

BMJ Open What are the mental health changes associated with the COVID-19 pandemic in people with medical conditions? An international survey

Shirin Modarresi ¹, Hoda Seens ^{2,3}, Uzair Hussain,⁴ James Fraser,⁵ Jacob Boudreau,² Joy MacDermid ^{1,6,7,8}

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ABSTRACT

Objectives The COVID-19 pandemic has negatively impacted mental health worldwide but there is paucity of knowledge regarding the level of change in mental health in people with a medical condition (physical/psychiatric). The objectives of this study were (1) to compare the change in mental health in people with and without medical conditions, (2) to assess the change in various types of medical conditions, (3) to evaluate the association between change in mental health and number of comorbidities, and (4) to investigate the influence of receiving treatment and activity limitation imposed by the medical condition(s).

Design Cross-sectional.

Setting Online international survey.

Participant English-speaking adults (age ≥18) were included in the study, with no exclusions based on sex/gender or location. 1276 participants (mean age 30.4, 77.7% female) were included.

Primary and secondary outcome measures Pre and during COVID-19 pandemic symptoms of anxiety (Generalized Anxiety Disorder-2) and depression (Patient Health Questionnaire-9) were assessed. The Self-Administered Comorbidity Questionnaire was used to collect data regarding medical conditions.

Repeated-measures analysis of covariance (objectives 1, 2 and 4) and Pearson's correlation coefficient (objective 3).

Results 50.1% of participants had a medical condition. During the COVID-19 pandemic, compared with people with no medical condition, people with both psychiatric and physical conditions experienced significantly higher symptoms of anxiety (12%, $p=0.009$) and depression (9.4%, $p<0.001$). Although not statistically significant, the increase in anxiety and depression occurred across seven major categories of conditions. An association was found between having a higher number of medical conditions with higher anxiety and depression symptoms ($r=0.16$ anxiety, $r=0.14$ depression, $p<0.001$). Receiving treatment and being functionally limited by the disease did not have a significant impact on the amount of change ($p>0.05$).

Conclusions During the COVID-19 pandemic, people who had a combination of psychiatric and physical conditions experienced greater symptoms of anxiety and depression. Patients with chronic diseases may need extra support to address their mental health as a result of the pandemic.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The sample size is large (N=1276), which adds to our confidence in the precision of the estimates.
- ⇒ Participants were not excluded based on geography and as a result people from 43 countries participated in the study.
- ⇒ Data regarding anxiety and depression pre-COVID-19 pandemic were collected during the pandemic, which can potentially lead to recall bias as participants may not accurately remember their previous mental status.
- ⇒ Although we were able to categorise several different medical conditions, we did not have a sufficient sample size to be confident in the effects in some of our categories or specific diseases.

INTRODUCTION

COVID-19 is a respiratory disease caused by SARS-CoV-2.¹ Coronaviruses were responsible for previous pandemics and epidemics such as severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome.²⁻⁴ The coronavirus is spread from person to person through close contact and droplets.⁵ COVID-19 infection often results in symptoms such as fever, cough, difficulty breathing, body ache, fatigue, sore throat, loss of smell and taste, and for many can ultimately lead to death; however, individuals may also present as asymptomatic.⁶ COVID-19 was first detected as pneumonia of unknown aetiology on 31 December 2019 by the WHO.⁷ The WHO later declared COVID-19 a pandemic on 11 March 2020.⁸ Based on the Johns Hopkins University and Medicine Coronavirus Resource Center, as of 10 January 2022, there have been 307 589 090 positive COVID-19 cases and 5 490 655 deaths due to COVID-19 worldwide.⁹

Since the start of the COVID-19 pandemic, several studies have reported on the impact of COVID-19 on mental health.¹⁰⁻¹³ Due to the



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For numbered affiliations see end of article.

Correspondence to

Dr Shirin Modarresi; smodarre@uwo.ca

COVID-19 pandemic, many individuals have been living in a state of lockdown for a majority of a year following government regulations. For many, this has created new stressors such as worries about falling ill, death, infected family members, loss of loved ones, physical distancing and economic loss.^{14 15} These stressors may foster new psychological symptoms or exacerbate existing ones, such as depression, anxiety, psychosomatic preoccupations, insomnia, increased substance use and domestic abuse.^{16–18} We have historically observed the negative effects of these stressors in previous pandemics. During the 1918 influenza pandemic, treatments were limited to non-pharmaceutical interventions such as isolation, quarantine, good hygiene and disinfectants.¹⁹ Then later research on the SARS outbreak showed that more than 30% of individuals developed depression from these same non-pharmaceutical interventions.²⁰ The COVID-19 pandemic has had disturbing ramifications to individuals. Medical systems are effectively overstressed managing the physical consequences of COVID-19, resulting in reduced medical resources for its psychological effects.

