



CLINICAL RESEARCH ARTICLE



## Saudi Arabia Mental Health Surveillance System (MHSS): mental health trends amid COVID-19 and comparison with pre-COVID-19 trends

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### ABSTRACT

**Background:** The impact of the COVID-19 pandemic on populations' mental health has started to emerge.

**Objectives:** To describe the mental health trends of the risk of major depressive disorder (MDD) and generalized anxiety disorder (GAD) between May and August 2020. It also compares the results with pre-COVID-19 results and identifies risk factors associated with increased likelihood of being at risk of MDD and GAD.

**Method:** This study utilizes repeated cross-sectional design, at national-level coverage of mental health screenings via computer-assisted phone interviews conducted in four waves monthly (between May and August 2020). Arabic-speaking adults from Saudi Arabia were recruited via a random phone list. The questionnaire includes the Arabic version of the Patient Health Questionnaire (PHQ-9) and the General Anxiety Disorder-7 (GAD-7). Pre-COVID-19 comparison was done using the PHQ-2 score to allow for comparison with a previous and similar national study conducted in 2018.

**Results:** Across the four waves, 16,513 participants completed the interviews, with an overall response rate of 81.3%. The weighted national prevalence of people at risk of MDD was 14.9% overall, and 13.8%, 13.6%, 16.8%, and 15.3% in Waves 1, 2, 3, and 4, respectively. The weighted national prevalence of people at risk of GAD was 11.4%, overall, and 10.9%, 10.7%, 12.4%, and 11.7% in Waves 1, 2, 3, and 4, respectively. The weighted national proportion of individuals who were at risk of MDD and GAD at the same time was 7.4% overall. The risk of MDD on PHQ-2 increased by 71.2%, from 12.5% in 2018 to 21.4% in 2020.

**Conclusions:** The risks of MDD and GAD in this study are relatively high. These results can help decision makers to understand the impact of the COVID-19 pandemic on the population's mental health and the most-impacted subgroups.

### Sistema de Vigilancia de Salud Mental de Arabia Saudita (MHSS): Tendencias de salud mental durante la pandemia COVID-19 y comparación con las tendencias pre COVID-19

**Antecedentes:** El impacto de la pandemia COVID-19 en la salud mental de la población ha comenzado a emerger.

**Objetivos:** Describir las tendencias en salud mental del riesgo de tener un trastorno depresivo mayor (MDD por sus siglas en inglés) y un trastorno de ansiedad generalizado (GAD por sus siglas en inglés) entre Mayo y Agosto de 2020. También compara los resultados con los resultados pre COVID-19 e identifica factores de riesgo asociados con el aumento de la probabilidad de estar en riesgo de sufrir MDD y GAD

**Método:** Este estudio utiliza un diseño transversal repetido, a un nivel de cobertura nacional de tamizaje sobre salud mental vía entrevistas telefónicas asistidas por computador, conducidas en 4 olas mensualmente (entre Mayo y agosto de 2020). Adultos que hablasen árabe de Arabia Saudita fueron reclutados mediante una lista aleatoria de teléfonos. El cuestionario incluía la versión árabe del Cuestionario de Salud del Paciente (PHQ-9) y de La Escala del Trastorno de Ansiedad Generalizada (GAD-7). Se hicieron comparaciones pre-COVID 19 usando el puntaje del PHQ-2 para permitir la comparación con un estudio previo nacional de características similares que fue realizado el 2018.

**Resultados:** A través de las cuatro olas, 16.513 participantes completaron las entrevistas, con una tasa de respuesta promedio de 81.3%. La prevalencia nacional calculada de personas en riesgo para MDD fue de 14.9% en general y de 13.8%, 13.6%, 16.8% y 15.3% en Olas 1, 2, 3 y 4 respectivamente. La prevalencia nacional calculada de personas en riesgo

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### PALABRAS CLAVE

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### 关键词

心理健康; 抑郁; 焦虑; 筛查; 监测; COVID-19

### HIGHLIGHTS

- In the first national study of COVID-19 impact on mental health from Saudi Arabia, the risk of depression in Saudi Arabia increased by 71.2% between May and August 2020 compared to 2018.

para GAD fue 11.4% en general y 10.9%, 10.7%, 12.4% y 11.7% en Olas 1, 2, 3 y 4 respectivamente. La proporción nacional calculada de individuos que estaban en riesgo para MDD y GAD al mismo tiempo fue de 7.4% en general. El riesgo de MDD según el PHQ-2 aumentó en un 71.2%, de 12.5% en 2018 a 21.4% en 2020.

