503 (54.5)	
Other	12 (28.6)	
Housing status		
Own Home	1149 (33.8)	
Living with Family	295 (61.8)	**.000**
Renting	644 (54.0)	
Other	23 (51.1)	

Logistic regression

Spearman correlation analysis were run on the six significant sociodemographic variables from the chi-square model (gender, education level, employment status, relationship status, and housing status). r_s values ranged from (r_s = .00 to r_s = .37) and did not reveal any evident collinearity among the independent variables. Therefore, binomial logistic regression was run to ascertain the effect of all six independent variables on the likelihood of participants to have MHDS.

The model containing the six predictors was statistically significant, X^2 (18) = 389.88, p < 0.00 and could explain 11.60 % of the variance in the likelihood that respondents will present with MHDS. The model accurately classified 64% of all cases.

Table 4.1.2.3: Logistic Regression Predicting Likelihood for Respondents to Present with Moderate to High Depression.

Variables	**B**	**SE**	**Wald**	**df**	**P-value**	**Odds Ratio**	**95% CI for Odds Ratio**	
							Lower	**Upper**
Gender								
Male			4.554	2	.103			
Female	.181	.099	3.388	1	.066	1.199	.988	1.455
Gender Diverse	.573	.393	2.125	1	.145	1.774	.821	3.834
Age (Years)								
≤25			76.159	3	.000			

26 - 40	-.223	.142	2.479	1	.115	.800	.606	1.056
41 - 60	-.790	.149	28.035	1	.000	.454	.339	.608
> 60	-1.145	.215	28.305	1	.000	.318	.209	.485
Education								
Less than High School Diploma			13.282	3	.004			
High School Diploma	-.021	.222	.009	1	.924	.979	.634	1.512
Post-Secondary Education	-.374	.201	3.446	1	.063	.688	.464	1.021
Other Education	.015	.457	.001	1	.973	1.016	.415	2.487
Employment status								
Employed			40.592	3	.000			
Unemployed	.557	.099	31.492	1	.000	1.746	1.437	2.121
Retired	-.264	.176	2.255	1	.133	.768	.544	1.084
Students	-.156	.161	.940	1	.332	.856	.624	1.173
Relationship status								
Married/Cohabiting/Partnered			32.412	4	.000			
Separated/Divorced	.573	.124	21.364	1	.000	1.774	1.391	2.262
Widowed	.086	.280	.094	1	.759	1.090	.630	1.885
Single	.268	.090	8.892	1	.003	1.307	1.096	1.559
Other	-1.074	.493	4.749	1	.029	.342	.130	.898
Housing status								
Own Home			30.330	3	.000			
Living with Family	.397	.149	7.108	1	.008	1.487	1.111	1.990
Renting	.406	.083	23.803	1	.000	1.501	1.275	1.767
Other	1.085	.391	7.684	1	.006	2.959	1.374	6.371
Constant	.069	.251	.076	1	.783	1.072		

Table 4.1.2.3 shows that except for gender, all other sociodemographic factors significantly predicted the likelihood to have MHDS in this model (age category, education level, employment status, relationship status, and housing status). The largest contribution was made by age, with a Wald statistic of 76.20. Participants who were 25 years or under were more likely to develop MHDS than individuals aged 41 - 60 years or above 60 years, with (OR: 2.2, 95% CI: .34-.608)

and (OR: 3.10, 95% CI: .21-.49), respectively, controlling for all other contributing factors in the model. Further analysis was run suggesting that individuals 25 years or under were 1.5 times more likely to report depressive symptoms than all other age categories in the same model (OR: 1.50, 95% CI: 1.14-2.00).

Conversely, people who identified as married, cohabiting or partnered were less likely to show symptoms early in the COVID-19 crisis, compared to all other categories except for "Other" who were 3 times less likely than married, cohabiting or partnered individuals to develop MHDS (OR: 0.72, 95% CI: .62-.84).

Likewise, compared to employed individuals, participants who identified as unemployed had an elevated risk for depressive symptoms (OR: 1.70, 95% CI: 1.44-2.12), while students and retired participants showed a lower, albeit not significant risk.

Regarding housing status, respondents who reported living with family or renting their home each demonstrated a 1.5 times greater likelihood to show MHDS in the early days of the pandemic than people owning homes (OR: 1.5, 95% CI: 1.11-2.00) and (OR: 1.50, 95% CI: 1.28-1.77), respectively. Similarly, people who responded as "Other" were 3 times more likely to demonstrate MHDS than respondents who owned their home, controlling for the other sociodemographic variables in the model (OR: 3.00, 95% CI: 1.37-6.37). Overall, participants who owned homes were less likely to present with MHDS in the early days of COVID-19 (OR: .66, 95% CI: .56-.77), compared to the rest of the respondents.

Finally, the reported education level accounted for less of the variance in the model (Wald statistic of 13.30), where participants with less than high school diploma exhibited a non-significant, mostly higher, likelihood of developing MHDS than the other educational categories.

Discussion

This online survey revealed the significant likelihood of depressive symptoms in the general population surveyed during the early days of the COVID-19 pandemic. In our large sample, more than 40% of participants expressed a likelihood of MHDS. By March 22, 2020, one day before launching the survey, Alberta recorded 259 positive COVID-19 cases [419], and two days after, declared the first COVID-19-related death [420]. Later, and by March 29, 2020, one day prior to closing the survey, the media had reported a greater than 2-fold increase in the number of cases

and three COVID-19-related deaths [421]. In this regard, the figures for psychological burdens, especially MDD symptoms, were expected to soar. This is in line with our findings, where the MDD prevalence demonstrated a steadily daily increase over the days of the survey.

Our findings are consistent with previous literature. For example, in China, an online survey ran from January 31 to February 2, 2020, to identify the psychological burden after the COVID-19 epidemic began [410], in which 16.5% out of 1,210 respondents reported moderate to severe depressive symptoms. In the two wildfire crises of California in 2003 and Fort McMurray in 2016, the prevalence of MDD was approximately one third (33%) among survivors; both three and 18 months after the wildfire, respectively [408] [289]. Similarly, in a survey completed by quarantined individuals in Toronto during the severe acute respiratory syndrome (SARS) epidemic (2003), 31% of the respondents reported depressive symptoms [422]. In a survey of health care providers in Wuhan city, the number of frontline health care providers with depressive symptoms is estimated at 50.4%, with correlates including nursing profession and female gender [423]. Compared to the frontline physicians, first responder nurses were more likely to develop behavioural disengagement with less planning abilities during similar epidemics, which were highly associated with aggravating levels of depression [424] [425]. This may be due to stress and fear of contracting the infection or spreading it to their families along with the perceived stigma and a sense of uncertainty [423].

While females comprised most of our survey respondents (86.9%) and showed a relatively higher likelihood to report likely MHDS than their male counterparts, gender did not significantly predict the development of depressive symptoms. This is in accord with a meta-analysis done on 90 prevalence studies for MDD, concluding that, while developing depression could be skewed more towards the female gender, no significant difference based on gender was elicited, and rather it might be completely nullified after one-year prevalence of depression [426]. Similar results were obtained with the prevalent MDD after the major crisis of the Fort McMurray wildfire [408]. Although young adults (≤ 25 years) were underrepresented in our cohort sample, they demonstrated a striking vulnerability to develop depressive manifestations during the current pandemic. Young people are usually regarded as able to express more grief, depression, and anxiety during epidemic crises, especially when they are involved in the care of affected individuals [411]. Again, younger people were prone to self-report depressive symptoms more often than older individuals [427] [428]. Given the fact that almost half of people with depression usually do not seek medical attention [429], self-rating tools are possibly more likely to capture

such depressive symptoms at an earlier stage. It is quite possible that the literature-reported estimates may be low due to under-reporting through clinicians' assessments [426].

While Alberta enjoyed the lowest pre-COVID-19 unemployment rates in patients with depression disorder at 13.2% compared to the national Canadian rate of 30.3%, unemployment rates are still expected to be high in people with depression. [430]. In the same study, both higher age and being a female were identified as high-risk categories. This partly matches with our results, where the majority (86.3%) of unemployed respondents in our survey were females, however, unemployed people had a lower mean age compared to employed respondents at 38.7 years versus 42 years, respectively [430].

In accordance with our findings, individuals with less education were more likely to demonstrate likely MHDS during the COVID-19 pandemic in China compared to highly educated respondents, respectively [410]. In contrast with our results, however, students in the same study were more prone to express MHDS risk during the pandemic [410]. In consideration with the fact that the youngest group of respondents (≥ 25y) in our study showed a high likelihood to develop likely MHDS, it seems that students may not be necessary belonging to this age group, however, they may be of older ages.

Being lonely and lacking emotional support has significantly been associated with developing depression. Social isolation itself was found to be 11.5 times more likely to be accompanied with likely MHDS [431] [432]. In addition, marriage can act as a supportive tool, as marriage/couple therapy is regarded as a viable tool in achieving recovery for outpatient women with depression [433], in postpartum depression [434], and might reduce service utilization and related costs [435]. Likewise, married people were deemed to be less likely to present with MHDS in our sample survey compared to all other relationships. However, this finding was not supported in other studies undertaken during similar crises like the Fort McMurray wildfire, the SARS epidemic, and the study of COVID-19 in China, where no difference was elicited based on marital status [408] [410] [422].

In conclusion, the current study provides the results of an online survey used alongside a supportive texting service to capture data related to the major depressive disorder symptoms during the COVID-19 pandemic. COVID-19 has been a social stressor that has negatively impacted psychological health, resilience, and coping capacity, aspects that become more challenging under the current restrictive regulations. Results of our survey identified several sociodemographic factors that significantly predicted the likelihood to develop MHDS with an accuracy of 64%.

Further research is required to understand the long-term impacts of the pandemic on the general public and other vulnerable groups such as young and socially disadvantaged populations. Additionally, the results of the present and the related studies [253, 374, 436] indicate that, during global public health emergencies, innovative and cost-effective interventions such as supportive text messaging could be useful for collecting population data [34-36, 437-440] as well as addressing the psychological burden at population level.

4.1.3 Prevalence, Demographic, and Clinical Correlates of Likely PTSD in Subscribers of Text4Hope during the COVID-19 Pandemic

Shalaby, R., Adu, M. K., Andreychuk, T., Eboreime, E., Gusnowski, A., Vuong, W., . . . Agyapong, V. I. O. (2021). Prevalence, Demographic, and Clinical Correlates of Likely PTSD in Subscribers of Text4Hope during the COVID-19 Pandemic. *Int J Environ Res Public Health, 18*(12). doi:10.3390/ijerph18126227.
Available at https://www.ncbi.nlm.nih.gov/pubmed/34207537

Abstract:

Background: During the COVID-19 pandemic, people may experience increased risk of adverse mental health, particularly post-traumatic stress disorder (PTSD).

Methods: A survey measured stress, anxiety, depression, and PTSD symptoms in Text4Hope subscribers using the Perceived Stress Scale, Generalized Anxiety Disorder 7-Item Scale, Patient Health Questionnaire-9, and PTSD Checklist for DSM-5 Part 3, respectively. A Chi-square test and multivariate logistic regression were employed.

Results: Most respondents were 41–60 years old (49.5%), Caucasian (83.3%), with post-secondary education (92.1%), employed (70.3%), married/cohabiting/partnered (64.9%), and homeowners (71.7%). Likely PTSD was reported in 46.8% of the respondents. Those who were afraid to contract the coronavirus had a history of depression before the pandemic, and those who received counselling during the pandemic exhibited a high prevalence of likely PTSD (OR (1.7 to 2.2)). Significant lower odds of likely PTSD were observed among subscribers who received absolute support from family/friends.

Conclusions: This paper presents findings on the prevalence of likely PTSD and identified vulnerable groups during the COVID-19 pandemic. Our results support the proposal that public health advice should incorporate mental health wellness campaigns aiming to reduce the psychological impact of pandemics.

1. Introduction

Post-traumatic stress disorder (PTSD) is defined as "the development of symptoms related to intrusion, avoidance, negative alterations in cognitions, mood, and arousal and reactivity following exposure to a traumatic event" [441]. Such events may include natural disasters, a serious traffic accident, terrorist act, conflict, or sexual assault, among others [442]. The defining attribute of a traumatic incident is its ability to elicit fear, helplessness, or horror in response to the threat of possible injury or death [443]. Thus, a patient must have experienced
such event(s) and presented with symptoms such as reliving the event and avoiding stimulus reminders (triggers) of the event for about four weeks, to be diagnosed with PTSD [441].

Universal population studies indicate that 28% to 90% of people in high-income countries have been exposed to at least one traumatic event in their course of life; the most frequent events are unanticipated bereavement, road traffic accidents, and physical assault [444, 445]. Despite this high exposure to stressors, the prevalence of PTSD ranges from 1.3% to 8.8% [446].

PTSD can occur in people of any ethnicity, nationality, or culture, and at any age. PTSD affects approximately 3.5% of U.S. adults every year, and an estimated 1 in 11 people will be diagnosed with PTSD in their lifetime; women are twice as likely as men to have PTSD [441]. According to the Government of Canada, three in four Canadians are at risk of exposure to one or more events throughout their lifetime that may lead to PTSD [447]. The latest estimated prevalence of lifetime PTSD is 9.2%, while the current prevalence (past month) was estimated at 1.7%, with an expectant higher risk reported among Indigenous people, refugees, and the LGBTQ2S+ community [447, 448].The outbreak of the Coronavirus Disease-19 (COVID-19), which was first identified in Wuhan (China) in December 2019, was declared to be a global pandemic that constitutes a public health emergency of international concern by the World Health Organization (WHO) in early 2020 [449]. There were about 77.9 million documented infections and 1.79 million deaths worldwide as of 22 December 2020 [450, 451]. The COVID-19 pandemic presents some characteristic features that increase vulnerability to mental health problems including PTSD. It has been shown that PTSD could result from the news of unprecedented numbers of seriously ill patients, the uncertainty of the course of the disease, high mortality rates, and the absence of a definitive treatment [450, 452]. The experiences faced by severely ill COVID-19 patients in the form of symptoms of extreme stressors, including fear of eminent death from the threatening illness, the feeling of loss of control, and the pain associated with medical interventions such as endotracheal

intubation [453], constitute the first diagnostic criterion for PTSD [454, 455]. Pandemic-associated psychological trauma and related PTSD are not limited to survivors of COVID-19. Frontline healthcare staff and relatives who had a family member die as a result of COVID 19 may also have developed some form of PTSD from witnessing other traumatic events, as was reported with previous coronavirus epidemics, such as the Middle East respiratory syndrome (MERS) and the severe acute respiratory syndrome (SARS) [456, 457]. With respect to these epidemics, close to 42% of survivors developed PTSD after a year, with similar population figures remaining above the cut-off up to four years post-pandemic [457]. The factors impacting PTSD are quite diverse, including sociodemographic factors and the pre-existing mental health conditions, among others. Being a female or of a relatively younger age were both perceived as a significant risk for developing PTSD, particularly when comorbid with depression [453]. Similarly, among the different ethnicity groups, minorities (non-white) people in the USA were described to be at more at risk to experience PTSD, with less of a likelihood to seek treatment support, either by visiting doctors, counsellors, or going to hospitals, compared to white people [444]. Likewise, pre-morbid depression and anxiety have been linked to a higher conditional risk of PTSD [444].

Given this precedent, the anticipation of PTSD in the more widespread COVID-19 pandemic necessitates monitoring and management of this expected negative impact [450, 452, 458]. This study aimed to evaluate the prevalence, demographic, and clinical correlates of likely PTSD in subscribers of "Text4Hope," an intervention developed at the peak of the first wave of the pandemic to reduce the psychological treatment gap and mitigate anxiety and stress related to the COVID-19 crisis among Canadians [270]. Collateral effects of the pandemic include mental health impacts in terms of anxiety, fear, hopelessness, and stigmatization, which additionally may hinder access to medical and mental health interventions [458]. The Text4Hope program broadcasted daily supportive text messages to the mobile phones of Canadians who subscribed to the service, thereby expanding access to mental health support and offering this service even during self-isolation and quarantine.

2. Materials and Methods

2.1. Study Design and Ethics Approval

This study comprised of a cross-sectional survey. Categorical data on sociodemographic and clinical variables were collected through an online survey. To enable blind review by the study team members, some information was masked for that process. Institutional ethics approval was provided for this study by the University of Alberta Health Research Ethics Board (approval PRO00086163).

2.2. Participant Recruitment and Data Collection

A self-administered questionnaire was administered to Text4Hope subscribers between 18 June and 19 August 2020, after three months of service use. Text4Hope is a mobile-based texting program introduced by Alberta Health Services (AHS) in partnership with other health organizations to provide Albertans with mental health support during the COVID-19 pandemic [459]. Self-subscription to the program occurred by texting "COVID19Hope" to a short code number to receive free daily supportive text messages over a three-month period. Messages were crafted on the basis of cognitive behavioral therapy (CBT) principles by AHS psychiatrists and mental health therapists, including the authors of the study (VA, MH). Survey questions were programmed into Select Survey, an online survey tool. All Text4Hope subscribers who completed the three-month program were invited to complete the survey, which included demographic and clinical questions including gender, age, ethnicity, highest level of education completed, employment, relationship and housing status, history of mental illness, and use of psychotropic medication before the pandemic.

2.3. Outcomes and Measures

The survey measured PTSD symptoms in subscribers using the PTSD Checklist for DSM-5 (PCL-5) Part 3 [304]. PCL-5 is a psychometrically sound instrument and consists of 20 questions, and the respondents' scores range from 0 to 80. The scale demonstrated good internal consistency (alpha = 0.96), test-retest reliability (r = 0.84), and convergent and discriminant validity [460].

The survey additionally included questions related to exposure to COVID-19 pandemic news, fears of contracting the coronavirus infection, and whether the subscriber had a family member or friend test positive for coronavirus infection. Subscribers were also asked about the levels of support they received from family and friends, their employer, and the Government of Canada during the pandemic.

No incentives were offered and completing the survey was voluntary and was not a prerequisite for access to Text4Hope. With 36,176 active subscribers receiving the exit survey link, a sample size of 1037 survey respondents was needed to estimate the prevalence of PTSD likelihood during the COVID-19 pandemic with a confidence level of 95% and a 3% margin of error.

2.4. Statistical Analysis

Results were analyzed using SPSS Version 20 [329]. Descriptive statistics were provided for demographic, clinical, and other variables based on gender analysis. Cross-tabular analyses using the Chi-square test explored relationships, categorical predictors, and the likelihood that respondents self-reported PTSD symptoms during the COVID-19 pandemic. Based on factors previously examined [444, 453], we were interested in examining the different factors that may ultimately lead to the outcome of likely PTSD. Two categories were calculated based on the PCL-5 total score: (0–32) for not likely PTSD and (33–80) for more likely PTSD.

Variables with a statistically significant or near significant relationship ($p \leq 0.1$) to the likelihood of respondents to self-report PTSD (PCL-5 score of 33 or more for likely PTSD) were included in a logistic regression model. Correlational analysis was performed before running the regression analysis 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 from the binary logistic regression analysis were examined to determine predictor variables for respondents to self-report PTSD symptoms during the COVID-19 pandemic, controlling for the other variables. There was no imputation for missing data and the data analyzed and reported reflect the number of responses for each question.

3. Results

Of 36,176 subscribers, 1079 respondents completed the exit survey giving a response rate of 3.0%. In all, 96 (8.9%) of subscribers identified as male, 953 (88.3%) identified as female, and 11 (1.0%)

identified as other gender. Tables 4.1.3.1 and Table 4.1.3.2 provide descriptive measures of demographic and clinical characteristics of the respondents by gender. From Table 4.1.3.1, most respondents were in the age group of 41–60 years (49.5%), identified as Caucasian (83.3%), had post-secondary education (92.1%), were employed (70.3%), were married, cohabiting, or partnered (64.9%), and were homeowners (71.7%). Regarding COVID-19 related variables, the majority reported that they listened daily to COVID-19 pandemic news updates (64.9%), watched daily the images of COVID-19-related deaths/sickness (34.1%), did not lose employment due to COVID-19 (67.0%), received absolute support from family/friends (49.9%), received absolute support from employers (39.3%), received absolute support from the Government of Canada (28.2%), and sought and received mental health counselling during the pandemic (73.7% and 69.7%, respectively).

Table 4.1.3.1: Demographic characteristics of the study population and support for respondents.

Variables	**Male**	**Female**	**Other**	**Overall**
	N (%)	**N (%)**	**N (%)**	**N (%)**
Age (Years)				
≤25	10 (10.5)	65 (6.9)	1 (9.1)	76 (7.2)
26–40	25 (26.3)	269 (28.5)	7 (63.6)	301 (28.7)
41–60	40 (42.1)	478 (50.6)	2 (18.2)	520 (49.5)
>60	20 (21.1)	132 (14.0)	1 (9.1)	153 (14.6)
Ethnicity				
Caucasian	75 (78.1)	797 (84.0)	8 (72.7)	880 (83.3)
Indigenous	5 (5.2)	24 (2.5)	0 (0.0)	29 (2.7)
Asian	6 (6.2)	56 (5.9)	2 (18.2)	64 (6.1)
Other	10 (10.4)	72 (7.6)	1 (9.1)	83 (7.9)
Education				
Less than High School Diploma	5 (6.1)	12 (1.5)	0 (0.0)	17 (1.9)
High School Diploma	5 (6.1)	40 (5.0)	1 (11.1)	46 (5.1)
Post-Secondary Education	71 (86.6)	744 (92.7)	8 (88.9)	823 (92.1)
Other Education	1 (1.2)	7 (0.9)	0 (0.0)	8 (0.9)

Employment status				
Employed	53 (64.6)	572 (71.1)	5 (55.6)	630 (70.3)
Unemployed	12 (14.6)	96 (11.9)	2 (22.2)	110 (12.3)
Retired	13 (15.9)	86 (10.7)	1 (11.1)	100 (11.2)
Students	4 (4.9)	31 (3.9)	1 (11.1)	36 (4.0)
Other	0 (0.0)	20 (2.5)	0 (0.0)	20 (2.2)
Relationship status				
Married/Cohabiting/Partnered	46 (56.1)	530 (66.1)	4 (44.4)	580 (64.9)
Separated/Divorced	10 (12.2)	84 (10.5)	0 (0.0)	94 (10.5)
Widowed	0 (0.0)	21 (2.6)	1 (11.1)	22 (2.5)
Single	24 (29.3)	161 (20.1)	4 (44.4)	189 (21.2)
Other	2 (2.4)	6 (0.7)	0 (0.0)	8 (0.9)
Housing status				
Own home	49 (59.8)	583 (73.2)	4 (44.4)	636 (71.7)
Living with family	12 (14.6)	65 (8.2)	1 (11.1)	78 (8.8)
Renting	21 (25.6)	148 (18.6)	4 (44.4)	173 (19.5)
Listened to COVID-19 pandemic news updates				
Not at all	2 (2.3)	22 (2.4)	0 (0.0)	24 (2.4)
Less than once a week	2 (2.3)	39 (4.3)	0 (0.0)	41 (4.0)
About once weekly	6 (6.8)	69 (7.5)	1 (9.1)	76 (7.5)
Every other day	20 (22.7)	192 (21.0)	3 (27.3)	215 (21.2)
Daily	58 (65.9)	592 (64.8)	7 (63.6)	657 (64.9)
Watched images of COVID-19-related deaths/sickness				
Not at all	16 (18.2)	160 (17.5)	1 (9.1)	177 (17.5)
Less than once a week	11 (12.5)	162 (17.7)	3 (27.3)	176 (17.4)
About once weekly	9 (10.2)	136 (14.9)	3 (27.3)	148 (14.6)
Every other day	15 (17.0)	151 (16.5)	1 (9.1)	167 (16.5)
Daily	37 (42.0)	305 (33.4)	3 (27.3)	345 (34.1)
Lost job due to the COVID-19 pandemic				
No	59 (67.0)	616 (67.4)	4 (36.4)	679 (67.0)
Yes	9 (10.2)	119 (13.0)	4 (36.4)	132 (13.0)
Did not have a job before the pandemic	20 (22.7)	179 (19.6)	3 (27.3)	202 (19.9)

Received sufficient support from family and friends				
Yes, absolute support	49 (55.7)	450 (49.2)	6 (54.5)	505 (49.9)
Yes, some support	22 (25.0)	284 (31.1)	3 (27.3)	309 (30.5)
Yes, but only limited support	8 (9.1)	134 (14.7)	1 (9.1)	143 (14.1)
Not at all	9 (10.2)	46 (5.0)	1 (9.1)	56 (5.5)
Received sufficient support from employer				
Yes, absolute support	37 (42.0)	357 (39.2)	3 (27.3)	397 (39.3)
Yes, some support	11 (12.5)	168 (18.4)	3 (27.3)	182 (18.0)
Yes, but only limited support	7 (8.0)	92 (10.1)	0 (0.0)	99 (9.8)
Not at all	5 (5.7)	69 (7.6)	1 (9.1)	75 (7.4)
Not Applicable/Not currently employed	28 (31.8)	225 (24.7)	4 (36.4)	257 (25.4)
Received sufficient support from the Government of Canada				
Yes, absolute support	23 (26.1)	254 (28.3)	4 (36.4)	281 (28.2)
Yes, some support	18 (20.5)	222 (24.7)	2 (18.2)	242 (24.3)
Yes, but only limited support	12 (13.6)	149 (16.6)	2 (18.2)	163 (16.3)
Not at all	35 (39.8)	273 (30.4)	3 (27.3)	311 (31.2)
Sought MH counselling during the pandemic				
No	63 (71.6)	677 (74.2)	5 (45.5)	745 (73.7)
Yes	25 (28.4)	235 (25.8)	6 (54.5)	266 (26.3)
Received MH counselling during the pandemic				
No	52 (59.1)	649 (70.9)	6 (69.7)	707 (69.7)
Yes	36 (40.9)	266 (29.1)	5 (45.5)	307 (30.3)

COVID-19: Coronavirus disease 2019; **MH**: Mental health.

Table 4.1.3.2: Psychiatric history and clinical self-report-based characteristics of respondents.

Variables	**Male**	**Female**	**Other**	**Overall**
	N %	**N %**	**N %**	**N %**
History of mental health diagnosis before the pandemic				
Depressive Disorder	27 (28.1)	293 (30.7)	6 (54.5)	326 (30.8)
Bipolar Disorder	5 (5.2)	24 (2.5)	2 (18.2)	31 (2.9)
Anxiety Disorder	31 (32.3)	294 (30.8)	6 (54.5)	331 (31.2)

Alcohol Abuse	1 (1.0)	7 (0.7)	1 (9.1)	9 (0.8)
Drug Abuse	1 (1.0)	5 (0.5)	1 (9.1)	7 (0.7)
Schizophrenia	1 (1.0)	2 (0.2)	0 (0.0)	3 (0.3)
Personality Disorder	4 (4.2)	19 (2.0)	3 (27.3)	26 (2.5)
No mental health diagnosis	49 (51.0)	491 (51.5)	4 (36.4)	544 (51.3)
On psychotropic medication before the pandemic				
Antidepressants	22 (22.9)	270 (28.3)	7 (63.6)	299 (28.2)
Antipsychotics	4 (4.2)	17 (1.8)	0 (0.0)	21 (2.0)
Sleeping tablets	10 (10.4)	79 (8.3)	1 (9.1)	90 (8.5)
Mood stabilizers	15 (15.6)	47 (4.9)	1 (9.1)	63 (5.9)
Benzodiazepines	3 (3.1)	22 (2.3)	0 (0.0)	25 (2.4)
On no psychotropic medication	56 (58.3)	565 (59.3)	4 (36.4)	625 (59.0)
Self-isolated/self-quarantined				
No	71 (74.0)	701 (73.6)	7 (63.6)	779 (73.6)
Yes	25 (26.0)	251 (26.4)	4 (36.4)	280 (26.4)
Had a family member or friend contract coronavirus				
No	78 (88.6%)	844 (92.4%)	10 (90.9)	932 (92.1%)
Yes	10 (11.4%)	69 (7.6%)	1 (9.1%)	80 (7.9%)
Was afraid to contract the coronavirus				
No	24 (27.3)	144 (15.8)	2 (18.2)	170 (16.8)
Yes	64 (72.7)	769 (84.2)	9 (81.8)	842 (83.2)
Respondents had likely PTSD based on PCL-5 scale	31 (41.9%)	339 (47.0%)	6 (66.7%)	376 (46.8%)

PTSD: post-traumatic stress disorder; **PCL-5**: PTSD Checklist for DSM-5 (Diagnostic and Statistical Manual of Mental Disorders).

Table 4.1.3.2 indicates that just over half of the respondents reported having no history of any mental health disorder (51.3%), while almost a third reported having a history of either anxiety or depressive disorder (31.2% and 30.8%, respectively), with the highest prevalence observed among other gender for the two conditions. Respondents who reported receiving antidepressant medications before the pandemic represented the highest proportion (28.2%), compared to respondents who reported use of other psychotropic medications (<10%). Again, other gender had

the highest rates of receiving all psychotropic medications except for mood stabilizers, where males reported the highest intake rate (15.6%).

Self-isolation or self-quarantine was reported by around 1 in 4 respondents (26.4%), and around 1 in 12 (7.9%) reported having a family member or friend test positive for coronavirus. More than 8 in 10 respondents were afraid of being infected (83.2%). Finally, almost a half of the respondents scored positive for the likelihood of PTSD based on the PCL-5 scale (46.8%), with other gender reporting the highest prevalence (66.7%).

3.1. Univariate Analysis

Table 4.1.3.3 summarizes relationships between demographic and clinical antecedents and likely PTSD: 23 out of 28 predictor variables were significantly or near significantly related to likely PTSD ($p \leq 0.1$). Furthermore, 2 out of the 23 variables did not proceed to the regression model as they showed a high correlation with other variables ('no history of mental health diagnosis before the pandemic' and 'on no psychotropic medication before the pandemic').

Table 4.1.3.3: Chi-Square test of association between the demographic and clinical antecedents and likely PTSD *

Variables	PTSD Likely		χ^2 Square Value	p-Value
	N	% **		
Gender				
Male	31	41.9	*	0.37
Female	339	47.0		
Other	6	66.7		
Age (Years)				
≤25	33	70.2	28.02	<0.001
26–40	121	56.5		
41–60	173	41.7		
>60	45	36.6		
Ethnicity				
Caucasian	314	46.2	7.31	0.06

Indigenous	17	73.9		
Asian	20	47.6		
Other	26	42.6		
Education				
Less than High School Diploma	6	54.5	8.5	0.04
High School Diploma	28	68.3		
Post-Secondary Education	338	45.9		
Other Education	2	33.3		
Employment status				
Employed	259	45.8	24.07	<0.001
Unemployed	62	62.6		
Retired	28	31.1		
Students	19	67.9		
Other	6	46.2		
Relationship status				
Married/Cohabiting/Partnered	222	42.6	15.41	0.004
Separated/Divorced	41	51.9		
Widowed	7	38.9		
Single	99	59.3		
Other	4	50.0		
Housing status				
Own home	233	40.2	40.41	<0.001
Living with family	40	70.2		
Renting	97	7.2		
Lost job due to the COVID-19 pandemic				
No	233	42.8	11.06	0.004
Yes	55	53.4		
Did not have a job before the pandemic	93	56.0		
Self-isolated/self-quarantined				
No	265	44.7	3.71	0.05
Yes	116	52.3		

Had a family member or friend contract coronavirus				
No	356	47.4	1.65	0.20
Yes	25	39.1		
Was afraid to contract the coronavirus				
No	36	27.5	23.57	<0.001
Yes	346	50.0		
Have listened to COVID-19 pandemic news updates				
Not at all	9	47.4	1.48	0.83
Less than once a week	17	53.1		
About once weekly	33	52.4		
Every other day	75	46.0		
Daily	248	46.0		
Watched images of COVID-19-related deaths/sicknesse				
Not at all	66	47.8	2.86	0.58
Less than once a week	69	48.3		
About once weekly	51	42.1		
Every other day	57	42.9		
Daily	139	49.5		
History of depressive disorder before the pandemic				
No	189	34.4	103.41	<0.001
Yes	193	72.3		
History of anxiety disorder before the pandemic				
No	187	34.6	96.72	<0.001
Yes	195	70.9		
History of bipolar disorder before the pandemic				
No	363	45.9	7.44	0.01
Yes	19	73.1		
History of schizophrenia before the pandemic				
No	380	46.7	*	0.60
Yes	2	66.7		
No history of mental health diagnosis before the pandemic				
No (positive history)	253	67.3	117.39	<0.001

Yes (negative history)	129	29.3		
On antidepressants before the pandemic				
No	220	38.1	60.96	<0.001
Yes	162	68.1		
On sleeping tablets before the pandemic				
No	334	45.1	9.0	0.003
Yes	48	63.2		
On mood stabilizers before the pandemic				
No	340	44.6	23.94	<0.001
Yes	42	79.2		
On benzodiazepines before the pandemic				
No	362	45.6	15.32	<0.001
Yes	20	87.0		
On antipsychotics before the pandemic				
No	366	46.0	9.07	0.003
Yes	16	80.0		
On no psychotropic medication before the pandemic				
No (on psychotropic medication)	199	65.2	66.46	<0.001
Yes (not on psychotropic medication)	183	35.8		
Received sufficient support from family and friends				
Yes, absolute support	123	29.9	108.58	<0.001
Yes, some support	144	56.9		
Yes, but only limited support	87	74.4		
Not at all	28	80.0		
Received sufficient support from employer				
Yes, absolute support	106	34.1	39.01	<0.001
Yes, some support	80	54.1		
Yes, but only limited support	50	62.5		
Not at all	36	64.3		
Not currently employed	108	50.0		
Received sufficient support from the Government of Canada				

Yes, absolute support	76	33.2	28.28	<0.001
Yes, some support	98	50		
Yes, but only limited support	59	48		
Not at all	144	56.9		
Received counselling during the pandemic				
No	216	37.6	65.55	<0.001
Yes	166	68.6		

*Fisher's exact test; ** percentage of each category in each variable who had likely PTSD.

3.2. Logistic Regression

The multivariate model including all 21 variables was statistically significant; X2 (42, N = 760) = 282.53, $p < 0.001$, and it correctly classified 74.6% of cases, indicating that the model could distinguish between respondents who did or did not exhibit likely PTSD during the COVID-19 pandemic. The model accounted for 31.0% (Cox and Snell R 2) to 41.4% (Nagelkerke R 2) of the variance in the likelihood of the respondents to present with PTSD. The goodness-of-fit statistic of the logistic regression model was assessed using Hosmer-Lemeshow goodness-of-fit test, which revealed there was not enough evidence to say that the model was a poor fit (3.13, $p = 0.93$).

Table 4.1.3.4 shows the results of the multivariate logistic regression analysis. In summary, the following groups indicated significant higher odds of experiencing PTSD: those who were afraid to contract the coronavirus, respondents who had a history of depression before the pandemic, and those who received counselling during the pandemic, with around a two times greater likelihood of reporting PTSD during the COVID-19 pandemic for each variable compared to respondents in the other categories of their respective variables (OR ranges from 1.70 to 2.20). Subscribers who received absolute support from family/friends had lower odds of reporting PTSD during the pandemic compared to those who did not. Respondents who reported receiving only limited support from their employer were twice as likely to achieve criteria for PTSD, compared to respondents who received absolute support from their employer (OR = 2.02, 95% CI: 1.06–3.83). In addition, Indigenous people were about four times as likely to achieve criteria for PTSD compared to those who identified as Caucasian (OR = 3.90; 95% CI: 1.10–13.78). Similarly, subscribers who reported renting had 67% higher odds of achieving the criteria for PTSD compared to those who owned homes (OR = 1.67; 95% CI: 1.01–2.78).

Table 4.1.3.4. Logistic regression predicting likelihood of respondents presenting with PTSD.

Predictor	B	SE	Wald	df	*p*-Value	Odds Ratio	95% CI for Odds Ratio	
							Lower	Upper
Age (Years)								
≤25			1.939	3	0.585			
26–40	0.048	0.500	0.009	1	0.923	1.049	0.394	2.794
41–60	−0.255	0.514	0.246	1	0.620	0.775	0.283	2.121
>60	−0.288	0.605	0.227	1	0.634	0.749	0.229	2.454
Ethnicity								
Caucasian			5.847	3	0.119			
Indigenous	1.361	0.644	4.462	1	0.035	3.899	1.103	13.783
Asian	−0.356	0.410	0.755	1	0.385	0.700	0.314	1.564
Other	−0.228	0.362	0.397	1	0.528	0.796	0.391	1.618
Education								
Less than High School Diploma			3.958	3	0.266			
High School Diploma	1.469	1.076	1.863	1	0.172	4.346	0.527	35.825
Post-Secondary Education	0.801	1.006	0.634	1	0.426	2.227	0.310	15.990
Other Education	−0.192	1.534	0.016	1	0.901	0.826	0.041	16.680
Employment status								
Employed			1.630	4	0.803			
Unemployed	−0.067	0.375	0.032	1	0.859	0.935	0.448	1.952
Retired	−0.262	0.439	0.357	1	0.550	0.770	0.326	1.818
Students	0.643	0.621	1.072	1	0.300	1.902	0.563	6.421
Other	0.002	0.763	0.000	1	0.998	1.002	0.225	4.467
Relationship status								
Married/Cohabiting/Partnered			0.549	4	0.969			
Separated/Divorced	−0.119	0.326	0.133	1	0.715	0.888	0.468	1.683
Widowed	0.248	0.668	0.138	1	0.710	1.282	0.346	4.747
Single	0.103	0.244	0.179	1	0.672	1.109	0.687	1.789
Other	0.011	1.002	0.000	1	0.991	1.011	0.142	7.214

Housing status								
Own home			4.545	2	0.103			
Living with family	0.602	0.440	1.871	1	0.171	1.825	0.771	4.323
Renting	0.514	0.259	3.923	1	0.048	1.672	1.005	2.780
Lost job due to the COVID-19 pandemic								
No			3.509	2	0.173			
Yes	0.443	0.340	1.701	1	0.192	1.557	0.800	3.031
Did not have a job before the pandemic	0.704	0.428	2.709	1	0.100	2.021	0.874	4.673
Self-isolated/self-quarantined								
No Yes	0.070	0.209	0.112	1	0.738	1.072	0.712	1.614
Were afraid to contract the coronavirus								
No Yes	0.808	0.273	8.767	1	0.003	2.243	1.314	3.830
Respondents had a history of depression before the pandemic								
No Yes	0.797	0.279	8.155	1	0.004	2.218	1.284	3.831
History of anxiety disorder before the pandemic								
No Yes	0.471	0.246	3.653	1	0.056	1.602	0.988	2.596
History of bipolar disorder before the pandemic								
No Yes	−0.043	0.667	0.004	1	0.949	0.958	0.259	3.541
On antidepressants before the pandemic								
No Yes	0.313	0.277	1.274	1	0.259	1.367	0.794	2.355
On sleeping tablets before the pandemic								
No Yes	−0.034	0.354	0.009	1	0.924	0.967	0.483	1.934
On benzodiazepine tablets before the pandemic								
No Yes	0.555	0.857	0.421	1	0.517	1.743	0.325	9.339

On mood stabilizers before the pandemic								
No Yes	0.812	0.479	2.873	1	0.090	2.251	0.881	5.754
On an antipsychotic before the pandemic								
No Yes	0.249	0.761	0.107	1	0.744	1.282	0.289	5.696
Received sufficient support from family and friends								
Yes, absolute support			36.395	3	0.000			
Yes, some support	0.873	0.209	17.463	1	0.000	2.394	1.590	3.604
Yes, but only limited support	1.554	0.302	26.391	1	0.000	4.730	2.615	8.558
Not at all	1.704	0.565	9.090	1	0.003	5.497	1.816	16.645
Received sufficient support from employer								
Yes, absolute support			8.094	4	0.088			
Yes, some support	0.412	0.260	2.515	1	0.113	1.510	0.907	2.514
Yes, but only limited support	0.702	0.327	4.604	1	0.032	2.017	1.063	3.829
Not at all	0.403	0.434	0.859	1	0.354	1.496	0.638	3.504
Not currently employed	−0.323	0.443	0.532	1	0.466	0.724	0.304	1.725
Received sufficient support from the Government of Canada								
Yes, absolute support			4.089	3	0.252			
Yes, some support	0.098	0.265	0.137	1	0.711	1.103	0.656	1.857
Yes, but only limited support	0.044	0.298	0.022	1	0.883	1.045	0.583	1.873
Not at all	0.453	0.257	3.125	1	0.077	1.574	0.952	2.602
Received counselling during the pandemic								
No Yes	0.550	0.212	6.760	1	0.009	1.734	1.145	2.625
Constant	−0.805	1.257	0.410	1	0.522	0.447		

Discussion

The results of this study indicate that almost 50% of subscribers reported having likely PTSD. After adjusting for confounders, identifying as Indigenous and living in rented accommodations were significantly associated with likely PTSD during the COVID-19 pandemic. Further, the

significant correlates of increased odds of experiencing likely PTSD included fear of COVID-19, a history of depression, and a history of receiving counselling. Conversely, our findings suggested that support from family may offer protection against PTSD. A relatively high prevalence of PTSD is not unexpected during stressful periods, where it can rise up to 40% among survivors in the first year after a disaster [447]. A general population-based study conducted to determine the level of COVID-19-related traumatic distress in the Republic of Ireland reported that 17.67% of the population met diagnostic requirements for PTSD [461]. Similarly, a parallel survey conducted in the United Kingdom estimated a 16.79% prevalence of PTSD [462]. Our current study prevalence estimate of 46.8% is high compared with these surveys done in Ireland and the UK. This large divergence may reflect differences in the respective study populations. Text4Hope subscribers, though drawn from the general population, may not represent general population demographics, given that subscribers to Text4Hope may have already been seeking mental health care compared to the respondents in the UK and Ireland studies. Further, the different instruments used in measuring the outcome may also contribute to the observed variance; our study used the PTSD Checklist for DSM-5 (PCL-5) Part 3, while the European studies applied the International Trauma Questionnaire, a self-report measure of ICD-11 PTSD.

The high odds of experiencing PTSD symptoms were found among respondents in this study who were afraid to contact the coronavirus, had a history of depression, or who received counselling, resonate with other studies in the literature. A case-control study in China reported that more than one-third of patients with a psychiatric diagnosis met diagnostic criteria for PTSD during the COVID-19 pandemic [463]. Similar results were reported up to four years after the SARS-CoV-1 pandemic [464]. Likewise, a cross sectional study of PTSD symptoms among healthcare workers and public service providers in Norway concluded that participants who had a pre-existing psychiatric diagnosis, higher levels of anxiety, and depression symptoms were associated with more PTSD symptoms [465].

In our study, a significant effect of family support during COVID-19 was strongly associated with a smaller likelihood of PTSD symptoms. This is in accord with a similar result from previous research that examined probable PTSD predictors among survivors of Fort McMurray wildfire six months after the disaster [466], and a Norwegian study that reported emotional support to be weakly protective against PTSD [465]. These findings are consistent with what we understand of the role of support from family and friends of trauma survivors, positively influencing the form of

post-traumatic cognition, which is a driver of PTSD symptoms, therefore reducing the likelihood of PTSD [467].

Our findings indicate an increased likelihood of PTSD symptoms among respondents who reported self-isolation and/or quarantine during the COVID-19 pandemic, compared to those who did not (52% vs. 45%); however, this difference was not significantly related to expressed PTSD symptoms. This observation is not clearly consistent with the evidence for an association between quarantine experience during epidemics and diverse mental health disorders, including PTSD symptoms [468-470].

Based on our analysis, Indigenous ethnicity and living in rented accommodations were sociodemographic correlates of having likely PTSD during the pandemic. Housing challenges have been identified as stressors associated with PTSD in previous studies in Canada [471]. These challenges may have been compounded during the pandemic. A review of studies suggests that pandemic-related worries and stressors (e.g., worry of being infected, housing problems, social isolation, and lack of support) may contribute to an increased risk of PTSD [472]. That review also indicates a disproportionately high risk for socio-economically disadvantaged and racialized populations.

In contrast with our results, other studies highlighted the effect of the female sex along with being married or cohabiting as potential predictors for the development of mental health symptoms during the current pandemic [469, 470]. This contrast could be due to the differences in the other variables included in the regression models between studies.

Overall, according to a recent systematic review and meta-analysis, COVID-19 has threatened the mental health of nearly one-third of the general population, in relation to challenges that include depression, anxiety, and stress [470], which may increase likelihood for the subsequent development of PTSD symptoms. Our study results, coupled with data from similar studies around the world, highlight the need for focused mental health support for vulnerable, minority, socio-economically disadvantaged, and racialized groups during the COVID-19 pandemic.

Our study is not without limitations, which include the use of self-reported questionnaires, including the PTSD checklist to score those likely to have PTSD, rather than a formal clinician-rated assessment. The use of well-validated and standardized scales, however, mitigates the risk of information bias with self-report questionnaires. Another limitation is selection bias, where our respondents were Text4Hope subscribers who might have opted to the service seeking mental

health support, and, therefore, affected the strength of the generalizability of our findings. In addition, this survey is unable to capture the direct effects of COVID-19 among persons with a confirmed diagnosis of PTSD, and this is an interesting area for future investigation. Another limitation is that, unlike stress, anxiety, and depression symptoms, we did not collect the baseline level of PTSD symptoms in our subscribers. As this study focused on uncontrolled real-world events (COVID-19), it was not possible to include a conventional set of controls such as those embodied in a control group design. We were also unable to report the changes in PTSD prevalence from baseline at this time point and we hoped that the six-month follow-up survey, which included the measurement of PTSD symptoms, would shed some light on range and severity of symptoms experienced between the three- and six-month time points. The variables in this study explained only 31%–41.4% of the variance for PTSD likelihood among subscribers. This may necessitate further research exploring additional potential predictors (e.g., childhood adverse experience, previous trauma as adults, and prior diagnosis of PTSD) that may enrich the explanatory value of the regression model.

It is notable that subscribers to the Text4Hope service reported significant improvement in stress and anxiety levels after six weeks [473], and improvements to stress, anxiety, and depression levels after three months of receiving the daily supportive text messages. This indicates that the likely PTSD prevalence rates in subscribers were probably much higher at baseline than the level reported in this three-month survey. Ordinarily, a population-based random sample would have been ideal for this study, but the uncertainties of the pandemic precluded that approach, and Text4Hope subscription was ostensibly randomly subscribed to. We do acknowledge selection bias in the advertisement and recruitment process leading to a likely non-representative sample of the Albertan population. Finally, the study sample is not representative of age or gender for Alberta. As such, the results may not be generalizable and should be interpreted with caution. Given that males made up a fraction of the sample population, the differences we observed must be interpreted with caution.

Notwithstanding these limitations, our study identified potential factors that increase the likelihood for individuals to develop PTSD symptoms during the COVID-19 pandemic. To our knowledge, this is the first study to evaluate likely PTSD and its correlates in Canada during this pandemic.

5. Conclusions

The current findings reveal significant factors that have policy implications for the management of the ongoing pandemic. The data support the proposal that public health advice during pandemics should incorporate mental health wellness campaigns aiming to reduce the psychological impact of pandemics. There is increasing attention being paid to this need in the media, and our data may serve to provide evidence-based support for such policy development and implementation. Cost-effective population-level interventions, such as supportive text messaging services, which are geographic-location independent, are free to the end user, do not require expensive data plans, and can reach thousands of people simultaneously [94, 216, 299, 300, 310, 369, 372, 374, 473-475], are useful for addressing PTSD and other psychological symptoms, such as anxiety and depression, during the COVID-19 pandemic.

4.1.4 COVID-19 pandemic: demographic and clinical correlates of disturbed sleep among 6,041 Canadians

Osiogo, F., **Shalaby, R.,** Adegboyega, S., Hrabok, M., Gusnowski, A., Vuong, W., . . . Agyapong, V. I. O. (2021). COVID-19 pandemic: demographic and clinical correlates of disturbed sleep among 6,041 Canadians. Int J Psychiatry Clin Pract, 1-8. doi:10.1080/13651501.2021.1881127. Available at https://www.ncbi.nlm.nih.gov/pubmed/33606597

Abstract

Objectives: Psychological burdens of the COVID-19 pandemic are likely to impact sleep negatively. We investigate prevalence and correlates of disturbed sleep among subscribers to Text4Hope a daily supportive text message program launched in Alberta to support residents to deal with stress, anxiety, and depression.

Methods: A survey link was sent to Text4Hope subscribers to assess demographic and clinical variables, including disturbed sleep, stress, anxiety, and depression using the third question on the Patient Health Questionnaire-9 (PHQ-9), Perceived Stress Scale, Generalised Anxiety Disorder 7-item scale, and PHQ-9, respectively. Data were analysed using univariate and logistic regression analyses.

Results: Overall, 6041 out of 32,805 Text4Hope subscribers completed the survey (18.4% response rate). Prevalence of disturbed sleep was 77.8%. Subscribers aged 41–60 years were twice as likely to present with sleep disturbance compared to individuals ≤25 years (OR 1.89, 95% CI: 1.27–2.81). Individuals with moderate/high anxiety and stress symptoms and those with passive death wish/suicidal ideation had higher probability for sleep disturbance [(OR 4.05, 95% CI: 3.33–4.93), (OR 2.42, 95% CI: 1.99–2.94), and (OR 2.39, 95% CI: 1.69–3.38)], respectively.

Conclusion: As the pandemic continues, more Canadians are likely to develop sleep problems, an important consideration for planning mental health services.

Introduction

The coronavirus disease (COVID-19) was first reported in China in December 2019 [200, 476, 477].This novel disease is characterised by flu-like symptoms such as rhinitis, fever, respiratory problems, and even death; with more clinical features being identified as the scientific community gains a greater understanding of the disease [19, 478-481]. By the beginning of 2020, the virus had spread from China to other parts of the world with human-to-human transmission quickly occurring. By 11 March 2020, the World Health Organisation (WHO) declared COVID-19 a pandemic [482]. As of 17 May 2020, the WHO reported 4,619,477 confirmed cases of COVID-19 and 31,1847 COVID-19-related deaths in 216 countries, areas, and territories [483]. Canada reported its first case of COVID-19 on 25 January 2020; and as of 18 May 2020, there have been over 77,000 confirmed cases and over 5800 deaths [484].

In the absence of an effective treatment or vaccine, governments around the world have resorted to public health measures such as hand washing, social/physical distancing, lockdown, and quarantine to control the spread of the infection [485-487]. Although a necessity, these measures are associated with a number of stressors, including job loss, financial stress, social isolation, lack of leisure opportunities, and suspension of many elective medical procedures. Thousands of people have become unwell with the virus and thousands have lost family, friends, and colleagues to the virus. Given the stresses, there has been a rise in various mental health issues during this pandemic, including depression, anxiety, suicidal thoughts, and sleep disturbances during [252, 486, 488, 489]. Disturbed sleep is associated with numerous negative consequences, including an overall feeling of poor quality of life [490]; cardiovascular complications [491]; increased anxiety and depression [492]; increased workplace injuries [493]; and death. [494]. In this study, we aimed to evaluate the prevalence and correlates of disturbed sleep symptoms in subscribers of the Text4Hope program during the COVID-19 pandemic. We hypothesised that the prevalence rates for disturbed sleep would be high because sleep disturbance is a common symptom associated with depression, anxiety, and stress which is on the rise because of COVID-19 [36]. We also hypothesized that several demographic and clinical variables would be correlated with disturbed sleep. Surveys have been used in other jurisdictions China [495] and Italy [496] during this COVID-19 pandemic to examine the quality of sleep at the population level. As far as we are aware, this is the first study to examine sleep disturbances as well as their demographic and clinical correlates of the COVID-19 pandemic amongst Canadians.

Methods

Design

This was a cross-sectional study examining Text4Hope baseline survey data that were collected one-week after the program (Text4Hope) launched (23 March to 30 March 2020). Text4Hope is a text-messaging program aimed at providing Albertans with support during the early days of the COVID-19 pandemic, in Canada. An advertisement about Text4Hope was provided by Alberta Health Services (AHS) on its official website, and the program was open to public subscription, without any restrictions. Individuals self-subscribed to the program by texting 'COVID19HOPE' to a short-code number. Once subscribed, individuals receive one daily text message, at the same time each day, for 12 weeks. Text messages are aligned with a cognitive behavioural framework. The content was written by mental health therapists and study authors (MH, VA), who are practicing psychologists and psychiatrists, respectively.

The baseline survey was administered via Select Survey, an online survey program, by AHS. All Text4Hope subscribers were invited to complete the survey. Individuals were asked demographic questions about their gender, age, ethnicity, highest level of education completed, current employment status, current relationship status, and current housing status.

Respondents were asked to complete a number of standardised questionnaires, including the Patient Health Questionnaire-9 (PHQ-9) [303] (for likely major depressive disorder (MDD); PHQ-9 $\geq$ 10) to assess depression. One of the questions on the PHQ-9, 'Trouble falling or staying asleep, or sleeping too much,' was used to screen sleep disturbance during the pandemic and represented the primary outcome. Results from the other scales, including the Perceived Stress Scale (PSS) [302] (for moderate to high stress; PSS $\geq$ 14), and the Generalised Anxiety Disorder 7-item (GAD-7) scale [301] (for likely generalised anxiety disorder (GAD); GAD-7 $\geq$ 10), were used to assess stress and anxiety, respectively. The study was approved by the University of Alberta Human Research Ethics Board (Pro00086163) and the survey took around 10 minutes to complete. Consent was implied if the participants completed the survey and submitted their responses. Because the population of Alberta is approximately 4.3 million people, the sample size needed to estimate prevalence rates with a confidence level of 99% and a 2% margin of error was 4200 individuals. Based on a similar study [94], the expected response rate was 20%.

Data analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 26 [418]. Descriptive statistics of the demographic and clinical characteristics are described in frequencies and percentages. The main outcome in the current study is the PHQ-9 question related to sleep. This item is coded based on four responses (not at all (0), several days (1), more than half the days (2), and nearly every day (3)) that for the purposes of analysis, it was collapsed into two categories (PHQ-9 ≥ 1) and (PHQ-9 < 1), which reflected endorsing disturbed sleep in the previous two weeks vs. no disturbed sleep in the preceding two weeks. Univariate analyses with chi-square test were used to ascertain the relationship of sociodemographic and clinical variables to the dependent variable (presence of sleep disturbance).

Variables with a statistically significant relationship with the dependent variable on univariate analysis ($p \leq 0.05$, two-tailed), or a trend towards significant relationship significance ($0.05 \geq p \leq 0.1$) were entered into a logistic regression model. Correlational analyses were conducted prior to the regression analysis to avoid the high inter-correlations among the predictor variables. Results from the binary logistic regression analysis were reported as odds ratios (OR) and confidence intervals (CI). We presented results in frequencies and percentages, and a two-tailed significance value of $p \leq 0.05$ or less was deemed statistically significant. Grossly incomplete responses were excluded from the analysis, and pairwise deletion analysis was run for the rest of the missing responses with no imputation.

Results

Overall, 6041 individuals completed the baseline questionnaire out of 32,805 individuals who subscribed to Text4Hope in the first week of the program, yielding an 18.4% response rate. In the first week of the survey, the likelihood to experience sleep disturbance symptoms (trouble falling or staying asleep or sleeping too much) was 77.8%. Descriptive statistical analysis of the sociodemographic and clinical data was performed by gender (male, female, other) groupings summarized in Table 4.1.4.1. The majority of respondents identified as female (86.6%), identified as Caucasian (82.3%), had post-secondary education (85.6%), were employed (72.2%), were married, cohabiting, or partnered (71.6%), and owned a home (66.6%), with 43.2% of respondents in the middle-age category (i.e., 41–60 years old). Moderate to severe stress and anxiety were

endorsed by 84.9% and 46.7% of the total respondents, respectively. Approximately one-fifth of participants had self-isolated or quarantined (19.2%) and 14.4% reported passive suicidal ideation.

Table 4.1.4.1: Gender distribution of demographic and clinical characteristics of respondents.

Variables	**Male *N* (%)**	**Female *N* (%)**	**Other gender *N* (%)**	**Overall *N* (%)**
Age (years)				
≤25	74 (10.3)	550 (10.8)	15 (30.6)	639 (10.9)
26–40	247 (34.3)	1905 (37.4)	21 (42.9)	2173 (37.1)
41–60	308 (42.8)	2213 (43.5)	11 (22.4)	2532 (43.2)
>60	91 (12.6)	423 (8.3)	2 (4.1)	516 (8.8)
Ethnicity				
Caucasian	560 (75.8)	4307 (83.5)	37 (61.7)	4904 (82.3)
Indigenous	20 (2.7)	180 (3.5)	4 (6.7)	204 (3.4)
Asian	73 (9.9)	226 (4.4)	1 (1.7)	73 (5.0)
Other	86 (11.6)	448 (8.7)	18 (30.0)	86 (1.4)
Education				
Less than high school diploma	43 (5.8)	166 (3.2)	8 (13.1)	217 (3.6)
High school diploma	93 (12.6)	483 (9.3)	6 (9.8)	582 (9.6)
Post-secondary education	598 (81.0)	4476 (86.5)	41 (67.2)	5115 (85.6)
Other education	4 (0.5)	49 (0.9)	6 (9.8)	59 (1.0)
Employment status				
Employed	509 (73.2)	3188 (72.2)	24 (57.1)	3721 (72.2)
Unemployed	89 (12.8)	618 (14.0)	9 (21.4)	716 (13.3)
Retired	59 (8.5)	336 (7.6)	1 (2.4)	396 (7.7)
Students	38 (5.5)	275 (6.2)	8 (19.0)	321 (6.2)
Relationship status				
Married/cohabiting/partnered	521 (70.7)	3728 (72.1)	28 (45.9)	4277 (71.6)
Separated/divorced	37 (5.0)	400 (7.7)	1 (1.6)	438 (7.3)
Widowed	6 (0.8)	85 (1.6)	0 (0.0)	91 (1.5)
Single	167 (22.7)	916 (17.7)	21 (34.4)	1104 (18.5)
Other	6 (0.8)	45 (0.9)	11 (18.0)	62 (1.0)

Housing status				
Own home	457 (63.6)	3427 (67.3)	23 (37.7)	3907 (66.6)
Living with family	74 (10.3)	460 (9.0)	13 (21.3)	547 (9.3)
Renting	184 (25.6)	1115 (22.6)	20 (32.8)	1354 (23.1)
Other				
Self-isolated/quarantined	118 (16.5)	996 (19.6)	12 (20.7)	1126 (19.2)
Trouble falling or staying asleep, or sleeping too much in the last 2 weeks	444 (72.7)	3518 (78.3)	43 (89.6)	4005 (77.8)
Have had passive death wish or thoughts of self-harm in the last 2 weeks	103 (16.9)	622 (13.9)	17 (35.4)	742 (14.4)
Respondents reported moderate/high stress	521 (79.2)	4115 (81.6)	47 (90.5)	4683 (84.9)
Respondents reported significant GAD symptoms	243 (40.9)	2087 (47.3)	30 (62.5)	2360 (46.7)
Respondents reported moderate/severe depression symptoms	228 (37.3)	1874 (41.8)	27 (56.2)	2129 (41.4)

Univariate analysis

A univariate analysis using chi-square indicated that all variables (except education level) were significantly associated with the outcome variable (see Table 4.1.4.2). Respondents who identified as gender diverse, were aged 25 years or less, identified as Indigenous, had less than high school education, were unemployed, single, and renting their home, appeared to have the highest likelihood of presenting disturbed sleep symptoms and thoughts of self-harm compared to individuals with other characteristics within the same demographic groups. Similarly, respondents who had to self-isolate or quarantine; those who experienced moderate to severe symptoms of either stress, depression, or anxiety; those worried about dirt, germs, and viruses and those who washed their hands repeatedly or in a special way due to fears of contamination with dirt, germ, and viruses both before and during the current pandemic; and those who had passive death wish

or thoughts of self-harm, all seemed to experience more disturbed sleep symptoms, compared to other respondents in their respective groups.

Table 4.1.4.2. Chi-squared test of association between demographic and clinical characteristics and isolation status and likelihood of experiencing disturbed sleep in the preceding 2 weeks.

Variables	**Have had disturbed sleep in the preceding 2 weeks *N* (%)**	**Have not had disturbed sleep in the preceding 2 weeks *N* (%)**	**Chi-square**	***p*-Value**
Gender				
Male	444 (72.7)	167 (27.3)	13.9	<0.001
Female	3518 (78.3)	973 (21.7)		
Gender diverse	43 (89.6)	5 (10.4)		
Age (years)				
≤25	460 (83.0)	94 (17.0)	49.74	<0.001
26–40	1512 (80.2)	373 (19.8)		
41–60	1690 (77.1)	502 (22.9)		
>60	301 (66.4)	152 (33.6)		
Ethnicity				
Caucasian	3352 (78.1)	942 (21.9)	6.55	0.09
Indigenous	147 (82.6)	31 (17.4)		
Asian	165 (73.3)	60 (26.7)		
Other	335 (75.5)	109 (24.5)		
Education				
Less than high school diploma	144 (81.8)	32 (18.2)	2.51	0.47
High school diploma	385 (79.2)	101 (20.8)		
Post-secondary education	3447 (77.5)	1001 (22.5)		
Other education	32 (76.2)	10 (23.8)		
Employment status				
Employed	2450 (76.7)	743 (23.3)	46.38	<0.001

Unemployed	512 (84.2)	96 (15.8)		
Retired	239 (66.9)	11 (33.1)		
Students	241 (84.0)	46 (16.0)		
Relationship status				
Married/cohabiting/partnered	2844 (76.6)	870 (23.4)	22.54	<0.001
Separated/divorced	314 (80.5)	76 (19.5)		
Widowed	58 (69.0)	26 (31.0)		
Single	762 (82.6)	161 (17.4)		
Other	29 (69.0)	13 (31.0)		
Housing status				
Own home	2557 (75.2)	844 (24.8)	38.6	<0.001
Living with family	392 (82.2)	85 (17.8)		
Renting	992 (83.2)	201 (16.8)		
Other	36 (80.0)	9 (20.0)		
Have had to self-isolate or quarantine				
Yes	810 (81.7)	181 (18.3)	11.08	<0.001
No	3196 (76.8)	963 (23.2)	363.28	<0.001
Respondents reported moderate/high stress				
Yes	3600 (82.5)	764 (17.5)	363.28	<0.001
No	404 (51.7)	377 (48.3)		
Respondents reported moderate/severe depression				
Yes	2049 (96.2)	81 (3.8)	711.6	<0.001
No	1962 (64.8)	1064 (35.2)		
Respondents reported significant GAD symptoms				
Yes	2158 (91.4)	202 (8.6)	470.75	<0.001
No	1784 (66.1)	916 (33.9)		
Worried about dirt, germs, and viruses				
Only since COVID-19 pandemic	2427 (78.1)	681 (21.9)	33.89	<0.001
Before and during COVID-19 pandemic	1049 (81.4)	240 (18.6)		

Never	529 (70.3)	223 (29.7)		
Wash hands repeatedly or in a special way due to fears of contamination with dirt, germs, and viruses				
Only since COVID-19 pandemic	2149 (77.6)	620 (22.4)	14.48	<0.001
Before and during COVID-19 pandemic	1358 (80.0)	339 (20.0)		
Never	494 (72.9)	184 (27.1)		
Have had passive death wish or thoughts of self-harm in the last 2 weeks				
Yes	693 (93.4)	49 (6.6)	122.27	<0.001
No	3319 (75.2)	1097 (24.8)		

Logistic regression

Correlational diagnostics were performed before logistic regression

Analysis to ensure that very strong correlations (Spearman's correlation coefficient of 0.7 to 1.0 or −0.7 to −1.0) among predictor variables were avoided. Consequently, MDD symptoms which was highly correlated with anxiety symptoms (Spearman's correlation coefficient of 0.76) was dropped from the regression model. PHQ-9 was used to assess the presence or absence of disturbed sleep and MDD symptoms and as such highly correlated, thus providing further justification to drop MDD symptoms from the model. Therefore, a logistic regression was completed to ascertain the effect of the independent variables, excluding MDD symptoms on the likelihood of participants endorsing sleep disturbance. The regression model was statistically significant (X^2 (29) = 622.72, $p < 0.001$) and could explain 21.1% of the variance in sleep disturbance. The model showed an accuracy of 78.2% of all the cases. Table 4.1.4.3 shows that the largest contribution was made by the 'significant anxiety symptoms' variable, with a Wald of 195.4, where experiencing anxiety symptoms was associated with a higher likelihood to develop sleep disturbance among respondents (OR 4.05, 95% CI: 3.33–4.93). Among demographic factors, individuals 41–60 years of age were almost two times more at risk to develop sleep disturbance symptoms during the COVID-19 pandemic, compared to individuals 25 years or less (OR 1.89, 95% CI: 1.27–2.81). For the rest of the independent variables, individuals who expressed moderate to high stress symptoms and those who showed passive death wishes or thoughts of self-harm were significantly more affected, with a two-fold risk of experiencing sleep disturbance (OR 2.42, 95%

CI: 1.99–2.94) (OR 2.39, 95% CI: 1.69–3.38), compared to the individuals who lack these symptoms in their respective groups.

Table 4.1.4.3. Logistic regression predicting likelihood of disturbed sleep.

Variables	***B***	**SE**	**Wald**	***df***	***p*-Value**	**Odds Ratio**	**95% CI for OR**	
							Lower	**Upper**
Gender								
Male			4.826	2.0	0.09			
Female	0.164	0.116	2.008	1.0	0.15	1.178	0.939	1.478
Gender diverse	1.418	0.768	3.415	1.0	0.07	4.131	0.918	18.595
Age (Years)								
≤25			16.49	3.0	0.00			
26–40	0.337	0.193	3.045	1.0	0.08	1.401	0.959	2.046
41–60	0.635	0.202	9.871	1.0	0.00	1.887	1.270	2.805
>60	0.320	0.259	1.531	1.0	0.22	1.377	0.830	2.286
Ethnicity								
Caucasian			7.138	3.0	0.07			
Indigenous	0.224	0.247	0.828	1.0	0.36	1.252	0.772	2.029
Asian	−0.325	0.192	2.884	1.0	0.09	0.722	0.496	1.051
Other	−0.270	0.143	3.547	1.0	0.06	0.764	0.577	1.011
Employment status								
Employed			3.853	3.0	0.28			
Unemployed	0.104	0.139	0.560	1.0	0.45	1.110	0.845	1.457
Retired	0.052	0.183	0.079	1.0	0.78	1.053	0.735	1.508
Students	0.436	0.227	3.688	1.0	0.06	1.547	0.991	2.415
Relationship status								
Married/cohabiting/partnered			5.225	4.0	0.27			
Separated/divorced	0.205	0.162	1.605	1.0	0.21	1.228	0.894	1.686
Widowed	−0.307	0.299	1.055	1.0	0.30	0.735	0.409	1.322
Single	0.192	0.120	2.558	1.0	0.11	1.212	0.958	1.534
Other	0.246	0.482	0.260	1.0	0.61	1.278	0.497	3.288

Housing status								
Own home			3.637	3.0	0.30			
Living with family	−0.033	0.199	0.028	1.0	0.87	0.967	0.654	1.430
Renting	0.188	0.113	2.732	1.0	0.10	1.206	0.966	1.507
Other	−0.233	0.486	0.231	1.0	0.63	0.792	0.306	2.052
Self-isolation / quarantine	0.214	0.110	3.808	1.0	0.05	1.239	0.999	1.535
Hand washing								
Only since COVID-19 pandemic			1.447	2.0	0.49			
Before and during COVID-19 pandemic	0.081	0.099	0.661	1.0	0.42	1.084	0.892	1.317
Never	−0.080	0.128	0.397	1.0	0.53	0.923	0.719	1.185
Dirt and Germs								
Only since COVID-19 pandemic			4.478	2.0	0.11			
Before and during COVID-19 pandemic	0.076	0.110	0.485	1.0	0.49	1.079	0.870	1.338
Never	−0.212	0.119	3.180	1.0	0.08	0.809	0.640	1.021
Significant anxiety symptoms	1.400	0.100	195.430	1.0	0.00	4.054	3.332	4.933
Moderate / high stress	0.882	0.100	78.555	1.0	0.00	2.416	1.988	2.937
Passive death wishes or thoughts of self-harm	0.870	0.177	24.199	1.0	0.00	2.387	1.688	3.376
Constant	−0.735	0.243	9.140	1.0	0.00	0.480		

Discussion

In this cross-sectional study, we looked at the demographic and clinical correlates of disturbed sleep among 6041 Canadians. In our study, the prevalence of disturbed sleep was 77.8%, two to six times higher than prevalence rates of sleep disturbances for the general Canadian population [497-499]. Thus, although this study did not incorporate baseline levels of sleep disturbance prior to the pandemic and does not provide definitive evidence of a causative link between the pandemic

and sleep disturbance, it can be inferred that the disturbance reported is likely related to the pandemic or its consequences. The rate of sleep disturbance in our study is higher than a prevalence of 18.0% of disturbed sleep reported for a study conducted in China during the pandemic [495] A similar study conducted in Italy, [496] also showed disturbed sleep patterns during the COVID-19 pandemic among respondents, with a prevalence of 11.9%. A possible explanation for the higher prevalence of sleep disturbance in our study compared to the Chinese and Italian studies may be in differences in the criteria for defining sleep disturbance. Whilst we used the score of one or greater on the third question on the PHQ-9 scale to define disturbed sleep, the Chinese study used the Pittsburgh Sleep Quality Index [500] and the Italian study used an Italian version of the Pittsburgh Sleep Quality Index to assess sleep quality over the past two weeks [501]. The high rates of sleep disturbance in our study may also reflect a selection bias, as people who are struggling with mental health and stress may be more likely to subscribe to Text4Hope, and thus show a higher level of sleep disturbance than would a random sample of the population. Individuals who identified as women were slightly more affected than those who identified as men. This finding is similar to reports from other studies [497, 502, 503]. All gender groups experienced significantly disturbed sleep in the preceding two weeks. The 'other gender' category represented most of the respondents who expressed trouble falling or staying asleep or sleeping too much in the last two weeks preceding the survey at 89.6%. It is not very clear why the other gender group were more affected. Similar studies in other countries, such as the Italy and China studies mentioned above, did not have a separate 'other gender' group; analysis was limited to male and female sexes.

Our study showed that, when controlling for all other variables in the logistic regression model, the only demographic factor that had a significant association with disturbed sleep was age. Individuals who belong to the 41–60-year age group were almost two times more at risk to develop sleep disturbance symptoms during the COVID-19 pandemic, compared to individuals of 25 years or less (OR 1.89, 95% CI: 1.27–2.81). It is not clear why this particular age range was more affected and this seems ironic, given that a previous study during the pandemic suggested that younger age population (≤25 years) had higher prevalence of stress, anxiety, and depression during the pandemic compared to the older population [36] and would be expected to have higher proportion of disturbed sleep. The higher burden of mental disorders noted in that study was consistent with a study by Viana and Andrade (2012) which estimated prevalence, age-of-onset,

gender distribution, and identified correlates of lifetime psychiatric disorders in the São Paulo Metropolitan Area and reported that younger ages were significant predictors for all mental disorder classes [504]. A possible explanation for the high prevalence of disturbed sleep symptoms in the middle-age group is the higher secreted levels of cortisol stress hormone that may induce stress, anxiety, and depression symptoms which include disturbed sleep [505].

In a previous Canadian study on a general population sample [498], sleep difficulties seem to worsen with older age. However, a second study [499] showed the prevalence of sleep difficulties to be highest in the 41–60 year age group, in accord with our results.

Our study showed that respondents' ethnicity and level of education were not significantly associated with disturbed sleep in the preceding two weeks. Individuals who expressed moderate to high stress symptoms and those who exhibited passive death wishes or thoughts of self-harm could significantly predict the dependent variable, as those individuals had over twice the risk of experiencing trouble falling or staying asleep or sleeping too much in the preceding two weeks (OR 2.42, 95% CI: 1.99–2.94) (OR 2.39, 95% CI: 1.69–3.38), compared to the individuals who lack these symptoms in their respective groups. The association between high stress and poor sleep has been reported by other authors (Carrillo-Gonzalez et al. 2019; Park et al. 2019; Bishop et al. 2020) [506-508]. Our results show a similar pattern.

Strengths and limitations

This study had a large sample size and was the first study to investigate sleep disturbances in Canada during the COVID-19 pandemic. The response rate in our study of 18.4% was slightly lower than the response rate of 21.7% reported in a similar survey [94]. However, our sample size was greater than the sample size of 3693 needed to estimate the prevalence rates for disturbed sleep in our overall sample of 32,805 subscribers or the 4200-sample size needed to estimate the prevalence rates for sleep disturbance in the entire Alberta population with a confidence interval of 99% and a 2% margin of error. Notwithstanding the large sample size, our study is limited by a potential selection bias. First, our study is not representative of the population in Alberta either by age or gender [509] and so our findings may not be generalized to the entire population. Second, the high rates of sleep disturbance in our study could be because people who are struggling with mental health and stress may be more likely to subscribe to Text4Hope, and thus show a higher level of sleep disturbance than would a random sample of the population.

Because of the cross-sectional nature of the study, it is difficult to draw a causal relationship between the variables and disturbed sleep. Also, as this was a cross sectional study, we did not have baseline values to compare our results with. Additionally, the study did not elaborate upon subscribers' pre-existing mental disorders which would have helped to establish epidemiological incidence, rather than the prevalence of such conditions. Also, although we included data on the ethnicity of subscribers, we did not gather information on their cultural identity. We also did not collect information on the COVID-19-related death rates in Alberta given we did not have a comparison group. Both the cultural identity of subscribers and the relative COVID-19-related death rates could potentially influence disturbed sleep among subscribers. Finally, we relied on self-rated scales to assess sleep disturbance, stress, anxiety, and depression symptomatology. While such scales are perceived valid tools for the assessment of symptom severity [303], they may potentially overestimate the levels of these conditions when compared to the structured method of clinical interviews using the Diagnostic and Statistical Manual of Mental Disorders 5th Edition (DSM-5) for diagnosis [510].

Conclusion and clinical implications

Our study shows an increase in disturbed sleep during the COVID-19 pandemic. We also found that individuals with moderate/high anxiety and stress symptoms had higher likelihood to develop sleep disturbance, compared to individuals lacking these symptoms. Given that the pandemic and lockdown are still ongoing, with some scientists predicting a possible second wave of the pandemic [511, 512], there is a need for more resources to be put in place for people with sleep disturbances and other difficulties during this pandemic. For instance, increasing access to cognitive behavioral therapy for insomnia [513, 514] is known to improve sleep problems. Some of this can be delivered via telemedicine [515], although, given the very high prevalence rates for disturbed sleep amongst the populations, not enough human resources may be available to address this issue speedily at the population level. Furthermore, with the finding that high and moderate stress, anxiety, and depression predict disturbed sleep, it may be more useful to address the burden of stress, anxiety, and depression that exist at the population level as a way of improving the sleep of individuals. Innovative and cost-effective interventions, such as supportive text messaging, which are geographic location independent, free to the end user and do not require expensive data plans, and can reach thousands of people simultaneously, may be useful in mitigating stress, anxiety, and

depression during pandemics, thereby improving sleep [248, 318, 372, 516-518]. Supportive text messages are associated with positive outcomes, including reduction of depressive and anxiety symptoms and achieve high user satisfaction amongst subscribers in previous research. For example, in randomized controlled trials, patients with depression who received daily supportive text messages showed symptom reduction on standardized self-report compared to a similar patient group not receiving messages (with large effect sizes: Cohen's $d = 0.85$, Cohen's $d = 0.67$) [217, 318]. In two user satisfaction surveys, over 80% of subscribers reported that a supportive text messaging program improved their mental health [94, 299]. Subscribers reported text messages made them feel more hopeful about managing issues (82%), in charge of managing depression and anxiety (77%), connected to a support system (75%), and improved their overall mental wellbeing (83%) [94].

4.1.5 COVID-19 pandemic: demographic and clinical correlates of passive death wish and thoughts of self-harm among Canadians

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Abstract

Background: Suicidal ideation can be triggered or exacerbated by psychosocial stressors including natural disasters and pandemics.

Aims: This study investigated prevalence rates and demographic and clinical correlates of self-reported passive death wishes and thoughts of self-harm among Canadians subscribing to Text4Hope; a daily supportive text message program.

Methods: A survey link was sent out to Text4Hope subscribers. Demographic information was captured and clinical data collected using the Perceived Stress Scale (PSS), Generalized Anxiety Disorder-7-item (GAD-7) scale, and Patient Health Questionnaire-9 (PHQ-9). Data were analysed with descriptive analysis, the chi-square test, and logistic regression.

Results: Responders showed an increase in prevalence rates for passive death wish and thoughts of self-harm compared to baseline Canadian statistics on suicidality. Responders aged ⩽25years, Indigenous, had less than high school education, unemployed, single, living with family, with increased anxiety, disordered sleep, and recent concerns about germs and contamination were at greatest risk.