In general, many factors can cause or exacerbate mental illnesses, such as environmental exposures and traumatic experiences.^{21 22} Another factor that can affect mental health is having multiple medical conditions.²³ Previous research has shown that people who suffer from chronic illness are more likely to suffer from depression.²⁴ A National Health Interview Survey in the USA showed that the likelihood of depression increases with each additional comorbid disorder.²⁵ The association between developing mental and physical comorbid disorders is bidirectional.²⁶ Canadians who report symptoms of depression report experiencing three times as many chronic physical health conditions as the average population.²⁷ Physical health conditions such as diabetes, heart disease, stroke, cancers, respiratory conditions and arthritis commonly coexist in individuals with mental illnesses.^{28–31} Individuals with multiple comorbidities are at increased risk of worsening health conditions as the presence of two or more diseases can worsen the prognosis of each disease present.³² The co-occurrence of health burdens within a specific socioeconomic context is referred to as a syndemic.³³ A syndemic approach proposes that there are common biological and social pathways to the development and maintenance of the co-occurring conditions and understanding these pathways and their interactions is crucial for their prognosis, treatment and related health policy. This approach has recently been examined in the context of the current pandemic, where the association between mental and physical conditions may be even more pronounced as individuals with comorbid disorders have historically been at increased risk of higher mortality rates.³⁴ During the COVID-19 pandemic, individuals with underlying health conditions are considered a 'high risk' population. Therefore, an individual with multiple comorbidities may have more anxiety regarding contracting the virus, which can ultimately further negatively affect their mental health. Previous reports have

proposed that people with pre-existing comorbidities are particularly vulnerable to negative mental health outcomes during the pandemic because they are already susceptible to mental disorders due to their underlying conditions.³⁵ Recent research has reported that the prevalence of anxiety and depression is significantly higher in people with comorbidities compared with healthy adults during the COVID-19 pandemic.³⁶ However, we currently have a paucity of knowledge regarding the magnitude of change in symptoms of mental disorders in people who have comorbidities.

The overall aim of this study is to gain a better understanding of the association of the COVID-19 pandemic and the mental health of people with one or more medical conditions. The specific objectives of the study are (1) to understand the association of having a medical condition and the change in mental health (anxiety and depression) during the COVID-19 pandemic, (2) to compare the change in the mental health of people with various types of medical conditions, (3) to evaluate the association between change in mental health and number of comorbidities, and (4) to investigate whether receiving treatment for the medical condition and limitations in activities due to having the condition have any influence on the change in mental health during the COVID-19 pandemic.

METHODS

Study design and participants

A survey study was conducted through the Qualtrics online survey platform (Qualtrics, Provo, Utah). The full questionnaire has been previously published.¹³ The survey was launched in June 2020 and ended in August 2020. Participant recruitment was accomplished through various online platforms including Facebook, Instagram, Twitter, Kijiji, Craigslist, organisational mailing lists, organisational newsletters and WhatsApp. No publicity was paid to the mentioned websites or organisations. In order to safeguard participants' anonymity, specific groups are not named. The time to complete the survey was between 20 and 30 min. The inclusion criteria were (1) ability to read and write in English, (2) being at least 18 years of age and (3) ability to provide written informed consent. We did not exclude participants based on location, ethnicity, sex or gender.

Participants' demographics and characteristics

Participants' characteristics such as age (in years), sex (male, female and other) and location were collected. Participants were asked to indicate any current medical problems using the Self-Administered Comorbidity Questionnaire (SCQ).³⁷ The SCQ includes common health problems that participants can choose from, such as heart disease, high blood pressure, lung disease, diabetes, stomach disease, kidney disease, cancer, depression, osteoarthritis, back pain and rheumatoid arthritis.³⁷ If a participant had a health problem other than the ones

listed, they would choose 'other' and write out the condition. The SCQ is easy to understand and answer by participants without medical background and is an efficient way to evaluate comorbidities in research studies.³⁷ The psychometric properties of the SCQ have been previously established.³⁷ The survey was set up in such a way that if a participant indicated having a medical condition, then they would also be asked to indicate if they receive treatment for their medical problem (yes/no). If they answered yes, they were then asked whether the medical condition limits their activities (yes/no). If a participant did not indicate that they have a medical condition, they would not receive the two subsequent questions.

Outcome measures

Participants' symptoms of anxiety were assessed using the Generalized Anxiety Disorder 2 (GAD-2). The GAD-2 is a quick, easy-to-use, two-item questionnaire that is designed to identify likely cases of generalised anxiety disorder.³⁸ The GAD-2 is a shorter version of the GAD-7 that has the two core items for diagnosing anxiety disorders.³⁹ The maximum score on the GAD-2 is 6, with a cut-off score of ≥ 3 for identifying an anxiety disorder. The GAD-2 has a sensitivity and specificity of 0.71 and 0.69, respectively. The diagnostic accuracy of the shorter version (GAD-2) has been assessed against the longer version (GAD-7) and the results indicate that it is a sensitive and efficient measure for routine clinical care.⁴⁰

Participants' symptoms of depression were assessed using the Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 is a nine-item questionnaire that is designed to screen for depressive symptoms.⁴¹ The maximum score on the PHQ-9 is 27, with higher scores denoting higher symptoms of depression. The sensitivity and specificity of the PHQ-9 are 88%, with a cut-off score of ≥ 10 for detecting major depressive disorder.⁴¹ The construct validity of the PHQ-9 as a measure of depression severity has been assessed using the 20-item Short Form Survey and the results indicate that scores of 5, 10, 15 and 20 represent mild, moderate, moderately severe and severe depression, respectively.⁴¹

Both GAD-2 and PHQ-9 closely follow the diagnostic criteria of the *Diagnostic and Statistical Criteria of Mental Disorders - Fifth Edition* and their psychometric adequacy has been previously reported in many populations.^{42 43} In this study, participants were asked to answer the GAD-2 and the PHQ-9 once before the COVID-19 pandemic (the before score) in a retrospective manner and once during the COVID-19 pandemic (the during score). Other types of data were also captured as part of the data collection in the survey, but only the variables listed above were extracted and used for the current analyses.