**Conclusiones:** El riesgo de MDD y GAD encontrado en este estudio es relativamente alto. Estos resultados pueden ayudar a entender a las personas que toman decisiones del impacto de la pandemia COVID-19 en la salud mental de la población y en los subgrupos más impactados.

### 沙特阿拉伯心理健康监测系统 (MHSS): COVID-19中的心理健康趋势以及与 COVID-19之前趋势的比较

**背景:** COVID-19疫情对人们心理健康的影响开始逐渐显现。

**目的:** 描述2020年5月至8月期间重性抑郁障碍 (MDD) 和广泛性焦虑症 (GAD) 风险的心理趋势。还将这些结果与COVID-19之前的结果进行比较, 并确定患MDD和GAD可能性增加的相关风险因素。

**方法:** 本研究利用重复的横断面设计, 通过2020年5月至8月每月进行的四次计算机辅助电话访谈, 在全国范围内进行心理健康筛查。通过随机电话列表招募了沙特阿拉伯中说阿拉伯语的成人。问卷包括阿拉伯语版的患者健康问卷 (PHQ-9) 和广泛性焦虑障碍量表 (GAD-7)。与COVID-19之前的比较使用了PHQ-2评分, 以便与2018年进行的前人的类似国家研究进行比较。

**结果:** 在这四次测量中, 16,513名参与者完成了访谈, 总回应率为81.3%。MDD风险人群的加权全国患病率总体上为14.9%, 在第1, 2, 3和4次测量中分别为13.8%, 13.6%, 16.8%和15.3%。GAD风险人群的加权全国患病率总体上为11.4%, 第1, 2, 3和4次分别为10.9%, 10.7%, 12.4%和11.7%。同时为MDD和GAD的风险人群的加权全国比例总体上为7.4%。PHQ-2的MDD风险从2018年的12.5%增加到2020年的21.4%, 共增加了71.2%。

**结论:** 本研究中MDD和GAD的风险较高。这些结果可以帮助决策者了解COVID-19疫情对人群心理健康和受影响最大亚群的影响。

## 1. Introduction

As it was increasingly exposed to the COVID-19 disease and its socioeconomical and health consequences, the general population became vulnerable to the psychological impacts of COVID-19 (Lee, 2020). Psychological distress may have been caused by the restriction of individual movement and social interaction, economic impacts and job loss, fear of getting COVID-19 oneself and/or giving it to loved ones, infection or death of a close individual or loved one due to COVID-19, media and news circulation of stressful information about COVID-19, and more known or unknown factors (Serafini et al., 2020). Many international and local health authorities, as well as scientific circulations issued, call for immediate prioritization and collection of high-quality data on the mental health effects of the COVID-19 pandemic across the population and vulnerable groups (Althumiri et al., 2018; Holmes et al., 2020; Javakhishvili et al., 2020; Olff et al., 2020). By mid-2020, evidence of the COVID-19 period's effect on mental health were starting to emerge (McGinty, Presskreischer, Han, & Barry, 2020; Pierce et al., 2020).

Traditionally, social life in Saudi Arabia has revolved around the family and social gatherings; family visits and events are very common (Yezli & Khan, 2020). Religion is another major pillar of Saudi society, and groups in mosques typically hold five group prayers each day (Yezli & Khan, 2020). Group prayers in mosques are also a kind of social gathering where neighbours socialize.

On the 2nd of March 2020, the Saudi authorities reported the first case of COVID-19. As COVID-19 continued to spread, the Saudi government enforced many drastic measures, for the first time in many decades, to curb the disease, including partial and 24-hour lockdowns, suspension of religious activities such as prayer in mosques, and Umrah mass gatherings (Ebrahim & Memish, 2020; Yezli & Khan, 2020). Consequently, as in many countries globally, the economic impact of the lockdown affected many businesses in Saudi Arabia, leading to lost jobs or cuts to monthly salaries. Moreover, the government increased the value-added tax (VAT) by 10% from 5% to 15% starting from the 1<sup>st</sup> of July 2020. In general, the complete (24 hours) or partial (usually starting at 3 pm to 6 am) lockdown in Saudi Arabia lasted around 3 months, between mid-March 2020 and the end of May 2020, and for some cities and business activities, the lockdown continued until the end of June 2020.