Conclusions: Our results indicate that suicidal thoughts may have increased in the general population as a result of COVID-19 and signals an urgent need for public education on appropriate health seeking methods and increased access to mental and social support especially during the COVID-19 pandemic and its immediate aftermath.

Introduction

Passive death wish, described as a desire to die during one's sleep or being killed by an accident, is a general wish not to be alive, typically due to overall dissatisfaction with one's existence or quality of life [519, 520]. Self-harm describes a wide range of behaviors and intentions including attempted hanging, self-poisoning, and superficial cutting [519] in efforts to self-inflict physical pain or near-death experiences most often during periods of extreme emotional distress [521]. About 11.8% of the Canadian population reported having passive death wishes in their lifetime and about 2.5% reported thoughts of suicide in the past year. A further 4.0% admitted to having suicide plans with about 3.1% attempting suicide in their lifetime [521]. Suicide is a primary psychiatric emergency, often related to a mental health disorder, usually depression, which may be prevented through adequate pharmacological and appropriate psychosocial interventions [522]. In Canada, about 11 people die by suicide each day, resulting in approximately 4000 deaths by suicide per year. Suicide is the second leading cause of death amongst 15−34year old and the cause of one third deaths in those aged 45−59 years. General estimates indicate approximately 20−25 attempts result in 1 completed suicide [521]. Suicide rates in men are 3−4 times higher than for women, however, women attempt suicide or report having suicidal thoughts three times as often as men [521]. A history of previous suicide attempts is a strong predictor of suicide across all age groups and all psychiatric diagnoses [523]. Other common risk factors include: deliberate self-harm practices, family history of suicide, presence of psychiatric disorders, substance use disorders, medical illnesses, and psychosocial factors (such as stress, hopelessness, unemployment, and marital status) [524, 525]. Passive death wish and recurrent thoughts of self-harm are associated with psychiatric disorders, such as depression, and are important risk factors for the eventual completion of suicide [520, 525, 526]. In December 2019, there was an unprecedented outbreak of a pneumonia of unknown etiology in Wuhan City, Hubei province in China. A novel coronavirus was identified as the causative agent, a beta coronavirus named SARS-CoV-2, which mainly affects the lower respiratory tract and manifests as pneumonia in humans [527]; this virus was subsequently termed COVID-19 by the World Health Organization (WHO). Despite rigorous global containment and quarantine efforts, the incidence of COVID-19 rose steadily, with about 6.6 million confirmed cases and over 400,000 deaths at the time of writing [519]. In response to this global outbreak, on 11 March 2020, the WHO declared COVID-19 a

public health emergency and a pandemic [21]. In response, Canada implemented a ban on all non-essential travel and events and a closure of all non-essential services including schools and businesses across the country. People were instructed to self-isolate at home and social gatherings (including places of worship, gyms, parks, and restaurants) were under lockdown. This near-total social shut-down was unprecedented in living memory for Canadians, resulting in an abrupt change in lifestyle and routine for many, and disrupting social contact between many families and loved ones. With these changes, many suffered protracted loss of emotional support and social contact and in turn, individuals reported extreme isolation and feelings of helplessness and fear of contracting the virus [528]. Media outlets and news sources were filled with news of rapidly rising COVID-19 related deaths and there was a corresponding increase in individuals reaching out for mental health and addiction support to cope with these feelings [520, 521, 529]. Several authors have indicated a concern for possible increases in suicide attempts as a response to the pandemic [528, 530-532].

In Alberta, the Text4Hope program was launched to provide free daily supportive text messages for those seeking mental health support during the COVID-19 pandemic [517]. Albertans were encouraged to enroll in the program and subscribers were invited to complete a series of self-report screening questionnaires aimed at identifying existing psychiatric distress and overall general mental health concerns. Previous studies have reported associations between various psychosocial stressors and increased anxiety and depressive symptoms, including passive death wishes and thoughts of self-harm. However, these associations were multifactorial in nature and were dependent on the presence and nature of an underlying psychiatric disorder, available psychological and social support, and premorbid personality [523, 528, 533, 534]. This study investigated demographic and clinical correlates of passive death wishes and thoughts of self-harm as reported by a general population of Canadians invited to subscribe to the free Text4Hope psychological support program during the COVID-19 pandemic.

Materials and method

This study was a cross-sectional online baseline survey aimed to collect demographics, clinical scores, and data related to death wish and thoughts of self-harm retrieved from the Patient Health Questionnaire-9 (PHQ-9) [303].

The study had prior ethics approval from the University of Alberta Health Research Ethics Board (Pro00086163) and participant consent was implied by completing the online survey

Study participants and data collection

Data were collected through an online questionnaire, administered for seven consecutive days, as part of a wide-scale baseline survey used at the launch of the Text4Hope program in Alberta. The data were collected from 4 p.m. on 23 March 2020 to 4 p.m. on 30 March 2020.

Text4Hope is a mobile-based program generated by Alberta Health Services (AHS), with the support of other health organizations, during the COVID-19 pandemic [415, 517]. Clients subscribed to the program by texting "COVID19Hope" to a short code number to receive daily free-subscription supportive text messages over a three-month duration. Messages were designed and reviewed by AHS psychiatrists and mental health therapists, including authors of the study, in alignment with the concepts of cognitive behavioral therapy (CBT). A voluntary survey was provided with the first Text4Hope text message to gather demographic, clinical, COVID-19, and self-isolation related data. No incentives were provided and completing the survey was not a prerequisite for receiving text messages. Survey questions were programmed into Select Survey, an online survey tool.

Statistical data analysis

The following sociodemographic variables were collected: gender, age, ethnicity, education level, social relationship, employment status, and housing condition. Several variables were collapsed into fewer categories to address the data set efficiently. Self-isolation/self-quarantine and clinical characteristics were assessed using validated scales for self-reported symptoms, including the Perceived Stress Scale (PSS) [302] (for moderate to high stress; PSS $\geq$ 14), the Generalized Anxiety Disorder 7-item (GAD-7) scale [301] (for likely generalized anxiety disorder; GAD-

$7 \geq 10$), and the Patient Health Questionnaire-9 (PHQ-9) [303] (for expressing trouble falling or staying asleep, or sleeping too much; question three on the PHQ-9 ≥ 1).

A key dependent variable was question nine on the PHQ-9, "Thoughts that you would be better off dead, or of hurting yourself in the last two weeks," and was initially identified as a four-category variable (Not at all, Several days, More than half the days, and Nearly everyday). For the purpose of analysis, this was collapsed into two categories, PHQ-9 ≥ 1 and PHQ-9 < 1 (have had passive death wish/thoughts of self-harm in the last two weeks and have not had passive death wish/thoughts of self-harm in the last two weeks), respectively.

Descriptive and inferential statistics were run using SPSS [418]. Age categories, 25 years or less, 26–40 years, 41–60 years and above 60 years were plotted against all independent variables (Table 4.1.5.1). Chi-square was employed for univariate analysis to examine associations between the sociodemographic/clinical variables and "Thoughts that you would be better off dead, or of hurting yourself" categorical variable (Table 4.1.5.2). Results from the Chi-square analyses were entered into a logistic regression model after calculating correlation coefficients to check for multicollinearity among the independent variables. Odds Ratio (OR) and confidence intervals (CI) were used to report the prediction of the likelihood to develop "thoughts of being better off dead, or of hurting oneself" (Table 4.1.5.3). Likelihood to develop "thoughts of being better off dead, or of hurting yourself" was reported as an overall percentage. The results are presented in frequencies and percentages, and statistical significance was defined by critical two-tailed significance value of $p \leq 0.05$.

Results

Out of 32,805 individuals who subscribed to Text4Hope in the first week of the program, 6041 individuals completed the baseline questionnaire, with a response rate of 18.4%. The likelihood to express passive death wish and thoughts of self-harm was 14.4%, where 488 (9.6%) reported having such thoughts on several days, 157 (3.1%) reported having these symptoms more than half the days, and 89 (1.8%) reported expressing these symptoms nearly every day. Descriptive statistical analysis of the sociodemographic and clinical data was identified by age groups, as illustrated in Table 4.1.5.1.

Of the 6041 respondents, the largest age group was 40−60 years, representing 2539 (43.3%) individuals, 640 (10.9%) were 25 years or less, 2174 (37.0%) were between 26 and 40 years, and 517 (8.8%) were above 60 years. Most respondents identified as female (86.9%). Additionally, Caucasian (82.6%), post-secondary education (85.8%), employed (72.3%), married, cohabiting, or partnered (71.9%), and owning home (66.7%) represented higher frequencies among survey respondents. Of the total responses, 84.9% reported experiencing moderate to severe stress symptoms, while significant anxiety and sleep disturbance symptoms represented 46.9% and 78.0% of the survey responders, respectively.

Table 4.1.5.1: Age distribution of demographic and clinical characteristics of respondents.

	≤25 y	**26–40 y**	**41–60 y**	**60 y**	**Overall**
Variables	***N* (%)**	***N* (%)**	***N* (%)**	***N* (%)**	***N* (%)**
Gender					
Male	74 (11.6)	247 (11.4)	308 (12.2)	91 (17.6)	720 (12.3)
Female	550 (86.1)	1905 (87.7)	2213 (87.4)	423 (82.0)	5091 (86.9)
Other	15 (2.3)	21 (1.0)	11 (0.4)	2 (0.4)	49 (0.8)
Ethnicity					
Caucasian	464 (72.8)	1745 (80.6)	2152 (85.1)	464 (90.4)	4825 (82.6)
Indigenous	28 (4.4)	90 (4.2)	72 (2.8)	8 (1.6)	198 (3.4)
Asian	58 (9.1)	137 (6.3)	93 (3.7)	5 (1.0)	293 (5.0)
Other	87 (13.7)	194 (9.0)	211 (8.3)	36 (7.0)	528 (9.0)
Education					
Less than High School Diploma	123 (19.2)	46 (2.1)	31 (1.2)	12 (2.3)	212 (3.6)
High School Diploma	116 (18.2)	176 (8.1)	213 (8.4)	59 (11.5)	564 (9.6)
Post-Secondary Education	395 (61.8)	1929 (88.9)	2265 (89.3)	439 (85.2)	5028 (85.8)
Other Education	5 (0.8)	18 (0.8)	26 (1.0)	5 (1.0)	54 (0.9)
Employment status					
Employed	161 (30.8)	1564 (82.4)	1793 (82.2)	140 (30.4)	3658 (72.3)
Unemployed	130 (24.9)	262 (13.8)	272 (12.5)	32 (7.0)	696 (13.7)
Retired	0 (0.0)	0 (0.0)	102 (4.7)	288 (62.6)	390 (7.7)
Students	231 (44.3)	72 (3.8)	15 (0.7)	0 (0.0)	318 (6.3)

Relationship status					
Married/Cohabiting/Partnered	334 (52.4)	1657 (76.3)	1891 (74.7)	330 (64.0)	4212 (71.9)
Separated/Divorced	6 (0.9)	85 (3.9)	264 (10.4)	75 (14.5)	430 (7.3)
Widowed	0 (0.0)	4 (0.2)	38 (1.5)	47 (9.1)	89 (1.5)
Single	289 (45.4)	408 (18.8)	321 (12.7)	55 (10.7)	1073 (18.3)
Other	8 (1.3)	17 (0.8)	18 (0.7)	9 (1.7)	52 (0.9)
Housing status					
Own Home	68 (10.8)	1294 (60.5)	2053 (82.3)	428 (86.1)	3843 (66.7)
Living with Family	349 (55.5)	137 (6.4)	47 (1.9)	9 (1.8)	542 (9.4)
Renting	205 (32.6)	693 (32.4)	366 (14.7)	56 (11.3)	1320 (22.9)
Other	7 (1.1)	16 (0.7)	29 (1.2)	4 (0.8)	56 (1.0)
Respondents reported moderate /high stress	575 (96.2)	1820 (90.2)	1910 (81.2)	321 (67.3)	4626 (84.9)
Respondents reported significant GAD symptoms	362 (66.5)	1079 (58.1)	796 (37.0)	101 (23.1)	2338 (46.9)
Trouble falling or staying asleep, or sleeping too much in the last two weeks	460 (83.0)	1512 (80.2)	1690 (77.1)	301 (66.4)	3963 (78.0)
Have had passive death wish or thoughts of self-harm in the last two weeks					
Not at all	367 (66.4)	1590 (84.4)	1970 (89.9)	422 (93.2)	4349 (85.6)
Several days	103 (18.6)	199 (10.6)	168 (7.7)	18 (4.0)	488 (9.6)
More than half the days	47 (8.5)	60 (3.2)	40 (1.8)	10 (2.2)	157 (3.1)
Nearly everyday	36 (6.5)	36 (1.9)	14 (0.6)	3 (0.7)	89 (1.8)

Univariate analysis

Univariate analyses with Chi-square revealed that all dependent variables in the model showed significant associations with the outcome variable (likelihood to express passive death wish and thoughts of self-harm) $p \leq 0.05$, as illustrated in Table 4.1.5.2.

Highest likelihood of presenting with passive death wish and thoughts of self-harm compared to individuals within the same demographic groups included those who identified as gender diverse;

were aged ≤25 years; identified as Indigenous; had not completed high school education; were unemployed; were single; or were living with their family (i.e., not living independently). Similarly, the following groups all seemed to experience more passive death wish and thoughts of self-harm compared to the other respondents in their respective groups: respondents who had to self-isolate or quarantine; those who experienced moderate to severe symptoms of stress or anxiety; those worried about dirt, germs, and viruses; those who washed their hands repeatedly or in a special way due to fears of contamination with dirt, germs, and viruses both before and during the current pandemic; and those having troubles falling or staying asleep, or sleeping too much in the last two weeks.

Table 4.1.5.2: Chi-squared test of association between demographic characteristics and self-isolation or self-quarantine status and likelihood of experiencing passive death wish or thoughts of self-harm in the preceding two weeks.

Variables	**Have *had* passive death wish/thoughts of self-harm in last two weeks N (%)**	**Have *not* had passive death wish/thoughts of self-harm in last two weeks *N* (%)**	**Chi Square**	***p*-value**
Gender				
Male	103 (16.9)	508 (83.1)	21.27	<0.001
Female	622 (13.9)	3868 (86.1)		
Gender Diverse	17 (35.4)	31 (64.6)		
Age (Years)				
≤25	186 (33.6)	367 (66.4)	221.29	<0.001
26–40	295 (15.6)	1590 (84.4)		
41–60	222 (10.1)	1970 (89.9)		
>60	31 (6.8)	422 (93.2)		
Ethnicity				
Caucasian	569 (13.2)	3726 (84.6)	29.13	<0.001

Indigenous	41 (23.0)	137 (77.0)		
Asian	48 (21.3)	177 (78.7)		
Other	80 (18.1)	362 (81.9)		
Education				
Less than High School Diploma	60 (34.1)	116 (65.9)	82.48	<0.001
High School Diploma	100 (20.6)	385 (79.4)		
Post-Secondary Education	571 (12.8)	3877 (87.2)		
Other Education	10 (23.8)	32 (76.2)		
Employment status				
Employed	361 (11.3)	2830 (88.7)	208.18	<0.001
Unemployed	183 (30.1)	425 (69.9)		
Retired	26 (7.3)	331 (92.7)		
Students	84 (29.3)	203 (70.7)		
Relationship status				
Married/Cohabiting/Partnered	442 (11.9)	3271 (88.1)	90.84	<0.001
Separated/Divorced	69 (17.7)	321 (82.3)		
Widowed	8 (9.5)	76 (90.5)		
Single	219 (23.7)	704 (76.3)		
Other	3 (7.1)	39 (92.9)		
Housing status				
Own Home	301 (8.9)	3100 (91.1)	287.75	<0.001
Living with Family	160 (33.5)	317 (66.5)		
Renting	265 (22.2)	927 (77.8)		
Other	9 (20.0)	36 (80.0)		
Have had to self-isolate of self-quarantine				
No	566 (13.6)	3592 (86.4)	10.64	<0.001
Yes	175 (17.7)	816 (82.3)		
Respondents reported moderate/high stress				
No	10 (1.3)	770 (98.7)	127.51	<0. 001
Yes	727 (16.7)	3636 (83.3)		
Respondents reported significant GAD symptoms				
No	153 (5.7)	2547 (94.3)	347.77	<0. 001

Yes	567 (24.0)	1793 (76.0)		
Worried about dirt, germs, and viruses				
Only since COVID-19 pandemic	411 (13.2)	2697 (86.8)	8.69	<00.01
Before and during COVID-19 pandemic	213 (16.5)	1076 (83.5)		
Never	115 (15.3)	638 (84.7)		
Wash hands repeatedly or in a special way due to fear of contamination with dirt, germ and viruses				
Only since COVID-19 pandemic	366 (13.2)	2404 (86.8)	9.07	<00.01
Before and during COVID-19 pandemic	279 (16.4)	1418 (83.6)		
Never	94 (13.9)	584 (86.1)		
Trouble falling or staying asleep, or sleeping too much in last two weeks				
No	49 (4.3)	1097 (95.7)	122.27	<0.001
Yes	693 (17.3)	3319 (82.7)		

Logistic regression

Spearman correlation analysis yielded no evidence for collinearity among the independent variables therefore, binomial logistic regression was run to determine the relationship of the independent variables to likelihood of participants having passive death wish and thoughts of self-harm, respectively. The regression model was statistically significant, X^2 (29) = 610.78, $p < .001$ and could explain 13.5%−24.1% of the variance in the likelihood that respondents will present with passive death wish and thoughts of self-harm. The model accurately classified 86.0% of all the cases. Table 4.1.5.3 shows that nine demographic and clinical factors independently predicted the likelihood of experiencing passive death wish and thoughts of self-harm in the model. The largest contribution was made by the "expressing significant anxiety symptoms" variable, with a Wald of 109.9, where experiencing these anxiety symptoms was associated with a significant higher likelihood to develop passive death wish and thoughts of self-harm, compared to individuals lacking these symptoms in our model (OR 3.4, 95% CI: 2.70−4.26). Male participants were 1.5 times more likely to develop passive death wish and thoughts of self-harm than females (95% CI: 1.2−2.01). Compared to individuals 25 years or younger, participants of all other age groups;

26−40 years, 41−60 years, and those above 60 years showed significantly less likelihood to develop passive death wish and thoughts of self-harm, when controlling for all other variables in the model [(OR 0.68, 95% CI: 0.49−0.95), (OR 0.63, 95% CI: 0.44−0.92) and (OR 0.37, 95% CI: 0.19–0.72), respectively]. Compared to others, individuals that identified as Indigenous or Asian were more likely to develop passive death wish and thoughts of self-harm [(OR 1.61, 95% CI: 1.04–2.48) and (OR 1.9, 95% CI: 1.27–2.93), respectively)]. Similarly, unemployed respondents were almost two times more likely to express passive death wish and thoughts of self-harm, compared to employed respondents (OR 1.90, 95% CI: 1.51−2.48). Likewise, separated or divorced individuals were at a higher risk of developing passive death wish and thoughts of self-harm, compared to the married, cohabiting, or partnered people (OR 1.70, 95% CI: 1.21−2.40). Additionally, individuals living with family or renting their homes were at a higher risk of having death and self-harm thoughts, compared to those owning homes [(OR 2.10, 95% CI: 1.43−3.00) (OR 1.7, 95% CI: 1.36−2.18), respectively].

Individuals who had never been worried about dirt and germs were at a higher risk to develop passive death wish and thoughts of self-harm, compared to those who developed worry about dirt and germs only after the COVID-19 pandemic (OR 1.40, 95% CI: 1.07−1.95). Moreover, individuals expressing moderate/high stress symptoms and those having trouble falling or staying asleep or sleeping too much in the two weeks pre-survey expressed a significantly higher likelihood to develop passive death wish and thoughts of self-harm in our sample, compared to individuals lacking such symptoms (OR 4.30, 95% CI: 2.25−8.35) (OR 2.35, 95% CI: 1.65−3.34), respectively. Other variables such as educational level, hand-washing, and self-isolation/self-quarantine status did not show significant prediction for the suicidal thoughts.

Table 4.1.5.3: Logistic regression predicting likelihood of experiencing passive death wish or thoughts of self-harm.

Variables	**B**	**SE**	**Wald**	**df**	***p*-value**	**Odds Ratio**	**95% CI for OR**	
							Lower	**Upper**
Gender								
Male			14.832	2	<0.001			

Female	−0.421	0.142	8.795	1	<0.001	0.656	0.497	0.867
Gender Diverse	0.653	0.437	2.230	1	0.14	1.921	0.815	4.526
Age (Years)								
≤25			9.952	3	0.02			
26–40	−0.385	0.170	5.167	1	0.02	0.680	0.488	0.948
41–60	−0.455	0.189	5.780	1	0.02	0.634	0.438	0.919
>60	–1.008	0.347	8.454	1	<0.001	0.365	0.185	0.720
Ethnicity								
Caucasian			14.597	3	<0.001			
Indigenous	0.473	0.222	4.554	1	0.03	1.605	1.039	2.479
Asian	0.654	0.214	9.342	1	0.002	1.924	1.265	2.927
Other	0.289	0.168	2.964	1	0.08	1.335	0.961	1.856
Employment status								
Employed			29.289	3	<0.001			
Unemployed	0.661	0.126	27.464	1	<0.001	1.937	1.512	2.480
Retired	0.522	0.301	3.003	1	0.08	1.685	0.934	3.040
Students	0.188	0.197	0.913	1	0.34	1.207	0.821	1.775
Relationship status								
Married/Cohabiting/Partnered			11.170	4	0.03			
Separated/Divorced	0.532	0.175	9.202	1	0.002	1.702	1.207	2.400
Widowed	0.091	0.473	0.037	1	0.85	1.096	0.433	2.771
Single	0.159	0.123	1.677	1	0.20	1.173	0.922	1.492
Other	−0.879	0.816	1.160	1	0.28	0.415	0.084	2.055
Housing status								
Own Home			25.083	3	<0.001			
Living with Family	0.729	0.189	14.904	1	<0.001	2.072	1.431	2.999
Renting	0.545	0.120	20.706	1	<0.001	1.724	1.363	2.180
Other	0.662	0.445	2.208	1	0.14	1.938	0.810	4.640
Education								
Less than High School Diploma			3.055	3	0.38			

High School Diploma	−0.022	0.254	0.007	1	0.93	0.979	0.595	1.611
Post-Secondary Education	−0.215	0.225	0.912	1	0.34	0.807	0.519	1.254
Other Education	0.291	0.564	0.266	1	0.61	1.338	0.443	4.038
Self-isolation / Quarantine	0.190	0.116	2.655	1	0.10	1.209	0.962	1.519
Repeated hand washing								
Only since COVID-19 pandemic			0.721	2	0.70			
Before and during COVID-19 pandemic	0.053	0.114	0.213	1	0.64	1.054	0.843	1.317
Never	0.135	0.166	0.655	1	0.42	1.144	0.826	1.585
Worried about dirt and germs								
Only since COVID-19 pandemic			5.883	2	0.05			
Before and during COVID-19 pandemic	0.079	0.121	0.426	1	0.51	1.082	0.854	1.372
Never	0.370	0.153	5.875	1	0.02	1.447	1.073	1.952
Significant Anxiety Symptoms	1.220	0.116	109.870	1	<0.001	3.388	2.697	4.257
Moderate or high stress	1.467	0.334	19.250	1	<0.001	4.334	2.251	8.345
Trouble falling or staying asleep, or sleeping too much in the last two weeks	0.853	0.180	22.563	1	<0.001	2.346	1.650	3.336
Constant	–4.451	0.458	94.573	1	<0.001	0.012		

Discussion

From an overall response rate of 18.4% (6041 out of 32,805 Text4Hope subscribers) our demographic spread showed representation across all of our age categories; 43.3% of respondents were 40−60 years, 37.0% were 26−40 years, 10.9% were 25 years or less, and 8.8% were over 60 years. The reduced representation of ≤25 years could be related to socioeconomic reasons, such as lack of financial independence, reduced economic means, or apathy or disinterest in the support

app; and for individuals >60 years of age, a possible lack of technical know-how of mobile technology. The majority of our responders self-identified as female (86.9%), employed (72.3%), with post-secondary education (85.8%), married, partnered, or cohabiting (71.9%), and home-owners (66.7%). This demographic is likely to be more financially stable, and this observation is suggestive that the Text4Hope program and other modern or technology-based health support might be more appealing to this section of the population. From our overall collated data, we observed that 14.4% of our survey population reported having experienced passive death wish or thought of self-harm during this period. This finding compares to about 11.8% of the Canadian population reported having death wishes in their lifetime and about 2.5% have had thoughts of suicide in the past 12 months [521], would suggest an increase in death wish and suicidal thoughts above previously reported or expected rates. The unprecedented changes to societal functioning and abrupt cessation of social supports could be a contributing factor to the rates of passive death wish and thoughts of self-harm observed. Further evaluation of the data might suggest an increase in other factors associated with worsening depressive symptoms, which have been strongly related to suicide attempts and eventual completion of suicide [533].

Demographic correlates

Our survey observed that multiple demographic factors correlate with likelihood of passive death wish and increased thoughts of self-harm. Males and those aged 25 years or less, were more likely to report passive death wish and self-harm thoughts. Previous surveys have reported gender differences in the occurrence of thoughts of suicide or passive death wish and self-harm ideations or practices. Females, compared to males, report a three-fold increase in suicide attempts, although overall rates of completed suicides in men are 3−4 times higher than in women [521], this is inconsistent with our observation, despite an overall majority of our participants identifying as female. It is possible that male participants who had greater symptom severity were more motivated to participate in the survey and it is possible that there are underlying gender differences in psychological effects of self-isolation or self-quarantine. The number of gender diverse respondents was too low for us to make any definitive conclusion with the observation for that group. Previous studies have also reported decreased suicidal risks in married or partnered individuals, particularly if there are children in the home. Suicidal risk is almost double in single people compared to married individuals [533]. Divorce is also associated with increased suicide

risks, with divorced men three times more likely to commit suicide compared to divorced women [535]. Our data indicate that separated or divorced participants and those living with family or renting (compared to home-owners) were more likely to report passive death wish and thoughts of self-harm than married, partnered, or cohabiting participants and home-owners. These observed patterns of passive death wish, and self-harm thoughts are consistent with existing literature and appear to be maintained during the COVID-19 pandemic.

We did not observe any correlation between level of education and passive death wish or thoughts of self-harm. While unemployment can be a risk factor for depressive symptoms and suicide, sudden loss of employment and a corresponding drop in income and social status, such as those observed during economic recessions, are strongly associated with increased suicide risks [533]. Our survey observed that unemployed participants were twice more likely to report passive death wish and self-harm thoughts than employed participants. However, our data do not include a distinction of long-term unemployment from more recent or COVID-19 related causes of unemployment. We also noted that, compared to other ethnic categories, participants who identified as Indigenous or Asian were more likely to report passive death wishes or thoughts of self-harm.

Clinical correlates

In accord with previous studies, increased occurrence of symptoms such as sleep disturbances, persistent anxiety, and increased perceived stress levels, all correlate with the presence and severity of a depressive disorder which is seen in about 90.0% of suicide victims [520, 533]. Our survey participants reporting significant anxiety symptoms, those experiencing significant sleep disturbances, and those reporting moderate to high stress levels all reported increased experiences of passive death wish and thoughts of self-harm. However, our data did not differentiate from those with pre-existing diagnosis of a depressive disorder or whether these symptoms being reported reached full clinical diagnostic criteria for a depressive disorder.

During the COVID-19 pandemic, there were numerous public awareness initiatives educating the public on hand hygiene and modes of transmission of viral particles. Amongst other methods, the public were encouraged on regular handwashing practices, wearing of face masks in public, and maintaining at least 2 meters distance from each other when in public (physical distancing) [536].

There was an increase in public awareness of dirt and germs on communal surfaces such as elevators, railings, and banisters and appropriate shielding of mouth and face when coughing or sneezing. These may have resulted in increased awareness and concerns about dirt and germs in some of our survey population. We observed that individuals who had never been worried about dirt and germs were significantly more likely to experience passive death wish and thoughts of self-harm compared to those who developed worries about dirt and germs only after the COVID-19 pandemic. To our knowledge, there is currently no literature on any correlation between increase passive death wish or self-harm and new onset worries about dirt or germs. We anticipate that further observations following the COVID-19 pandemic will elaborate further on any such associations in the future.

There were no correlations of increased passive death wish or self-harm thoughts and either hand-washing practices or self-isolation in quarantine during the period of our survey. As our survey was completed from 23 March to 30 March 2020, one week into the social restrictions, it possible that the full psychological effects of social isolation/quarantine were yet to manifest [537, 538].

Conclusion

From our data, we observed greater reports of passive death wish and self-harm thoughts, compared to pre-COVID-19 Canadian statistics on suicidality within the population. In particular, individuals identifying as Indigenous or Asian, male, aged 25 years and below, single or divorced, unemployed, non-home-owners, with recent (post-COVID-19 outbreak) concerns about contamination, increased anxiety, and poor sleep patterns were more likely to report passive death wishes or thoughts of self-harm. This is mostly consistent with previous studies which reported greater risks of suicidality amongst single or divorced and unemployed individuals with greater occurrence of depressive symptoms and psychosocial stressors. It is however note-worthy that contrary to previous Canadian statistics on suicide and suicidality, males were 1.5 times more likely to report passive death wishes and self-harm thoughts. This is rather concerning as males have greater risks of completed suicide as they often adopt more lethal means [520, 521, 529].

While we do not have the demographic distribution of all individuals who enrolled for the Text4Hope supportive text messages, the demographics mostly represented in our survey were

those least likely to report passive death wishes and self-harm thoughts included: females (86.9%), Caucasians (82.6%), employed (72.3%), married, partnered, cohabiting (71.9%), home-owners (66.7%), and those aged greater than 25 years (89.9%). It is therefore important to educate the population at increased risk on appropriate health-seeking behavior and lifestyle adaptations [530] and ensuring prompt access to both mental and social care support services (including psychological support, employment, financial support, and accommodations) especially during and after the COVID-19 pandemic [532, 534]. In comparison, other studies investigating the association between suicides and COVID-19 have reported increases in suicide risk factors through various means such as forced isolation, collective hypervigilance and fear of contracting the disease, economic problems, risk of domestic and intimate partner violence, and risk of alcohol and drug use during isolation [410, 532, 539-543]

Participants in this study were enrolled in the Text4Hope support service to provide supportive psychological therapy delivered by text messaging. Supportive text messages are effective in alleviating symptoms of depression [217, 310, 369, 372] and high user satisfaction has been reported for text interventions in mental health [94, 299, 544]. Text message interventions are cost-effective, geographic location independent, free to the end user, do not require expensive data plans, can reach thousands of people simultaneously [94, 270, 300, 475, 545] and can be incorporated into global suicide prevention strategies during pandemics.

Study limitations

Our survey was conducted using a series of self-reported questionnaires across a large sample of participants. It was completed by a total of 6041 participants, but despite this large group size, only represented 18.4% of 32,805 persons registered for the Text4Hope program. Our survey outcomes should therefore be interpreted with caution when considering the entire population seeking mental health support via the Text4Hope program. Our study also did not account for individuals with pre-existing mental health conditions or those with severity meeting diagnostic threshold for depressive or anxiety disorders. In addition, although we screened for presence of passive death wishes and its frequency of occurrence, we did not collect information of suicidal planning, intent, or previous attempts. Further studies are recommended to investigate COVID-19-specific changes in suicidal behavior, plans, and attempts to aid mental health service planning during pandemics.

4.1.6 COVID-19 Pandemic and Mental Health: Prevalence and Correlates of New-Onset Obsessive-Compulsive Symptoms in a Canadian Province

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Abstract

Background: This cross-sectional online survey investigates the prevalence of obsessive-compulsive disorder (OCD) symptoms at an early stage of the COVID-19 pandemic in Canada.

Methods: OCD symptoms, moderate/high stress, likely generalized anxiety disorder (GAD) and likely major depressive disorder (MDD) were assessed with the Brief Obsessive-Compulsive Scale (BOCS), Perceived Stress Scale (PSS), Generalized Anxiety Disorder 7-item (GAD-7) scale, and Patient Health Questionnaire-9 (PHQ-9) scale, respectively.

Results: Out of 32,805 individuals subscribed to Text4Hope, 6041 completed an online survey; the response rate was 18.4%. Overall, 60.3% of respondents reported onset of OCD symptoms and 53.8% had compulsions to wash hands during the COVID-19 pandemic. Respondents who showed OCD symptoms only since the start of COVID-19 were significantly more likely to have moderate/high stress ($z = 6.4$, $p < 0.001$), likely GAD ($z = 6.0$, $p < 0.001$), and likely MDD ($z = 2.7$, $p < 0.01$). Similarly, respondents who engaged in compulsive hand washing were significantly more likely to have moderate/high stress ($z = 4.6$, $p < 0.001$) and likely GAD ($z = 4.6$ $p < 0.001$), but not likely MDD ($z = 1.4$, $p = 0.16$).

Conclusion: The prevalence of OCD symptoms increased during the COVID-19 pandemic, at a rate significantly higher than pre-pandemic rates reported for the sample population. Presenting with OCD symptoms increased the likelihood of presenting with elevated stress, likely GAD, and likely MDD.

1. Introduction

The 2019 coronavirus disease (COVID-19) can cause a form of severe acute respiratory syndrome that may rapidly lead to death in vulnerable persons. It has a high droplet transmission rate from person to person, with a fatality rate of 2–5% [546, 547]. In March of 2020, approximately 136 countries imposed stringent measures to limit the spread of COVID-19, including staying at home, physical distancing of 2 m, and prohibition of social gatherings. This has been accompanied by extensive public health campaigns on regular hand washing, hygiene, and personal protective equipment (PPE) such as face masks and gloves.

While these measures are important, they may negatively impact the mental health of vulnerable individuals. Limitations and restrictions imposed on individuals aimed towards the protection of the public from communicable diseases can result in mental illness [548] In this context, public perception is positively correlated with the psychological impact of an outbreak [252]. An important risk factor for mental illness during a pandemic is an individual's constant worry about self and family members [252]. Excessive worry is an accepted etiologic factor in the development of obsessive-compulsive disorder (OCD) symptoms [549]

OCD is characterized by obsessions, including fear of contamination by dirt or germs, which generate distress that frequently results in compulsions to temporarily alleviate anxiety. While the lifetime prevalence of OCD symptoms is over 25% [550], the lifetime prevalence of the full disorder is much less, estimated at 2–3% for the general population [551]. OCD is highly comorbid with anxiety disorders and depression [552], including major depressive disorder (MDD), social anxiety disorder and generalized anxiety disorder (GAD) [553]. Individuals with OCD may experience a significant impairment in psychosocial and occupational level of functioning, leading to, or exacerbating, poor quality of life [554]. In the absence of early intervention, OCD can run a chronic course [555]. The diminished quality of life seen in people diagnosed with OCD is comparable to the level observed with other severe mental disorders like schizophrenia [556]. The etiology of OCD is associated with the interplay of multiple risk factors, such as gene, environment and life stressors [557].

There is a paucity of data describing the prevalence of OCD symptoms during communicable disease pandemics, despite the fact that these represent a period of time when people are required

to be hypervigilant about preventing the threat of the contamination of self and others. Our study aimed to increase our knowledge in this area by investigating associations between OCD symptoms and symptoms of perceived stress, GAD and MDD using a population-based, cross-sectional survey design during the COVID-19 pandemic. Stressful life events may precipitate or predispose individuals to development of OCD symptoms. The intense focus on danger of contamination from a virus during COVID-19, with the ensuing major disruption of personal health, social routines, health-systems and the economy, may increase the risks associated with the genesis of OCD symptoms in the population [558].

Data collection for this study occurred during the initial phase of the COVID-19 epidemic in the province of Alberta, Canada, currently comprising a census population of 4,413,146 persons [559]. At the close of the survey collection on 30 March 2020, 690 COVID-19 cases were identified in the province, of which 65 were suspected to be community-acquired, 94 were recovered, and 47 had been hospitalized, with a total of 17 admissions to intensive care units [560]. The objectives of our study are to determine the prevalence and correlates of OCD symptoms amongst a cross-section of Canadian subscribers to the Text4Hope program during the COVID-19 pandemic, and to examine the association between new onset OCD symptoms and high/moderate perceived stress, likely GAD, and likely MDD.

2. Materials and Methods

This is a cross-sectional study based on data collected online from subscribers to Text4Hope, a daily supportive text message service launched in partnership with Alberta Health Services, the Provincial health authority to support the mental health of Alberta residents. Individuals self-subscribed to Text4Hope by texting "COVID19HOPE" to a designated short code number. Subscribers receive a link to the online survey designed to gather demographic variables such as age, gender, ethnicity, education, employment status, relationship status and housing status. The 10 min (average duration) survey also assessed obsessive-compulsive symptoms with two items on the Brief Obsessive-Compulsive Scale (BOCS) [305], perceived stress with the Perceived Stress Scale (PSS) [302], likely GAD with the Generalized Anxiety Disorder 7-item (GAD-7)

scale [301], and likely MDD with the Patient Health Questionnaire-9 (PHQ-9) scale [303]. The two modified questions from the BOCS were:

- I am worried about dirt, germs and viruses. Ex. Fear of getting germs from touching door handles or shaking hands or sitting in certain chairs or seats or fear of getting COVID-19.
- I wash my hands very often or in a special way to be sure I am not dirty or contaminated.

Ex. Washing one's hands many times a day or for long periods after touching, or thinking one has touched, a contaminated object.

The responses to the above questions were modified to these three Likert scales: "Only during COVID-19 Pandemic", "Before and During COVID-19 Pandemic," or "Never".

The study was approved by the University of Alberta Human Ethics Review Board (Pro00086163), and consent was implied if the participants completed the online survey and submitted responses. With an estimated population of 4,371,316 in Alberta, we calculated the minimum sample size required to estimate mental disorder prevalence rates with a confidence level of 99% and a 2% margin of error as $n = 4200$. Given the expected response rate of 20% [94], we planned to extract data after at least 20,785 individuals had subscribed to Text4Hope. Data were collected 23–30 March 2020, with 32,805 subscriptions to Text4Hope, thus exceeding the target sample size. The data were analyzed with Statistical Package for Social Sciences (SPSS) version 20 [329] using descriptive statistics and Chi-Square tests. Two tailed significance ($p < 0.05$) was used to assess the relationship between obsessive-compulsive symptoms and other mental health variables. For mental health variables with statistically significant relationship with OCD symptoms, we performed post-hoc analysis, comparing those who had new onset OCD symptoms with those who had never had OCD symptoms and reported corresponding z-scores, adjusted residuals and *p*-values. Given the cross-sectional study design, there was no imputation for missing data and the results were based on completed survey responses.

3. Results

Of the 32,805 individuals invited to complete an online survey, 6041 responded, yielding a response rate of 18.4%. Table 4.1.6.1 provides descriptive summaries of the demographic and clinical characteristics of the respondents.

Table 4.1.6.1: Demographic and clinical characteristics of respondents.

Variables	**Overall**
Gender	
Male	740 (12.4%)
Female	5185 (86.6%)
Other Gender	61 (1.0%)
Age (Years)	
≤25	640 (10.9%)
26–40	2174 (37%)
41–60	2539 (43.3%)
>60	517 (8.8%)
Ethnicity	
Caucasian	4910 (82.2%)
Indigenous	205 (3.4%)
Asian	301 (5.0%)
Other	554 (9.3%)
Education	
Less than High School Diploma	218 (3.6%)
High School Diploma	583 (9.7%)
Post-Secondary Education	5123 (85.6%)
Other Education	59 (1.0%)
Employment status	
Employed	3726 (72.1%)
Unemployed	719 (13.9%)
Retired	399 (7.7%)
Student	322 (6.2%)
Relationship status	
Married/Common-law/Partnered	4284 (71.6%)

Separated/Divorced	438 (7.3%)
Widowed	93 (1.6%)
Single	1105 (18.5%)
Other	62 (1.0%)
Housing status	
Own Home	3917 (66.6%)
Living with Family	548 (9.3%)
Renting	1355 (23.0%)
Other	63 (1.1%)
Worried about dirt, germs, and viruses	
Only since COVID-19 pandemic	3111 (60.3%)
Before and during COVID-19 pandemic	1293 (25.1%)
Never	753 (14.6%)
Wash hands very often or in a special way to be sure he/she is not dirty or contaminated	
Only since COVID-19 pandemic	2771 (53.8%)
Before and during COVID-19 pandemic	1702 (33.0%)
Never	678 (13.2%)
Respondents had moderate/high stress [a]	4689 (84.9%)
Respondents had likely GAD [b]	2362 (46.7%)
Respondents had likely MDD [c]	2130 (41.3%)

[a] Moderate or high stress defined as Perceived Stress Scale score ≥14. [b] Likely GAD defined as Generalized Anxiety Disorder-7 scale score ≥10. [c] Likely MDD defined as Patient Health Questionnaire -9 scale score ≥10.

The data displayed in Table 4.1.6.1 indicate that 60.3% of respondents had obsessions related to contamination with dirt, germs or viruses, and 53.8% had compulsions to wash hands repeatedly or in a special way, which both started during the COVID-19 pandemic. The one-week prevalence rates for moderate/high stress, likely GAD and likely MDD in Alberta were 84.9%, 46.7% and 41.4%, respectively.

Table 4.1.6.2 suggests there were statistically significant correlations between obsessions related to dirt, germs and viruses, and all demographic variables assessed. The groups of respondents who identified as male, over 60 years of age, Caucasian, with post-secondary education, retired, widowed, or living in their own homes contained a higher proportion of respondents who

expressed worry related to contamination with dirt, germs and viruses, compared to other respondents.

Table 4.1.6.2: Demographic characteristics of respondents with obsessive symptoms (dirt, germs, and viruses).

Variables	**Worried about Dirt, Germs, and Viruses**			***p*-Value**	*** Effect Size (Phi)**
	Only Since COVID-19 Pandemic "After"	**Before and During COVID-19 Pandemic**	**Never**		
Gender					
Male	388 (63.2%)	106 (17.3%)	120 (19.5%)	<0.001	0.08
Female	2694 (60.1%)	1168 (26%)	623 (13.9%)		
Other Gender	25 (52.1%)	16 (33.3%)	7 (14.6%)		
Age (Years)					
≤25	308 (55.7%)	166 (30%)	79 (14.3%)	<0.001	0.06
26–40	1146 (60.8%)	494 (26.2%)	246 (13%)		
41–60	1333 (60.9%)	513 (23.4%)	344 (15.7%)		
>60	281 (62.0%)	96 (21.2%)	76 (16.8%)		
Ethnicity					
Caucasian	2630 (61.2%)	1023 (23.8%)	642 (14.9%)	<0.001	0.07
Indigenous	101 (56.4%)	57 (31.8%)	21 (11.7%)		
Asian	131 (58.5%)	73 (32.6%)	20 (8.9%)		
Other	241 (54.8%)	131 (29.8%)	68 (15.5%)		
Education					
Less than High School Diploma	93 (52.8%)	53 (30.1%)	30 (17.0%)	0.01	0.06
High School Diploma	280 (57.7%)	133 (27.4%)	72 (14.8%)		
Post-Secondary Education	2714 (61.0%)	1085 (24.4%)	647 (14.6%)		
Other Education	19 (45.2%)	19 (45.2%)	4 (9.5%)		
Employment status					
Employed	1994 (62.4%)	739 (23.1%)	460 (14.4%)	<0.01	0.07
Unemployed	327 (54.0%)	186 (30.7%)	92 (15.2%)		

Retired	225 (63.2%)	75 (21.1%)	56 (15.7%)		
Student	172 (59.9%)	73 25.4(%)	42 (14.6%)		
Relationship status					
Married/Common-law/Partnered	2287 (61.6%)	911 (24.5%)	515 (13.9%)	<0.001	0.07
Separated/Divorced	243 (62.5%)	87 (22.4%)	59 (15.2%)		
Widowed	56 (66.7%)	18 (21.4%)	10 (11.9%)		
Single	507 (55.0%)	257 (27.9%)	158 (17.1%)		
Other	16 (38.1%)	17 (40.5%)	9 (21.4%)		
Housing status					
Own Home	2087 (61.4%)	807 (23.7%)	505 (14.9%)	<0.001	0.07
Living with Family	249 (52.1%)	142 (29.7%)	87 (18.2%)		
Renting	722 (60.7%)	320 (26.9%)	148 (12.4%)		
Other	26 (56.5%)	16 (34.8%)	4 (8.7%)		

* Effect size as measured by Phi: A value of 1 is considered a small effect, 3 a medium effect and 5 a large effect.

Table 4.1.6.3 suggests that all demographic variables except gender and relationship status had statistically significant relationships with compulsive hand washing. Groups of respondents who identified as being over 60 years of age, Caucasian, with post-secondary education, retired or homeowners had higher proportions of respondents who were engaged in compulsive hand washing compared to other respondents.

Table 4.1.6.3: Demographic characteristics of respondents with compulsive symptoms (repeated hand washing).

Variables	**Wash Hands Very Often or in a Special Way to Be Sure He/She Is Not Dirty or Contaminated**			***p*-Value**	*** Effect Size (Phi)**
	Only since COVID-19 Pandemic "After"	**Before and during COVID-19 Pandemic**	**Never**		
Gender					
Male	350 (57.3%)	189 (30.9%)	72 (11.8%)	0.06	0.04

Female	2395 (53.4%)	1495 (33.4%)	592 (13.2%)		
Other Gender	22 (45.8%)	14 (29.2%)	12 (25.0%)		
Age (Years)					
≤25	264 (47.7%)	238 (43.0%)	51 (9.2%)	<0.001	0.11
26–40	989 (52.5%)	658 (34.9%)	237 (12.6%)		
41–60	1198 (54.7%)	656 (30.0%)	335 (15.3%)		
>60	284 (63.3%)	121 (26.9%)	44 (9.8%)		
Ethnicity					
Caucasian	2363 (55.1%)	1348 (31.4%)	577 (13.5%)	<0.001	0.08
Indigenous	82 (45.8%)	79 (44.1%)	18 (10.1%)		
Asian	119 (53.1%)	83 (37.1%)	22 (9.8%)		
Other	197 (44.7%)	184 (41.7%)	60 (13.6%)		
Education					
Less than High School Diploma	79 (44.6%)	83 (46.9%)	15 (8.5%)	<0.001	0.09
High School Diploma	251 (51.9%)	196 (40.5%)	37 (7.6%)		
Post-Secondary Education	2417 (54.4%)	1403 (31.6%)	620 (14.0%)		
Other Education	19 (45.2%)	17 (40.5%)	6 (14.3%)		
Employment status					
Employed	1789 (56.1%)	991 (31.1%)	408 (12.8%)	<0.001	0.09
Unemployed	276 (45.5%)	242 (39.9%)	89 (14.7%)		
Retired	220 (62.1%)	92 (26.0%)	42 (11.9%)		
Student	142 (49.5%)	112 (39.0%)	33 (11.5%)		
Relationship status					
Married/Common-law/Partnered	2030 (54.7%)	1182 (31.9%)	496 (13.4%)	0.09	0.05
Separated/Divorced	205 (52.6%)	126 (32.3%)	59 (15.1%)		
Widowed	45 (53.6%)	32 (38.1%)	7 (8.3%)		
Single	468 (50.8%)	342 (37.1%)	111 (12.1%)		
Other	21 (51.2%)	16 (39.0%)	4 (9.8%)		

Housing status					
Own Home	1894 (55.8%)	1022 (30.1%)	477 (14.1%)	<0.001	0.10
Living with Family	208 (43.5%)	215 (45.0%)	55 (11.5%)		
Renting	626 (52.6%)	430 (36.1%)	134 (11.3%)		
Other	19 (41.3%)	20 (43.5%)	7 (15.2%)		

* Effect size as measured by Phi: A value of 1 is considered a small effect, 3 a medium effect, and 5 a large effect.

The data displayed in Table 4.1.6.4 indicate significant correlations between obsessions about dirt, germs and viruses, and between those who engaged in compulsive hand washing and the likelihood that respondents had moderate/high stress, likely GAD and likely MDD. Post-hoc analysis using adjusted residuals indicates that respondents who were worried about dirt, germs and viruses only since the start of the COVID-19 pandemic were significantly more likely to have moderate/high stress ($z = 6.4, p < 0.001$), likely GAD ($z = 6.0, p < 0.001$) and likely MDD ($z = 2.7, p < 0.01$) compared to respondents who have never been worried about dirt, germs and viruses. Similarly, respondents who engage in compulsive hand washing were significantly more likely to have moderate/high stress ($z = 4.6, p < 0.001$) and likely GAD ($z = 4.6\ p < 0.001$), but not likely MDD ($z = 1.4, p = 0.16$), compared to respondents who have never engaged in compulsive hand washing.

Table 4.1.6.4: Chi-Square test of association between obsessive-compulsive symptoms and perceived stress, likely GAD and likely MDD.

Variables	**Perceived Stress**			**Generalized Anxiety Disorder**			**Major Depressive Disorder**		
	Moderate/High Stress	***p*-Value**	**Effect Size (Phi)**	**GAD Likely**	***p*-Value**	**Effect Size (Phi)**	**MDD Likely**	***p*-Value**	*** Effect Size (Phi)**
Worried about dirt, germs, and viruses									
Only since COVID-19 pandemic	2656 (85.6%)	<0.001	0.11	1445 (47.3%)	<0.001	0.10	1276 (41.1%)	<0.001	0.06
Before and during COVID-19 pandemic	1133 (88.0%)			656 (51.7%)			581 (45.1%)		

Never	571 (76.0%)			258 (35.1%)			268 (35.6%)		
Wash hands very often or in a special way to be sure hands are not dirty or contaminated									
Only since COVID-19 pandemic	2359 (85.3%)	<0.001	0.08	1288 (47.3%)	<0.001	0.07	1111 (40.1%)	0.01	0.05
Before and during COVID-19 pandemic	1471 (86.8%)			820 (49.2%)			759 (44.8%)		
Never	526 (78.0%)			249 (37.4%)			252 (37.2%)		

* Effect size as measured by Phi: A value of 1 is considered a small effect, 3 a medium effect, and 5 a large effect.

4. Discussion

To our knowledge, this population-based, cross-sectional survey of 6501 respondents during the COVID-19 pandemic is the first to report the prevalence of OCD symptoms and their correlation with stress, anxiety and depression symptoms. The high levels of stress, anxiety and depression symptoms underscore the need for focused the mental health prevention, intervention and follow-up of affected vulnerable groups during the COVID-19 pandemic. These results align with the prevalence rates in a survey-based measurement of 1257 health care workers in fever clinics and wards for COVID-19 patients in China, which also used the PHQ-9 and GAD-7, in which participants reported high rates of distress (71.5%), anxiety (44.6%) and depression (50.4%) [281]. Similarly, in another survey study of the initial stage of the COVID-19 epidemic in China, 1652 respondents rated the psychological impact as moderate-to-severe, with one-third reporting moderate-to-severe anxiety, and 16.5% reporting moderate-to-severe depressive symptoms [278]. Further, an Italian study by Magnavita and colleagues [561] found similar levels of anxiety and depression during a comparable period in the pandemic. These studies both show similar findings in different geographical jurisdictions. The results of this early-stage pandemic study support the proposal that surveying the OCD symptom dimensions are important for future pandemic planning, where strict public health measures (e.g., requiring regular handwashing, use of facemask and social distancing) are implemented or enforced. While 25.1–33.1% of the sample reported pre-COVID-19 OCD symptoms, an additional 60.3% were obsessed with fears of contamination and 53.8% had compulsive hand-washing. Post-hoc analysis revealed that those

with new onset OCD symptoms are statistically more likely to have high stress, likely GAD, and likely MDD. This is a 10 to 30-fold increase in OCD symptoms relative to the prevalence reported in the pre-pandemic general population [550].

These results indicate that both previous and new onset OCD contamination symptoms correlate with, and may serve as a marker for, a moderate/high stress group that is more vulnerable to GAD and MDD during COVID-19. Because global pandemics are associated with increased somatic and cognitive anxiety [562, 563], the combination of this stress and specific OCD contamination worries may result in negative-valence cognitive ruminations that activate vulnerabilities to GAD and MDD. The correlation among OCD, GAD and MDD has been explained by the overlap of common genetics, neurobiology, and shared psychological constructs [564, 565].
The lifetime prevalence of OCD symptoms is over 25%, but only a small proportion fulfill the full criteria for OCD, with a lifetime prevalence of 2.1% [550]. In a four year follow-up of a subgroup of 181 severe acute respiratory syndrome (SARS) survivors that used the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV), common diagnoses included post-traumatic stress disorder (54.5%), depression (39.0%) and OCD (15.6%)—the latter of which is seven times higher than the lifetime prevalence rate of OCD (2.1%) [566]. Thus, whether the new-onset OCD symptoms observed in our study are related to true OCD disease risk, are an expression of specific phobia-type risks in the context of COVID-19, or are a combination of both, will be for future research to determine. It may also be that the obsessive-compulsive symptoms are an adaptive response to protect the self and others from the virus, as the behaviors sampled are in line with public health recommendations. In order to evaluate the adaptive nature of OCD symptoms during the COVID-19 pandemic, the persistence or resolution of these symptoms must be determined in the recovery stage of the pandemic when the acute phase has ended.

In this study, OCD contamination symptoms were associated with male gender, an age over 60 years, Caucasian ethnicity, post-secondary education, retired employment status, widowed relationship status, and living in your own home. These findings are in contrast with other studies reporting significant association of OCD with younger age, marital status [567] and female gender, specifically with OCD contamination symptoms [568]. The mean age of respondents in our study is 42 years (age range 11–88 years), which is higher than the generally reported mean age of the

onset of 17.9 years for OCD [569]. This is important because the onset of OCD prior to 20 years of age is associated with a poor prognosis, whereas an onset over 20 tends to have a shorter course and better outcomes [570]. Therefore, given the later age of onset of OCD symptoms in our study, those who develop OCD symptoms during the COVID-19 pandemic are likely to have a better prognosis.

This study suggests that OCD symptoms are associated with the liabilities of increased stress, GAD and MDD. In balance, in a survey of 705 Hong Kong and 1201 Singaporean residents during the SARS epidemic, general anxiety measured using the State-Trait Anxiety Inventory (STAI) was adaptive and positively associated with the adoption of personal protection measures in Hong Kong [571]. Determining to what degree GAD and OCD symptoms are adaptive versus a liability during the initial phase of the COVID-19 pandemic will require further work. This study, however, adds the association of depressive symptoms in a pandemic to obsessive symptoms, which may indicate a further risk of vulnerability to adverse psychological sequelae.

The limitations of the present study include the use of a self-reported questionnaire for cognitive and behavioral symptoms of OCD, GAD and MDD that would require objective clinical assessment for definitive diagnosis. Secondly, our study is not representative of the population in Alberta either by age or gender [509], and so our findings may not be generalized to the entire population. Thirdly, we cannot claim to have sufficient statistical power to clearly determine the strength of the correlation between the COVID-19 pandemic and the onset of OCD. Furthermore, the increased OCD symptoms may be a reflection of the real threat posed by COVID-19. As a result, it is possible that once the pandemic is over, a proportion of those with new-onset OCD symptoms would not continue to report these symptoms. Post-pandemic studies are therefore required to determine and understand the temporal relationship between OCD symptoms and the COVID-19 pandemic. We used well-validated and standardized scales to mitigate the risk of information bias that could possibly be introduced in a self-reported questionnaire. However, the lack of randomization may have introduced selection bias and, therefore, effected the strength of the generalizability of our finding. Lastly, this survey is unable to measure the direct effect of COVID-19 on persons with a confirmed diagnosis of OCD, and this is an interesting area for future investigation. Our data support the proposal that public health advice during pandemics should incorporate mental health wellness campaigns aiming to reduce the psychological impact of

pandemics. There is increasing attention being paid to this need in the media, and our data may serve to provide evidence-based support for such policy implementation.

5. Conclusions

The results of our study reveal a surge in reported obsessive-compulsive symptoms with corresponding high level of stress, likely GAD and likely MDD during the COVID-19 pandemic. The use of a large population-based sample of Canadians is a significant strength of this study. As our findings correspond to some prevalence rates observed in recent studies from different geographic jurisdictions [278, 281], as described above, conclusions drawn from our data regarding the prevalence of OCD symptoms, likely GAD and likely MDD correlates are likely fairly representative of the general Canadian population. Innovative and cost-effective interventions with the capability to be deployed quickly at the population level, such as supportive text messaging which is free to the end user, does not require expensive data plans, can reach thousands of people simultaneously, is independent of geographic location [94, 216, 299, 300, 310, 369, 372, 475], and could be particularly useful for those experiencing OCD symptoms and those who are at a higher risk of experiencing stress, anxiety and depression during the COVID-19 pandemic.

4.2 Mental health prevalence in relation to sociodemographic characteristics and in specific study groups, during the COVID-19 pandemic

This section focuses upon the prevalence of various mental health symptoms in specific sociodemographic and vulnerable groups, including age groups, ethnicity condition, relationship status, healthcare workers against non-healthcare workers, and within different groups of healthcare workers.

The following sub-sections describe our findings in relation to our published papers.

4.2.1 COVID-19 Pandemic: Age-Related Differences in Measures of Stress, Anxiety and Depression in Canada

Nwachukwu, I., Nkire, N., **Shalaby, R.,** Hrabok, M., Vuong, W., Gusnowski, A., . . . Agyapong, V. I. O. (2020). COVID-19 Pandemic: Age-Related Differences in Measures of Stress, Anxiety and Depression in Canada. Int J Environ Res Public Health, 17(17). doi:10.3390/ijerph17176366. Available at https://www.ncbi.nlm.nih.gov/pubmed/32882922

Abstract

Background: The spread of COVID-19 along with strict public health measures have resulted in unintended adverse effects, including greater levels of distress, anxiety, and depression. This study examined relative presentations of these psychopathologies in different age groups in a Canadian cohort during the COVID-19 pandemic.

Methodology: Participants were subscribers to the Text4Hope program, developed to support Albertans during the COVID-19 pandemic. A survey link was used to gather demographic information and responses on several self-report scales, such as Perceived Stress Scale (PSS), Generalized Anxiety Disorder 7-item (GAD-7) scale, and Patient Health Questionnaire-9 (PHQ-9).

Results: There were 8267 individuals who completed the survey, giving a response rate of 19.4%. Overall, 909 (11.0%) respondents identified as ≤25 years, 2939 (35.6%) identified as (26–40) years, 3431 (41.5%) identified as (41–60) years, 762 (9.2%) identified as over 60 years, and 226 (2.7%) did not identify their age. Mean scores on the PSS, GAD-7, and PHQ-9 scales were highest among those aged ≤25 and lowest amongst those aged >60 years old.

Conclusions: The finding that the prevalence rates and the mean scores for stress, anxiety, and depression on standardized scales to decrease from younger to older subscribers is an interesting observation with potential implications for planning to meet mental health service needs during COVID-19.

1. Introduction

With its discovery in Wuhan, China, and its subsequent rapid spread around the world, the coronavirus disease (COVID-19) pandemic has caused palpable fear [572-574] To manage the illness in the absence of a proven cure or an effective vaccine, governments have adopted extreme public health measures including shutting down all but essential services and industries, promoting hand hygiene measures, restricting travel and closing borders, implementing social distancing, self-isolation, and quarantine measures [575]. Typically, social distancing has been achieved through limiting the distance between individuals in public spaces, limiting the number of individuals who are allowed to gather together, self-isolation/quarantine for 14 days after travel or if individuals present with COVID-19 like symptoms or have been in contact with potentially infected individuals. These measures have caused a widespread disruption of both the social fabric of society and economic activities [576]. These abrupt changes to the pattern of human activities have had indirect negative effects on the physical and mental health of individuals across the world. Self-isolation measures and quarantine, despite their considerable clinical utility, often have unintended adverse effects [280] including greater levels of distress, anxiety, depression, and post-traumatic stress disorder (PTSD). For the current COVID-19 pandemic, published studies examining rates of anxiety and depression are consistently reporting prevalence estimates of around 20% [278, 577, 578]. A recent meta-analysis reported rates of depression and anxiety that exceed 20% with differences in certain demographic variables such as gender and occupation [579]. In the severe acute respiratory syndrome (SARS) outbreak in Taiwan during late April to mid-May 2003, a relationship between age and the development of psychological symptoms was reported, with younger age groups at higher risk [580].For the COVID-19 pandemic, several studies have also reported a possible negative relationship between depression, anxiety, PTSD, and age [577, 581]

In an online survey of Chinese subjects, prevalence of generalized anxiety disorder and depressive symptoms was significantly higher in participants younger than 35 years than in participants aged 35 years or older [582] with age and amount of time spent focusing on COVID-19 identified as potential risk factors for psychological illness. Individuals ≤35 years of age appear to be more likely to develop anxiety and depressive symptoms during the COVID-19 pandemic [583]. In a nationwide survey examining psychological distress among Chinese people in the COVID-19 pandemic using a COVID-19 Peritraumatic Distress Index (CPDI) [584]; the authors examined

frequency of anxiety, depression, specific phobias, cognitive change, avoidance and compulsive behavior, physical symptoms, and loss of social functioning in the past week, with scores on the CPDI ranging from 0 to 100. A CPDI score between 28 and 51 indicates mild to moderate distress while a score ≥52 indicates severe distress. In that study, participants under 18 years had the lowest CPDI scores. Individuals from 18–30 years or >60 years of age presented the highest CPDI scores, thus presenting a more nuanced view of the effect of the pandemic on psychological symptoms across the age spectrum. Possible explanations for their finding include the idea that teenagers and children have shown relatively low morbidity and mortality in the pandemic and therefore may feel less stressed by it and, because of school closures and quarantine measures they may recognize that they have had limited exposure to the coronavirus. Younger adults on the other hand may be exposed to more information about the virus via social media, a factor that has been shown to increase vulnerability [585]. In addition, their loss of social connections with friends may have further increased their vulnerability to mental distress. The highest mortality rates for the virus are reported among the elderly, thus potentially exposing this age group to be more adversely affected psychologically [584]. The majority of initial studies examining the impact of age on stress, anxiety, and depression levels in the current COVID-19 pandemic arise from Asia. This present study sets out to examine the evidence for the impact of age on stress, anxiety, and depression levels in the COVID-19 pandemic from the perspective of a Canadian cohort with the goal of informing policy planning in relation to age-appropriate mental health supports and resource allocations during this COVID-19 pandemic period.

2. Methods

This was a cross-sectional survey exploring the mean differences of perceived stress, anxiety, and depression symptom scores among subscribers of various age categories who enrolled in the Text4Hope program. The study recruitment procedures and statistical methods have been described in related papers [586]. In summary, the Text4Hope program is a daily supportive text message service, launched by Alberta Health Services (Alberta, Edmonton), the Provincial Health Authority on 23 March 2020 to support the mental health of Albertans during the COVID-19 pandemic. Subscribers were sent an online survey link with an accompanying message: “To help us evaluate the Text4Hope program’s effectiveness, please complete a short survey….” The survey questions included demographic information such as gender, age, ethnicity, education, relationship

status, employment status, and housing status. Respondents also completed clinical self-assessments for stress, anxiety, and depression using the Perceived Stress Scale (PSS), the Generalized Anxiety Disorder 7-item (GAD-7) scale and the Patient Health Questionnaire-9 (PHQ-9), respectively. Participant consent was implied by submission of subscribers' survey responses. The survey link has no expiry date as enrollment to the Text4Hope program is ongoing. Ethical approval for the research was obtained through the University of Alberta Health Research Ethics Board (Pro00086163).

Data analysis was undertaken using SPSS version 26 (IBM Inc, Endicott, NY, USA) [587]. Demographic characteristics of respondents were summarized in absolute numbers and percentages, by age category. One-way analysis of variance (one-way ANOVA) with two tailed significance (p-value < 0.05) was performed to assess the differences between the ethnic groupings and the corresponding mean scores for PSS, GAD-7, and PHQ-9, respectively. As all variables violated the homogeneity of variance assumption based on the Levene Statistic test of homogeneity, we determined statistically significant differences for the mean scores for the various clinical measures across age groups using the Welch F test and a Games–Howell post hoc test.

3. Results

Of the 44,992 subscribers who joined Text4Hope in the first 6 weeks, 8267 responded to the online survey invitation, yielding a 19.4% response rate. Our sample size of 8267 indicates that any prevalence rate estimates for the entire sample of 44,992 subscribers would have a 99% confidence interval and a margin of error of only 1.28%. Of the 8267 respondents, 909 (11.0%) identified as ≤25 years, 2939 (35.6%) identified as aged 26–40 years, 3431(41.5%) identified as aged 41–60 years, 762 (9.2%) identified as >60 years, and 226 (2.7%) did not identify their age. The mean age for our sample was 42.09 years (Standard Deviation = 13.44 years).

Additional demographic characteristics of the respondents are shown in Table 4.2.1.1, which indicates a majority of respondents self-identified as female, (n = 6991, 87.1%), Caucasian (n = 6579, 82.3%), with post-secondary education (n = 6835, 85.2%), as employed (n = 5883 73.3%), as married, cohabiting, or partnered (n = 5706, 71.1%), and as home-owners (n = 5194, 65.9%).

Table 4.2.1.1: Age distribution of demographic, clinical, and other characteristics of respondents.

Variables	≤25 Years	26–40 Years	41–60 Years	>60 Years	Overall
	909 (11.0)	**2939 (35.6%)**	**3431 (41.5%)**	**226 (2.7%)**	**8267 (100%)**
	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**
Gender					
Male	108 (11.3)	336 (35.0)	396 (41.3)	119 (12.4)	959 (11.9)
Female	776 (11.1)	2568 (36.7)	3009 (43.0)	638 (9.1)	6991 (87.1)
Other	23 (29.1)	33 (41.8)	19 (24.1)	4 (5.1)	79 (1.0)
Ethnicity					
Caucasian	646 (9.8)	2355 (35.8)	2905 (44.2)	673 (10.2)	6579 (82.3)
Indigenous	47 (15.9)	124 (42.0)	111 (37.6)	13 (4.4)	295 (3.7)
Asian	88 (22.1)	188 (47.1)	113 (28.3)	10 (2.5)	39 (5.0)
Other	125 (17.2)	261 (36.0)	283 (39.0)	56 (7.7)	725 (9.1)
Education					
Less than High School Diploma	199 (62.2)	58 (18.1)	49 (15.3)	14 (4.4)	320 (4.0)
High School Diploma	170 (21.6)	248 (31.5)	276 (35.1)	93 (11.8)	787 (9.8)
Post-Secondary Education	530 (7.8)	2598 (38.0)	3064 (44.8)	643 (9.4)	6835 (85.2)
Other Education	9 (11.1)	30 (37.0)	34 (42.0)	8 (9.9)	81 (1.0)
Employment Status					
Employed	358 (6.1)	2407 (40.9)	2832 (48.1)	286 (4.9)	5883 (73.3)
Unemployed	177 (19.1)	349 (37.6)	362 (39.1)	39 (4.2)	927 (11.6)
Retired	0 (0.0)	0 (0.0)	125 (22.9)	420 (77.1)	545 (6.8)
Students	334 (74.6)	95 (21.2)	18 (4.0)	1 (0.2)	448 (5.6)
Other	39 (17.8)	82 (37.4)	84 (38.4)	14 (6.4)	219 (2.7)
Relationship Status					
Married/Cohabiting/Partnered	455 (8.0)	2251 (39.4)	2513 (44.0)	487 (8.5)	5706 (71.1)
Separated/Divorced	11 (1.8)	111 (18.3)	383 (63.0)	103 (16.9)	608 (7.6)
Widowed	0 (0.0)	5 (3.9)	49 (38.0)	75 (58.1)	129 (1.6)
Single	426 (28.4)	545 (36.4)	445 (29.7)	83 (5.5)	1499 (18.7)
Other	13 (16.2)	24 (30.0)	31 (38.8)	12 (15.0)	80 (1.0)
Housing Status					

Own Home	88 (1.7)	1731 (33.3)	2743 (52.8)	632 (12.2)	5194 (65.9)
Living with Family	513 (65.9)	188 (24.1)	66 (8.5)	12 (1.5)	779 (9.9)
Renting	282 (15.3)	948 (51.5)	530 (28.8)	80 (4.3)	1840 (23.3)
Other	12 (16.9)	25 (35.2)	28 (39.4)	6 (8.5)	71 (0.9)

The data displayed in Table 4.2.1.2 illustrate the prevalence rates for clinically meaningful stress, anxiety, and depression. These data suggest the prevalence of high/moderate stress, likely GAD and likely MDD were highest in those aged 25 or under and lowest in those aged over 60 years.

Table 4.2.1.2: Chi-Square test of association between age categories and the prevalence of perceived stress, likely generalized anxiety disorder, and likely major depressive disorder.

Psychological Concern	**Age Categories**				
	≤25 Years *n* (%)	**26–40 Years *n* (%)**	**41–60 Years *n* (%)**	**>60 Years *n* (%)**	**Total Prevalence *n* (%)**
Perceived Stress					
Moderate or High Stress [a]	823 (96.3)	2500 (91.1)	2610 (81.9)	475 (68.2)	6408 (85.7)
Chi [2]	353.21				
p-value	≤0.001				
Effect Size (Phi)	0.22				
Generalized Anxiety Disorder (GAD)					
GAD likely [b]	515 (65.5)	1481 (58.6)	1090 (37.5)	147 (23.3)	3233 (47.2)
Chi [2]	491.81				
p-value	≤0.001				
Effect Size (Phi)	0.27				
Major Depressive Disorder (MDD)					
MDD likely [c]	534 (66.8)	1308 (50.9)	1064 (35.9)	172 (26.4)	3078 (44.1)
Chi [2]	378.10				
p-value	≤0.001				
Effect Size (Phi)	0.23				

[a]Moderate or high stress defined as PSS score ≥ 14; [b]Likely GAD defined as GAD-7 scale score ≥ 10; [c]Likely MDD defined as PHQ-9 scale score ≥ 10.

Mean scores for all the respondents were 20.79 (SD = 6.83, *n* = 7589) on the PSS, 9.68 (SD = 5.87, *n* = 6944) on the GAD-7 scale, and 9.43 (SD = 6.29, *n* = 7082) on the PHQ-9 scale.

The data displayed in Table 4.2.1.3 indicate that the mean scores on the PSS, GAD-7, and PHQ-9 scales were highest among those aged 25 years and under and lowest amongst those who were over 60 years old. There is an observed trend for the mean scores for all three scales to decrease with a shift from a younger age bracket to an older age bracket.

Table 4.2.1.3: Mean scores on the PSS, GAD-7 Scale and PHQ-9 Scale by age.

Outcome Measures	**Age in Years**	***n***	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Minimum**	**Maximum**
						Lower Bound	**Upper Bound**		
PSS Total Score	≤25	855	25.4	6.29	0.215	24.97	25.82	1	40
	26–40	2743	22	6.209	0.119	21.77	22.23	2	40
	41–60	3185	19.46	6.584	0.117	19.23	19.69	0	40
	>60	696	16.65	6.771	0.257	16.14	17.15	0	39
	Total	7479	20.81	6.833	0.079	20.65	20.96	0	40
GAD-7 Total Score	≤25	786	12.23	5.697	0.203	11.83	12.63	0	21
	26–40	2526	11.12	5.63	0.112	10.9	11.34	0	21
	41–60	2904	8.53	5.625	0.104	8.33	8.74	0	21
	>60	631	6.35	5.172	0.206	5.94	6.75	0	21
	Total	6847	9.71	5.863	0.071	9.57	9.85	0	21
PHQ-9 Total Score	≤25	800	13.05	6.734	0.238	12.59	13.52	0	27
	26–40	2569	10.35	6.086	0.12	10.12	10.59	0	27
	41–60	2961	8.31	5.897	0.108	8.1	8.52	0	27
	>60	652	6.65	5.609	0.22	6.22	7.08	0	27
	Total	6982	9.45	6.29	0.075	9.3	9.6	0	27

Results from the Levene test for homogeneity of variances suggested there was a violation of the assumption of equality of means for the PSS, GAD-7, and PHQ-9 scales ($p > 0.05$). Because of this, it was appropriate to apply the Welch F test and a Games–Howell post hoc test to determine mean score differences on the three scales between the different age groups. Welsh F tests confirmed that the differences between the groups in terms of their mean PSS, GAD-7, and PHQ-9 scores were statistically significant.

There were statistically significant differences between and within age groups for scores on the PSS ($F = 319.89$, $p < 0.001$), GAD-7 scale ($F = 225.23$, $p < 0.001$), and PHQ-9 ($F = 195.82$, $p < 0.001$).

The results of the Games–Howell post hoc test are as presented in Table 4.2.1.4. The results displayed in Table 4.2.1.4 confirm statistically significant differences in mean scores on the PSS, GAD-7, and PHQ-9 scales between each of the age categories and any other age category ($p < 0.001$ for each comparison). The mean scores for the PSS, GAD-7, and PHQ-9 scales declined significantly with a shift from a younger age to an older age group suggesting that older respondents had less stress, anxiety, and depression symptoms compared to younger respondents.

Table 4.2.1.4: Games-Howell post hoc multiple comparison.

Outcome Measures	**(I) Age2 (Years)**	**(J) Age2 (Years)**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
						Lower Bound	**Upper Bound**
PSS Total Score	≤25	26–40	3.396 *	0.246	0.000	2.76	4.03
		41–60	5.936 *	0.245	0.000	5.31	6.57
		>60	8.747 *	0.335	0.000	7.89	9.61
	26–40	≤25	−3.396 *	0.246	0.000	−4.03	−2.76
		41–60	2.540 *	0.166	0.000	2.11	2.97
		>60	5.351 *	0.283	0.000	4.62	6.08
	41–60	≤25	−5.936 *	0.245	0.000	−6.57	−5.31
		26–40	−2.540 *	0.166	0.000	−2.97	−2.11
		>60	2.811 *	0.282	0.000	2.09	3.54
	>60	≤25	−8.747 *	0.335	0.000	-9.61	−7.89

		26–40	−5.351 *	0.283	0.000	−6.08	−4.62
		41–60	−2.811 *	0.282	0.000	−3.54	−2.09
GAD-7 Total Score	≤25	26–40	1.116 *	0.232	0.000	0.52	1.71
		41–60	3.699 *	0.228	0.000	3.11	4.29
		>60	5.884 *	0.289	0.000	5.14	6.63
	26–40	≤25	−1.116 *	0.232	0.000	−1.71	−0.52
		41–60	2.583 *	0.153	0.000	2.19	2.98
		>60	4.769 *	0.234	0.000	4.17	5.37
	41–60	≤25	−3.699 *	0.228	0.000	−4.29	−3.11
		26–40	−2.583 *	0.153	0.000	−2.98	−2.19
		>60	2.186 *	0.231	0.000	1.59	2.78
	>60	≤25	−5.884 *	0.289	0.000	−6.63	−5.14
		26–40	−4.769 *	0.234	0.000	−5.37	−4.17
		41–60	−2.186 *	0.231	0.000	−2.78	−1.59
PHQ-9 Total Score	≤25	26–40	2.701 *	0.267	0.000	2.02	3.39
		41–60	4.744 *	0.262	0.000	4.07	5.42
		>60	6.405 *	0.324	0.000	5.57	7.24
	26–40	≤25	−2.701 *	0.267	0.000	−3.39	−2.02
		41–60	2.043 *	0.162	0.000	1.63	2.46
		>60	3.704 *	0.250	0.000	3.06	4.35
	41–60	≤25	−4.744 *	0.262	0.000	−5.42	−4.07
		26–40	−2.043 *	0.162	0.000	−2.46	−1.63
		>60	1.661 *	0.245	0.000	1.03	2.29
	>60	≤25	−6.405 *	0.324	0.000	−7.24	−5.57
		26–40	−3.704 *	0.250	0.000	−4.35	−3.06
		41–60	−1.661 *	0.245	0.000	−2.29	−1.03

*The mean difference is significant at the 0.05 level.

For each of the three scales, the greatest mean differences were observed between respondents who were ≤25 years compared to those >60 years. For the PSS and the GAD-7, the respective mean differences in scores were 8.75, with a 95% CI of 7.89–9.61 and $p < 0.001$, and 6.41, with a

95% CI of 5.57–7.24 and $p < 0.001$. For the PHQ-9, the mean difference in the score between these age groups was 5.88, with a 95% CI of 5.14–6.63 and $p < 0.001$.

Overall, the results suggest a decrease in severity of stress, anxiety, and depression symptoms with increasing age during COVID-19 in a Canadian sample.

4. Discussion

Our results indicate that about two-thirds of our respondents were aged between 26 and 60 years, and the remaining respondents were aged either 25 years and under or over 60 years. This contrasts with a study by Gonzalez-Sanguino et al [577]. where the majority of respondents were aged between 18–39 years (56.63%). The respondents in our sample were spread over a wider middle age range. Furthermore, the average age of the sample population in the study by Gonzalez-Sanguino et al [577] was lower than the average age for our study participants (37.92 vs. 42.09, respectively). Our study results are, however, similar to those of other studies which have a lower representation of the elderly population [278, 577]; and this underrepresentation of this important segment of the population may limit us in relation to inferences made for those over 60 years of age in this study.