Analytical approach

Descriptive analysis

Age, sex, location, medical conditions, number of conditions, as well as participants' level of anxiety and depression before and during the COVID-19 pandemic were

calculated as mean and SD or frequencies and percentages, as appropriate. The scores for anxiety and depression before the COVID-19 pandemic are referred to as the before score and the scores that were obtained during the COVID-19 pandemic are referred to as the during score. To assess the amount of change in anxiety and depression, the following formula was used: $\delta = 100 (Y_f - Y_i) / Y_{\max}$, where Y_f is the during value, Y_i is the before value and Y_{\max} is the maximum possible score (6 on GAD-2 and 27 on PHQ-9).

Assessment of change in mental health based on having a medical condition

To assess the change in GAD-2 and PHQ-9 scores before and during the COVID-19 pandemic within each group (ie, those who have a medical condition and those who do not), a paired-samples t-test was used. The amount of change in each group was calculated using the above-mentioned formula.

To compare the change in GAD-2 and PHQ-9 scores before and during the COVID-19 pandemic in people with and without a medical condition, we conducted a repeated-measures analysis of covariance (ANCOVA). In this model, the before and during scores were considered as the repeated variable, and whether or not there was a medical condition present was the between-subject factor, controlling for age, sex and location.

Assessment of change in mental health based on various types of medical conditions

To assess the change in GAD-2 and PHQ-9 scores before and during the COVID-19 pandemic depending on having various medical conditions, repeated-measures ANCOVA was conducted with the various types of medical conditions as the between-subject factor, controlling for age, sex and location. For this analysis, we categorised the health conditions based on the organ system: 1=cardiovascular, 2=respiratory, 3=endocrine and metabolic, 4=gastrointestinal, 5=haematology and oncology, 6=psychiatric, 7=musculoskeletal (MSK), skin and connective tissue, 8=neurology and ophthalmology, and 9=other. Conditions that could not be grouped into categories 1–8 due to being written vaguely by the participants or small sample sizes (< 20) were categorised as 'other'. Participants with psychiatric conditions were removed from those that endorsed any of the other above-mentioned conditions. In addition, we conducted the same analysis but using three larger categories of only psychiatric conditions, only physical conditions, and participants who had both psychiatric and physical conditions.

Assessment of change in mental health based on the number of medical conditions

Pearson's r correlation coefficient was used to evaluate the association between the amount of change in GAD-2 and PHQ-9 scores before and during the COVID-19 pandemic and the number of medical conditions participants had.

Assessment of the influence of receiving treatment for the medical condition and activity limitation on changes in mental health

To assess whether receiving treatment had a mitigating effect on the association of COVID-19 pandemic with changes in the mental health of individuals with a medical condition, repeated-measures ANCOVA was conducted with answers to receiving treatment (yes/no) as the between-subject factor.

Participants who had a medical condition and reported receiving treatment were also asked whether the condition limits their activities (yes/no). A repeated-measures ANCOVA was conducted with the answer to this question as the between-subject factor to understand whether this feature has an influence on the amount of change in the mental health of people with a medical condition.

Missing data

In this study, we used the complete case approach to handle missing data with regard to PHQ-9 and GAD-2 scores. Therefore, participants who did not answer all the items on both tools were excluded from the study. Missing data on age, sex and location were less than 10% of the sample.

All analyses were conducted using Python V.3 Pingouin package, accepting an alpha error rate (p value) of 0.05 to indicate statistical significance, and visualisations were produced using Python V.3 Seaborn package.

Patient and public involvement

Patients or the public were not involved in the design, or conduct, or reporting or dissemination plans of our research.

RESULTS

Sample description

In total, 1847 people from 43 different countries participated in the survey, of whom 1276 with complete data were included in this study. The mean age of the included sample was 30.4 (SD 13.4), ranging from 18 to 79, and majority of the participants were female (77.7%). In total, 50.1% of the participants had at least one medical condition, and according to the responses to the SCQ the most prevalent condition (among those who reported having a medical condition) was depression (24.6%). The mean score on the GAD-2 before the COVID-19 pandemic was 2.1 (SD 1.6) and during the pandemic was 3.3 (SD 1.9), which corresponds to a 20% increase on the scale. The mean PHQ-9 score before the COVID-19 pandemic was 6.3 (SD 5.4) and during the pandemic was 10.8 (SD 6.7), which corresponds to a 17% increase on the scale. [Table 1](#) summarises participants' characteristics as well as the responses to PHQ-9, GAD-2 and SCQ.