Public health surveillance is one of the keystones of public health practice, empowering decision makers to lead and manage public health programmes more effectively by providing timely and useful information and evidence (Thacker, Qualters, & Lee, 2012). Public health surveillance is defined as 'the systematic, ongoing collection, management, analysis, and interpretation of data, followed by timely dissemination of these data to public health programs to stimulate public health action' (Porta, 2014). Mental health surveillance systems data can be used to track trends in mental

illness and psychological distress associated with exposure to traumatic events, such as military combat, or large-scale disasters, such as COVID-19 (Norris, 2006; Olf et al., 2020; Reeves, Pratt, & Thompson et al., 2011). Surveillance data are vital to the public health goals of reducing the incidence, prevalence, severity, and economic impact of mental conditions via providing timely signals to decision makers and establishing opportunities for early intervention. (BinDhim et al., 2020). Mental health screening tools are now included in the most established health surveillance surveys, such as the Centers for Disease Control and Prevention's (CDC) National Health Interview Survey (NHIS) and the Behavioural Risk Factor Surveillance System (BRFSS), which highlights the importance of mental health surveillance for the general population (Colpe et al., 2010).

Although some published peer-reviewed scientific articles have looked at the prevalence of mental health conditions in Saudi Arabia, none of these were conducted with the benefit of larger national coverage, with most focusing on specific samples, such as university students or hospital visitors (Al-Gelban, Al-Amri, & Mostafa, 2009; Al-Qadhi, Ur Rahman, Ferwana, & Abdulmajeed, 2014; Ibrahim, Dania, Lamis, Ahd, & Asali, 2013). However, the Saudi Food and Drug Authority reported the prevalence of risk of depression on a national level as part of the Saudi Health, Diet, and Physical Activity national survey, which provided a prevalence on the Patient Health Questionnaire-2 (PHQ-2) of 12.5% out of 3,698 participants from the 13 administrative regions of Saudi Arabia (Althumiri et al., 2018; Arroll et al., 2010). However, on an international level, some data are currently available from the UK and the USA that demonstrate the impact of COVID-19 on population mental health (McGinty et al., 2020; Pierce et al., 2020). In the UK, clinically significant levels of mental distress rose from 18.9% in 2018 to 27.3% in April 2020. (7) In April 2020 in the USA, 13.6% of US adults reported symptoms of serious psychological distress, relative to 3.9% in 2018 (McGinty et al., 2020).

Thus, the aim of this project is to identify, track, and monitor trends of the populations at risk of major depressive disorder (MDD) and generalized anxiety disorder (GAD) during the COVID-19 pandemic. This article covers three main objectives: 1) describe the mental health trends (anxiety & depression) between May and August 2020, 2) compare the results with pre-COVID-19 results, and 3) identify risk factors associated with increased likelihood of high risk of MDD or GAD.

## 2. Method

### 2.1. Design

This report consists of repeated cross-sectional, national-level mental health screening conducted via computer-assisted phone interviews in four waves on a monthly basis (between May and August 2020). The full methodology and rationale were previously published as a study protocol article 'as a pre-print (not yet peer-reviewed)' (BinDhim et al., 2020).

### 2.2. Participants and recruitment

Adults aged 18 years and older from Saudi Arabia were recruited via a random phone number list generated by the Sharik Association for Health Research, a research participants' database (Sharik Association for Health Research [SharikHealth], 2015). The Sharik database, of individuals interested in participating in health research, currently has more than 64,000 potential participants and is growing on a daily basis, covering the 13 administrative regions of Saudi Arabia (Sharik Association for Health Research [SharikHealth], 2015).

Participants were contacted by phone up to three times. If a participant did not respond, another potential participant with a similar demographic profile (age, sex, region) was invited. Each participant was eligible to participate once across the four waves.

### 2.3. Sample size

This surveillance system used a proportional quota sampling technique to achieve an equal distribution of participants, stratified by age, sex, and region within and across the 13 administrative regions of Saudi Arabia. We used two age groups based on the Saudi median adult age of 36 years (one group was between 18 to 36 years and the second group was over 37 years). This led to a quota of 52 for this study, which helped increase the diversity of the sample and reduced the risk of nonprobability sampling bias.

