

# Factors Associated with Depression and Anxiety in the Adult Population of Qatar in the First Year of the COVID-19 pandemic: Results from an Online Survey

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## Research Article

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# Abstract

**Background:** There is limited data from Arabic-speaking countries on risk factors for depression and anxiety during the COVID-19 pandemic. Country-specific data is necessary given differences in culture, demographics, COVID-19 infection and mortality rates.

**Aim:** To identify factors associated with symptoms of depression-anxiety in the adult population of Qatar during the first year of the COVID-19 pandemic.

**Method:** We conducted a cross-sectional online survey in Qatar between July and December 2020 after the first COVID-19 wave and before the beginning of the second wave. Depression-anxiety was defined as a cut-off of 20 or higher on the PHQ-ADS scale.

**Results:** Of 1138 participants, 71.05% were female, 69.0% Arabs, and 70.0% Non-Qataris. 77% were < 40 years (the median age in Qatar is 32 years). In a fully-adjusted model, six variables were significantly associated with PHQ-ADS; Arab ethnicity (OR=1.67, p=0.026), never married (OR=2.04, p < 0.001 (versus married), prior history of psychiatric disorder (versus no history) (OR=1.76, p=0.039), increased worries due to social media use for COVID-related news/updates (OR=1.72, p=0.003), those with a history of COVID-19 (OR=1.76, p=0.039), loneliness (OR=1.91, p < 0.001), and lower levels of religiosity (OR=0.96, p=0.039). These associations also pertained in the reduced model, with exception of religiosity which was only marginally statistically significant (OR=0.97, p=0.055).

**Conclusions:** The potential risk factors identified may assist with anxiety and depression prevention in future COVID-19 waves, and similar crises, and assist with early intervention to treat sufferers.

## 1. Introduction

The first cases of coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), were reported in Wuhan, China, in December 2019. In March 2020, the World Health Organization (WHO) declared the outbreak a pandemic, with 177 million confirmed cases and over 3.8 million fatalities worldwide by June 2021 (Worldometer, n.d.). Depression and anxiety are major public health problems due to their high prevalence, occurrence during working life and relatively low rates of treatment, all of which lead to a high disability. Hence, the pandemic may increase burden of anxiety and depressive disorders through fear of illness, isolation, bereavement, unemployment, and financial insecurity.

Rates of depression and anxiety in the US and Europe increased in the early months of the pandemic (Daly and Robinson, 2021; Varga et al., 2021). In the UK, mental health deteriorated in April 2020, one month after the first national lockdown (Pierce et al., 2020). The deterioration persisted and by October 2020 had not return to pre-pandemic levels (Pierce et al., 2021). A 20-week longitudinal study spanning the first lockdown in England, showed the highest levels of depression and anxiety in the early stages (Fancourt et al., 2021). Both studies (Fancourt et al., 2021; Pierce et al., 2021) showed mental health improvements, with trajectories differing between individuals, although 10% of subjects had deteriorating or consistently poor mental health throughout 6-month period.

Qatar, on the west coast of the Arabian Peninsula, has a population of 2.9 million, median age of 32 years, and 90% of whom are expatriate workers (Qatar Population 2021, n.d.). To date, there have been no data published on the mental health of the general adult population in Qatar during the pandemic (Burhamah et al., 2020). Seven Arab countries in the early stage of the pandemic (Egypt, Kuwait, Jordan, Saudi Arabia, Algeria, Iraq, and Palestine) reported that 17.0% experienced moderate or severe depressive symptoms measured by the Patient Health Questionnaire-9 or PHQ-9, while 6.3% experienced moderate or severe symptoms of generalized anxiety disorder on the GAD-7 (Shuwiekh et al., 2020). Using the same measures, a large survey (N = 4132) conducted online in Kuwait during the final five days of the first national lockdown (25th to 30th of May, 2020) reported 30.1% depression and 25.3% anxiety (Burhamah et al., 2020). An online community adult survey from the United Arab Emirates (UAE) conducted between April 8th and April 22nd, 2020 (N = 1039) reported 55.7% depression and 58.4% anxiety using the same cut-offs (score of  $\geq 10$ ) for these scales. In a convenience sample survey conducted in Saudi Arabia between April 2nd and 5th, 2020 using the Depression, Anxiety, and Stress Scale (DASS-21) scales reported similar rates to what's been reported in Kuwait: 28.3%, 24.0%, and 22.3% moderate or severe depressive, anxiety, and stress symptoms, respectively (Alkhamees et al., 2020).