Effect of having a medical condition on mental health during the COVID-19 pandemic

Both groups of people with (23% increase) and without (17% increase) a medical condition experienced

Table 1 Participant characteristics and demographic information

	Mean (SD) or frequency (valid percent)
Age	30.4 (13.4), range: 18–79
Sex (%)	Female=78 Male=21 Other=1
Location by country (%)	Canada=74.1 USA=18.5 Europe (France, Germany, Ireland, Italy, The Netherlands, Romania, Slovakia, Spain, Sweden, Switzerland, UK, Croatia)=2.7 Asia (China, Iran, India, Israel, Japan, Kazakhstan, Malaysia, Oman, Pakistan, Philippines, Qatar, Saudi Arabia, Singapore, United Arab Emirates)=2.5 America (Argentina, Bahamas, Brazil, Peru, Honduras, Jamaica, Saint Kitts and Nevis, Antigua and Barbuda, Mexico)=0.8 Oceania (Australia, New Zealand)=0.7 Africa (Ethiopia, Namibia, Nigeria, South Africa)=0.5 Other=0.3
Generalised Anxiety Disorder-2	Before=2.1 (1.6) After=3.3 (1.9)
Patient Health Questionnaire-9	Before=6.3 (5.4) After=10.8 (6.7)
Health condition (%)	No health condition=49.9 With at least one health condition=50.1
Self-administered Comorbidity Questionnaire* (%)	Heart disease=1.5 High blood pressure=7.7 Lung disease=6.3 Diabetes=3.0 Ulcer or stomach disease=2.9 Kidney disease=0.3 Cancer=0.5 Depression=24.6 Osteoarthritis, degenerative arthritis=5 Back pain=18 Rheumatoid arthritis=2.4 Other=26.7
Mental/physical health condition* (%)	Mental=35.4 Physical=63.3

*Percentages correspond to the subsample who had a medical condition. For instance, 1.5% of participants who reported having a medical condition had a heart disease.

significantly more symptoms of anxiety during the pandemic ($p < 0.001$). Both groups of people with (19% increase) and without (13% increase) a medical condition experienced significantly more symptoms of depression during the pandemic ($p < 0.001$). However, comparing people with a medical condition (either psychiatric or physical or both) with those without any medical condition, the increase in depression (6% difference, $p < 0.001$) was significantly higher in people with a medical condition, but was not the case for anxiety (7% difference, $p = 0.08$) (see [table 2](#) for more details).

Effect of having psychiatric or physical health conditions on mental health during the COVID-19 pandemic

People in all three categories of only psychiatric (anxiety 21% increase, depression 20% increase), only physical (anxiety 22% increase, depression 18%), and combination of physical and psychiatric (anxiety 29% increase, depression 22% increase) experienced significantly greater symptoms of anxiety and depression during the pandemic compared with before the pandemic. Compared with people with no medical condition, people with only psychiatric conditions experienced higher anxiety (GAD-2) (4% difference, which was not statistically significant, $p = 0.39$) and significantly higher depression (PHQ-9) (6.6% difference, $p = 0.004$). Compared with people with no medical condition, people with physical conditions experienced higher levels of anxiety and depression (5% difference in anxiety and 4.6% difference in depression), but the difference in both was not statistically significant. Compared with people with no medical condition, people who had both psychiatric and physical conditions experienced significantly higher levels of anxiety (12% difference, $p = 0.009$) and depression (9.4%, $p < 0.001$). *This group had the highest level of difference in both anxiety and depression* (see [table 3](#) for more details and [figures 1 and 2](#) for a visual inspection of the amount of change for all categories of no medical condition, psychiatric, physical, and combination of psychiatric and physical).

Effect of having various types of physical conditions on mental health during the COVID-19 pandemic

Compared with before the pandemic, people in each category of physical conditions (except other) experienced significantly increased symptoms of anxiety during the COVID-19 pandemic. Compared with people with no medical condition, the increase in GAD-2 scores was higher in people with cardiovascular (14%), endocrine and metabolic (6%), gastrointestinal (15%), MSK, skin and connective tissue (7%), neurological and ophthalmological (6%), respiratory (3%), and haematological and oncological (6%) conditions. This difference was not statistically significant in all conditions (see [table 4](#) for more details).

People in each category of physical conditions experienced significantly increased symptoms of depression during the COVID-19 pandemic. Compared with people

	Before (SD)	After (SD)	Amount of change	F statistics or t-value	P value
Table 2 Effect of having a medical condition on mental health during the COVID-19 pandemic					
Generalized Anxiety Disorder-2					
No medical condition	1.8 (1.5)	2.8 (1.9)	1 point on the scale (17% increase)	10.6	<0.001
With a medical condition	2.3 (1.7)	3.7 (1.8)	1.4 points on the scale (23% increase)	14.7	<0.001
Comparing people who had a medical condition and those who did not	–	–	0.4-point difference (7% difference)	3.07	0.08
Patient Health Questionnaire-9					
No medical condition	5.1 (4.4)	8.7 (6.2)	3.6 points on the scale (13% increase)	12.1	<0.001
With a medical condition	7.5 (6.0)	12.7 (6.6)	5.2 points on the scale (19% increase)	15.1	<0.001
Comparing people who had a medical condition and those who did not	–	–	1.3-point difference (6% difference)	13.89	<0.001