Our results indicate that the prevalence rates for moderate/high stress, likely GAD, and likely MDD as well as the mean scores on the PSS, GAD-7, and PHQ-9 scales were highest amongst those aged under 25 years, and lowest amongst those over 60 years. This finding is consistent with some previous studies that reported higher scores in stress, anxiety, and depressive symptoms in younger people compared to older ages [577, 580, 581]. The finding that people aged 60 years and above reported lower scores on our rating scales is both interesting and curious, given that COVID-19 infections have been shown to cause significantly higher morbidity and mortality in this age group compared to the younger age group [588, 589]. Since there was stronger emphasis of the need for people over 60 years to take more stringent measures with social distancing and they are also likely to have higher prevalence of underlying medical conditions, it may have been expected that they would be more distressed during the pandemic. On the other hand, older people tend to be less socially mobile than younger ones, thus possibly explaining their reported lower scores on rating scales for stress, anxiety, and depression during a pandemic lockdown. People above 60 years are also more likely to have experienced various major life events in the past, possibly including having lived through past epidemics or pandemics, hence their increased resilience as

found in our study. Additionally, younger people, especially those under 25 years, may have perceived their academic, social, occupational, and economic prospects to be more threatened by COVID-19 compared to those over 60 years and this will likely, at least in part, explain their increased stress levels according to our study [582, 583]. As outlined in the introduction, several studies have reported lower rates of anxiety and depression in older age groups compared to younger ones [577, 580, 581]. Another hypothesis that could be propounded to explain this finding include that younger people, especially those under 25 years of age, are known to spend more time on social media and other news outlets. For example, in a 2019 US study, 90% of people aged 18 to 29 were active on social media, compared to 45% of those aged over 65 years [590]. High consumption rates of news about the COVID-19 pandemic have been associated with increased levels of distress [585]. Having said this, one might also have expected that increased opportunities for social connection through social media outlets that are readily available to younger people would limit the impact of physical distancing on them, perhaps compared to older adults.

One group particularly vulnerable to the effects of the COVID-19 pandemic continues to be older adults in senior care homes [588]. At the time this survey was designed in the context of Text4Hope, that fact was not known. It is likely that the majority of seniors responding to the Text4Hope survey are not in care, and this limitation must be taken into account in interpreting these and similar results on decreased severity of mental health indices in the older population. More research directed specifically at understanding the impact of social connectedness with stress, anxiety, and depression is needed to shed more light in this area.

According to the UK Office for National Statistics, a population-based survey found that people over seventy years of age reported feeling happier than those aged 16 to 69 years during the period before a national lockdown was imposed in the wake of COVID-19 in the United Kingdom (UK) [591]. Interestingly, this gap in reported feelings of happiness between the groups decreased by the third week of the lockdown. Again, the UK government recommended stricter social distancing measures for those over 70 years of age, possibly explaining why they would have become increasingly more anxious and distressed as the pandemic continued. In comparison, our study data were collected at a single point at the beginning of the lockdown when social distancing was imposed across the province of Alberta, Canada.

The clinical and practical utility of our study derives mainly from its potential to serve as a guide to healthcare planners in directing treatment and support services in a more targeted and age-

appropriate way during this COVID-19 pandemic and related crisis situations in the future. With the knowledge that younger people, including students [575], tend to suffer disproportionately higher levels of stress, anxiety, and depression, equitable attention must be paid to ensure that their needs are met in all relevant areas. For example, online platforms may be used to deliver psychotherapeutic interventions and support networks to young people in their homes so as to minimize the spread of the virus while mitigating their increased vulnerability to mental distress during the pandemic. Educational institutions and authorities may also need to develop online platforms and portals to aid the delivery of lectures and other learning materials with a view to maintaining as much of their daily structure and routine as possible.

Our study was limited in being a snapshot of self-reported experiences of mental health signs and symptoms at the beginning of the Alberta lockdown, as opposed to a more longitudinal evaluation, especially if administered by a trained clinician. It is possible therefore that data collected a few weeks further down the line from our original data set would reflect similar findings as did the aforementioned UK study [574]. Furthermore, our study is not representative of the population in Alberta either by age or gender [509] and so our findings may not be generalized to the entire population. In addition, although the ANOVA analysis allowed for comparison of the stress, anxiety, and depression levels between all the age groups as a strength, it did not take into account potential confounding factors such as sex, ethnicity, relationship status, employment and education status, which is a limitation. Age is likely to be one of the several factors upon which vulnerability to mental health effects of COVID-19 would be based. In addition, other social determinants of health, along with co-morbid physical health conditions, are known to play significant parts in increasing vulnerability in times of crisis [579]. Any interventions aimed at mitigating mental health effects of COVID-19 must therefore take of all these various factors into account. Finally, our survey did not ask participants about pre-existing stress, anxiety, and depression. It is possible that some respondents had these baseline stress, anxiety, and depression and so the reported scores on the standardized scales may not all be attributable to the COVID-19 pandemic.

5. Conclusions

Our results also indicate that both the prevalence rates as well as the mean scores for stress, anxiety, and depression on standardized scales were highest amongst those under 25 years, and lowest amongst those over 60 years. The trend for mean scores across the stress, depression, and anxiety

scales to decrease in severity from younger to older age has potential implications for planning to meet mental health service needs during COVID-19. Innovative and cost-effective interventions such as supportive text messaging which are independent of geographic location, are free to the end user, do not require expensive data plans, and can reach thousands of people simultaneously [216, 299, 300, 310, 369, 372, 475, 592] could be useful particularly to a younger age population who seem to be most impacted psychologically during the COVID-19 pandemic.

4.2.2 COVID-19 pandemic: influence of relationship status on stress, anxiety, and depression in Canada

Nkire, N., Nwachukwu, I., **Shalaby, R.,** Hrabok, M., Vuong, W., Gusnowski, A., . . . Agyapong, V. I. O. (2021). COVID-19 Pandemic: Influence of Relationship Status on Stress, Anxiety, and Depression in Canada. Ir J Psychol Med, 1-26. doi:10.1017/ipm.2021.1. Available at https://www.ncbi.nlm.nih.gov/pubmed/33597900

Abstract

Objective: To examine the impact of relationship status on levels of stress, anxiety, and depression during the coronavirus (COVID-19) pandemic to identify relationship status groups who are at greater risk of mental health difficulties.

Methods: The sample was drawn from individuals who subscribed to the Text4Hope program, a cognitive behavioral therapy inspired text messaging service developed to support Albertans during the COVID-19 pandemic. A survey link was sent to the subscribers to ascertain their relationship status and assess psychopathology using the Perceived Stress Scale-10 (PSS-10), Generalized Anxiety Disorder 7-item (GAD-7) scale, and Patient Health Questionnaire-9 (PHQ-9). Data analysis was carried out using SPSS-26 for descriptive statistics.

Results: Within the first 6 weeks of the pandemic, 8267 of 44·992 subscribers responded to the online survey giving a response rate of 19.4%. Mean scores on the PSS, GAD-7, and PHQ-9 were highest among those who were single and lowest among those who were widowed. Overall, mean scores on the PHQ-9 were higher in groups who self-identified as separated or divorced when compared with groups who identified as having partners, including the categories of married or cohabiting.

Conclusions: Relationship status during the COVID-19 pandemic has an influence on the mental health of individuals. Our findings highlight relationship groups at risk of mental health problems during the pandemic and for whom treatments and mitigation should be targeted.

Introduction

Background

Since its discovery in Wuhan China, coronavirus disease-19 (COVID-19) has spread rapidly across the world in a few months [593]. Having been declared a global pandemic in January 2020, Canada has not been spared [594]. As it has progressed, the pandemic leaves in its wake a significant death toll, worsening economic indices, and increased global disease burden [595]. This trail of devastation has caused governments to take unprecedented actions to curb the spread of this novel disease, including partial shutdown of the economy, physical distancing, and quarantine [439, 596]. These measures coupled with the direct effects of the illness itself have disturbed the natural rhythm and structure of individuals' lives, which in turn has had an adverse impact on mental health and well-being [278].

Quarantine and self-isolation are well-established means for managing highly contagious disease outbreaks in an epidemic [597]. The two terms, although used interchangeably, have different meanings. Self-isolation is the sequestration of individuals who have been diagnosed with a contagious disease from those who are not sick [280, 598], while quarantine is the separation and limitation of movement of individuals who have potentially been exposed to a contagious disease to see whether they become unwell, thereby reducing the risk of infection to others [597, 599]. well-intentioned methods of managing a pandemic produce unintended consequences. Prior research indicates that both measures may increase anxiety, stress and depression [596], increase suicidal risk [600], escalate boredom, increase fears of infecting family particularly among those with young children, limit supplies of essential goods, affect family finances, induce frustration and anger and litigation [601, 602], and in some circumstances, result in the stigmatization of affected individuals. As well, by putting cohabiting individuals (eg. partners, roommates and families) in unusually close proximity for a long time in a mostly closed unit, it may expose or worsen existing tensions in relationships. While for single individuals, it may reduce access to previous supports, which may in turn increase their stress.

Stress levels, anxiety, and depression are usually elevated during crises [278]. As workplaces have closed and individuals have become limited to their family units or households, intimate partner

relationships became an important source of coping with stress posed by the pandemic. Relationships have a bidirectional association with mental health such that a good relationship bodes well for good mental health, while severe mental illness may pose a strain on relationships. Some researchers have observed that relationships on the whole predict better mental health outcomes [603]; They also note that the quality of the relationship plays a role in ensuring good mental health. They further posit that established committed relationships are associated with greater benefit to mental health [603]. A contentious or troubled relationship is associated with more mental health problems in mothers and children [604, 605]. To further highlight the importance of the quality of relationship on mental health, prior studies have shown that single people have better mental health outcomes than those who are in an unhappy union [606]. Some authors show that levels of anxiety and depression are considerably higher in single mothers than in married mothers [607, 608], and the Millennium Cohort Study demonstrates that mothers in unstable families (separated or divorced) have worse mental health outcomes than those in stable family units [609]. Individuals who are in unstable relationships show higher levels of depression and anxiety than those in stable relationships [604, 610], which supports the view that positive interaction with partners or a spouse reduces the risk of depression and anxiety [611]. Research indicates that marital status differences in mental health are greatest when the comparison group is the divorced or widowed and smaller or nonsignificant in comparison to the never married, suggesting a more nuanced effect of marriage on mental health outcomes such as anxiety and depression [612, 613]. (Cairney & Krause, 2005; Williams & Carlson, 2012).

The impact of relationships and relationship status on anxiety and depression during a pandemic, such as COVID-19, is less studied, and most of the studies in this area involve Asian cohorts. The predominance of studies comprising primarily Asians or set in Asian countries may limit generalizability to other countries and races; hence, the need for a study set in, and comprised of samples from, a different jurisdiction. The evidence varies for studies published to date. Hawryluck et al. [614] found no relationship between marital status and psychological outcomes in quarantine during a crisis, and Wang et al. [278], in examining the psychological responses during the initial phases of the COVID-19 pandemic in China, found that marital status did not significantly impact depression and anxiety scores. However, Tan and colleagues [615] in their study of the immediate mental health status of the Chinese workforce during the COVID-19

pandemic found that respondents who were divorced, separated, or widowed had higher impact of event, stress, anxiety, and depression scores than individuals who were single; and the married group had lower scores. This study differs from others in that it examined mental health issues in subjects returning to work in a pandemic. The added strain of returning to work in a pandemic and the attendant stress of finding appropriate childcare may have affected responses; while this was not explicitly explored in the study, it does deserve further examination.

The present study examines the impact of relationship status on reports of stress, anxiety, and depression during the COVID-19 pandemic in a Canadian cohort. It aims to add to the literature in this area, which to the best of our knowledge is limited. Most of the literature in this area arises from Asia and may therefore not be generalizable to Canadian subjects; this in turn limits the evidence available for channelling appropriate resources and treatments to those who might need it. Findings may help to provide individuals in at-risk relationship status group with additional mental health supports/services during this and future pandemics.

Method

A cross-sectional survey was used to explore mean differences in perceived stress, anxiety, and depression symptom scores according to the relationship status of Text4Hope subscribers.

Recruitment

The study recruitment procedures and sample size estimations have been described in the published study protocol [616]. An online survey link was sent to subscribers to the Text4Hope program, a daily supportive text message service, launched by Alberta Health Services on March 23, 2020, to help Albertans cope with the mental health effects of the COVID-19 pandemic. In addition to demographic information, we assessed clinical characteristics using validated scales for self-reported symptoms, including the Perceived Stress Scale (PSS), the Generalized Anxiety Disorder 7-item (GAD-7) scale, and the Patient Health Questionnaire-9 (PHQ-9). The PSS is a validated 10-item questionnaire used to assess the self-reported level of stress in the previous 1 month by assessing thoughts and feelings. Each item on the scale is scored between 0 (never) to 5

(very often). Higher scores on the scale indicates higher levels of stress [302]. The GAD-7 is a validated 7-item questionnaire used to assess the self-reported levels of anxiety in respondents in the 2 weeks prior to assessment [301]. It is based on DSM-IV-TR symptoms of anxiety. Each item on the scale is scored between 0 (not at all) and 4 (nearly every day).

The PHQ-9 is a 9-item validated instrument used to diagnose and measure the severity of depression in general medical and mental health settings [303]; it is the major depression module of the full PHQ. Each of the nine items on the questionnaire is scored between 0 (not at all) and 3 (nearly every day). It may be used to plan and monitor treatment of depression.

Sample size estimation

Based on a provincial population estimate of approximately 4.3 million, the necessary sample size to generate prevalence estimates was 4157, assuming a 99% confidence level and 2% error. Previous research employing similar methodology in Alberta generated a 20% response rate [94]. Therefore, we aimed to extract and analyze data after obtaining a minimum recruited sample of 20 785 Text4Hope subscribers.

Data analysis

Data analysis was undertaken using the IBM Statistical Package for Social Sciences (SPSS) Statistics for Windows, version 26 [418]. One-way analysis of variance (ANOVA) with two-tailed significance ($p < 0.05$) was performed to assess the statistical differences between relationship status and corresponding mean scores on the PSS, the GAD-7, and the PHQ-9. For variables which did not violate the assumptions of homogeneity of variance in the mean scores on the ANOVA test, we performed a Tukey's post hoc test to determine if there were statistically significant differences in the mean scores of the various clinical measures between the different relationship status groupings. For variables which violated the homogeneity of variance assumption, we determined if there were statistically significant differences for the mean scores for the various clinical measures between the different relationship status groupings using the Welch F test and a Games-Howell post hoc test (as these tests do not require groups to have equal standard deviations).

Results

Of the 44·992 subscribers who joined Text4Hope in the first 6 weeks, 8267 responded to the online survey invitation, yielding a 19.4% response rate. Of the 8267 respondents, 5799 (70.1%) identified as either married, cohabiting, or partnered, 618 (7.5%) identified as either separated or divorced, 136 (1.6%) identified as widowed, 1541 (18.6%) identified as single, 95 (1.1%) identified as "other," and 78 (0.9%) did not identify their relationship status.

The other demographic characteristics of the respondents are as shown in Table 4.2.2.1.

Table 4.2.2.1: Distribution of demographic characteristics of respondents by relationship status

Variables	**Married/cohabiting/ partnered N (%)**	**Separated/ divorced N (%)**	**Widowed N (%)**	**Single N (%)**	**Other N (%)**	**Overall N (%)**
Gender						
Male	691 (70.60)	52 (5.30)	8 (0.80)	222 (22.70)	6 (0.60)	979 (12.00)
Female	5055 (71.20)	565 (8.00)	125 (1.80)	1287 (18.10)	72 (1.00)	7104 (86.90)
Other	45 (48.90)	1 (1.10)	1 (1.10)	29 (31.50)	16 (17.40)	92 (1.10)
Age						
≤25	455 (50.30)	11 (1.20)	0 (0.00)	426 (47.10)	13 (1.40)	905 (11.30)
26–40	2251 (76.70)	111 (3.80)	5 (0.20)	545 (18.60)	24 (0.80)	2936 (36.60)
41–60	2513 (73.50)	383 (11.20)	49 (1.40)	445 (13.0)0	31 (0.90)	3421 (42.60)
>60	487 (64.10)	103 (13.60)	75 (9.90)	83 (10.90)	12 (1.60)	760 (9.50)
Ethnicity						
Caucasian	4820 (72.10)	533 (8.00)	117 (1.80)	1167 (17.50)	47 (0.70)	6684 (82.00)
Indigenous	178 (58.90)	25 (8.30)	4 (1.30)	90 (29.80)	5 (1.70)	302 (3.70)

Asian	276 (68.30)	14 (3.50)	1 (0.20)	110 (27.20)	3 (0.70)	404 (5.00)
Other	499 (65.80)	43 (5.70)	10 (1.30)	168 (22.20)	38 (5.00)	758 (9.30)
Education						
Less than high school diploma	114 (34.90)	23 (7.00)	4 (1.20)	177 (54.10)	9 (2.80)	327 (4.00)
High school diploma	532 (65.80)	58 (7.20)	21 (2.60)	190 (23.50)	8 (1.00)	809 (9.90)
Post-secondary education	5097 (73.40)	534 (7.70)	105 (1.50)	1158 (16.70)	53 (0.80)	6947 (85.00)
Other education	47 (51.60)	2 (2.20)	4 (4.40)	13 (14.30)	25(27.50)	91 (1.10)
Employment status						
Employed	4530 (75.70)	443 (7.40)	45 (0.80)	924 (15.40)	40 (0.70)	5982 (73.20)
Unemployed	534 (56.00)	102 (10.70)	24 (2.50)	282 (29.60)	12 (1.30)	954 (11.70)
Retired	384 (68.80)	53 (9.50)	62 (11.10)	54 (9.70)	5 (0.900)	558 (6.80)
Students	204 (45.40)	7 (1.60)	0 (0.00)	233 (51.90)	5 (1.10)	449 (5.50)
Other	137 (58.50)	13 (5.60)	5 (2.10)	46 (19.70)	33 (14.10)	234 (2.90)
Housing status						
Own home	4314 (81.80)	354 (6.70)	106 (2.00)	475 (9.00)	28 (0.50)	5277 (65.7)
Living with family	300 (38.10)	36 (4.60)	2 (0.30)	435 (55.30)	14 (1.80)	787 (9.8)
Renting	1031 (54.80)	214 (11.40)	20 (1.10)	589 (31.30)	27 (1.40)	1881 (23.4)
Other	33 (40.70)	5 (6.20)	2 (2.50)	18 (22.20)	23 (28.40)	81 (1.0)

As demonstrated in Table 4.2.2.1, the majority of respondents were female, (n = 7104, 86.9%), were Caucasians (n = 6684, 82.0%), had post-secondary education (n = 6947, 85.0%), were employed (n = 5982, 73.2%), were married, cohabiting, or partnered (n = 5799, 70.1%), and owned their own home (n = 5277, 65.7%). The mean scores for all the respondents were 20.79 (s.d. = 6.83, n = 7589) on the PSS, 9.68 (s.d. = 5.87, n = 6944) on the GAD-7 scale, and 9.43 (s.d. = 6.29, n = 7082) on the PHQ-9 scale.

Table 4.2.2.2 presents the means and standard deviations for the PSS, GAD-7, and PHQ-9 in relation to the various relationship status groups.

Table 4.2.2.2: Mean scores on the GAD-7 scale, PHQ-9 scale, and PSS by relationship status

Scale	Self-reported relationship status	N	Mean	Std. deviation	Std. error	95% confidence interval for mean	
						Lower bound	Upper bound
GAD-7 total score	Married/cohabiting/partnered	4942	9.60	5.80	0.10	9.40	9.80
	Separated/divorced	539	9.30	6.00	0.30	8.80	9.80
	Widowed	117	7.40	5.53	0.50	6.40	8.40
	Single	1270	10.40	5.90	0.10	10.00	10.70
	Other	66	9.10	5.90	0.70	7.70	10.60
	Total	6934	9.70	5.80	0.10	9.50	9.80
PHQ-9 total score	Married/cohabiting/partnered	5034	8.90	6.00	0.10	8.70	9.000
	Separated/divorced	549	10.40	6.70	0.30	9.80	10.90
	Widowed	120	7.90	6.20	0.60	6.80	9.10
	Single	1302	11.30	6.70	0.10	10.90	11.70
	Other	67	9.40	7.16	0.90	7.60	11.10
	Total	7072	9.40	6.29	0.10	9.30	9.60
PSS total score	Married/cohabiting/partnered	5378	20.40	6.65	0.10	20.20	20.60
	Separated/divorced	582	20.90	7.17	0.30	20.40	21.50
	Widowed	129	17.90	6.90	0.60	16.70	19.10
	Single	1410	22.40	7.00	0.20	22.00	22.80
	Other	78	21.60	7.20	0.800	19.90	23.20
	Total	7577	20.80	6.80	0.10	20.60	20.90

GAD-7, Generalized Anxiety Disorder 7 scale; PHQ, Patient Health Questionnaire; PSS, Perceived Stress Scale.

Table 4.2.2.2 shows that the mean scores on the PSS, GAD-7, and PHQ-9 were highest among those who were single and lowest among those who were widowed. Respondents who were either married, cohabiting, or partnered and those who were either separated or divorced had similar

mean scores on the PSS and GAD-7. However, respondents who were either separated or divorced had a higher mean score on the PHQ-9 than respondents who were either married, cohabiting, or partnered.

Table 4.2.2.3 represents the results of the one-way ANOVA comparing the sums of squares between and within relationship status groups for the PSS, GAD-7, and PHQ-9.

Table 4.2.2.3: One way ANOVA comparing sums of squares between and within groups

		Sum of squares	**DF**	**Mean square**	**F statistic**	**Sig.**
GAD-7 total score	Between groups	1350.20	4	337.60	9.90	< 0.01*
	Within groups	237·190.60	6929	34.20		
	Total	238·540.80	6933			
PHQ-9 total score	Between groups	7087.10	4	1771.80	45.90	< 0.01*
	Within groups	272·566.90	7067	38.60		
	Total	279·654.50	7071			
PSS total score	Between groups	5590.10	4	1397.50	30.50	< 0.01*
	Within groups	347·437.80	7572	45.90		
	Total	353·027.90	7576			

GAD-7, Generalized Anxiety Disorder 7 scale; PHQ, Patient Health Questionnaire; PSS, Perceived Stress Scale; DF, degree of freedom.
*$p < 0.05$.

Table 4.2.2.3 demonstrates that there were statistically significant differences between and within relationship status groups for scores on the PSS ($F = 30.46$, $p < 0.01$), GAD-7 ($F = 9.86$, $p < 0.01$), and PHQ-9 ($F = 45.94$, $p < 0.01$). The Levene statistic test of homogeneity of variances suggested no violation of the assumption of equality of means for the GAD-7 ($p > 0.05$), and thus, a Tukey's *post hoc* test was conducted to determine statistically significant differences in the mean scores between the different relationship status groups as presented in Table 4.2.2.4. However, the Levene statistic test of homogeneity of variances suggested there was a violation of the assumption of equality of means for the PSS and PHQ-9 ($p < 0.05$). Consequently, a Welch F test and a Games-Howell *post hoc* test were carried out to determine statistically significant differences in the mean scores on the two scales between the different relationship status groups. The Welsh F tests were

statistically significant in each case, which confirms that the differences between the groups in terms of their mean PSS and PHQ-9 scores were statistically significant. Results of the Games-Howell *post hoc* test is presented in Table 4.2.2.5.

Table 4.2.2.4: Tukey HSD *post hoc* multiple comparison

Dependent variable	**(I) Relationship**	**(J) Relationship**	**Mean difference (I–J)**	**Std. error**	***p*-Value***	**95% confidence interval**	
						Lower bound	**Upper bound**
GAD-7 total score	Married/cohabiting/partnered	Separated/divorced	0.30	0.27	0.78	−0.42	1.03
		Widowed	2.23	0.55	<0.01*	0.73	3.72
		Single	−0.77	0.18	<0.01*	−1.27	−0.26
		Other	0.47	0.73	0.97	−1.51	2.45
	Separated/divorced	Married/cohabiting/partnered	−0.30	0.27	0.78	−1.03	0.42
		Widowed	1.92	0.60	0.01*	0.30	3.55
		Single	−1.07	0.30	<0.01*	−1.89	−0.25
		Other	0.16	0.76	1.00	−1.92	2.25
	Widowed	Married/cohabiting/partnered	−2.23	0.55	<0.01*	−3.72	−0.73
		Separated/divorced	−1.92	0.60	0.01*	−3.55	−0.30
		Single	−2.99	0.57	<0.01*	−4.54	−1.45
		Other	−1.76	0.90	0.29	−4.22	0.70
	Single	Married/cohabiting/partnered	0.77	0.18	<0.01*	0.26	1.27
		Separated/divorced	1.07	0.30	<0.01*	0.25	1.89
		Widowed	2.99	0.57	<0.01*	1.45	4.54
		Other	1.23	0.74	0.45	−0.78	3.25
	Other	Married/cohabiting/partnered	−0.47	0.73	0.97	−2.45	1.51
		Separated/divorced	−0.16	0.76	0.10	−2.25	1.92

		Widowed	1.76	0.90	0.29	−0.70	4.22
		Single	−1.23	0.74	0.45	−3.25	0.78

GAD-7, Generalized Anxiety Disorder-7 item scale.
*$p < 0.05$.

Table 4.2.2.5: Games-Howell *post hoc* multiple comparison

Dependent variable	**(I) Relationship**	**(J) Relationship**	**Mean difference (I–J)**	**Std. error**	**Sig.**	**95% confidence interval**	
						Lower bound	**Upper bound**
PHQ-9 total score	Married/cohabiting/partnered	Separated/divorced	−1.52	0.30	<0.01*	−2.33	−0.70
		Widowed	0.93	0.57	0.48	−0.65	2.50
		Single	−2.47	0.20	<0.01*	−3.02	−1.91
		Other	−0.52	0.88	0.976	−2.98	1.94
	Separated/divorced	Married/cohabiting/partnered	1.52	0.30	<0.01*	0.70	2.33
		Widowed	2.44	0.63	0.01*	0.70	4.18
		Single	−0.95	0.34	0.04*	−1.88	−0.03
		Other	0.99	0.92	0.81	−1.57	3.56
	Widowed	Married/cohabiting/partnered	−0.93	0.57	0.48	−2.50	0.65
		Separated/divorced	−2.44	0.63	0.01*	−4.18	−0.70
		Single	−3.40	0.59	<0.01*	−5.03	−1.76
		Other	−1.45	1.04	0.64	−4.33	1.43
	Single	Married/cohabiting/partnered	2.47	0.20	<0.01*	1.91	3.02
		Separated/divorced	0.954	0.34	0.04*	0.03	1.88
		Widowed	3.40	0.59	<0.01*	1.76	5.03
		Other	1.95	0.89	0.20	−0.55	4.45
	Other	Married/cohabiting/partnered	0.519	0.88	0.98	−1.94	2.98
		Separated/divorced	−0.99	0.92	0.81	−3.56	1.57

		Widowed	1.45	1.04	0.64	−1.43	4.33
		Single	−1.95	0.89	0.20	−4.45	0.55
PSS total score	Married/cohabiting/partnered	Separated/divorced	−0.54	0.31	0.42	−1.39	0.31
		Widowed	2.49	0.61	0.01*	0.80	4.19
		Single	−1.99	0.21	<0.01*	−2.57	−1.43
		Other	−1.18	0.83	0.62	−3.50	1.15
	Separated/divorced	Married/cohabiting/partnered	0.537	0.31	0.42	−0.31	1.39
		Widowed	3.03	0.68	<0.01*	1.17	4.89
		Single	−1.46	0.35	<0.01*	−2.42	−0.50
		Other	−0.64	0.88	0.95	−3.08	1.80
	Widowed	Married/cohabiting/partnered	−2.49	0.61	0.01*	−4.19	−0.80
		Separated/divorced	−3.03	0.68	<0.01*	−4.89	−1.17
		Single	−4.49	0.63	<0.01*	−6.24	−2.74
		Other	−3.67	1.03	<0.01*	−6.50	−0.84
	Single	Married/cohabiting/partnered	1.99	0.21	<0.01*	1.43	2.57
		Separated/divorced	1.46	0.35	<0.01*	0.50	2.42
		Widowed	4.49	0.63	<0.01*	2.74	6.24
		Other	0.82	0.85	0.87	−1.54	3.18
	Other	Married/cohabiting/partnered	1.18	0.83	0.62	−1.15	3.50
		Separated/divorced	0.64	0.88	0.95	−1.80	3.08
		Widowed	3.67	1.03	<0.01*	0.84	6.50
		Single	−0.82	0.85	0.87	−3.18	1.54

PHQ, Patient Health Questionnaire; PSS, Perceived Stress Scale.
*The mean difference is significant at the 0.05 level.

Table 4.2.2.4 suggests that respondents who identified as either married, cohabiting, or partnered had significantly higher mean scores on the GAD-7 compared to respondents who identified as widowed (mean difference = 2.23, 95% CI = 0.73–3.72, and $p < 0.01$) but not respondents who identified as separated or divorced or other ($p > 0.05$). On the other hand, respondents who were

either married, cohabiting, or partnered were significantly more likely to have a lower mean score on the GAD-7 compared to respondents who were single (mean difference = 0.77, 95% CI = −1.27–−0.26, $p < 0.01$). Table 4.2.2.4 also suggests that respondents who were single had a significantly higher mean score on the GAD-7 compared to respondents who were either separated or divorced (mean difference = 1.07, 95% CI = 0.25–1.89, $p < 0.01$) and respondents who were widowed (mean difference = 2.99, 95% CI = 1.45–4.54, $p < 0.01$). Finally, respondents who were either separated or divorced had a significantly higher mean score on the GAD-7 compared to respondents who were widowed (mean difference = 1.92, 95% CI = 0.3–3.55, $p < 0.01$).

Table 4.2.2.5 shows that respondents who identified as either married, cohabiting, or partnered had significantly lower mean scores on the PHQ-9 compared to respondents who identified as separated or divorced (mean difference = −1.52, 95% CI = −2.33–−0.7, $p < 0.01$) and respondents who identified as single (mean difference = −2.47, 95% CI = −3.02–−1.91, $p < 0.01$), but not respondents who identified as either widowed or other ($p > 0.05$). On the other hand, respondents who were single had significantly higher mean scores on the PHQ-9 compared to respondents who were separated or divorced (mean difference = 0.95, 95% CI = 0.03–1.88, $p = 0.04$) and those who were widowed (mean difference = 3.40, 95% CI = 1.76–5.03, $p < 0.01$). Finally, respondents who identified as separated or divorced had a significantly higher mean score on the PHQ-9 compared to respondents who were widowed (mean difference = 2.44, 95% CI = 0.70–4.18, $p < 0.01$).

Table 4.2.2.5 also shows that respondents who identified as either married, cohabiting, or partnered had significantly higher mean scores on the PSS compared to respondents who identified as widowed (mean difference = 2.94, 95% CI = 0.8–4.19, $p < 0.01$) and a significantly lower mean score than respondents who identified single (mean difference = −1.99, 95% CI = −2.57–−1.43, $p < 0.01$), but not respondents who identified as either widowed or other ($p > 0.05$). On the other hand, respondents who were single had significantly higher mean scores on the PSS compared to respondents who were separated or divorced (mean difference = 1.46, 95% CI = 0.50–2.42, $p < 0.01$) and those who were widowed (mean difference = 4.49, 95% CI = 2.74–6.24, $p < 0.01$). Finally, respondents who identified as separated or divorced had a significantly higher mean score on the PSS compared to respondents who were widowed (mean difference =3.03, 95% CI = 1.17–4.89, $p < 0.01$).

Discussion

This is the first study in Canada to specifically examine the impact of relationship status on measures of self-reported stress, anxiety, and depression during the COVID-19 pandemic. The majority of the participants in this study were Caucasian (*n* = 6684, 82%), female (*n* = 7104, 86.9%), aged between 26 and 60 years (*n* = 6357, 79.2%), with post-secondary school education (*n* = 6947, 85.0%), employed (*n* = 5982, 73.2%), and living in their own home (*n* = 5277, 65.7%). These figures (see Table 4.2.2.1) suggest a degree of socioeconomic stability within the sample, prior to COVID-19 pandemic onset.

The majority of individuals in the cohort identified as married, cohabiting, or partnered (*n* = 5799, 70.1%). This is comparable to the findings of Wang *et al.* [278] who surveyed the general public in mainland China in the early weeks of the COVID-19 pandemic and found that 76.4% of their participants reported being married. We found a consistent trend of higher mean scores on the PSS, GAD-7, and PHQ-9 in responders who identified as single compared to those who were married, cohabiting, or partnered, or indeed in any other relationship category. This suggests that being in a relationship of some sort mitigates the risk of developing symptoms of anxiety, depression, or stress during the COVID-19 pandemic. This is not surprising as having someone around helps to provide a means of socializing particularly with the restrictions in socializing put in place at some points during the pandemic. Individuals who identified as separated or divorced also reported higher mean scores across measures compared to those who were married, partnered, or cohabiting, although this difference was more distinct for PHQ-9 than GAD-7 or PSS. Individuals who were widowed consistently reported low levels of anxiety and depression compared to other groups; this was not in alignment with the finding of Tan *et al.* [615]. It is possible that having been through the loss of a partner and its attendant grief, these individuals may have developed the resilience to help them cope with the pandemic.

Social isolation and loneliness have been identified as major adverse consequences of the COVID-19 pandemic [617]. Other studies have reported that when people are isolated or lonely, they become significantly more vulnerable to anxiety, depression, deliberate self-harm, and suicide [27, 618, 619]. Single individuals are certainly more likely to feel the effects of loneliness and isolation more than the married [619], and this may explain the consistently higher levels of stress, anxiety, and depression among the single compared to other subgroups within this cohort. Available

evidence suggests that measures aimed at reducing loneliness and promoting connectedness can be protective against emotional problems, deliberate self-harm, and completed suicide [620, 621]. While this study did not specifically ask respondents about loneliness, we hypothesize that single individuals were more likely to be lonely and socially isolated in quarantine and self-isolation, and future studies may explore this hypothesis. As such, results from the present study suggests a need for early interventions that are targeted at people who are single, with a view to preventing or mitigating mental health consequences of the COVID-19 pandemic or future crisis situations.

Wang *et al.* in their study of a Chinese cohort demonstrated that 75.2% of respondents reported experiencing some worry about the prospects of a family member becoming infected with the COVID-19 virus [278]. This same study found that increased levels of concern that a family member would become infected was significantly associated with depression, anxiety, and stress (DAS) subscale scores (B = 0.50, 95% CI = 0.04–0.96); the present study showed that respondents who are married, cohabiting, or partnered had higher mean anxiety scores compared to widowed. This finding may be a reflection of the concerns about infecting a partner. It merits further exploration.

This study has several strengths and limitations. The use of anonymous online surveys ensures an element of blinding and mitigated the risk of bias on the part of a potential assessor or bias on the part of the respondent; it also ensured anonymity of the individuals completing the survey. On the downside, the nature and quality of relationships in the different subgroups was not explored; as well, the survey did not clarify whether people who identified as single had other close and reliable social networks such as supportive roommate situations which could well impact their coping abilities and sense of distress. The use of a self-report survey poses a limitation in the actual definition of illness, as assessment by trained mental health clinicians administering the survey may yield potentially differing results. Generalization is limited by the study sample being based primarily in Alberta Canada, and the respondents are individuals who are specifically enrolling into a service to receive anxiety and stress support. Furthermore, we were unable to measure respondents' pre-COVID-19 baseline scores for stress, anxiety, and depression. The relatively low response rate may open the study to nonresponse bias. However, the study sample was greater than the projected sample size of 4157 needed to accurately estimate prevalence rates of mental health conditions in an Alberta population with a 99% confidence and a 2% margin of error. The use of

an anonymous recruitment process also meant that we were unable to compare how responders differed from non-responders both clinically and demographically although our representative sample suggest the two groups would have similar characteristics. In addition, while a one-way ANOVA allowed for comparison of the stress, anxiety, and depression levels between all the relationship groups as a strength, it did not take into account potential confounding factors such as sex, age, ethnicity, employment, and education status, which is a limitation. The impact of these confounding factors could be assessed using regression models, although such models would also have the limitation of not allowing for a comparison of the stress, anxiety, and depression between all relationship status categories. Notwithstanding these limitations, the findings from this study shed light on the effects of relationship status on reports of stress, anxiety, and depression in the early stages of the COVID-19 pandemic. The nature of recruitment into this study allowed for increased respondent diversity and generalizability as well as affording us the opportunity to investigate some demographic predictors. The findings are in alignment with existing literature from other geographical areas.

Results from this study suggests that being single and separated or divorced are risk factors for more severe outcome stress, anxiety, and depression scores specifically during the COVID-19 pandemic. Services aimed at providing mental health supports during pandemics should consider allocating more resources to supporting these particular groups of people. For example, supportive text messages are independent of geographic location, are free to the end users, do not require expensive data plans, and can reach thousands of people simultaneously [94, 545]. Previous research has reported that daily supportive text messages are effective in reducing depressive symptoms as well as supporting individuals with problem drinking [216, 217, 310, 318, 372, 475, 622] High user satisfaction has also been reported [94, 299]. Therefore, innovative and cost-effective interventions such as the Text4Hope program [300, 586] could be useful particularly to a single and separated or divorced individual who seem to be most impacted psychologically during the COVID-19 pandemic.

4.2.3 Ethnicity COVID-19 Pandemic: Stress, Anxiety, and Depression Levels Highest amongst Indigenous Peoples in Alberta

Lawal, M. A., **Shalaby, R.,** Chima, C., Vuong, W., Hrabok, M., Gusnowski, A., . . . Agyapong, V. I. O. (2021). COVID-19 Pandemic: Stress, Anxiety, and Depression Levels Highest amongst Indigenous Peoples in Alberta. Behavioral sciences (Basel, Switzerland), 11(9), 115. doi:10.3390/bs11090115. Available at https://www.ncbi.nlm.nih.gov/pubmed/34562953

Abstract

This study explores differences in stress, anxiety, and depression experienced by different ethnic groups during the COVID-19 pandemic. This was a cross-sectional online survey of subscribers of the COVID-19 Text4Hope text messaging program in Alberta. Stress, anxiety, and depression were measured among Caucasian, Indigenous, Asian, and other ethnic groups using the Perceived Stress Scale (PSS)-10, Generalized Anxiety Disorder (GAD)-7, and Patient Health Questionnaire (PHQ)-9 scales, respectively. The burden of depression and stress were significantly higher in Indigenous populations than in both Caucasian and Asian ethnic groups. The mean difference between Indigenous and Caucasian for PHQ-9 scores was 1.79, 95% CI of 0.74 to 2.84, $p < 0.01$ and for PSS-10 it was 1.92, 95% CI of 0.86 to 2.98, $p < 0.01$). The mean difference between Indigenous and Asian for PHQ-9 scores was 1.76, 95% CI of 0.34 to 3.19, $p = 0.01$ and for PSS-10 it was 2.02, 95% CI of 0.63 to 3.41, $p < 0.01$. However, Indigenous participant burden of anxiety was only significantly higher than Asian participants' (mean difference for GAD-7 was 1.91, 95% CI of 0.65 to 3.18, $p < 0.01$). Indigenous people in Alberta have higher burden of mental illnesses during the COVID-19 pandemic. These findings are helpful for service planning and delivery.

Introduction

Several studies have reported increased or high levels of psychological distress and perceived mental illnesses in different populations during a pandemic or epidemic of a disease [278, 584, 623-630] and during mass disasters [631-633]. By early 2020, the Chinese Center for Disease Control and Prevention investigated clusters of patients with pneumonia of unknown etiology in Wuhan, leading to the isolation of a novel coronavirus (2019-nCoV) [634]. The World Health Organization (WHO) declared a global pandemic [635] on 11 March 2020 and by July, there were around 10 million coronavirus disease (COVID-19) cases and approximately 510,000 COVID-related deaths. Canada reported about 104,000 COVID cases with approximately 8600 related deaths in the same period [636].

The WHO has reported that one in four people will suffer mental or neurological disorders [637]. The 2017 Global Burden of Disease Study revealed that, depressive disorders and anxiety disorders were the third and eighth leading causes of years lived with disability (YLDs), respectively [638, 639]. In Canada, mental health and substance use disorders are the second leading cause of YLDs. Around 20% of Canadian residents experience mental illness each year, most frequently mood and anxiety disorders [640]. Suicide can occur in psychotic and affective disorders but it is a core symptom of depressive disorder [641] and around 4000 deaths by suicide occur in Canada annually [642]. The total annual cost of mental illnesses to the Canadian economy was estimated at $51 billion (CAD) in 2008 with a projected increase to $2.5 trillion (CAD) by 2041 [640].

Indigenous peoples are a diverse set of communities living across Canada, comprising First Nations, Métis, and Inuit populations [643]. Indigenous peoples constituted 4.9% of the population of Canada in 2016 [644]. Collectively, Indigenous peoples carry the highest burden of physical and mental illnesses in Canada [645-651]. a trend that extends to other countries with Indigenous populations [652-657]. However, one study reported similar prevalence of depression and anxiety for Indigenous and non-Indigenous populations in the Canadian province of British Columbia [658]. Additionally, a systematic review and meta-analysis study that combined studies of Indigenous people of the Americas reported significantly lower lifetime prevalent rates of generalized anxiety, panic, and all depressive disorders in Indigenous populations. However, post-traumatic stress disorder (PTSD) and social phobia were significantly higher relative to the non-

Indigenous population [659]. Despite these findings, the overwhelming majority of studies [645-656] and a United Nations report [657] agreed that the burdens of physical and of mental illnesses are generally higher in Indigenous peoples compared to non-Indigenous populations.

Worldwide, suicide rates among Indigenous peoples are generally significantly higher than in non-Indigenous populations [660]. In a 2019 Canadian study, relative to non-Indigenous persons, the suicide rate among Inuit peoples was nine times higher; three times higher among First Nations peoples; and two times higher among Métis peoples [661]. However, suicide rates varied by First Nations Band, with a reported suicide rate of zero about 60% of bands. In addition, suicide rates were highest in people aged 15–24 years among First Nations males and Inuit males and females [661]. The reasons for the disproportionately higher burden of physical and mental illnesses among the Canadian Indigenous populations is attributable to social determinants of health (e.g., education, housing, socioeconomic status, access to services, etc.). Indigenous peoples often experience inequities that predispose them to experience poorer health outcomes compared to non-Indigenous populations [662-664]. The Truth and Reconciliation Commission of Canada report detailed intergenerational trauma inflicted upon Indigenous peoples from the imposition of the residential school system and the Indian Act in Canada over several decades [665].

Numerous studies, using standardized questionnaires, have reported high levels of psychological distress, anxiety, and depression due to the COVID-19 pandemic [278, 584, 623-630, 666, 667]. The prevalence of anxiety and depression, as measured by different standardized questionnaires, varied widely during the COVID-19 pandemic. For depression, the prevalence ranged from 14.6% to 53.8% during the COVID-19 pandemic [278, 623, 624, 626, 627, 666], in excess of expected worldwide prevalence of 2% to 6% in 2017 [48]. Reported prevalence for anxiety during the COVID-19 pandemic range from 8.3% to 50.3% [278, 623, 624, 626, 627, 629, 630, 666], also far higher expected worldwide prevalence of 2.5% to 7% in 2017 [668]. For stress during the COVID-19 pandemic, estimated prevalence ranges from 7.6% to 53.8% [2,5,8,9,47]. These worldwide prevalence for anxiety disorders and depression used for comparison were gleaned from a combination of survey-, medical- and epidemiological data, and meta-regression modelling in cases where raw data is missing [668]. Different studies reported variable epidemiological risk factors that are significantly associated with increased prevalence of anxiety, depression, and

stress, measured by standardized questionnaires, during the COVID-19 pandemic in different populations [278, 584, 623-628, 630, 666].

Risk factors positively associated with depression in these studies included age 21–40 years [626, 630], female gender[278, 624], alcohol use[630], negative affect, detachment, an acquaintance infected with COVID-19, prior medical problems, stressful situations [624], specific physical health symptoms, poor self-rated health status [278], being close to the epicenter of the outbreak [630], being quarantined or affected by quarantine [625, 666], financial burden due to massive quarantine [627], and spending more time exposed to COVID-19 related news [627]. Risk factors reported to be significantly associated with increased prevalence of anxiety included age 20–46 years [623, 624, 626, 630], female gender[278, 624], negative affect, detachment, stressful situations, prior medical problems [624], family members infected with COVID-19 [624, 630], being infected with COVID-19 [630], specific physical health symptoms, poor self-rated health status and student status [278], quarantine or affected by quarantine [7,46], financial burden due to massive quarantine [627], perceived impact of COVID-19 [628], and time spent exposed to COVID-19 related news information [627, 630].

Most factors that are positively associated with anxiety and depression during the COVID-19 pandemic may also bey associated with stress. These include age 20–46 years [623, 624, 630], female gender[278, 584, 624], negative affect, detachment, having an acquaintance infected with COVID-19 [624], higher educational level, migrant status, being close to the epicenter of a COVID-19 outbreak [584], quarantined or affected by quarantine [666], student status, specific physical health symptoms, and poor self-rated health status [278]. Despite the positive association of these factors with anxiety, depression, and stress during the COVID-19 pandemic some studies reported no such relationship for several of these factors. For instance, gender had no effect on anxiety and depression in two of these studies [623, 628]. However, in a global report of anxiety disorder and depression estimates, females were reported to have higher prevalence of depression compared to males (4.1% versus 2.7%, respectively). In the same report, females had higher prevalence of anxiety disorders than males (4.7% versus 2.8%, respectively) [668]. In that report, median estimates for prevalence of depression and anxiety were higher in females for all the countries considered.

Given the generally greater burden of health among Indigenous peoples in Canada, in the absence of published detailed mental health studies addressing this inequity, we hypothesized that perceived stress, anxiety, and depression, measured by standardized instruments, would be higher for among Indigenous persons relative to other ethnic groups.

Text4Hope is a texting service that delivers once-daily supportive messages to support individuals' mental health during the COVID-19 pandemic. Text messages were based on cognitive-behavioral therapy concepts and developed by mental health professionals (i.e., psychiatrists, psychologists, and mental health therapists). The program offers mental health support, aims to ameliorate pandemic-related negative thoughts and feelings, and help individuals to develop healthy coping and resiliency skills [300]. The program was modeled after the Text4Mood [94] and Text4Support [213] mental health texting services provided to people in Alberta, Canada. Ultimately, such services are evidence-based, clinically relevant, and cost-effective interventions applied as a therapeutic alliance to mental healthcare services for individuals with depressive and drug use disorders [216, 217, 369, 622]. The aim of this program is to close the psychological treatment gap experienced in healthcare systems during the COVID-19 pandemic.

The aim of this study was to determine the burden of anxiety, depression, and stress in relation to ethnicity for Text4Hope subscribers who completed the baseline survey.

Materials and Methods

A cross-sectional survey was used to explore mean differences in perceived stress, anxiety, and depression symptom scores among the various ethnic groupings for Text4Hope subscribers who completed the baseline survey. This study explored each participant's demographic characteristics (gender, age, level of education, employment status, relationship status, and housing status) and stratified them by their self-identified ethnicity (Caucasian, Indigenous, Asian, and Other). The mean scores, standard deviations, and standard errors from the Perceived Stress Scale (PSS)-10 [302], Generalized Anxiety Disorder (GAD)-7 [301], and Patient Health Questionnaire (PHQ)-9 [303] for self-reported symptoms of stress, anxiety, and depression, respectively, were stratified by ethnicity. The PSS is a 10-item validated self-report questionnaire (with an associated Cronbach's alpha of >0.70) which is used to assess the level of stress in the previous month. Each

item on the scale is scored between 0 (never) to 5 (very often). Higher scores on the scale indicate higher levels of stress. The GAD-7 is a 7-item validated questionnaire (associated with a Cronbach's alpha of 0.92) which is used to assess the self-reported levels of anxiety in respondents in the two weeks prior to assessment. Each item on the scale is scored between 0 (not at all) to 3 (nearly every day). Higher scores on the scale indicate higher levels of anxiety. The PHQ-9 is a 9-item validated instrument (associated with a Cronbach's alpha of 0.89) which used to diagnose and measure the severity of depression in general medical and mental health settings. Each of the 9 questionnaire items is scored between 0 (not at all) to 3 (nearly every day). Higher scores on the scale indicate higher levels of depression.

The mean scores for stress, anxiety, and depression were compared among the ethnic groups and their differences were calculated using appropriate statistical methods to determine the mean differences and a 95% confidence interval in their PSS-10, GAD-7, and PHQ-9 scores. These mean differences and their 95% confidence interval depict the burden of anxiety, depression, and stress for each ethnic group relative to the other ethnic groups.

Recruitment

The study recruitment procedures and sample size estimations have been described earlier [270, 438] [36, 439]. In summary, Text4Hope was launched by AHS on 23 March 2020. The program's aim was to send daily supportive text messages to help support Albertans dealing with mental health concerns due to the COVID-19 pandemic. An online survey link was sent to self-subscribers and requested demographic information including gender, age, ethnicity, education, relationship status, employment status, type of employment, housing status, isolation status, and clinical characteristics of stress, anxiety, depression and obsessive-compulsive symptoms. Clinical characteristics were assessed using validated scales for self-reported symptoms, including the PSS-10, GAD-7, and PHQ-9. Participant consent was implied by submission of subscribers' survey responses. Ethical approval for the research study was obtained through the University of Alberta Health Research Ethics Board (Pro00086163). Data was collected between 24 March 2020 and 4 May 2020.

Statistical Methods

Data analysis was undertaken using IBM Statistical Package for Social Sciences (SPSS) Statistics for Windows, version 26 (IBM Corp., Armonk, NY., USA) [418]. Demographic characteristics of respondents were summarized in absolute numbers and percentages, by ethnic category. A one-way analysis of variance (One-Way ANOVA) with two tailed significance ($p < 0.05$) was used to assess statistical differences between the ethnic groups for corresponding mean scores on the PSS-10, GAD-7, and PHQ-9. For variables that did not violate the assumptions of homogeneity of variance in the mean scores on the ANOVA test, we performed a Turkey's post hoc test to determine if there were statistically significant differences in the mean scores of the various clinical measures between the different ethnic groups. For variables which violated the homogeneity of variance assumption, we determined if there were statistically significant differences for the mean scores for the various clinical measures between the different ethnic groupings using the Welch F test and a Games–Howell post-hoc test (as these tests do not require groups to exhibit homogeneity of error variance).

Results

Demographic Characteristics of Respondents

Of the 44,992 subscribers who joined Text4Hope in the first 6 weeks, 8267 responded to the online survey invitation, yielding a 19.4% response rate. Of the 8267 respondents, 6685 (81.0%) identified as Caucasian, 302 (3.7%) identified as Indigenous, 407 (4.9%) identified as Asian, 756 (9.2%) identified as belonging to "Other" ethnic groups, and 103 (1.2%) did not identify their ethnicity. The other demographic characteristics of the respondents are displayed in Table 4.2.3.1.

Table 4.2.3.1: Demographic characteristics of respondents by self-reported ethnicity.

Variables	**Caucasian** ***N*** **(%)**	**Indigenous** ***N*** **(%)**	**Asian** ***N*** **(%)**	**Other** ***N*** **(%)**	**Overall** ***N*** **(%)**
Gender					
Male	751 (76.5)	32 (3.3)	93 (9.5)	105 (10.7)	981 (12.0)
Female	5884 (83.1)	263 (3.7)	312 (4.4)	620 (8.8)	7079 (86.9)

Other	50 (55.6)	7 (7.8)	2 (2.2)	31 (34.4)	90 (1.1)
Age					
≤25	646 (71.3)	47 (5.2)	88 (7.9)	125 (13.8)	906 (11.1)
26–40	2355 (80.4)	124 (4.2)	188 (6.4)	261 (8.9)	2928 (36.6)
41–60	2905 (85.1)	111 (3.3)	113 (3.3)	283 (8.3)	3412 (42.7)
>60	673 (89.5)	13 (1.7)	10 (1.3)	56 (7.4)	752 (9.4)
Education					
Less than High School Diploma	214 (65.2)	35 (10.7)	17 (5.2)	62 (18.9)	328 (4.0)
High School Diploma	621 (77.7)	50 (6.3)	21 (2.6)	106 (13.3)	798 (9.8)
Post-Secondary Education	5815 (83.9)	212 (3.1)	388 (5.2)	547 (7.9)	6932 (85.1)
Other Education	35 (38.9)	4 (4.4)	8 (8.9)	43 (47.8)	90 (1.1)
Employment Status					
Employed	4970 (83.4)	196 (3.3)	300 (5.0)	490 (8.2)	5956 (73.1)
Unemployed	744 (78.2)	66 (6.9)	34 (3.6)	107 (11.3)	951 (11.7)
Retired	498 (89.9)	8 (1.4)	6 (1.1)	42 (7.6)	554 (6.8)
Students	310 (68.4)	25 (5.5)	53 (11.7)	65 (14.3)	453 (5.6)
Other	161 (68.8)	7 (3.0)	12 (5.5)	54 (23.1)	234 (2.9)
Relationship Status					
Married/Cohabiting/Partnered	4820 (83.5)	178 (3.1)	276 (4.8)	499 (8.6)	5773 (70.9)
Separated/Divorced	533 (86.7)	25 (4.1)	14 (2.3)	43 (7.0)	615 (7.5)
Widowed	117 (88.6)	4 (3.0)	1 (0.8)	10 (7.6)	132 (1.6)
Single	1167 (76.0)	90 (5.9)	110 (7.2)	168 (10.9)	1535 (18.8)
Other	47 (50.5)	5 (5.4)	3 (3.2)	38 (40.9)	93 (1.1)
Housing Status					
Own Home	4532 (86.3)	123 (2.3)	197 (3.8)	401 (7.6)	5243 (65.7)
Living with Family	533 (67.6)	43 (5.5)	99 (12.6)	113 (14.3)	788 (9.8)
Renting	1466 (78.0)	123 (6.5)	93 (4.9)	197 (10.5)	1879 (23.5)
Other	39 (48.1)	6 (7.4)	6 (7.4)	30 (7.0)	81 (1.0)

In Table 4.2.3.1, the majority of respondents identified as female (n = 7079, 86.9%), aged between 26 and 60 years (n = 6340, 79.3%), had post-secondary education (n = 6932, 85.1%), were

employed (*n* = 5956, 73.1%), were married, cohabiting, or partnered (*n* = 5773, 70.9%), and owned their own home (*n* = 5243, 65.7%).

Association between Ethnic Categories and Prevalence of Perceived Stress, Likely GAD, and Likely MDD

The data displayed in Table 4.2.3.2 illustrate prevalence rates for clinically meaningful stress, anxiety, and depression. These data suggest the prevalence of moderate to high stress, likely Generalized Anxiety Disorder (GAD), and likely Major Depressive Disorder (MDD) were highest in respondents that identified as Indigenous.

Table 4.2.3.2: Association between ethnic categories and prevalence of perceived stress, likely GAD, and likely MDD.

Variable	**Ethnic Categories**				
	Caucasian ***N*** **(%)**	**Indigenous** ***N*** **(%)**	**Asian** ***N*** **(%)**	**Other** ***N*** **(%)**	**Total Prevalence** ***N*** **(%)**
Perceived Stress					
Moderate or High Stress [a]	5593 (85.2)	279 (92.1)	329 (86.1)	618 (88.0)	6819 (85.7)
Chi square value	14.71				
p-value	<0.01				
Effect Size (Phi)	0.04				
Generalized Anxiety Disorder (GAD)					
GAD likely [b]	2848 (47.1)	144 (51.8)	137 (41.6)	296 (44.7)	3425 (47.1)
Chi square value	6.4				
p-value	0.09				
Effect Size (Phi)	0.03				
Major Depressive Disorder (MDD)					
MDD likely [c]	2695 (43.7)	149 (52.8)	149 (44.2)	305 (47.5)	3298 (44.4)
Chi Square value	11.8				
p-value	0.01				
Effect Size (Phi)	0.04				

[a] Moderate or High Stress defined as PSS-10 score ≥ 14; [b] Likely GAD defined as GAD-7 score ≥ 10; [c] Likely MDD defined as PHQ-9 score ≥ 10.

The mean score for all respondents (n = 7589) on the PSS-10 was 20.79 (SD = 6.83). For the PHQ-9 scale, the mean score for all the respondents (n = 7082) was 9.43 (SD = 6.29) and for the GAD-7 scale, the mean score for all respondents (n = 6944) was 9.68 (SD = 5.87). Chi square analysis revealed significant association between the prevalence of likely stress and depression and the ethnicity of the participants, but not for the likely anxiety symptoms.

Table 4.2.3.3 presents the means and standard deviations for each of the PSS-10, PHQ-9, and GAD-7 scales by ethnicity groups.

Table 4.2.3.3: Descriptive illustration of mean scores of GAD-7, PHQ-9 and PSS-10 scales by ethnic group.

Variables	***N***		**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Minimum**	**Maximum**
						Lower Bound	Upper Bound		
GAD-7 Total Score	**Caucasian**	5750	9.69	5.83	0.08	9.54	9.84	0	21
	Indigenous	262	10.56	5.91	0.37	9.84	11.28	0	21
	Asian	307	8.65	5.96	0.34	7.98	9.32	0	21
	Other	595	9.75	5.99	0.25	9.26	10.23	0	21
	Total	6914	9.68	5.86	0.07	9.54	9.82	0	21
PHQ-9 Total Score	**Caucasian**	5859	9.30	6.19	0.08	9.15	9.46	0	27
	Indigenous	266	11.10	6.50	0.40	10.31	11.88	0	27
	Asian	315	9.33	6.82	0.38	8.58	10.09	0	27
	Other	612	10.04	6.71	0.27	9.51	10.57	0	27
	Total	7052	9.44	6.29	0.08	9.29	9.58	0	27
PSS-10 Total Score	**Caucasian**	6243	20.65	6.83	0.09	20.48	20.82	0	40
	Indigenous	286	22.56	6.36	0.38	21.82	23.30	8	40
	Asian	359	20.55	6.78	0.36	19.84	21.25	2	39
	Other	668	21.51	6.91	0.27	20.99	22.04	1	40
	Total	7556	20.79	6.83	0.08	20.64	20.94	0	40

Table 4.2.3.3 suggests that respondents that self-identified as Indigenous had the highest mean scores on the PSS-10, PHQ-9, and GAD-7 scales, while respondents that self-identified as Caucasian or Asian had fairly similar mean scores on the PSS-10 and PHQ-9 but not the GAD-7 scales.

Table 4.2.3.4 represents the results of One-Way ANOVA comparing sums of squares between and within ethic groups for the PSS-10, PHQ-9, and GAD-7 scales.

Table 4.2.3.4: ANOVA comparing sums of squares between and within ethnic groups.

Variables		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
GAD-7 Total Score	**Between Groups**	533.18	3	177.73	5.183	<0.01
	Within Groups	236,941.86	6910	34.29		
	Total	237,475.03	6913			
PHQ-9 Total Score	**Between Groups**	1061.60	3	353.87	8.984	<0.01
	Within Groups	277,609.70	7048	39.39		
	Total	278,671.30	7051			
PSS-10 Total Score	**Between Groups**	1397.14	3	465.71	10.013	<0.01
	Within Groups	351,233.05	7552	46.51		
	Total	352,630.20	7555			

Table 4.2.3.4 suggests that there were statistically significant differences between and within ethnic groups for scores on the PSS-10 ($F = 10.013$, $p < 0.001$), the PHQ-9 ($F = 8.98$, $p < 0.001$), and the GAD-7 ($F = 5.18$, $p < 0.001$). The Levene's Statistic test of homogeneity of variances suggested no violation of the assumption of equality of means for the PSS-10 and the GAD-7 ($p > 0.05$) and so we ran the Turkey's post-hoc test to determine statistically significant differences in the mean scores between the different ethnic groups as presented in Table 4.2.3.5 But in contrast, the Levene Statistic test of homogeneity of variances indicated a violation of the assumption of homogeneity of error variance for the PHQ-9 scores ($p < 0.05$). Consequently, we ran a Welch F test and a Games-Howell post-hoc test to determine statistically significant differences between mean scores on the PHQ-9 between the different ethnic groups. The Welch F test was statistically significant which confirms that the differences between the groups in terms of their mean PHQ-9

scores are statistically significant. The results of the Games–Howell post-hoc test is as presented in Table 4.2.3.5.

Table 4.2.3.5: Tukey HSD and Games-Howell post-hoc multiple comparisons.

Dependent Variable	Ethnicity	Ethnicity	Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
[a]GAD-7 Total Score	**Caucasian**	Aboriginal	-0.87	0.37	0.09	-1.82	.08
		Asian	1.04*	0.34	0.01	0.16	1.92
		Other	-0.06	0.25	0.99	-0.71	0.59
	Indigenous	Caucasian	0.87	0.37	0.09	-0.08	1.82
		Asian	1.91*	0.49	<0.01	0.65	3.18
		Other	0.82	0.43	0.24	-0.30	1.93
	Asian	Caucasian	-1.04*	0.34	0.01	-1.92	-0.16
		Aboriginal	-1.91*	0.49	<0.01	-3.18	-0.65
		Other	-1.10*	0.41	0.04	-2.16	-0.04
	Other	Caucasian	0.06	0.25	0.99	-0.59	0.71
		Aboriginal	-0.82	0.43	0.24	-1.93	0.30
		Asian	1.10*	0.41	0.04	0.04	2.16
[a]PSS-10 Total Score	**Caucasian**	Aboriginal	-1.92*	0.41	<0.01	-2.98	-0.86
		Asian	0.10	0.37	0.99	-0.85	1.05
		Other	-0.87*	0.28	0.01	-1.58	-0.15
	Indigenous	Caucasian	1.92*	0.41	<0.01	0.86	2.98
		Asian	2.02*	0.54	<0.01	0.63	3.41
		Other	1.05	0.48	0.13	-0.19	2.29
	Asian	Caucasian	-0.10	0.37	0.99	-1.05	0.85
		Aboriginal	-2.02*	0.54	<0.01	-3.41	-0.63
		Other	-0.97	0.45	0.13	-2.11	0.18
	Other	Caucasian	0.87*	0.28	0.01	0.15	1.58
		Aboriginal	-1.05	0.48	0.12	-2.29	0.19
		Asian	0.97	0.45	0.13	-0.18	2.11
[b]PHQ-9 Total Score	**Caucasian**	Other	-0.74*	0.28	0.05	-1.46	-0.01
		Asian	-0.03	0.39	0.99	-1.04	0.99
		Indigenous	-1.79*	0.41	<0.01	-2.84	-0.74
	Indigenous	Other	1.06	0.48	0.126	-.18	2.30
		Asian	1.76*	0.55	0.01	.34	3.19
		Caucasian	1.79*	0.41	<0.01	.74	2.84
	Asian	Other	-0.71	0.47	0.44	-1.92	0.51
		Caucasian	0.03	0.39	0.99	-0.99	1.04
		Indigenous	-1.76*	0.55	0.01	-3.19	-0.34
	Other	Asian	0.71	0.47	0.44	-0.51	1.92
		Caucasian	0.74*	0.28	0.05	0.01	1.46
		Indigenous	-1.06	0.48	0.13	-2.30	0.18

[a] Tukey HSD post hoc multiple comparison; [b] Games-Howell post hoc multiple comparison; * The mean difference is significant at the 0.05 level.

Table 4.2.3.5 suggests that respondents who self-identified as Indigenous had significantly higher mean scores on the GAD-7 compared to respondents that self-identified as Asian (Mean Difference = 1.91, 95% CI = 0.65–3.18 and $p < 0.01$) but not respondents that self-identified as Caucasian ($p > 0.05$) or "Other" ethnic groups ($p > 0.05$). On the other hand, respondents that identified as Caucasian had significantly higher mean scores on the GAD-7 compared to respondents that identified as Asian (Mean Difference = 1.04, 95% CI = 0.16–1.92, $p = 0.01$) but not respondents that identified as "Other" ethnic groups ($p > 0.05$). However, respondents that identified as Asian had significantly lower mean scores on the GAD-7 compared to respondents that identified as "Other" (Mean Difference= −1.10, 95% CI= −2.16 to −0.04, $p < 0.05$). Table 4.2.3.5 also suggests that respondents that identified as Indigenous had higher mean scores on the PSS-10 than both respondents that identified as Caucasian (Mean Difference = 1.92, 95% CI = 0.86–2.98, $p < 0.01$) or Asian (Mean Difference = 2.02, 95% CI = 0.63–3.41, $p < 0.01$) but not respondents that identified as "Other" ethnic groups ($p = 0.13$). There were no statistically significant differences in the mean scores between respondents that identified as Caucasian or Asian for the mean PSS-10 scores ($p > 0.05$). However, respondents that identified as Caucasian had significantly lower mean scores on the PSS-10 compared to respondents that identified as "Other" ethnic groups (Mean Difference = −0.87, 95% CI = −1.58 to −0.15, $p < 0.05$).

Table 4.2.3.5 suggests that respondents that identified as Indigenous had significantly higher mean scores on the PHQ-9 compared to respondents that identified as Asian (Mean Difference =1.76, 95% CI = 0.34–3.19 and $p < 0.05$) or Caucasian (Mean Difference = 1.79, 95% CI = 0.74–2.84, $p < 0.01$), but not those who identified as "Other" ethnic groups ($p > 0.05$). On the other hand, respondents that identified as Caucasian had significantly lower mean scores on the PHQ-9 compared to respondents that identified as "Other" ethnic groups (Mean Difference = −0.74, 95% CI = −1.46–−0.01, $p = 0.05$).

Discussion

To our knowledge, this is the first study to examine how depression, anxiety, and stress symptoms vary among ethnic groups in Canada during the COVID-19 pandemic. The demographics of our study population suggest that the demographic profile of subscribers of the Text4Hope program and Text4Mood programs [94] are comparable. Our study found that respondents identifying as

Indigenous reported higher levels of depression, anxiety, and stress than other ethnic groups in Alberta, Canada as measured by the PHQ-9, GAD-7, and PSS-10, respectively. Persons who identified as Caucasian or Asian reported similar levels of depression and stress, but respondents that identified as Caucasian reported more anxiety than respondents that identified as Asian. However, the significantly lower mean GAD-7 score reported by respondents that identified as Asian, compared to other ethnic groups, is not surprising given that in a global study of anxiety disorders, Asian people had lower prevalence of anxiety disorders (2% to 4%) compared to the rest of the world (4% to 6%), with the exception of some countries in South America, Eastern Europe, and Finland with similar prevalence of anxiety disorders [668].

Overall, the prevalence of distress was high, which is consistent with previous research. For example, significant stress was reported by over 90% of respondents that identified as Indigenous, and significant anxiety and depression were reported by over 50%. High rates of anxiety, depression, and stress found in this study are consistent with previous research showing high levels of population-level distress during the pandemic [278, 623, 624, 626, 627, 629, 630, 666], with rates grossly elevated compared to pre-COVID-19 estimates [48]. For instance, the prevalence of significant anxiety symptoms in our study of 47.1%, was similar to the rates reported in different studies across the world during the COVID-19 pandemic [278, 623, 624, 626, 627, 629, 630, 666], yet is much higher than an estimated global pre-COVID-19 rate in 2017 of 2.5% to 7% for anxiety [668].

The COVID-19 pandemic has likely accentuated pre-existing differences in the burden of mental health. For example, although a higher burden of mental health conditions among Indigenous peoples compared to non-Indigenous people in Canada was reported prior to the pandemic [649-651, 669-671], as well as in other countries with Indigenous populations [655, 656, 660], it is likely that COVID-19 has placed additional stressors on this group. The reasons for the disproportionately higher burden of physical and mental illnesses among Indigenous peoples may include inequalities related to social determinants of health (e.g., education, housing, socioeconomic status, access to services, etc.), which can place Indigenous peoples at greater risk of poorer health outcomes compared to non-Indigenous populations [662-664]. This pattern of data likely stems from broad societal events; for example, in Canada, Indigenous people have experienced intergenerational trauma related to the Residential School System and the

Government of Canada's Indian Act over decades [665]. It has been documented that natural disasters and public health crises exaggerate pre-existing social inequities, and our findings are consistent with this.

Our study has several limitations, including a lack of baseline data on the stress, anxiety, and depression levels immediately prior to the COVID-19 pandemic and related restrictions, limiting direct pre- and post-COVID-19 comparisons. Second, the response rate in our study of 19.4% was low. However, our sample size was greater than the sample size of 3693 needed for prevalence rates estimates for stress, anxiety, and depression in our overall sample of 44,992 subscribers or the 4200-sample size needed for prevalence rate estimates in the entire Alberta population with a confidence interval of 99% and a 2% margin of error. Third, our study likely evinces selection bias given the rather low response rate; specifically, it is possible that non-respondents may differ in a systematic way compared to respondents. For example, they may be more (or less) affected by the pandemic or may have limitations in literacy or English fluency. Similarly, our study has some limited generalizability. The respondents that self-identified as Indigenous in our study represented 3.7% of our sample, lower than estimated proportion of the Indigenous population in Canada (4.9%) [644]. Furthermore, the vast majority of our respondents identified as female (86.9%), which is an overrepresentation in our study relative to Canadian population estimates of 50.3% [672]. This may likely increase the prevalence of perceived anxiety and depression in our study population given that females reportedly have higher prevalence of anxiety disorders and depression in all the countries considered in a global study [668] Finally, although the ANOVA analysis allowed for comparison of the stress, anxiety, and depression levels between all the ethnic groups as a strength, it did not take into account potential confounding factors such as gender, age, relationship status, employment status, and education status, which is a limitation as ethnicity is likely to be one of several key factors upon which vulnerability to mental health effects of COVID-19 would be based. In addition, other social determinants of health, along with co-morbid physical health conditions, are known to play a significant role in increasing vulnerability in times of crisis [631]. Any interventions aimed at mitigating mental health effects of COVID-19 must therefore take of all these various factors into account.

Conclusions

The results of our study indicate that stress, anxiety, and depression levels are high in the general population during the COVID-19 pandemic, and are significantly associated with specific risk factors, such as Indigenous ethnicity. These results suggest a need for population-level mental health support, with enhanced psychological intervention for specific groups, such as Indigenous persons. Future studies should consider using a prospective study design in randomly selected participants from the general population with participants screened by trained clinicians for the presence of depression, anxiety, and stress using standardized objective assessment instruments. This will minimize recall bias and ensure that study findings are generalizable to the entire population.

Despite several limitations, this study provides useful data about the mental health ethnicity correlates of the COVID-19 pandemic. These findings are important for government and healthcare planning to determine the nature and quality of services required to address mental health challenges arising during this pandemic, as well as future pandemics that enforce public health measures. Specifically, planning for and implementing virtual care programs as well as supportive text messages is a relatively low-cost and easily scalable means of supporting individuals during public health crises [217, 248, 516, 518, 673], especially appropriate for supporting persons at additional risk of negative outcomes [216, 369, 622].

4.2.4 Prevalence of Perceived Stress, Anxiety, Depression, and Obsessive-Compulsive Symptoms in Health Care Workers and Other Workers in Alberta During the COVID-19 Pandemic: Cross-Sectional Survey

Mrklas, K., **Shalaby, R**., Hrabok, M., Gusnowski, A., Vuong, W., Surood, S., . . . Agyapong, V. I. O. (2020). Prevalence of Perceived Stress, Anxiety, Depression, and Obsessive-Compulsive Symptoms in Health Care Workers and Other Workers in Alberta During the COVID-19 Pandemic: Cross-Sectional Survey. JMIR Ment Health, 7(9), e22408. doi:10.2196/22408. Available at https://www.ncbi.nlm.nih.gov/pubmed/32915764

Abstract

Background: During pandemics, effective containment and mitigation measures may also negatively influence psychological stability. As knowledge about COVID-19 rapidly evolves, global implementation of containment and mitigation measures has varied greatly, with impacts to mental wellness. Assessing the impact of COVID-19 on the mental health needs of health care workers and other workers may help mitigate mental health impacts and secure sustained delivery of health care and other essential goods and services.

Objective: This study assessed the self-reported prevalence of stress, anxiety, depression, and obsessive-compulsive symptoms in health care workers and other workers seeking support through Text4Hope, an evidence-based SMS text messaging service supporting the mental health of residents of Alberta, Canada, during the COVID-19 pandemic.

Methods: An online cross-sectional survey gathered demographic (age, gender, ethnicity, education, relationship, housing and employment status, employment type, and isolation status) and clinical characteristics using validated tools (self-reported stress, anxiety, depression, and contamination/hand hygiene obsessive-compulsive symptoms). Descriptive statistics and chi-square analysis were used to compare the clinical characteristics of health care workers and other workers. Post hoc analysis was conducted on variables with >3 response categories using adjusted residuals. Logistic regression determined associations between worker type and likelihood of self-reported symptoms of moderate or high stress, generalized anxiety disorder, and major depressive disorder, while controlling for other variables.

Results: Overall, 8267 surveys were submitted by 44,992 Text4Hope subscribers (19.39%). Of these, 5990 respondents were employed (72.5%), 958 (11.6%) were unemployed, 454 (5.5%) were students, 559 (6.8%) were retired, 234 (2.8%) selected “other,” and 72 (0.9%) did not indicate their employment status. Most employed survey respondents were female (n=4621, 86.2%). In the general sample, the 6-week prevalence rates for moderate or high stress, anxiety, and depression symptoms were 85.6%, 47.0%, and 44.0%, respectively. Self-reported symptoms of moderate or high stress, anxiety, and depression were all statistically significantly higher in other workers than in health care workers (P<.001). Other workers reported higher obsessive-compulsive symptoms (worry about contamination and compulsive handwashing behavior) after the onset of the

pandemic (P<.001), while health care worker symptoms were statistically significantly higher before and during the COVID-19 pandemic (P<.001). This finding should be interpreted with caution, as it is unclear the extent to which the adaptive behavior of health care workers or the other workers might be misclassified by validated tools during a pandemic.

Conclusions: Assessing symptoms of prevalent stress, anxiety, depression, and obsessive-compulsive behavior in health care workers and other workers may enhance our understanding of COVID-19 mental health needs. Research is needed to understand more fully the relationship between worker type, outbreak phase, and mental health changes over time, as well as the utility of validated tools in health care workers and other workers during pandemics. Our findings underscore the importance of anticipating and mitigating the mental health effects of pandemics using integrated implementation strategies. Finally, we demonstrate the ease of safely and rapidly assessing mental health needs using an SMS text messaging platform during a pandemic.

Introduction

Significant public health efforts have been implemented to contain the spread of SARS-CoV-2 [674] and mitigate its far-reaching impacts [675], including the negative psychological effects of the COVID-19 pandemic. After its first recognition in December 2019, COVID-19 spread rapidly, leading to it being declared a Public Health Emergency of International Concern, and later, a global pandemic, by the World Health Organization (WHO) [676]. Confirmed COVID-19 cases reached 1 million on April 1, 2020, doubling again only 9 days later [677]. Despite widespread efforts to "flatten the curve," predictions on the ultimate resolution of the pandemic remain elusive due to variance in geographic disease burden, physical distancing requirements, and outbreak phase, among other factors [678], both within and beyond Canadian borders.

As knowledge of the COVID-19 pandemic increases and multilevel emergency response plans are activated [676], the implementation of containment and mitigation measures to stop the spread of COVID-19 continues to vary greatly by outbreak phase and between jurisdictions [678]. Unfortunately, pandemic containment and mitigation measures [679-681], while effective in limiting COVID-19 disease transmission, also likely contribute to negative psychological sequelae of affected individuals. The dynamic and rapidly changing circumstances related to the pandemic are creating uncertainty, stress, and anxiety, among other known adverse psychosocial correlates of the pandemic [468, 682-686].

The negative impact of COVID-19 on global mental health is clear and increasing [279, 281, 468, 624, 626, 685-694]. From a societal perspective, the emergent mental health burdens in health care workers [281, 578, 626, 683-685, 687, 693-698] and other workers is of significant concern to the sustainment of health care services, as well as the maintenance of critical goods, services, and supply chains in other economic sectors.

While there is a dearth of research comparing health care workers' mental health symptoms to that of other workers, especially during outbreaks, emerging research into health care worker mental health during the COVID-19 pandemic has documented high rates of depression [281, 578, 626, 683, 695, 696], anxiety [281, 578, 626, 683-685, 694-696], stress [578, 695, 696], and other mental health conditions, including fear, insomnia [626], grief [693], posttraumatic stress disorder somatization [693], obsessive-compulsive symptoms [683, 685, 695], and vicarious

traumatization [690]. Similar effects for health care workers were found in reviews and studies assessing the effects of past outbreaks [614, 699-707].