A major limitation of most published studies on mental health impact of COVID-19 pandemic in the Arabic-speaking region is the lack of representative pre-pandemic baseline data on general population mental health. However, these studies identify sociocultural factors associated with psychological distress, which may help in prevention and early intervention for mental illness in current and future pandemics. The significant social differences to western countries including younger population, large number of migrants relative to the size of nationals, high level of communal religious observance, and multigenerational living arrangements with large household sizes emphasize the importance of studies in Arabic countries. These factors have been impacted by the isolation and social distancing measures imposed during the pandemic.

In addition to culture, the consequences of the COVID-19 pandemic on mental health is likely to vary between countries over time, reflecting infection rate and mortality. Qatar reported its first case of COVID-19 in late February 2020. This was followed by a rapid rise in infections, peaking in late May, falling during June and July 2020. From August 2020, infection rate remained relatively low until February 2021 when a second wave

began. The Government managed the first wave through a strict lockdown, restricting the entry of travelers to the country and making the wearing of facemasks in public and the use of a smart phone contact-tracing app compulsory. These policies, together with a well-resourced national health service, that provides free medical care to all residents and nationals, and a young population, account for the country's relatively low COVID-19 mortality. A four-phase easing of the lockdown began in mid-June 2020 with phase 4 commencing on September 1st. Some lockdown measures were reintroduced in March 2021 and a COVID-19 vaccination programme from December 2020.

At the time of writing (June 2021), the total number of people tested for COVID-19 in Qatar is 1908717, the number of cases who tested positive is 206302, the number of recovered patients is 191071, the number of active COVID-19 under treatment is 14766, and the total number of deaths is 465 ("Qatar COVID," n.d.).

We conducted the first cross-sectional online survey to identify factors associated with symptoms of depression and anxiety in adults living in Qatar between July and December 2020, after the first wave had resolved in Qatar and loosening of lockdown measures, before the second wave had started. In addition to variables that are typically associated with depression and anxiety including younger age (Moffitt et al., 2007), ethnicity (de Wit et al., 2008), female (Naser et al., 2020), loneliness (Vindegaard and Benros, 2020), and prior history of mental illness (Costa et al., 2020; Liu et al., 2020), we predicted that being infected with or having a close friend or relative infected with COVID-19 or having experienced death of a family member or friend or having been quarantined due to COVID-19 would be positively associated with moderate to severe levels of symptomology. In contrast, religiosity was hypothesized to be negatively associated with moderate-to-severe levels of these symptoms in our context though findings from published studies were mixed (Braam et al., 2001; Park et al., 2012). Furthermore, following social media outlets for COVID-19 related news and updates would be positively associated with moderate to severe levels of these symptoms as per existing findings on negative impact of social media use on mental health (Ni et al., 2020). Any changes in living arrangements or employment status were hypothesized to be significant stressors that would be positively associated with moderate to severe levels of depression or anxiety symptoms.

## **2. Materials And Methods**

### **2.1. Study design and Sample**

A convenience sample of 1138 participants were recruited through social media and completed a cross-sectional online survey made available on study website from July to December 2020. Participants were included in the study if they were a resident of Qatar (nationals and expatriates), age 18 years and above, and read/speak Arabic or English.

### **2.2. Ethics**

The study protocol was approved by Qatar University Institutional Review Board (QU-IRB 1338 EA/20) and Hamad Medical Corporation (MRC05-089) is in accordance with standard research protocols and HIPAA. Electronic consent was obtained from each respondent.