Table 3 Assessment of change in mental health based on having only psychiatric conditions, only physical conditions or a combination of both

	Before, mean (SD)	After, mean (SD)	P value (within group)	Mean difference (compared with no disease)	Per cent difference (compared with no disease)	F statistics (to compare with no disease)	P value (compared with no disease)
Generalized Anxiety Disorder-2							
Only psychiatric conditions (n=178)	2.94 (1.67)	4.17 (1.57)	<0.001	+0.23	4	0.75	0.39
Only physical conditions (n=273)	1.66 (1.32)	2.98 (1.75)	<0.001	+0.32	5	0.037	0.85
Both psychiatric and physical conditions (n=189)	2.66 (1.76)	4.38 (1.62)	<0.001	+0.72	12	6.93	0.009
Patient Health Questionnaire-9							
Only psychiatric conditions	9.37 (6.17)	14.66 (5.94)	<0.001	1.69	6.6	8.51	0.004
Only physical conditions	4.78 (4.10)	9.52 (5.79)	<0.001	1.14	4.6	2.45	0.118
Both psychiatric and physical conditions	9.56 (6.35)	15.62 (6.23)	<0.001	2.46	9.4	14.33	<0.001

with no medical condition, the increase in PHQ-9 scores was higher in people with cardiovascular (8%), endocrine and metabolic (5%), gastrointestinal (13%), MSK, skin and connective tissue (7%), neurological and ophthalmological (3%), haematological and oncological (11%), and respiratory (4%) conditions. This difference was not statistically significant for people in all conditions (see [table 4](#) for more details).

Effect of number of medical conditions on change in mental health during the COVID-19 pandemic

There was a small but significant positive correlation between increased anxiety ($r=0.16$, $p<0.001$) and increased depression ($r=0.14$, $p<0.001$) and the number of comorbidities.

Effects of receiving treatment for the medical condition(s) and activity limitation on changes in mental health

In people with a medical condition (either psychiatric, physical or both), there was no significant difference in the changing amounts of anxiety and depression regardless of receiving treatment for the medical condition and if the medical condition imposed a limitation on their activities ($p>0.05$) (see [table 5](#) for more details).

DISCUSSION

This study demonstrates that people with medical conditions experienced a larger increase in their anxiety and depression symptoms during the COVID-19 pandemic, with the greatest increase seen in those who had both psychiatric and physical conditions. The number of medical conditions has a small yet positive correlation with depression and anxiety, demonstrating that additional comorbidities were slightly associated with an increase in anxiety and depression symptoms during the COVID-19 pandemic. In addition, we demonstrated that receiving treatment and being limited by the medical condition do not significantly impact the mental health of people who have a medical condition.

When investigating the nature of the medical conditions and comparing the symptoms with before the pandemic, we found that individuals' mental health has changed regardless of whether they had a previously diagnosed physical or psychiatric condition. Previous reports have demonstrated that in general there is a high prevalence of anxiety and/or depression comorbid with other medical conditions.⁴⁴⁻⁴⁷ During the pandemic, this comorbidity can potentially be due to increased fear of contracting the virus, more severe complications and higher probability of mortality.^{48 49} During the COVID-19 pandemic, people with chronic conditions have reported that the fear of unavailability of health services may have negatively influenced their mental health.⁴⁸ When we stratified the data based on psychiatric, physical and both conditions, we found that compared with people who had no medical condition the difference was statistically significant for people with psychiatric conditions (for depression) and