Multiple studies of mental health symptoms in the general public during the current pandemic and past outbreaks also show evidence of depression [279, 468, 581, 614, 624, 626, 683, 686, 700, 701, 708], anxiety [279, 581, 624, 626, 683, 700, 708, 709], stress [279, 581, 624], and other mental health conditions [279], including posttraumatic stress disorder [573, 614, 708-710], distress [614, 686, 700], fear [700, 709, 710], guilt, anger, and vicarious traumatization [690], conditions that can exacerbate panic or hysteria reactions [711]. Despite similar trends in both health care workers and the general population, the extent to which the mental health symptoms of health care workers and other workers differ is unclear. Notably, similar effects are also reported by individuals after exposure to other natural disasters and negative social conflict events including emergencies, terrorist attacks, earthquakes, and other calamities [468, 614, 682, 688, 699, 708, 712, 713].

Negative effects on mental well-being also occur more frequently in those with pre-existing mental health concerns [624, 694, 705, 707], which has important implications during the COVID-19 pandemic [711, 714]. In Canada, approximately 75.0% of those who accessed health services for a mental illness sought help for mood and anxiety problems. In Alberta in particular, a relatively high proportion of Albertans are known to experience mood and anxiety disorders (eg, 12.9% for females and 6.4% for males) [715].

Studies that describe, assess, and compare the mental health symptoms of health care workers and other workers during the COVID-19 pandemic can offer service planners, policy makers, and leaders important insights about how best to mitigate mental health risks and preserve worker health and well-being. Ultimately, such research can help protect the sustained delivery of health care services, goods, and services in other key economic sectors, as well as maintain supply chains.

Unfortunately, adequate resources to limit negative psychological effects are almost invariably lacking during pandemics and other crises [281, 705, 706, 716, 717], evidenced by the mental health and well-being lessons emerging early in the COVID-19 pandemic. Attention to mental health and well-being is commonly superseded by urgent physical and public health needs during an emergency (ie, immediately caring for people with the disease, as well as monitoring, testing,

and preventing further disease burden). However, systematic integration of mental health and well-being supports into the overall pandemic response may effectively mitigate and/or prevent health care and other worker, patient, and public harms, avoid burnout, and further help preserve the long-term stability and effectiveness of health care systems [41, 573, 698, 714, 718]. Although mental health harms are often noted or alluded to in pandemic guidance, there is a real need and opportunity to define practical measures guiding health care professionals in the psychological care of patients with COVID-19 and go beyond mere calls to action [714, 719]. The sustainable delivery of goods and services in health care and other sectors is contingent on worker health and well-being. It is essential to understand if and how worker mental health varies during pandemics so that adequate supports are put in place.

Given the known risks associated with declining mental health correlates from past emergency situations and emerging COVID-19 studies, it is critical to understand the needs of health care workers and other essential workers and offer them appropriate, digital, and timely access to mental health supports. Within this context, we launched Text4Hope, a cognitive-behavioral therapy (CBT)–based SMS text messaging service that delivers once-daily supportive messages to support individuals' mental health during the COVID-19 pandemic. The program offers support-seeking subscribers help identifying and modifying pandemic-related negative thoughts, feelings, and behaviors through texted advice and encouragement regarding the development of coping and resiliency skills [720]. The program was modeled after the Text4Mood program, a pre-existing, effective, evidence-based, and low-cost SMS text messaging intervention, developed as a therapeutic adjunct to support and optimize the mental health and treatment outcomes of people with mental health and addictions concerns residing in Alberta, Canada [94, 217, 248, 309, 516]. This study is an effort to better understand the mental health symptoms of health care workers and other workers during the COVID-19 pandemic, and to contribute evidence for mental health service planning. The specific aim of the study was to explore self-reported perceived stress, anxiety, depression, and obsessive-compulsive symptoms in health care workers and other workers who sought mental health support by subscribing to Text4Hope during the early phase of the COVID-19 pandemic.

Methods

A cross-sectional survey was used to explore the self-reported prevalence of perceived stress, anxiety, depression, and obsessive-compulsive symptoms in health care workers and other workers who subscribed to Text4Hope.

Recruitment

Text4Hope was offered to Alberta residents in the early stages of the COVID-19 pandemic through government and provincial health care delivery service news releases, email notifications, and website [720] postings related to COVID-19. Albertans seeking mental health support were invited to join the 3-month program by texting "COVID19HOPE" to a short code number. Subscription triggered a welcome text message containing a 5-10 minute online survey link requesting demographic characteristics (gender, age, ethnicity, education, relationship status, employment, type of employment [health care or other], housing status, and isolation status) and clinical characteristics (self-reported perceived symptoms of stress, anxiety, depression, and contamination- and cleanliness-associated obsessive-compulsive behaviors).

Clinical characteristics were assessed using validated screening scales for self-reported symptoms, including the Perceived Stress Scale (PSS; PSS score ≥14 indicates moderate or high stress) [302], the Generalized Anxiety Disorder 7-item (GAD-7) Scale (GAD-7 score ≥10 indicates likely generalized anxiety disorder [GAD]) [301], the Patient Health Questionnaire-9 (PHQ-9; a score ≥10 indicates likely major depressive disorder [MDD]) [303], and two items on the Brief Obsessive-Compulsive Scale (BOCS; pertaining to worry about dirt, germs, and viruses and handwashing behavior) [305]. Validated scales were chosen to better understand support seekers' self-reported symptoms, potential symptom severity, and to screen for symptomatology. These scales were not intended as diagnostic tools.

Participant consent was indicated via submission of subscribers' survey responses. The continuation of participation in the Text4Hope program was not dependent on the completion of the survey by participants; this was clearly stated to subscribers in the SMS text messaging program information provided at subscription. Ethical approval for the research was obtained through the University of Alberta Health Research Ethics Board (Pro00086163).

Based on a provincial population estimate of approximately 4.3 million people, the necessary sample size to generate prevalence estimates was 4157, assuming a 99% confidence level and 2%

error. Previous research employing similar methodology in Alberta generated a 20% response rate [94]. Therefore, we planned to extract and analyze data after obtaining a minimum recruited sample of 20,785 Text4Hope subscribers.

Analysis

Data analysis was undertaken using SPSS Statistics for Windows (Version 26; IBM Corp) [418]. Demographic characteristics of employed respondents were summarized by absolute numbers and percentages, by employment category (health care workers and other workers). Chi-square analysis with two-tailed significance ($P<.05$) was performed to assess the statistical differences between health care workers and other workers by their clinical characteristics. Variables with more than three responses in the chi-square test were subjected to post hoc analysis using adjusted residuals, with z scores and P values reported.

To assess the impact of "worker type" on self-reported symptoms of moderate or high stress, likely GAD, and likely MDD while controlling for demographic characteristics and isolation status, we entered all demographic predictors along with "worker type" into a logistic regression model. Correlation analysis was performed before the logistic regression analysis to rule out very strong correlations among predictor variables. Odds ratios from the binary logistic regression analysis were examined to determine the association between "worker type" and the likelihood of respondents self-reporting symptoms of moderate or high stress, likely GAD, and likely MDD, controlling for the other variables in the model. There were no imputations for missing data and the results presented reflect completed responses from the survey.

Results

Overview

During the first 6 weeks after launching the program (March 23 to May 4, 2020), a total of 44,992 subscribers joined Text4Hope; this data was extracted for analysis and is presented here. Of the 44,992 subscribers, 8267 responded to the online survey invitation, yielding a 19.4% response rate. Overall, 5990 (72.5%) respondents reported current employment, 958 (11.6%) reported current unemployment, 454 (5.5%) were students, 559 (6.8%) were retired, and 72 (0.9%) did not indicate

their employment status. Of those who indicated they were employed, 1414 (23.6%) indicated health care industry employment and 3951 (66.0%) indicated employment in other industries. The remaining 625 (10.4%) of employed respondents did not indicate an industry affiliation.

The 6-week prevalence rates in the sample (n=8267) for moderate or high stress, likely GAD, and likely MDD were 85.6%, 47.0%, and 44.0%, respectively. Descriptive demographic characteristics of survey respondents, by worker type, are displayed in Table 4.2.4.1. There was no imputation for missing data and the data analyzed and displayed were from the data set remaining after cases with missing data were excluded.

Table 4.2.4.1: Demographic characteristics of employed survey respondents.

Demographics and characteristics	Health care workers (N=1414)	Other workers (N=3951)	*P* value	Chi-square test result	Degrees of freedom	Total, n (%)
Sex			<.001	53.10	2	N/A[a]
Male	105 (7.4)	588 (14.9)	N/A	N/A	N/A	693 (12.9)
Female	1298 (91.1)	3323 (84.2)	N/A	N/A	N/A	4621 (86.2)
Gender diverse	9 (0.6)	37 (0.9)	N/A	N/A	N/A	46 (0.9)
Age (years)			.003	13.80	3	N/A
≤25	60 (3.4)	272 (7.0)	N/A	N/A	N/A	332 (6.3)
26-40	540 (38.8)	1511 (38.9)	N/A	N/A	N/A	2051 (38.9)
41-60	714 (51.4)	1915 (45.3)	N/A	N/A	N/A	2629 (49.9)
>60	76 (5.5)	183 (4.7)	N/A	N/A	N/A	259 (4.9)
Ethnicity			.01	11.05	3	N/A
Caucasian	1175 (83.3)	3266 (83.2)	N/A	N/A	N/A	4441 (83.1)
Indigenous	37 (2.6)	140 (3.6)	N/A	N/A	N/A	177 (3.3)
Asian	94 (6.7)	188 (4.8)	N/A	N/A	N/A	282 (5.3)
Other	107 (7.4)	333 (8.5)	N/A	N/A	N/A	438 (8.2)
Education			<.001	90.71	3	N/A

Less than high school diploma	6 (0.4)	81 (2.1)	N/A	N/A	N/A	87 (1.6)
High school diploma	38 (2.7)	382 (9.7)	N/A	N/A	N/A	240 (7.8)
Postsecondary	1358 (96.3)	3456 (87.6)	N/A	N/A	N/A	4814 (89.9)
Other education	8 (0.6)	28 (0.7)	N/A	N/A	N/A	36 (0.7)
Relationship status			<.001	21.73	4	N/A
Married, cohabiting, or partnered	1098 (77.2)	2876 (72.9)	N/A	N/A	N/A	3974 (74.2)
Separated or divorced	116 (8.2)	296 (7.5)	N/A	N/A	N/A	412 (7.7)
Widowed	9 (0.6)	29 (0.7)	N/A	N/A	N/A	38 (0.7)
Single	183 (13.0)	715 (18.1)	N/A	N/A	N/A	898 (16.8)
Other	7 (0.5)	30 (0.8)	N/A	N/A	N/A	37 (0.7)
Housing status			<.001	28.74	3	N/A
Own home	1083 (77.2)	2752 (70.4)	N/A	N/A	N/A	3836 (72.2)
Living with family	51 (3.6)	242 (6.2)	N/A	N/A	N/A	294 (5.5)
Renting	259 (18.4)	892 (22.8)	N/A	N/A	N/A	1115 (21.7)
Other	10 (0.7)	21 (0.5)	N/A	N/A	N/A	31 (0.6)
Self-isolated or self-quarantined	303 (21.7)	681 (17.5)	<.001	12.20	1	984 (18.6)

[a]N/A: not applicable.

Of employed support-seeking respondents, over 90.0% were aged ≥26 years (n=4939). Of this group, more than half were aged ≥41 years (n=2888) (Table 4.2.4.1). Most respondent workers identified as female (n=4621, 86.2%), were Caucasian (n=4441, 83.1%), were married, cohabiting, or partnered (n=3974, 74.2%), reported completion of postsecondary education (n=4814, 89.9%), and owned their own home (n=3836, 72.2%). There were statistically significant differences between health care workers and other workers on all demographic variables and isolation status. Health care workers had higher proportions of self-reported postsecondary education and home ownership, and higher rates of married, cohabiting, or partnered relationship status than other workers.

Univariate Analysis

In Table 4.2.4.2, we assessed the association between worker type and perceived stress, likely GAD, and likely MDD. Table 4.2.4.2 suggests that other workers reported higher moderate or high stress, higher likely GAD, and higher likely MDD compared to health care workers, with small effect sizes for each condition.

Table 4.2.4.2: Chi-square test of association between worker type, perceived stress, likely generalized anxiety disorder, and likely major depressive disorder.

Psychological symptom	Health care worker, n (%)	Other worker, n (%)	*P* value	Effect size (φ)
Perceived stress (moderate or high stress[a])	1079 (81.7)	3149 (85.6)	<.001	0.05
Likely generalized anxiety disorder[b]	461 (38.1)	1600 (47.7)	<.001	0.09
Likely major depressive disorder[c]	401 (32.1)	1490 (43.6)	<.001	0.10

[a]Moderate or high stress was defined as a Perceived Stress Scale score ≥14.
[b]Likely generalized anxiety disorder was defined as a Generalized Anxiety Disorder Scale score ≥10.
[c]Likely major depressive disorder was defined as a Patient Health Questionnaire score ≥10.

Logistic Regression

To assess the impact of "worker type" on moderate or high stress, likely GAD, and likely MDD while controlling for demographic characteristics and isolation status, we entered all seven characteristics in Table 4.2.4.1 and "worker type" into a logistic regression model.

For moderate or high stress, the full model containing all eight predictors was significant (X2[df=20, N=4874] =235.25, P<.001), suggesting the model was able to distinguish between respondents who reported moderate or high stress and those who did not. The model explained between 4.7% (Cox and Snell R2) and 8.2% (Nagelkerke R2) of the variance and correctly classified 84.7% of all cases. Controlling for all demographic characteristics and isolation status, health care worker type made a unique statistical contribution (Wald=8.44, P<.01) to the likelihood

that a respondent presented with moderate or high stress. Other workers were 1.3 times more likely to report moderate or high stress during the COVID-19 pandemic compared to health care workers when all demographic variables and isolation status were controlled for (OR 1.30, 95% CI 1.10-1.55).

For likely GAD, the full model containing all eight predictor variables was significant (X2[df=20, N=4454] =364.75, P<.001), meaning the model was able to distinguish between respondents who had likely GAD and those who likely did not have GAD. The model explained between 7.9% (Cox and Snell R2) and 10.5% (Nagelkerke R2) of the variance and correctly classified 62.5% of all cases. Controlling for all demographic characteristics and isolation status, health care worker type made a unique statistical contribution (Wald=21.62, P<.001) to the likelihood of respondents meeting the cutoff threshold for likely GAD. Other workers were 1.4 times more likely to meet the cutoff threshold for likely GAD during the COVID-19 pandemic compared to health care workers when all demographic variables and isolation status were controlled for (OR 1.40, 95% CI 1.22-1.62).

For likely MDD, the full model containing all eight predictors was significant (X2[df=20, N=4 535] =341.33, P<.001), implying the model was able to distinguish between respondents who had likely MDD and those who likely did not have MDD. The model explained between 7.3% (Cox and Snell R2) and 9.8% (Nagelkerke R2) of the variance and correctly classified 63.9% of all cases. Controlling for all demographic characteristics and isolation status, health care worker type made a unique statistical contribution (Wald=27.79, P<.001) to the likelihood that respondents presented with likely MDD. Other workers were 1.5 times more likely to meet the cutoff threshold for likely MDD during the COVID-19 pandemic compared to health care workers when all demographic variables and isolation status were controlled for (OR 1.47, 95% CI 1.30-1.71).

As shown in Table 4.2.4.3, there were statistically significant associations between worker type and the tendency to worry about dirt, germs, and viruses and the tendency to wash hands repeatedly or in a special way due to fears of contamination. Post hoc analysis using adjusted residuals demonstrated that health care workers were significantly less likely to worry about dirt, germs, and viruses since the start of the COVID-19 pandemic compared to other workers (53.9% versus 62.5%, respectively; z=5.3, P<.001). Conversely, the proportion of health care workers who were worried about dirt, germs, and viruses before the COVID-19 pandemic was significantly higher

than other workers (28.2% versus 22.1%, respectively; z=4.3, P<.001). Though the proportion of health care workers reporting compulsive hand washing due to fears of contamination after the COVID-19 pandemic began was lower than the proportion of other workers reporting the same (46.1% versus 57.6%, respectively; z=7.0, P<.001), a significantly higher proportion of health care workers engaged in compulsive hand washing before the pandemic due to fears of contamination (35.3% versus 29.3%, respectively; z=3.9, P<.001). In sum, the self-reported prevalence of obsessive-compulsive symptoms (ie, pre-existing worry and compulsive handwashing behavior) was higher in health care workers than in other workers, while the self-reported prevalence of worry about hand contamination and compulsive hand washing after the COVID-19 pandemic began was higher in other workers compared to health care workers.

Table 4.2.4.3: Chi-square test of association between worker type and manifestation of obsessive-compulsive symptoms.

Clinical variable	Health care workers, n (%)	Other workers, n (%)	*P* value	Effect size (φ)
Worried about dirt, germs, and viruses			<.001	0.08
Only since the COVID-19 pandemic	663 (53.9)	2137 (62.5)	N/A[a]	N/A
Before and during the COVID-19 pandemic	347 (28.2)	756 (22.1)	N/A	N/A
Never	220 (17.9)	525 (15.4)	N/A	N/A
Wash hands repeatedly or in a special way due to fears of contamination with dirt, germs, and viruses			<.001	0.11
Only since the COVID-19 pandemic	566 (46.1)	1969 (57.6)	N/A	N/A
Before and during the COVID-19 pandemic	433 (35.3)	1002 (29.3)	N/A	N/A
Never	229 (18.6)	447 (13.1)	N/A	N/A

[a]N/A: not applicable.

Discussion

Overview

This is the first large-sample, cross-sectional Canadian study to examine the self-reported prevalence of stress, anxiety, depression, and obsessive-compulsive symptoms by worker type during the COVID-19 pandemic. We used an online survey to gather self-reported symptoms of stress, anxiety, depression, and obsessive-compulsive behaviors in support-seeking individuals subscribing to the Text4Hope daily SMS text messaging support program. Text4Hope sent once-daily supportive text messages to provide Alberta residents with advice and encouragement to develop coping skills and optimize resiliency during the COVID-19 pandemic.

Principal Results

Our study sample comprised support-seeking individuals who subscribed to Text4Hope and had self-reported elevated symptomatology. The proportion of employed respondent subscribers (n=3721, 72.2%) was comparable to the 2017 Alberta employment rate (66.7%), the full-time employment rate for females (73.3%), and the proportion of female Albertans employed in the health care/social assistance sector, particularly in the ≥45 years age cohort (79.5%) [721]. Respondent demographics were comparable to only some Alberta resident worker characteristics (ethnicity, housing status) and Alberta health care worker characteristics (age, ethnicity, gender, education, and housing status)) [722, 723].

Health care worker demographic characteristics were comparable to surveyed health care worker characteristics in other international jurisdictions during the COVID-19 pandemic [281, 626, 683, 684].

We found that the overall self-reported 6-week prevalence of moderate or high stress, likely GAD, and likely MDD symptoms were higher than baseline [715] during the early COVID-19 outbreak phase and were statistically significantly higher in other workers than in health care workers.

The prevalence of pre–COVID-19 worry and compulsive handwashing behavior was higher in health care workers than in other workers, while worry and compulsive handwashing behavior after the COVID-19 pandemic began was significantly higher in other workers than in health care workers.

Limitations

Our study has several important limitations. The prevalence of self-reported stress, anxiety, depression, and obsessive-compulsive symptoms was assessed in health care workers and other workers who voluntarily sought support by subscribing to Text4Hope. Despite demographic similarities, voluntary subscribers seeking support may differ significantly from the non-subscribing employed or general employed population of Alberta, thereby influencing self-reported symptom prevalence rates. In addition, an overall elevated symptomatology, while higher than that of the general population, would be expected given that survey respondents were a sample of mental health support-seeking subscribers. Not all respondents answered every survey question, resulting in missing data for multiple variables and reduced sample sizes, thereby potentially reducing the generalizability of the findings.

Given both the dearth of comparative evidence on mental health burden in workers and the limitations of our study design, we were unable to explore subtle dynamics related to subtypes of health care workers and other workers (eg, frontline versus non-frontline, high-risk occupations in the "other" category). Similarly, we were unable to further refine our understanding of other pandemic dynamics that likely occurred during the study period, such as fluctuating employment status, disease exposure risk, and worker access to and use of personal protective equipment. This study is limited by its inability to address these factors, which nonetheless ought to be considered in comparisons with other, related literature.

There are several limitations related to the use of screening tools. Logistics, sample size, cost, resources, and time factors precluded the use of diagnostic interviews; our use of screening scales estimated self-reported symptom burden and was not intended to yield mental health diagnoses. However, a screening tool is appropriate in the context of capturing data quickly at a general population level and was thus the tool indicated for use in the current study. In addition, it should be noted that it is unclear the extent to which the BOCS screening tool is valid for and can differentiate the range of adaptive-to-obsessive-compulsive behaviors during a pandemic. For example, consistent and repeated handwashing has been emphasized as an important means of avoiding COVID-19 transmission.

Finally, we assessed self-reported symptoms during an early pandemic phase. It is possible that the timing of these measurements (and/or other contextual features that we did not study) were maligned with studies measuring the same outcomes during different pandemic phases and could bias the interpretation of our findings.

Comparison With Prior Work

Several studies of health care worker mental health during the COVID-19 pandemic revealed higher stress [281, 683-685, 694, 696], anxiety [281, 626, 696], depressive [281, 626, 683, 684], and obsessive-compulsive symptoms [683]; these results align well with our 6-week prevalence findings. These studies also found that heightened stress, anxiety, and depressive symptoms were consistently more pronounced in females, and in those with increased exposure to afflicted individuals (e.g., frontline health care workers, close proximity to higher intensity outbreak conditions). Although our 6-week prevalence findings matched this overall increase in health care worker mental health burden during an outbreak, higher levels of stress, anxiety, and depressive symptoms were also reported by other workers in our study.

Based on existing evidence, there may be several plausible explanations for our findings, although their interpretation should be approached with caution, given the lack of published studies directly comparing mental health symptoms by worker type, particularly during COVID-19.

There are many possible factors contributing to mental health concerns among the general public during times of societal unrest, as documented during previous infectious disease outbreaks [699] [704-708], emergencies, disasters [279, 309, 687-689, 709], and the current pandemic [281, 704, 724]. Within the Alberta context, several of these factors (eg, high unemployment [722], job uncertainty, strict confinement, and mitigation measures, as well as pre-existing, unaddressed mental health concerns arising in part from economic downturn and natural disasters [309, 715, 725] or other contextual factors may be contributing to the increased mental health symptoms in other workers. These factors may be more prevalent in other workers who actively sought support by subscribing to Text4Hope, contributing to a higher symptom burden in this worker group. Current trends in Alberta align with this hypothesis: a recent Mental Health Index survey of 3000 Canadians [726] showed Alberta residents experienced the highest national month-over-month decline in Mental Health Index scores. Decreases were observed in all Index subscores (including

risk measures for anxiety, depression, work productivity, optimism, and isolation, in decreasing order of magnitude), with greater declines among the unemployed, females, and younger individuals. Albertans had the second highest reported Mental Stress Change Score across Canada [726]. Nonetheless, our observation of elevated symptomatology overall might be anticipated given that respondents were a sample of mental health support-seeking Text4Hope subscribers.

Alternatively, it is also possible that the health care workers seeking support in our study sample were protected from mental health harms due to the influence of other documented but unassessed modifiers such as the following: ready access to relevant knowledge, training, protocols, timely information, personal protective equipment, and a support network of peers experiencing similar stress, as well as coordinated efforts, clear communication, and other occupational and/or social supports [684, 685, 707, 717, 718, 727]. Past research shows the presence of these and other precautionary measures may help health care workers feel a heightened sense of certainty or control over their situation. Perhaps support-seeking health care worker respondents' pre-existing knowledge and training served to reinforce their roles and practice, provided comfort and enhanced resiliency, and helped mitigate the negative effects of the pandemic as well as subsequent confinement and mitigation strategies [573, 684, 685, 702, 704, 705, 707, 718].

Such a resilience hypothesis in health care workers would contrast with recent COVID-19–related studies by Lai and colleagues [281] and Huang and colleagues [626], which demonstrated an increased risk of negative mental health sequelae in females [281, 578, 683-686, 696], nurses [281, 578, 683, 684, 686, 696], frontline staff, and those with closer proximity to higher intensity outbreak working conditions [281, 624, 683, 684, 686, 693, 694, 718]. Similar findings from past outbreaks also implicated concerns about health of self and family, disease spread, adequate supplies/resources, an influx of suspected cases, occupational changes, pre-existing chronic disease, isolation, and feelings about isolation and vulnerability as key negative contributing factors [281, 704, 707, 728]. Zhang and colleagues' recent survey comparing medical and nonmedical health care worker mental health symptoms in China post–COVID-19 showed higher prevalence and total scores for insomnia, anxiety (GAD-2), depression (PHQ-2), somatization, and obsessive-compulsive (Symptom Checklist 90-Revised) symptoms in health care workers [683]. Similar findings for anxiety occurred in a mixed sample survey undertaken during the COVID-19 pandemic [685]. Additionally, a quasi-comparator study of mental health concerns in frontline

workers and administrative health care workers found frontline workers were 1.4 times more likely to feel fear and 2 times more likely to suffer anxiety and depression than their administrative (i.e., non-frontline, low-risk exposure) counterparts (despite lower relative exposure, both worker groups were health care sector employed, making clear comparisons difficult) [683, 685, 695]. Lastly, the most relevant large post–COVID-19 pandemic web-based survey by Huang and Zhao [626] failed to find any statistically significant differences between health care and other workers' prevalence of anxiety or depressive symptoms, and only a higher prevalence of sleep disruptions in health care workers.

Clearly, large longitudinal studies that specifically compare the symptoms, risk exposure [281], and other contextual correlates (eg, pre-existing knowledge of disease and disease transmission, outbreak phase, and geographic proximity to high-risk situations) of health care workers and other workers are needed. Ongoing evidence syntheses would also help to clarify and explain these apparent discrepancies in the future.

Our self-reported 6-week prevalence rates for likely GAD (47.0%) and likely MDD (44.0%) were slightly higher and lower than symptom estimates reported by Lai et al [281] (44.6% GAD, 50.4% MDD), even considering the authors' use of a slightly lower GAD-7 cutoff score (7). Our prevalence estimates for likely MDD (44.0%) were also higher than the estimates of moderate or severe depression symptoms reported by Kang et al (28.6%) [578] and Huang and Zhao (20.1%) [626] in the post-pandemic period. Although these findings may reflect true mental health burden differences, it is possible that the timing of symptom measurement during a pandemic influences symptom severity, particularly if the implementation of confinement and mitigation measures varies as widely as during the COVID-19 pandemic [678]. This study captured 6-week prevalence in an early pandemic phase, whereas Lai et al measured the same burden during the pandemic. Kang and colleagues and Huang and Zhao both measured health care worker symptoms in the post-pandemic phase. It is also possible that jurisdictions most rapidly affected by the pandemic have less knowledge, less time to prepare and assess/address risk, and possess fewer supplies and resources, and thus may report higher mental health concerns [684, 685]. Furthermore, despite the elevated psychopathology we observed, we note that respondents were a sample of mental health support-seeking Text4Hope subscribers and our findings should be considered in light of this context.

In our study, the prevalence of worry about dirt, germs, and viruses and compulsive handwashing behavior since the COVID-19 pandemic began was significantly higher in other workers than in health care workers. This finding is aligned with a population-based study by Wang et al [279] early in the COVID-19 pandemic, in which members of the general public reported newly adopting handwashing after touching contaminated objects (66.6%), washing their hands with soap (56.5%), and always washing their hands after coughing, sneezing, or rubbing their nose (41.0%). These authors found that handwashing behavior was linked to lower mental health symptom scores, suggesting they had a protective effect during the early stages of the pandemic [279]. This finding aligns with our observation of lower reported worry in other workers before and during the COVID-19 pandemic, and their subsequent adoption of compulsive handwashing behavior since the onset of the COVID-19 pandemic.

With respect to health care workers' obsessive-compulsive symptoms, it is unclear the extent to which professional training; heightened attention to dirt, germs, and viruses; handwashing behavior, and disease transmission could appear maladaptive when assessed with the BOCS tool during a pandemic. Using a different validated scale, Zhang and colleagues [683] recently observed higher measures of obsessive-compulsive symptoms after the peak of the COVID-19 pandemic in frontline health care workers, which aligns with our finding of higher health care worker worry and handwashing due to fears of contamination before and during the pandemic. The BOCS tool was validated for use in adult psychiatric outpatients, not specifically for pandemics, nor for profession-specific groups, and therefore we advise caution in the interpretation of these findings. Certainly, the negative impacts of pervasive multimodal media and recurring widespread handwashing advice during COVID-19 are well documented [585] and particularly problematic for those with pre-existing obsessive-compulsive behaviors [729]. Further study is needed to understand how worry of contamination and compulsive handwashing behavior relate to worker type and timing of symptom assessment during outbreak phases. Future research is also needed to understand the extent to which worry and handwashing due to fears of contamination are adaptive during a pandemic, when assessed with validated scales.

Conclusions

Demographic and clinical correlate data pertaining to mental health needs were successfully collected through Text4Hope and provided insight on the state of mental health concerns in health care workers and other workers.

Overall, our study findings mirrored much of the emerging literature documenting increased stress, anxiety, and depression symptoms arising during the current COVID-19 pandemic, and during previous infectious disease outbreaks. However, as compared to the literature and given our stated limitations, discrepant findings may be a function of measurement timing during a particular outbreak phase (early, interim, post), attributable to pre-existing context, and/or may be related to our study population, which was comprised of support-seeking individuals. A health care worker resilience hypothesis (e.g., that health care workers are protected by knowledge, resources, supplies, messaging, and heightened certainty and control over workload [281, 684]) is not well supported by our findings, nor the bulk of the existing and emergent COVID-19 pandemic literature pertaining to mental health concerns in this group. Furthermore, we note that the array of documented mental health risk factors, combined with higher proportions of females working in health care, community, caregiving, and domestic roles, seems to indicate an increased mental health vulnerability for females during COVID-19.

We observed support-seeking health care workers report significantly higher worry about contamination and compulsive handwashing symptoms prior to the onset of the COVID-19 pandemic and a higher proportion of other workers reporting these symptoms only since the onset of the pandemic. However, both of these findings should be interpreted with caution given it is unclear the extent to which validated scales accurately differentiate adaptive and maladaptive symptoms associated with worry about contamination and handwashing behavior in health care workers, or accurately differentiate symptoms during pandemic periods.

These findings add to our understanding of mental health needs during the COVID-19 pandemic; however, further research is required to understand and confirm in more detail the potential effects of a given outbreak phase on the measurement of mental health burden, the role of context, and the extent to which validated tools have utility in health care workers and in different worker groups during pandemics. The findings also underline the importance of anticipating and mitigating mental health needs as an integrated part of planning and confinement/mitigation strategy implementation [458, 714, 718, 730-733] and highlight the ease with which current mental

health needs can be safely assessed using a self-subscribing SMS text messaging platform. This study took place in a nation where the health care system is publicly funded, reasonably accessible to most residents, and operationally sound; however, it is possible that the mental health effects we observed could be further amplified, particularly for females, in nations where these circumstances are not the norm.

4.2.5 The Mental Health Impact of the COVID-19 Pandemic Among Physicians, Nurses, and Other Health Care Providers in Alberta: Cross-sectional Survey

El Gindi, H., **Shalaby, R.,** Gusnowski, A., Vuong, W., Surood, S., Hrabok, M., . . . Agyapong, V. (2022). The Mental Health Impact of the COVID-19 Pandemic Among Physicians, Nurses, and Other Health Care Providers in Alberta: Cross-sectional Survey. JMIR Form Res, 6(3), e27469. doi:10.2196/27469. Available at JMIR Formative Research - The Mental Health Impact of the COVID-19 Pandemic Among Physicians, Nurses, and Other Health Care Providers in Alberta: Cross-sectional Survey

ABSTRACT

Background: During the COVID-19 pandemic, threats to mental health, psychological safety, and well-being are evident, particularly among the first responders and the health care staff.

Objective: This study aims to examine the prevalence and potential predictors of the likely stress, generalized anxiety disorder, and major depressive disorder among health care workers (HCWs).

Methods: A cross-sectional survey was used through a survey link sent to gather demographic information and responses on several self-report scales, including the Perceived Stress Scale, the Generalized Anxiety Disorder 7-item scale, and the Patient Health Questionnaire-9 among HCWs enrolled in the Text4Hope program.

Results: The result from this study suggests that during the COVID-19 pandemic, HCWs reported a high likelihood of moderate-to-high perceived stress (n=840, 81.2%), moderate-to-severe anxiety (n=369, 38.6%), and depression (n=317, 32.7%) symptoms. Nurses and other HCWs were significantly more likely to report depressive symptoms compared to physicians (F(2, 159.47)=15.89, 95% CI –5.05 to –2.04). Younger age groups of HCWs (≤30 years) were more prone to report likely stress, anxiety, and depressive symptoms compared to HCWs 41-50 and >50 years old (odds ratio [OR] 1.82-3.03). Similarly, females and those who reported a lack of social support (separated/divorced and single) among HCWs had a higher likelihood to report likely stress and depressive symptoms, respectively (OR 1.8 and 1.6, respectively).

Conclusions: This cross-sectional study explored a high level of mental health burdens during the COVID-19 pandemic among HCWs in Alberta. Levels of psychological symptoms were more noticeable in the female gender and the nursing profession.

Introduction

Background

During pandemics, an exponential increase in the demand for health care services takes place. Several factors contribute to increased physical and mental health strain for health care workers (HCWs). This can include long work shifts, a lack of personal protective equipment, and limited resources to care for patients [1,2]. With a lack of PPE, HCWs can feel unprepared to deal with unknown viruses and bacteria. In addition, with pandemic demand–induced limits on resources, such as ventilators or general medical supplies, it can be difficult to care for patients.

In November 2019, a novel coronavirus disease caused by SARS-CoV-2, called COVID-19, was first reported in Wuhan, China. The disease rapidly spread throughout China and prevailed worldwide, resulting in a global health emergency [734]. On March 11, 2020, The World Health Organization (WHO) declared the COVID-19 outbreak as a global pandemic [735].

Alberta Health Services (AHS) defines healthcare professionals/providers as "individuals that work in the health field and can include doctors, nurses (RNs, LPNs), dentists, psychologists, physiotherapists, pharmacists, and dieticians, etc." [736]. Nursing staff constitutes the largest health profession in Canada followed by physicians and other regulated HCWs [737]. As of July 2020, the Canadian Institute for Health Information (CIHI) reported that 19.4% of all confirmed infections of COVID-19 cases were among HCWs in Canada and in the province of Alberta it was 8.8% [738]. HCWs are exposed to mental health stresses due to the nature of their work that usually involves trauma and vulnerability [739].

During the 2003 SARS outbreak, HCWs expressed immediate psychological distress manifested as fear and anxiety that exhibited a relative decrease during the early phases of the epidemic [734]. However, depression and posttraumatic stress symptoms emerged later during the epidemic and lasted for longer periods, affecting the long-term mental wellbeing of HCWs [734]. A greater psychological impact was coupled with the higher risk of exposure to the virus, especially among frontliners who usually face both heavy workloads and a higher risk of infection [46, 740]. One year after the SARS outbreak, HCWs who were in close contact with infected patients or virus material had elevated levels of stress, depression, and anxiety [741].

One study examining the psychological effects of COVID-19 on HCWs in Italy found that depression and post-traumatic stress symptoms were higher in HCWs caring for patients in COVID-19 wards compared to other HCW caring for patients in other units [742].

Additionally, emotional impacts in terms of contagion fear and infecting loved ones, uncertainty, and stigma were documented among healthcare staff [743], leading to the isolation from their families, changing routine, and a narrowing down of their social support network [744]. During the pandemic of COVID-19, healthcare professionals declared five main requests from their institutions [742]: "hear me, protect me, prepare me, support me, and care for me" [46]. Burnout is also an ongoing problem among Physicians and other HCWs during the COVID-19 pandemic. It is characterized by "emotional exhaustion, depersonalization, and a feeling of low personal accomplishment" and attributed to many factors including heavy workloads that may exacerbate burnout and negatively impact the overall productivity of the healthcare system [745] [746]. HCWs are predisposed to moral injury during the current pandemic, a term that can be defined as *the psychological distress that results from actions, or the lack of them, which violate someone's moral or ethical Code*. Despite it is not a mental health condition, people with moral injury are more likely to experience negative thoughts about themselves or others together with an intense feeling of shame, guilt, or disgust.[747]
During the COVID-19 pandemic, several studies examined the impacts of the pandemic upon the psychological health and mental wellbeing of the general population. A number of studies examined such impacts among the HCWs with many interesting findings; for example, the frontliners and those who have experienced physical symptoms, such as headache, throat pain, and lethargy were at more risk of developing stress, anxiety, and depressive symptoms during the pandemic, compared to the other comparative groups [296, 748].

In a systematic review assessing the impact of COVID-19 on HCWs mental health, the authors found that the prevalence of anxiety was estimated between 9 to 90% (median 24%) and depression to be between 5 and 51% (median 21%) [749]. In another systematic review and meta-analysis, Pappa and colleagues examined thirteen research studies to compute the prevalence of anxiety, depression, and insomnia during the current pandemic [750]. The authors reported 23.2% for anxiety and 22.8% for depression. Additionally, discrepancies of the prevalence or the severity of

such symptoms were reported among different demographic and occupational groups, such as in nurses, women, and frontliners, who were usually reported to have more severe symptoms, compared to other HCWs [281, 750].

Aim and objectives

This study aimed to examine the psychological impacts of COVID-19 pandemic among different groups of HCWs who were subscribers of the Text4Hope program.

Primary objectives:

1. Studying the demographic characteristics and the prevalence and mean scores of perceived stress, likely major depressive disorder (MDD), and likely generalized anxiety disorder (GAD) among HCWs.
2. Studying the predictors of developing likely stress, MDD, and GAD among HCWs groups.

METHOD

Study design

A cross-sectional survey was used to explore mean differences in perceived stress, anxiety, and depression symptom scores of HCWs enrolled in Text4Hope.

Ethics

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committee on human experimentation and with the Declaration of Helsinki of 1975, as revised in 2008. Participant consent was implied by submission of the subscribers' survey responses. The University of Alberta Health Research Ethics Board provided ethics approval for this research (Pro00086163).

Recruitment

The study recruitment procedures and sample size estimations are described in a published study protocol [270]. The study participants are subscribers to the Text4Hope program, a daily supportive text message service, launched by Alberta Health Services (AHS) on March 23, 2020, to help Albertans cope with the mental health effects of the COVID-19 pandemic. An online survey link was sent to subscribers who were enrolled during March 23 to May 2, 2020. Subscribers

receive free daily supportive text messages, which are cognitive behavioural therapy based and created by a team of mental health professionals [406]. In addition to demographic information, clinical characteristics were assessed using self-report scales, including the Perceived Stress Scale (for moderate to high stress; PSS ≥ 14) [302], the Generalized Anxiety Disorder-7 (GAD-7) Scale (for likely generalized anxiety disorder; GAD-7 ≥ 10) [751], the Patient Health Questionnaire-9 (PHQ-9) (for likely major depressive disorder or MDD; PHQ-9 ≥ 10) [303]. The PSS is a validated 10-item questionnaire used to assess the self-reported level of stress in the previous 1 month by assessing thoughts and feelings. Each item on the scale is scored between 0 (never) to 4 (very often). Higher scores on the scale denotes higher levels of stress. The GAD-7 is a validated 7-item questionnaire used to assess the self-reported levels of anxiety in respondents in the two weeks prior to assessment. It is based on the Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision (DSM-IV-TR) symptoms of anxiety. Each item on the scale is scored between 0 (not at all) to 3 (nearly every day). The PHQ-9 is a 9-item validated instrument used to diagnose and measure the severity of depression in general medical and mental health settings; it is the major depression module of the full Patient Health Questionnaire (PHQ). Each of the 9-items on the questionnaire is scored between 0 (not at all) to 3 (nearly every day). It may be used to plan and monitor treatment of depression. Participant consent was implied by submission of subscribers' survey responses.

Data analysis

Data analysis was undertaken using the IBM Statistical Package for Social Sciences (SPSS) Statistics for Windows, version 25 [329]. Descriptive analysis illustrates the differences between the three categories of HCWs (physicians, nurses, and other) by their socio-demographic characteristics (i.e., gender, age, ethnicity, education, relationship status, housing status, and self-isolation/quarantine status) and examine the prevalence of clinical characteristics (i.e., moderate/high stress, likely GAD, likely MDD) among the three HCWs groups.

One-Way Analysis of Variance (One-Way ANOVA) with two-tailed significance (p-value <0.05) was performed to assess the statistical differences of mean scores on the PSS, the GAD-7, and the PHQ-9 among HCWs groups. For variables which did not violate the assumptions of homogeneity of variance in the mean scores on the ANOVA test, we performed a Tukey's post-hoc test. For

variables which violated the homogeneity of variance assumption, we used the non-parametric Welch F test and Games-Howell post-hoc tests.

To examine potential predictors of the self-reported clinically meaningful symptoms of moderate or high stress, likely GAD, and likely MDD, we entered all demographic predictors, self-isolation, along with "HCWs type" into a multivariate logistic regression model. Correlation analysis was performed before the logistic regression analysis to rule out very strong correlations among predictor variables. Odds ratios from the binary logistic regression analysis were examined to determine the association between "HCWs type" and the likelihood of respondents self-reporting symptoms of moderate or high stress, likely GAD, and likely MDD, controlling for the other variables in the model.

RESULTS

Of the 8267 subscribers who responded to the Text4Hope online survey in the first 6 weeks, 1414 (17.1%) self-identified as HCWs, while 1096 (13.3%) provided their specific occupation type. Of these 1096, 63 (5.7%) were physicians, 355 (32.4%) nurses, and 678 (61.9%) other HCWs (eg, occupational therapist, psychologist, dietitian, pharmacist, and first responder). The demographic and clinical characteristics of the respondents are shown in Table 4.2.5.1.

Table 4.2.5.1: Distribution of the demographic and clinical characteristics by HCW[a] type

Variables, n (%)	Physician (N =63)	Nurses (N =355)	Other (N =678)	Total (N =1096)[b]
Gender				
Male	17 (27.0)	10 (2.8)	55 (8.1)	82 (7.5)
Female	46 (73.0)	343 (96.9)	617 (91.1)	1006 (92.0)
Other	0 (0.0)	1 (0.3)	5 (0.7)	6 (0.5)
Age				
≤30	13 (21.0)	5 (16.8)	90 (13.5)	162 (15.0)
31-40	9 (14.5)	107 (30.4)	214 (32.2)	330 (30.6)
41-50	19 (30.6)	78 (22.2)	193 (29.0)	290 (26.9)
>50	21 (33.9)	108 (30.7)	168 (25.3)	297 (27.5)

Ethnicity				
Caucasian	48 (76.2)	309 (87.0)	562 (83.0)	919 (83.9)
Indigenous	1 (1.6)	6 (1.7)	24 (3.5)	31 (2.8)
Asian	10 (15.9)	15 (4.2)	44 (6.5)	69 (6.3)
Other	4 (6.3)	25 (7.0)	47 (6.9)	76 (6.9)
Education				
Less than High School Diploma	0 (0.0)	1 (0.3)	2 (0.3)	3 (0.3)
High School Diploma	0 (0.0)	1 (0.3)	16 (2.4)	17 (1.6)
Post-Secondary Education	63 (100.0)	351 (99.2)	652 (96.4)	1066 (97.5)
Other Education	0 (0.0)	1 (0.3)	6 (0.9)	7 (0.6)
Relationship Status				
Married/Cohabiting/Partnered	51 (81.0)	291 (82.0)	510 (75.3)	852 (77.8)
Separated/Divorced	3 (4.8)	24 (6.8)	61 (9.0)	88 (8.0)
Widowed	0 (0.0)	3 (0.8)	3 (0.4)	6 (0.5)
Single	9 (14.3)	37 (10.4)	98 (14.5)	144 (13.2)
Other	0 (0.0)	0 (0.0)	5 (0.7)	5 (0.5)
Housing Status				
Own Home	49 (77.8)	287 (80.8)	500 (73.9)	836 (76.3)
Living with Family	4 (6.3)	12 (3.4)	24 (3.5)	40 (3.7)
Renting	10 (15.9)	55 (15.5)	147 (21.7)	212 (19.4)
Other	0 (0.0)	1 (0.3)	6 (0.9)	7 (0.6)
Self-isolate/Quarantine				
No	41 (65.1)	273 (77.1)	540 (80.1)	854 (78.3)
Yes	22 (34.9)	81 (22.9)	134 (19.9)	237 (21.7)
Symptoms, n (%)[c]				
Perceived Stress (moderate or high[d])	41 (68.3)	279 (82.5)	520 (81.6)	840 (81.2)
Likely GAD[e]	20 (36.4)	116 (37.4)	233 (39.4)	369 (38.6)
Likely MDD[f]	9 (16.1)	99 (31.3)	209 (35.1)	317 (32.7)
Clinical conditions severity, mean (SD)				
PSS-10[g] ANOVA $F_{(2, 1032)}$ =1.13, *P*= .32	18.07 (7.25)	19.25 (6.27)	19.35 (6.28)	19.25 (6.34)
GAD-7[h] ANOVA F(2, 953)=0.80, *P*=.45	4.46 (4.36)	7.42 (5.17)	8.01 (5.72)	7.61 (5.53)

PHQ-9[i] Welch statistics F(2, 159.47)=15.89, *P*<.001	7.58 (5.25)	8.18 (5.32)	8.46 (5.58)	8.32 (5.48)

a: HCW: health care worker. **b**: Data were reported according to the provided responses; the total percentages may not add up to 100%. **c**: Multiple responses were possible. **d**: Moderate-to-high stress was defined as PSS-10 score of ≥14. **e**: Likely GAD was defined as a GAD-7 score of ≥10. **f**: Likely MDD was defined as a PHQ-9 score of ≥10. **g**: PSS-10: Perceived Stress Scale. **h**: GAD-7: Generalized Anxiety Disorder 7-item. **i**: PHQ-9: Patient Health Questionnaire-9.

As presented in Table 4.2.5.1, most of the 1096 respondents were female (n=1006, 91.8%), aged 31-40 years (n=330, 30.1%), and Caucasian (n=919, 83.9%); had postsecondary education (n=1066, 97.3%); were married, cohabiting, or partnered (n=852, 77.7%); and owned their own home (n=836, 76.3%). Except for a few variables, nurses represented the highest percentage of these responses.

Among the 1096 respondents, 237 (21.7%) reported having self-isolated/quarantined during the pandemic time. Among those who reported their clinical symptoms, most respondents who self-reported moderate-to-high perceived stress were nurses (279/338, 82.5%), while those who self-reported likely GAD and likely MDD were other HCWs (233/591, 39.4%) and (209/596, 35.1%), respectively.

The mean scores for all HCWs were 19.25 (SD 6.34, n=1035) on the PSS-10 scale, 8.32 (SD 5.48, n=956) on the GAD-7 scale, and 7.61 (SD 5.53, n=968) on the PHQ-9 scale.

One-way ANOVA revealed a significant difference among the 3 groups of HCWs only in terms of their PHQ-9 mean scores. The Welch test and Games-Howell posthoc tests showed that physicians (mean=4.46, SD 4.36) scored significantly lower on the PHQ-9 scale compared to nurses (mean=7.42, SD 5.17, 95% CI –4.51 to –1.4, P<.01) and to other HCWs (mean=8.01, SD 5.72, 95% CI –5.05 to –2.04, P<.001).

Logistic regression:

Spearman correlation analysis revealed no high collinearity among the suggested variables (r_s < 0.4), so all the variables were entered into the multivariate regression model.

Table 4.2.5.2 presents data indicating that for moderate-to-high likely stress, the model containing the 8 predictors was statistically significant (χ221=68.76, P<.001). The model explained between

6.6% (Cox and Snell R2) and 10.6% (Nagelkerke R2) of the variance and correctly classified 80.8% of all cases. The type of HCWs did not significantly contribute to the likely stress model among all the HCWs. Controlling for all other factors in the model, age categories made a unique statistical contribution (Wald=34.24, P<.001) to the likelihood that a respondent presented with moderate-to-high stress.

Table 4.2.5.2: Logistic regression predicting likelihood for the respondents among HCWs[a] to present with moderate-to-high stress.

Variables	B	SE	Wald	*df*	*P*-value[b]	OR[c] (95%CI)
Gender						
Male	—[d]	—	5.451	2	.07	—
Female	.683	.293	5.442	1	.02	1.980 (1.115-3.515)
Other	.714	1.211	.347	1	.56	2.041(0.190-21.907)
Age						
≤30	—	—	34.244	3	<.001	—
31-40	.567	.330	2.956	1	.09	1.763 (0.924-3.366)
41-50	-.310	.313	.980	1	.32	0.733 (0.397-1.355)
>50	-.845	.309	7.469	1	.01	0.429 (0.234-0.787)
Ethnicity						
Caucasian	—	—	.548	3	.91	—
Indigenous	.358	.644	.309	1	.58	1.430 (0.405-5.052)
Asian	-.160	.368	.189	1	.66	0.852 (0.414-1.753)
Other	-.070	.337	.043	1	.84	0.933 (0.482-1.805)
Education						
Less than High School Diploma	—	—	1.442	3	.70	—
High School Diploma	1.430	1.661	.741	1	.39	4.177(0.161-108.342)
Post-Secondary Education	.751	1.282	.343	1	.56	2.118 (0.172-26.144)
Other Education	-.043	1.597	.001	1	.98	0.958 (0.042-21.934)
Relationship Status						
Married/Cohabiting/Partnered	—	—	1.239	4	.87	—

Separated/Divorced	-.090	.300	.089	1	.77	0.914 (0.508-1.646)
Widowed	-.362	.885	.167	1	.68	0.696 (0.123-3.948)
Single	.253	.297	.730	1	.39	1.288 (0.720-2.304)
Other	-.444	1.272	.122	1	.73	0.641 (0.053-7.758)
Housing Status						
Own Home	—	—	2.175	3	.54	—
Living with Family	.743	.656	1.285	1	.26	2.103 (0.582-7.599)
Renting	.296	.265	1.244	1	.27	1.344 (0.799-2.261)
Other	20.278	15888.453	.000	1	.99	640763554.13 (0 to upper level)
Self-isolate/Quarantine						
No	—	—	—	—	—	—
Yes	-.108	.204	.281	1	.60	0.898 (0.602-1.339)
Healthcare Worker Type						
Physician	—	—	2.874	2	.24	—
Nurses	.573	.339	2.864	1	.09	1.774 (0.913-3.446)
Other	.474	.321	2.180	1	.14	1.606 (0.856-3.012)
Constant	-.200	1.347	.022	1	.88	.819 (—)

[a]HCW: health care worker.
[b]Significant P values are italicized.
[c]OR: odds ratio.
[d]—: Not applicable.

HCWs who were >50y were less likely to report moderate or high stress during the COVID-19 pandemic compared to respondents who were ≤30y, when all other variables in the model were controlled for (OR=0.43, 95% CI 0.23-0.79). While the gender variable did not contribute significantly to the model, females were almost two times more likely to report moderate or high stress during the COVID-19 pandemic compared to males, when controlling for other variables (OR 2.0, 95% CI 1.12-3.52).

The data of Table 4.2.5.3 indicate that for likely GAD, the 8-predictor model was statistically significant (χ221=70.82, P<.001), explaining between 7.3% (Cox and Snell R2) and 9.9% (Nagelkerke R2) of the variance and correctly classified 64.9% of all cases. The type of HCWs did not significantly contribute to likely GAD among all the HCWs. Likewise, age categories made

a unique statistical contribution (Wald=41.85, P<.001) to the probability that a respondent presented with likely GAD, after controlling for all other factors in this model. HCWs who were 41-50 years old and those who were >50 years old had a lower probability of reporting likely GAD symptoms during the COVID-19 pandemic compared to those who were ≤30 years old (OR 0.41, 95% CI 0.26-0.66 vs OR 0.33, 95% CI 0.2-0.53).

Table 4.2.5.3: Logistic regression predicting likelihood for the respondents among HCWs[a] to present with likely GAD[b].

Variables	B	SE	Wald	*df*	*P*-value[b]	OR[c] (95%CI)
Gender						
Male	—[d]	—	4.250	2	.12	—
Female	.468	.296	2.497	1	.11	1.597 (0.894-2.852)
Other	1.657	.973	2.898	1	.09	5.243 (0.778-35.319)
Age						
≤30	—	—	41.852	3	<.001	—
31-40	-.045	.224	.040	1	.84	0.956 (0.616-1.483)
41-50	-.887	.243	13.344	1	<.001	0.412 (0.256-0.663)
>50	-1.121	.250	20.131	1	<.001	0.326 (0.200-0.532)
Ethnicity						
Caucasian	—	—	2.910	3	.41	—
Indigenous	.453	.421	1.161	1	.28	1.574 (0.690-3.591)
Asian	-.247	.312	.625	1	.43	0.781 (0.424-1.441)
Other	.288	.291	.984	1	.32	1.334 (0.755-2.359)
Education						
Less than High School Diploma	—	—	2.004	3	.57	—
High School Diploma	-.585	1.444	.164	1	.69	0.557 (0.033--9.442)
Post-Secondary Education	-1.194	1.285	.864	1	.35	0.303 (0.024-3.760)
Other Education	-1.790	1.669	1.151	1	.28	0.167 (0.006-4.394)
Relationship status						
Married/Cohabiting/Partnered	—	—	2.865	4	.58	—
Separated/Divorced	.148	.274	.293	1	.59	1.160 (0.678-1.984)
Widowed	-.673	1.110	.367	1	.55	0.510 (0.058-4.498)
Single	.293	.220	1.768	1	.18	1.340 (0.870-2.064)
Other	-.691	1.072	.416	1	.52	0.501 (0.061-4.095)
Housing Status						
Own Home	—	—	3.756	3	.29	—
Living with Family	.027	.412	.004	1	.95	1.028 (0.458-2.305)
Renting	.028	.196	.020	1	.89	1.028 (0.699-1.510)
Other	2.323	1.200	3.748	1	.05	10.210 (0.972-107.273)
Self-isolate/Quarantine						
No	—	—	—	—	—	—
Yes	-.236	.172	1.879	1	.17	0.790 (0.563-1.107)

Healthcare Worker Type Physician	—	—	.400	2	.82	—
Nurses	-.113	.330	.117	1	.73	0.893 (0.467-1.706)
Other	-.019	.318	.003	1	.95	.981 (0.526-1.831)
Constant	.848	1.351	.394	1	.53	2.334 (—)

[a]HCW: health care worker.
[b]GAD: generalized anxiety disorder.
[c]Significant P values are italicized.
dOR: odds ratio.
[e]—: Not applicable.

The data displayed in Table 4.2.5.4 indicate that for likely MDD, the model containing the 8 predictors was statistically significant (χ221=69.14, P<.001). The model explained between 7.0% (Cox and Snell R2) and 9.8% (Nagelkerke R2) of the variance and correctly classified 68% of all cases. After controlling for all other factors in the model, the type of HCWs made a unique statistical contribution (Wald=6.1, P=.05) to the likelihood that a respondent presented with moderate-to-high MDD. Nurses and other HCWs exhibited a 2 times greater probability of presenting with likely MDD during the pandemic compared to physicians (OR 2.32, 95% CI 1.06-5.10 vs OR 2.60, 95% CI 1.20-5.58). The variable of age categories made a unique statistical contribution (Wald=24.54, P<.001) to the probability that a respondent presented with likely MDD. Like the previous (GAD) model, HCWs who were 41-50 and >50 years old had a lower OR to report likely GAD symptoms during the COVID-19 pandemic compared to those ≤30 years old (OR 0.55, 95% CI 0.34-0.90 vs OR 0.39, 95% CI 0.24-0.65). Although the relationship status variable did not contribute significantly to the model, separated/divorced and single respondents reported a higher likelihood of MDD compared to married/cohabiting/partnered respondents when controlling for other variables (OR 1.80, 95% CI 1.04-3.02 vs OR 1.60, 95% CI 1.07-2.52).

Table 4.2.5.4: Logistic regression predicting likelihood for the respondents among HCWs[a] to present with likely MDD[b].

Variables	B	SE	Wald	*df*	*P*-value[c]	OR[d] (95% CI)
Gender Male	—[d]	—	.619	2	.73	—
Female	.031	.294	.011	1	.92	1.032 (.580-1.836)
Other	.714	.918	.606	1	.44	2.042 (.338-12.340)

Age						
≤30	—	—	24.539	3	<.001	—
31-40	-.025	.227	.012	1	.91	0.975 (.625-1.523)
41-50	-.590	.247	5.703	1	.02	0.554 (.342-.900)
>50	-.934	.258	13.111	1	<.001	.393 (.237-.652)
Ethnicity						
Caucasian	—	—	1.282	3	.73	—
Indigenous	.046	.427	.011	1	.92	1.047 (.453-2.418)
Asian	-.075	.321	.054	1	.82	0.928 (.495-1.740)
Other	.319	.295	1.168	1	.28	1.376 (.771-2.455)
Education						
Less than High School Diploma	—	—	3.471	3	.32	—
High School Diploma	-.677	1.406	.232	1	.63	0.508 (.032-7.989)
Post-Secondary Education	-1.500	1.272	1.390	1	.24	0.223 (.018-2.701)
Other Education	-.950	1.640	.336	1	.56	0.387 (.016-9.628)
Relationship status						
Married/Cohabiting/Partnered	—	—	8.863	4	.07	—
Separated/Divorced	.574	.271	4.493	1	.03	1.776 (1.044-3.020)
Widowed	-.273	1.109	.060	1	.81	0.761 (.087-6.691)
Single	.495	.219	5.107	1	.02	1.640 (1.068-2.519)
Other	-.537	1.055	.259	1	.61	0.584 (.074-4.623)
Housing Status						
Own Home	—	—	4.775	3	.19	—
Living with Family	.356	.413	.744	1	.39	1.428 (.636-3.206)
Renting	.225	.195	1.326	1	.25	1.252 (.854-1.836)
Other	2.195	1.201	3.340	1	.07	8.980 (.853-94.562)
Self-isolate/Quarantine						
No	—	—	—	—	—	—
Yes	-.114	.177	.418	1	.52	0.892 (.631-1.261)
Healthcare worker group						
Physician	—	—	6.076	2	.048	—
Nurses	.843	.402	4.396	1	.04	2.322 (1.056-5.104)
Other	.952	.391	5.932	1	.02	2.592 (1.204-5.578)
Constant	.095	1.358	.005	1	.94	1.099 (—)

From the three models collectively, there was a trend for age, whereby HCWs who were below 40 years old appeared more likely to exhibit psychological clinical symptoms compared to older participants.

Discussion

Using self-reported data from the Text4Hope service, this study illustrates the different mental health impacts of the COVID-19 pandemic on HCWs, including physicians, nurses, and other

HCWs. The study suggests that more than 4 in 5 HCWs expressed a likelihood of reporting moderate-to-high perceived stress rates, while around a third expressed a likelihood of reporting moderate-to-severe anxiety and depressive symptoms during the COVID-19 pandemic. In Muller et. al's [749] systematic review, it was determined that the prevalence of mental health distress ranged from 7% to 97%, with a median of 37%. In our study, the prevalence of GAD and depression in HCWs was 38.6% and 32.7%, respectively, which was comparable to the medians reported in the aforementioned 2 systematic review [749, 750].

In a survey of health care providers in Wuhan, the number of frontline health care providers with depressive symptoms was estimated to be 50.4%, with correlates of nursing profession and female gender [281]. This higher figure compared with the prevalence of depression in our study may be explained by the demographics of the population that study focused on, as most participants were female, nurses, of lower ages, and with a junior technical title that could be considered as elevating COVID-19 exposure risk factors for the development of depressive symptoms [36, 281].

Physicians had the lowest prevalence of GAD and depression in this study (20/63 [36.4%] and 9/63 [16.1%], respectively), followed by nurses (116/355 [37.4%] and 99/355 [31.3%], respectively) and was highest in other HCW groups (233/678 [39.4%] and 209/678 [35.1%], respectively). Pappa et al [750] noted similar trends in the prevalence of depression and anxiety between physicians and nurses in their systematic review. Physicians had a lower prevalence of depression (25.4%) when compared with nurses (30.3%), and this was the case for GAD that was found in 21.7% of physicians, while 25.8% of nurses were affected [750].

Compared to the frontline physicians, first responder nurses are more likely to develop behavioral disengagement during similar epidemics, a result highly associated with aggravating levels of depression [424] [425]. This may be due to stress and the fear of contracting the infection or spreading it to their families, along with the perceived stigma and sense of uncertainty [281]. Consistent with our research, where nurses were found to be more likely to report moderate-to-severe likely stress symptoms compared to the physicians, in a study carried out in Wuhan, China, nurses were also reported to experience higher levels of different psychological impacts, such as

distress, anxiety, depression, and insomnia, when compared to their physician counterparts during the COVID-19 pandemic [281].

Females comprised most of our survey respondents (1006/1096, 92%) and showed a higher likelihood to report stress, GAD, and depressive symptoms compared to their male counterparts. However, this was statistically significant only for likely stress symptoms. This was consistent with other studies. For example, after pooling the prevalence from 6 studies that reported complete data for anxiety symptoms based on gender during the COVID-19 pandemic, Pappa et al [750]. reported a lower prevalence of anxiety in males (20.9%) compared to females (29.1%). Conversely, they noted that the prevalence of depression was higher in males (26.9%) than in females (20.3%) [750]. Several studies have demonstrated that being a woman, getting exposed to patients with SARS-CoV-2 infection, and worrying about being infected are the most common risk factors associated with increased mental health problems in HCWs during the pandemic [749].

Younger HCWs were generally at a higher risk of developing likely stress, anxiety, and depression compared to other groups. This finding is aligned with other previous findings that consistently report a higher risk among younger ages during the pandemic [36, 752, 753]. This may be attributed to the longer duration the younger generation usually spends focusing upon the data of the pandemic or to the lack of experiencing similar stressful situations in their few years of experience compared to older groups, who possibly have passed by similar experiences [36, 752].

In our study, the lack of a confiding relationship (separated/divorced and single) appeared to be a risk factor for HCWs to self-report likely depression. It is likely that HCWs who are in confiding relationships have better social supports that those who are single, divorced, or widowed. This finding appears clearly in the literature, where social, family, and friend support is found to be the most commonly reported protective factor associated with a reduction in mental health problems among HCWs [749, 754].

Not surprisingly, the younger age group of HCWs expressed a higher likelihood to show likely stress, GAD, and MDD symptoms compared to the other older groups. Additionally, the likelihood to report the 3 clinical conditions of focus in our study seemed to decrease with age, where HCWs

who were ≤30 years old were at a higher risk of developing likely stress, GAD, and MDD during the pandemic compared to those who were 41-50 and >50 years old (OR 1.82-3.03). This aligns with previous research that reported the same finding among all subscribers of Text4Hope [36, 755]. Relatively little experience and the lack of exposure to similar epidemics in the younger age group could predispose younger people to a greater likelihood of developing maladjustment and mental distress in this context [36, 756].

Other researchers are examining COVID-19-related measurements among HCWs across Canada, including exposure to the virus and other mental health parameters [745]. Preliminary results from the other study suggests that there are high COVID-19 infection rates among HCWs and that physicians are more likely than other HCWs to develop mental health symptoms. These results differ from the findings of our study, which suggest that physicians are less likely to develop mental health symptoms during the COVID-19 pandemic compared to nurses and other HCWs. Observed differences between each study's results could be attributed to differences in data collection periods (eg, early pandemic, during a wave), differences in COVID-19 positivity rates and R values, or even differences in the level of resource strain (eg, bed capacity, worker shortages) on the health care system. Although our data were collected during the early phase of the pandemic, when the health system was not strained, data from an ongoing Canadian study were collected at a later stage of the pandemic, when infection rates were higher and health care systems across Canada were under greater strain.

During the COVID-19 pandemic, some digital initiatives took place to mitigate psychological distress among health care professionals; these included a digital support package on psychological well-being provided for HCWs in the United Kingdom. The package was easily delivered and reached the target group, with a high rate of usage and accepted cost [46]. In a recent review of the literature demonstrating the mental health problems that HCWs are facing during the COVID-19 pandemic, the authors concluded that health authorities need to build multidisciplinary mental health teams in order to mitigate mental health and psychological consequences of the pandemic on both patients and HCWs. It was suggested that electronic media through web apps could be used for this purpose [739]. In Alberta, Canada, the AHS launched a supportive text message program (Text4Hope). The service aims to support the mental health of Albertans during the

COVID-19 pandemic and is presented as a feasible and reliable medium for wide-scale data collection for epidemiological research, as illustrated by this report.

Limitations

This study had several limitations. The data were obtained via an online request sent to all subscribers of the Text4Hope service, and there was a risk of selection bias, where the HCWs who responded may have been more interested in the service and not necessarily representative of all HCWs in Alberta. Females also showed overrepresentation in our cohort, which may limit the generalization of the provided results. Additionally, as self-report scales were used in this study and participants were not clinically assessed or confirmed, the results need to be interpreted carefully.

Finally, this was a cross-sectional study with no established baseline prevalence or a control group to compare with. It cannot draw any inferences about the impact of the pandemic on HCWs' mental health; thus, the presented findings may need further similar studies across different timepoints into the pandemic to validate our results.

Conclusion

This cross-sectional study explored the impact of the COVID-19 pandemic on the mental health and well-being of HCWs in Alberta. Overall, we highlighted the prevalence of the psychological distress symptoms in the early phase of the COVID-19 pandemic. Nurses were observed to be at high risk for developing stress, depression, and anxiety during the pandemic. Tracking such symptoms through digitally supported means is highly emphasized, particularly during pandemics where physical contact is not a viable option. Usually, digitally provided programs may yield high fidelity in relation to their acceptability and engagement [757]. Such services are impactful and cost-effective and fulfil essential social distancing requirements with remote delivery.

In the light of time progression and the development of the knowledge around the pandemic and the available vaccination, we aim to examine the changes in these symptoms and their timely progress among the health care providers after 1 year of the initiation of the Text4Hope service. From the literature, positive impacts of similar interventions were reported, in terms of reducing depressive symptoms and increasing the abstinence duration in alcohol use disorder, after 3 months

of receiving daily supportive text messages in the community settings [94, 758]. The availability of the texting service on most cell phones, and the lack of required software or app downloads to function, rendered text messaging services significantly advantageous over similar technologies (e.g., email or messaging apps) [94].

4.3 Outcome results of Text4Hope services

This section represents the outcome results of the Text4Hope service, which will be presented in the following five subsections. We will explore the six-week (mid-point) and three-month (end of service) effects, in terms of detected changes in the outcome measures across the period of the service and in a comparison to a quasi-non-interventional group in three subsections. Additionally, another subsection will focus on examining the satisfaction and participants' anticipated receptivity of the service based on their gender.

Finally, the last subsection provides a short report summarizing the outcome results of Text4Hope after one year of launching the service.

The following sub-sections describe our findings in relation to our published/in submission papers.

4.3.1 Changes in Stress, Anxiety, and Depression Levels of Subscribers to a Daily Supportive Text Message Program (Text4Hope) During the COVID-19 Pandemic: Cross-Sectional Survey Study

Agyapong, V. I. O., Hrabok, M., Vuong, W., **Shalaby, R.,** Noble, J. M., Gusnowski, A., . . . Greenshaw, A. J. (2020). Changes in Stress, Anxiety, and Depression Levels of Subscribers to a Daily Supportive Text Message Program (Text4Hope) During the COVID-19 Pandemic: Cross-Sectional Survey Study. JMIR Ment Health, 7(12), e22423. doi:10.2196/22423. Available at https://www.ncbi.nlm.nih.gov/pubmed/33296330

Abstract

Background: In addition to the obvious physical medical impact of COVID-19, the disease poses evident threats to people's mental health, psychological safety, and well-being. Provision of support for these challenges is complicated by the high number of people requiring support and the need to maintain physical distancing. Text4Hope, a daily supportive SMS text messaging program, was launched in Canada to mitigate the negative mental health impacts of the pandemic among Canadians.

Objective: This paper describes the changes in the stress, anxiety, and depression levels of subscribers to the Text4Hope program after 6 weeks of exposure to daily supportive SMS text messages.

Methods: We used self-administered, empirically supported web-based questionnaires to assess the demographic and clinical characteristics of Text4Hope subscribers. Perceived stress, anxiety, and depression were measured with the 10-Item Perceived Stress Scale (PSS-10), the Generalized Anxiety Disorder–7 (GAD-7) scale, and the Patient Health Questionnaire–9 (PHQ-9) scale at baseline and sixth week time points. Moderate or high perceived stress, likely generalized anxiety disorder, and likely major depressive disorder were assessed using cutoff scores of ≥14 for the PSS-10, ≥10 for the GAD-7, and ≥10 for the PHQ-9, respectively. At 6 weeks into the program, 766 participants had completed the questionnaires at both time points.

Results: At the 6-week time point, there were statistically significant reductions in mean scores on the PSS-10 and GAD-7 scales but not on the PHQ-9 scale. Effect sizes were small overall. There were statistically significant reductions in the prevalence rates of moderate or high stress and likely generalized anxiety disorder but not likely major depressive disorder for the group that completed both the baseline and 6-week assessments. The largest reductions in mean scores and prevalence rates were for anxiety (18.7% and 13.5%, respectively).

Conclusions: Text4Hope is a convenient, cost-effective, and accessible means of implementing a population-level psychological intervention. This service demonstrated significant reductions in anxiety and stress levels during the COVID-19 pandemic and could be used as a population-level mental health intervention during natural disasters and other emergencies.

Introduction

COVID-19, an acute respiratory disease, was first reported in December 2019 in Wuhan, China. Since the outbreak was declared a pandemic by the World Health Organization [759, 760], this disease has continued to have significant, unprecedented impacts on health and patterns of human life worldwide. These impacts include school and business closures as well as the ongoing psychological and social tolls of uncertainty, vigilance, and quarantine. In addition to the obvious physical medical impact of this disease [276, 761], it poses evident threats to people's mental health, psychological safety, and well-being [762-764], particularly given the risk of recurrent outbreaks [765].

In multiple global jurisdictions, a series of mental health concerns have arisen, including increased stress, anxiety, depression, fear, insomnia, and obsessive-compulsive behaviors. Population-level studies have summarized these effects [766, 767]. For example, in a study in China, over half of the respondents rated the psychological impact of COVID-19 as moderate or severe, with 29% reporting significant anxiety symptoms and 17% reporting significant depressive symptoms [278].

The emergence of mental health issues during the COVID-19 pandemic was not entirely unexpected. There have been reports of increases in stress symptoms, confusion, anger, anxiety, and depression [280, 289, 309, 411] as well as in problematic drug and alcohol use [764] related to previous pandemics. Stressors include long quarantine durations, infection fears, frustration, boredom, inadequate supplies, inadequate information, financial loss, and stigma. Quarantine, in particular, is associated with a number of negative psychological and social effects (eg, posttraumatic stress, anger, fear, financial loss, and stigma) [280].

Although research has provided a description of the psychological impact of COVID-19 [704], the literature regarding interventions or guidelines for managing the mental health impacts of the virus is limited [768] Countries that were impacted initially by the COVID-19 pandemic identified several problems that increased the difficulty of providing psychological interventions during the pandemic, including barriers to participation, limited efficiency of outreach, and limited capacity of frontline workers to provide support due to competing demands on their time and energy [573]. Provision of psychological support during this pandemic is further complicated by the high number of people requiring support and the need to maintain physical distancing.

The COVID-19 pandemic has further reinforced the need and urgency of transforming the delivery of mental health services [41] to include telehealth, text messaging, and other digital platforms. Mobile health technologies offer a unique and innovative solution in this context. More

specifically, SMS text messaging via mobile phones offers a convenient, cost-effective, and accessible means of implementing population-level interventions. In Canada, almost 90% of residents own a smartphone [298]. Additionally, SMS text messaging is embedded in 98% of mobile phones [49]. Texting is free to the majority of end users, does not require technical skill to use, and is included in most mobile plans. SMS text messages are also cost-effective for providers [50].

Previous research examining the effectiveness of supportive text messages has demonstrated positive outcomes, including reduction of depressive symptoms and high user satisfaction [94, 299, 310]. For example, evaluation of Text4Mood, a text messaging intervention administered following large-scale forest fires in Fort McMurray, Alberta, found that supportive text messages helped subscribers feel more hopeful about managing issues (82%), in charge of managing their depression and anxiety (77%), and connected to a support system (75%); moreover, subscribers stated that the intervention improved their overall mental well-being (83%) [94]. Similar findings were observed in other studies, including Text4Baby, which sought to assist women by providing supportive and informative text messaging during pregnancy, and another text intervention aimed to support the mental health of impoverished women in Bangalore. Participants in both interventions indicated that receiving these text messages gave them a sense of reassurance and made them feel supported [769].

On March 23, 2020, Alberta Health Services, along with the coauthors of this paper, initiated Text4Hope, a 3-month-long, supportive daily text messaging program using principles of cognitive behavioral therapy (CBT), as an additional mental health support for people living in Alberta during the COVID-19 pandemic [459]. The messages ultimately seek to reduce or inhibit negative thought patterns while suggesting and reinforcing the use of healthy self-coping mechanisms. This program was intended to complement existing addiction and mental health services that individuals might be accessing at the time of participation.

This paper evaluates the impact of Text4Hope on measures of stress, anxiety, and depression symptoms and provides estimates of prevalence rates 6 weeks into the program.

Methods

The Text4Hope Program

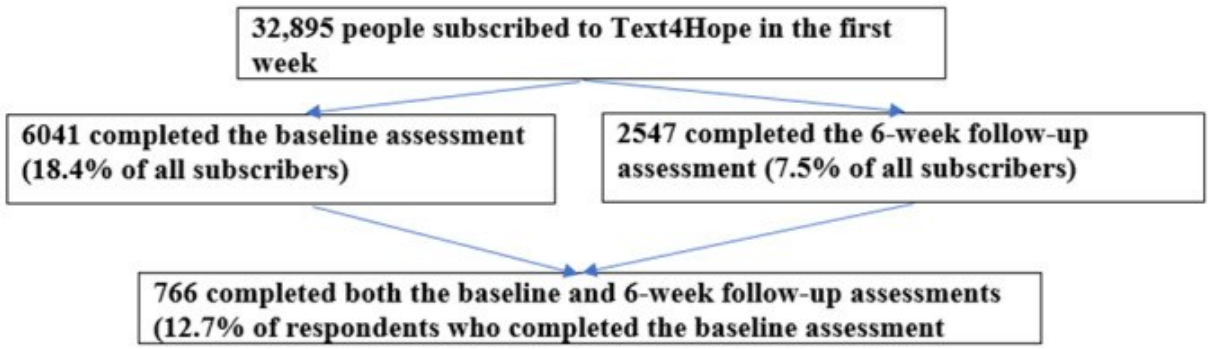
This cross-sectional comparative study sought to assess the effectiveness of community implementation of a supportive SMS text message intervention program focused on reducing symptoms of stress, anxiety, and depression during the COVID-19 pandemic. The study protocol [270] was approved by the Research and Ethics Board of the University of Alberta (Pro00086163).

In the Text4Hope program [300], individuals self-subscribe to receive daily supportive SMS text messages for three months by texting the word "COVID19HOPE" to a short code number. The messages are aligned with a cognitive behavioral framework, with content written by mental health professionals and coauthors of this paper (VIOA, MH). The messages were uploaded to a web-based platform, which delivered messages at 9 AM each day. The first message welcomed subscribers to the service and invited them to complete a web-based baseline survey that captured demographic and clinical information. At 6 weeks, subscribers were invited again via a text message link to complete a web-based follow-up survey. At baseline and at 6 weeks, we collected clinical information on stress, anxiety, and depression about each subject based on the 10-Item Perceived Stress Scale (PSS-10) [302], Generalized Anxiety Disorder-7 (GAD-7) scale [301], and the Patient Health Questionnaire-9 (PHQ-9) [303], respectively.

Data Collection

We were able to cross-reference clinical and demographic responses from individuals by asking clients to enter the mobile number they used for Text4Hope at the baseline and 6-week time points. No incentives were offered to respondents. Participation in the program was voluntary, and completing the survey was not required to receive the supportive SMS text messages. Subscribers could opt out at any time by texting "STOP" to the same sort code number used to enroll in the program. Baseline data collection occurred between March 23 and 30, 2020, and the sixth week follow-up data were collected between May 3 and 11, 2020. Figure 4.3.1.1 presents the subscriber flowchart, which indicates the number of subscribers who completed the web-based surveys at each time point. Furthermore, on May 11, 2020, there were 45,775 subscribers to the Text4Hope program, of which 6178 subscribers opted out of the program, giving a dropout rate of 13.5%.

Figure 4.3.1.1: Flowchart of subscriber participation from baseline to the sixth week.