### **2.3. Participation Procedures**

The study website, adverts, study information and questionnaire were available in Arabic and English. Arabic is the official language of Qatar and English is widely spoken. The survey was programmed in Qualtrics ("Qualtrics XM - Experience Management Software," n.d.). The first page of the Qualtrics survey link showed a hyperlink of the study information sheet. After participants confirmed that they have read the study information sheet, they were required to complete a tick box consent form before able to complete the survey. The entire survey required approximately 30 minutes to complete.

### **2.4. Translation**

For our main dependent variable, officially translated versions of the PHQ-9 and GAD-7 in Arabic were obtained from the following website ([www.phqscreeners.com](http://www.phqscreeners.com)), which was developed by the MAPI research institute using internationally accepted translation methodology (Acquadro et al., 2012). For other psychosocial indices, we used the process of translation and adaptation of instruments as outlined by the WHO guidelines (WHO 2020, n.d.).

## **2.5. Measures**

### **2.5.1. Depression Symptoms**

The nine-item Physician Health Questionnaire (PHQ-9) is a relatively brief and well-validated screening measure of depression used globally in both clinical and general population samples (Alonso et al., 2004; Gelaye et al., 2014; Hyphantis et al., 2011; Kiely and Butterworth, 2015; Kocalevent et al., 2013; Kroenke et al., 2010; McGuire et al., 2013; Mitchell et al., 2016; Navinés et al., 2012). The PHQ-9 captures the frequency of nine symptom criteria for diagnosis of Major Depressive Episode (MDE) in the DSM-5 (American Psychiatric Association, 2013) within the past 2 weeks with 4-point response options for each symptom: 0 = "not at all," 1 = "several days," 2 = "more than half the days," and 3 = "nearly every day." Total scores can range from 0 to 27. In the general population, several studies have established the validity of the PHQ-9 or shorter versions (Kroenke et al., 2009; Löwe et al., 2005; Martin et al., 2006; Rancans et al., 2018). The PHQ-9 has been validated in Arabic-speaking outpatient population with

sensitivity and specificity for diagnosing MDE using a cutoff of 10 were 77% and 46%, respectively (Sawaya et al., 2016). Item 9 of the PHQ-9 (thoughts that you would be better off dead or thoughts of hurting yourself in some way) assesses passive thoughts of death or self-injury. It is sometimes used as a screener for suicide risk. However, its predictive value has been reported to be low (Kim et al., 2021).

## 2.5.2. Anxiety Symptoms

The GAD-7 is a relatively brief and well-validated screening measure for GAD symptoms used in both clinical and community samples to date (Spitzer et al., 2006). Although not a diagnostic instrument, the GAD-7 captures the frequency of seven symptom criteria for GAD in the DSM-5 (Roehr, 2013) over the past 2 weeks with the same 4-point response options for each symptom as in the PHQ-9. Cut-off scores of 5, 10, and 15 denote mild, moderate and severe GAD symptoms, respectively (Kroenke et al., 2010, 2007). Previous studies have shown that the GAD-7 exhibits good psychometric properties (Kertz et al., 2012; Löwe et al., 2008) and acceptable sensitivity, but less-than-ideal specificity (Kertz et al., 2012; Spitzer et al., 2006).

## 2.5.3. Combined Depression and Anxiety Symptoms

Our dependent variable was defined based on combining depression and anxiety into one scale known as PHQ-ADS (Kroenke et al., 2016). The PHQ-ADS threshold scores of 10, 20, and 30 were previously found to indicate mild, moderate, and severe levels of depression and anxiety symptoms, respectively (Kroenke et al., 2016). As per previous findings, a cut-off 20 was used in our study to dichotomize our dependent variable into moderate-to-severe levels versus mild levels or no symptoms of anxiety or depression (Kroenke et al., 2016).

## 2.5.4. Past Psychiatric History

We also assessed whether the respondent had any previous history of mental illness by administering the following question: "Have you ever been diagnosed with mental health problems by a professional even if you don't have it currently? By professional we mean any doctor, nurse or person with specialized training such as a psychologist or psychiatrist".