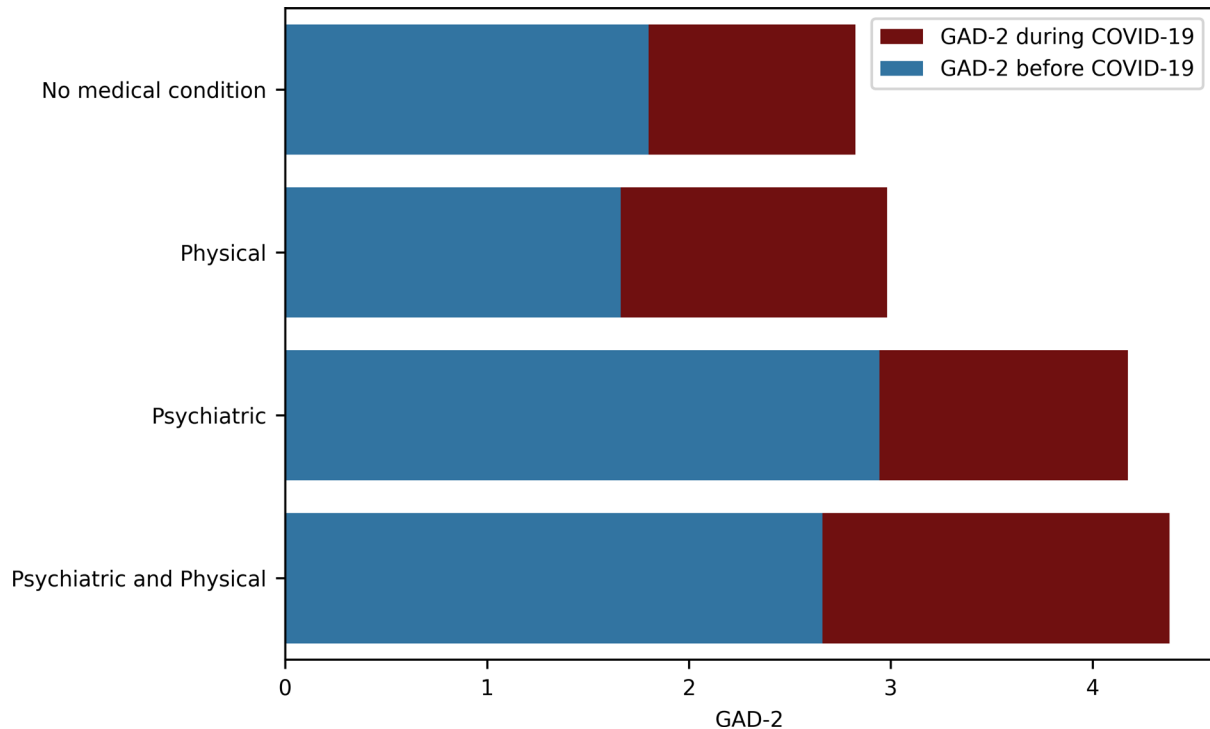


Figure 1 Changing levels of anxiety before and during the COVID-19 pandemic. GAD-2, Generalized Anxiety Disorder-2.

those with a combination of both psychiatric and physical, but not for those who had only physical conditions. A recent systematic review concluded that people with pre-existing psychiatric conditions report significantly more severe symptoms of anxiety and depression during a pandemic.⁵⁰ The reasons for the exacerbation of mental health concerns among people with a pre-existing psychiatric condition have been proposed to be due to disease

control measures such as social distancing, quarantine, separation from loved ones, isolation, inability to participate in group activities, the sense of not having control over the situation, as well as dissatisfaction about government actions.⁵⁰⁻⁵³ As the greatest increase in symptoms was observed in participants who had both physical and psychiatric conditions, we can possibly infer that these individuals may have suffered exacerbation of symptoms

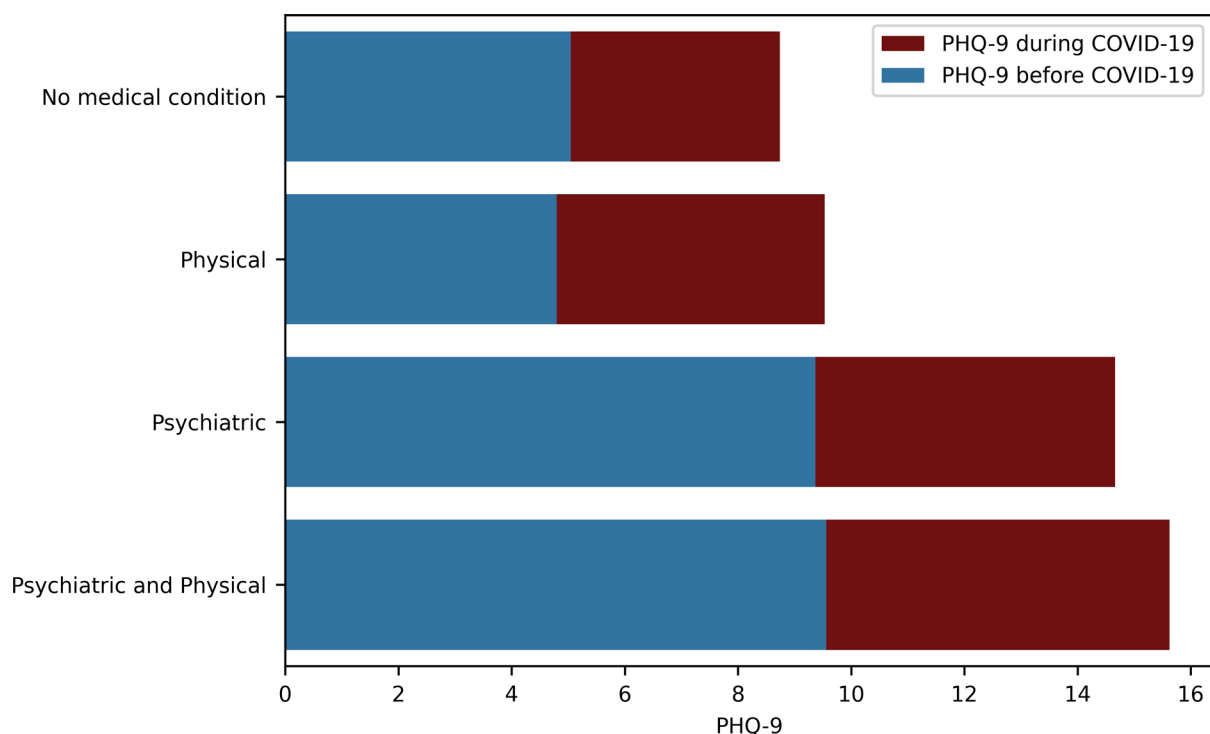


Figure 2 Changing levels of depression before and during the COVID-19 pandemic. PHQ-9, Patient Health Questionnaire-9.