Outcome Measures

Primary outcomes included the mean differences in scores on the PSS-10, GAD-7, and PHQ-9 scales at the sixth week versus baseline and the changes in the prevalence rates of self-reported moderate or high stress, likely generalized anxiety disorder (GAD), and likely major depressive disorder (MDD) at the sixth week from baseline.

Hypothesis

In a sixth-week evaluation report, 77% of subscribers to the related Text4Mood program indicated that the daily supportive text messages helped them to manage their depression and anxiety [94], which informed our decision to evaluate the Text4Hope program at the sixth week and to determine if subscribers generally had reduced anxiety and depression. Furthermore, a randomized controlled trial of daily supportive text messaging resulted in close to 25% additional improvement in mood (measured by the Beck Depression Inventory [BDI]) in the intervention group compared to the control group [310]. On this basis, we hypothesized that the Text4Hope intervention would result in >25% reduction in mean scores and prevalence rates in all 3 factors, the PSS-10, GAD-7, and PHQ-9 scales, at the sixth week versus baseline.

Sample Size Considerations

With a projection that daily supportive text messages would result in a 25% reduction in mean PSS-10, GAD-7, and PHQ-9 scores at the sixth week from baseline, a population variance of 5.0 for each scale mean score, a one-sided significance level α=.05, and an acceptable difference between sample mean and population mean score for each scale of zero ($\mu - \mu 0 = 0$), we estimated that a sample size of 686 would be sufficient to detect mean differences between the baseline and 6-week PSS-10, GAD-7, and PHQ-9 scores with a power of 80% (β=.2).

Statistical Analysis

Data analysis was undertaken using SPSS for Windows version 26 (IBM Corporation) [418]. To assess the primary outcome measures for our intervention, we used the paired *t* test to assess the mean difference between the mean PSS-10, GAD-7, and PHQ-9 scale scores at baseline and the sixth week for subscribers who completed the instruments at both time points. In addition, we used the chi-square test to compare prevalence rates for perceived stress, likely GAD, and likely MDD at baseline and the sixth week. Moderate or high perceived stress, likely GAD, and likely MDD were assessed using cutoff scores of ≥14 on the PSS-10 [302], ≥10 on the GAD-7 [301], and ≥10 on the PHQ-9 [303], respectively. There was no imputation for missing data, and the total numbers reported represent the total responses recorded for each variable.

Results

Participant Demographics

Of the 766 individuals who completed both the baseline and 6-week surveys, 73 (9.6%) identified as male, 678 (88.7%) identified as female, and 13 (1.7%) identified as other gender. Table 4.3.1.1 provides the distribution of the demographic characteristics by gender of subscribers who completed both the baseline and sixth week surveys. Table 4.3.1.1 summarizes the demographic characteristics of the respondents who completed both the baseline and 6-week surveys as n (%). The data presented in Table 4.3.1.1 suggest that the majority of the respondents were aged between 26 and 60 years (601/758, 79.3%), White (656/766, 85.9%), had a postsecondary education (678/764, 88.7%), were employed (555/764, 72.6%), were married, cohabiting, or partnered (507/763, 66.4%), and owned homes (521/760, 68.6%).

Table 4.3.1.1: Demographic characteristics of respondents who completed both surveys by identified gender (N=766), n (%). Note that some category totals do not sum to N due to incomplete data.

Variable	Male	Female	Other	Total
Age (years)				
≤25	5 (6.9)	53 (7.9)	5 (38.5)	63 (8.3)
26-40	17 (23.6)	207 (30.8)	6 (46.2)	230 (30.3)
41-60	33 (45.8)	337 (50.1)	1 (7.7)	371 (48.9)
60	17 (23.6)	76 (11.3)	1 (7.7)	94 (12.4)
Ethnicity				
White	55 (75.3)	590 (87.0)	11 (84.6)	656 (85.9)
Indigenous	1 (1.4)	16 (2.4)	0 (0)	17 (2.2)
Asian	4 (5.5)	18 (2.7)	0 (0)	22 (2.9)
Other	13 (17.8)	54 (8.0)	2 (15.4)	69 (9.0)
Education				
Less than high school diploma	5 (6.8)	14 (2.1)	1 (7.7)	20 (2.6)
High school diploma	7 (9.6)	53 (7.8)	1 (7.7)	61 (8.0)
Postsecondary education	61 (83.6)	606 (89.4)	11 (84.6)	678 (88.7)
Other education	0 (0)	5 (0.7)	0 (0)	5 (0.7)
Employment status				
Employed	52 (71.2)	496 (73.2)	7 (53.8)	555 (72.6)
Unemployed	10 (13.7)	79 (11.7)	2 (15.4)	91 (11.9)
Retired	9 (12.3)	58 (8.6)	1 (7.7)	68 (8.9)
Student	2 (2.7)	33 (4.9)	3 (23.1)	38 (5.0)
Other	0 (0)	12 (1.8)	0 (0)	12 (1.6)
Relationship status				
Married, cohabiting, or partnered	49 (67.1)	452 (66.8)	6 (46.2)	507 (66.4)
Separated or divorced	6 (8.2)	64 (9.5)	1 (7.7)	71 (9.3)
Widowed	2 (2.7)	16 (2.4)	0 (0)	18 (2.4)
Single	15 (20.5)	137 (20.2)	6 (46.2)	158 (20.7)
Other	1 (1.4)	8 (1.2)	0 (0)	9 (1.2)
Housing status				

Own a home	49 (67.1)	465 (69.0)	7 (53.8)	521 (68.6)
Living with family	7 (9.6)	56 (8.3)	3 (23.1)	66 (8.7)
Renting	16 (21.9)	147 (21.8)	2 (15.4)	165 (21.7)
Other	1 (1.4)	6 (0.9)	1 (7.7)	8 (1.1)

Outcome Measures

Table 4.3.1.2 presents the changes in primary outcome measures after 6 weeks from baseline for subscribers who completed both the baseline and 6-week surveys. The data displayed in Table 4.3.1.2 indicate that for subscribers who completed both the baseline and 6-week surveys, the mean scores on the PSS-10 and GAD-7 scales were significantly lower at 6 weeks compared to the mean scores at baseline, suggesting improvement in stress and anxiety symptoms. The effect size as measured by Cohen *d* was small (<0.5) for both the stress and anxiety scales.

Table 4.3.1.2: Comparison of the baseline and 6-week mean scores on the PSS-10, GAD-7, and PHQ-9 scales for subscribers who completed both the baseline and sixth week surveys (N=766).

Measure	**Responses, n[a]**	**Scores**			**Mean difference (95% CI)**	***P* value**	***t* value**	**Effect size (Cohen d)**
		Baseline score, mean (SD)	Six-week score, mean (SD)	Change from baseline, %				
PSS-10[b]	684	20.35 (6.7)	19.51 (7.0)	4.1	–0.83 (0.42 to 1.24)	<.001	3.99	0.2
PHQ-9[c]	630	8.94 (6.0)	8.74 (5.8)	2.2	–0.20 (–0.17 to 0.57)	.28	1.08	0.2
GAD-7[d]	612	9.62 (5.6)	7.82 (5.2)	18.7	–1.80 (1.44 to 2.16)	<.001	9.86	0.4

[a]Not all subscribers completed all three scales; therefore, n for each scale is less than the total N.
[b]PSS-10: 10-Item Perceived Stress Scale.
[c]PHQ-9: Patient Health Questionnaire-9.
[d]GAD-7: Generalized Anxiety Disorder–7.

There was a reduction in the mean score on the GAD-7 scale of 19.0% at the sixth week compared to the baseline scores. The reduction in the PSS-10 scores at six weeks compared to the baseline scores, although statistically significant, was much smaller (4.1%). There was no statistically

significant within-subjects difference between the baseline and sixth week PHQ-9 mean scores (*P*>.05).

Table 4.3.1.3 indicates that there were statistically significant reductions in the prevalence rates of moderate or high stress and likely GAD but not of likely MDD when comparing the baseline and 6-week assessments. The largest reduction in prevalence rates was for anxiety (13.5%).

Table 4.3.1.3: Comparison of the baseline and 6-week prevalence of moderate or high stress, likely generalized anxiety disorder, and likely major depressive disorder.

Condition	Prevalence, n/total responses (%)		Change in prevalence rate (sixth week from baseline), %	χ^2 (df)	*P* value
	Baseline	Sixth week			
Moderate or high stress[a]	642/748 (85.8)	582/742 (80.4)	–5.4	7.78 (1)	.01
Likely major depressive disorder[b]	288/723 (39.8)	262/688 (38.1)	–1.7	0.46 (1)	.50
Likely generalized anxiety disorder[c]	326/712 (45.8)	220/682 (32.3)	–13.5	26.76 (1)	<.001

[a]Assessed using a cutoff score of ≥14 on the 10-Item Perceived Stress Scale.
[b]Assessed using a cutoff score of ≥10 on the Patient Health Questionnaire-9.
[c]Assessed using a cutoff score of ≥10 on the Generalized Anxiety Disorder-7.

To assess the generalizability of our data, based on the mental health burden in our baseline samples, we examined the clinical parameters between people who only responded to the baseline survey versus those who responded to both surveys (baseline and sixth week) (Table 4.3.1.4 and Table 4.3.1.5). No statistical difference was elicited between the two groups (all *P*>.05), suggesting that at baseline, the mental health burden was similar between our study sample and subscribers who did not complete the 6-week survey.

Table 4.3.1.4: Comparison of the prevalence rates of moderate or high stress, likely generalized anxiety disorder, and likely major depressive disorder between subscribers who only completed the baseline survey and subscribers who completed both the baseline and 6-week surveys.

Condition	Prevalence rate at baseline, n/total responses (%)	χ^2 (df)	*P* value

	Subscribers who completed the baseline assessment but not the 6-week assessment	Subscribers who completed both the baseline and 6-week assessments		
Moderate or high stress	4065/4798 (84.7)	642/748 (85.8)	0.62 (1)	.43
Likely major depressive disorder	1848/4447 (41.6)	288/723 (39.8)	0.76 (1)	.38
Likely generalized anxiety disorder	2040/4364 (46.7)	326/712 (45.8)	0.23 (1)	.63

Table 4.3.1.5: Comparison of the mean scores on the PSS-10, GAD-7, and PHQ-9 scales between subscribers who only completed the baseline survey and subscribers who completed both the baseline and 6-week surveys.

Scale	Score at baseline, mean (SD)		Independent *t* test	*P* value
	Subscribers who completed the baseline assessment but not the 6-week assessment	Subscribers who completed both the baseline and 6-week assessments		
PSS-10[a]	20.55 (6.77)	20.30 (6.71)	0.96	.34
PHQ-9[b]	9.03 (6.22)	8.94 (6.0)	0.35	.73
GAD-7[c]	9.64 (5.93)	9.56 (5.65)	0.37	.72

[a]PSS-10: 10-Item Perceived Stress Scale.
[b]PHQ-9: Patient Health Questionnaire-9.
[c]GAD-7: Generalized Anxiety Disorder–7.

Similarly, we examined the clinical parameters between subscribers who responded to the 6-week survey only and subscribers who responded to both surveys (Table 4.3.1.6 and Table 4.3.1.7). No statistical difference was elicited in prevalence of stress, anxiety, or depression symptoms between the two groups ($P>.05$), suggesting that after receiving the intervention for 6 weeks, the mental health burden was similar between our study sample and subscribers who only completed the 6-week survey.

Table 4.3.1.6: Comparison of the prevalence rates of moderate or high stress, likely generalized anxiety disorder, and likely major depressive disorder between subscribers who completed both the baseline and 6-week surveys and subscribers who only completed the 6-week survey.

Condition	Prevalence rate at sixth week, n/total responses (%)		χ^2 (df)	*P* value
	Subscribers who completed the 6-week assessment but not the baseline assessment	Subscribers who completed both the baseline and 6-week assessments		
Moderate or high stress	1217/1518 (80.2)	582/724 (80.4)	0.01 (1)	.91
Likely major depressive disorder	483/1378 (35.1)	262/688 (38.1)	1.83 (1)	.18
Likely generalized anxiety disorder	430/1361 (31.6)	220/682 (32.3)	0.09 (1)	.76

Table 4.3.1.7: Comparison of the mean scores on the PSS-10, GAD-7, and PHQ-9 between subscribers who completed both the baseline and 6-week surveys and subscribers who only completed the 6-week survey.

Scale	Score at sixth week, mean (SD)		Independent *t* test	*P* value
	Subscribers who completed the sixth-week assessments but not the baseline assessments	Subscribers who completed both the baseline and sixth week assessments		
PSS-14[a]	19.36 (7.12)	19.44 (7.05)	–0.25	.80
PHQ-9[b]	8.20 (5.79)	8.69 (5.75)	–1.79	.07
GAD-7[c]	7.55 (5.40)	7.71 (5.21)	–0.66	.51

[a]PSS-10: 10-Item Perceived Stress Scale.
[b]PHQ-9: Patient Health Questionnaire-9.
[c]GAD-7: Generalized Anxiety Disorder–7.

Discussion

Principal Findings

The Text4Hope program was provided as an intervention tool for the general population to support the mental well-being of individuals living in the Canadian province of Alberta during the global COVID-19 pandemic. Other technology-based interfaces have been deployed during the COVID-19 pandemic to track the disease spread in populations [677], to gather data related to the general knowledge, attitudes, and behavior of the public related to the pandemic [770, 771], and to offer mental health support to the public during the pandemic [42, 689, 772, 773]. To the best of our knowledge, this is the first study to assess the impact of a text-messaging intervention on self-reported symptoms of stress, anxiety, and depression experienced during the COVID-19 pandemic. Our study yielded interesting results regarding temporal changes in the self-reported severity and rates of symptomatology related to the three psychiatric health conditions under study. After receiving daily messages for 6 weeks, we observed significant reductions in the respondents' mean scores on the GAD-7 (18.7%) and the PSS-10 (4.0%), suggesting that the program was effective in reducing anxiety and stress symptomatology in the respondents. There was no significant reduction in the mean PHQ-9 score at 6 weeks from baseline. In terms of prevalence rates, the largest significant reduction in prevalence rate was for likely GAD (13.5%), followed by moderate or high stress (4.1%). Again, there was no significant reduction in the prevalence rate of likely MDD at 6 weeks from baseline.

The self-reported rates of anxiety symptoms in our study at baseline were higher than those reported in other studies [582, 774]. However, the greatest improvement recorded after the provision of the Text4Hope program was for anxiety, with a 13.5% reduction in symptom prevalence rate and 19% improvement in GAD-7 score. Text4Hope achieved a small Cohen *d* effect size (0.4) in mitigating anxiety symptoms, which is comparable to the effect sizes found for an internet CBT program aimed at reducing anxiety symptoms [775]. Typically, interventions that do not include therapist support demonstrate lower effect size outcomes compared to those including therapists [776, 777]. By contrast, our intervention reached thousands of individuals during the pandemic, and it aimed to provide a general population intervention rather than individual psychotherapy. The overall change in GAD-7 scores in our study (–1.8) appears to be consistent with the magnitude of score changes recorded after providing other remote health services. For example, adding a telephone service to computerized CBT in combating anxiety yielded a reduction of 1.18 in GAD-7 scores [778]. Again, the percentage of change in GAD-7 scores in our study after providing a daily text message for 6 weeks (19.0%) is consistent with the effect of medications on anxiety symptoms; in a very large randomized controlled trial in the

United Kingdom, sertraline was evidently effective in reducing GAD-7 scores by 21% after 6 weeks, and this result was described as clinically important [779].

Our findings indicate that there was a modest effect of the program on improving stress symptoms, with greater benefit than other internet-based cognitive behavioral theory (iCBT) platforms [780]. In a Japanese study, iCBT was used to alleviate anxiety, stress, and depressive symptoms in university students [780]. The most significant effect was mainly reported for anxiety, while stress symptoms did not show a difference between case and control group members after the intervention period [780].

There was no significant change between baseline and 6-week mean scores for likely MDD. Comparing our results with other remotely delivered health services yielded variable results. Two meta-analyses found that the effectiveness of iCBT programs, including MoodGYM, in mitigating depressive symptoms showed small effect sizes, especially in short-term assessments [775, 776, 781]. On the other hand, a significant improvement in BDI-II score with moderate effect size was observed at 3 months in patients with depression and comorbid alcohol use disorder who received supportive SMS text messages twice daily compared to the control group, who only received a thank-you SMS text message every fortnight [310]. The Text4Hope program was primarily designed as a health promotion tool to support the general population in Alberta during the COVID-19 pandemic and to combat potential stress and anxiety symptoms that are usually associated with epidemics or global crises. Our study participants were members of the general population rather than a patient sample, which may account for the observed differences in results. Furthermore, in a previous randomized trial [310], participants received the intervention for 12 weeks compared to 6 weeks in our study, which may account for the observed differences in the effects.

Another study examined the effect of sertraline, an antidepressant of the selective serotonin reuptake inhibitor class, in ameliorating depressive symptoms; this study reported only a 5% relative reduction (95% CI 7%-15%; *P*=.41) in the mean PHQ-9 score at week 6 [779], which is not vastly different from the apparent 2% improvement observed with our Text4Hope intervention.

Three months after the launch of the Text4Hope program, the dropout rate was 13.5%. A high withdrawal rate is not uncommon for a texting service provided via SMS. When Bendsten and Bendsten [782] compared an SMS texting service to services provided via email, they found that people in the SMS group opted out at significantly higher rates than those in the email group (20.1% versus 5.2%, respectively). Additionally, in a review study on behavioral changing interventions provided via SMS text message, authors reported a wide range of withdrawal rates

(0%-57%) among participants [783]. They justified this result as being due to the untailored and unilateral nature of these texting programs, which may be less engaging and therefore may result in low retention rates [783].

Limitations of the Study

Our study has several limitations. For ethical reasons, we lacked a comparative control group that did not receive the Text4Hope intervention during the same phase of the pandemic against which the recorded changes in stress, anxiety, and depression levels could be compared. It is therefore possible that the reductions in stress, anxiety, and depression levels are not all attributable to the Text4Hope intervention. Second, we relied on self-rated scales to assess stress, anxiety, and depression symptomatology, which could potentially overestimate the levels of these mental disorders when compared with prevalence rates that would have been obtained using structured clinical interviews with the *Diagnostic and Statistical Manual of Mental Disorders 5th Edition*. Third, our results may not be generalizable to the general population and are at risk of participation bias, where individuals with pre-existing mental health conditions are characteristically more inclined to enroll in the Text4Hope program compared with individuals with no pre-existing mental health disorders. We did not ask subscribers about pre-existing mental disorders, which would have helped to distinguish new symptoms from pre-existing ones but may have resulted in limited enrolment; in our experience, subtle changes in signup processes for subscribers can result in marked decreases in participation. Finally, the sample size of subscribers who completed both the baseline and 6-week assessments was rather small, and it is possible that other subscribers had variable changes in their mental health parameters from baseline to the sixth week. This limitation notwithstanding, our sample size was larger than the projected 686 subscribers needed to detect mean differences between the baseline and 6-week PSS-10, GAD-7, and PHQ-9 scores with a power of 80%. In addition, the mental health burden in our sample at baseline and at the sixth week were not significantly different from those of subscribers who only completed the baseline survey and the subscribers who completed the 6-week survey, respectively (Table 4.3.1.4 and Table 4.3.1.5). Furthermore, the demographic characteristics of subscribers who completed both the baseline and 6-week surveys mirror those of all 8267 subscribers who completed the baseline survey by July 12, 2020 [36]. Specifically, the proportions of the various demographic characteristics in our sample compared to the proportions of the same demographics in the larger sample of 8267 subscribers was as follows: female gender, 88.7% versus 87.1%, respectively; White, 85.9% versus 82.3%, respectively; postsecondary education, 88.7% versus 85.2%, respectively; employed, 72.6% versus 73.3%, respectively; married, cohabiting, or partnered,

66.4% versus 71.1%, respectively; and homeowner, 68.6% versus 65.9%, respectively [36]. These proportions support the generalizability of our results to all subscribers. Future studies using this style of intervention could attempt to minimize attrition by offering incentives for participation or by sending messages encouraging people to continue subscribing.

Finally, the effect sizes in our study were relatively small, which may minimize the strength of the produced results. However, interventions that do not include therapists often report low effect sizes compared to those including therapists [776, 777].

Conclusion

The Text4Hope program resulted in statistically significant reductions in mean scores on the PSS-10 and GAD-7 scales but not the PHQ-9 scale at the sixth week from baseline. The program also resulted in statistically significant reductions in subscribers' prevalence rates of moderate or high stress and likely GAD but not of likely MDD. The largest reductions in the mean scores and prevalence rates were observed for anxiety symptoms. It should be noted this paper reports data from the midpoint of the Text4Hope program implementation, and the rates of change for outcomes for stress, anxiety, and depression may differ after the program ends at 3 months.

The relatively large improvements in anxiety symptoms achieved in our sample after 6 weeks of receiving the intervention during the COVID-19 pandemic suggest that the Text4Hope program is a useful intervention that can be deployed during natural and humanitarian disasters to support individuals at the population level. Over half of Canadians have reported that their mental health needs are not fully met [15]. A commonly reported reason is the cost of services [15]. As such, free mobile-based services such as Text4Hope can help address financial barriers. In the Canadian context and in other global contexts, these services can also be delivered remotely, which helps maintain essential physical distancing requirements during pandemics but also provides a means of access for those at rural or remote locations with little or no capacity for accessing mental health support services. We did not differentiate urban from rural or remote subscribers, as the program was offered to everyone in the province; however, regardless of geographical region, the pattern of urban, rural, and remote subscribers' locations is of interest in relation to understanding the full value of SMS text messaging in this context. This is an additional step that we are considering in evaluating this program approach.

4.3.2 Mental Health Outreach via Supportive Text Messages during the COVID-19 Pandemic: Improved Mental Health and Reduced Suicidal Ideation after Six Weeks in Subscribers of Text4Hope Compared to a Control Population

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Abstract

Background: In March 2020, Alberta Health Services launched Text4Hope, a free mental health text-message service. The service aimed to alleviate pandemic-associated stress, generalized anxiety disorder (GAD), major depressive disorder (MDD), and suicidal propensity. The effectiveness of Text4Hope was evaluated by comparing psychiatric parameters between two subscriber groups.

Methods: A comparative cross-sectional study with two arms: Text4Hope subscribers who received daily texts for six weeks, the intervention group (IG); and new Text4Hope subscribers who were yet to receive messages, the control group (CG). Logistic regression models were used in the analysis.

Results: Participants in the IG had lower prevalence rates for moderate/high stress (78.8% vs. 88.0%), likely GAD (31.4% vs. 46.5%), and likely MDD (36.8% vs. 52.1%), respectively, compared to respondents in the CG. After controlling for demographic variables, the IG remained less likely to self-report symptoms of moderate/high stress (OR = 0.56; 95% CI = 0.41–0.75), likely GAD (OR = 0.55; 95% CI = 0.44–0.68), and likely MDD (OR = 0.50; 95% CI = 0.47–0.73). The mean Composite Mental Health score, the sum of mean scores on the PSS, GAD-7, and PHQ-9 was 20.9% higher in the CG.

Conclusions: Text4Hope is an effective population-level intervention that helps reduce stress, anxiety, depression, and suicidal thoughts during the COVID-19 pandemic. Similar texting services should be implemented during global crises.

Introduction

On 11 March 2020, the World Health Organization (WHO) declared Coronavirus disease (COVID-19) to be a global pandemic and public health threat [784]. As of 4 August 2020, there were 18,142,718 confirmed COVID-19 cases worldwide, including 691,013 COVID-19-related deaths [785]. At the same time, Canada reported 116,884 COVID-19 cases and 8945 COVID-19-related deaths [785]. Many governments declared stringent restrictions to contain the spread of COVID-19, with a reported transmissibility rate exceeding other similar viruses [786]. Non-essential businesses and recreational facilities were closed, flights and air traffic stopped, and home schooling replaced in-person instruction. Many governments provided personal instructions, including frequent hand washing, physical distancing, self-isolation/quarantine, and mask wearing [787]. These factors apparently sparked higher levels of anxiety, depression, and suicidal thoughts. Some studies reported mental health deterioration in almost half of study populations, with over 70% worried about personal infection. These figures were more prominent among younger individuals, females, nursing staff, and those needing quarantine or forced to stay at home [278, 579]. Long-term effects of COVID-19 are yet to be fully realized and researchers have emphasized a need to incorporate web-based mental health services into healthcare [788]. The pandemic provided a stimulus to integrate technology-based health supports, including mobile-based services like text messaging (TextM). TextM does not compromise public health requirements for physical distancing, while allowing users to receive important mental health support. Moreover, TextM is remotely delivered, scalable, economically reliable, convenient, and there is growing evidence of applicability in mental health [673]. Most Canadians (90%) own mobile phones [789], and as TextM is included in most personal phone plans, TextM delivery is economically feasible for healthcare providers [673]. Generally, text messages are popular [94], and their clinical advantages are well documented as an intervention for alcohol dependence, substance use disorder, and affective disorders [790]. For example, in three separate randomized controlled trials in Ireland and Canada, patients with Major Depressive Disorder recorded less depressive symptoms on standardized self-reported instruments after daily supportive text messages for three months as part of their usual treatment, compared to patients who received only the usual care [217, 369, 372]. High user satisfaction has also been reported with supportive text message interventions in both in a clinical trial and in a population level program [94, 299]. As such, the study team and stakeholders wanted to incorporate supportive text messages as a way to alleviate mental health symptoms in the general population during the COVID-19 pandemic. In March 2020, Alberta Health Services (AHS) inaugurated the Text4Hope TextM service to support mental health of

Albertans during COVID-19 [459]. Thousands of people signed up for the service only days after launch and enrollment continues to increase to date. The Text4Hope program sends once daily supportive text messages to subscribers for three consecutive months. Messages were designed in the framework of cognitive behavioral therapy (CBT). Text4Hope aimed to improve psychological resilience, alleviate mental health burdens, and enable development of coping mechanisms to prevent and overcome the potential distress and anxiety that may arise in the COVID-19 pandemic [270]. Participants receive a different non-personalized pre-programmed message from a web application each day for three months. Examples of the messages sent were:

- When bad things happen that we can't control, we often focus on the things we can't change. Focus on what you can control; what can you do to help yourself (or someone else) today?
- Put yourself on a media diet. It's important to stay informed, but only check the news and social media intermittently, rather than continuously.
- Advocate for your needs using assertiveness. Assertiveness is being respectful to you and the other person. Be direct, non-aggressive, and specific with your request.

Canadians seeking mental health support were invited to join the three-month program by texting "COVID19HOPE" to a short code number.

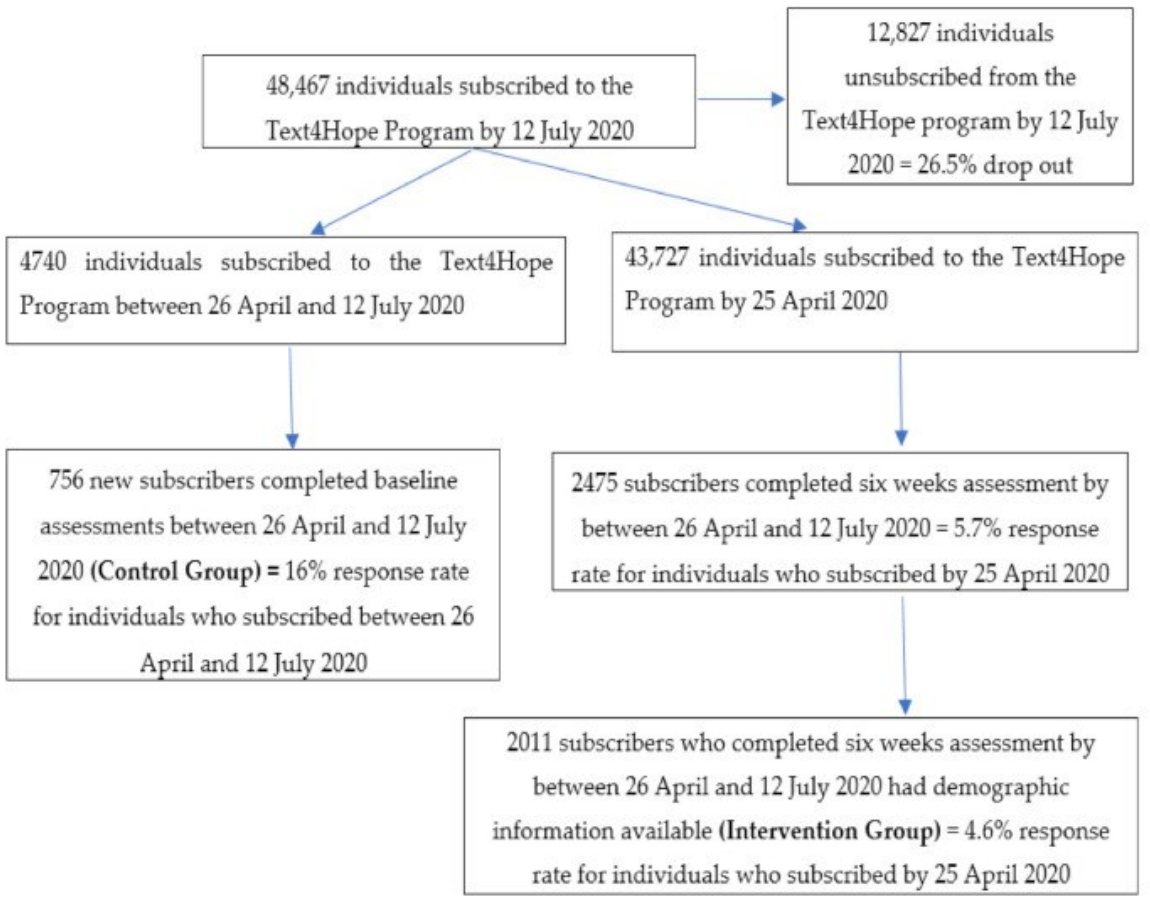
The objective of this study was to assess the effectiveness of Text4Hope in reducing psychological impacts due to COVID-19, six weeks into the service. The study examined subscriber responses, collected between 26 April and 12 July 2020, compared to subscribers who had subscribed earlier and already received messages for six weeks with a matching control group of subscribers who had just started Text4Hope and had not yet received messages. Assessment was completed by comparing scores of psychiatric scales for stress, anxiety, major depressive disorder, suicidal ideation/thoughts of self-harm, and sleep disorder.

Materials and Methods

We used a comparative cross-sectional survey design involving two study arms of Text4Hope subscribers. Participants in the intervention group (IG) were Text4Hope subscribers who received once daily supportive text messages for six weeks and completed six-week evaluation measures between 26 April and 12 July 2020. Participants in the control group (CG) were Text4Hope subscribers who joined the program in the same time frame and completed baseline evaluation

measures before receiving any intervention. Figure 4.3.2.1 shows the number of the participants in the study flow chart.

Figure 4.3.2.1: Subscriber flowchart as of 12 July 2020.



Recruitment

Recruitment strategies for this study were as described in the published study protocol [17] and in related publications [95, 300, 473]. In brief, Text4Hope was launched through an announcement by Alberta's Chief Medical Officer of Health on behalf of AHS and the Government of Alberta on 23 March 2020. The announcement was broadcast widely across many electronic and print media networks in Alberta to inform Albertans about the program [473]. Additionally, Albertans were made aware of the program via websites dedicated to the service, electronic media, social media feeds, posters at addiction and mental health clinics, emergency departments and wards, and through word of mouth. Subscription to Text4Hope triggered a welcome text message containing a 10-min online survey link requesting demographic characteristics (i.e., gender, age, ethnicity, education, relationship status, employment status, and housing status) and clinical characteristics

(self-reported perceived symptoms of stress, anxiety, and depression). Subscribers were only sent a single text message with a survey link each time they were eligible to complete a survey. Clinical characteristics were assessed using validated screening scales for self-reported symptoms, including the Perceived Stress Scale (PSS) (for moderate/high stress; PSS ≥ 14) [302], the Generalized Anxiety Disorder 7-item (GAD-7) scale (for likely generalized anxiety disorder or GAD; GAD-7 ≥ 10) [301], and the Patient Health Questionnaire-9 (PHQ-9) (for likely major depressive disorder or MDD; PHQ-9 ≥ 10) [303]. The PSS is a validated 10-item questionnaire (with an associated Cronbach's alpha of > 0.70) which is used to assess the self-reported level of stress in the previous 1 month by assessing thoughts and feelings. Each item on the scale is scored between 0 (never) to 5 (very often). Higher scores on the scale indicate higher levels of stress [302]. The GAD-7 is a validated 7-item questionnaire (associated with a Cronbach's alpha of 0.92) which is used to assess the self-reported levels of anxiety in respondents in the two weeks prior to assessment. Each item on the scale is scored between 0 (not at all) to 3 (nearly every day). Higher scores on the scale indicate higher levels of anxiety [301]. The PHQ-9 is a 9-item validated instrument (associated with a Cronbach's alpha of 0.89) which used to diagnose and measure the severity of depression in general medical and mental health settings. Each of the 9 questionnaire items is scored between 0 (not at all) to 3 (nearly every day). Higher scores on the scale indicate higher levels of depression [303]. Since the PHQ-9 asks respondents to reflect on their experience in the past two weeks, we were able to assess recent sleep and suicidal thinking. Specifically, scale items 3 and 9 were used to assess sleep and suicide, respectively. These scales are not formal diagnostic tools. Participant consent was implied via submission of subscribers' survey responses and a follow-up survey was sent to subscribers six weeks after enrolment in the program. Ethical approval for the research study was obtained through the University of Alberta Health Research Ethics Board (Pro00086163).

Outcome Measures

For each participant in the CG, we computed individual baseline mean scores on the PSS, GAD-7, and PHQ-9 scales and defined the Composite Mental Health (CMH) score as the sum of these three values. In the same time frame, we computed six-week scores on the PSS, GAD-7, and PHQ-9 scales as well as the CMH score for each IG participant. One primary outcome of this study was the difference of CMH score in the IG, minus the CMH score over the CG subjects. Other primary outcomes were differences between IG and CG in self-reported prevalence rates of moderate/high stress, likely GAD, and likely MDD. Secondary outcomes were differences in self-reported rates

for disturbed sleep and suicidal ideation/thoughts of self-harm between IG and CG as measured with PHQ-9 scale questions 3 and 9, respectively.

Hypothesis

We hypothesized that participants receiving daily supportive TextMs for six weeks (IG) would have at least 25% lower CMH scores, and respective prevalence rates for each of moderate/high stress, likely GAD, likely MDD, disturbed sleep, and suicidal ideation/thoughts of self-harm, compared to Text4Hope subscribers who had not yet received the intervention (CG).

Sample Size Considerations

We estimated a sample size of 62 per group would be sufficient to detect a 25% difference in mean CMH score between the IG and the CG, given a two-sided significance level $\alpha = 0.05$ and a power of 80% ($\beta = 0.2$).

Analysis

We analyzed the data using IBM Statistical Package for Social Sciences (SPSS) Statistics for Windows, version 26 (IBM Corp., Armonk, NY, USA) [418]. Demographic characteristics and prevalence rates for moderate/high stress, likely GAD, and likely MDD for respondents in both the IG and CG were summarized by numbers and percentages and compared by chi-square analysis with a two tailed criterion ($\alpha < 0.05$) used to determine statistical differences between the IG and CG (intervention arms) for PSS, GAD-7, and PHQ-9 scale mean scores. In addition, mean CMH scores were compared using independent *t*-tests. Bonferroni correction of the *p*-value was used.

To assess the impact of the supportive text message intervention on our clinical measures, while controlling for demographic characteristics, we entered all demographic predictors along with "intervention arm" into a logistic regression model. Correlation analyses were performed before the logistic regression analysis to rule out very strong correlations among predictor variables. We examined the odds ratios from the binary logistic regression analysis to determine the respective associations between "intervention arm" and the likelihood of respondents self-reporting symptoms of moderate/high stress, likely GAD, likely MDD, disturbed sleep, and suicidal ideation/thoughts of self-harm in the preceding two weeks, controlling for the other variables in the model. There were no imputations for missing values.

Results

Table 4.3.2.1 summarizes the demographic characteristics of respondents in both the IG and CG in absolute numbers and percentages. The data in this table indicate that most respondents identified as female (n = 2347, 88.0%), aged between 26 and 60 years (n = 2036, 76.7%), Caucasian (n = 2198, 82.8%), had post-secondary education (n = 2054, 87.7%), were married, cohabiting, or partnered (n = 1553, 66.3%), employed (n = 1638, 70.4%), and lived in their own homes (n = 1560, 67.5%). Table 4.3.2.1 also suggests that despite a lack of participant randomization, the IG and CG were similar with respect to their gender, ethnicity, and relationship status ($p > 0.05$), but not with respect to their age, education, employment status, or housing status ($p < 0.001$).

Table 4.3.2.1: Demographic characteristics of study participants.

Demographic Characteristics	**Intervention Group (IG) *n* = 2011 ***	**Control Group (CG) *n* = 756 ***	***p*-Value ****	**Chi-Square**	**Degrees of Freedom (df)**	**Total *n* (%)**
Gender						
Male	214 (10.7)	72 (10.9)	0.96	0.082	2	286 (10.7)
Female	1767 (88.1)	580 (87.7)				2347 (88.0)
Other Gender	25 (1.2)	9 (1.4)				34 (1.3)
Age (Years)						
≤25	173 (8.6)	92 (14.2)	<0.001	20.39	3	265 (10.0)
26–40	554 (27.6)	191 (29.5)				745 (28.1)
41–60	1002 (49.9)	289 (44.6)				1291 (48.6)
>60	278 (13.9)	76 (11.7)				354 (13.3)
Ethnicity						
Caucasian	1669 (83.6)	529 (80.6)	0.17	5.09	3	2198 (82.8)
Indigenous	59 (3.0)	29 (4.4)				88 (3.3)
Asian	105 (5.3)	34 (5.2)				139 (5.2)
Other	164 (8.2)	64 (9.8)				228 (8.6)
Education						
Less than High School Diploma	44 (2.6)	43 (6.5)	<0.001	34.06	3	87 (3.7)
High School Diploma	116 (6.9)	65 (9.8)				181 (7.7)
Post-Secondary	1512 (89.9)	542 (82.0)				2054 (87.7)

Other Education	10 (0.6)	11 (1.7)				21 (0.9)
Relationship status						
Married/Cohabiting/Partnered	1100 (65.4)	453 (68.5)	0.25	5.39	4	1553 (66.3)
Separated/Divorced	171 (10.2)	52 (7.9)				223 (9.5)
Widowed	41 (2.4)	10 (1.5)				51 (2.2)
Single	354 (21.0)	138 (20.9)				492 (21.0)
Other	17 (1.0)	8 (1.2)				25 (1.1)
Employment						
Employed	1185 (71.1)	453 (68.5)	<0.001	186.8	4	1638 (70.4)
Unemployed	203 (12.2)	52 (7.9)		6		255 (11.0)
Retired	173 (10.4)	10 (1.5)				183 (7.9)
Student	80 (4.8)	138 (20.9)				218 (9.4)
Other	26 (1.6)	8 (1.2)				34 (1.5)
Housing Status						
Own Home	1160 (69.6)	400 (61.9)	<0.001	18.59	3	1560 (67.5)
Living with Family	150 (9.0)	88 (13.6)				238 (10.3)
Renting	343 (20.6)	147 (22.8)				490 (21.2)
Other	13 (0.8)	11 (1.7)				24 (1.0)

* There was no imputation for missing values for a particular characteristic and so total number of responses for each demographic variable is less than the Total *n* for the Intervention Group (IG) or Control Group (CG). ** Bonferroni corrected significant $p < 0.007$.

Table 4.3.2.2 indicates that the IG mean scores on the PSS, GAD-7, and PHQ-9 as well as the CMH score were significantly lower than scores for the CG. The mean scores on the PSS, GAD-7, and PHQ-9 scales and the CMH score were higher for the CG compared to the IG, 14.5%, 27.4%, 28.8%, and 20.9%, respectively.

Table 4.3.2.2: Independent sample *t*-test comparing the mean scores for IG and CG on the Perceived Stress Scale (PSS), the Generalized Anxiety Disorder 7-item (GAD-7), and Patient Health Questionnaire-9 (PHQ-9) scales and the Composite Mental Health (CMH) score.

		n	**Mean**	**Std. Deviation**	**Std. Error**	**T**	**df**	***p*-Value ***	**Mean Difference (MD)**	**95% Confidence Interval of MD**
	IG	1864	19.50	7.12	0.16	8.41	2472	<0.001	2.82	2.17–3.48

PSS Total Score	CG	610	22.32	7.41	0.30					
GAD-7 Total Score	IG	1704	7.55	5.31	0.13	7.70	2308	<0.001	2.07	1.54–2.60
	CG	557	9.62	6.08	0.26					
PHQ-9 Total Score	IG	1738	8.60	5.98	0.14	8.33	2259	<0.001	2.48	1.86–3.10
	CG	572	11.08	6.73	0.28					
CMH Score	IG	1700	35.64	16.94	0.41	8.77	2253	<0.001	7.44	5.78–9.12
	CG	555	43.08	18.55	0.78					

* Bonferroni corrected significant $p < 0.0125$.

Table 4.3.2.3 indicates that there were statistically significant differences in prevalence rates for moderate/high stress, likely GAD, and likely MDD during the study period. Participants in the IG had significantly lower prevalence rates for moderate/high stress (78.8% vs. 88.0%), likely GAD (31.4% vs. 46.5%), likely MDD (36.8% vs. 52.1%), and suicidal ideation/thoughts of self-harm (16.9% vs. 26.6%) in the two weeks preceding data collection, compared to respondents in the CG, but not for disturbed sleep symptoms ($p > 0.01$). The effect size of the intervention on each of these clinical variables was small, but significant.

Table 4.3.2.3: Chi-square test of association between prevalence of clinical parameters and study arm.

	Study Arm	
	IG *n* (%)	**CG *n* (%)**
Perceived Stress		
Moderate/High Stress [a]	1468 (78.8%)	537 (88.0%)
p-value	<0.001 *	
Effect Size (Phi)	−0.102	
Generalized Anxiety Disorder (GAD)		
GAD likely [b]	535 (31.4%)	265 (46.5%)
p-value	<0.001 *	
Effect Size (Phi)	−0.146	
Major Depressive Disorder (MDD)		

MDD likely [c]	639 (36.8%)	298 (52.1%)
p-value	<0.001 *	
Effect Size (Phi)	−0.135	
Suicidal Ideation/Thoughts of Self Harm [d]		
Experienced Suicidal Ideation/Self Harm Thoughts	293 (16.9%)	152 (26.6%)
p-value	<0.001 *	
Effect Size (Phi)	−0.106	
Sleep Disturbances [e]		
Experienced Sleep Disturbances	1336 (76.9%)	466 (85.1%)
p-value	0.020	
Effect Size (Phi)	−0.047	

[a] Moderate/High Stress defined as PSS ≥ 14. [b] Likely GAD defined as GAD-7 ≥ 10. [c] Likely MDD defined as PHQ-9 ≥ 10. [d] Suicidal ideation/thoughts of self-harm defined as PHQ-9 item 9 ≥ 1. [e] Sleep Disturbances defined as PHQ-9 item 3 ≥ 1. * Bonferroni corrected significant $p < 0.01$.

Logistic Regression

To assess the impact of the supportive text message intervention on the likelihood for respondents to present with moderate/high stress, likely GAD, likely MDD, disturbed sleep, and suicidal ideation/thoughts of self-harm in the two weeks preceding data collection, whilst controlling for demographic characteristics, we entered all seven characteristics in Table 4.3.2.1 and "treatment type" into logistic regression models. Table 4.3.2.4 summarizes the output from five separate logistic regression models predicting likelihood of clinical variables of interest in IG vs. CG.

Table 4.3.2.4: Odds for subscribers in the IG to have various clinical characteristic compared to the CG.

Clinical Variables of Interest	***p*-Value**	**Odds Ratio**	**95% CI for OR**	
			Lower	**Upper**
Moderate/High Stress[a]	<0.001	0.56	0.41	0.75
GAD likely [b]	<0.001	0.55	0.44	0.68
MDD likely [c]	<0.001	0.50	0.47	0.73
Experienced Suicidal Ideation/Self Harm Thoughts	<0.001	0.59	0.45	0.77
Experienced Sleep Disturbances	*0.150*	0.77	0.60	1.01

[a] Moderate or High Stress defined as PSS ≥ 14 [b] Likely GAD defined as GAD-7 ≥ 10 [c] Likely MDD defined as PHQ-9 ≥ 10.

For moderate/high stress, the full model (eight predictors) was significant, x^2 (df = 23, n = 2777) = 194.82, $p < 0.001$, suggesting the model distinguished between respondents who reported moderate/high stress and others. The model explained between 8.7% (Cox and Snell R2) and 13.9% (Nagelkerke R2) of the variance and correctly classified 81.3% of all cases. Controlling for all demographic characteristics, "intervention arm" made a unique statistically significant contribution (Wald = 14.2, $p < 0.001$) to the likelihood for respondents to present with moderate/high stress. Respondents who received daily supportive TextM for six weeks (IG) were 0.56 times less likely to report moderate/high stress during the study period compared to respondents who had not received the daily TextM (CG), when all demographic variables were controlled for (OR = 0.56; 95% CI = 0.41–0.75), as shown in Table 4.3.2.4.

For likely GAD, the full model containing all eight predictor variables was significant, x^2 (df = 23, n = 2777) = 225.23, $p < 0.001$, indicating distinction between respondents who had likely GAD and those who did not. The model explained between 10.6% (Cox and Snell R2) and 14.5% (Nagelkerke R2) of the variance and correctly classified 63.9% of all cases. Controlling for all demographic characteristics, the "intervention arm" made a unique statistically significant contribution (Wald = 27.63, $p < 0.001$) to the likelihood for respondents to meet the cut-off threshold for likely GAD. The IG was about 0.55 times less likely to meet the cut-off threshold for likely GAD during the study period compared to CG, when all demographic variables were controlled for (OR = 0.55; 95% CI = 0.44–0.68), as shown in Table 4.3.2.4.

For likely MDD, the full model containing all eight predictors was significant, x^2 (df = 23, n = 2777) = 194.97, $p < 0.001$, implying the model was able to distinguish between respondents who had likely MDD versus those who did not. The model explained between 9% (Cox and Snell R2) and 12.2% (Nagelkerke R2) of the variance and correctly classified 58.6% of all cases. Controlling for all demographic characteristics, "intervention arm" made a unique statistically significant contribution (Wald = 22.37, $p < 0.001$) to the likelihood for respondents to present with likely MDD. Respondents in the IG were about 0.59 times less likely to meet the cut-off threshold for likely MDD during the study period compared to the CG, when all demographic variables were controlled for (OR = 0.50; 95% CI = 0.47–0.73) as shown in Table 4.3.2.4.

For suicidal ideation, the full model containing all eight predictors was significant, x^2 (df = 23, n = 2777) = 209.13, $p < 0.001$, implying the model discriminated between respondents who had suicidal ideation or thoughts of self-harm in the two weeks preceding data collection and those

who did not. The model explained between 9.7% (Cox and Snell R2) and 15.4% (Nagelkerke R2) of the variance and correctly classified 80.7% of all cases. Controlling for all demographic characteristics, "intervention arm" made a unique statistically significant contribution (Wald = 15.13, $p < 0.001$) to the likelihood for respondents to have had suicidal ideation or thoughts of self-harm in the preceding two weeks. Respondents in the IG were about 0.59 times less likely to have had suicidal ideation or thoughts of self-harm in the two weeks preceding data collection compared to the CG, when all demographic variables were controlled for (OR = 0.59; 95% CI = 0.45–0.77) as shown in Table 4.3.2.4.

For disturbed sleep, the full model containing all eight predictors was significant, x^2 (df = 23, n = 2777) = 55.82, $p < 0.001$, implying the model could distinguish between respondents who had experienced disturbed sleep in the preceding two weeks and those who had not. Nevertheless, the model only explained between 2.7% (Cox and Snell R2) and 4.1% (Nagelkerke R2) of the variance and correctly classified 78.3% of all cases. For sleep disturbance, controlling for all demographic characteristics, "intervention arm" failed to (Wald = 3.49, p = 0.15) distinguish IG and CG on disturbed sleep in the preceding two weeks. Thus, respondents in the IG were no more and no less likely to have experienced disturbed sleep in the preceding two weeks during the study period compared to the CG (OR = 0.77; 95% CI = 0.60–1.01), as shown in Table 4.3.2.4.

Discussion

To our knowledge, this is the first examination of the short-term impact (six weeks) of a texting-based intervention aimed at alleviating pandemic-associated stress, generalized anxiety disorder (GAD), major depressive disorder (MDD), and suicidal propensity during COVID-19 in comparison to a control group. This study demonstrates the effectiveness of Text4Hope over six consecutive weeks on various psychological symptomatology, including stress, GAD, MDD, and suicidal ideation or thoughts of self-harm, but not for disturbed sleep symptoms. A related study which had no control group reported there were statistically significant reductions in the prevalence rates for clinically meaningful stress and anxiety as well as statistically significant reductions in mean scores on the PSS-10 and GAD-7 scales when comparing the baseline and sixth week assessments in subscribers of Text4Hope [473]. A second longer term study which also had no control group reported there were statistically significant reductions in the prevalence rates for clinically meaningful stress, anxiety and depression as well as statistically significant reductions in mean scores on the PSS-10, GAD-7, and PHQ-9 scales when comparing the baseline and third month assessments in subscribers of Text4Hope [95].

The current study which, even though non-randomized, reasonably controls for the mental health impacts of the changing COVID-19 infection rates and their related health, social, financial, and occupational disruptions to the lives of the two study populations and augments the previous study.

Overall, the five clinical parameters measured showed likely significantly higher prevalence rates in the CG, ranging from 9.2% for moderate/high stress symptoms to 15.3% for likely MDD symptoms, compared to the IG. All clinical parameters, except for stress symptoms, have improved by over 25% and the CMH score was over 20% higher in the CG compared to the IG. Due to a lack of randomization of study participants between the IGs and CGs, there were some between group demographic differences with the CG population being younger with a larger proportion of students. Consequently, this cohort reported lower educational attainment and were more likely to rent accommodations or live with their families, rather than owning homes. The regression model controlled for such differences and revealed similar results for all the clinical presentations under study. As such, lower scores in IG compared to CG in all clinical domains suggests the effectiveness of Text4Hope as an intervention to alleviate psychological symptoms.

During the COVID-19 pandemic, technology-based interfaces have been widely deployed in a number of health-related services, including tracking the spread of COVID-19 [677], gathering data related to public knowledge and behavior regarding the pandemic [771], or providing mental health support during the pandemic [42]. Similarly, Text4Hope was designed in response to the different psychiatric burdens that may result from, or be worsened by, the pandemic. Generally, TextM are popular and enjoy high rates of acceptability and satisfaction, where upwards of 80% of message recipients report a marked improvement in their overall mental wellbeing [94]. Clinical advantages of TextM platforms are supported in several medical fields, including mental health: employed as reminders, support, and self-monitoring of clinical symptoms [790]. In the context of affective disorders, TextM were successfully deployed to generate positive feelings in people living with depression and bipolar disorder [351, 791]. In a randomized control trial, TextM significantly reduced participant scores on the Beck Depression Inventory-II scale after three months of receiving twice-daily supportive TextM, compared to a CG, mean (SD) = 8.5 (8.0) vs. 16.7 (10.3), F (1, 49) = 9.54, $p = 0.003$, respectively[217]. Similar results were obtained when TextM were coupled with CBT; TextM were used to improve treatment adherence and track the progression of the clinical condition in patients with mood disorder [771]. Within the comorbidity of alcohol dependence and substance use disorder with depression, or either alone, TextM were recognized to enhance medication adherence, time to first drink, and relapse prevention [216, 792].

Compared to the CG, Text4Hope improved GAD-7 and PSS scores in the IG; this suggests effects comparable to other computerized, web-based, or mobile based intervention programs that target anxiety and stress symptoms. Such programs usually express high initial rates of acceptance and feasibility by both therapists and patients [793]. A web-based CBT program was provided to graduate students in the United States for four-weekly sessions [777]. The program improved anxiety symptoms in 18.8% of the service recipients. In the same context, when combining a telephone service with computerized CBT, a reduction of 1.18 in GAD-7 mean score was observed [778], which is less than the 2.07 reduction in GAD-7 mean score for the IG, compared to the CG, as observed in our study. Additionally, this difference is comparable with the effect of some medications used to manage anxiety, such as sertraline. A United Kingdom study showed sertraline, when used for a six-week period, could reduce GAD-7 scores by (21%) [779], compared to (27.4%) in our study, albeit this difference was between the two treatment groups, rather than one group.

Improvement in stress symptoms scores in our study was inconsistent with another study in Japan in which an online CBT program of six to eight sessions was offered to university students [793]. In this study, the program impacted how clients thought about anxiety and stress, however, there were only reductions in anxiety symptoms [780]. Opposite to the "SleepTrackTXT2 behavioral intervention" that improved sleepiness, fatigue, and concentration among emergency medical service clinicians in the short-term [794], our study showed no significant change in the disturbed sleep symptoms in IG compared to the CG.

TextM are perceived as an acceptable, feasible, and supportive tool during the transition period after discharge for an attempted suicide [217, 795]. A mobile (smartphone) app used for data collection in one study showed reliability (r = 0.84) when compared with paper-based PHQ-9 scores [390]. As such, text messages and online applications can be reliably used to assess the mental health impacts of a population during disasters. Text4Hope yielded lower scores of suicidal thoughts in the IG compared to the CG. Taken together, texting programs appear to improve positive thinking and reduce negative suicidal/self-harm thoughts, especially during major crises.

The study has several limitations and therefore our results should be interpreted with caution. First, the two groups under study were not randomly assigned, which was reflected in the significant differences observed in the demographic characteristics between the IG and CG. Efforts were made to control for these differences in the logistic regression model used in the analysis. Second, effect sizes were relatively small. However, interventions that do not include therapist support

often report low effect sizes compared to those including therapists [777, 796]. Third, the opt-out rate at three months from Text4Hope is high (around 26%) and so it is possible that the impact of the intervention could be different in the group who unsubscribe from the program. In a review of 93 mental health apps targeting anxiety, depression, or emotional well-being, the medians of app 15-day and 30-day retention rates were only 3.9% (IQR 10.3%) and 3.3% (IQR 6.2%), respectively [797]. This indicates that ourText4Hope program achieved a higher retention rate compared to other mental health apps. This may be because Text4Hope is unidirectional and requires no additional effort or action on the part of the subscriber following enrolment. It is also possible that the message content, crafted by mental health professionals, the high anxiety, stress, and depression levels experienced by the population level due to the COVID-19 pandemic, and the reduced availability of face-to face services contributed to the high Text4Hope retention rate. Fourth, although we used validated instruments to assess stress, anxiety, and depression, these self-assessed instruments are not diagnostic of clinical conditions for which structured clinical interviews are needed. Finally, the majority of respondents in our study identified as female, 26 to 60 years of age, partnered, and employed. Thus, it is unclear how these results would generalize to a broader population of Canadians with different sociodemographic characteristics. However, the baseline demographic and clinical characteristics of the sample are similar to the characteristics of the larger sample of subscribers who completed baseline surveys within the first three months following the launch of Text4Hope [36]. It would therefore be reasonable to conclude that the supportive messages would have similar effects on all Text4Hope subscribers. Notwithstanding the limitations, our study achieved very high power. Based on the actual sample size of 555 minimum per group achieved in our study and the mean CMH scores observed for the IG and CG, our study achieved a power of 1.0.

Conclusions

Texting-based programs are evidently feasible, cost-effective, and of clinical significance. They can be deployed quickly during pandemics to support at risk populations, which can be crucial to mitigating negative short- and long-term psychological impacts. After six weeks of its application, the Text4Hope program effectively ameliorated various psychiatric burdens during the COVID-19 pandemic, including stress, GAD, MDD, and thoughts of suicide/self-harm. These negative thoughts and feelings are usually triggered and easily thrive, during major crises and natural disasters. To this end, similar initiatives might be considered, especially in the context of technology-based, remotely accessible, and population-level interventions, within different

clinical contexts, for vulnerable populations. This study along with two related published outcome studies [270, 459]. on the Text4Hope program may serve to provide evidence-based support for such policy implementation in high-, middle-, and low-income countries. The research team therefore plans to explore national scale-up and implementation of the Text4Hope program in multiple languages to benefit all Canadians. The team will also disseminate this program for adaptation and potential global use through the E-Text4PositiveMentalHealth platform, currently under development, and formation of partnerships with national and regional health authorities and institutions.

4.3.3 Gender Differences in Satisfaction with a Text Messaging Program (Text4Hope) and Anticipated Receptivity to Technology-Based Health Support During the COVID-19 Pandemic: Cross-sectional Survey Study

Shalaby, R., Vuong, W., Hrabok, M., Gusnowski, A., Mrklas, K., Li, D., . . . Agyapong, V. I. O. (2021). Gender Differences in Satisfaction With a Text Messaging Program (Text4Hope) and Anticipated Receptivity to Technology-Based Health Support During the COVID-19 Pandemic: Cross-sectional Survey Study. JMIR Mhealth Uhealth, 9(4), e24184. doi:10.2196/24184. Available at https://www.ncbi.nlm.nih.gov/pubmed/33750738

Abstract

Background: In March 2020, Text4Hope—a community health service—was provided to Alberta residents. This free service aims to promote psychological resilience and alleviate pandemic-associated stress, anxiety, and depression symptoms during the COVID-19 pandemic.

Objective: This study aimed to evaluate the feedback, satisfaction, experience, and perceptions of Text4Hope subscribers and to examine any differences based on gender after subscribers received 6 weeks of daily supportive text messages. Additionally, this study examined subscribers' anticipated receptivity to technology-based medical services that could be offered during major crises, emergencies, or pandemics.

Methods: Individuals self-subscribed to Text4Hope to receive daily supportive text messages for 3 months. Subscribers were invited to complete a web-based survey at 6 weeks postintervention to provide service satisfaction–related information. Overall satisfaction was assessed on a scale of 0-10, and satisfaction scores were analyzed using a related-measures *t* test. Likert scale satisfaction responses were used to assess various aspects of the Text4Hope program. Gender differences were analyzed using one-way analysis of variance (ANOVA) and Chi-square analyses.

Results: A total of 2032 subscribers completed the baseline and 6-week surveys; 1788 (88%) were female, 219 (10.8%) were male, and 25 (1.2%) were other gender. The mean age of study participants was 44.58 years (SD 13.45 years). The mean overall satisfaction score was 8.55 (SD 1.78), suggesting high overall satisfaction with Text4Hope. The ANOVA analysis, which was conducted using the Welch test (n=1716), demonstrated that females had significantly higher mean satisfaction scores than males (8.65 vs 8.11, respectively; mean difference=0.546; 95% CI 0.19 to 0.91; $P<.001$) and non-significantly lower satisfaction scores than other gender respondents (mean difference=−0.938; 95% CI −0.37 to 2.25; $P=.15$). More than 70% of subscribers agreed that Text4Hope helped them cope with stress (1334/1731, 77.1%) and anxiety (1309/1728, 75.8%), feel connected to a support system (1400/1729, 81%), manage COVID-19–related issues (1279/1728, 74%), and improve mental well-being (1308/1731, 75.6%). Similarly, subscribers agreed that messages were positive, affirmative, and succinct. Messages were always or often read by 97.9% (1681/1716) of respondents, and more than 20% (401/1716, 23.4%) always or often returned to messages. The majority of subscribers (1471/1666, 88.3%) read the messages and either reflected upon them or took a positive action. Subscribers welcomed almost all technology-based services as part of their health care during crisis or emergency situations. Text4Hope was perceived to be effective by many female subscribers, who reported higher satisfaction and improved coping after receiving text messages for 6 weeks.

Conclusions: Respondents affirmed the high quality of the text messages with their positive feedback. Technology-based services can provide remotely accessible and population-level interventions that align with the recommended physical distancing practices for pandemics. Text4Hope subscriber feedback revealed high satisfaction and acceptance at 6 weeks postintervention.

Introduction

Background

On March 11, 2020, the World Health Organization declared COVID-19 a global pandemic [482]. By March 23, 2020, there were 332,930 COVID-19 cases worldwide and 14,509 deaths attributed to the pandemic [22]. On this date, Alberta Health Services (the provincial health authority in Alberta, Canada) launched Text4Hope—a free, mobile, community mental health service that aims to support mental well-being and resilience, improve coping mechanisms, and safeguard against pandemic-associated thoughts in Alberta residents [517]. The service was advertised on the Alberta Health Services and Text4Hope funders' websites and was launched on March 23, 2020. Thousands of people have signed up for the service, and enrollment continues to increase to date. Text4Hope is a text-based mental health support program that involves daily, evidence-based, cognitive behavioral therapy–derived text messages. These messages were carefully designed to accompany a rapidly evolving health crisis and to be scalable, remotely deliverable, and accessible. They were also designed to be cost-effective for funding organizations and free to subscribers [798]. The Text4Hope program was developed based on lessons from the Text4Mood and Text4Support programs [94, 213]. Similar to the Text4Mood program, individual Text4Hope self-subscribers receive daily text messages. However, while the Text4Mood messages were crafted to mainly address anxiety, depression, and general well-being among residents of Northern Alberta, the Text4Hope messages were crafted to predominantly address COVID-19–related stress, anxiety, and depression among all Albertans. In contrast to both Text4Mood and Text4Hope, Text4Support was specifically designed to provide support for the eight most commonly observed addiction and mental health concerns in the Edmonton Zone [213]. In this program, a mental health therapist or psychiatrist sorts clients into 1 of the 8 categories, and patients are enrolled by a coordinator inputting the patients' mobile phone numbers into a web-based program. Text4Hope fills a service gap in Alberta, as social distancing measures may have resulted in high-risk individuals (from a health perspective) not being able to access addiction and mental health services during the early stage of the pandemic. Text4Hope also offers mental health support to those who might not feel comfortable with in-person contact.

During similar crises, the effective and efficient mobilization of community resources was strongly encouraged to support and properly meet mental health needs and avoid future adverse mental

health consequences [689]. During pandemics, negative thoughts accompanied by growing uncertainties can pose a threat to personal health and mental well-being. The transmissibility of SARS-CoV-2 has been shown to exceed that of similar viruses (eg, MERS-CoV [Middle East respiratory syndrome coronavirus], H1N1, and SARS-CoV [severe acute respiratory syndrome coronavirus]) [786]. As such, strict policies and regulations were enforced to contain viral spread, including physical distancing, self-isolation, quarantine, travel restrictions, the closure of public schools, and disinfection protocols. However, these measures have likely contributed to mental strain and psychological distress during the COVID-19 pandemic [799, 800]. Other iterations of texting programs were developed to support patients with major depressive disorders [369] and alcohol use disorder [216, 217]. Individuals in these programs reported an improvement in depression scores and felt better supported in their attempts to quit drinking alcohol after receiving text messages [217, 782]. Supportive text messaging services can be tailored to meet the needs of diverse populations. For example, Text4baby and Quit4baby are two services that are provided to pregnant women in the United States [243, 245], while Text4Mood and Text4Support are mental health services that are provided to people in Canada [94, 213]. Ultimately, such services provide people with hopefulness and support and aim to close the psychological treatment gap in health care systems [94].

To make the best use of resources and enhance the use of texting technology as part of routine practice in health care, it is essential to assess user satisfaction and better understand subscribers' experiences. The assessment of user satisfaction is a quality method that affects client retention and clinical outcomes [389]. In the customer service industry, relative satisfaction and customer expectations are considered critical components for guaranteeing customer loyalty [801]. In health care systems, self-reported continuity of care strongly correlates with client satisfaction. A recent study has demonstrated that a 7.2% reduction in the frequency of reporting "at least good overall satisfaction" was associated with a 1% increase in hospital bed occupancy [389]. Generally, asynchronous web-based and text-based services have been accepted by an increasing number of individuals who perceive such services as supportive and promising [390]. Most of these programs have usually stated that more than 85% of text message recipients report high satisfaction, high convenience, easy use, and better control over life activities, while above 90% report increased life productivity after receiving text messages [335, 802]. Additionally, telephone services are frequently associated with having lower attrition rates than face-to-face services, which is likely

due to the accessibility provided by technology that removes geographical barriers. This is especially helpful to those who are tentative about seeking medical attention or require medications [404]. Agyapong and colleagues [94], who evaluated Text4Mood, found that 80% of participants agreed that asynchronous supportive text messages should be provided during follow-up care, and approximately 50% of participants agreed to the use of videoconferencing consultations. A number of variables may affect users' satisfaction with texting services, such as sociodemographic characteristics, health status, and disease severity. Similarly, one's gender identity may be an important determinant of service acceptability and satisfaction. However, it should be noted that inconsistent findings have been reported for gender identity effects. Although females are highly accepting of surveys and have a high desire to respond to surveys that are delivered to them via a texting service [803], in a feasibility study, the high fidelity of a texting service program was also reported when the program was provided to a group of disadvantaged men at risk of substance or alcohol abuse [804]. In yet another study, authors found no difference between male and female university students in terms of their satisfaction with texting services for alcohol use intervention [782]. Additionally, the initial reports of our program revealed that a majority of our subscribers reported their gender as female (86.9%). This overrepresentation of females in text messaging services has necessitated investigations into user satisfaction and anticipated agreement to receiving technology-based medical services based on gender. Such investigations will allow targeted gender-based interventions to be developed in accordance with user preferences.

This study occurred in Alberta, the Canadian Province where the Text4Hope program was launched. As of July 1, 2020, Alberta had a population of 4,421,876 people, with 68% of the population aged between 15 and 64 years. Alberta has consistently consisted of more males than females (101 males per 100 females), mainly due to the large proportion of working-age males migrating to the province [805]. In 2006, the racial and ethnic composition of Alberta was 80.3% White Canadians, 13.9% visible minority groups, and 5.8% Indigenous groups (3% First Nations, 2.6% Metis, and 0.1% other Indigenous groups). Visible minority groups included the following: Chinese (3.7%), South Asian (3.2%), Filipino (1.6%), Black (1.4%), Southeast Asian (0.9%), Latin American (0.8%), Arab (0.8%), Korean (0.4%), West Asian (0.3%), and Japanese 0.3% [806]. In 2016, more than half (54%) of Canadians aged 25-64 years had either college or university qualifications (an increase from the 48.3% in 2006) [807]. Alberta's gross domestic product at

basic prices was CAN $334.5 billion (US $265.2 billion) in 2019 (largely unchanged from Alberta's gross domestic product in 2018) [808].

Objective

The aim of this study was to evaluate subscribers' overall satisfaction with Text4Hope; obtain feedback about subscribers' experiences and the impact of the texting intervention; explore the perceptions of subscribers about their anticipated receptivity toward diverse, technology-based medical services that are offered as a part of their health care during major crises, emergencies, or pandemics (such as the COVID-19 pandemic); and examine any differences that are based on gender after subscribers received 6 weeks of daily supportive text messages.

Hypotheses

Based on previous Text4Mood research [94], our hypotheses were as follows: (1) the mean overall satisfaction level with Text4Hope would be at least 7.5 (75%) and (2) at least 75% of subscribers would express anticipated agreement with receiving diverse, technology-based medical services during crises or emergencies. Additionally, we believed that there would be a difference in the satisfaction measure based on the self-declared gender identity of the respondents.

Methods

Study Design

This cross-sectional study assessed subscribers' satisfaction and experiences with Text4Hope and their perceptions of technology-based support after they received 6 weeks of daily text messages.

Data Collection

The data collection methods were fully described in the study protocol [809]. In summary, subscribers joined the Text4Hope program [517] and received daily supportive text messages for 3 months by texting the word "COVID19HOPE" to a short code number. The messages were in line with a cognitive behavioral framework that addressed the aspects of potential stresses, anxiety, and depression, and the content was written by mental health professionals. Text message delivery was unidirectional and not specifically tailored to the end users. The following are examples of the messages that were sent: When bad things happen that we can't control, we often focus on the

things we can't change. Focus on what you can control; what you can do to help yourself (or someone else) today. [Example 1]

What lies behind you and what lies before you are tiny matters compared to what lies within you. Have faith in yourself and success can be yours. [Example 2]

Set goals for today, even if they are small. Goals should be "SMART": Specific, Measurable, Achievable, Realistic, and Timely. [Example 3]

The messages were uploaded to a web-based platform, which delivered automated messages at 9 AM. The first message welcomed subscribers to the service and invited them to voluntarily complete a web-based baseline survey, which was used to capture demographic and clinical information that primarily pertained to anxiety, stress, depression, and self-isolation. At 6 weeks postintervention, subscribers were invited (via a text message link) to complete a follow-up web-based survey. The 6-week survey included standardized scales that were used for the Text4Hope baseline assessments [36, 439] as well as an adopted version of the Text4Mood user satisfaction survey [94]. Each survey took 5-10 minutes to complete. No incentives were offered to respondents for completing the baseline or 6-week surveys. Consent was implied if participants clicked on the survey links and submitted their responses.

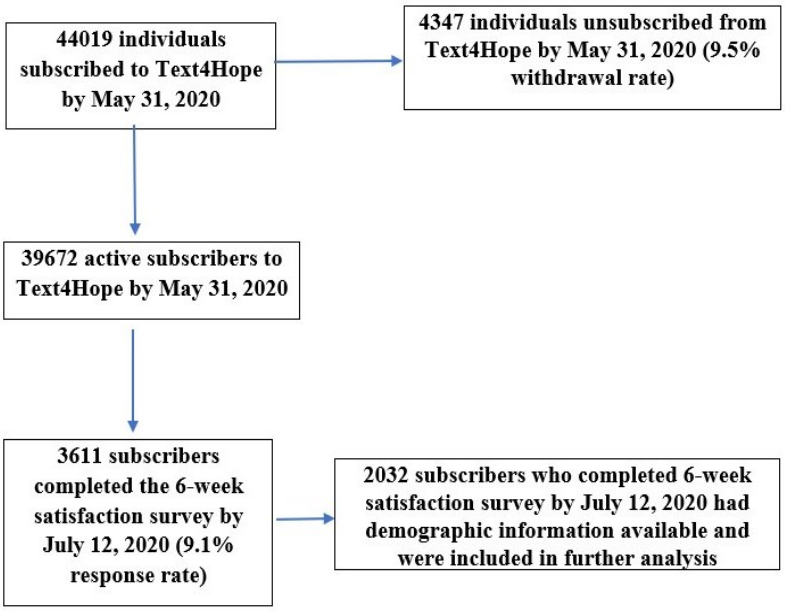
Outcome Measures

The primary outcome measure was subscribers' overall satisfaction with the Text4Hope daily supportive text messages. Overall satisfaction at 6 weeks postintervention was based on an 11-point Likert scale (0=very dissatisfied; 5=neither satisfied nor dissatisfied; 10=very satisfied). This overall satisfaction score allowed us to determine whether people liked texting-based services. If people are satisfied with the population-based services they receive, then the services are potentially feasible and can aid in future service planning during pandemics. The satisfaction scale has been used to compare service satisfaction across all addiction and mental health services in the Edmonton Zone. The reliability and validity of this scale has not been tested, although it has been in use for several years.

Secondary outcomes included the perceived impacts of and subscribers' feedback for the daily supportive text messages at 6 weeks postintervention as well as subscribers' anticipated receptivity to diverse, technology-based medical services (eg, telephone, videoconferencing, and email for health care) during the COVID-19 pandemic. Gender differences in both primary and secondary

measures constituted the exploratory outcome measures. Participation in the program was voluntary, and the receipt of supportive text messages was not contingent on survey completion. Subscribers could opt out of Text4Hope at any time by texting the word "STOP" to a short code number. Six-week satisfaction data were collected between May 31 and July 12, 2020. Figure 4.3.3.1 depicts a subscriber flowchart, which indicates the number of subscribers who completed the web-based surveys at each time point. The study protocol [809] was approved by the Research and Ethics Board of the University of Alberta (approval number: Pro00086163).

Figure 4.3.3.1. Subscription flowchart



Sample Size Considerations

In total, 44,019 individuals were subscribed to Text4Hope on May 31, 2020. We estimated that a sample size of 1775 was needed to estimate the overall mean satisfaction rate (based on an 11-point scale from 0 to 10) for the entire population with a 3% margin of error and 99% confidence.

Analysis

Data were analyzed using SPSS Statistics for Windows, version 26 (IBM Corporation) [418]. Demographic characteristics were summarized as raw numbers and percentages. We measured subscribers' overall satisfaction on an 11-point Likert scale (0=very dissatisfied; 5=neither

satisfied nor dissatisfied; 10=very satisfied) and analyzed responses by using the related sample *t* test. We explored gender differences in satisfaction, which was measured on the same scale, by using one-way analysis of variance (ANOVA) tests. A Bonferroni-corrected, two-tailed criterion ($\alpha<.002$) was used to determine statistical differences. Likert scale satisfaction responses to various aspects of Text4Hope and anticipated receptivity to technology-based interventions (web-based counseling, telephone counseling, text and email messaging, telephone consultations for physical and mental health, and video consultations for physical and mental health) were summarized as frequency counts of response categories and percentages. We compared gender differences in satisfaction and preferences for technology-based interventions by using the Fisher exact test with two-tailed, Bonferroni-corrected criteria for 23 variables ($\alpha<.002$) to determine statistical differences. There was no imputation for missing data, and the results were based on completed survey responses. Between May 31 and July 12, 2020, 39,672 active Text4Hope subscribers were invited to complete the 6-week survey. Of these subscribers, 3611 completed the survey, yielding a response rate of 9.1%. Of the 2032 subscribers who had available demographic information from their baseline survey and were included in further analysis, 1788 (88%) were female, 219 (10.8%) were male, and 25 (1.2%) were other gender. Table 4.3.3.1 provides a descriptive analysis of the demographics of respondents.

Table 4.3.3.1: Demographic and clinical characteristics of respondents at 6 weeks postintervention

Variables	Male (n=219), n (%)	Female (n=1788), n (%)	Other gender, (n=25), n (%)	Overall (N=2032), n (%)
Age (years)				
≤25	15 (7)	151 (8.6)	7 (28)	173 (8.6)
26-40	53 (24.8)	490 (27.7)	12 (48)	555 (27.7)
41-60	105 (49.1)	891 (50.5)	4 (16)	1000 (49.9)
>60	41 (19.2)	234 (13.3)	2 (8)	277 (13.8)
Ethnicity				
White	177 (81.2)	1492 (83.9)	19 (76)	1688 (83.5)
Indigenous	6 (2.8)	54 (3)	0 (0)	60 (3)
Asian	15 (6.9)	90 (5.1)	1 (4)	106 (5.2)
Other	20 (9.2)	142 (8)	5 (20)	167 (8.3)

Education				
Less than a high school diploma	7 (4)	35 (2.3)	2 (8.7)	44 (2.6)
High school diploma	14 (8)	102 (6.8)	1 (4.3)	117 (6.9)
Postsecondary education	155 (88.1)	1349 (90.2)	19 (82.6)	1523 (89.9)
Other education	0 (0)	9 (0.6)	1 (4.3)	10 (0.6)
Employment status				
Employed	120 (69)	1059 (71.5)	12 (52.2)	1191 (70.9)
Unemployed	26 (14.9)	177 (11.9)	3 (13)	206 (12.3)
Retired	23 (13.2)	151 (10.2)	2 (8.7)	176 (10.5)
Student	4 (2.3)	71 (4.8)	5 (21.7)	80 (4.8)
Other	1 (0.6)	24 (1.6)	1 (4.3)	26 (1.5)
Relationship status				
Married/cohabiting/partnered	112 (63.3)	987 (66)	11 (47.8)	1110 (65.5)
Separated/divorced	14 (7.9)	154 (10.3)	1 (4.3)	169 (10)
Widowed	3 (1.7)	37 (2.5)	1 (4.3)	41 (2.4)
Single	46 (26)	303 (20.3)	9 (39.1)	358 (21.1)
Other	2 (1.1)	14 (0.9)	1 (4.3)	17 (1)
Housing status				
Own home	122 (69.7)	1037 (70.1)	12 (52.2)	1171 (69.8)
Living with family	14 (8)	132 (8.9)	4 (17.4)	150 (8.9)
Renting	38 (21.7)	300 (20.3)	5 (21.7)	343 (20.5)
Other	1 (0.6)	10 (0.7)	2 (8.7)	13 (0.8)

Results

Demographic and Clinical Characteristics:

Table 4.3.3.1 displays subscribers' demographic characteristics based on different genders. The data indicated that most respondents were aged between 26 and 60 years (1555/2032, 77.6%); were White (1688/2032, 83.5%); were married, cohabiting, or partnered (1110/2032, 65.5%); reported the completion of postsecondary education (1523/2032, 89.9%); were employed (1191/2032, 70.9%); and owned their own home (1171/2032, 69.8%).