## 2.5.5. Pandemic-related Questions

We included questions about personal history of COVID-19 (reported positive status confirmed by a test), death of family member or a friend due to COVID-19, and any experience with quarantine since the pandemic started. We also asked respondents about any changes in their living arrangement since the pandemic started.

## 2.5.6. COVID-19 related Social Media Use

Among those who indicated any social media use for finding COVID-19 related news or updates, we asked the following question: "Did surfing the net and/or using social media to look for coronavirus updates, alter your level of worry about coronavirus?" Respondents answered using one of three following options: "yes, it reduced my worries", "no, it had no effect on my worries", and "yes, it increased my worries".

## 2.5.7. Loneliness

We assessed levels of loneliness using a 3-item version of the revised UCLA loneliness scale (Russell, 1996), which have been shown to have good convergent and discriminant validity as well as reliability in large population-based health surveys (Hughes et al., 2004). The first item was "how often do you feel that you lack companionship?" The second item was "how often do you feel left out?" and the third item was "how often do you feel isolated from others?" The following three response options were provided for each item or statement: 1 "Hardly ever", 2 "Some of the time", and 3 "Often". As in the revised UCLA scale, responses on these three questions were summed for each participant, with higher scores indicating greater loneliness.

## 2.5.8. Religiosity

We administered a brief measure of religiosity, the 5-item Duke University Religion Index or DUREL, which assess intrinsic and extrinsic (organizational and non-organizational) dimensions of religiosity (Koenig and Büssing, 2010). First, for each of the three subscales, the items were summed into a composite score. As recommended by the authors of the scale, we then explored how each of the three subscales correlate with our dependent variable, the PHQ-ADS, and with each other, before summing all items into one index score for each respondent, with higher scores indicating greater religiosity.

## 2.5.9. Sociodemographic and other variables

We collected standard information about age, gender, nationality, education, marital and employment status. Cultural background or ethnicity was determined based on questions in relation to nationality (country of origin) and language chosen to complete the interview (Arabic versus English). We used these variables to define two cultural groups: Arab versus non-Arab, as we were most interested in accounting for cultural differences in depression and anxiety symptoms between mainstream culture of Qatar (Arabic) versus other cultures.

## 2.6. Statistical Analysis

For each scale, we assessed distributional properties (normality, skewness, and kurtosis) as well as inter-item (tem-test and item-rest) correlations, Cronbach's alpha, and average (inter-item) covariance.

We calculated descriptive statistics including proportions/percentages, mean, standard deviation (SD), and standard errors (SEs) for all variables in the study.

For bivariate associations, the Chi-square test of proportions were initially used to compare the distribution of the categorical independent variables across the two levels of the PHQ-ADS defined by cut-off of 20 or higher: moderate-to-severe versus mild or no symptoms of depression or anxiety. Similarly, we used one way ANOVA (F-test) to compare the mean scores of loneliness and religiosity across the two-levels of PHQ-ADS.

We also fitted univariable (one variable only) and multivariable logistic regression models to identify associations between the abovementioned potential explanatory variables identified from the literature and moderate-to-severe levels relative to mild levels or no symptomology of depression or anxiety as the reference group. We estimated odds ratios (ORs) with corresponding 95% confidence intervals (CI) and robust SEs from the exponentiated coefficients of associations between these variables and our dependent variable- the PHQ-ADS.

Only one potential explanatory variable was entered into each univariable model and the corresponding unadjusted OR was estimated for the association between each variable and the PHQ-ADS. For multivariable models, we fitted a fully-adjusted model by simultaneously regressing all of the following potential explanatory variables on PHQ-ADS: Arab ethnicity, nationality (Qatari versus non-Qatari), gender, age, marital status, employment status, previous mental illness status, COVID-19 related variables (personal infection status, death or infection of someone in immediate social circle of the respondent, quarantine status, change in living arrangements), effect of COVID-19 related social media use, loneliness, and religiosity. Another competing model was also fitted – a reduced model fitted based on adjusting for only the variables that were statistically significant in the fully-adjusted model in addition to adjustment for age and gender.