Table 4 Assessment of change in mental health based on various types of physical conditions

Various physical conditions	Before, mean (SD)	After, mean (SD)	P value (within group)	Mean difference (compared with no disease)	Per cent difference (compared with no disease)	F statistics (to compare with no disease)	P value (compared with no disease)
Generalized Anxiety Disorder-2							
Cardiovascular	1.27 (1.09)	3.11 (1.87)	<0.001	+0.84	+14	1.23	0.27
Endocrine and metabolic	1.49 (1.18)	2.89 (1.77)	<0.001	+0.40	+6	0.08	0.79
Gastrointestinal	2.11 (1.21)	4.05 (1.28)	<0.001	+0.94	+15	0.81	0.37
Musculoskeletal, skin and connective tissue	1.67 (1.35)	3.08 (1.68)	<0.001	+0.41	+7	0.008	0.93
Neurology and ophthalmology	1.18 (1.15)	2.53 (1.75)	<0.001	+0.35	+6	0.04	0.83
Respiratory	1.95 (1.49)	3.15 (1.89)	<0.001	+0.20	+3	0.06	0.81
Haematology and oncology	1.47 (0.81)	2.87 (1.41)	<0.001	+0.40	+6	0.35	0.56
Other	1.78 (1.36)	2.5 (1.77)	0.08	-0.28	-5	2.52	0.11
Patient Health Questionnaire-9							
Cardiovascular	4.03 (3.57)	9.60 (5.72)	<0.001	+1.97	+8	2.65	0.104
Endocrine and metabolic	5.04 (4.13)	9.81 (6.39)	<0.001	+1.17	+5	0.16	0.69
Gastrointestinal	5.79 (3.55)	12.68 (5.52)	<0.001	+3.29	+13	3.1	0.08
Musculoskeletal, skin and connective tissue	4.81 (3.81)	9.84 (5.74)	<0.001	+1.43	+6	2.72	0.10
Neurology and ophthalmology	4.41 (3.48)	8.82 (5.38)	<0.001	+0.81	+3	0.009	0.92
Respiratory	5.75 (4.76)	10.35 (6.31)	<0.001	+1.0	+4	0.24	0.631
Haematology and oncology	3.87 (2.92)	10.4 (5.40)	<0.001	+2.93	+11	1.44	0.23
Other	4.61 (4.31)	7.72 (6.34)	0.012	-0.49	-1	0.65	0.42

The other category as written by participants included autoimmune disorder, obesity, allergies, septic shock, rheumatic fever, surgical complications/recovery, endometriosis, kidney disease, kidney stones and interstitial cystitis.

from the aforementioned disease control measures, fear of contracting the virus, higher probability of morbidity and mortality, and reduced healthcare services. The combined effects of all these factors may have led to the heightened symptoms in this group of participants.

We also investigated the association between changes in anxiety and depression symptoms in various specific types of physical conditions and found that the difference was not statistically significant. This may have been due to insufficient sample sizes in some of the smaller categories. Our study also identified that there was a significant small positive correlation between the number of medical conditions and the increase in anxiety and depression symptoms during the COVID-19 pandemic. This means that there was a slight association between the number of medical conditions and the severity of anxiety and depression symptoms during the pandemic. It is important to recognise that having two or more diseases simultaneously

can worsen the prognosis of each condition, which can lead to more severe complications and less effective treatment strategies.³² The risk of reaching endpoints in COVID-19 treatment such as admission to intensive care units, invasive ventilation or death is two times higher in people with two or more comorbidities compared with people with one other pre-existing medical condition.⁵⁴ This can help to explain the increased anxiety and depression symptoms in people with multiple comorbidities, especially for those with both physical and psychiatric conditions.

Another result of this study was that there was no significant difference in the amount of increase in depression and anxiety symptoms of individuals receiving treatment for their medical condition compared with those who were not receiving treatment. Additionally, there was no significant difference in the amount of increase in depression and anxiety symptoms

Table 5 Effects of receiving treatment for the medical condition and activity limitation on changes in mental health

	Amount of change	F value	P value
Generalized Anxiety Disorder-2			
A+X	1.34 points on the scale (22% increase)	0.09	0.76
B+Y	1.38 points on the scale (23% increase)		
A+X	1.34 points on the scale (22% increase)	3.53	0.06
C+Z	1.71 points on the scale (26% increase)		
B+Y	1.38 points on the scale (23% increase)	2.16	0.14
C+Z	1.71 points on the scale (26% increase)		
Patient Health Questionnaire-9			
A+X	4.99 points on the scale (18% increase)	2.14	0.14
B+Y	5.8 points on the scale (21% increase)		
A+X	4.99 points on the scale (18% increase)	0.05	0.83
C+Z	5.14 points on the scale (19% increase)		
B+Y	5.8 points on the scale (21% increase)	0.92	0.34
C+Z	5.14 points on the scale (19% increase)		

The letters A B and C represent the various responses to the treatment question (ie, do you receive treatment for the medical condition?), and the letters X, Y and Z represent the various responses to the activity question (ie, does your medical condition limit your activities?). The two similarly shaded rows indicate the two groups of combinations that are being compared with each other and the *F* and *p* values correspond to that particular comparison.