Primary Outcome Measure

Respondents were asked to rate their overall satisfaction with the daily supportive text messaging (Text4Hope) service on a scale of 0-10, in which 0 represented "very dissatisfied," 5 represented "neither satisfied nor dissatisfied," and 10 represented "very satisfied." Respondents' (n=2940) mean overall satisfaction score was 8.55 (SD 1.78), suggesting that overall, respondents' satisfaction with the Text4Hope program was high. The ANOVA analysis, which was conducted using the Welch test (n=1716), demonstrated that females had significantly higher mean satisfaction scores than males (8.65 vs 8.11, respectively; mean difference=0.546; 95% CI 0.19 to 0.91; *P*<.001) and non-significantly lower satisfaction scores than other gender respondents (mean difference=−0.938; 95% CI −0.37 to 2.25; *P*=0.15).

Secondary Outcome Measures

In Table 4.3.3.2, we show subscribers' level of agreement regarding Text4Hope benefits. This table displays the perceived impact of Text4Hope messages after subscribers received daily text messages for 6 weeks.

Table 4.3.3.2. Gender differences in the perceived impact of daily messages at 6 weeks postintervention.

Perceived impact of daily messages from Text4Hope	Male, n (%)	Female, n (%)	Other gender, n (%)	*P*value[a]	Total, n (%)
Helped subscribers cope with stress related to the COVID-19 pandemic					
Agree	144 (75.8)	1177 (77.4)	13 (61.9)	.05	1334 (77.1)
Neutral	33 (17.4)	284 (18.7)	5 (23.8)	N/A[b]	322 (18.6)
Disagree	13 (6.8)	59 (3.9)	3 (14.3)	N/A	75 (4.3)
Helped subscribers cope with anxiety related to the COVID-19 pandemic					
Agree	133 (70.4)	1162 (76.5)	14 (66.7)	.05	1309 (75.8)
Neutral	44 (23.3)	297 (19.6)	4 (19)	N/A	345 (20)
Disagree	12 (6.3)	59 (3.9)	3 (14.3)	N/A	74 (4.3)
Helped subscribers cope with depression related to the COVID-19 pandemic					
Agree	103 (54.5)	856 (56.4)	9 (42.9)	.04	968 (56.1)
Neutral	63 (33.3)	561 (37)	9 (42.9)	N/A	633 (36.7)

Disagree	23 (12.2)	100 (6.6)	3 (14.3)	N/A	126 (7.3)
Helped subscribers cope with loneliness related to the COVID-19 pandemic					
Agree	71 (37.4)	757 (49.9)	9 (42.9)	.01	837 (48.5)
Neutral	85 (44.7)	592 (39.1)	9 (42.9)	N/A	686 (39.7)
Disagree	34 (17.9)	167 (11)	3 (14.3)	N/A	204 (11.8)
Made subscribers feel connected to a support system during the COVID-19 pandemic					
Agree	144 (75.8)	1242 (81.8)	14 (66.7)	.05	1400 (81)
Neutral	33 (17.4)	211 (13.9)	4 (19)	N/A	248 (14.3)
Disagree	13 (6.8)	65 (4.3)	3 (14.3)	N/A	81 (4.7)
Made subscribers feel hopeful about managing issues related to the COVID-19 pandemic					
Agree	134 (70.5)	1133 (74.7)	12 (57.1)	.09	1279 (74)
Neutral	46 (24.2)	324 (21.4)	6 (28.6)	N/A	376 (21.8)
Disagree	10 (5.3)	60 (4)	3 (14.3)	N/A	73 (4.2)
Improved subscribers' overall mental well-being					
Agree	136 (71.6)	1159 (76.2)	13 (61.9)	.06	1308 (75.6)
Neutral	38 (20)	289 (19)	5 (23.8)	N/A	332 (19.2)
Disagree	16 (8.4)	72 (4.7)	3 (14.3)	N/A	91 (5.3)
Enhanced subscribers' quality of life					
Agree	104 (55)	941 (62.5)	12 (60)	.11	1057 (61.7)
Neutral	68 (36)	474 (31.5)	5 (25)	N/A	547 (31.9)
Disagree	17 (9)	90 (6)	3 (15)	N/A	110 (6.4)

[a]Bonferroni-corrected, two-tailed criteria for significance ($\alpha<.002$).
[b]N/A: not applicable.

The results in Table 4.3.3.2 indicate that about three-quarters of respondents agreed that the daily text messages helped them cope with stress (1334/1731, 77.1%) and anxiety (1309/1728, 75.8%) as well as manage COVID-19–related issues (1279/1728, 74%), while about half of the respondents agreed that the messages helped them cope with depression (968/1727, 56.1%) and loneliness (837/1727, 48.5%). About 80% of respondents agreed that they felt connected to a support system due to receiving the daily messages (1400/1729, 81%), a little over 70% of respondents agreed that the daily messages helped to improve their mental well-being (1308/1731, 75.6%), and about 60% of respondents agreed that the daily messages helped to enhance their quality of life (1057/1714, 61.7%). Overall, compared to males and respondents of other gender

identities, a higher proportion of females agreed with all Text4Hope benefits; however, there were no statistically significant gender differences in the levels of agreement expressed for all areas assessed.

Table 4.3.3.3 describes subscribers' opinions about Text4Hope messages after they received 6 weeks of daily text messages. The data indicated that about three-quarters of respondents always found the Text4Hope text messages to be positive (1336/1732, 77.1%), affirmative (1231/1727, 71.3%), and succinct (1254/1722, 72.8%). More than 80% of respondents (1505/1753, 87.4%) indicated that the messages were always or often relevant. Again, compared to males and respondents of other gender identities, a higher proportion of females reported that they found the messages to be always positive, affirmative, succinct, and relevant (P<.001 for each posthoc comparison using z-scores).

Most respondents (1531/1716, 89.2%) indicated that they always read the text messages, and about 20% of respondents indicated that they always or often returned to read the text messages (401/1716, 23.4%). Neither factor indicated gender differences upon analysis. Table 4.3.3.3 data shows that slightly more than 70% respondents (1270/1666, 76.2%) indicated that they read and reflected on the text messages, while about 10% of respondents indicated that they took positive or beneficial actions after reading the text messages (201/1666, 12.1%). Although not statistically significant (P=.003), compared to males and respondents of other gender identities, a higher proportion of females indicated that they read the text messages, reflected on the messages, and took positive or beneficial actions after reading the messages. No subscribers indicated that they read the messages and took a negative action.

Table 4.3.3.3. Gender differences in the feedback about Text4Hope messages at 6 weeks postintervention.

Feedback	Male, n (%)	Female, n (%)	Other gender, n (%)	*P*value[a]	Total, n (%)
Text4Hope text messages were positive					
Always	131 (68.9)	1193 (78.4)	12 (57.1)	<.001	1336 (77.1)
Often	55 (28.9)	291 (19.1)	6 (28.6)	N/A[b]	352 (20.3)
Sometimes	3 (1.6)	35 (2.3)	2 (9.5)	N/A	40 (2.3)

Rarely	1 (0.5)	2 (0.1)	1 (4.8)	N/A	4 (0.2)
Never	0 (0)	0 (0)	0 (0)	N/A	0 (0)
Text4Hope text messages were affirmative					
Always	118 (62.8)	1104 (72.7)	9 (42.9)	<.001	1231 (71.3)
Often	57 (30.3)	347 (22.9)	10 (47.6)	N/A	414 (24)
Sometimes	11 (5.9)	58 (3.8)	1 (4.8)	N/A	70 (4.1)
Rarely	1 (0.5)	8 (0.5)	0 (0)	N/A	9 (0.5)
Never	1 (0.5)	1 (0.1)	1 (4.8)	N/A	3 (0.2)
Text4Hope text messages were succinct					
Always	128 (67.7)	1114 (73.7)	12 (57.1)	.09	1254 (72.8)
Often	49 (25.9)	300 (19.8)	5 (23.8)	N/A	354 (20.6)
Sometimes	12 (6.3)	92 (6.1)	4 (19)	N/A	108 (6.3)
Rarely	0 (0)	6 (0.4)	0 (0)	N/A	6 (0.3)
Never	0 (0)	0 (0)	0 (0)	N/A	0 (0)
Text4Hope text messages were relevant					
Always	95 (50.5)	945 (62.4)	12 (57.1)	<.001	1052 (61.1)
Often	64 (34)	386 (25.5)	3 (14.3)	N/A	453 (26.3)
Sometimes	20 (10.6)	163 (10.8)	3 (14.3)	N/A	186 (10.8)
Rarely	7 (3.7)	19 (1.3)	2 (9.5)	N/A	28 (1.6)
Never	2 (1.1)	1 (0.1)	1 (4.8)	N/A	4 (0.2)
Subscribers' frequency of reading messages					
Always	161 (84.7)	1351 (89.8)	19 (90.5)	.61	1531 (89.2)
Often	23 (12.1)	125 (8.3)	2 (9.5)	N/A	150 (8.7)
Sometimes	5 (2.6)	25 (1.7)	0 (0)	N/A	30 (1.7)
Rarely	1 (0.5)	2 (0.1)	0 (0)	N/A	3 (0.2)
Never	0 (0)	2 (0.1)	0 (0)	N/A	2 (0.1)
Subscribers' frequency of returning to messages					
Always	7 (3.7)	73 (4.9)	0 (0)	.47	80 (4.7)
Often	33 (17.4)	287 (19.1)	1 (4.8)	N/A	321 (18.7)
Sometimes	76 (40)	635 (42.2)	13 (61.9)	N/A	724 (42.2)
Rarely	46 (24.2)	327 (21.7)	4 (19)	N/A	377 (22)
Never	28 (14.7)	183 (12.2)	3 (14.3)	N/A	214 (12.5)
Actions taken by subscribers after reading text messages					

Read text and took a positive or beneficial action	14 (7.7)	186 (12.7)	1 (5)	.003	201 (12.1)
Read text and reflected on the messages	138 (75.4)	1119 (76.5)	13 (65)	N/A	1270 (76.2)
Read the text and took no action	25 (13.7)	138 (9.4)	6 (30)	N/A	169 (10.1)
Read text and took a negative or harmful action	0 (0)	0 (0)	0 (0)	N/A	0 (0)
Did not read the text	2 (1.1)	2 (0.1)	0 (0)	N/A	4 (0.2)
Other	4 (2.2)	18 (1.2)	0 (0)	N/A	22 (1.3)

[a]Bonferroni-corrected, two-tailed criteria for significance ($\alpha<.002$).
[b]N/A: not applicable.

We explored subscribers' anticipated receptivity to welcoming diverse, technology-based services as part of their health care during crisis or emergency situations, such as the COVID-19 pandemic. The results displayed in Table 4.3.3.4 suggest that at least 80% of respondents agreed with receiving web-based counseling (1390/1674, 83%), telephone counseling (1346/1672, 80.5%), and text messages (1465/1669, 87.8%) as part of their health care during any crisis or emergency situation, such as the COVID-19 pandemic. There were no gender differences in respondents' preferences for welcoming web-based counseling, telephone counseling, and text messaging as part of their health care during any crisis or emergency situation. Similarly, about 70% of respondents agreed with receiving consultations via video and telephone for both physical (video: 1190/1674, 71.1%; telephone: 1193/1665, 71.7%) and mental (video: 1244/1674, 74.3%; telephone: 1245/1669, 74.6%) health care during any crisis or emergency situation, such as the COVID-19 pandemic. There were no gender-based differences in expressed preferences. Finally, about 60% of respondents agreed with receiving email messages as part of their health care during a crisis or emergency situation, such as the COVID-19 pandemic (1084/1669, 64.9%). Compared to female and male respondents, a higher proportion of other gender respondents agreed with receiving email messages as part of their health care during a crisis or emergency situation.

Table 4.3.3.4. Anticipated receptivity of subscribers to receiving diverse, technology-based services as part of their health care during crisis or emergency situations, such as the COVID-19 pandemic.

Subscribers' anticipated receptivity to services	Male, n (%)	Female, n (%)	Other gender, n (%)	*P*value[a]	Total, n (%)
Subscribers would welcome web-based counseling for stress, anxiety, and depression					
Agree	152 (80.9)	1220 (83.3)	18 (85.7)	.55	1390 (83)
Neutral	26 (13.8)	198 (13.5)	3 (14.3)	N/A[b]	227 (13.6)
Disagree	10 (5.3)	47 (3.2)	0 (0)	N/A	57 (3.4)
Subscribers would welcome telephone counseling for stress, anxiety, and depression					
Agree	151 (80.3)	1176 (80.4)	19 (90.5)	.80	1346 (80.5)
Neutral	29 (15.4)	229 (15.7)	2 (9.5)	N/A	260 (15.6)
Disagree	8 (4.3)	58 (4)	0 (0)	N/A	66 (3.9)
Subscribers would welcome text messaging for stress, anxiety, and depression					
Agree	159 (84.6)	1288 (88.2)	18 (85.7)	.12	1465 (87.8)
Neutral	19 (10.1)	132 (9)	1 (4.8)	N/A	152 (9.1)
Disagree	10 (5.3)	40 (2.7)	2 (9.5)	N/A	52 (3.1)
Subscribers would welcome email messaging for stress, anxiety, and depression					
Agree	106 (56.7)	962 (65.8)	16 (76.2)	.01	1084 (64.9)
Neutral	45 (24.1)	345 (23.6)	4 (19)	N/A	394 (23.6)
Disagree	36 (19.3)	154 (10.5)	1 (4.8)	N/A	191 (11.4)
Subscribers would welcome mental health video consultations					
Agree	132 (70.2)	1094 (74.7)	18 (85.7)	.29	1244 (74.3)
Neutral	42 (22.3)	284 (19.4)	1 (4.8)	N/A	327 (19.5)
Disagree	14 (7.4)	87 (5.9)	2 (9.5)	N/A	103 (6.2)
Subscribers would welcome physical health video consultations					
Agree	119 (63.3)	1055 (72)	16 (76.2)	.12	1190 (71.1)
Neutral	50 (26.6)	279 (19)	4 (19)	N/A	333 (19.9)
Disagree	19 (10.1)	131 (8.9)	1 (4.8)	N/A	151 (9)
Subscribers would welcome mental health telephone consultations					
Agree	126 (67.4)	1102 (75.4)	17 (81)	.19	1245 (74.6)
Neutral	44 (23.5)	259 (17.7)	3 (14.3)	N/A	306 (18.3)
Disagree	17 (9.1)	100 (6.8)	1 (4.8)	N/A	118 (7.1)
Subscribers would welcome physical health telephone consultations					
Agree	124 (66.3)	1052 (72.2)	17 (81)	.30	1193 (71.7)
Neutral	44 (23.5)	258 (17.7)	3 (14.3)	N/A	305 (18.3)

Disagree	19 (10.2)	147 (10.1)	1 (4.8)	N/A	167 (10)

[a]Bonferroni-corrected, two-tailed criteria for significance (α<.002). 0
[b]N/A: not applicable.

Discussion

This study provided results regarding subscribers' satisfaction with Text4Hope after they received the texting intervention for 6 weeks. Our results revealed considerable satisfaction with Text4Hope. The total number of subscribers who completed the baseline and 6-week surveys was 2032, and a majority of subscribers were female (1788/2032, 88%). The mean age of study participants was 44.58 years. Overall service satisfaction was high, and more than 70% of subscribers agreed that Text4Hope helped them cope with stress (1334/1731, 77.1%) and anxiety (1309/1728, 75.8%), feel connected to a support system (1400/1729, 81%), manage COVID-19–related issues (1279/1728, 74%), and improve mental well-being (1308/1731, 75.6%). Similarly, subscribers agreed that the text messages were positive, affirmative, and succinct. Text messages were always or often read by 97.9% (1681/1716) of respondents, and more than 20% (401/1716, 23.4%) always or often returned to messages. Most subscribers (1471/1666, 88.3%) read the messages and either reflected upon them or took a positive action. Subscribers welcomed almost all technology-based services as part of their health care during crisis or emergency situations. Text4Hope was perceived to be effective by more female subscribers than male or other gender subscribers. The withdrawal rate for Text4Hope was approximately 10% at 6 weeks postintervention. Untailored and unilateral texting services often have high withdrawal rates that range from 0% to 57% [782, 783]. Additionally, prior studies have reported that withdrawal rates may be higher for people who receive interventions via SMS text messages compared to those for people who receive the same intervention via email [782]. In a review of 93 mental health apps that target anxiety, depression, or emotional well-being, the median 15-day and 30-day app retention rates were only 3.9% (IQR 10.3%) and 3.3% (IQR 6.2%), respectively [797]. It is possible that our Text4Hope program achieved a higher retention rate compared to those of other mental health apps because it is unidirectional and requires no additional effort or action on the part of the subscriber following enrollment. It is also possible that the message content, which was crafted by mental health professionals; the high anxiety, stress, and depression levels that the population has experienced due to the COVID-19 pandemic; and the reduced availability of face-to-face services contributed to the high Text4Hope retention rate.

Female respondents comprised the majority of the sample in our study (1788/2032, 88%). In other texting-based services, females were also highly represented (>80% of participants) [94]. There were obvious gender differences in subscriber satisfaction rates for Text4Hope. Another study, in which 240 university students received a fully automated, multiple-session alcohol intervention, reported that the majority of students were satisfied with the content and length of the texts; no gender-based differences in responses were reported [782].

Subscribers' overall satisfaction with our provided service (8.55) was high. This is in line with the 95% satisfaction rate of the Text4Mood program reported by Agyapong et al [94]. Similar findings were reported in a review of text message use among a population with mental health concerns [791]. Bendsten and Bendsten [782] previously reported on participant satisfaction (range 57.9%-84.6%) in relation to the frequency, content, and length of messages. Our study results indicated that females were generally more satisfied with the overall program than males. Generally, the relationship between user satisfaction with health services and self-reported gender seems inconclusive. In a systematic review of 39 studies, the majority of the studies (66.7%) showed that there was no significant relationship between the two factors, and the rest were nearly equally divided in terms of favoring either males or females [810]. Self-reported levels of the ability to cope with psychiatric burdens was mostly lower in Text4Hope respondents than in respondents from the Text4Mood study by Agyapong et al [94]. This was true for respondents with depression (56.1% vs 76.7%) and those who experienced loneliness (48.5% vs 57%). However, our results on participants' ability to cope with stress symptoms were consistent with those of Agyapong et al [94] (77.1% vs 77.2%). These differences could be attributed to the unprecedented COVID-19 pandemic, associated distress, and the strict pandemic-related restrictions (eg, self-isolation and quarantine). These restrictions may be perceived as limitations of personal freedom and activity and may contribute to feelings of loneliness. Similarly, while the perceived improvement in quality-of-life scores was positive for more than half of our respondents (1057/1714, 61.7%), it was about 14% lower than that of the Agyapong et al study [94]. This may reflect the potentially high negative and multifocal impacts of the COVID-19 pandemic on people's perceived quality of life. In addition, females reported high satisfaction with the Text4Hope program's ability to help them cope with loneliness and depression. This may be in line with the view that depressive symptoms are more frequently experienced by females [811] than males and the fact that people are usually more willing to participate in research that is related to a condition or disease that they

have experienced [812]. Text4Hope therefore seems to be a useful support service that helps to ameliorate distressing symptoms in this differentially affected group.

More than 70% of the people in our study reported that the Text4Hope messages were always positive (1336/1732, 77.1%), affirmative (1231/1727, 71.3%), and succinct (1254/1722, 72.8%). About 60% of respondents reported that the messages were always relevant (1052/1753, 61.1%). These results typically came from females, who are usually satisfied with texting services and actively interact with such text messages [390]. Our satisfaction rates were higher than the rates reported by Agyapong et al [94], which ranged from 45.1% to 60%. Similarly, the feeling of being connected to the health care system received higher positive response rates than those in the Agyapong et al study [94] (81% vs 75.2%, respectively). This result may reflect Alberta residents' true need to connect with a health care system during the absence of the regular, conventional care that was provided before the COVID-19 pandemic, given that all of our subscribers were actively seeking help through the texting program.

The number of Text4Hope respondents who reported that they always or often read the text messages was similar to that of the 2016 Agyapong et al study [94] and higher than that of the 2013 Agyapong et al study [299] (84%). Additionally, more than half our subscribers (1125/1716, 65.6%) reported that they always, often, or sometimes returned to the text messages. This is fairly comparable to the Agyapong et al study [94], wherein 33% of respondents reported that they returned to text messages more than once, with no gender differences observed. This is also consistent with the Bendsten & Bendsten study, which reported no differences based on gender in students' satisfaction with a texting service for alcohol use disorder [14]. Consistent with the observations in the study by Agyapong et al [94], the majority of our respondents (1471/1666, 88.3%) reported that they reflected on text messages or took positive actions after reading the text messages, and we believe this could be attributed to the reported positive impact of the program on respondents.

With regard to subscribers' anticipated agreement with the provision of diverse, technology-based medical services, our respondents generally praised the use of these services during the COVID-19 pandemic and other similar crises. Compared to the other proposed technology-based medical services, our results showed that text messaging was the most highly accepted intervention, with an overall agreement rate of 87.8% (1465/1669). This could be explained by the simple nature of

such programs, which is important to the end users who usually own cell phones, and by the short and easy-to-read nature of the daily text messages.

Our study reported slightly lower levels of acceptance for video consultation services for both mental and physical health compared to those for web-based counseling services. This may be attributed to the lack of required physical interaction in video consultation services, as the one-way nature of web-based counseling services is usually more accepted and welcomed by users [813]. However, when therapeutic interaction is required, users may prefer face-to-face services, especially in times of global crises, due to privacy concerns related to therapy in the context of web communication [814]. Additionally, the physical presence of a therapist could play a therapeutic role and promote more interaction, subsequently improving resilience and overall psychological outcomes, especially on a long-term basis [299].

This study has several limitations. For instance, there was a low response rate (9.1%) among the 6-week subscribers, which may have been due to the incentive-free and optional nature of the survey. Thus, the reported levels of satisfaction may have been skewed if there was a systematic difference in the measured features between responders and non-responders.

Notwithstanding the low response rate, our sample size exceeded the 1775 respondents needed to estimate satisfaction rates for the entire subscriber population with a 3% margin of error and 99% confidence. Consequently, our study was sufficiently powered to provide satisfaction rate estimates for the entire population of Text4Hope subscribers. Furthermore, Text4Hope has achieved a higher retention rate than those of other mental health apps that target anxiety, depression, or emotional well-being [797, 801]. This high retention rate potentially reflects Text4Hope user satisfaction, which may not be captured through surveys for which completion may be considered time-consuming by some subscribers.

It is also possible that we achieved high satisfaction because people who like technology may have been drawn to the Text4Hope program. Additionally, there is potential for social desirability bias, which may have resulted in respondents reporting higher satisfaction and better perceived benefits from receiving text messages. However, this is unlikely due to the anonymous nature of the survey.

There are several other possible limitations. It is possible that our finding that texting was the most accepted mode of delivery for technology-based health services was biased, as those who liked text messaging were likely to sign up for Text4Hope and therefore participate in the survey. It would have been ideal to include a control group for the comparison of Text4Hope subscribers'

and nonsubscribers' anticipated receptivity to technology based medical services. Additionally, although there was a statistically significant gender difference in overall satisfaction between males and females ($P<.001$), the magnitude of the difference was very small and unlikely to be practically meaningful, especially given the imbalance of gender identity subsample sizes. Similarly, our study population was skewed toward females, which is not representative of the population in Alberta or Canada. Finally, respondents' feedback regarding their ability to cope with psychiatric conditions was self-assessed and was not corroborated by clinical assessments.

In conclusion, our results indicate that texting-based programs are acceptable to end users, as high overall satisfaction was reported by subscribers of all gender identities. However, female subscribers reported significantly higher satisfaction scores than male subscribers. Our respondents affirmed the high quality of the text messages by consistently reading and rereading the text messages and providing positive feedback regarding the messages' supportive nature. Text-based mental health support services can be easily deployed during pandemics to support at-risk populations and alleviate the negative mental health impacts that have been well-documented during uncertain times. Based on Text4Hope subscriber feedback, messages from text-based support interventions that have a 160-character limit, are written by health professionals, and are delivered daily can result in high levels of acceptance and satisfaction upon implementation.

4.3.4 Text4Hope: Receiving Daily Supportive Text Messages for 3 Months During the COVID-19 Pandemic Reduces Stress, Anxiety, and Depression

Agyapong, V. I. O., Hrabok, M., **Shalaby, R.,** Vuong, W., Noble, J. M., Gusnowski, A., . . . Greenshaw, A. J. (2021). Text4Hope: Receiving Daily Supportive Text Messages for 3 Months During the COVID-19 Pandemic Reduces Stress, Anxiety, and Depression. Disaster Med Public Health Prep, 1-5. doi:10.1017/dmp.2021.27.
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Abstract

Background: This study reports on the changes in stress, anxiety, and depressive symptoms of subscribers after 3 months using Text4Hope, a supportive text messaging program designed to provide support during the pandemic.

Methods: Standardized self-report measures were used to evaluate perceived stress (measured with the Perceived Stress Scale-10 [PSS-10]), anxiety (measured with the General Anxiety Disorder Scale 7 [GAD-7]), and depressive symptoms (measured with the Patient Health Questionnaire [PHQ-9]), at baseline and 3rd month (n = 373).

Results: After 3 months of using Text4Hope, subscribers' self-reports revealed significant ($p<$ 0.001) mean score reductions compared with baseline on: the GAD-7 by 22.7%, PHQ-9 by 10.3%, and PSS-10 scores by 5.7%. Reductions in inferred prevalence rates for moderate to high symptoms were also observed, with anxiety demonstrating the largest reduction (15.7%).

Conclusions: Observed Text4Hope-related reductions in psychological distress during COVID-19 indicate that Text4Hope is an effective, convenient, and accessible means of implementing a population-level psychological intervention.

Introduction

Coronavirus disease 2019 (COVID-19), an acute respiratory disease, was first reported in December 2019 in Wuhan, China. The virus has spread internationally and, through late 2020, continues to have unprecedented impact on our health and ways of life. The closing of schools and businesses, extremely high unemployment rates, and the effect of quarantine are additional stressors due to public health measures in place to limit spread of COVID-19. There are significant psychological effects of the pandemic [278, 468] that affect the general population and may be more pronounced in certain groups (e.g. female, socially stressed, frontline worker, pre-existing psychological disorder; see Lai et al [281]). Provision of support for these challenges are complicated by the high number of people requiring support and the need to maintain physical distancing.

Mobile health technology offers a unique and innovative solution in this context. Specifically, this tool offers a convenient, cost-effective, and accessible means for implementing population-level interventions. Smartphone ownership is prevalent in Canada, text-messaging is free to end-users, does not require technical skill for use, and does not require expensive data plans. Text messages are also cost-effective to providers, costing cents per message to deliver [94]. Use of supportive text messages has shown positive outcomes in randomized controlled trials, including reduction of depressive symptoms [217], increased abstinence duration in alcohol use disorder [217], and high user satisfaction evinced by previous research [299].

This study describes effects of implementation of the Text4Hope program [406], a low-cost, evidence-based, supportive text messaging service free to all Canadians who wish to subscribe during the early phase of the COVID-19 pandemic. Baseline data collected at the start of messaging indicated that the majority of subscribers endorsed elevated levels of stress and depressive and anxiety symptoms [36]. The primary aim of the study was to assess whether the Text4Hope program would reduce stress, anxiety, and depressive symptoms at the third-month follow-up. A randomized controlled trial of daily supportive text messaging resulted in close to a 25% additional improvement in Becks Depression Inventory scale-measured mood at the third-month follow-up assessment in the intervention group compared with the control group [217]. Based on this, the study hypothesis was that the Text4Hope intervention would result in ≥25% reduction in mean scores and prevalence rates in all 3 factors: the Perceived Stress Scale-

10 (PSS-10), General Anxiety Disorder Scale 7 (GAD-7), and Patient Health Questionnaire (PHQ-9) scales at 3rd month versus baseline. This study is part of a larger project [809], with additional results forthcoming. A literature search on major scientific data bases, including MEDLINE, Scopus, Embase, Web of Science, Google Scholar, Chemical Abstracts, and PsychINFO, suggests that this is the first study to report 3rd-month outcomes for a supportive text message program which seeks to address stress, anxiety, and depression at the population level during a pandemic.

Methods

Complete methods details, including sample size estimations and citations for standardized scales are provided in the published protocol [253, 809]. In summary, this cross-sectional study was approved by the Research and Ethics Board of the University of Alberta (Pro00086163). Participation was voluntary; individuals self-subscribed to receive daily supportive text messages for 3rd month by texting the word "COVID19HOPE" once to a specified number. This program was launched through an announcement by Alberta's Chief Medical Officer of Health on behalf of Alberta Health Services and the Government of Alberta on March 23, 2020. The announcement was widely broadcast across many electronic and print media networks in Alberta to inform Albertans about the program [790]. Albertans were further made aware of the program by means of websites dedicated to the service (https://www.albertahealthservices.ca/topics/Page17019.aspx and https://mentalhealthfoundation.ca/text4hope/), electronic media, social media feeds, posters at addiction and mental health clinics, emergency departments and wards, and through word of mouth. The messages were aligned with a cognitive behavioral framework, with content written by mental health professionals and co-authors (V.I.O.A. who is a psychiatrist and M.H. who is a Clinical Psychologist). Most of the messages were adopted or modified from messages used in 2 randomized controlled trials in Alberta [216, 369], and also the Text4Mood program, which reported positive effects on the mental wellbeing of Albertans and achieved high satisfaction rates [94]. The messages were delivered to subscriber cell phones daily at 9 am Mountain Time. Each subscriber received the Text4Hope daily messages for 3 months, with the option to subscribe for an extended 6-mo Text4Mood program on completion of the Text4Hope program. Examples of the Text4Hope text messages include:

- Put yourself on a media diet. It is important to stay informed, but only check the news and social media intermittently, rather than continuously.
- Take a moment to notice how you feel right now. Do not judge your emotions or try to change them. Just observe them and see your stress levels reduce.
- Make yourself a "coping kit." Include healthy things that help you feel better like music, inspirational messages, or a friend's number.

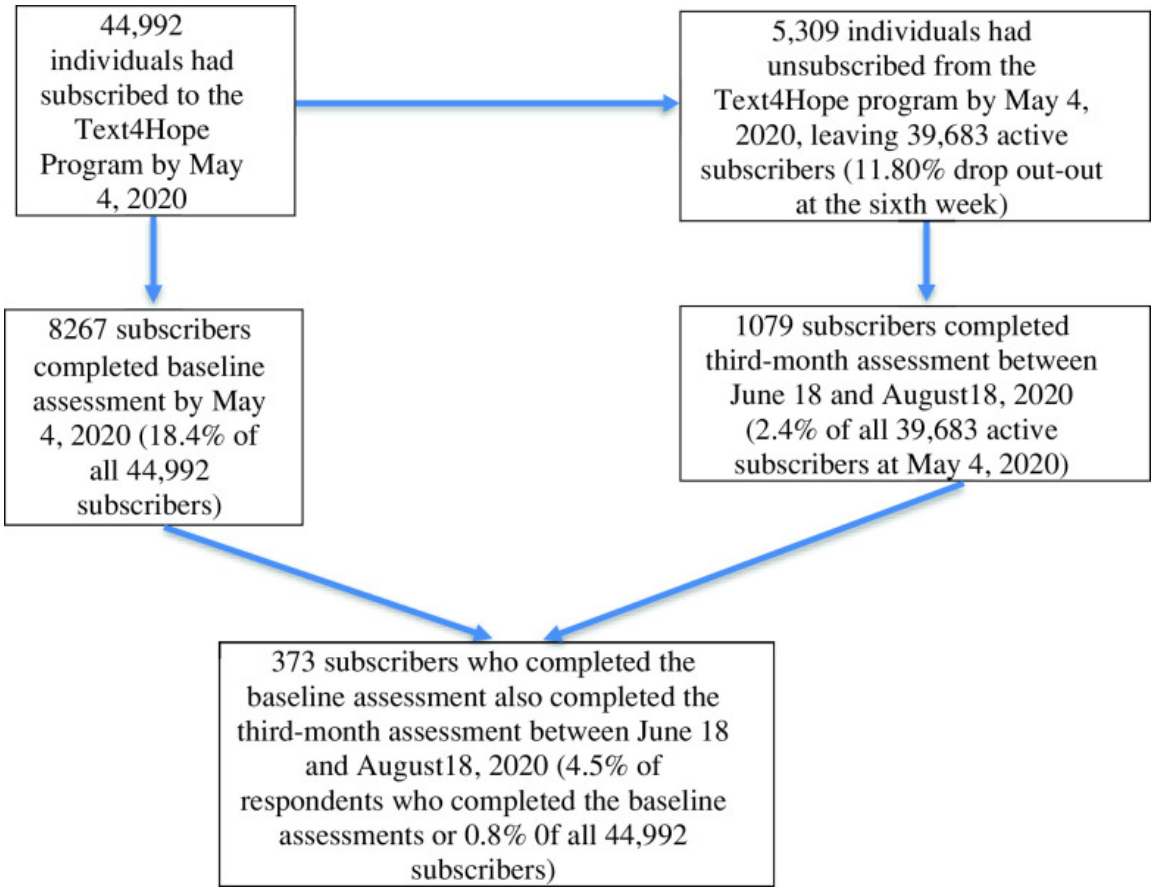
Subscribers were sent a link to the online survey by means of the first text messages they received the same day after subscribing to the program and invited to complete a baseline survey that assessed their mental wellbeing using validated scales for stress, anxiety, and depression. Follow-up surveys were sent by means of text messages to all subscribers' 6th week and 3rd month after they started receiving daily supportive text messages. Consent was implied if subscribers accessed, completed, and submitted their responses to the online survey. No personally identifiable information apart from subscriber phone numbers was collected, and phone numbers were only used to link the baseline data with the 6th week and 3rd month data for individual subscribers to facilitate measurement of change in the psychometric scales. Data were collected using the Survey Select tool, and extracted data were stored without the identifying phone numbers on a password protected computer. Primary outcome measures at 3rd month were the mean difference in scores on the PSS-10 [302], GAD-7 scale [301], and the PHQ-9, respectively [303].

With a prediction that daily supportive text messages would result in a 25% reduction in mean PSS-10, GAD-7, and PHQ-9 scores at 3rd month from baseline, a population variance of 5.0 for each scale mean score, a 1-sided significance level $\alpha = 0.05$, and an acceptable difference between sample mean and population mean score for each scale of zero (μ-$\mu 0 = 0$), the estimate was that a sample size of 686 would be sufficient to detect mean differences between the baseline and 3rd month PSS-10, GAD-7, and PHQ-9 scores with a power of 80% ($\beta = 0.2$). Data analysis was undertaken using IBM Statistical Package for Social Sciences (SPSS) Statistics for Windows, version 26. Paired t-tests were used to assess differences between the mean PSS-10, GAD-7, and PHQ-9 scale scores at baseline and 3rd month for subscribers who completed the instruments at both time points. In addition, Chi-Square test was used to compare prevalence rates for perceived stress, likely GAD, and likely MDD at baseline and 3rd month. Moderate or high perceived stress, likely GAD, and likely MDD were assessed using cut-off scores of PSS-10 $\geq$ 14, GAD-7 $\geq$ 10,

and PHQ-9 ≥ 10, respectively [809]. There was no imputation for missing data and totals reported represent total responses recorded for each variable.

Figure 4.3.4.1 is the study flow chart for individuals who subscribed to Text4Hope between March 24, 2020, and May 4, 2020.

Figure 4.3.4.1: Subscriber flowchart.



Results

The majority of the 1079 subscribers who responded to the 3rd month surveys were female (*n* = 953; 89.1%), 26 to 60 years of age (*n* = 824; 78.3%), Caucasian (*n* = 883; 83.4%), homeowners

(*n* = 638; 71.8%), had postsecondary education (*n* = 825; 92.1%), and were employed (*n* = 631; 70.3%).

Table 4.3.4.1 presents changes in primary outcome measures after 3rd month compared with baseline. The data indicate that mean scores on each of the PSS-10, PHQ-9, and GAD-7 scales were significantly lower at 3rd month compared with mean scores at baseline, suggesting improvement in stress, depression, and anxiety symptoms. The largest reduction in mean scores at 3rd month compared with baseline scores was on GAD-7 (-22.7%) followed by PHQ-9 (-10.3%) and then PSS-10 (-5.7%). The data of Table 4.3.4.1 indicate statistically significant reductions in the inferred prevalence rates for moderate/high stress, depressive symptoms, and anxiety symptoms comparing baseline and 3rd month assessments. Anxiety was associated with the largest inferred prevalence rate reduction (15.7%).

Table 4.3.4.1: Comparison of the baseline and third month mean scores on the PSS-10, PHQ-9, and GAD-7 and the prevalence rates of moderate or high stress, likely MDD, and likely GAD*[+]

Measure	***N***	**Baseline Scores**	**Third-month Scores**	**Mean Difference (SD)**	**95% Confidence Interval**	**df**	**t-value**	***P*–value**
		Mean (SD)	**Mean (SD)**					
PSS-10	335	20.21(7.23)	19.07(7.74)	1.149 (6.317) −5.7% from baseline	0.47-1.83	334	3.33	<0.001
PHQ-9	302	9.32(6.23)	8.36 (6.62)	0.96 (5.28) −10.3% from baseline	0.36-1.56	301	3.16	0.002
GAD-7	292	9.07(6.02)	7.01(5.84)	2.06 (4.92) −22.7% from baseline	1.49-2.62	292	7.16	<0.001

Variables	Baseline Moderate or High Stress prevalence	Third-Month Moderate or High Stress prevalence	Baseline Likely MDD prevalence	Third-Month Likely MDD prevalence	Baseline Likely GAD prevalence	Third-Month Likely GAD prevalence
***N* (%)**	272 (81.2%)	249 (74.3%)	132 (43.7%)	102 (33.8%)	119 (40.6%)	73 (24.9%)
% Change in prevalence rates from baseline	−6.9%		−9.9%		−15.7%	
Chi squared	73.73		55.67		65.17	
P-value	<0.001		<0.001		<0.001	

[+]Moderate or high perceived stress, likely GAD, and likely MDD were assessed using cutoff scores of PSS-10 ≥ 14, PHQ-9 ≥ 10, and GAD-7 ≥ 10, respectively.

Discussion

The impact of COVID-19 on health, way of life, and psychological safety and wellbeing is difficult to overstate. The threat posed by the pandemic to psychological well-being requires use of innovative techniques that can serve the high number of people requiring support while respecting the need to maintain physical distancing. Text4Hope was designed to provide mental health support on a Provincial (Canada) scale during the COVID-19 pandemic. This study examines changes in stress, depression, and anxiety symptoms after 3rd month of receiving Text4Hope messages from this low-cost, evidence-based, scalable, supportive messaging service that was delivered at no direct cost to end users. Although self-reported levels of stress, anxiety, and depressive symptoms remained high overall following the study period, both the mean scores for stress, anxiety and depression on standardized scales and the prevalence rates for clinically meaningful stress, anxiety, and depression showed statistically significant reductions (6% to over 20%; $P < 0.01$). The significant reductions in depression symptoms in particular are consistent

with results reported in previous randomized controlled trials of supportive text message interventions for the treatment of major depressive disorder [217, 369]. Significant reductions in anxiety with supportive text messaging were also reported in other randomized controlled clinical trials [815]. This study did not, however, achieve the >25% reduction in stress, depression, or anxiety mean scores at the third month as stated in the study hypothesis. It is possible that levels of stress, anxiety, and depression remain high due to overall media coverage of surges in COVID infections. It is also possible that levels of stress, anxiety, and depression will improve further if subscribers continue to receive supportive text messages for a few more months. This is why subscribers completing the 3rd month intervention are offered information on how to subscribe for 6 additional months of supportive text messages through the Text4Mood program. As of December 20, 2020, over 5000 individuals who had completed the 3rd month Text4Hope program had enrolled on the 6th month Text4Mood program to receive additional support. Evaluation of this extended text support is underway to assess possible incremental benefits to subscribers who opt to join this program.

Limitations of the present study include the very low response rate (4.5% of subscribers who completed baseline assessments and 0.8% of all subscribers), the relatively small sample size and missing data, which could lead to sampling error. It is possible that subscribers who did not participate in the surveys and those who provided incomplete responses might have different 3rd month outcomes compared with those who fully completed both surveys. Furthermore, it is possible that the demographic and baseline clinical characteristics of those who completed the assessments at both time points could be different from those of the large number of Text4Hope subscribers who completed the baseline assessments (n = 8267). However, a related study [36] published by this research group, which examined the baseline demographic and clinical characteristics of the larger sample of subscribers who completed the baseline assessments (n = 8267), had similarities with the baseline characteristics of participants who were studied as part of this 3rd month evaluation of Text4Hope (n = 1079). For example, in terms of demographic characteristics, there were 87.1% versus 89.1% female gender, 77.1% versus 78.3% aged 26-60 y, 82.3% versus 83.4% Caucasians, 85.2% versus 92.1% postsecondary education and 73.4% versus 70.3% employed for all subscribers who completed baseline assessments (n = 8267)8 and subscribers who completed the third-month assessments (n = 1079), respectively. In terms of clinical characteristics at baseline, the mean PSS score was 20.79 (standard deviation [SD] = 6.83;

n = 7589) vs. 20.21 (SD = 7.23; n = 335), mean PHQ-9 scores was 9.68 (SD = 5.87; n = 7082) vs. 9.32 (SD = 6.23; n = 302), and the mean GAD score was 9.43 (SD = 6.29; n = 6944) vs. 9.07(6.02; n = 292) for all subscribers who completed baseline assessments and subscribers who completed both the baseline and third-month assessments, respectively [36].

Another limitation is the lack of a control group who did not receive the Text4Hope intervention. It is possible, that stress, anxiety, and depression levels would have naturally decreased over time without the intervention. This is plausible as the reported daily mean new COVID-19 infections in Alberta, calculated using an SPSS program from the officially reported daily new infections, had reduced marginally from 104 (SD = 77) during the baseline data collection time period to 78 (SD = 33) during the 3rd month data collection period [816]. It should be noted that a natural history of improvement is unlikely, however, as the majority of Canadians recently surveyed reported that their mental health is the same or has worsened since the initial COVID-19 wave [817].

Finally, the study used self-reported questionnaires for assessing symptomatology and, therefore, lacked comprehensive assessment to evaluate whether or not symptomatology reported met criteria for clinically significant mental health conditions. The study sample also evidenced multiple protective factors, including high levels of education and employment, and the sample was predominantly female. Therefore, it is unclear how findings from this study may generalize to other demographic groups.

Conclusions

Limitations notwithstanding, the results from this study support the proposal that public health interventions during pandemics may benefit from mental health wellness campaigns aimed at reducing psychological impacts. This study may serve to provide evidence-based support for such policy implementation in high-, middle-, and low-income countries. The research team, therefore, plans to explore national scale-up and implementation of the Text4Hope program in multiple languages to benefit all Canadians. The team will also disseminate this program for adaptation and potential global use through the E-Text4PositiveMentalHealth platform, currently under development, and formation of partnerships with national and regional health authorities and institutions.

4.3.5 Text Message Support for Mental Health Outreach during COVID-19 Pandemic: Text4Hope One Year Data Outcomes

This work is in preparation for submission to a peer-reviewed journal

Introduction

Coronavirus disease 2019 (COVID-19) continues to have implications on mental health [278, 468]. The high number of people requiring support, the need to maintain physical distancing, and limited resources have affected access to mental health services [278, 818]. Text4Hope was implemented to provide additional mental health support during the COVID-19 pandemic. It is a mobile-based, convenient, cost-effective, and accessible means of disseminating cognitive-behavioral based interventions via text messaging [586]. This study presents Text4Hope longitudinal data of self-reported changes in stress, anxiety, and depression, and user satisfaction one year after the service began (March 2020 - March 2021).

Methods

Individuals self-subscribed to Text4Hope to receive a daily supportive text message for three months [586]. Standardized questionnaires were used at the beginning and end of the program (via survey links) to screen for stress, likely major depressive disorder (MDD), and likely generalized anxiety disorder (GAD), using the Perceived Stress Scale-10 (PSS-10, cutoff score of ≥ 14), Patient Health Questionnaire-9 (PHQ-9, cutoff score of ≥ 10), and Generalized Anxiety Disorder-7 (GAD-7, cutoff score of ≥ 10), respectively [586]. The Research and Ethics Board of the University of Alberta (Pro00086163) approved the study.

Data size:

Baseline responses

9737 responses were provided at baseline. We removed 158 lines of data: 2 were invalid (person's response was clearly not taking the questions seriously). One hundred were resubscribed (i.e., they re-joined Text4Support after they completed the program). 56 were duplicate entries (i.e., they completed the survey more than once within the first 2 weeks of joining).

There were 9579 valid lines of data (i.e., at least one demographic and one outcome question were answered). 365 lines were invalid numbers. 365/9579 = 3.8% of the data removed/excluded. We ended by **9214** lines eligible for **baseline** data analysis

6-Week responses

There were 4206 valid lines of data. 96 lines were invalid numbers (96/4206; 2.3%) of the data removed/excluded. We ended by **4110** lines eligible for **six-week** data analysis

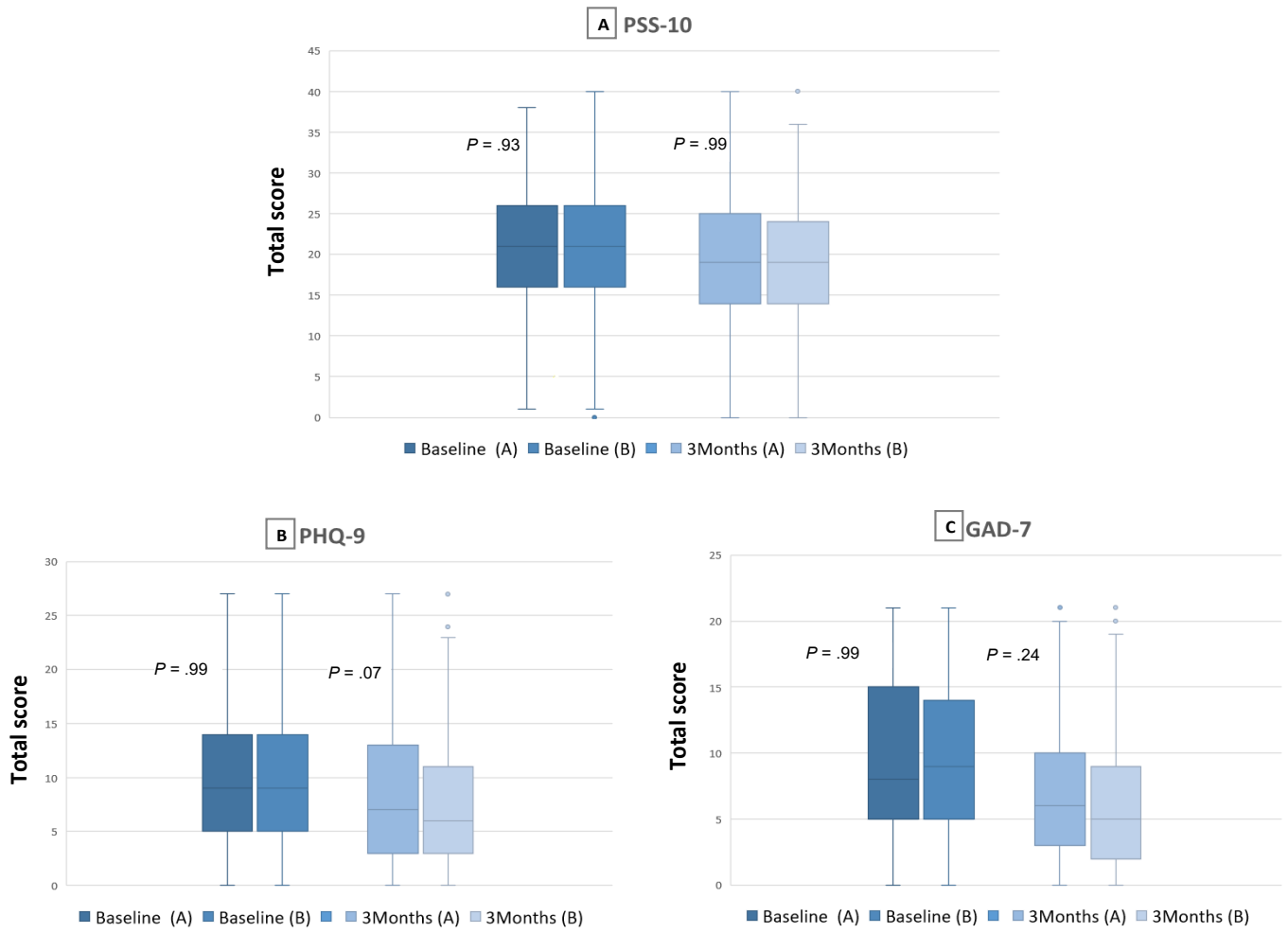
12-Week responses

There were 1306 valid lines of data. 20 lines were invalid numbers (20/1306; 1.5%) of the data removed/excluded. We ended by **1286** lines eligible for **three-month** data analysis

Data analysis:

Data analysis was completed using SPSS version 25. An independent t-test was used to compare differences in PSS-10, PHQ-9, and GAD-7 mean scores between subscribers completing baseline only (N=8778) and subscribers completing three-month surveys only (N=850) (N= 9628; Population (A). Welch's t-test was applied when equal variances were not assumed. To avoid potential overlap, participants who responded to both surveys (Population (B), N= 436) were analyzed separately using a paired t-test. Comparison between the two study populations (A & B) showed no statistically significant difference **(**Figure 4.3.5.1).

Figure 4.3.5.1: A Comparison Between the Two Study Populations (A) and (B)



A. PSS-10: Perceived Stress Scale-10; **B.** PHQ-9: Patient Health Questionnaire-9; **C.** GAD-7: Generalized Anxiety Disorder-7

Participants who responded to the baseline or three-month surveys, were referred to as population (A) and participants who responded to both surveys were referred to as Population (B). Median, IQR, Minimum, and Maximum score values were reported. The two populations did not show significant difference on the three measurement scales, either at baseline or three-month surveys (*P*= Bonferroni adjusted p value).

Chi-squared analysis was used to compare the baseline to the three-month prevalence of the outcome measures. Subscribers' experience with Text4Hope was examined using frequencies and proportions. No imputation of missing data was applied, and Bonferroni correction p values were reported.

Results

In terms of sociodemographic characteristics among the 10064 participants who provided complete responses at baseline and three-month surveys, the majority identified as females (86.8%); between 41 and 60 years (42.5%); White (82.0%); with post-secondary education (85.3%); employed (67.5%); married, cohabiting or partnered (70.5%); and owned homes (65.7%).

Overall, a significant reduction from baseline to three-month was reported on all mean scores for both study groups (Table 4.3.5.1A and 4.3.5.1B). In population A, the effect size was small (stress, likely MDD) to medium (likely GAD) (Hedge's g = 0.3 and 0.6, respectively), and small in population B. Similarly, the prevalence showed significant reductions on all measurement scales. (Table 4.3.5.1C).

Table 4.3.5.1: Mean Scores and Prevalence Changes Reported in the Three Clinical Conditions, Moderate-to-High Stress, Likely Major Depressive Disorder (MDD), and Likely Generalized Anxiety Disorder (GAD), from Baseline to Three-Months

A. Comparison of the mean scores on the PSS-10, PHQ-9, and GAD-7 between subscribers who completed the baseline survey only (N=8778) and subscribers who completed three-month survey only (N=850) (Population A)

	Baseline		**Three-month**						
Measure	**n**	**m (SD)**	**n**	**m (SD)**	**Mean Difference (95% CI)**	**Change from Baseline, %**	***t* value**	***P* value[b]**	**Effect size (Hedge's g)**
PSS-10	8180	21.15 (6.93)	759	18.98 (7.20)	-2.17 (1.66-2.69)	10.3	8.24	<.001	0.3
PHQ-9	7645	9.75 (6.41)	696	7.65 (6.16)	-2.11 (1.63-2.59)	21.6	8.60[a]	<.001	0.3

GAD-7	7485	9.78 (5.89)	683	6.55 (5.51)	-3.22 (2.79-3.66)	32.9	14.54[a]	<.001	0.6

B. Paired t-test results for subscribers who responded to both baseline and three-month surveys (N=436) (Population B)

		Baseline	**Three-month**					
Measure	**n**	**m (SD)**	**m (SD)**	**Mean Difference (95% CI)**	**Change from Baseline, %**	***t* value**	***P* value[b]**	**Effect size (Cohen's d)**
PSS-10	394	20.71 (7.35)	19.39 (7.73)	-1.32 (.70-1.94)	6.4	4.18	<.001	0.2
PHQ-9	360	9.71 (6.43)	8.53 (6.65)	-1.18 (.64-1.73)	12.15	4.24	<.001	0.2
GAD-7	350	9.30 (6.02)	7.19 (5.74)	-2.11 (1.60-2.62)	22.7	8.17	<.001	0.4

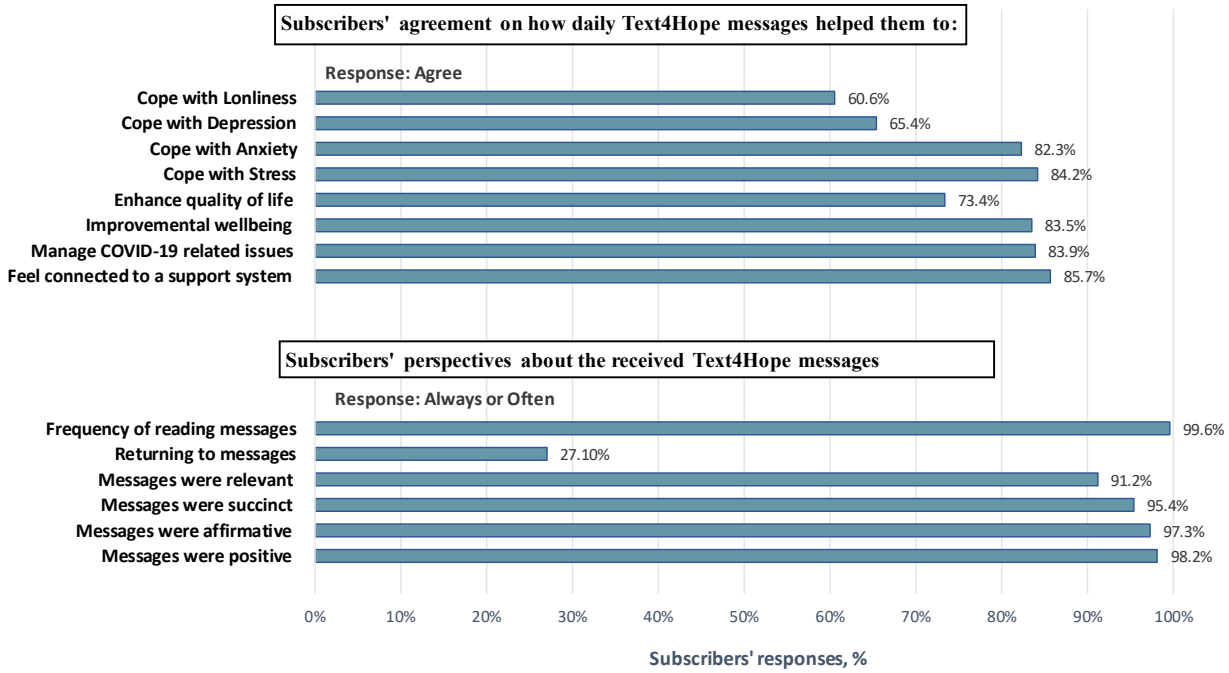
C. Prevalence of moderate to high stress, likely GAD, and likely MDD (Population A)

Clinical Condition	**Prevalence n/N (%)**		**Change from Baseline (%)**	**$\chi 2$ (df)**	***p* value***
	Baseline	**Three-month**			
Moderate to High Stress	7076/8180 (86.5)	575/759 (75.8)	-10.7 (12.37)	65.04 (1)	<.001
Likely MDD	3496/7645 (45.7)	213/696 (30.6)	-15.1 (33.04)	59.1 (1)	<.001
Likely GAD	3567/7485 (47.7)	179/683 (26.2)	-21.5 (45.07)	115.96 (1)	<.001

N: total sample; n: sample; M: mean; SD: standard deviation, CI: confidence interval
[a] indicates Welch's t-test was used
[b] Bonferroni corrected p value

By the exit of the service, 89.4% subscribers reported their satisfaction with Text4Hope, and 60.6-85.7% agreed that the service helped them in diverse ways (Figure 4.3.5.2). Messages were read and well perceived by more than 90% of the subscribers.

Figure 4.3.5.2: Subscribers' Experience and Feedback about Text4Hope



Discussion

This study summarized Text4Hope outcomes after one year. There was a significant improvement in all outcome measures after three months of using the service. Aligned with the early results of Text4Hope [253], the improvement was more prominent for likely GAD that resulted in a 45% reduction in the prevalence of anxiety. Additionally, subscribers reported high service satisfaction, and shared that Text4Hope helped them to cope with stress and anxiety, and, to a lesser extent with depression and loneliness. Future studies need to examine the discrepancy between perceived benefits and the changes in depression rating scores among subscribers.

Most subscribers reported enhanced quality of life and felt Text4Hope helped them to manage COVID-19 related issues and feel connected to a support system. This shows the value of remote health services in supporting the sense of security and connectedness in disaster times [819].

Limitations of this study include a potential lack of generalizability, given the sociodemographic characteristics of our study population. It is unclear how this program would fare in a more diverse

sociodemographic group. In addition, the study lacks a control group to compare results, therefore, we may not be able to attribute the observed improvements fully to only the intervention.

Chapter 5: Conclusions, implications for practice and policy and future directives

Principal findings and study limitations:

The two studies overall presented in this thesis illustrated possible interventions to close the treatment gap emerged after hospital discharge from acute psychiatric care and during the COVID-19 pandemic. Two different modalities were provided: Supportive text service represented in Text4Support and Text4Hope services and peer support services.

Through the pilot study, we provided a comprehensive evaluation of outcomes of peer support and the daily supportive text messages in comparison to usual care through a controlled observational study. A total of 181 patients were enrolled into four study arms and followed up for six-months post-discharge, using continuous comparative assessment. Overall, positive outcomes were reported primarily for the treatment group who received the combined service of PSW and TxM, in terms of the overall recovery, quality of life and overall outcome measure parameters, including the risk of suicide. The study participants reported marked satisfaction with Text4Support service and provided constructive feedback including future recommendations that could improve participants' engagement and receptivity, thus would be helpful to consider in future service designing.

During the pandemic, Text4Hope service could effectively trace the prevalence of mental health conditions among Albertans and record possible changes over time. It was reported that mental health burden was generally high during the COVID-19 pandemic, including anxiety, stress, depression, disordered sleep symptoms, and suicidal thoughts.

Different sociodemographic groups expressed higher vulnerability to develop different mental health conditions during the pandemic, including people of young age, indigenous population, unemployment, single, and with lower education levels, compared to their comparative groups while controlling for the rest of the factors. Significant improvements in prevalence and mean scores were recorded after introducing Text4Hope in terms of self-reported clinical measures, including the likely GAD, MDD, PTSD, suicide thoughts, and stress symptoms. The outcome was significantly positive in the short- and long-term of service provision, and was evident after one year of the service, particularly for the symptoms of GAD. Furthermore, the service gained a high level of satisfaction, as reported by the participants, entailing high commitment to read the daily

messages along with a perceived better sense of control and mood improvement during difficult times of the pandemic.

Study limitations:

As illustrated in the previous sections/subsections, our studies demonstrated several limitations. To summarize, in respect to the pilot study, the small sample size, the small proportion of participants who completed the surveys at all time points (67/181; 37%), along with the high number of dropouts in the PSW arms; were examples of serious limitations that urged the need to timely change the type of analysis from *intention-to-treat* to *to-treat (as-treated)* analysis and the type of the study from an RCT to a controlled observational trial.

Text4Hope study relied on self-rated scales to assess mental health symptomatology, with no clinical support using the *DSM-5*. The risk of participation bias may not be excluded, where individuals with pre-existing mental health conditions may be more inclined to enroll in the Text4Hope program compared with individuals with no pre-existing mental health disorders. Additionally, the sample size upon which the follow-up data was established was rather small. This limitation notwithstanding, the study sample was larger than the projected sample size with adequate power, additionally a support to potential generalizability of our results to all Text4Hope subscribers was provided. Finally, the constant over-representation of the female participants in Text4Hope surveys, compared to both males and other gender, across all time points may limit the generalizability of the data to the whole community of Alberta, notwithstanding, this may be fairly representative of the females in this community. While the participants of other gender showed a high propensity for some psychological burdens, their numbers were markedly lower than female participants, that urges the need for further research work that focuses primarily on this vulnerable group.

Conclusion, implications for practice and policy with future directives:

The results of both studies allowed for a better understanding of the novel interventions applied in the mental health field, including peer support and supportive texting services, and their effective role in addressing and closing the treatment gaps experienced during challenging times such as post-discharge and during pandemics. The value of PSWs in the field of mental health is supported

through the results of the current research. The lived experience that the PSWs generously share with their clients, and primarily depend on, has proved to be an effective support and a strong shield against various challenges experienced after hospital discharge. Clinical and non-clinical challenges have been addressed through the provision of study interventions, including reducing the risk of suicide or self harm, improvement of the overall psychological parameters, and reporting a better quality of life. This research could successfully provide an additional piece of evidence supporting the value and the utility of this workforce to be systematically incorporated in the post-discharge phase of the patients' journey. Thus, increased value may be more evident to policy makers, stakeholders, and health administration in relation to incorporating such a workforce in provision of routine post discharge mental health services. Additionally, the combination of PSWs and TxM services in this research apparently provided a synergistic effect where both interventions potentiated the actions of one another. This finding needs further confirmation with a wide-scale study that includes a larger population with a strong engagement and retention profile, aiming to support the rigorousness of the design and provide robust results minimizing potential limitations or confounders.

The two studies highlighted the challenges experienced over the study periods and provided potential courses of action to avoid future challenges and improve the quality of study outcomes. We subsequently secured funds required to replicate this pilot study through a wider pragmatic design using a stepped wedge approach to include most discharged patients from acute care units in all the geographical zones in the province of Alberta. The newly funded study will test and generate new knowledge regarding the feasibility, effectiveness, and scalability of a combination of PSWs and TxM interventions to improve health care outcomes and reduce costs, in terms of reduced readmission rates, emergency visits, and *no-show* or cancelled outpatient appointments. Further steps to enhance better engagement and commitment are necessary to be considered, when providing the service and the follow-up clinical surveys.

Regarding Text4Hope service, the marked improvement in mental health symptomatology, particularly GAD symptoms, after Text4Hope introduction suggests that texting services are useful interventions that can be widely implemented during natural and humanitarian disasters to combat disaster-related mental health symptoms. Free mobile-based services such as Text4Hope can overcome financial barriers, while maintaining essential physical distancing required during pandemics, and providing access for those at rural or remote locations who have no other access

to mental health services. The pattern of urban, rural, and remote subscriber locations is of interest in relation to understanding the full value of text messaging in this context. Additionally, the asynchronous supportive communication service in other contexts, such as email is still under-researched despite promising potential. Such services are scalable, cost-effective, and more approachable to people who are hard to reach, including the homeless, or those who have internet access but no access to a cell phone. We introduced such an initiative with an ongoing project comparing text messaging to email messaging to support patients with major depressive disorder, through a randomized hybrid effectiveness-implementation trial [820]. The results of that study would examine the feasibility, effectiveness, and acceptability of using automated emails as a strategy for delivering supportive messages to patients with MDD as a non-inferior intervention compared to text messaging. In addition, the results from the reported studies in this thesis support the proposal that during pandemics the public may benefit from mental health wellness campaigns aimed at reducing psychological impacts. Our results provide useful evidence to build support for such policy implementation in high-, middle-, and low-income countries. As a research team, we have explored national scale-up and implementation of the Text4Hope program in multiple languages, including Arabic and French to benefit all Canadians with different ethnicities. Our team will also disseminate this program across different initiatives provided for first responders, schoolteachers, and Black youth in Canada. Furthermore, the service will be disseminated for adaptation and potential global use through the E-Text4PositiveMentalHealth platform, and formation of partnerships with national and regional health authorities and institutions. To this end, future health service design may need to incorporate such interventions in routine service and further explore their great potential. Researchers, policy- and decision-makers may be persuaded to further support innovative interventions that are associated with evidence of feasibility and positive outcomes via comprehensive support and guided investments that ensure the provision and effective implementation of these services.

References

1. Saloni Dattani, H.R., Max Roser *"Mental Health". Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/mental-health' [Online Resource].* 2021.
2. Chaulagain, A., et al., *WHO Mental Health Gap Action Programme Intervention Guide (mhGAP-IG): the first pre-service training study.* International Journal of Mental Health Systems, 2020. **14**(1): p. 47.
3. Charlson, F., et al., *New WHO prevalence estimates of mental disorders in conflict settings: a systematic review and meta-analysis.* Lancet (London, England), 2019. **394**(10194): p. 240-248.
4. *The Centre for Addiction and Mental Health (CAMH). Mental Illness and Addiction: Facts and Statistics. 2021. Available at https://www.camh.ca/en/driving-change/the-crisis-is-real/mental-health-statistics Accessed October 11, 2021.*
5. *World Health Organization (WHO). World Bank and WHO: Half the world lacks access to essential health services, 100 million still pushed into extreme poverty because of health expenses*. 2017; Available from: https://www.who.int/news/item/13-12-2017-world-bank-and-who-half-the-world-lacks-access-to-essential-health-services-100-million-still-pushed-into-extreme-poverty-because-of-health-expenses Accessed on October 25, 2021.
6. Keynejad, R.C., et al., *WHO Mental Health Gap Action Programme (mhGAP) Intervention Guide: a systematic review of evidence from low and middle-income countries.* Evidence Based Mental Health, 2018. **21**(1): p. 30.
7. (WHO), W.H.O. *Mental Health Atlas, 2017*. 2017; Available from: https://www.who.int/publications/i/item/9789241514019 Accessed on October 26, 2021.
8. The, W.H.O.W.M.H.S.C., *Prevalence, Severity, and Unmet Need for Treatment of Mental Disorders in the World Health Organization World Mental Health Surveys.* JAMA, 2004. **291**(21): p. 2581-2590.
9. Kale, R. *The treatment gap*. 2002; Available from: https://onlinelibrary.wiley.com/doi/pdf/10.1046/j.1528-1157.43.s.6.13.x#:~:text=Treatment%20gap%E2%80%94%20Prevalence.-,A%20simple%20definition%20of%20the%20treatment%20gap%20is%20the%20number,outcome%20measure%20in%20health%20care. Accessed December 24, 2021.
10. Jansen, S., et al., *The "treatment gap" in global mental health reconsidered: sociotherapy for collective trauma in Rwanda.* European journal of psychotraumatology, 2015. **6**: p. 28706-28706.
11. Patel, V., et al., *Reducing the treatment gap for mental disorders: a WPA survey.* World Psychiatry, 2010. **9**(3): p. 169-176.
12. Qin, X. and C.-R. Hsieh, *Understanding and Addressing the Treatment Gap in Mental Healthcare: Economic Perspectives and Evidence From China.* INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 2020. **57**: p. 0046958020950566.
13. Saddichha, S., et al., *Online interventions for depression and anxiety - a systematic review.* Health psychology and behavioral medicine, 2014. **2**(1): p. 841-881.
14. Kohn, R., et al., *Mental health in the Americas: an overview of the treatment gap.* Rev Panam Salud Publica, 2018. **42**: p. e165.
15. *Statistics Canada. Health fact sheets, Mental health care needs, 2018. URL: https://www150.statcan.gc.ca/n1/pub/82-625-x/2019001/article/00011-eng.htm accessed June 17, 2020.*
16. Henderson, C., S. Evans-Lacko, and G. Thornicroft, *Mental illness stigma, help seeking, and public health programs.* American journal of public health, 2013. **103**(5): p. 777-780.

17. Tzeng, N.-S., et al., *What could we learn from SARS when facing the mental health issues related to the COVID-19 outbreak? A nationwide cohort study in Taiwan.* Translational Psychiatry, 2020. **10**(1): p. 339.
18. Wang, C., et al., *A novel coronavirus outbreak of global health concern.* Lancet, 2020. **395**(10223): p. 470-473.
19. Sohrabi, C., et al., *World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19).* Int J Surg, 2020. **76**: p. 71-76.
20. Auwaerter, P.M.D., *Coronavirus COVID-19 (SARS-CoV-2).* 2020.
21. *World Health Organization (WHO). Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. URL: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020. Accessed August 24, 2020*. 2020.
22. *World Health Organization. Coronavirus disease 2019 (COVID-19). Situation Report – 63. URL: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200323-sitrep-63-covid-19.pdf?sfvrsn=b617302d_4*. 2020.
23. *Province of Alberta. Public Health Act. https://www.qp.alberta.ca/documents/Acts/P37.pdf. Accessed on April 20, 2020.* 2019.
24. *World Health Organization. Coronavirus disease 2019 (COVID-19). Situation Report – 65. URL: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200325-sitrep-65-covid-19.pdf?sfvrsn=ce13061b_2*. 2020.
25. *World Health Organization (WHO). COVID-19 disrupting mental health services in most countries, WHO survey. 2020.* . Available from: https://www.who.int/news/item/05-10-2020-covid-19-disrupting-mental-health-services-in-most-countries-who-survey Accessed on October 28, 2021.
26. Gualano, M.R., et al., *Effects of Covid-19 Lockdown on Mental Health and Sleep Disturbances in Italy.* Int J Environ Res Public Health, 2020. **17**(13).
27. Nkire, N., et al., *COVID-19 Pandemic: Demographic Predictors of Self-Isolation or Self-Quarantine and Impact of Isolation and Quarantine on Perceived Stress, Anxiety, and Depression.* Front Psychiatry, 2021. **12**: p. 553468.
28. Nirmita Panchal, R.K., Cynthia Cox, and Rachel Garfield *The Implications of COVID-19 for Mental Health and Substance Use*. 2021; Available from: https://www.kff.org/coronavirus-covid-19/issue-brief/the-implications-of-covid-19-for-mental-health-and-substance-use/ Accessed on October 19, 2021.
29. Ruiz, M.C., et al., *A Cross-Cultural Exploratory Study of Health Behaviors and Wellbeing During COVID-19.* Frontiers in Psychology, 2021. **11**(3897).
30. Strudwick, G., et al., *Digital Interventions to Support Population Mental Health in Canada During the COVID-19 Pandemic: Rapid Review.* JMIR mental health, 2021. **8**(3): p. e26550-e26550.
31. Ettman, C.K., et al., *Prevalence of Depression Symptoms in US Adults Before and During the COVID-19 Pandemic.* JAMA Netw Open, 2020. **3**(9): p. e2019686.
32. *COVID-19 National Survey Dashboard. Centre for Addiction and Mental Health. [2021-02-26]. https://www.camh.ca/en/health-info/mental-health-and-covid-19/covid-19-national-survey Accessed on October 19, 2021.*
33. Canada, M.H.C.o., *COVID-19 and Suicide: Prevention is Possible.* 2020.
34. Sapara, A., et al., *COVID-19 pandemic: demographic and clinical correlates of passive death wish and thoughts of self-harm among Canadians.* J Ment Health, 2021: p. 1-9.
35. Nkire, N., et al., *COVID-19 Pandemic: Influence of Relationship Status on Stress, Anxiety, and Depression in Canada.* Ir J Psychol Med, 2021: p. 1-26.

36. Nwachukwu, I., et al., *COVID-19 Pandemic: Age-Related Differences in Measures of Stress, Anxiety and Depression in Canada.* Int J Environ Res Public Health, 2020. **17**(17).
37. Fung, A.W., et al., *Prevalence of anxiety disorders in community dwelling older adults in Hong Kong.* Int Psychogeriatr, 2017. **29**(2): p. 259-267.
38. Churchill, B., *COVID-19 and the immediate impact on young people and employment in Australia: A gendered analysis.* Gend Work Organ, 2020.
39. Ozdin, S. and S. Bayrak Ozdin, *Levels and predictors of anxiety, depression and health anxiety during COVID-19 pandemic in Turkish society: The importance of gender.* Int J Soc Psychiatry, 2020. **66**(5): p. 504-511.
40. Prevention, C.f.D.C.a. *Mental Health. Coping with stress*. 2021; Available from: https://www.cdc.gov/mentalhealth/stress-coping/cope-with-stress/index.html Accessed on October 18, 2021.
41. Wind, T., et al., *The COVID-19 pandemic: The 'black swan' for mental health care and a turning point for e-health.* Internet Interventions, 2020. **20**: p. 100317.
42. Liu, S., et al., *Online mental health services in China during the COVID-19 outbreak.* The lancet. Psychiatry, 2020. **7**(4): p. e17-e18.
43. Bäuerle, A., et al., *Psychological support in times of COVID-19: the Essen community-based CoPE concept.* Journal of public health (Oxford, England), 2020. **42**(3): p. 649-650.
44. Hyun, J., et al., *Psychosocial Support during the COVID-19 Outbreak in Korea: Activities of Multidisciplinary Mental Health Professionals.* J Korean Med Sci, 2020. **35**(22): p. e211.
45. Moreno, C., et al., *How mental health care should change as a consequence of the COVID-19 pandemic.* The lancet. Psychiatry, 2020. **7**(9): p. 813-824.
46. Blake, H., et al., *Mitigating the Psychological Impact of COVID-19 on Healthcare Workers: A Digital Learning Package.* Int J Environ Res Public Health, 2020. **17**(9).
47. D'Arcey, J., et al., *The Use of Text Messaging to Improve Clinical Engagement for Individuals With Psychosis: Systematic Review.* JMIR Ment Health, 2020. **7**(4): p. e16993.
48. Canada, S. *Table 22-10-0115-01 Smartphone use and smartphone habits by gender and age group, inactive*

2021; Available from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2210011501 Accessed on October 19, 2021.
49. Terry, M., *Text messaging in healthcare: the elephant knocking at the door.* Telemed J E Health, 2008. **14**(6): p. 520-4.
50. Guerriero, C., et al., *The cost-effectiveness of smoking cessation support delivered by mobile phone text messaging: Txt2stop.* Eur J Health Econ, 2013. **14**(5): p. 789-97.
51. Seyffert, M., et al., *Internet-Delivered Cognitive Behavioral Therapy to Treat Insomnia: A Systematic Review and Meta-Analysis.* PloS one, 2016. **11**(2): p. e0149139.
52. Zhang, X., et al., *Risk Factors of Psychological Responses of Chinese University Students During the COVID-19 Outbreak: Cross-sectional Web-Based Survey Study.* J Med Internet Res, 2021. **23**(7): p. e29312.
53. Malakoutikhah, A., et al., *Anxiety, anger, and mindfulness as predictors of general health in the general population during COVID-19 outbreak: A survey in southeast Iran.* J Community Psychol, 2021.
54. Getzmann, S., J. Digutsch, and T. Kleinsorge, *COVID-19 Pandemic and Personality: Agreeable People Are More Stressed by the Feeling of Missing.* International Journal of Environmental Research and Public Health, 2021. **18**(20).