We evaluated the fit of our models using the Pearson-chi square goodness of fit test and the likelihood ratio test. The latter was carried out to compare the fit of the fully-adjusted model versus the reduced model.

To evaluate the effect of missing data on robustness of our findings, we conducted a sensitivity analysis by re-running our logistic regression models that were based on complete data analysis (list wise deletion) using full information maximum likelihood estimation (FIML) with Monte Carlo integration algorithm (2000 iterations).

All statistical analyses were carried out in Stata ("Stata: Software for Statistics and Data Science | Stata," n.d.) with the exception of our sensitivity analysis, which was conducted in Mplus (Asparouhov, n.d.). A p-value less than 0.05 (typically  $\leq 0.05$ ) was considered statistically significant.

### 3. Results

The total initial sample was 2134. However, after restricting our analysis to include only those participants who completed at least 80% of the survey and responded to basic demographics (age and gender), our total final sample was reduced to 957 participants.

The characteristics of the respondents are shown in Table 1. The majority were female (71.0%), Arabs (69.0%), and Non-Qataris (70.0%). Approximately 52.0% were married and 51.0% were employed. The sample comprised of 28.0% in the youngest age category (18 to 24 years), while 23.0% of the sample was 40 years of age and above.

**Table 1:** Sample Characteristics and Bivariate Associations with Moderate-to-Severe Depression or Anxiety Symptoms (dependent variable)

	Frequency (n)	Percentage (%)	Frequency above cut-off 20 PHQ- Ads (n)	Frequency above cut-off 20 PHQ- Ads (%)	Chi/F- statistic (P-value)
<b>Ethnicity</b>					
Arab	658	69.0	239	37.0	0.581
Non-Arab	299	31.0	101	35.0	
<b>Nationality</b>					
Non-Qatari	673	70.0	236	36.0	0.750
Qatari	284	30.0	104	37.0	
<b>Education level</b>					
Below university	313	33.0	115	38.0	0.005
Under graduate	435	45.0	171	40.0	
Graduate	208	22.0	54	27.0	
<b>Gender</b>					
Male	276	29.0	71	26.0	0.000
Female	681	71.0	269	40.0	
<b>Age group</b>					
18-24	272	28.0	132	49.0	0.000
25-29	172	18.0	77	46.0	
30-34	168	18.0	47	29.0	
35-39	123	13.0	33	27.0	
40+	222	23.0	51	24.0	
<b>Marital status</b>					
Ever married	495	52.0	136	28.0	0.000
Never married	462	48.0	204	45.0	
<b>Employment status</b>					
Employed	488	51.0	141	29.0	0.000
Unemployed	468	49.0	199	44.0	
<b>Social media use</b>					
Increased worries	326	34.0	153	48.0	0.000
No effect or reduced worries	631	66.0	187	30.0	
<b>Covid-19 illness: self</b>					
Yes /Maybe	131	14.0	57	44.0	0.043
No	826	86.0	283	35.0	
<b>Covid-19 Illness: In immediate social circle</b>					
Yes/maybe	542	57.0	199	37.0	0.456
No	414	43.0	141	35.0	
<b>Covid-19 Family/Friend Death</b>					
Yes	108	11.0	46	44.0	0.087
No	848	89.0	294	35.0	
<b>Quarantine status</b>					

Yes	135	14.0	46	35.0	0.771
No	821	86.0	294	36.0	
<b>Previous psychiatric disorder</b>					
Yes	159	17.0	81	53.0	0.000
No	798	83.0	259	33.0	
<b>Covid-19 related change in living arrangement</b>					
Yes					
No					
<b>Mean loneliness score<sup>1</sup> (SD)</b>	5.84 (1.999)	—	7.25 (1.645)	—	0.000
<b>Mean religiosity score<sup>2</sup> (SD)</b>	26.11 (5.345)	—	25.15 (5.282)	—	0.000

<sup>1</sup>Assessed using 3-item version of the revised UCLA loneliness scale (Russell 1996)

<sup>2</sup>Assessed using 5-item Duke University Religion Index (DUREL) (Koenig and Büssing 2010).