A: receiving treatment for the medical condition; X: activity limited by the medical condition; B: not receiving treatment for the medical condition; Y: activity not limited by the medical condition; C: receiving treatment for one condition but not another comorbid condition; Z: activity not limited by any condition.

of individuals based on whether or not their activities or functions were limited by the medical condition. In other words, receiving treatment for the condition and the activity-limiting aspect of the medical condition did not have a significant effect on the amount of change in mental health. Sangha and colleagues argue that the treatment item of the SCQ serves as a surrogate for disease severity.³⁷ This holds with the assumption that those who do not receive treatment have a mild form of the disease and those who receive treatment have a more severe form. Based on this assumption, our results potentially indicate that, although having a medical condition (psychiatric or physical) can have a negative impact on mental health during the COVID-19 pandemic, the severity of the condition does not exacerbate this negative outcome. Another aspect of this finding is that, although having treatment may indicate a more severe disease, if the treatment is effective then the person's risk is potentially decreased to the level of somebody who does not need treatment, which suggests that higher severity may be counterbalanced by effective treatment. An important aspect to point out is that the majority of the medical conditions reported by people were chronic and psychiatric diseases. This study highlights a significant gap in the current chronic disease management and that people with chronic diseases may have been neglected during the pandemic when people were only being seen for emergency issues. This lack of attention to chronic and psychiatric diseases during the pandemic may have been partially responsible for

the increase in mental health symptoms in this population. Given our results on mental health outcomes, especially in people with chronic diseases, it becomes evident that focusing only on the physical consequences of contracting the COVID-19 virus is a narrow and limited approach. The increase in symptoms of anxiety and depression during the COVID-19 pandemic in people with medical conditions further confirms the notion put forth by Horton⁵⁵ in 2020 that COVID-19 is not a pandemic, but rather a syndemic, and a syndemic approach is needed to protect the health of people.

Strengths and limitations

A principal strength of this study is its large sample size, which adds to our confidence in the precision of the estimates. Additionally, participants were not excluded based on geography and as a result people from 43 countries participated in the study. The main limitation of this study is that data regarding the prepandemic levels of anxiety and depression were collected during the pandemic. This can potentially lead to recall bias as participants may not accurately remember their previous mental status. It is important to note that the data collection started only 2 months after the WHO declared COVID-19 a pandemic, which is a relatively short period for recall bias to have a significant effect. Aside from recall bias, which is a systematic error that can happen when participants are asked about the past, people with depression or anxiety may remember past experiences or emotional states differently from those



who do not experience these conditions due to possible neurostructural changes that can lead to memory problems.⁵⁶ Therefore, there is a possibility that for some participants the significant difference may be due to this type of error. In addition, in our analyses, we controlled for important possible confounding variables including age, sex and location. However, it is possible that other confounders that we did not control for have impacted the results, such as socioeconomic status. While the SCQ has been validated to be equivalent to medical chart abstraction, we did not confirm the reports with medical records. Finally, although we were able to categorise several different medical conditions, we did not have a sufficient sample size to be confident in the effects in some of the categories or specific diseases.

CONCLUSION

This study demonstrates that, compared with before the COVID-19 pandemic, people with only psychiatric, only physical, and combination of physical and psychiatric conditions experienced significantly greater symptoms of anxiety and depression during the pandemic. Compared with people with no medical condition, people who had both psychiatric and physical conditions experienced the highest levels of anxiety and depression. The increase in anxiety and depression was slightly correlated with the number of comorbidities but was not related to whether individuals were receiving treatment or whose condition limited activity. It is important that policymakers and healthcare providers consider the impact of the COVID-19 pandemic on the mental health of the general population and consider the greater impact on those with existing medical conditions. The study findings indicate that chronic disease management may have been neglected during the pandemic, potentially leading to more severe symptoms of anxiety and depression.

Author affiliations

¹School of Rehabilitation Science, McMaster University, Hamilton, Ontario, Canada

²Health and Rehabilitation Sciences Department, Western University, London, Ontario, Canada

³Health and Rehabilitation Sciences Department, Windsor University School of Medicine, Cayon, Saint Kitts and Nevis

⁴University Health Network, Toronto, Ontario, Canada

⁵Department of Computer Science, University of Guelph, Guelph, Ontario, Canada

⁶Health and Rehabilitation Sciences, Western University, London, Ontario, Canada

⁷School of Physical Therapy, Western University, London, Ontario, Canada

⁸Roth McFarlane Hand and Upper Limb Centre, St. Joseph's Health Care London, London, Ontario, Canada

Twitter Joy MacDermid @joymacdermid

Contributors SM developed the study, interpreted the data, drafted and revised the manuscript, and is the guarantor of the study. HS developed the study, collected the data and edited the manuscript. UH analysed the data, interpreted the data, developed the figures, and edited the manuscript. JF collected the data and edited the manuscript. JB cleaned the data and helped draft the manuscript. JM supervised the study and edited the manuscript.

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ORCID iDs

Shirin Modarresi <http://orcid.org/0000-0002-2652-0480>

Hoda Seens <http://orcid.org/0000-0003-2773-4947>

Joy MacDermid <http://orcid.org/0000-0001-9311-7379>

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