55. Tyler, N., N. Wright, and J. Waring, *Interventions to improve discharge from acute adult mental health inpatient care to the community: systematic review and narrative synthesis.* BMC health services research, 2019. **19**(1): p. 883-883.
56. Wright, N., et al., *From admission to discharge in mental health services: a qualitative analysis of service user involvement.* Health Expectations, 2016. **19**(2): p. 367-376.
57. Barua B, P.M., Emes J. . *Sustainability of health care spending in Canada* 2017; Available from: https://www.fraserinstitute.org/studies/sustainability-of-health-care-spending-in-canada-2017. Accessed October 24, 2021.
58. *Waring J, Marshall F, Bishop S, et al. An ethnographic study of knowledge sharing across the boundaries between care processes, services and organisations: the contributions to 'safe' hospital discharge. Southampton (UK): NIHR Journals Library; 2014 Sep. (Health Services and Delivery Research, No. 2.29.) Chapter 2, Hospital discharge and patient safety: reviews of the literature. Available from: https://www.ncbi.nlm.nih.gov/books/NBK259995/ Accessed on October 28, 2021*.
59. Phillips, M.S., et al., *Factors Associated With Multiple Psychiatric Readmissions for Youth With Mood Disorders.* J Am Acad Child Adolesc Psychiatry, 2020. **59**(5): p. 619-631.
60. Kalb, L.G., et al., *Trends in Psychiatric Emergency Department Visits Among Youth and Young Adults in the US.* Pediatrics, 2019. **143**(4).
61. Statistica, F.M. *Rate of hospital discharges in Canada from 1980 to 2018*. 2020; Available from: https://www.statista.com/statistics/831709/rate-of-hospital-discharges-canada/ Accessed on October 26, 2021.
62. Information, C.I.f.H. *Mental Health and Addictions Hospitalizations in Canada, 2019–2020.* . 2021; Available from: https://apps.cihi.ca/mstrapp/asp/Main.aspx Accessed on October 26, 2021.
63. Bardach, N.S., et al., *ED Visits and Readmissions After Follow-up for Mental Health Hospitalization.* Pediatrics, 2020. **145**(6).
64. Elhassan, N.M., et al., *Sociodemographic and clinical characteristics of patients with recurrent psychiatric readmissions in Qatar.* J Int Med Res, 2020. **48**(12): p. 300060520977382.
65. Kalseth, J., et al., *Psychiatric readmissions and their association with environmental and health system characteristics: a systematic review of the literature.* BMC psychiatry, 2016. **16**(1): p. 376-376.
66. Donisi, V., et al., *Pre-discharge factors predicting readmissions of psychiatric patients: a systematic review of the literature.* BMC psychiatry, 2016. **16**(1): p. 449-449.
67. Chavez, L.J., et al., *Unhealthy alcohol use in older adults: Association with readmissions and emergency department use in the 30 days after hospital discharge.* Drug Alcohol Depend, 2016. **158**: p. 94-101.
68. Hunt, I.M., et al., *Suicide in recently discharged psychiatric patients: a case-control study.* Psychological Medicine, 2009. **39**(3): p. 443-449.
69. Bojanić, L., et al., *Early Post-Discharge Suicide in Mental Health Patients: Findings From a National Clinical Survey.* Frontiers in Psychiatry, 2020. **11**(502).
70. Bickley, H., et al., *Suicide Within Two Weeks of Discharge From Psychiatric Inpatient Care: A Case-Control Study.* Psychiatric Services, 2013. **64**(7): p. 653-659.
71. Schmutte, T., C. Dunn, and W. Sledge, *Characteristics of Inpatients With a History of Recurrent Psychiatric Hospitalizations: A Matched-Control Study.* Psychiatric Services, 2009. **60**(12): p. 1683-1685.
72. Bryksa, E., et al., *Family Members' Perspectives of Health Care System Interactions With Suicidal Patients and Responses to Suicides: Protocol for a Qualitative Research Study.* JMIR Res Protoc, 2019. **8**(8): p. e13797.

73. Parra-Uribe, I., et al., *Risk of re-attempts and suicide death after a suicide attempt: A survival analysis.* BMC Psychiatry, 2017. **17**(1): p. 163.
74. *World Health Organization (WHO). mhGAP Mental Health Gap Action Programme*. 2008; Available from: https://www.who.int/publications/i/item/9789241596206 Accessed on October 24, 2021.
75. Roosa Tikkanen, R.O., Elias Mossialos, Ana Djordjevic, George A. Wharton. *International Health Care System Profiles. Canada.* . 2020; Available from: https://www.commonwealthfund.org/international-health-policy-center/countries/canada Accessed on October 25, 2021.
76. Boora, N., et al., *Improving Community Care for Patients Discharged from Hospital Through Zone Wide Implementation of a Seamless Care Transition Policy.* International Journal for Quality in Health Care, 2021.
77. Herman, D., et al., *Critical Time Intervention: An Empirically Supported Model for Preventing Homelessness in High Risk Groups.* The Journal of Primary Prevention, 2007. **28**(3): p. 295-312.
78. *Caanadian Mental Health Association. Transitional Discharge Model Peer Support Program. 2017. Available at https://cmhamiddlesex.ca/wp-content/uploads/2017/02/2017-05-31-Transitional-Discharge-Model-Fact-Sheet.pdf Accessed on October 12, 2021.*
79. Harerimana, B., S. Gyamfi, and C. Forchuk, *Implementation of a Transitional Discharge Model*, in *From Therapeutic Relationships to Transitional Care*. 2021. p. 94-99.
80. Tyler, N., et al., *Improving mental health care transitions through information capture during admission to inpatient mental health services: a quality improvement study.* BMC health services research, 2021. **21**(1): p. 1132-1132.
81. Mahomed, F., M.A. Stein, and V. Patel, *Involuntary mental health treatment in the era of the United Nations Convention on the Rights of Persons with Disabilities.* PLoS Med, 2018. **15**(10): p. e1002679.
82. Williams, V. and P. Heslop, *Mental health support needs of people with a learning difficulty: a medical or a social model?* Disability & Society, 2005. **20**(3): p. 231-245.
83. Nathan, J. and M. Webber, *Mental Health Social Work And The Bureau-Medicalisation Of Mental Health Care: Identity In A Changing World.* Journal of Social Work Practice, 2010. **24**(1): p. 15-28.
84. Bassett, H. and C. Lloyd, *Occupational Therapy in Mental Health: Managing Stress and Burnout.* British Journal of Occupational Therapy, 2001. **64**(8): p. 406-411.
85. Kumar, A., et al., *Peer support in an outpatient program for veterans with posttraumatic stress disorder: Translating participant experiences into a recovery model.* Psychol Serv, 2018.
86. Landers, G.M. and M. Zhou, *An analysis of relationships among peer support, psychiatric hospitalization, and crisis stabilization.* Community Ment Health J, 2011. **47**(1): p. 106-12.
87. Shaffer, S.L., et al., *Brief Critical Time Intervention to Reduce Psychiatric Rehospitalization.* Psychiatr Serv, 2015. **66**(11): p. 1155-61.
88. Brasier, C., et al., *Peer support work for people experiencing mental distress attending the emergency department: Exploring the potential.* Emergency Medicine Australasia, 2021.
89. Morgan, C., et al., *The effectiveness of unguided internet cognitive behavioural therapy for mixed anxiety and depression.* Internet Interventions, 2017. **10**: p. 47-53.
90. Lorenzo-Luaces, L., E. Johns, and J.R. Keefe, *The Generalizability of Randomized Controlled Trials of Self-Guided Internet-Based Cognitive Behavioral Therapy for Depressive Symptoms: Systematic Review and Meta-Regression Analysis.* Journal of medical Internet research, 2018. **20**(11): p. e10113.
91. Firth, J., et al., *Can smartphone mental health interventions reduce symptoms of anxiety? A meta-analysis of randomized controlled trials.* J Affect Disord, 2017. **218**: p. 15-22.

92. Agyapong, V.I.O., et al., *Prevalence Rates and Predictors of Generalized Anxiety Disorder Symptoms in Residents of Fort McMurray Six Months After a Wildfire.* Frontiers in Psychiatry, 2018. **9**(345).
93. Firth, J., et al., *The efficacy of smartphone-based mental health interventions for depressive symptoms: A meta-analysis of randomized controlled trials.* World Psychiatry, 2017. **16**(3): p. 287-298.
94. Agyapong, V.I., et al., *Cross-sectional survey evaluating Text4Mood: mobile health program to reduce psychological treatment gap in mental healthcare in Alberta through daily supportive text messages.* BMC Psychiatry, 2016. **16**(1): p. 378.
95. Agyapong, V.I.O., et al., *Text4Hope: Receiving Daily Supportive Text Messages for 3 Months During the COVID-19 Pandemic Reduces Stress, Anxiety, and Depression.* Disaster Med Public Health Prep, 2021: p. 1-5.
96. Kaltenthaler, E., K. Cavanagh, and P. McCrone, *Evaluating the role of electronic and web-based (E-CBT) CBT in mental health.* Technology in mental health: Applications in practice, supervision and training., 2nd ed., 2016: p. 212-222.
97. Rozental, A., G. Andersson, and P. Carlbring, *In the absence of effects: An individual patient data meta-analysis of non-response and its predictors in internet-based cognitive behavior therapy.* Frontiers in Psychology, 2019. **10**.
98. Agyapong, V.I.O., et al., *Implementation and Evaluation of a Text Message-Based Addiction Counseling Program (Text4Hope-Addiction Support): Protocol for a Questionnaire Study.* JMIR Res Protoc, 2020. **9**(11): p. e22047.
99. Simon, N., et al., *Acceptability of internet-based cognitive behavioural therapy (i-CBT) for post-traumatic stress disorder (PTSD): a systematic review.* European Journal of Psychotraumatology, 2019. **10**(1).
100. Lewis, C., et al., *Internet-delivered cognitive behavioural therapy for post-traumatic stress disorder: systematic review and meta-analysis.* Acta psychiatrica Scandinavica, 2019. **140**(6): p. 508-521.
101. Firth, J., et al., *Mobile Phone Ownership and Endorsement of "mHealth" Among People With Psychosis: A Meta-analysis of Cross-sectional Studies.* Schizophrenia bulletin, 2016. **42**(2): p. 448-55.
102. Ye, Y.-Y., et al., *Internet-Based Cognitive Behavioral Therapy for Insomnia (ICBT-i) Improves Comorbid Anxiety and Depression-A Meta-Analysis of Randomized Controlled Trials.* PloS one, 2015. **10**(11): p. e0142258.
103. Weiner, D.B., *The apprenticeship of Philippe Pinel: a new document, "observations of Citizen Pussin on the insane".* Am J Psychiatry, 1979. **136**(9): p. 1128-34.
104. Chinman, M., et al., *Peer support services for individuals with serious mental illnesses: assessing the evidence.* Psychiatr Serv, 2014. **65**(4): p. 429-41.
105. Darby Penney, M., *<DPenney_Defining_peer_support_2018_Final.pdf>.* Advocates for Human Potential, Inc., 2018.
106. Moran, G.S., et al., *Benefits and mechanisms of recovery among peer providers with psychiatric illnesses.* Qual Health Res, 2012. **22**(3): p. 304-19.
107. Clarke, G.N., et al., *Psychiatric hospitalizations, arrests, emergency room visits, and homelessness of clients with serious and persistent mental illness: findings from a randomized trial of two ACT programs vs. usual care.* Ment Health Serv Res, 2000. **2**(3): p. 155-64.
108. Davidson, L., et al., *Supported socialization for people with psychiatric disabilities: Lessons from a randomized controlled trial.* Journal of Community Psychology, 2004. **32**(4): p. 453-477.
109. O'Donnell, M., et al., *A study of client-focused case management and consumer advocacy: the Community and Consumer Service Project.* Aust N Z J Psychiatry, 1999. **33**(5): p. 684-93.

110. Solomon, P. and J. Draine, *The efficacy of a consumer case management team: 2-year outcomes of a randomized trial.* J Ment Health Adm, 1995. **22**(2): p. 135-46.
111. Pitt, V., et al., *Consumer-providers of care for adult clients of statutory mental health services.* Cochrane Database Syst Rev, 2013(3): p. CD004807.
112. Lloyd-Evans, B., et al., *A systematic review and meta-analysis of randomised controlled trials of peer support for people with severe mental illness.* BMC Psychiatry, 2014. **14**(1): p. 39.
113. Davidson L, T.J., Staeheli MR et al, *<Recovery_guides_An_emerging_model_of_community-bas.pdf>.* Lightburn A, Sessions P (eds). Community based clinical practice. London: Oxford University Press, 2006: p. 476-501.
114. Felton, C.J., et al., *Consumers as peer specialists on intensive case management teams: impact on client outcomes.* Psychiatr Serv, 1995. **46**(10): p. 1037-44.
115. Beales, A., T. Basset, and J. Wilson, *Peer support – the what, why, who, how and now.* The Journal of Mental Health Training, Education and Practice, 2015. **10**(5): p. 314-324.
116. MacNeil, C. and S. Mead, *A Narrative Approach to Developing Standards for Trauma-Informed Peer Support.* American Journal of Evaluation, 2016. **26**(2): p. 231-244.
117. Canadian Mental Health Association, B.D., *Peer Support Guide For Parents of Children or Youth with Mental Health Problems.* 2007.
118. *Family Matters Peer Support and Recovery Program*, M.D.A.o. Ontario, Editor.
119. Quinn, J., C. Barrowclough, and N. Tarrier, *The Family Questionnaire (FQ): a scale for measuring symptom appraisal in relatives of schizophrenic patients.* Acta Psychiatr Scand, 2003. **108**(4): p. 290-6.
120. Leggatt, M. and G. Woodhead, *Family peer support work in an early intervention youth mental health service.* Early Interv Psychiatry, 2016. **10**(5): p. 446-51.
121. Mahomed, F., et al., *'They love me, but they don't understand me': Family support and stigmatisation of mental health service users in Gujarat, India.* Int J Soc Psychiatry, 2019. **65**(1): p. 73-79.
122. Davidson, L. and M. Rowe, *Peer Support within Criminal Justice Settings: The Role of Forensic Peer Specialists*. 2008.
123. Short R, W.-N.K., Cross SL, Hurst M, Gordish L, Raia J., *The impact of forensic peer support specialists on risk reduction and discharge readiness in a psychiatric facility: A five-year perspective. International Journal of Psychosocial Rehabilitation.* 2012. **16**(2): p. 3-10.
124. Davidson, L., et al., *Peer support among persons with severe mental illnesses: a review of evidence and experience.* World Psychiatry, 2012. **11**(2): p. 123-8.
125. Berger, M., T.H. Wagner, and L.C. Baker, *Internet use and stigmatized illness.* Soc Sci Med, 2005. **61**(8): p. 1821-7.
126. Highton-Williamson, E., S. Priebe, and D. Giacco, *Online social networking in people with psychosis: A systematic review.* Int J Soc Psychiatry, 2015. **61**(1): p. 92-101.
127. Naslund, J.A., et al., *The future of mental health care: peer-to-peer support and social media.* Epidemiol Psychiatr Sci, 2016. **25**(2): p. 113-22.
128. Mead, S., D. Hilton, and L. Curtis, *Peer support: a theoretical perspective.* Psychiatr Rehabil J, 2001. **25**(2): p. 134-41.
129. *Peer Support*. Mental Health Foundation, UK.
130. Solomon, P., *Peer support/peer provided services underlying processes, benefits, and critical ingredients.* Psychiatr Rehabil J, 2004. **27**(4): p. 392-401.
131. Davidson, L., et al., *Peer support among adults with serious mental illness: a report from the field.* Schizophr Bull, 2006. **32**(3): p. 443-50.
132. Mead, S., *Intentional peer support: an alternative approach*. Vol. 1. 2014.

133. Sunderland, K., Mishkin, Wendy, Peer Leadership Group, Mental Health Commission of Canada, *<peer_support_guidelines.pdf.pdf>.* 2013.
134. Peterson, D., *A Mad People's History of Madness*. Contemporary Community Health Series. 1981, Pittsburgh, Pa: University of Pittsburgh Press.
135. Shaw, C., *<Peer-Support-in-Secure-Settings-Final-Report-4-Nov-14.pdf>.* 2014.
136. Meads, S., *<definingpeersupport-pdf>.* 2003.
137. Ostrow, L., et al., *Medicaid Reimbursement of Mental Health Peer-Run Organizations: Results of a National Survey.* Adm Policy Ment Health, 2017. **44**(4): p. 501-511.
138. Stratford, A.C., et al., *The growth of peer support: an international charter.* J Ment Health, 2017: p. 1-6.
139. Mead, S., *Peer Support as a Socio-Political Response to Trauma and Abuse.* Intentional peer support, 2001.
140. Wilson, A., M. Hutchinson, and J. Hurley, *Literature review of trauma-informed care: Implications for mental health nurses working in acute inpatient settings in Australia.* Int J Ment Health Nurs, 2017. **26**(4): p. 326-343.
141. Barnum Goetz, S. and A. Taylor-Trujillo, *A Change in Culture: Violence Prevention in an Acute Behavioral Health Setting.* Journal of the American Psychiatric Nurses Association, 2012. **18**: p. 96-103.
142. Ashmore, T., *The implementation of trauma informed care in acute mental health inpatient units: A comparative study*. 2014.
143. Brown, V.B., M. Harris, and R. Fallot, *Moving toward trauma-informed practice in addiction treatment: a collaborative model of agency assessment.* J Psychoactive Drugs, 2013. **45**(5): p. 386-93.
144. Guay, S., et al., *Effects of a peer support programme for youth social services employees experiencing potentially traumatic events: a protocol for a prospective cohort study.* BMJ Open, 2017. **7**(6): p. e014405.
145. Gillard, S.G., et al., *Introducing peer worker roles into UK mental health service teams: a qualitative analysis of the organisational benefits and challenges.* BMC Health Serv Res, 2013. **13**: p. 188.
146. Tookey, P., et al., *From client to co-worker: a case study of the transition to peer work within a multi-disciplinary hepatitis c treatment team in Toronto, Canada.* Harm Reduct J, 2018. **15**(1): p. 41.
147. Stastny, P. and C. Brown, *[Peer specialist: origins, pitfalls and worldwide dissemination].* Vertex, 2013. **24**(112): p. 455-9.
148. Simpson, A., C. Oster, and E. Muir-Cochrane, *Liminality in the occupational identity of mental health peer support workers: A qualitative study.* Int J Ment Health Nurs, 2018. **27**(2): p. 662-671.
149. Cabassa, L.J., et al., *Peer-based health interventions for people with serious mental illness: A systematic literature review.* J Psychiatr Res, 2017. **84**: p. 80-89.
150. Chinman, M., et al., *A cluster randomized trial of adding peer specialists to intensive case management teams in the Veterans Health Administration.* J Behav Health Serv Res, 2015. **42**(1): p. 109-21.
151. Druss, B.G., et al., *The Health and Recovery Peer (HARP) Program: a peer-led intervention to improve medical self-management for persons with serious mental illness.* Schizophr Res, 2010. **118**(1-3): p. 264-70.
152. Chien, W.T., et al., *Peer support for people with schizophrenia or other serious mental illness.* Cochrane Database Syst Rev, 2019. **4**: p. CD010880.

153. Reif, S., et al., *Peer recovery support for individuals with substance use disorders: assessing the evidence.* Psychiatr Serv, 2014. **65**(7): p. 853-61.
154. Best, D.W. and D.I. Lubman, *The recovery paradigm - a model of hope and change for alcohol and drug addiction.* Aust Fam Physician, 2012. **41**(8): p. 593-7.
155. Watson, D.P., et al., *Replication of an emergency department-based recovery coaching intervention and pilot testing of pragmatic trial protocols within the context of Indiana's Opioid State Targeted Response plan.* J Subst Abuse Treat, 2019.
156. McGuire, A.B., et al., *Emergency department-based peer support for opioid use disorder: Emergent functions and forms.* J Subst Abuse Treat, 2019.
157. Litt, M.D., et al., *Changing network support for drinking: initial findings from the network support project.* J Consult Clin Psychol, 2007. **75**(4): p. 542-55.
158. Barrenger, S.L., E.K. Hamovitch, and M.R. Rothman, *Enacting lived experiences: Peer specialists with criminal justice histories.* Psychiatr Rehabil J, 2019. **42**(1): p. 9-16.
159. Angell, B., et al., *Engagement processes in model programs for community reentry from prison for people with serious mental illness.* Int J Law Psychiatry, 2014. **37**(5): p. 490-500.
160. Thomas, K., et al., *"They didn't give up on me": a women's transitions clinic from the perspective of re-entering women.* Addict Sci Clin Pract, 2019. **14**(1): p. 12.
161. Kim, S.H., *[Effects of a volunteer-run peer support program on health and satisfaction with social support of older adults living alone].* J Korean Acad Nurs, 2012. **42**(4): p. 525-36.
162. Chapin, R.K., et al., *Reclaiming joy: pilot evaluation of a mental health peer support program for older adults who receive Medicaid.* Gerontologist, 2013. **53**(2): p. 345-52.
163. Ahmed, S.M. and A.-G.S. Palermo, *Community engagement in research: frameworks for education and peer review.* American journal of public health, 2010. **100**(8): p. 1380-1387.
164. Byrom, N., *Grand challenges. Oxford: Student Minds.* 2014.
165. Davies, E.B., et al., *An experimental study exploring the impact of vignette gender on the quality of university students' mental health first aid for peers with symptoms of depression.* BMC Public Health, 2016. **16**(1): p. 187.
166. Byrom, N., *An evaluation of a peer support intervention for student mental health.* J Ment Health, 2018. **27**(3): p. 240-246.
167. Lubman, D.I., et al., *Australian adolescents' beliefs and help-seeking intentions towards peers experiencing symptoms of depression and alcohol misuse.* BMC Public Health, 2017. **17**(1): p. 658.
168. Sokol, R. and E. Fisher, *Peer Support for the Hardly Reached: A Systematic Review.* Am J Public Health, 2016. **106**(7): p. e1-8.
169. Fortuna, K.L., et al., *Feasibility, Acceptability, and Preliminary Effectiveness of a Peer-Delivered and Technology Supported Self-Management Intervention for Older Adults with Serious Mental Illness.* Psychiatr Q, 2018. **89**(2): p. 293-305.
170. Whiteman, K.L., et al., *Systematic Review of Integrated General Medical and Psychiatric Self-Management Interventions for Adults With Serious Mental Illness.* Psychiatr Serv, 2016. **67**(11): p. 1213-1225.
171. Pathare, S. and L.S. Shields, *Supported Decision-Making for Persons with Mental Illness: A Review.* Public Health Reviews, 2012. **34**(2): p. 15.
172. Morrissey, F., *The United Nations Convention on the Rights of Persons with Disabilities: a new approach to decision-making in mental health law.* Eur J Health Law, 2012. **19**(5): p. 423-40.
173. Szmukler, G., *"Capacity", "best interests", "will and preferences" and the UN Convention on the Rights of Persons with Disabilities.* World Psychiatry, 2019. **18**(1): p. 34-41.
174. Jeste, D.V., et al., *Supported Decision Making in Serious Mental Illness.* Psychiatry, 2018. **81**(1): p. 28-40.

175. Craigie, J., *A Fine Balance: Reconsidering Patient Autonomy in Light of the UN Convention on the Rights of Persons with Disabilities.* Bioethics, 2015. **29**(6): p. 398-405.
176. Henderson, J.L., et al., *Integrated collaborative care teams to enhance service delivery to youth with mental health and substance use challenges: protocol for a pragmatic randomised controlled trial.* BMJ Open, 2017. **7**(2): p. e014080.
177. Gagne, C.A., et al., *Peer Workers in the Behavioral and Integrated Health Workforce: Opportunities and Future Directions.* Am J Prev Med, 2018. **54**(6S3): p. S258-S266.
178. Smith, R. and N. Greenwood, *The impact of volunteer mentoring schemes on carers of people with dementia and volunteer mentors: a systematic review.* Am J Alzheimers Dis Other Demen, 2014. **29**(1): p. 8-17.
179. Huang, L., et al., *Transforming mental health care for children and their families.* Am Psychol, 2005. **60**(6): p. 615-27.
180. Singla, D.R., E. Kumbakumba, and F.E. Aboud, *Effects of a parenting intervention to address maternal psychological wellbeing and child development and growth in rural Uganda: a community-based, cluster randomised trial.* Lancet Glob Health, 2015. **3**(8): p. e458-e469.
181. Manandhar, D.S., et al., *Effect of a participatory intervention with women's groups on birth outcomes in Nepal: cluster-randomised controlled trial.* The Lancet, 2004. **364**(9438): p. 970-979.
182. Balaji, M., et al., *The acceptability, feasibility, and effectiveness of a population-based intervention to promote youth health: an exploratory study in Goa, India.* J Adolesc Health, 2011. **48**(5): p. 453-60.
183. Tripathy, P., et al., *Effect Of A Participatory Intervention With Women's Groups On Birth Outcomes And Maternal Depression In Jharkhand And Orissa, India: A Cluster-Randomised Controlled Trial.* Lancet, 2010. **375**: p. 1182-92.
184. Jordans, M.J.D., et al., *Evaluation of outcomes for psychosis and epilepsy treatment delivered by primary health care workers in Nepal: a cohort study.* Int J Ment Health Syst, 2017. **11**: p. 70.
185. Kohrt, B.A., et al., *The Role of Communities in Mental Health Care in Low- and Middle-Income Countries: A Meta-Review of Components and Competencies.* Int J Environ Res Public Health, 2018. **15**(6).
186. Repper, J. and T. Carter, *A review of the literature on peer support in mental health services.* J Ment Health, 2011. **20**(4): p. 392-411.
187. Hardy, S., N. Hallett, and E. Chaplin, *Evaluating a peer support model of community wellbeing for mental health: A coproduction approach to evaluation.* Mental Health & Prevention, 2019. **13**: p. 149-158.
188. Fisher, E.B., et al., *Peer support in health care and prevention: cultural, organizational, and dissemination issues.* Annu Rev Public Health, 2014. **35**: p. 363-83.
189. Fisher, E.B., et al., *Peer support for self-management of diabetes improved outcomes in international settings.* Health Aff (Millwood), 2012. **31**(1): p. 130-9.
190. Singh, P. and D.A. Chokshi, *Community health workers--a local solution to a global problem.* N Engl J Med, 2013. **369**(10): p. 894-6.
191. Fisher, E.B., et al., *Contributions of Peer Support to Health, Health Care, and Prevention: Papers from Peers for Progress.* Ann Fam Med, 2015. **13 Suppl 1**: p. S2-8.
192. MacLellan, J., et al., *Peer Support Workers in Health: A Qualitative Metasynthesis of Their Experiences.* PLoS One, 2015. **10**(10): p. e0141122.
193. Tondora, J., et al., *A clinical trial of peer-based culturally responsive person-centered care for psychosis for African Americans and Latinos.* Clin Trials, 2010. **7**(4): p. 368-79.
194. Cabassa, L.J., et al., *Peer-led healthy lifestyle program in supportive housing: study protocol for a randomized controlled trial.* Trials, 2015. **16**: p. 388.

195. Sweeney, A., et al., *The relationship between therapeutic alliance and service user satisfaction in mental health inpatient wards and crisis house alternatives: a cross-sectional study.* PLoS One, 2014. **9**(7): p. e100153.
196. Mancini, M.A., *An Exploration of Factors that Effect the Implementation of Peer Support Services in Community Mental Health Settings.* Community Ment Health J, 2018. **54**(2): p. 127-137.
197. Ahmed, A.O., et al., *The professional experiences of peer specialists in the Georgia Mental Health Consumer Network.* Community Ment Health J, 2015. **51**(4): p. 424-36.
198. Walker, G. and W. Bryant, *Peer support in adult mental health services: a metasynthesis of qualitative findings.* Psychiatr Rehabil J, 2013. **36**(1): p. 28-34.
199. Villani, M. and V. Kovess-Masfety, *[Peer support programs in mental health in France: Status report and challenges].* Encephale, 2018. **44**(5): p. 457-464.
200. Cronise, R., et al., *The peer support workforce: Results of a national survey.* Psychiatr Rehabil J, 2016. **39**(3): p. 211-21.
201. Corrigan, P.W., K.A. Kosyluk, and N. Rusch, *Reducing self-stigma by coming out proud.* Am J Public Health, 2013. **103**(5): p. 794-800.
202. Davis, J.K., *Predictors of job satisfaction among peer providers on professional treatment teams in community-based agencies.* Psychiatr Serv, 2013. **64**(2): p. 181-4.
203. Clossey, L., et al., *Predicting job satisfaction of mental health peer support workers (PSWs).* Social Work in Mental Health, 2018. **16**(6): p. 682-695.
204. Kemp, V. and A.R. Henderson, *Challenges faced by mental health peer support workers: peer support from the peer supporter's point of view.* Psychiatr Rehabil J, 2012. **35**(4): p. 337-40.
205. Greer, A.M., et al., *Peer engagement barriers and enablers: insights from people who use drugs in British Columbia, Canada.* Can J Public Health, 2019. **110**(2): p. 227-235.
206. Clossey, L., et al., *The experience of certified peer specialists in mental health.* Social Work in Mental Health, 2015. **14**(4): p. 408-427.
207. Vandewalle, J., et al., *Peer workers' perceptions and experiences of barriers to implementation of peer worker roles in mental health services: A literature review.* Int J Nurs Stud, 2016. **60**: p. 234-50.
208. Gowen, K., et al., *Young adults with mental health conditions and social networking websites: seeking tools to build community.* Psychiatr Rehabil J, 2012. **35**(3): p. 245-50.
209. Miller, B.J., et al., *How connected are people with schizophrenia? Cell phone, computer, email, and social media use.* Psychiatry Res, 2015. **225**(3): p. 458-63.
210. Naslund, J.A., et al., *Naturally occurring peer support through social media: the experiences of individuals with severe mental illness using YouTube.* PLoS One, 2014. **9**(10): p. e110171.
211. Perry, B.L. and B.A. Pescosolido, *Social network activation: the role of health discussion partners in recovery from mental illness.* Soc Sci Med, 2015. **125**: p. 116-28.
212. Chyzzy, B. and C.-L. Dennis, *16. Mobile Phone-Based Peer Support In The Prevention of Postpartum Depression Among Adolescent Mothers: A Pilot Randomized Controlled Trial.* Journal of Adolescent Health, 2019. **64**(2): p. S8-S9.
213. Urichuk, L., et al., *Enhancing peer support experience for patients discharged from acute psychiatric care: protocol for a randomised controlled pilot trial.* BMJ Open, 2018. **8**(8): p. e022433.
214. Hurley, J., et al., *A critical discussion of Peer Workers: implications for the mental health nursing workforce.* J Psychiatr Ment Health Nurs, 2016. **23**(2): p. 129-35.
215. Burke, E.M., et al., *Providing mental health peer support 1: A Delphi study to develop consensus on the essential components, costs, benefits, barriers and facilitators.* International Journal of Social Psychiatry, 2018. **64**(8): p. 799-812.

216. Agyapong, V.I.O., et al., *Randomized controlled pilot trial of supportive text messaging for alcohol use disorder patients.* J Subst Abuse Treat, 2018. **94**: p. 74-80.
217. Agyapong, V.I., et al., *Supportive text messaging for depression and comorbid alcohol use disorder: single-blind randomised trial.* J Affect Disord, 2012. **141**(2-3): p. 168-76.
218. Gill, K., *New Moves: Targeting physical and mental illness well-being in people with mental illness*. Vol. 108. 2012. 18-23.
219. Martin, M.B. and S.L. Martin, *Healthy Amistad: improving the health of people with severe mental illness.* Issues Ment Health Nurs, 2014. **35**(10): p. 791-5.
220. Lorig, K., et al., *Effectiveness of the chronic disease self-management program for persons with a serious mental illness: a translation study.* Community Ment Health J, 2014. **50**(1): p. 96-103.
221. Bouchard, L., M. Montreuil, and C. Gros, *Peer support among inpatients in an adult mental health setting.* Issues Ment Health Nurs, 2010. **31**(9): p. 589-98.
222. Hurley, J., et al., *Qualitative study of peer workers within the 'Partners in Recovery' programme in regional Australia.* Int J Ment Health Nurs, 2018. **27**(1): p. 187-195.
223. Simmons, D., et al., *Challenges in the Ethical Review of Peer Support Interventions.* Ann Fam Med, 2015. **13 Suppl 1**: p. S79-86.
224. Sporinova, B., et al., *Association of Mental Health Disorders With Health Care Utilization and Costs Among Adults With Chronic Disease.* JAMA Network Open, 2019. **2**(8): p. e199910-e199910.
225. WHO, *World Health Organization & United Nations Development Programme. Mental health investment case: a guidance note. World Health Organization. https://apps.who.int/iris/handle/10665/340246. License: CC BY-NC-SA 3.0 IGO. Accessed December 5, 2021.* 2021.
226. WHO, *The World Health Report 2001: Mental Disorders affect one in four people. Available at https://www.who.int/news/item/28-09-2001-the-world-health-report-2001-mental-disorders-affect-one-in-four-people Accessed December 6, 2021.* 2001.
227. Wittchen, H.U., et al., *The size and burden of mental disorders and other disorders of the brain in Europe 2010.* Eur Neuropsychopharmacol, 2011. **21**(9): p. 655-79.
228. Solutions, S., *Top 5 Barriers to Mental Healthcare Access. Available at https://www.socialsolutions.com/blog/barriers-to-mental-healthcare-access/ Accessed in December 6, 2021.* 2021.
229. Moroz, N., I. Moroz, and M.S. D'Angelo, *Mental health services in Canada: Barriers and cost-effective solutions to increase access.* Healthcare Management Forum, 2020. **33**(6): p. 282-287.
230. *Statistics Canada. Health fact sheets, Mental health care needs, 2018. URL: https://www150.statcan.gc.ca/n1/pub/82-625-x/2019001/article/00011-eng.htm accessed June 17, 2020.*
231. Cox, K.L., S.M. Allida, and M.L. Hackett, *Text messages to reduce depressive symptoms: Do they work and what makes them effective? A systematic review.* Health Education Journal, 2021. **80**(3): p. 253-271.
232. Rodriguez-Pulido, F., et al., *Treatment of Depression in Primary Care with Computerized Psychological Therapies: Systematic Reviews.* J Med Syst, 2020. **44**(3): p. 67.
233. Wilks, C.R., G.G. Zieve, and H.K. Lessing, *Are Trials of Computerized Therapy Generalizable? A Multidimensional Meta-analysis.* Telemedicine journal and e-health : the official journal of the American Telemedicine Association, 2016. **22**(5): p. 450-457.
234. Jimenez-Molina, A., et al., *Internet-Based Interventions for the Prevention and Treatment of Mental Disorders in Latin America: A Scoping Review.* Frontiers in psychiatry, 2019. **10**: p. 664.
235. SAMHSA, *Substance Abuse and Mental Health Services Administration (SAMHSA). Telehealth for the Treatment of Serious Mental Illness and Substance Use Disorders. Available at*

https://store.samhsa.gov/sites/default/files/SAMHSA_Digital_Download/PEP21-06-02-001.pdf *accessed in December 6, 2021.* 2021.
236. Gliddon, E., et al., *Online and Mobile Technologies for Self-Management in Bipolar Disorder: A Systematic Review.* Psychiatric Rehabilitation Journal, 2017. **40**.
237. Alvarez-Jimenez, M., et al., *Online, social media and mobile technologies for psychosis treatment: a systematic review on novel user-led interventions.* Schizophrenia research, 2014. **156**(1): p. 96-106.
238. Kumar, V., et al., *The Effectiveness of Internet-Based Cognitive Behavioral Therapy in Treatment of Psychiatric Disorders.* Cureus, 2017. **9**(8): p. e1626-e1626.
239. Gurol-Urganci, I., et al., *Mobile phone messaging reminders for attendance at healthcare appointments.* Cochrane Database Syst Rev, 2013. **2013**(12): p. Cd007458.
240. Välimäki, M., H. Hätönen, and C.E. Adams, *Mobile.net: Mobile Telephone Text Messages to Encourage Adherence to Medication and to Follow up With People With Psychosis: Methods and Protocol for a Multicenter Randomized Controlled Two-Armed Trial.* JMIR Res Protoc, 2012. **1**(2): p. e8.
241. MacDougall, S., et al., *Text Message Interventions in Adolescent Mental Health and Addiction Services: Scoping Review.* JMIR Mental Health, 2021. **8**(1): p. e16508-e16508.
242. Abroms, L.C., et al., *A randomized trial of Text2Quit: a text messaging program for smoking cessation.* Am J Prev Med, 2014. **47**(3): p. 242-50.
243. Abroms, L.C., et al., *Quit4baby: results from a pilot test of a mobile smoking cessation program for pregnant women.* JMIR Mhealth Uhealth, 2015. **3**(1): p. e10.
244. *A Guide for Enrolling Patients and Clients in Text4baby* https://safehealthcareforeverywoman.org/wp-content/uploads/TrainingDeckForStaffUse3_2016.pdf.
245. Evans, W.D., et al., *Initial Outcomes From a 4-Week Follow-Up Study of the Text4baby Program in the Military Women's Population: Randomized Controlled Trial.* J Med Internet Res, 2014. **16**(5): p. e131.
246. Abroms, L.C., et al., *A content analysis of popular smartphone apps for smoking cessation.* Am J Prev Med, 2013. **45**(6): p. 732-6.
247. Noble, J.M., et al., *Text4Support Mobile-Based Programming for Individuals Accessing Addictions and Mental Health Services-Retroactive Program Analysis at Baseline, 12 Weeks, and 6 Months.* Front Psychiatry, 2021. **12**: p. 640795.
248. Agyapong, V.I.O., D.M. McLoughlin, and C.K. Farren, *Six-months outcomes of a randomised trial of supportive text messaging for depression and comorbid alcohol use disorder.* Journal of Affective Disorders, 2013. **151**(1): p. 100-104.
249. Shalaby, R., et al., *Recovery Following Peer and Text Messaging Support After Discharge From Acute Psychiatric Care in Edmonton, Alberta: Controlled Observational Study.* JMIR Form Res, 2021. **5**(9): p. e27137.
250. L., C., *Mobile internet usage in Canada - statistics & facts. Available at* https://www.statista.com/topics/3529/mobile-usage-in-canada/#dossierKeyfigures *Accessed on December 15, 2021* 2021.
251. ITU, *International Telecommunication Union. Statistics: time series of ICT data for the world, by geographic regions and by level of development, for the following indicators (2005-2019; excel).* 2019.
252. Li, S., et al., *The Impact of COVID-19 Epidemic Declaration on Psychological Consequences: A Study on Active Weibo Users.* Int J Environ Res Public Health, 2020. **17**(6).

253. Agyapong, V.I.O., et al., *Changes in Stress, Anxiety, and Depression Levels of Subscribers to a Daily Supportive Text Message Program (Text4Hope) During the COVID-19 Pandemic: Cross-Sectional Survey Study.* JMIR Ment Health, 2020. **7**(12): p. e22423.
254. *Covidence* https://www.covidence.org/
255. Mason, M., et al., *Text messaging interventions for adolescent and young adult substance use: a meta-analysis.* Prevention Science, 2015. **16**(2): p. 181-188.
256. Hutton, A., et al., *mHealth Interventions to Reduce Alcohol Use in Young People: A Systematic Review of the Literature.* Comprehensive child and adolescent nursing, 2020. **43**(3): p. 171-202.
257. Bastola, M.M., et al., *The Effectiveness of Mobile Phone-Based Text Messaging to Intervene with Problem Drinking in Youth and Younger Adult Population: A Meta-Analysis.* Telemed J E Health, 2020. **26**(3): p. 270-277.
258. Boland, V.C., et al., *The Methodological Quality and Effectiveness of Technology-Based Smoking Cessation Interventions for Disadvantaged Groups: A Systematic Review and Meta-analysis.* Nicotine Tob Res, 2018. **20**(3): p. 276-285.
259. Song, T., S. Qian, and P. Yu, *Mobile Health Interventions for Self-Control of Unhealthy Alcohol Use: Systematic Review.* JMIR mHealth and uHealth, 2019. **7**(1): p. e10899-e10899.
260. Fowler, L.A., S.L. Holt, and D. Joshi, *Mobile technology-based interventions for adult users of alcohol: A systematic review of the literature.* Addict Behav, 2016. **62**: p. 25-34.
261. Tofighi, B., et al., *Mobile phone messaging for illicit drug and alcohol dependence: A systematic review of the literature.* Drug Alcohol Rev, 2017. **36**(4): p. 477-491.
262. Senanayake, B., et al., *Effectiveness of text messaging interventions for the management of depression: A systematic review and meta-analysis.* Journal of Telemedicine & Telecare, 2019. **25**(9): p. 513-523.
263. Dwyer, A., et al., *Suitability of Text-Based Communications for the Delivery of Psychological Therapeutic Services to Rural and Remote Communities: Scoping Review.* JMIR mental health, 2021. **8**(2): p. e19478-e19478.
264. Berrouiguet, S., et al., *Fundamentals for Future Mobile-Health (mHealth): A Systematic Review of Mobile Phone and Web-Based Text Messaging in Mental Health.* Journal of Medical Internet Research, 2016. **18**(6): p. 13-13.
265. Watson, T., S. Simpson, and C. Hughes, *Text messaging interventions for individuals with mental health disorders including substance use: A systematic review.* Psychiatry research, 2016. **243**: p. 255-62.
266. Berry, N., et al., *Acceptability of Interventions Delivered Online and Through Mobile Phones for People Who Experience Severe Mental Health Problems: A Systematic Review.* JOURNAL OF MEDICAL INTERNET RESEARCH, 2016. **18**(5).
267. Bramley, D., et al., *Smoking cessation using mobile phone text messaging is as effective in Maori as non-Maori.* N Z Med J, 2005. **118**(1216): p. U1494.
268. Hussain-Shamsy, N., et al., *Mobile health for perinatal depression and anxiety: Scoping review.* Journal of Medical Internet Research, 2020. **22**(4).
269. Yue, J.L., et al., *Mental health services for infectious disease outbreaks including COVID-19: a rapid systematic review.* Psychol Med, 2020. **50**(15): p. 2498-2513.
270. Agyapong, V.I.O., et al., *Closing the Psychological Treatment Gap During the COVID-19 Pandemic With a Supportive Text Messaging Program: Protocol for Implementation and Evaluation.* JMIR Res Protoc, 2020. **9**(6): p. e19292.
271. Ho, C.S., C.Y. Chee, and R.C. Ho, *Mental Health Strategies to Combat the Psychological Impact of Coronavirus Disease 2019 (COVID-19) Beyond Paranoia and Panic.* Ann Acad Med Singap, 2020. **49**(3): p. 155-160.

272. Ahern, E., S. Kinsella, and M. Semkovska, *Clinical efficacy and economic evaluation of online cognitive behavioral therapy for major depressive disorder: a systematic review and meta-analysis.* Expert review of pharmacoeconomics & outcomes research, 2018. **18**(1): p. 25-41.
273. Christ, C., et al., *Internet and Computer-Based Cognitive Behavioral Therapy for Anxiety and Depression in Adolescents and Young Adults: Systematic Review and Meta-Analysis.* J Med Internet Res, 2020. **22**(9): p. e17831.
274. Jee, Y., *WHO International Health Regulations Emergency Committee for the COVID-19 outbreak.* Epidemiol Health, 2020. **42**: p. e2020013.
275. Tan, W., et al., *Is returning to work during the COVID-19 pandemic stressful? A study on immediate mental health status and psychoneuroimmunity prevention measures of Chinese workforce.* Brain Behav Immun, 2020. **87**: p. 84-92.
276. Poston, J.T., B.K. Patel, and A.M. Davis, *Management of Critically Ill Adults With COVID-19.* JAMA, 2020. **323**(18): p. 1839-1841.
277. Guo, Y.R., et al., *The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status.* Mil Med Res, 2020. **7**(1): p. 11.
278. Wang, C., et al., *Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China.* Int J Environ Res Public Health, 2020. **17**(5).
279. Wang, C., et al., *A longitudinal study on the mental health of general population during the COVID-19 epidemic in China.* Brain Behav Immun, 2020. **87**: p. 40-48.
280. Brooks, S.K., et al., *The psychological impact of quarantine and how to reduce it: rapid review of the evidence.* The Lancet, 2020. **395**(10227): p. 912-920.
281. Lai, J., et al., *Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019.* JAMA Netw Open, 2020. **3**(3): p. e203976.
282. Beaglehole, B., et al., *Psychological distress and psychiatric disorder after natural disasters: systematic review and meta-analysis.* Br J Psychiatry, 2018. **213**(6): p. 716-722.
283. *Office of the United Nations High Commissioner for Human Rights Analytical Study on the Impacts of Climate Change on the Right to Health. [2020-02-10].* https://www.ohchr.org/EN/Issues/HRAndClimateChange/Pages/StudyImpact.aspx*. Accessed April 2020.*
284. Goldmann, E. and S. Galea, *Mental health consequences of disasters.* Annu Rev Public Health, 2014. **35**(1): p. 169-83.
285. Johannesson, K.B., H. Arinell, and F.K. Arnberg, *Six years after the wave. Trajectories of posttraumatic stress following a natural disaster.* J Anxiety Disord, 2015. **36**: p. 15-24.
286. Kar, N. and B.K. Bastia, *Post-traumatic stress disorder, depression and generalised anxiety disorder in adolescents after a natural disaster: a study of comorbidity.* Clin Pract Epidemiol Ment Health, 2006. **2**: p. 17.
287. Yelland, C., et al., *Bushfire impact on youth.* J Trauma Stress, 2010. **23**(2): p. 274-7.
288. Marthoenis, M., et al., *Prevalence, comorbidity and predictors of post-traumatic stress disorder, depression, and anxiety in adolescents following an earthquake.* Asian J Psychiatr, 2019. **43**: p. 154-159.
289. Marshall, G.N., et al., *Psychiatric disorders among adults seeking emergency disaster assistance after a wildland-urban interface fire.* Psychiatr Serv, 2007. **58**(4): p. 509-14.
290. Aslam, N. and A. Kamal, *Stress, Anxiety, Depression, and Posttraumatic Stress Disorder among General Population Affected by Floods in Pakistan.* Pakistan journal of medical research, 2016. **2016**: p. 29-32.
291. Foa, E.B., D.J. Stein, and A.C. McFarlane, *Symptomatology and psychopathology of mental health problems after disaster.* J Clin Psychiatry, 2006. **67 Suppl 2**: p. 15-25.

292. Geng, F., et al., *A Prospective Study of Psychiatric Symptoms Among Adolescents After the Wenchuan Earthquake.* J Trauma Stress, 2018. **31**(4): p. 499-508.
293. Farooqui, M., et al., *Posttraumatic stress disorder: a serious post-earthquake complication.* Trends Psychiatry Psychother, 2017. **39**(2): p. 135-143.
294. Fernandez, A., et al., *Flooding and mental health: a systematic mapping review.* PLoS One, 2015. **10**(4): p. e0119929.
295. Hetherington, E., et al., *Risk and Protective Factors for Mental Health and Community Cohesion After the 2013 Calgary Flood.* Disaster Med Public Health Prep, 2018. **12**(4): p. 470-477.
296. Chew, N.W.S., et al., *A multinational, multicentre study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak.* Brain Behav Immun, 2020. **88**: p. 559-565.
297. Hao, F., et al., *Do psychiatric patients experience more psychiatric symptoms during COVID-19 pandemic and lockdown? A case-control study with service and research implications for immunopsychiatry.* Brain, behavior, and immunity, 2020. **87**: p. 100-106.
298. *Ibrahim D. Government of Canada (Statistics Canada) 2016. Apr 13. Canadians' experiences with emergencies and disasters, 2014 https://www150.statcan.gc.ca/n1/pub/85-002-x/2016001/article/14469-eng.htm. Accessed 2020-02-10.*
299. Agyapong, V.I., et al., *Perception of patients with alcohol use disorder and comorbid depression about the usefulness of supportive text messages.* Technol Health Care, 2013. **21**(1): p. 31-9.
300. Agyapong, V.I.O., *Coronavirus Disease 2019 Pandemic: Health System and Community Response to a Text Message (Text4Hope) Program Supporting Mental Health in Alberta.* Disaster Med Public Health Prep, 2020: p. 1-2.
301. Spitzer, R.L., et al., *A brief measure for assessing generalized anxiety disorder: the GAD-7.* Arch Intern Med, 2006. **166**(10): p. 1092-7.
302. Cohen, S., T. Kamarck, and R. Mermelstein, *A global measure of perceived stress.* Journal of Health and Social Behavior, 1983. **24**(4): p. 385-396.
303. Kroenke, K., R.L. Spitzer, and J.B. Williams, *The PHQ-9: validity of a brief depression severity measure.* J Gen Intern Med, 2001. **16**(9): p. 606-13.
304. Weathers, F.W., Litz, B.T., Keane, T.M., Palmieri, P.A., Marx, B.P., Schnurr, P.P. . *The PTSD Checklist for DSM-5 (PCL-5). Scale available from the National Center for PTSD*. 2013; Available from: www.ptsd.va.gov Accessed December12, 2020.
305. Bejerot, S., et al., *The Brief Obsessive-Compulsive Scale (BOCS): a self-report scale for OCD and obsessive-compulsive related disorders.* Nordic journal of psychiatry, 2014. **68**(8): p. 549-559.
306. *Braid T. Todayville Edmonton. 2020. May 14. You are NOT alone! Text4Hope aims to help Albertans shoot down the Covid-19 Blues https://www.todayville.com/edmonton/you-are-not-alone-text4hope-aims-to-help-albertans-shoot-down-the-covid-19-blues/ Accessed June 8, 2020.*
307. *Frequently Asked Questions – RE-AIM. [2020-04-07]. http://www.re-aim.org/about/frequently-asked-questions/.*
308. *Health Quality Council of Alberta The Alberta Quality Matrix for Health. https://hqca.ca/about/how-we-work/the-alberta-quality-matrix-for-health-1/ Accessed [2020-04-07].*
309. Agyapong, V.I.O., et al., *Prevalence Rates and Predictors of Generalized Anxiety Disorder Symptoms in Residents of Fort McMurray Six Months After a Wildfire.* Front Psychiatry, 2018. **9**: p. 345.
310. Agyapong, V.I., D.M. McLoughlin, and C.K. Farren, *Six-months outcomes of a randomised trial of supportive text messaging for depression and comorbid alcohol use disorder.* J Affect Disord, 2013. **151**(1): p. 100-4.
311. Ng, C., et al., *APEC digital hub for mental health.* The Lancet Psychiatry, 2017. **4**(3): p. e3-e4.

312. Proudfoot, J.G., et al., *Mechanisms underpinning effective peer support: a qualitative analysis of interactions between expert peers and patients newly-diagnosed with bipolar disorder.* BMC Psychiatry, 2012. **12**: p. 196.
313. Jacobson, N., L. Trojanowski, and C.S. Dewa, *What do peer support workers do? A job description.* BMC Health Serv Res, 2012. **12**: p. 205.
314. Onken, S.J., et al., *An analysis of the definitions and elements of recovery: a review of the literature.* Psychiatr Rehabil J, 2007. **31**(1): p. 9-22.
315. Myrick, K. and P. Del Vecchio, *Peer support services in the behavioral healthcare workforce: State of the field.* Psychiatr Rehabil J, 2016. **39**(3): p. 197-203.
316. Shalaby, R.A.H. and V.I.O. Agyapong, *Peer Support in Mental Health: Literature Review.* JMIR Ment Health, 2020. **7**(6): p. e15572.
317. Lloyd-Evans, B., et al., *A systematic review and meta-analysis of randomised controlled trials of peer support for people with severe mental illness.* BMC Psychiatry, 2014. **14**: p. 39.
318. Agyapong, V.I.O., et al., *Randomized controlled pilot trial of supportive text messages for patients with depression.* BMC Psychiatry, 2017. **17**(1): p. 286.
319. Cusick, J. *Luminate Wellness. What is Peer Support? URL: http://www.luminatewellness.com/peer-support-training#:~:text=Foundations%20of%20Support%3A%20A%20Peer%20Perspective&text=It%20is%20written%20to%20support,unintentionally%20cause%20harm%20to%20someone. Accessed December 27, 2020*.
320. *Alberta Health Services. Text4Support Information Survey & Consent. URL: https://survey.albertahealthservices.ca/T4Sjoin# Accessed December 28, 2020*.
321. Giffort, D., et al., *Construction of a scale to measure consumer recovery.* Springfield, IL: Illinois Office of Mental Health, 1995. **10**: p. 15487760500339360.
322. Corrigan, P.W., et al., *Recovery as a Psychological Construct.* Community Mental Health Journal, 1999. **35**(3): p. 231-239.
323. Salzer, M.S. and E. Brusilovskiy, *Advancing recovery science: reliability and validity properties of the Recovery Assessment Scale.* Psychiatr Serv, 2014. **65**(4): p. 442-53.
324. Lloyd, C., et al., *The association between leisure motivation and recovery: A pilot study.* Australian Occupational Therapy Journal, 2007. **54**(1): p. 33-41.
325. Huguelet, P., et al., *A Randomized Trial of Spiritual Assessment of Outpatients With Schizophrenia: Patients' and Clinicians' Experience.* Psychiatric Services, 2011. **62**(1): p. 79-86.
326. Hancock, N., A. Bundy, and A. Honey, *Recovery Assessment Scale - Domains & Stages (RAS-DS)*. 2015.
327. Yazdani, K., et al., *Impact of employment on recovery among individuals who are homeless with severe mental illness: Vancouver at home/Chez Soi Trial*. 2019.
328. Haynes, R.B., *Clinical epidemiology: how to do clinical practice research*. 2012: Lippincott williams & wilkins.
329. *Statistics I.S. IBM SPSS Statistics for Windows, Version 20.0. IBM Corp; Armonk, NY, USA: 2011.*
330. Gillard, S., et al., *Peer support for discharge from inpatient to community mental health services: Study protocol clinical trial (SPIRIT Compliant).* Medicine, 2020. **99**(10): p. e19192-e19192.
331. Simpson, A., et al., *Results of a pilot randomised controlled trial to measure the clinical and cost effectiveness of peer support in increasing hope and quality of life in mental health patients discharged from hospital in the UK.* BMC psychiatry, 2014. **14**: p. 30-30.
332. Scanlan, J.N., N. Hancock, and A. Honey, *Evaluation of a peer-delivered, transitional and post-discharge support program following psychiatric hospitalisation.* BMC Psychiatry, 2017. **17**(1): p. 307.

333. Lawn, S., A. Smith, and K. Hunter, *Mental health peer support for hospital avoidance and early discharge: An Australian example of consumer driven and operated service.* Journal of Mental Health, 2009. **17**(5): p. 498-508.
334. Sledge, W.H., et al., *Effectiveness of peer support in reducing readmissions of persons with multiple psychiatric hospitalizations.* Psychiatr Serv, 2011. **62**(5): p. 541-4.
335. Ben-Zeev, D., S.M. Kaiser, and I. Krzos, *Remote "hovering" with individuals with psychotic disorders and substance use: feasibility, engagement, and therapeutic alliance with a text-messaging mobile interventionist.* Journal of dual diagnosis, 2014. **10**(4): p. 197-203.
336. Depp, C.A., et al., *Mobile interventions for severe mental illness: design and preliminary data from three approaches.* The Journal of nervous and mental disease, 2010. **198**(10): p. 715-721.
337. Granholm, E., et al., *Mobile Assessment and Treatment for Schizophrenia (MATS): a pilot trial of an interactive text-messaging intervention for medication adherence, socialization, and auditory hallucinations.* Schizophrenia bulletin, 2012. **38**(3): p. 414-425.
338. Berrouiguet, S., et al., *Fundamentals for Future Mobile-Health (mHealth): A Systematic Review of Mobile Phone and Web-Based Text Messaging in Mental Health.* J Med Internet Res, 2016. **18**(6): p. e135.
339. Goodwin, N. and S. Lawton-Smith, *Integrating care for people with mental illness: the Care Programme Approach in England and its implications for long-term conditions management.* International journal of integrated care, 2010. **10**: p. e040-e040.
340. Hickie, I.B., et al., *Right care, first time: a highly personalised and measurement-based care model to manage youth mental health.* Med J Aust, 2019. **211 Suppl 9**: p. S3-s46.
341. Faessler, L., et al., *Psychological distress in medical patients 30 days following an emergency department admission: results from a prospective, observational study.* BMC Emergency Medicine, 2016. **16**(1): p. 33.
342. Chavasiri, S., *Depression and Quality of Life in Spinal Cord Injury Patients Living in the Community After Hospital Discharge.* Siriraj Medical Journal, 2020. **72**(1): p. 59-66.
343. Chung, C.R., et al., *Cognitive Impairment and Psychological Distress at Discharge from Intensive Care Unit.* Psychiatry investigation, 2017. **14**(3): p. 376-379.
344. Vlake, J.H., et al., *Psychological distress and health-related quality of life in patients after hospitalization during the COVID-19 pandemic: A single-center, observational study.* PLOS ONE, 2021. **16**(8): p. e0255774.
345. Walter, F., et al., *Multiple adverse outcomes following first discharge from inpatient psychiatric care: a national cohort study.* The Lancet Psychiatry, 2019. **6**(7): p. 582-589.
346. Loch, A.A., *Discharged from a mental health admission ward: is it safe to go home? A review on the negative outcomes of psychiatric hospitalization.* Psychology research and behavior management, 2014. **7**: p. 137-145.
347. Large, M., et al., *Risk Factors for Suicide Within a Year of Discharge from Psychiatric Hospital: A Systematic Meta-Analysis.* Australian & New Zealand Journal of Psychiatry, 2011. **45**(8): p. 619-628.
348. Lorentzen, V., et al., *CORE-OM as a routine outcome measure for adolescents with emotional disorders: factor structure and psychometric properties.* BMC psychology, 2020. **8**(1): p. 86-86.
349. Barkham, M., et al., *A core approach to practice-based evidence: A brief history of the origins and applications of the CORE-OM and CORE System.* Counselling and Psychotherapy Research, 2006. **6**(1): p. 3-15.
350. Barkham, M., et al., *Service profiling and outcomes benchmarking using the CORE-OM: Toward practice-based evidence in the psychological therapies.* Journal of Consulting and Clinical Psychology, 2001. **69**(2): p. 184-196.

351. Aguilera, A. and R.F. Muñoz, *Text Messaging as an Adjunct to CBT in Low-Income Populations: A Usability and Feasibility Pilot Study.* Professional psychology, research and practice, 2011. **42**(6): p. 472-478.
352. Kilbourne, A.M., et al., *Measuring and improving the quality of mental health care: a global perspective.* World psychiatry : official journal of the World Psychiatric Association (WPA), 2018. **17**(1): p. 30-38.
353. Roe, D., M. Slade, and N. Jones, *The utility of patient-reported outcome measures in mental health.* World psychiatry : official journal of the World Psychiatric Association (WPA), 2022. **21**(1): p. 56-57.
354. Davidson, L. and J. Tondora, *Person-centred care planning as foundational to clinical practice.* World psychiatry : official journal of the World Psychiatric Association (WPA), 2022. **21**(1): p. 1-2.
355. Lyne, K.J., et al., *Dimensions of variation on the CORE-OM.* Br J Clin Psychol, 2006. **45**(Pt 2): p. 185-203.
356. Falkenström, F., et al., *Factor analysis of the Clinical Outcomes in Routine Evaluation - Outcome Measures (CORE-OM) in a Kenyan sample.* BMC psychology, 2018. **6**(1): p. 48-48.
357. *Outcome evaluation (Core report) 2011-2012 Counselling services. Available at file:///C:/Users/reham/Downloads/OutcomeReport2011-2012%20(1).pdf Accessed on July 21, 2021.*
358. Sales, C.M., et al., *Capturing and missing the patient's story through outcome measures: A thematic comparison of patient-generated items in PSYCHLOPS with CORE-OM and PHQ-9.* Health expectations : an international journal of public participation in health care and health policy, 2018. **21**(3): p. 615-619.
359. Brand, C., et al., *A national evaluation of the Irish public health counselling in primary care service- examination of initial effectiveness data.* BMC psychiatry, 2021. **21**(1): p. 227-227.
360. Evans, C., et al., *Towards a standardised brief outcome measure: Psychometric properties and utility of the CORE–OM.* British Journal of Psychiatry, 2002. **180**(1): p. 51-60.
361. *IBM. IBM support. Release notes - IBM® SPSS® Statistics 25.0. URL: https://www.ibm.com/support/pages/release-notes-ibm%C2%AE-spss%C2%AE-statistics-250 Accessed December 8, 2020.*
362. Ruxton, G.D., *The unequal variance t-test is an underused alternative to Student's t-test and the Mann–Whitney U test.* Behavioral Ecology, 2006. **17**(4): p. 688-690.
363. Serralta, F.B., M.R. Zibetti, and C. Evans, *Psychological Distress of University Workers during COVID-19 Pandemic in Brazil.* International journal of environmental research and public health, 2020. **17**(22): p. 8520.
364. Zeldovich, M. and R.W. Alexandrowicz, *Comparing outcomes: The Clinical Outcome in Routine Evaluation from an international point of view.* Int J Methods Psychiatr Res, 2019. **28**(3): p. e1774.
365. Werbart, A., et al., *Everyday evidence: Outcomes of psychotherapies in Swedish public health services.* Psychotherapy (Chic), 2013. **50**(1): p. 119-30.
366. *World Health Organization. Depression and other common mental disorders: global health estimates. 2017 Licence: CC BY-NC-SA 3.0 IGO URl: https://apps.who.int/iris/bitstream/handle/10665/254610/WHO-MSD-MER-2017.2-eng.pdf;jsessionid=9CB70AF65B16E393152C34AF19CBB754?sequence=1*
367. Gibbard, I. and T. Hanley, *A five-year evaluation of the effectiveness of person-centred counselling in routine clinical practice in primary care.* Counselling and Psychotherapy Research, 2008. **8**: p. 215-222.

368. Barkham, M., et al., *Psychological treatment outcomes in routine NHS services: what do we mean by treatment effectiveness?* Psychol Psychother, 2012. **85**(1): p. 1-16.
369. Agyapong, V.I.O., et al., *Randomized controlled pilot trial of supportive text messages for patients with depression.* BMC Psychiatry, 2017. **17**(1): p. 286.
370. Bauer, S., et al., *Technology-enhanced maintenance of treatment gains in eating disorders: efficacy of an intervention delivered via text messaging.* J Consult Clin Psychol, 2012. **80**(4): p. 700-6.
371. Pijnenborg, G.H.M., et al., *The efficacy of SMS text messages to compensate for the effects of cognitive impairments in schizophrenia.* British Journal of Clinical Psychology, 2010. **49**(2): p. 259-274.
372. O'Reilly, H., et al., *Alcohol Use Disorder and Comorbid Depression: A Randomized Controlled Trial Investigating the Effectiveness of Supportive Text Messages in Aiding Recovery.* Alcohol Alcohol, 2019. **54**(5): p. 551-558.
373. Saleem, J.J., et al., *Veterans' response to an automated text messaging protocol during the COVID-19 pandemic.* J Am Med Inform Assoc, 2020. **27**(8): p. 1300-1305.
374. Agyapong, V.I.O., et al., *Mental Health Outreach via Supportive Text Messages during the COVID-19 Pandemic: Improved Mental Health and Reduced Suicidal Ideation after Six Weeks in Subscribers of Text4Hope Compared to a Control Population.* Int J Environ Res Public Health, 2021. **18**(4).
375. *Mental Health Foundation. Peer Support, 2012 URL: https://www.mentalhealth.org.uk/sites/default/files/need_2_know_peer_support1.pdf [accessed 2021-24-7].*
376. McBeath, M., M.T.B. Drysdale, and N. Bohn, *Work-Integrated Learning and the Importance of Peer Support and Sense of Belonging.* Education & Training, 2018. **60**(1): p. 39-53.
377. Burke, E.M., et al., *Providing mental health peer support 2: Relationships with empowerment, hope, recovery, quality of life and internalised stigma.* International Journal of Social Psychiatry, 2018. **64**(8): p. 745-755.
378. Johnson, S., et al., *Peer-supported self-management for people discharged from a mental health crisis team: a randomised controlled trial.* Lancet, 2018. **392**(10145): p. 409-418.
379. Rodgers, M., et al., *Integrated Care to Address the Physical Health Needs of People with Severe Mental Illness: A Mapping Review of the Recent Evidence on Barriers, Facilitators and Evaluations.* International journal of integrated care, 2018. **18**(1): p. 9-9.
380. Dorgo, S., K.M. Robinson, and J. Bader, *The effectiveness of a peer-mentored older adult fitness program on perceived physical, mental, and social function.* J Am Acad Nurse Pract, 2009. **21**(2): p. 116-22.
381. Reynolds, W., et al., *The effects of a transitional discharge model for psychiatric patients.* Journal of Psychiatric and Mental Health Nursing, 2004. **11**(1): p. 82-88.
382. Eboreime, E., et al., *Reducing readmission rates for individuals discharged from acute psychiatric care in Alberta using peer and text message support: Protocol for an innovative supportive program.* BMC Health Services Research, 2022. **22**(1): p. 332.
383. Geffen, L.N., et al., *Peer-to-peer support model to improve quality of life among highly vulnerable, low-income older adults in Cape Town, South Africa.* BMC geriatrics, 2019. **19**(1): p. 279-279.
384. Haas, K., A. Martin, and K.T. Park, *Text Message Intervention (TEACH) Improves Quality of Life and Patient Activation in Celiac Disease: A Randomized Clinical Trial.* The Journal of pediatrics, 2017. **185**: p. 62-67.e2.

385. *The WHOQOL Group. WHOQOL-BREF Introduction, Administration, Scoring And Generic Version of The Assessment1996 May 9, 2014. Available from: http://www.who.int/mental_health/media/en/76.pdf Accessed on September 23, 2021.*
386. Purba, F.D., et al., *Quality of life of the Indonesian general population: Test-retest reliability and population norms of the EQ-5D-5L and WHOQOL-BREF.* PloS one, 2018. **13**(5): p. e0197098-e0197098.
387. Shalaby, R., et al., *Gender Differences in Satisfaction With a Text Messaging Program (Text4Hope) and Anticipated Receptivity to Technology-Based Health Support During the COVID-19 Pandemic: Cross-sectional Survey Study.* JMIR Mhealth Uhealth, 2021. **9**(4): p. e24184.
388. Everitt, H.A., et al., *Assessing telephone-delivered cognitive-behavioural therapy (CBT) and web-delivered CBT versus treatment as usual in irritable bowel syndrome (ACTIB): a multicentre randomised trial.* Gut, 2019. **68**(9): p. 1613-1623.
389. Stamboglis, N. and R. Jacobs, *Factors Associated with Patient Satisfaction of Community Mental Health Services: A Multilevel Approach.* Community mental health journal, 2020. **56**(1): p. 50-64.
390. Torous, J., et al., *Utilizing a Personal Smartphone Custom App to Assess the Patient Health Questionnaire-9 (PHQ-9) Depressive Symptoms in Patients With Major Depressive Disorder.* JMIR Mental Health, 2015. **2**(1): p. e8.
391. Reis, J., et al., *Patients' expectations for and experiences with primary healthcare services received from a patient centered medical home.* Patient Education and Counseling, 2020. **103**(6): p. 1223-1229.
392. Noble, L.M., B.C. Douglas, and S.P. Newman, *What do patients expect of psychiatric services? A systematic and critical review of empirical studies.* Soc Sci Med, 2001. **52**(7): p. 985-98.
393. Sharma, A., et al., *A Consensus-Based Checklist for Reporting of Survey Studies (CROSS).* Journal of General Internal Medicine, 2021. **36**(10): p. 3179-3187.
394. Tong, A., P. Sainsbury, and J. Craig, *Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups.* International Journal for Quality in Health Care, 2007. **19**(6): p. 349-357.
395. Thorne, S., et al., *Qualitative metasynthesis: reflections on methodological orientation and ideological agenda.* Qual Health Res, 2004. **14**(10): p. 1342-65.
396. Rathbone, A.L. and J. Prescott, *The Use of Mobile Apps and SMS Messaging as Physical and Mental Health Interventions: Systematic Review.* J Med Internet Res, 2017. **19**(8): p. e295.
397. Shalaby, R., et al., *Prevalence, Demographic, and Clinical Correlates of Likely PTSD in Subscribers of Text4Hope during the COVID-19 Pandemic.* Int J Environ Res Public Health, 2021. **18**(12).
398. Alimoradi, Z., et al., *Sleep problems during COVID-19 pandemic and its' association to psychological distress: A systematic review and meta-analysis.* EClinicalMedicine, 2021. **36**: p. 100916-100916.
399. Berrouiguet, S., et al., *Toward mHealth Brief Contact Interventions in Suicide Prevention: Case Series From the Suicide Intervention Assisted by Messages (SIAM) Randomized Controlled Trial.* JMIR mHealth and uHealth, 2018. **6**(1): p. e8-e8.
400. Mayer, G., et al., *Acceptance and Expectations of Medical Experts, Students, and Patients Toward Electronic Mental Health Apps: Cross-Sectional Quantitative and Qualitative Survey Study.* JMIR mental health, 2019. **6**(11): p. e14018-e14018.
401. Wright, J.H., et al., *Computer-Assisted Cognitive-Behavior Therapy for Depression: A Systematic Review and Meta-Analysis.* J Clin Psychiatry, 2019. **80**(2).
402. Marko-Holguin, M., et al., *A Two-Way Interactive Text Messaging Application for Low-Income Patients with Chronic Medical Conditions: Design-Thinking Development Approach.* JMIR mHealth and uHealth, 2019. **7**(5): p. e11833-e11833.

403. Rasalingam, A., J. Clench-Aas, and R.K. Raanaas, *Peer Victimization and Related Mental Health Problems in Early Adolescence: The Mediating Role of Parental and Peer Support.* Journal of Early Adolescence, 2017. **37**(8): p. 1142-1162.
404. Mohr, D.C., et al., *Effect of telephone-administered vs face-to-face cognitive behavioral therapy on adherence to therapy and depression outcomes among primary care patients: a randomized trial.* JAMA, 2012. **307**(21): p. 2278-85.
405. MacDougall, S., et al., *Text Message Interventions in Adolescent Mental Health and Addiction Services: Scoping Review.* JMIR Ment Health, 2021. **8**(1): p. e16508.
406. Agyapong, V.I.O., *Coronavirus Disease 2019 Pandemic: Health System and Community Response to a Text Message (Text4Hope) Program Supporting Mental Health in Alberta.* Disaster Med Public Health Prep, 2020. **14**(5): p. e5-e6.
407. Latif, E., *The impact of economic downturn on mental health in Canada.* International Journal of Social Economics, 2015. **42**(1): p. 33-46.
408. Moosavi, S., et al., *Mental Health Effects in Primary Care Patients 18 Months After a Major Wildfire in Fort McMurray: Risk Increased by Social Demographic Issues, Clinical Antecedents, and Degree of Fire Exposure.* Frontiers in psychiatry, 2019. **10**: p. 683-683.
409. Brown, M.R.G., et al., *After the Fort McMurray wildfire there are significant increases in mental health symptoms in grade 7-12 students compared to controls.* BMC Psychiatry, 2019. **19**(1): p. 18.
410. Wang, C., et al., *Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China.* International journal of environmental research and public health, 2020. **17**(5): p. 1729.
411. Van Bortel, T., et al., *Psychosocial effects of an Ebola outbreak at individual, community and international levels.* Bulletin of the World Health Organization, 2016. **94**(3): p. 210-214.
412. Van Bortel, T., et al., *Psychosocial effects of an Ebola outbreak at individual, community and international levels.* Bull World Health Organ, 2016. **94**(3): p. 210-4.
413. Asgary, R., et al., *Ebola policies that hinder epidemic response by limiting scientific discourse.* Am J Trop Med Hyg, 2015. **92**(2): p. 240-241.
414. Horton, R., *Offline: 2019-nCoV—“A desperate plea&#x201d.* The Lancet, 2020. **395**(10222): p. 400.
415. *Alberta Health Services. Text4Hope Supporting Mental Health & Wellness in a Time of Stress & Isolation. URL: https://www.albertahealthservices.ca/topics/Page17019.aspx.* 2020.
416. Kroenke, K. and R. Spitzer, *The PHQ-9: A New Depression Diagnostic and Severity Measure.* Psychiatric Annals, 2002. **32**: p. 509-521.
417. Kim, Y.E. and B. Lee, *The Psychometric Properties of the Patient Health Questionnaire-9 in a Sample of Korean University Students.* Psychiatry investigation, 2019. **16**(12): p. 904-910.
418. *(IBM Release Notes - IBM® SPSS® Statistics 26.0) URL: https://www.ibm.com/support/pages/release-notes-ibm%C2%AE-spss%C2%AE-statistics-260. Accessed on April 23, 2020.*
419. *Alberta. Update 9: COVID-19 pandemic in Alberta (March 22 at 3:30 p.m.). URL: https://www.alberta.ca/release.cfm?xID=698982A0AAF92-BB89-8CFB-A8A0955224EB8F6D.* 2020.
420. *Alberta. Update 11: COVID-19 pandemic in Alberta (March 24 at 5:30 p.m.). URL: https://www.alberta.ca/release.cfm?xID=6991495C078D0-94B5-A5E1-368E71969C52907A.* 2020.
421. *Alberta, Update 16: COVID-19 pandemic in Alberta (March 29 at 5:30 p.m.). ULI: https://www.alberta.ca/release.cfm?xID=6995496444280-A170-CFA9-FE8A1EFC9B1B348C.* 2020.

422. Hawryluck, L., et al., *SARS control and psychological effects of quarantine, Toronto, Canada.* Emerging infectious diseases, 2004. **10**(7): p. 1206-1212.
423. Lai, J., et al., *Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019.* JAMA network open, 2020. **3**(3): p. e203976-e203976.
424. Burker, E.J., et al., *Planning helps, behavioral disengagement does not: coping and depression in the spouses of heart transplant candidates.* Clinical Transplantation, 2005. **19**(5): p. 653-658.
425. Wong, T.W., et al., *The psychological impact of severe acute respiratory syndrome outbreak on healthcare workers in emergency departments and how they cope.* Eur J Emerg Med, 2005. **12**(1): p. 13-8.
426. Lim, G.Y., et al., *Prevalence of Depression in the Community from 30 Countries between 1994 and 2014.* Scientific Reports, 2018. **8**(1): p. 2861.
427. Carter, J.D., et al., *The relationship of demographic, clinical, cognitive and personality variables to the discrepancy between self and clinician rated depression.* Journal of Affective Disorders, 2010. **124**(1): p. 202-206.
428. Enns, M.W., D.K. Larsen, and B.J. Cox, *Discrepancies between self and observer ratings of depression: The relationship to demographic, clinical and personality variables.* Journal of Affective Disorders, 2000. **60**(1): p. 33-41.
429. *Mental Health Commission of Canada (2013). Making the case for investing in mental health in Canada. URL: https://cmha.ca/fast-facts-about-mental-illness.*
430. Rizvi, S.J., et al., *Depression and employment status in primary and tertiary care settings.* Canadian journal of psychiatry. Revue canadienne de psychiatrie, 2015. **60**(1): p. 14-22.
431. Hämmig, O., *Health risks associated with social isolation in general and in young, middle and old age.* PloS one, 2019. **14**(7): p. e0219663-e0219663.
432. Barger, S.D., N. Messerli-Bürgy, and J. Barth, *Social relationship correlates of major depressive disorder and depressive symptoms in Switzerland: nationally representative cross sectional study.* BMC public health, 2014. **14**: p. 273-273.
433. Waring, E.M., *The role of marital therapy in the treatment of depressed married women.* Can J Psychiatry, 1994. **39**(9): p. 568-71.
434. Hajiheidari, M., M. Sharifi, and F. Khorvash, *The effect of interpersonal psychotherapy on marriage adaptive and postpartum depression in isfahan.* Int J Prev Med, 2013. **4**(Suppl 2): p. S256-61.
435. Madsen, J.W., L.M. Tomfohr-Madsen, and B.D. Doss, *The Impact of Couple Therapy on Service Utilization among Military Veterans: The Moderating Roles of Pretreatment Service Utilization and Premature Termination.* Family Process, 2017. **56**(3): p. 620-635.
436. Agyapong, V.I.O., et al., *Text4Hope: Receiving Daily Supportive Text Messages for Three Months during the COVID-19 Pandemic Reduces Stress, Anxiety, and Depression.* Disaster Medicine and Public Health Preparedness, 2021: p. 1-15.
437. Osiogo, F., et al., *COVID-19 pandemic: demographic and clinical correlates of disturbed sleep among 6,041 Canadians.* Int J Psychiatry Clin Pract, 2021: p. 1-8.
438. Mrklas, K., et al., *Prevalence of Perceived Stress, Anxiety, Depression, and Obsessive-Compulsive Symptoms in Health Care Workers and Other Workers in Alberta During the COVID-19 Pandemic: Cross-Sectional Survey.* JMIR Ment Health, 2020. **7**(9): p. e22408.
439. Abba-Aji, A., et al., *COVID-19 Pandemic and Mental Health: Prevalence and Correlates of New-Onset Obsessive-Compulsive Symptoms in a Canadian Province.* Int J Environ Res Public Health, 2020. **17**(19): p. 6986.
440. Hrabok, M., et al., *Mental Health Outreach via Supportive Text Messages during the COVID-19 Pandemic: One-week Prevalence and Correlates of Anxiety Symptoms.* Can J Psychiatry, 2021. **66**(1): p. 59-61.