In terms of COVID-related variables, 14.0% reported a positive test for COVID-19 or suspected that they contracted the virus; 14.0% reported having been quarantined, and 11.0% reported having experienced death of a family member or a friend due to COVID-19. Furthermore, 38.8% reported changes in living arrangement due to the pandemic.

The mean, standard deviation, skewness, Cronbach's alpha, average covariance, and bivariate correlations for all continuous scales are shown in Table 2.

**Table 2:** Distribution, Psychometric Properties and Bivariate Correlations for Main Study Scales.

	Mean (SD)	Median	Range Min- Max	Skewness	Cronbach's Alpha	Average inter-item covariance	PHQ-9	GAD-7	PHQ- ADS	Loneliness	Religiosity
<b>PHQ-9</b>	9.6 (7.1)	8	0-27	0.69	0.906	0.571	1.000				
<b>GAD-7</b>	7.4 (5.9)	6	0-21	0.74	0.922	0.664	0.800*	1.000			
<b>PHQ-ADS</b>	17.0 (12.4)	14	0-48	0.70	0.945	0.561	0.954*	0.932*	1.000		
<b>Loneliness</b>	5.8 (1.9)	6	3-9	0.10	0.815	0.362	0.585*	0.564*	0.610*	1.000	
<b>Religiosity</b>	26.1 (5.3)	27	11-33	-1.15	0.776	0.887	-0.155*	-0.168*	-0.172*	-0.178*	1.000

Bivariate Pearson's correlations, N = 889 to N=951 due to occasional missing data on paired variables.

\*Correlations significant at the 1.0% level after Bonferroni adjustment.

The point prevalence of depressive and anxiety symptoms based on a cut-off of 10 or higher on the PHQ-9 was 43.0% (95%CI 39.9-46.2). The point prevalence of anxiety symptoms, using a cut-off of 10 or higher, on the GAD-7 was 31.6% (95%CI: 28.7-34.7). The point prevalence of moderate-to-severe depressive or anxiety symptoms on the PHQ-ADS scale was 36.2% (95% CI 33.2-39.4). Based on the 9<sup>th</sup> item of the PHQ-9, approximately 24.0% of our sample reported having thoughts of death or self-injury within the last two weeks including 13.4% who reported feeling this way several days, 4.7% more than half of the days, and 6.1% nearly every day in the in the past two-weeks. The percentage of participants who reported previous history of mental health problems was 17.0%.

Results of the unvariable and multivariable models are shown in Table3.

**Table 3:** Bivariate and Multivariate Logistic Regression Models

Variables	Unadjusted <sup>¶</sup>				Reduced Model (N=887)				Fully-adjusted Model (N= 886)			
	OR	P-value	CI		OR	P-value	CI		OR	P-value	CI	
<b>Arab ethnicity (Non-Arab ref)</b>												
Arab	1.08	0.581	0.812	1.450	1.67	0.012	1.120	2.482	1.67	0.026	1.065	2.622
<b>Nationality (Non-Qatari ref)</b>												
Qatari	1.05	0.750	0.784	1.401	--	--	--	--	0.87	0.537	0.572	1.338
<b>Education level (Diploma or Less ref)</b>												
Graduate degree or higher	1.76	0.001	1.245	2.481	--	--	--	--	1.10	0.681	0.699	1.730
<b>Gender (Male ref)</b>												
Female	1.86	0.000	1.362	2.543	1.17	0.444	0.782	1.750	1.18	0.435	0.777	1.798
<b>Age</b>												
In years	0.96	0.000	0.949	0.975	0.99	0.216	0.968	1.007	0.99	0.283	0.968	1.009
<b>Marital status (Never Married ref)</b>												
Ever married	0.49	0.000	0.373	0.641	0.60	0.018	0.397	0.916	0.59	0.015	0.388	0.901
<b>Employment status (Unemployed ref)</b>												
Employed	0.53	0.000	0.408	0.700	--	--	--	--	0.90	0.603	0.620	1.320
<b>Previous mental illness (No ref)</b>												
	2.28	0.000	1.609	3.244	1.76	0.011	1.142	2.720	1.80	0.009	1.159	2.786
<b>People in your immediate social circle infected (No ref)</b>												
	1.11	0.456	0.845	1.451	--	--	--	--	0.93	0.712	0.653	1.338
<b>Effect of social media (No effect/ reduced worries ref)</b>												
Increased my worries	2.11	0.000	1.598	2.790	1.78	0.001	1.250	2.534	1.72	0.003	1.206	2.464
<b>Personal History of COVID_19 (No ref)</b>												
	1.47	0.044	1.010	2.144	1.70	0.033	1.043	2.778	1.76	0.039	1.030	3.008
<b>Death due to the coronavirus (No ref)</b>												
	0.70	0.088	0.464	1.055	--	--	--	--	0.68	0.154	0.395	1.158
<b>Been under quarantine (No ref)</b>												
	0.94	0.771	0.642	1.390	--	--	--	--	0.90	0.703	0.527	1.540
<b>Change in living arrangement (No ref)</b>												
	1.31	0.050	0.999	1.723	--	--	--	--	1.28	0.183	0.891	1.832
<b>Loneliness</b>												
	2.01	0.000	1.829	2.211	1.93	0.000	1.744	2.133	1.91	0.000	1.729	2.120
<b>Religiosity</b>												
	0.95	0.000	0.923	0.971	0.97	0.055	0.935	1.001	0.96	0.039	0.931	0.998

Abbreviations: Ref, reference group; OR, Odds Ratio; CI, 95% Confidence Intervals. Note. Dependent variable is moderate to severe levels of depression-anxiety based on the PHQ-ADS.

Variables that were significantly associated with moderate-to-severe levels of depression or anxiety on the PHQ-ADS in univariable models were: females, of younger age, never married, unemployed, with prior mental illness, those who stated that social media use for COVID-19 related updates/news increased their worries, those who were infected/or suspected of being infected with COVID-19, those with higher levels of loneliness, and lower levels of religiosity (Table 3).

In the fully-adjusted model, the following variables were significantly associated with PHQ-ADS including Arab ethnicity (OR=1.67, p=0.026), participants who were never married (OR=2.04, p < 0.001) (versus married), prior history of psychiatric disorder (versus no history), participants who stated that social media use for COVID-related news/updates increased their worries (OR=1.72, p=0.003), reported infected/or suspected of being with COVID-19 (OR=1.76, p=0.039), experienced higher levels of loneliness (OR=1.91, p < 0.001), and reported lower levels of religiosity (OR=0.96, p=0.039) (Table 3).

Results from the reduced model (Table 3) were the same as the fully-adjusted model with the exception of religiosity, which was only marginally statistically significant (OR=0.97, p=0.055). Comparing the fit of these two models, the likelihood ratio statistic was 7.00 and the associated p-value was 0.428 suggesting that the reduced model did not show a statistically significant improvement in model fit compared to the fully-adjusted model. Additionally, the p-value of goodness of fit test of the fully-adjusted model (Pearson  $\chi^2=867.82$ , p= 0.495) was greater than that of the reduced model (Pearson  $\chi^2=860.82$ , p= 0.476) suggesting that the former is a better fit to the data.

The results of the sensitivity analysis for these models are presented in Appendix I showing that these model estimates were robust in relation to item missingness in our data.

## Discussion

To our knowledge, this is the first study to report on depression and anxiety in the general population in Qatar between July and December 2020, after the first wave had resolved in Qatar, and before the second wave had started.

Our finding that a history of confirmed or suspected COVID-19 was associated with depression-anxiety resonates with findings from several studies in which a diagnosis of COVID-19 was associated with chronic or deteriorating mental health (Pierce et al., 2021; Taquet et al., 2021). To what extent this reflects psychosocial consequences (e.g. financial repercussions) versus biological consequences of infection is unclear. Neuro-inflammation is one possible biological mechanism by which COVID-19 infection could lead to depression-anxiety.