441. Yehuda, R., *Post-traumatic stress disorder.* New England journal of medicine, 2002. **346**(2): p. 108-114.
442. Diagnostic, A., *statistical Manual of mental disorders–Fifth edition (DSM-5).* Edisi ke-5. Washington DC: American Psychiatric Association, 2013.
443. Spitzer, R.L., et al., *DSM-IV-TR casebook: A learning companion to the diagnostic and statistical manual of mental disorders, text rev*. 2002: American Psychiatric Publishing, Inc.
444. Roberts, A.L., et al., *Race/ethnic differences in exposure to traumatic events, development of post-traumatic stress disorder, and treatment-seeking for post-traumatic stress disorder in the United States.* Psychol Med, 2011. **41**(1): p. 71-83.
445. Ogle, C.M., D.C. Rubin, and I.C. Siegler, *Cumulative exposure to traumatic events in older adults.* Aging & Mental Health, 2014. **18**(3): p. 316-325.
446. Atwoli, L., et al., *Epidemiology of posttraumatic stress disorder: prevalence, correlates and consequences.* Current opinion in psychiatry, 2015. **28**(4): p. 307.
447. *Government of Canada. Federal Framework on Posttraumatic Stress Disorder: Recognition, collaboration and support. URL: https://www.canada.ca/en/public-health/services/publications/healthy-living/federal-framework-post-traumatic-stress-disorder.html Accessed December, 26, 2020.*
448. Van Ameringen, M., et al., *Post-Traumatic Stress Disorder in Canada.* CNS Neuroscience & Therapeutics, 2008. **14**(3): p. 171-181.
449. Nishiura, H., et al., *The extent of transmission of novel coronavirus in Wuhan, China, 2020*. 2020, Multidisciplinary Digital Publishing Institute.
450. Peeri, N.C., et al., *The SARS, MERS and novel coronavirus (COVID-19) epidemics, the newest and biggest global health threats: what lessons have we learned?* International journal of epidemiology, 2020.
451. Wu, A., et al., *Genome composition and divergence of the novel coronavirus (2019-nCoV) originating in China.* Cell host & microbe, 2020.
452. Guan, W.-j., et al., *Clinical characteristics of coronavirus disease 2019 in China.* New England journal of medicine, 2020. **382**(18): p. 1708-1720.
453. Asimakopoulou, E., M. Madianos, *The Prevalence of Major Depression–PTSD Comorbidity among ICU Survivors in Five General Hospitals of Athens: A Cross-sectional Study.* 2014.
454. Gavriilaki, E. and R.A. Brodsky, *Severe COVID-19 infection and thrombotic microangiopathy: success does not come easily.* British Journal of Haematology, 2020. **189**(6): p. e227-e230.
455. Kaseda, E.T. and A.J. Levine, *Post-traumatic stress disorder: A differential diagnostic consideration for COVID-19 survivors.* The Clinical Neuropsychologist, 2020. **34**(7-8): p. 1498-1514.
456. Maunder, R.G., et al., *Factors associated with the psychological impact of severe acute respiratory syndrome on nurses and other hospital workers in Toronto.* Psychosom Med, 2004. **66**(6): p. 938-42.
457. Park, H.Y., et al., *Posttraumatic stress disorder and depression of survivors 12 months after the outbreak of Middle East respiratory syndrome in South Korea.* BMC Public Health, 2020. **20**(1): p. 605.
458. Xiang, Y.-T., et al., *Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed.* The Lancet Psychiatry, 2020. **7**(3): p. 228-229.
459. *Alberta Health Services. Text4Hope Supporting Mental Health & Wellness in a Time of Stress & Isolation. URL: https://www.albertahealthservices.ca/topics/Page17019.aspx Accessed August 6, 2020. 2020.* 2020.

460. Bovin, M.J., et al., *Psychometric properties of the PTSD Checklist for Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (PCL-5) in veterans.* Psychol Assess, 2016. **28**(11): p. 1379-1391.
461. Karatzias, T., et al., *Posttraumatic Stress Symptoms and Associated Comorbidity During the COVID-19 Pandemic in Ireland: A Population-Based Study.* J Trauma Stress, 2020.
462. Shevlin, M., et al., *Anxiety, depression, traumatic stress and COVID-19-related anxiety in the UK general population during the COVID-19 pandemic.* BJPsych Open, 2020. **6**(6): p. e125.
463. Hao, F.Y., et al., *Do psychiatric patients experience more psychiatric symptoms during COVID-19 pandemic and lockdown? A case-control study with service and research implications for immunopsychiatry.* Brain Behavior and Immunity, 2020. **87**: p. 100-106.
464. Steardo, L., Jr., L. Steardo, and A. Verkhratsky, *Psychiatric face of COVID-19.* Transl Psychiatry, 2020. **10**(1): p. 261.
465. Johnson, S.U., O.V. Ebrahimi, and A. Hoffart, *PTSD symptoms among health workers and public service providers during the COVID-19 outbreak.* Plos One, 2020. **15**(10).
466. Agyapong, V.I.O., et al., *Prevalence Rates and Correlates of Likely Post-Traumatic Stress Disorder in Residents of Fort McMurray 6 Months After a Wildfire.* International Journal of Mental Health and Addiction, 2019.
467. Woodward, M.J., et al., *Social support, posttraumatic cognitions, and PTSD: The influence of family, friends, and a close other in an interpersonal and non-interpersonal trauma group.* J Anxiety Disord, 2015. **35**: p. 60-7.
468. Brooks, S.K., et al., *The psychological impact of quarantine and how to reduce it: rapid review of the evidence.* Lancet (London, England), 2020. **395**(10227): p. 912-920.
469. Gualano, M., et al., *Effects of Covid-19 Lockdown on Mental Health and Sleep Disturbances in Italy.* International Journal of Environmental Research and Public Health, 2020. **17**: p. 4779.
470. Salari, N., et al., *Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis.* Global Health, 2020. **16**(1): p. 57.
471. Motz, T.A. and C.L. Currie, *Racially-motivated housing discrimination experienced by Indigenous postsecondary students in Canada: impacts on PTSD symptomology and perceptions of university stress.* Public Health, 2019. **176**: p. 59-67.
472. Boyraz, G. and D.N. Legros, *Coronavirus Disease (COVID-19) and Traumatic Stress: Probable Risk Factors and Correlates of Posttraumatic Stress Disorder.* Journal of Loss and Trauma, 2020. **25**(6-7): p. 503-522.
473. Agyapong, V.I.O., et al. *Changes in Stress, Anxiety, and Depression Levels of Subscribers to a Daily Supportive Text Message Program (Text4Hope) During the COVID-19 Pandemic: Cross-Sectional Survey Study*. JMIR mental health, 2020. **7**, e22423 DOI: 10.2196/22423.
474. Mao, W. and V.I.O. Agyapong, *The Role of Social Determinants in Mental Health and Resilience After Disasters: Implications for Public Health Policy and Practice.* Frontiers in public health, 2021. **9**: p. 658528-658528.
475. Agyapong, V.I.O., et al., *Supportive text messages to reduce mood symptoms and problem drinking in patients with primary depression or alcohol use disorder: protocol for an implementation research study.* JMIR research protocols, 2015. **4**(2): p. e55-e55.
476. Wang, D., et al., *Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China.* JAMA, 2020.
477. Paules, C.I., H.D. Marston, and A.S. Fauci, *Coronavirus Infections-More Than Just the Common Cold.* JAMA, 2020.
478. Chen, Q., et al., *Clinical characteristics of 145 patients with corona virus disease 2019 (COVID-19) in Taizhou, Zhejiang, China.* Infection, 2020.

479. Hu, Y., et al., *Prevalence and severity of corona virus disease 2019 (COVID-19): A systematic review and meta-analysis.* J Clin Virol, 2020. **127**: p. 104371.
480. Yin, R., et al., *Concomitant neurological symptoms observed in a patient diagnosed with coronavirus disease 2019.* J Med Virol, 2020.
481. Su, L., et al., *The different clinical characteristics of corona virus disease cases between children and their families in China - the character of children with COVID-19.* Emerg Microbes Infect, 2020. **9**(1): p. 707-713.
482. Walsh, P.E., et al., *Understanding paid peer support in mental health.* Disability & Society, 2018. **33**(4): p. 579-597.
483. Yu, S., et al., *Mental Health in China: Stigma, Family Obligations, and the Potential of Peer Support.* Community Ment Health J, 2018. **54**(6): p. 757-764.
484. Shepardson, R.L., et al., *Perceived barriers and facilitators to implementation of peer support in Veterans Health Administration Primary Care-Mental Health Integration settings.* Psychol Serv, 2018.
485. Jung, F., et al., *How we should respond to the Coronavirus SARS-CoV-2 outbreak: A German perspective.* Clin Hemorheol Microcirc, 2020.
486. Roy, D., et al., *Study of knowledge, attitude, anxiety & perceived mental healthcare need in Indian population during COVID-19 pandemic.* Asian J Psychiatr, 2020. **51**: p. 102083.
487. Ramesh, N., A. Siddaiah, and B. Joseph, *Tackling Corona Virus Disease 2019 (COVID 19) in Workplaces.* Indian J Occup Environ Med, 2020. **24**(1): p. 16-18.
488. Zhang, W.R., et al., *Mental Health and Psychosocial Problems of Medical Health Workers during the COVID-19 Epidemic in China.* Psychother Psychosom, 2020: p. 1-9.
489. Wang, S., et al., *Sleep disturbances among medical workers during the outbreak of COVID-2019.* Occup Med (Lond), 2020.
490. Lucena, L., et al., *The association of insomnia and quality of life: Sao Paulo epidemiologic sleep study (EPISONO).* Sleep Health, 2020.
491. Manolis, T.A., et al., *Cardiovascular Complications of Sleep Disorders: A Better Night's Sleep for a Healthier Heart / From Bench to Bedside.* Curr Vasc Pharmacol, 2020.
492. Zvolensky, M.J., et al., *Worry among Latinx college students: relations to anxious arousal, social anxiety, general depression, and insomnia.* J Am Coll Health, 2019: p. 1-8.
493. Kling, R.N., C.B. McLeod, and M. Koehoorn, *Sleep problems and workplace injuries in Canada.* Sleep, 2010. **33**(5): p. 611-8.
494. Rockwood, K., et al., *Sleep disturbances and mortality: results from the Canadian Study of Health and Aging.* J Am Geriatr Soc, 2001. **49**(5): p. 639-41.
495. Huang, Y. and N. Zhao, *Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey.* Psychiatry Res, 2020. **288**: p. 112954.
496. Cellini, N., et al., *Changes in sleep pattern, sense of time and digital media use during COVID-19 lockdown in Italy.* J Sleep Res, 2020: p. e13074.
497. Ohayon, M., *Epidemiological study on insomnia in the general population.* Sleep, 1996. **19**(3 Suppl): p. S7-15.
498. Sutton, D.A., H. Moldofsky, and E.M. Badley, *Insomnia and health problems in Canadians.* Sleep, 2001. **24**(6): p. 665-70.
499. Morin, C.M., et al., *Prevalence of insomnia and its treatment in Canada.* Can J Psychiatry, 2011. **56**(9): p. 540-8.
500. Liu, X., M. Tang, and L. Hu, *Reliability and validity of the Pittsburgh sleep quality index.* Chinese journal of psychiatry, 1996. **29**: p. 103-107.

501. Curcio, G., et al., *Validity of the Italian version of the Pittsburgh Sleep Quality Index (PSQI).* Neurol Sci, 2013. **34**(4): p. 511-9.
502. McArdle, N., et al., *The prevalence of common sleep disorders in young adults: a descriptive population-based study.* Sleep, 2020.
503. Laver, K.E., et al., *Sleep Disturbance and Disorders within Adult Inpatient Rehabilitation Settings: A Systematic Review to Identify Both the Prevalence of Disorders and the Efficacy of Existing Interventions.* J Am Med Dir Assoc, 2020.
504. Viana, M.C. and L.H. Andrade, *Lifetime Prevalence, age and gender distribution and age-of-onset of psychiatric disorders in the Sao Paulo Metropolitan Area, Brazil: results from the Sao Paulo Megacity Mental Health Survey.* Braz J Psychiatry, 2012. **34**(3): p. 249-60.
505. Vgontzas, A.N., et al., *Chronic insomnia is associated with nyctohemeral activation of the hypothalamic-pituitary-adrenal axis: clinical implications.* J Clin Endocrinol Metab, 2001. **86**(8): p. 3787-94.
506. Carrillo-Gonzalez, A., M. Camargo-Mendoza, and L.C. Cantor-Cutiva, *Relationship Between Sleep Quality and Stress with Voice Functioning among College Professors: A Systematic Review and Meta-analysis.* J Voice, 2019.
507. Bishop, T.M., et al., *Sleep, suicide behaviors, and the protective role of sleep medicine.* Sleep Med, 2020. **66**: p. 264-270.
508. Park, W.S., K.I. Yang, and H. Kim, *Insufficient sleep and suicidal ideation: a survey of 12,046 female adolescents.* Sleep Med, 2019. **53**: p. 65-69.
509. *Statistica Population of Alberta, by Age and Sex 2019. [(accessed on 6 August 2020)]; Available online: https://www.statista.com/statistics/605969/population-of-alberta-by-age-and-sex/.*
510. *American Psychiatric Association. DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS. FIFTH EDITION. DSM-5. 2013. Available at http://repository.poltekkes-kaltim.ac.id/657/1/Diagnostic%20and%20statistical%20manual%20of%20mental%20disorders%20_%20DSM-5%20%28%20PDFDrive.com%20%29.pdf Accessed October 2, 2021.*
511. Ali, I., *COVID-19: Are We Ready for the Second Wave?* Disaster Med Public Health Prep, 2020: p. 1-3.
512. Xu, S. and Y. Li, *Beware of the second wave of COVID-19.* Lancet, 2020. **395**(10233): p. 1321-1322.
513. Dewald-Kaufmann, J., E. de Bruin, and G. Michael, *Cognitive Behavioral Therapy for Insomnia (CBT-i) in School-Aged Children and Adolescents.* Sleep Med Clin, 2019. **14**(2): p. 155-165.
514. Sadler, P., et al., *Cognitive behavior therapy for older adults with insomnia and depression: a randomized controlled trial in community mental health services.* Sleep, 2018. **41**(8).
515. Ritterband, L.M., et al., *Effect of a Web-Based Cognitive Behavior Therapy for Insomnia Intervention With 1-Year Follow-up: A Randomized Clinical Trial.* JAMA Psychiatry, 2017. **74**(1): p. 68-75.
516. Agyapong, V.I.O., et al., *Perception of patients with alcohol use disorder and comorbid depression about the usefulness of supportive text messages.* Technology and Health Care, 2013. **21**: p. 31-39.
517. Agyapong, V., *COVID-19 Pandemic: Health System and Community Response to a Text Message (Text4Hope) Program Supporting Mental Health in Alberta.* Disaster Medicine and Public Health Preparedness, 2020: p. 1-5.
518. Agyapong, V.I.O., et al., *Supportive Text Messages to Reduce Mood Symptoms and Problem Drinking in Patients With Primary Depression or Alcohol Use Disorder: Protocol for an Implementation Research Study.* JMIR Res Protoc, 2015. **4**(2): p. e55.
519. Skegg, K., *Self-harm.* Lancet, 2005. **366**(9495): p. 1471-83.

520. Ayalon, L. and S. Shiovitz-Ezra, *The relationship between loneliness and passive death wishes in the second half of life.* International Psychogeriatrics, 2011. **23**(10): p. 1677-1685.
521. Skinner, R., et al., *Suicide and self-inflicted injury hospitalizations in Canada (1979 to 2014/15).* Health promotion and chronic disease prevention in Canada : research, policy and practice, 2016. **36**(11): p. 243-251.
522. Jayaram, G., *Suicide Risk Management and Prevention*. 2015. p. 47-72.
523. Bodner, E., A. Shrira, and Y. Palgi, *YOUNGER SUBJECTIVE AGE, DAILY HASSLES, AND PASSIVE DEATH WISHES IN ADULTHOOD AND LATE LIFE.* Innovation in Aging, 2017. **1**(suppl_1): p. 709-709.
524. Kawohl, W. and C. Nordt, *COVID-19, unemployment, and suicide.* The Lancet Psychiatry, 2020. **7**(5): p. 389-390.
525. Klomek, A.B., *Suicide prevention during the COVID-19 outbreak.* The Lancet Psychiatry, 2020. **7**(5): p. 390.
526. Lee, G.R. and M. Ishii-Kuntz, *Social interaction, loneliness, and emotional well-being among the elderly.* Res Aging, 1987. **9**(4): p. 459-82.
527. Thakur, V. and A. Jain, *COVID 2019-suicides: A global psychological pandemic.* Brain, behavior, and immunity, 2020. **88**: p. 952-953.
528. McIntyre, R.S. and Y. Lee, *Projected increases in suicide in Canada as a consequence of COVID-19.* Psychiatry research, 2020: p. 113104.
529. *Skinner, R., et al., Suicide and self-inflicted injury hospitalizations in Canada (1979 to 2014/15). Health promotion and chronic disease prevention in Canada: research, policy and practice, 2016. 36(11): p. 243.*
530. Pruitt, L.D., L.S. Mcintosh, and G. Reger, *Suicide Safety Planning During a Pandemic: The Implications of COVID-19 on Coping with a Crisis.* Suicide and Life-Threatening Behavior. **n/a**(n/a).
531. Sinyor, M., M.J. Spittal, and T. Niederkrotenthaler, *Changes in Suicide and Resilience-related Google Searches during the Early Stages of the COVID-19 Pandemic.* The Canadian Journal of Psychiatry, 2020: p. 0706743720933426.
532. Gunnell, D., et al., *Suicide risk and prevention during the COVID-19 pandemic.* The Lancet Psychiatry, 2020. **7**(6): p. 468-471.
533. Bostwick, J.M. and V.S. Pankratz, *Affective Disorders and Suicide Risk: A Reexamination.* American Journal of Psychiatry, 2000. **157**(12): p. 1925-1932.
534. Monteith, L.L., et al., *Preventing Suicide in Rural Communities During the COVID-19 Pandemic.* The Journal of Rural Health, 2020.
535. Hirsch, J.K., *A review of the literature on rural suicide: risk and protective factors, incidence, and prevention.* Crisis, 2006. **27**(4): p. 189-99.
536. *World Health Organiztion. Mental health and psychosocial considerations during the COVID-19 outbreak, 18 March 2020. Geneva: World Health Organization; 2020. URL: https://www.who.int/docs/default-source/coronaviruse/mental-health-considerations.pdf . Accessed on November 28, 2020.*
537. Hotopf, M., et al., *The scope of mental health research in the COVID-19 Pandemic and its aftermath.* The British Journal of Psychiatry, 2020: p. 1-7.
538. Beland, L.-P., et al., *The Short-Term Economic Consequences of COVID-19: Occupation Tasks and Mental Health in Canada.* 2020.
539. Aquila, I., et al., *The role of the COVID-19 pandemic as a risk factor for suicide: What is its impact on the public mental health state today?* Psychological trauma : theory, research, practice and policy, 2020.

540. Santini, Z.I., et al., *Social disconnectedness, perceived isolation, and symptoms of depression and anxiety among older Americans (NSHAP): a longitudinal mediation analysis.* The Lancet Public Health, 2020. **5**(1): p. e62-e70.
541. Rana, U., *Elderly Suicides in India: An Emerging Concern during COVID-19 Pandemic.* International Psychogeriatrics, 2020: p. 1-7.
542. Thakur, V. and A. Jain, *COVID 2019-Suicides: A global psychological pandemic.* Brain, behavior, and immunity, 2020.
543. Brown, S. and D.L. Schuman, *Suicide in the Time of COVID-19: A Perfect Storm.* The journal of rural health, 2020.
544. Shalaby, R., et al., *COVID-19 Pandemic: Gender difference in satisfaction with a daily supportive text message program (Text4Hope) and anticipated receptivity for technology-based health support during emergencies-Cross Sectional Survey (Preprint).* JMIR mHealth and uHealth, 2020. **9**.
545. I.O. Agyapong, V., C. K. Farren, and D. M. McLoughlin, *Mobile Phone Text Message Interventions in Psychiatry - What are the Possibilities?* Current Psychiatry Reviews, 2011. **7**(1): p. 50-56.
546. Li, L.Q., et al., *COVID-19 patients' clinical characteristics, discharge rate, and fatality rate of meta-analysis.* J Med Virol, 2020.
547. Onder, G., G. Rezza, and S. Brusaferro, *Case-Fatality Rate and Characteristics of Patients Dying in Relation to COVID-19 in Italy.* Jama, 2020.
548. Grad, F.P., *Communicable disease and mental health: restrictions of the person.* Am J Law Med, 1986. **12**(3-4): p. 381-403.
549. López-Solà, C., et al., *Aetiological overlap between obsessive-compulsive related and anxiety disorder symptoms: multivariate twin study.* Br J Psychiatry, 2016. **208**(1): p. 26-33.
550. Ruscio, A.M., et al., *The epidemiology of obsessive-compulsive disorder in the National Comorbidity Survey Replication.* Molecular psychiatry, 2010. **15**(1): p. 53-63.
551. Karno, M., et al., *The epidemiology of obsessive-compulsive disorder in five US communities.* Arch Gen Psychiatry, 1988. **45**(12): p. 1094-9.
552. Fontenelle, L.F., M.V. Mendlowicz, and M. Versiani, *The descriptive epidemiology of obsessive-compulsive disorder.* Prog Neuropsychopharmacol Biol Psychiatry, 2006. **30**(3): p. 327-37.
553. Lochner, C., et al., *Comorbidity in obsessive–compulsive disorder (OCD): A report from the International College of Obsessive–Compulsive Spectrum Disorders (ICOCS).* Comprehensive Psychiatry, 2014. **55**(7): p. 1513-1519.
554. Fullana, M.A., et al., *Obsessions and compulsions in the community: prevalence, interference, help-seeking, developmental stability, and co-occurring psychiatric conditions.* The American journal of psychiatry, 2009. **166**(3): p. 329-336.
555. Fineberg, N.A., et al., *Early intervention for obsessive compulsive disorder: An expert consensus statement.* Eur Neuropsychopharmacol, 2019. **29**(4): p. 549-565.
556. Bobes, J., et al., *Quality of life and disability in patients with obsessive-compulsive disorder.* European Psychiatry, 2001. **16**(4): p. 239-245.
557. Cromer, K.R., N.B. Schmidt, and D.L. Murphy, *An investigation of traumatic life events and obsessive-compulsive disorder.* Behaviour Research and Therapy, 2007. **45**(7): p. 1683-1691.
558. Rosso, G., et al., *Stressful life events and obsessive–compulsive disorder: clinical features and symptom dimensions.* Psychiatry Research, 2012. **197**(3): p. 259-264.
559. *Government of Alberta Alberta Economic Indicators. Available at https://economicdashboard.alberta.ca/Population. Accessed on April , 2020.*
560. *Government of Alberta Update 17: COVID-19 pandemic in Alberta (March 30 at 5:30 p.m.). Available at https://www.alberta.ca/release.cfm?xID=69963CD9BA6AE-0981-2AB2-0CA2FAF111F464C6. Accessed on April , 2020.*

561. Magnavita, N., G. Tripepi, and R.R. Di Prinzio, *Symptoms in Health Care Workers during the COVID-19 Epidemic. A Cross-Sectional Survey.* Int J Environ Res Public Health, 2020. **17**(14).
562. Chong, M.Y., et al., *Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital.* Br J Psychiatry, 2004. **185**: p. 127-33.
563. Ramalingaswami, V., *Psychosocial Effects of the 1994 Plague Outbreak in Surat, India.* Military Medicine, 2001. **166**(suppl_2): p. 29-30.
564. Goodwin, G.M., *The overlap between anxiety, depression, and obsessive-compulsive disorder.* Dialogues in clinical neuroscience, 2015. **17**(3): p. 249-260.
565. Armstrong, T., D.H. Zald, and B.O. Olatunji, *Attentional control in OCD and GAD: specificity and associations with core cognitive symptoms.* Behaviour research and therapy, 2011. **49**(11): p. 756-762.
566. Lam, M.H., et al., *Mental morbidities and chronic fatigue in severe acute respiratory syndrome survivors: long-term follow-up.* Arch Intern Med, 2009. **169**(22): p. 2142-7.
567. Subramaniam, M., et al., *Obsessive--compulsive disorder: prevalence, correlates, help-seeking and quality of life in a multiracial Asian population.* Soc Psychiatry Psychiatr Epidemiol, 2012. **47**(12): p. 2035-43.
568. Labad, J., et al., *Gender differences in obsessive-compulsive symptom dimensions.* Depress Anxiety, 2008. **25**(10): p. 832-8.
569. Brakoulias, V., et al., *Comorbidity, age of onset and suicidality in obsessive–compulsive disorder (OCD): An international collaboration.* Comprehensive Psychiatry, 2017. **76**: p. 79-86.
570. Anholt, G.E., et al., *Age of onset in obsessive–compulsive disorder: admixture analysis with a large sample.* Psychological Medicine, 2014. **44**(1): p. 185-194.
571. Leung, G., et al., *Community psycho-behavioural surveillance and related impact on outbreak control in Hong Kong and Singapore during the SARS epidemic.* Hong Kong medical journal = Xianggang yi xue za zhi / Hong Kong Academy of Medicine, 2009. **15 Suppl 9**: p. 30-4.
572. Li, Q., et al., *Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia.* N Engl J Med, 2020. **382**(13): p. 1199-1207.
573. Li, W., et al., *Progression of Mental Health Services during the COVID-19 Outbreak in China.* Int J Biol Sci, 2020. **16**(10): p. 1732-1738.
574. Zhu, N., et al., *A Novel Coronavirus from Patients with Pneumonia in China, 2019.* N Engl J Med, 2020. **382**(8): p. 727-733.
575. *Government of Canada. Coronavirus disease (COVID-19): Outbreak update. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection.html accessed on June 16, 2020.*
576. Nicola, M., et al., *The socio-economic implications of the coronavirus pandemic (COVID-19): A review.* International Journal of Surgery, 2020. **78**: p. 185-193.
577. González-Sanguino, C., et al., *Mental health consequences during the initial stage of the 2020 Coronavirus pandemic (COVID-19) in Spain.* Brain, Behavior, and Immunity, 2020.
578. Kang, L., et al., *Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: A cross-sectional study.* Brain, Behavior, and Immunity, 2020.
579. Pappa, S., et al., *Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis.* Brain Behav Immun, 2020.
580. Su, T.-P., et al., *Prevalence of psychiatric morbidity and psychological adaptation of the nurses in a structured SARS caring unit during outbreak: A prospective and periodic assessment study in Taiwan.* Journal of Psychiatric Research, 2007. **41**(1): p. 119-130.

581. Ozamiz-Etxebarria, N., et al., *Stress, anxiety, and depression levels in the initial stage of the COVID-19 outbreak in a population sample in the northern Spain.* Cad Saude Publica, 2020. **36**(4): p. e00054020.
582. Huang, Y. and N. Zhao, *Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey.* Psychiatry Research, 2020. **288**: p. 112954.
583. Wang, Y., et al., *Study on the public psychological states and its related factors during the outbreak of coronavirus disease 2019 (COVID-19) in some regions of China.* Psychol Health Med, 2020: p. 1-10.
584. Qiu, J., et al., *A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations.* Gen Psychiatr, 2020. **33**(2): p. e100213.
585. Gao, J., et al., *Mental health problems and social media exposure during COVID-19 outbreak.* PLoS One, 2020. **15**(4): p. e0231924.
586. Agyapong, V.I.O., et al., *COVID-19: Closing the Psychological Treatment Gap during the Pandemic, a Protocol for Implementation and Evaluation of Text4Hope (a Supportive Text Message Program).* JMIR Res Protoc, 2020.
587. *IBM Corp., Armonk, N.Y., USA. URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5588246/.*
588. Onder, G., G. Rezza, and S. Brusaferro, *Case-Fatality Rate and Characteristics of Patients Dying in Relation to COVID-19 in Italy.* Jama, 2020. **323**(18): p. 1775-1776.
589. *[The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China].* Zhonghua Liu Xing Bing Xue Za Zhi, 2020. **41**(2): p. 145-151.
590. *Statista Percentage of U.S. [(accessed on 16 June 2020)];Population Who Currently Use Any Social Media from 2008 to 2019. Available online: https://www.statista.com/statistics/273476/percentage-of-us-population-with-a-social-network-profile/.*
591. *Office for National Statistics: Personal and Economic Well-Being in Great Britain: May 2020. [(accessed on 16 June 2020)]; Available online: https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/bulletins/personalandeconomicwellbeingintheuk/may2020.*
592. Agyapong, V.I.O., et al., *Cross-sectional survey evaluating Text4Mood: mobile health program to reduce psychological treatment gap in mental healthcare in Alberta through daily supportive text messages.* BMC psychiatry, 2016. **16**(1): p. 378-378.
593. Oud, M., et al., *Effectiveness of CBT for children and adolescents with depression: A systematic review and meta-regression analysis.* Eur Psychiatry, 2019. **57**: p. 33-45.
594. Brown, J.S., et al., *Outcome, costs and patient engagement for group and individual CBT for depression: a naturalistic clinical study.* Behav Cogn Psychother, 2011. **39**(3): p. 355-8.
595. Gautam, R. and M. Sharma, *2019-nCoV Pandemic: A disruptive and stressful atmosphere for Indian academic fraternity.* Brain Behav Immun, 2020.
596. Nkire N, M.K., Hrabook M, Gusnowski A, Vuong W, Surood S, Abba Aji A, Urichuk L, Greenshaw Agyapong VIO, *COVID-19 pandemic: Demographic predictors of selfisolation and quarantine on perceived stress, anxiety and depression.* Front Psych, 2020.
597. Taha, S., et al., *Intolerance of uncertainty, appraisals, coping, and anxiety: The case of the 2009 H1N1 pandemic.* British Journal of Health Psychology, 2014. **19**(3): p. 592-605.
598. Manuell, M.-E. and J. Cukor, *Mother Nature versus human nature: Public compliance with evacuation and quarantine.* Disasters, 2010. **35**: p. 417-42.
599. Williams, A.C. and H.W. Potts, *Group membership and staff turnover affect outcomes in group CBT for persistent pain.* Pain, 2010. **148**(3): p. 481-6.

600. Barbisch, D., K.L. Koenig, and F.Y. Shih, *Is There a Case for Quarantine? Perspectives from SARS to Ebola.* Disaster Med Public Health Prep, 2015. **9**(5): p. 547-53.
601. Miles, S.H., *Kaci Hickox: public health and the politics of fear.* Am J Bioeth, 2015. **15**(4): p. 17-9.
602. Brooks, S.K., et al., *The psychological impact of quarantine and how to reduce it: rapid review of the evidence.* Lancet, 2020. **395**(10227): p. 912-920.
603. Braithwaite, S. and J. Holt-Lunstad, *Romantic relationships and mental health.* Curr Opin Psychol, 2017. **13**: p. 120-125.
604. Hannighofer, J., et al., *Impact of Relationship Status and Quality (Family Type) on the Mental Health of Mothers and Their Children: A 10-Year Longitudinal Study.* Frontiers in Psychiatry, 2017. **8**(266).
605. Dush, C.M.K. and P.R. Amato, *Consequences of relationship status and quality for subjective well-being.* Journal of Social and Personal Relationships, 2005. **22**(5): p. 607-627.
606. Holt-Lunstad, J., W. Birmingham, and B.Q. Jones, *Is there something unique about marriage? The relative impact of marital status, relationship quality, and network social support on ambulatory blood pressure and mental health.* Ann Behav Med, 2008. **35**(2): p. 239-44.
607. Crosier, T., P. Butterworth, and B. Rodgers, *Mental health problems among single and partnered mothers. The role of financial hardship and social support.* Soc Psychiatry Psychiatr Epidemiol, 2007. **42**(1): p. 6-13.
608. Rousou, E., et al., *Mental health among single mothers in Cyprus: a cross-sectional descriptive correlational study.* BMC Women's Health, 2019. **19**(1): p. 67.
609. Baldridge, S., *Family stability and childhood behavioral outcomes: a critical review of the literature. .* J Fam Strengths, 2011. **11**(1): p. 1-24.
610. Cairney, J., et al., *Stress, social support and depression in single and married mothers.* Soc Psychiatry Psychiatr Epidemiol, 2003. **38**(8): p. 442-9.
611. Santini, Z.I., et al., *The association of relationship quality and social networks with depression, anxiety, and suicidal ideation among older married adults: Findings from a cross-sectional analysis of the Irish Longitudinal Study on Ageing (TILDA).* Journal of Affective Disorders, 2015. **179**: p. 134-141.
612. Cairney, J. and N. Krause, *The Social Distribution of Psychological Distress and Depression in Older Adults.* Journal of Aging and Health, 2005. **17**(6): p. 807-835.
613. Williams K, F.A., Carlson DL., *Mental status and mental health. In a handbook for the study of mental health. Social contexts, theories and systems. 2nd edition. Cambridge press, Edited by Scheid TL and Brown TN.* 2012.
614. Hawryluck, L., et al., *SARS control and psychological effects of quarantine, Toronto, Canada.* Emerg Infect Dis, 2004. **10**(7): p. 1206-12.
615. Tan, W., et al., *Is returning to work during the COVID-19 pandemic stressful? A study on immediate mental health status and psychoneuroimmunity prevention measures of Chinese workforce.* Brain, Behavior, and Immunity, 2020.
616. Agyapong VIO, H.M., Vuong W, Gusnowski A, Shalaby R, Mrklas K, Li D, Urichuck L, Snaterse M, Surood S, Cao B, Li X, Greiner R, Greenshaw A., *COVID-19: Closing the Psychological Treatment Gap during the Pandemic, a Protocol for Implementation and Evaluation of Text4Hope (a Supportive Text Message Program).* JMIR Preprints. 11/04/2020:19292, 2020.
617. Menon, M., et al., *Individual factors predicted to influence outcome in group CBT for psychosis (CBTp) and related therapies.* Front Psychol, 2015. **6**: p. 1563.
618. Elovainio, M., et al., *Contribution of risk factors to excess mortality in isolated and lonely individuals: an analysis of data from the UK Biobank cohort study.* Lancet Public Health, 2017. **2**(6): p. e260-e266.

619. Matthews, T., et al., *Lonely young adults in modern Britain: findings from an epidemiological cohort study.* Psychological medicine, 2019. **49**(2): p. 268-277.
620. O'Connor, R.C. and O.J. Kirtley, *The integrated motivational-volitional model of suicidal behaviour.* Philos Trans R Soc Lond B Biol Sci, 2018. **373**(1754).
621. Stack, S., *Suicide: media impacts in war and peace, 1910-1920.* Suicide Life Threat Behav, 1988. **18**(4): p. 342-57.
622. Hartnett, D., et al., *Supportive text messages for patients with alcohol use disorder and a comorbid depression: a protocol for a single-blind randomised controlled aftercare trial.* BMJ Open, 2017. **7**(5): p. e013587.
623. Ahmed, M.Z., et al., *Epidemic of COVID-19 in China and associated Psychological Problems.* Asian J Psychiatr, 2020. **51**: p. 102092.
624. Mazza, C., et al., *A Nationwide Survey of Psychological Distress among Italian People during the COVID-19 Pandemic: Immediate Psychological Responses and Associated Factors.* Int J Environ Res Public Health, 2020. **17**(9).
625. Zhang, J., et al., *The differential psychological distress of populations affected by the COVID-19 pandemic.* Brain Behav Immun, 2020. **87**: p. 49-50.
626. Huang, Y. and N. Zhao, *Chinese mental health burden during the COVID-19 pandemic.* Asian J Psychiatr, 2020. **51**: p. 102052.
627. Li, J., et al., *Anxiety and depression among general population in China at the peak of the COVID-19 epidemic.* World Psychiatry, 2020. **19**(2): p. 249-250.
628. Tull, M.T., et al., *Psychological Outcomes Associated with Stay-at-Home Orders and the Perceived Impact of COVID-19 on Daily Life.* Psychiatry Res, 2020. **289**: p. 113098.
629. Madani, A., S.E. Boutebal, and C.R. Bryant, *The Psychological Impact of Confinement Linked to the Coronavirus Epidemic COVID-19 in Algeria.* Int J Environ Res Public Health, 2020. **17**(10).
630. Moghanibashi-Mansourieh, A., *Assessing the anxiety level of Iranian general population during COVID-19 outbreak.* Asian J Psychiatr, 2020. **51**: p. 102076.
631. Moosavi, S., et al., *Mental Health Effects in Primary Care Patients 18 Months After a Major Wildfire in Fort McMurray: Risk Increased by Social Demographic Issues, Clinical Antecedents, and Degree of Fire Exposure.* Front Psychiatry, 2019. **10**: p. 683.
632. Harada, N., et al., *Mental health and psychological impacts from the 2011 Great East Japan Earthquake Disaster: a systematic literature review.* Disaster Mil Med, 2015. **1**: p. 17.
633. McKinzie, A.E., *In their own words: disaster and emotion, suffering, and mental health.* Int J Qual Stud Health Well-being, 2018. **13**(1): p. 1440108.
634. Zhu, N., et al., *A Novel Coronavirus from Patients with Pneumonia in China, 2019.* N Engl J Med, 2020. **382**(8): p. 727-733.
635. World Health Organization. *Timeline of WHO's response to COVID-19*. 2020 June 30, 2020 [cited 2020 July 2, 2020]; Available from: https://www.who.int/news-room/detail/29-06-2020-covidtimeline.
636. World Health Organization. *Coronavirus disease (COVID-19) Situation Report – 163*. 2020 July 1, 2020 [cited 2020 July 1, 2020]; Available from: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200701-covid-19-sitrep-163.pdf?sfvrsn=c202f05b_2.
637. World Health Organization. *Mental disorders affect one in four people* 2001 [cited 2020 July 1, 2020]; Available from: https://www.who.int/whr/2001/media_centre/press_release/en/#:~:text=Geneva%2C%204%20October%E2%80%94%20One%20in,ill%2Dhealth%20and%20disability%20worldwide.
638. Disease, G.B.D., I. Injury, and C. Prevalence, *Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories,*

1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet, 2018. **392**(10159): p. 1789-1858.
639. Lang, J.J., et al., *Global Burden of Disease Study trends for Canada from 1990 to 2016.* CMAJ, 2018. **190**(44): p. E1296-E1304.
640. Smetanin, P., Stiff, D., Briante, C., Adair, C.E., Ahmad, S. and Khan, M., *The Life and Economic Impact of Major Mental Illnesses in Canada: 2011 to 2041. RiskAnalytica, on behalf of the Mental Health Commission of Canada 2011.*, Mental Health Commission of Canada, Editor. 2011, Risk Analytica: Toronto, Canada p. 116 - 122.
641. American Psychiatric Association, *Depressive Disorders*, in *Diagnostic and Statistical Manual of Mental Disorders*. 2013, American Psychiatric Association Arlington, VA. p. 155-188.
642. Government of Canada. *Suicide in Canada: Key statistics (infographic)*. 2019 March 4, 2020 [cited 2020 July 2, 2020]; Available from: https://www.canada.ca/en/public-health/services/publications/healthy-living/suicide-canada-key-statistics-infographic.html.
643. Statistics Canada. *Aboriginal Peoples in Canada: First Nations People, Métis and Inuit*. National Household Survey, 2011 2013 [cited 2020 July 1, 2020]; Available from: https://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-011-x/99-011-x2011001-eng.pdf.
644. Statistics Canada. *First Nations People, Metis and Inuit in Canada: Diverse and Growing Populations*. 2018 July 5, 2020 [cited 2020 July 5, 2020]; Available from: https://www150.statcan.gc.ca/n1/en/pub/89-659-x/89-659-x2018001-eng.pdf?st=W7cSG4EI.
645. MacMillan, H.L., et al., *Aboriginal health.* CMAJ, 1996. **155**(11): p. 1569-78.
646. Carriere, G., et al., *Acute care hospitalization by Aboriginal identity, Canada, 2006 through 2008.* Health Rep, 2016. **27**(8): p. 3-11.
647. Park, J., et al., *Avoidable mortality among First Nations adults in Canada: A cohort analysis.* Health Rep, 2015. **26**(8): p. 10-6.
648. Ospina, M.B., et al., *Prevalence of asthma and chronic obstructive pulmonary disease in Aboriginal and non-Aboriginal populations: a systematic review and meta-analysis of epidemiological studies.* Can Respir J, 2012. **19**(6): p. 355-60.
649. Kielland, N. and T. Simeone. *Current Issues in Mental Health in Canada: The Mental Health of First Nations and Inuit Communities*. 2014 January 6, 2014 [cited 2020 July 5, 2020]; Government Document]. Available from: https://lop.parl.ca/staticfiles/PublicWebsite/Home/ResearchPublications/InBriefs/PDF/2014-02-e.pdf.
650. Canada, G.o., *THE MENTAL HEALTH AND WELL-BEING OF ABORIGINAL PEOPLES IN CANADA*, in *The Human Face of Mental Health and Mental Illness in Canada 2006*. 2006, Government of Canada Canada p. 159 - 179.
651. Lavoie, J.G., et al., *Hospitalization for mental health related ambulatory care sensitive conditions: what are the trends for First Nations in British Columbia?* Int J Equity Health, 2018. **17**(1): p. 156.
652. Pulver, L.J., et al., *Indigenous Health – Australia, Canada, Aotearoa, New Zealand and the United States - Laying claim to a future that embraces health for us all*. 2010: Geneva.
653. IHS Special Diabetes Program for Indians | 2014 Report to Congress, *Changing the Course of Diabetes: Turning Hope into Reality*. 2014: USA.
654. National Center for Chronic Disease Prevention and Health Promotion in Centers for Disease Control and Prevention. *Native Americans with Diabetes*. 2017 January 10, 2017 [cited 2020 July 1, 2020]; Available from: https://www.cdc.gov/vitalsigns/aian-diabetes/index.html.
655. Nasir, B.F., et al., *Common mental disorders among Indigenous people living in regional, remote and metropolitan Australia: a cross-sectional study.* BMJ Open, 2018. **8**(6): p. e020196.

656. McNamara, B.J., et al., *Factors relating to high psychological distress in Indigenous Australians and their contribution to Indigenous-non-Indigenous disparities.* Aust N Z J Public Health, 2018. **42**(2): p. 145-152.
657. United Nations Department of Economic and Social Affairs. *State of the World's Indigenous Peoples* [cited 2020 July 5, 2020]; Available from: https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/03/The-State-of-The-Worlds-Indigenous-Peoples-WEB.pdf.
658. Thommasen, H.V., et al., *Prevalence of depression and prescriptions for antidepressants, Bella Coola Valley, 2001.* Can J Psychiatry, 2005. **50**(6): p. 346-52.
659. Kisely, S., et al., *The prevalence of depression and anxiety disorders in indigenous people of the Americas: A systematic review and meta-analysis.* J Psychiatr Res, 2017. **84**: p. 137-152.
660. Pollock, N.J., et al., *Global incidence of suicide among Indigenous peoples: a systematic review.* BMC Med, 2018. **16**(1): p. 145.
661. Kumar, M.B. and M. Tjepkema. *Suicide among First Nations people, Métis and Inuit (2011-2016): Findings from the 2011 Canadian Census Health and Environment Cohort (CanCHEC)*. National Household Survey: Aboriginal Peoples 2019 July 5, 2020 [cited 2020 July 5, 2020]; Available from: https://www150.statcan.gc.ca/n1/en/pub/99-011-x/99-011-x2019001-eng.pdf?st=8IX6ph_I.
662. Willows, N., et al., *Associations between household food insecurity and health outcomes in the Aboriginal population (excluding reserves).* Health Rep, 2011. **22**(2): p. 15-20.
663. Kim, P.J., *Social Determinants of Health Inequities in Indigenous Canadians Through a Life Course Approach to Colonialism and the Residential School System.* Health Equity, 2019. **3**(1): p. 378-381.
664. Kaspar, V., *The lifetime effect of residential school attendance on indigenous health status.* Am J Public Health, 2014. **104**(11): p. 2184-90.
665. Truth and Reconciliation Commission of Canada. *Honouring the Truth, Reconciling for the Future Summary of the Final Report of the Truth and Reconciliation Commission of Canada*. 2015 [cited 2020 July 2, 2020]; Available from: http://nctr.ca/assets/reports/Final%20Reports/Executive_Summary_English_Web.pdf.
666. Lei, L., et al., *Comparison of Prevalence and Associated Factors of Anxiety and Depression Among People Affected by versus People Unaffected by Quarantine During the COVID-19 Epidemic in Southwestern China.* Med Sci Monit, 2020. **26**: p. e924609.
667. Zhang, Y. and Z.F. Ma, *Impact of the COVID-19 Pandemic on Mental Health and Quality of Life among Local Residents in Liaoning Province, China: A Cross-Sectional Study.* Int J Environ Res Public Health, 2020. **17**(7).
668. Ritchie, H. and M. Roser, *Mental Health Published online at OurworldInData.org. Retrieved from: https:/ourworldindata.org/mental-health.* Our World in Data, 2018.
669. Statista. *Canadian Aboriginal's life stress perception 2007-2014, by Aboriginal identity*. 2016 December 9, 2016 [cited 2020 July 1, 2020]; Available from: https://www.statista.com/statistics/817337/perceived-life-stress-among-aboriginals-canada-by-aboriginal-identity/.
670. Statista. *Share of Canadian Aboriginals with a mood disorder 2007-2014, by Aboriginal identity*. 2016 December 9, 2016 [cited 2020 July 4, 2020]; Available from: https://www.statista.com/statistics/817334/mood-disorders-among-aboriginals-canada-by-aboriginal-identity/.
671. Cardinal, J., et al. *First Nations in Alberta: a focus on health service use. Edmonton: Alberta Health and Wellness; 2004.* . 2004 [cited 2020 July 1, 2020]; Available from:

https://open.alberta.ca/dataset/212381eb-ba02-49c8-82d0-27950a9a16df/resource/43a8b731-3937-41f1-b52e-06bba2e0b613/download/First-Nation-Service-Use-2004.pdf.
672. Statistics Canada. *Table 17-10-0005-01 Population estimates on July 1st, by age and sex*. 2019 [cited 2020 July 02, 2020]; Available from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000501.
673. Agyapong, V., *Mobile Phone Text Message Interventions in Psychiatry - What are the Possibilities?* Current Psychiatry Reviews, 2011. **7**: p. 50-56.
674. Zu, Z.Y., et al., *Coronavirus Disease 2019 (COVID-19): A Perspective from China.* Radiology, 2020: p. 200490.
675. WHO, *World Health Organization (WHO), 2020a. Public statement on collaboration on COVID-19 vaccine development. April 13 2020. URL: https://www.who.int/news-room/detail/13-04-2020-public-statement-for-collaboration-on-covid-19-vaccine-development Accessed: 13 April 2020.* 2020a.
676. WHO, *World Health Organization (WHO), 2020b. WHO Timeline – COVID-19. 8 April 2020. URL: https://www.who.int/news-room/detail/08-04-2020-who-timeline---covid-19 Accessed 13 April 2020.* 2020b.
677. Dong, E., H. Du, and L. Gardner, *An interactive web-based dashboard to track COVID-19 in real time.* Lancet Infect Dis, 2020.
678. Petherick A, H.T., Phillips T, Webster S, *Variation in Government Responses to COVID-19. Blavatnik School Working Paper. 7 April 2020. URL: https://www.bsg.ox.ac.uk/research/publications/variation-government-responses-covid-19 Accessed 13 April 2020.* 2020.
679. Norman., L., *World Bank Group Blogs: Smart containment and mitigation measures to confront the COVID-19 pandemic: Tailoring the pandemic response to the realities of developing countries. April 7 2020. URL: https://blogs.worldbank.org/developmenttalk/smart-containment-and-mitigation-measures-confront-covid-19-pandemic-tailoring. Accessed 13 April 2020.* 2020.
680. Bank, W., *World Development Report 2014 : Risk and Opportunity—Managing Risk for Development. Washington, DC. © World Bank. URL: https://openknowledge.worldbank.org/handle/10986/16092 License: CC BY 3.0 IGO. Accessed 13 April 2020.* 2013.
681. Canada, G.o., *Government of Canada. (2020). Public Health Agency of Canada: Community-based measures to mitigate the spread of coronavirus disease (COVID-19) in Canada - Provincial and territorial resources for COVID-19. URL:*

https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/symptoms/provincial-territorial-resources-covid-19.html. Accessed 13 April 2020. 2020.
682. Beaglehole, B., et al., *Psychological distress and psychiatric disorder after natural disasters: systematic review and meta-analysis.* The British Journal of Psychiatry, 2018. **213**: p. 1-7.
683. Zhang, W., et al., *Mental Health and Psychosocial Problems of Medical Health Workers during the COVID-19 Epidemic in China.* Psychotherapy and Psychosomatics, 2020. **89**(4): p. 242-250.
684. Cai, H., et al., *Psychological Impact and Coping Strategies of Frontline Medical Staff in Hunan Between January and March 2020 During the Outbreak of Coronavirus Disease 2019 (COVID-19) in Hubei, China.* Med Sci Monit, 2020. **26**: p. e924171.
685. Yuan, S., et al., *Comparison of the Indicators of Psychological Stress in the Population of Hubei Province and Non-Endemic Provinces in China During Two Weeks During the Coronavirus Disease 2019 (COVID-19) Outbreak in February 2020.* Med Sci Monit, 2020. **26**: p. e923767.

686. Zhang, S.X., et al., *Unprecedented disruption of lives and work: Health, distress and life satisfaction of working adults in China one month into the COVID-19 outbreak.* Psychiatry research, 2020. **288**: p. 112958-112958.
687. Torales, J., et al., *The outbreak of COVID-19 coronavirus and its impact on global mental health.* Int J Soc Psychiatry, 2020. **66**(4): p. 317-320.
688. Fardin, M.A., *COVID-19 and Anxiety: A Review of Psychological Impacts of Infectious Disease Outbreaks.* Arch Clin Infect Dis, 2020. **15**(COVID-19): p. e102779.
689. Duan, L. and G. Zhu, *Psychological interventions for people affected by the COVID-19 epidemic.* Lancet Psychiatry, 2020. **7**(4): p. 300-302.
690. Li, Z., et al., *Vicarious traumatization in the general public, members, and non-members of medical teams aiding in COVID-19 control.* Brain Behav Immun, 2020.
691. Losada-Baltar, A., et al., *"We Are Staying at Home." Association of Self-perceptions of Aging, Personal and Family Resources, and Loneliness With Psychological Distress During the Lock-Down Period of COVID-19.* J Gerontol B Psychol Sci Soc Sci, 2021. **76**(2): p. e10-e16.
692. Lee, S.A., *Coronavirus Anxiety Scale: A brief mental health screener for COVID-19 related anxiety.* Death Stud, 2020: p. 1-9.
693. Selman, L.E., et al., *Bereavement Support on the Frontline of COVID-19: Recommendations for Hospital Clinicians.* J Pain Symptom Manage, 2020. **60**(2): p. e81-e86.
694. Abdessater, M., et al., *COVID19 pandemic impacts on anxiety of French urologist in training: Outcomes from a national survey.* Prog Urol, 2020. **30**(8-9): p. 448-455.
695. Lu, W., et al., *Psychological status of medical workforce during the COVID-19 pandemic: A cross-sectional study.* Psychiatry Res, 2020. **288**: p. 112936.
696. Huang, J., et al., *Mental health survey of 230 medical staff in a tertiary infectious disease hospital for COVID-19.* Zhonghua lao dong wei sheng zhi ye bing za zhi = Zhonghua laodong weisheng zhiyebing zazhi = Chinese journal of industrial hygiene and occupational diseases, 2020. **38**: p. E001.
697. Perlis, R.H., *Exercising Heart and Head in Managing Coronavirus Disease 2019 in Wuhan.* JAMA Network Open, 2020. **3**(3): p. e204006-e204006.
698. Cullen, W., G. Gulati, and B.D. Kelly, *Mental health in the Covid-19 pandemic.* Qjm, 2020.
699. Verma, S., et al., *Post-SARS psychological morbidity and stigma among general practitioners and traditional Chinese medicine practitioners in Singapore.* Annals of the Academy of Medicine, Singapore, 2004. **33**: p. 743-8.
700. Lee, S.M., et al., *Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients.* Compr Psychiatry, 2018. **87**: p. 123-127.
701. Liu, X., et al., *Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic.* Comprehensive psychiatry, 2012. **53**(1): p. 15-23.
702. Chowell, G., et al., *Transmission characteristics of MERS and SARS in the healthcare setting: a comparative study.* BMC medicine, 2015. **13**: p. 210-210.
703. Leung, G.M., et al., *The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong.* J Epidemiol Community Health, 2003. **57**(11): p. 857-63.
704. Rajkumar, R.P., *COVID-19 and mental health: A review of the existing literature.* Asian J Psychiatr, 2020. **52**: p. 102066.
705. Shah, K., et al., *Focus on Mental Health During the Coronavirus (COVID-19) Pandemic: Applying Learnings from the Past Outbreaks.* Cureus, 2020. **12**(3): p. e7405.
706. Röhr, S., et al., *[Psychosocial Impact of Quarantine Measures During Serious Coronavirus Outbreaks: A Rapid Review].* Psychiatr Prax, 2020. **47**(4): p. 179-189.

707. Kisely, S., et al., *Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis.* Bmj, 2020. **369**: p. m1642.
708. Honermann, B., *An "Epidemic within an outbreak:" the mental health consequences of infectious disease epidemics. In: O'Neill Institute for National & Global Health Law Blog [Internet]. Washington: O'Neill Institute. URL: https://oneill.law.georgetown.edu/epidemic-within-outbreak-mental-health-consequences-infectious-disease-epidemics/ Accessed 10 April 2020.* 2015.
709. Cao, W., et al., *The psychological impact of the COVID-19 epidemic on college students in China.* Psychiatry Res, 2020. **287**: p. 112934.
710. Hong, X., et al., *Posttraumatic stress disorder in convalescent severe acute respiratory syndrome patients: a 4-year follow-up study.* Gen Hosp Psychiatry, 2009. **31**(6): p. 546-54.
711. Kim, S.-W. and K.-P. Su, *Using psychoneuroimmunity against COVID-19.* Brain, Behavior, and Immunity, 2020.
712. van Ommeren, M., S. Saxena, and B. Saraceno, *Mental and social health during and after acute emergencies: emerging consensus?* Bull World Health Organ, 2005. **83**(1): p. 71-5; discussion 75-6.
713. Fan, F., et al., *Longitudinal trajectories of post-traumatic stress disorder symptoms among adolescents after the Wenchuan earthquake in China.* Psychological medicine, 2015. **45**: p. 1-12.
714. Kaufman, K.R., et al., *A global needs assessment in times of a global crisis: world psychiatry response to the COVID-19 pandemic.* BJPsych Open, 2020: p. 1-11.
715. *Public Health Agency of Canada (PHAC). (201620). Report from the Canadian Chronic Disease Surveillance System: Mood and anxiety disorders in Canada, 2016 . Ottawa: Her Majesty the Queen in Right of Canada. URL: https://www.canada.ca/en/public-health/services/reports-publications/health-promotion-chronic-disease-prevention-canada-research-policy-practice/vol-36-no-12-2016/report-summary-mood-anxiety-disorders-canada-2016.html. Accessed 13 April 2020.*
716. Taylor, S., *The psychology of pandemics : preparing for the next global outbreak of infectious disease.* 2019.
717. Holmes, E.A., et al., *Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science.* The lancet. Psychiatry, 2020. **7**(6): p. 547-560.
718. Ripp, J., L. Peccoralo, and D. Charney, *Attending to the Emotional Well-Being of the Health Care Workforce in a New York City Health System During the COVID-19 Pandemic.* Acad Med, 2020. **Publish Ahead of Print**.
719. Wax, R.S. and M.D. Christian, *Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients.* Canadian Journal of Anesthesia/Journal canadien d'anesthésie, 2020.
720. AHS, *Alberta Health Services. Text4Hope Advertisement: Text4Hope – Supporting Mental Health and Wellness in a Time of Stress and Isolation. Accessed: 11April 2020. URL: https://www.albertahealthservices.ca/topics/Page17019.aspx.* 2020.
721. Alberta, G.o., *Government of Alberta. 2017b Alberta Labour Force Profiles Aged 45 and older. ISBN 978-1-4601-3907-3 URL: work.ab.ca/documents/labour-profile-aged-45-and-older.pdf Accessed: 10 April 2020.* 2017b.
722. Canada, S., *Statistics Canada. (2019). Census Profile 2016: Province of Alberta. 2019-08-09. URL: https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=PR&Code1=48&Geo2=PR&Code2=01&SearchText=Canada&SearchType=Begins&SearchPR=01&B1=Housing&TABID=1&type=1. Accessed 13 April 2020.* 2019.

723. Alberta, G.o., *Government of Alberta. 2018. Industry Profiles 2018: Health Care and Social Assistance. Edmonton: Government of Alberta. ISBN 978-1-4601-3778-9.* 2018.
724. Nussbaumer-Streit, B., et al., *Quarantine alone or in combination with other public health measures to control COVID-19: a rapid review.* Cochrane Database of Systematic Reviews, 2020(4).
725. *Government of Alberta. (2020). Increasing mental health supports in response to COVID-19. [Press release]. Retrieved from:*

https://www.alberta.ca/release.cfm?xID=70099FD5A018B-07BD-2B06-3BD3E6BD3108AF41.
726. Shepell, M., *The Mental Health Index Report Canada - April 2020 Spotlight on the mental health impact of the COVID-19 pandemic. https://www.morneaushepell.com/ca-en/insights/mental-health-index-report. Accesssed on 2020-05-09.* 2020.
727. Klomek, A.B., *Suicide prevention during the COVID-19 outbreak.* Lancet Psychiatry, 2020. **7**(5): p. 390.
728. Gunnell, D., et al., *Suicide risk and prevention during the COVID-19 pandemic.* The lancet. Psychiatry, 2020. **7**(6): p. 468-471.
729. Banerjee, D.D., *The other side of COVID-19: Impact on obsessive compulsive disorder (OCD) and hoarding.* Psychiatry Res, 2020. **288**: p. 112966.
730. Maunder, R., et al., *The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital.* Canadian Medical Association Journal, 2003. **168**(10): p. 1245.
731. *Pan American Health Organization. (2009). Protecting Mental Health During Epidemics. May 4, 2009 URL: https://www.paho.org/en/documents/protecting-mental-health-during-epidemics Accessed 13 April 2020.*
732. Park, S.C. and Y.C. Park, *Mental Health Care Measures in Response to the 2019 Novel Coronavirus Outbreak in Korea.* Psychiatry Investig, 2020. **17**(2): p. 85-86.
733. Wu, A.W., C. Connors, and G.S. Everly Jr., *COVID-19: Peer Support and Crisis Communication Strategies to Promote Institutional Resilience.* Annals of Internal Medicine, 2020.
734. Kang, L., et al., *Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: A cross-sectional study.* Brain Behav Immun, 2020. **87**: p. 11-17.
735. *World Health Organization (WHO). WHO director-general's opening remarks at the media briefing on COVID-19 – March 11, 2020. Geneva, Switzerland: WHO; 2020. URL: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020 Accessed November 29, 2020.*
736. *Alberta Health Services, Health Care Glossary. URL: https://www.albertahealthservices.ca/about/Page12677.aspx. Accessed on November 15, 2020.*
737. *Canadaís Health Care Providers. URL: https://secure.cihi.ca/free_products/hctenglish.pdf. Accessed November 10, 2020*.
738. *Canadian Instotute for Health Information. COVID-19 cases and deaths among health care workers in Canada, 2020. URL: https://www.cihi.ca/en/covid-19-cases-and-deaths-among-health-care-workers-in-canada accessed on November 15, 2020.*
739. Spoorthy, M.S., S.K. Pratapa, and S. Mahant, *Mental health problems faced by healthcare workers due to the COVID-19 pandemic-A review.* Asian journal of psychiatry, 2020. **51**: p. 102119-102119.
740. Wu, K. and X. Wei, *Analysis of Psychological and Sleep Status and Exercise Rehabilitation of Front-Line Clinical Staff in the Fight Against COVID-19 in China.* Med Sci Monit Basic Res, 2020. **26**: p. e924085.

741. McAlonan, G.M., et al., *Immediate and sustained psychological impact of an emerging infectious disease outbreak on health care workers.* Can J Psychiatry, 2007. **52**(4): p. 241-7.
742. Di Tella, M., et al., *Mental health of healthcare workers during the COVID-19 pandemic in Italy.* J Eval Clin Pract, 2020. **26**(6): p. 1583-1587.
743. Maunder, R., et al., *The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital.* Cmaj, 2003. **168**(10): p. 1245-51.
744. Ornell, F., et al., *The impact of the COVID-19 pandemic on the mental health of healthcare professionals.* Cad Saude Publica, 2020. **36**(4): p. e00063520.
745. *CBC News. University of Alberta study examines COVID-19 toll on health-care workers. URL: https://www.cbc.ca/news/canada/edmonton/u-of-a-study-mental-health-care-covid-1.5818020#:~:text=An%20ongoing%20study%20at%20the,British%20Columbia%2C%20Ontario%20and%20Quebec. Accessed November 27, 2020.*
746. Patel, R.S., et al., *Factors Related to Physician Burnout and Its Consequences: A Review.* Behavioral sciences (Basel, Switzerland), 2018. **8**(11): p. 98.
747. Greenberg, N., et al., *Managing mental health challenges faced by healthcare workers during covid-19 pandemic.* Bmj, 2020. **368**: p. m1211.
748. Alshekaili, M., et al., *Factors associated with mental health outcomes across healthcare settings in Oman during COVID-19: frontline versus non-frontline healthcare workers.* BMJ Open, 2020. **10**(10): p. e042030.
749. Muller, A.E., et al., *The mental health impact of the covid-19 pandemic on healthcare workers, and interventions to help them: A rapid systematic review.* Psychiatry research, 2020. **293**: p. 113441-113441.
750. Pappa, S., et al., *Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis.* Brain, behavior, and immunity, 2020. **88**: p. 901-907.
751. mSpitzer, R.L., et al., *A brief measure for assessing generalized anxiety disorder: the GAD-7.* Arch Intern Med, 2006. **166**(10): p. 1092-7.
752. Huang, Y. and N. Zhao, *Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey.* Psychiatry research, 2020. **288**: p. 112954-112954.
753. Lei, L., et al., *Comparison of Prevalence and Associated Factors of Anxiety and Depression Among People Affected by versus People Unaffected by Quarantine During the COVID-19 Epidemic in Southwestern China.* Medical science monitor : international medical journal of experimental and clinical research, 2020. **26**: p. e924609-e924609.
754. Liu, X.S.L.Z.R.W.Y.L.J.W.C.H.X.Z.F., *Perceived Social Support and Its Impact on Psychological Status and Quality of Life of Medical Staffs After Outbreak of SARS-CoV-2 Pneumonia: A Cross-Sectional Study*. 2020.
755. Hrabok, M., et al., *Mental Health Outreach via Supportive Text Messages during the COVID-19 Pandemic: One-week Prevalence and Correlates of Anxiety Symptoms.* The Canadian Journal of Psychiatry, 2020: p. 0706743720969384.
756. An, Y., et al., *Prevalence of depression and its impact on quality of life among frontline nurses in emergency departments during the COVID-19 outbreak.* Journal of affective disorders, 2020. **276**: p. 312-315.
757. Bohlken, J., et al., *COVID-19 Pandemic: Stress Experience of Healthcare Workers - A Short Current Review.* Psychiatrische Praxis, 2020. **47**(4): p. 190-197.
758. Agyapong, V., D.M. McLoughlin, and C.K. Farren, *581 – 6-month outcomes of a single blind randomised trial of supportive text messaging for depression and comorbid alcohol use disorder.* European Psychiatry, 2013. **28**: p. 1.

759. *Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV) [Internet]. [cited 2020 Mar 26]. Available from: https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov).*
760. Organization, W.H., *WHO Director-General's opening remarks at the media briefing on COVID-19-11 March 2020*. 2020.
761. Guo, Y.-R., et al., *The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status.* Military Medical Research, 2020. **7**(1): p. 11-11.
762. *Canadian Centre for Substance Use and Addiction, "COVID-19, Alcohol and Cannabis Use [infographic]," CCSUA, 2020. [Online]. Available: https://www.ccsa.ca/covid-19-alcohol-and-cannabis-use-infographic. [Accessed 17 04 2020].; .*
763. *E. Uguen-Csenge, "Mental illness will be 'next wave' of COVID-19 pandemic, epidemiologist says," 4 4 2020. [Online]. Available: https://www.cbc.ca/news/canada/british-columbia/months-isolation-mental-health-covid-1.5521649. [Accessed 4 2020].*
764. *Canadian Centre on Substance Use and Addiction, "Canadians Under 54 Drinking More While at Home Due to COVID-19 Pandemic," CCSUA, 15 4 2020. [Online]. Available: https://www.ccsa.ca/canadians-under-54-drinking-more-while-home-due-covid-19-pandemic. [Accessed 17 4 2020].*
765. Xu, C., et al., *Estimation of reproduction numbers of COVID-19 in typical countries and epidemic trends under different prevention and control scenarios.* Front Med, 2020.
766. Chevance, A., et al., *Ensuring mental health care during the SARS-CoV-2 epidemic in France: A narrative review.* Encephale, 2020.
767. Torales, J., et al., *The outbreak of COVID-19 coronavirus and its impact on global mental health.* International Journal of Social Psychiatry, 2020. **66**(4): p. 317-320.
768. Khawam, E., H. Khouli, and L. Pozuelo, *Treating acute anxiety in patients with COVID-19.* Cleve Clin J Med, 2020.
769. Chandra, P.S., et al., *'SMS' for mental health—feasibility and acceptability of using text messages for mental health promotion among young women from urban low income settings in India.* Asian J Psychiatr, 2014. **11**: p. 59-64.
770. Kebede, Y., et al., *Knowledge, perceptions and preventive practices towards COVID-19 early in the outbreak among Jimma university medical center visitors, Southwest Ethiopia.* PLOS ONE, 2020. **15**(5): p. e0233744.
771. Zhong, B.-L., et al., *Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey.* International journal of biological sciences, 2020. **16**(10): p. 1745-1752.
772. Xiao, C., *A Novel Approach of Consultation on 2019 Novel Coronavirus (COVID-19)-Related Psychological and Mental Problems: Structured Letter Therapy.* Psychiatry Investig, 2020. **17**(2): p. 175-176.
773. Figueroa, C.A. and A. Aguilera, *The Need for a Mental Health Technology Revolution in the COVID-19 Pandemic.* Frontiers in Psychiatry, 2020. **11**(523).
774. Gao, J., et al., *Mental health problems and social media exposure during COVID-19 outbreak.* PloS one, 2020. **15**(4): p. e0231924-e0231924.
775. Twomey, C. and G. O'Reilly, *Effectiveness of a freely available computerised cognitive behavioural therapy programme (MoodGYM) for depression: Meta-analysis.* Australian & New Zealand Journal of Psychiatry, 2016. **51**(3): p. 260-269.
776. Spek, V., et al., *Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: a meta-analysis.* Psychol Med, 2007. **37**(3): p. 319-28.

777. Howell, A.N., et al., *Web-based CBT for the prevention of anxiety symptoms among medical and health science graduate students.* Cognitive Behaviour Therapy, 2019. **48**(5): p. 385-405.
778. Brabyn, S., et al., *The second Randomised Evaluation of the Effectiveness, cost-effectiveness and Acceptability of Computerised Therapy (REEACT-2) trial: does the provision of telephone support enhance the effectiveness of computer-delivered cognitive behaviour therapy? A randomised controlled trial.* Health Technol Assess, 2016. **20**(89): p. 1-64.
779. Duffy L, L.G., Ades A, et al., *Antidepressant treatment with sertraline for adults with depressive symptoms in primary care: the PANDA research programme including RCT. (Programme Grants for Applied Research, No. 7.10.) Phase 3: the PANDA randomised controlled trial.* NIHR Journals Library, 2019.
780. Shirotsuki, K., et al., *Internet-Based Cognitive Behavior Therapy for Stress and Anxiety among Young Japanese Adults: A Preliminary Study.* Psych, 2019. **1**(1): p. 353-363.
781. Littlewood, E., et al., *A randomised controlled trial of computerised cognitive behaviour therapy for the treatment of depression in primary care: the Randomised Evaluation of the Effectiveness and Acceptability of Computerised Therapy (REEACT) trial.* Health Technol Assess, 2015. **19**(101): p. viii, xxi-171.
782. Bendtsen, M. and P. Bendtsen, *Feasibility and User Perception of a Fully Automated Push-Based Multiple-Session Alcohol Intervention for University Students: Randomized Controlled Trial.* JMIR mHealth uHealth, 2014. **2**(2): p. e30.
783. Fjeldsoe, B.S., A.L. Marshall, and Y.D. Miller, *Behavior Change Interventions Delivered by Mobile Telephone Short-Message Service.* American Journal of Preventive Medicine, 2009. **36**(2): p. 165-173.
784. *World Hea;th Organization (WHO). Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. URL: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020. Accessed August 24, 2020*. 2020.
785. *World Health Organization (WHO). WHO Coronavirus Disease (COVID-19) Dashboard. URL: https://covid19.who.int/. Access August 2020.* 2020.
786. Chen, J., *Pathogenicity and transmissibility of 2019-nCoV—A quick overview and comparison with other emerging viruses.* Microbes and Infection, 2020. **22**(2): p. 69-71.
787. *World Health Organization (WHO). Timeline of WHO's response to COVID-19. URL: https://www.who.int/news-room/detail/29-06-2020-covidtimeline. Accessed on August 6, 2020.*
788. Thomas, R., et al., *Adapting to the impact of COVID-19 on mental health: an international perspective.* Journal of psychiatry & neuroscience : JPN, 2020. **45**: p. 229-233.
789. *Government of Canada. Canadian Radio-television and Telecommunications Commission. Communications Monitoring Report 2018. URL: https://crtc.gc.ca/eng/publications/reports/policymonitoring/2018/cmr1.htm#s10i. Accessed on August 5, 2020.* 2018.
790. *Pearson H. Coronavirus: new texting initiative gives Albertans mental health support. Global News 2020. https://globalnews.ca/news/6722244/coronavirus-alberta-mental-health-support-texts/. Accessed December 26, 2020.*
791. Berrouiguet, S., et al., *Fundamentals for Future Mobile-Health (mHealth):A Systematic Review of Mobile Phone and Web-Based Text Messaging in Mental Health.* Journal of Medical Internet Research, 2016. **18**(6): p. 1-14.
792. Tofighi, B., A. Abrantes, and M.D. Stein, *The Role of Technology-Based Interventions for Substance Use Disorders in Primary Care: A Review of the Literature.* The Medical clinics of North America, 2018. **102**(4): p. 715-731.

793. Pramana, G., et al., *The SmartCAT: An m-Health Platform for Ecological Momentary Intervention in Child Anxiety Treatment.* Telemedicine and e-Health, 2014. **20**(5): p. 419-427.
794. Patterson, P.D., et al., *Real-Time Fatigue Mitigation with Air-Medical Personnel: The SleepTrackTXT2 Randomized Trial.* Prehospital Emergency Care, 2019. **23**(4): p. 465-478.
795. Czyz, E.K., et al., *Augmenting Safety Planning With Text Messaging Support for Adolescents at Elevated Suicide Risk: Development and Acceptability Study.* JMIR mental health, 2020. **7**(5): p. e17345-e17345.
796. Spek, V., et al., *Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: A meta-analysis.* Psychological Medicine, 2007. **37**(3): p. 319-328.
797. Baumel, A., et al., *Objective User Engagement With Mental Health Apps: Systematic Search and Panel-Based Usage Analysis.* J Med Internet Res, 2019. **21**(9): p. e14567.
798. *Text4Hope: Supporting mental health & wellness in a time of stress & isolation. Alberta Health Services. URL: https:/ /www.albertahealthservices.ca/topics/Page17019.aspx [accessed 2020-04-11].*
799. *Public Health Act. Province of Alberta. URL: https://www.qp.alberta.ca/documents/Acts/P37.pdf [accessed 2020-04-20].*
800. *Coronavirus disease 2019 (COVID-19) Situation Report – 65. World Health Organization. 2020 Mar 25. URL: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200325-sitrep-65-covid-19.pdf?sfvrsn=ce13061b_2 [accessed 2020-04-20].*
801. Ferrell, O.C. and M. Hartline, *Marketing strategy, text and cases*. 2012: Nelson Education.
802. Rathbone, A.L. and J. Prescott, *The Use of Mobile Apps and SMS Messaging as Physical and Mental Health Interventions: Systematic Review.* Journal of Medical Internet Research, 2017. **19**(8): p. 1-1.
803. Garcia, C., et al., *Teenagers and Texting: Use of a Youth Ecological Momentary Assessment System in Trajectory Health Research With Latina Adolescents.* JMIR Mhealth Uhealth, 2014. **2**(1): p. e3.
804. Irvine, L., et al., *Can text messages reach the parts other process measures cannot reach: an evaluation of a behavior change intervention delivered by mobile phone?* PLoS One, 2012. **7**(12): p. e52621.
805. *Population projections. Alberta and Census Divisions, 2020 – 2046. URL: https://open.alberta.ca/dataset/*

90a09f08-c52c-43bd-b48a-fda5187273b9/resource/bb7c6ef6-ade5-4def-ae55-ef1fd5d4e563/download/

2020-2046-alberta-population-projections.pdf [accessed 2020-11-14].
806. *Alberta population. World Population Review. URL: https://worldpopulationreview.com/canadian-provinces/ alberta-population [accessed 2020-12-21].*
807. *Education in Canada: Key results from the 2016 Census. Statistics Canada. 2017 Nov 29. URL: https://www150.statcan.gc.ca/ n1/daily-quotidien/171129/dq171129a-eng.htm [accessed 2020-12-21].*
808. *Gross domestic product. Government of Alberta. URL: https://economicdashboard.alberta.ca/GrossDomesticProduct [accessed 2020-11-13].*
809. Agyapong, V.I.O., et al., *Closing the Psychological Treatment Gap During the COVID-19 Pandemic With a Supportive Text Messaging Program: Protocol for Implementation and Evaluation.* JMIR research protocols, 2020. **9**(6): p. e19292.
810. Crow, R., et al., *The measurement of satisfaction with healthcare: implications for practice from a systematic review of the literature.* Health Technol Assess, 2002. **6**(32): p. 1-244.

811. Kang, H.-J., et al., *Sex differences in the genetic architecture of depression.* Scientific reports, 2020. **10**(1): p. 9927-9927.
812. Glass, D.C., et al., *A telephone survey of factors affecting willingness to participate in health research surveys.* BMC Public Health, 2015. **15**: p. 1017.
813. Brenes, G.A., et al., *Telephone-Delivered Cognitive Behavioral Therapy and Telephone-Delivered Nondirective Supportive Therapy for Rural Older Adults With Generalized Anxiety Disorder: A Randomized Clinical Trial.* JAMA Psychiatry, 2015. **72**(10): p. 1012-20.
814. Almathami, H.K.Y., K.T. Win, and E. Vlahu-Gjorgievska, *Barriers and Facilitators That Influence Telemedicine-Based, Real-Time, Online Consultation at Patients' Homes: Systematic Literature Review.* Journal of medical Internet research, 2020. **22**(2): p. e16407-e16407.
815. Kwan, M.K., et al., *Can Intraoperative Text Messages Reduce Parental Anxiety of Children Undergoing Posterior Spinal Fusion Surgery for Adolescent Idiopathic Scoliosis?* Spine (Phila Pa 1976), 2016. **41**(4): p. E225-30.
816. *Government of Alberta. COVID-19 Alberta statistics- Interactive aggregate data on COVID-19 cases in Alberta. https://www.alberta.ca/stats/covid-19-alberta-statistics.htm#data-export. Accessed December 21, 2020.*
817. *Global News. 25% of Canadians say their mental health is worse than in 1st coronavirus wave: poll. https://globalnews.ca/news/7407408/canadians-mental-health-first-coronavirus-wave/. Accessed October 28, 2020.*
818. de Girolamo, G., et al., *Mental Health in the Coronavirus Disease 2019 Emergency—The Italian Response.* JAMA Psychiatry, 2020. **77**(9): p. 974-976.
819. Torous, J. and T. Wykes, *Opportunities From the Coronavirus Disease 2019 Pandemic for Transforming Psychiatric Care With Telehealth.* JAMA Psychiatry, 2020. **77**(12): p. 1205-1206.
820. Adu, M.K., et al., *Text Messaging Versus Email Messaging to Support Patients With Major Depressive Disorder: Protocol for a Randomized Hybrid Type II Effectiveness-Implementation Trial.* JMIR Res Protoc, 2021. **10**(10): p. e29495.

Appendix section

Appendix 3.2.1: Text messages and peer support services to enhance care for patients discharged from acute psychiatric care. A randomized control feasibility trial

Key Informant Telephone Interview Questions for Patients About Text4Support Experience

1. Can you tell me about your experience with Text4Support?
    a. Have you ever received any type of text messages for mental health before?
    b. Did you like the idea at first (idea of receiving daily texts at first)?
    c. Can you describe what was your expectation before receiving daily texts from Text4Support, did you like the idea?

2. Does receiving daily text messages help you? If so, how do they help you? Please explain.

3. What did you like the best about receiving daily text messages from Text4Support?

4. And what didn't you like about it?
    a. Do you have any challenges with receiving the daily text messages?
    b. If so, what are they?
    c. What could have been done to help you to overcome this challenge?

5. What are the needs were satisfied when you receive daily text messages?

6. Is it fair to say it is very beneficial to add daily text messages to your treatment as usual plan?

7. Would you recommend daily text messages from Text4Support to family and friends if they need similar support?

8. What were the benefits you gain from receiving daily text messages? Please explain and provide some examples.

9. Do you think that the frequency of receiving daily text messages met your needs?
    - If yes, please explain.
    - If No, why and what are your suggestions about how these messages can better serve your needs?

10. Would you like to receive daily text messages continuously?

11. From your point of view, how can we improve the daily text messages service?

12. Is there anything else you would like to tell me that you haven't talked about yet?