In our study, past psychiatric history was independently associated with current depression-anxiety. This is not surprising as both of these conditions are often recurrent. The data highlights the importance of maintaining mental health services for those with mental health disorders during the pandemic. In practice, services have been disrupted in many countries including shortages of medication and consultations moving from face to face to remote. Qatar mitigated against this by setting up the first national mental health line early on during the pandemic.

We found that lower levels of religiosity were associated with depression-anxiety. A meta-analysis found that positive religious coping is associated with better mental health outcomes in those facing stressful life events (Smith et al., 2003). A study conducted in United Arab Emirates (UAE) in the initial phase of the COVID-19 pandemic (April 2020) found that positive religious coping was associated with lower depression scores in Muslims but not Christians (Thomas and Barbato, 2020). Two studies from Qatar, one conducted in elderly population being quarantined for COVID-19, also supported this negative association between religiosity and depression-anxiety (Ouanes et al., 2021; Reagu et al., 2021). These findings suggest that health care professionals should assess spirituality as it may be another facet to help build resilience at times of stress.

The finding that loneliness was associated with depression-anxiety in our study is not surprising. Studies in both the US and the UK have reported high rates of loneliness during the pandemic (Bu et al., 2020a, 2020b; Losada-Baltar et al., 2021). Across several studies, female gender has been associated with loneliness during the pandemic in addition to younger age, lower socioeconomic status, preexisting mental health condition and living alone. There is an extensive literature showing that loneliness is associated with an increased risk of a range of psychiatric disorders (Santini et al., 2020). The pandemic is likely to have caused loneliness through quarantine and lockdown restrictions including home working and social distancing. Several other studies, including in the UK, Poland and the US (Jia et al., 2020; Kantor and Kantor, 2020; Okruszek et al., 2020), have reported an association between loneliness and anxiety and /or depression during the pandemic (Manca et al., 2020). It should be noted that our methodology assessed loneliness and depression-anxiety in the last 2 weeks during a time when infection rates had fallen after the first wave of COVID-19 and lockdown measures had been significantly relaxed. An even stronger relationship between loneliness and mood disorders may have been observed if the data were gathered when infection rates were higher and lockdown measures were more stringent.

Various interventions may be considered for combatting pandemic associated loneliness including connecting to friends and relatives by telephone and social media, using online group games, and the use of support groups. However, careful use of social media is required as shown by our finding that excessive searching for COVID-19 related information was associated with depression and/or anxiety. This finding resonates with other research. A study in China found that spending  $\geq 2$  hours daily on COVID-19 news via social media was associated with probable anxiety and depression in community-based adults (Ni et al., 2020).

The main weakness of the study is due to the convenience nature of its sample. As such it is not meaningful to comment on the prevalence of either depression or anxiety. Though these rates were relatively high including higher than expected rates of suicidal ideation, these may be well due to selection bias. However, the data can be used to investigate factors associated with depression and/or anxiety. The main strength is the use of a range of standardized instruments including the GAD-7 and PHQ-9 to assess depression and anxiety. Some studies have assessed anxiety and depression in the general population during the pandemic using single-item questions (Santini and Koyanagi, 2021).

## Conclusions

This study adds to the growing literature on potential risk factors for depression and anxiety symptoms during the pandemic. The factors we identified may assist in designing support and interventions for those at greater risk of depression and anxiety in future COVID-19 waves or lockdowns in Qatar and other Arab-speaking countries. The data presented here represent findings at one point during the pandemic in Qatar. The pandemic is a fluid event and further work is needed to determine how psychiatric morbidity varies at different points in the pandemic and between countries.

## Declarations

**Declarations of interest:** Professor Haddad reports personal fees from Janssen, Lundbeck, Otsuka, New Bridge Pharmaceuticals and Sunovion, outside the submitted work.

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**Data Availability:** The data that support the findings of this study are available from the corresponding author upon reasonable request and pending additional ethical approval.

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