We calculated the sample size on the basis of the depth of the sub-analysis we needed to reach, which compared the age and sex groups across regions with a medium effect size of approximately 0.3 with 80% power and a 95% confidence level (Cohen, 2013). Thus, each quota required 78 participants and a total sample of 312 per region to form a grand total of 4,056 participants per wave. Once the quota sample was reached, participants with similar characteristics were not eligible to participate in the study. Quota sampling is an automated process with no human interference, as the sampling process is controlled automatically by the data collection system (BinDhim, 2012).

#### 2.4. Questionnaire design & validation

The data collection included such general demographic variables as age, sex, region, educational level, and marital status. It also included COVID-19 categorizing variables, such as employment category (e.g. healthcare professional, security, etc.), and worries about getting COVID-19. In addition, other health-related risk factors, such as a history of chronic health conditions, obesity, and smoking, were collected.

The main mental health screening tool used here was the Patient Health Questionnaire (PHQ-9) (Becker, Al Zaid, & Al Faris, 2002; Kroenke & Spitzer, 2002; Kroenke, Spitzer, & Williams, 2001). PHQ-9 was selected over other depression screening tools because 1) it has been validated for use among various age groups, including adolescents, adults, and the elderly, (BinDhim et al., 2016, 2015); and 2) it has been shown to have consistent performance regardless of the mode of administration (e.g. patient self-report, interviewer-administered in person or by telephone, or touch-screen devices). (BinDhim et al., 2016, 2015; Fann et al., 2009) 3) PHQ-9 showed validity and reliability to screen for depression in a Saudi sample (AlHadi et al., 2017; Al-Qadhi et al., 2014; Becker et al., 2002). Moreover, 4) PHQ-9 has been used for mental health screening in various international surveys and surveillance systems (e.g. the CDC in the USA uses the PHQ-9 in the Behavioural Risk Factor Surveillance System and the National Health and Nutrition Examination Survey), which can also allow for international comparison (Reeves et al., 2011). Finally, PHQ-2, which uses a subset of PHQ-9 questions, was used in a national-level survey in Saudi Arabia in 2018 with cut-off point 3, with a methodology almost identical to that of this study, covering the 13 regions of Saudi Arabia and using an identical sampling technique that should allow for pre-COVID-19 comparison (Althumiri et al., 2018).

Finally, anxiety was measured using Generalized Anxiety Disorder-7 (GAD-7), which has also shown good validity and reliability in various studies (Spitzer, Kroenke, Williams, & Löwe, 2006). GAD-7 also demonstrated good validity in a general population screening, including in the Arabic language among the Saudi population (Alosaimi, Al-Sultan, Alghamdi, Almohaimeed, & Alqannas, 2014; Löwe et al., 2008; Plummer, Manea, Trepel, & McMillan, 2016; Sawaya, Atoui, Hamadeh, Zeinoun, & Nahas, 2016).

After finalizing the first draft of the survey, we conducted linguistic validation via a focus group of eight participants, who were asked to discuss and answer the survey (excluding the previously validated screening tools 'PHQ-9 & GAD-7') as one group.

According to the results of the focus group and feedback from the researchers and interviewers, the questionnaire was edited further until the final version of it was produced. Afterwards, in a pilot stage, 115 participants were interviewed by phone to assess internal consistency, and this stage showed high internal consistency for PHQ-9 (Cronbach's alpha = 0.86) and GAD-7 (Cronbach's alpha = 0.91). The average interview time was 7 minutes.

#### 2.5. Outcome Measures

To determine the prevalence of the high risk of depression and anxiety in our sample, we used a score of more than 10, which in pooled estimates of 10 studies had the best trade-off between sensitivity, 0.89 (95% CI 0.75 to 0.96), and specificity, 0.89 (95% CI 0.79 to 0.94) (Manea, Gilbody, & McMillan, 2012).

In terms of GAD-7, pooled sensitivity and specificity values appeared acceptable at a cut-off point of 8 [sensitivity: 0.83 (95% CI 0.71–0.91), specificity: 0.84 (95% CI 0.70–0.92)], and cut-off scores between 7 and 10 also had similar pooled estimates of sensitivity/specificity (Plummer et al., 2016). In addition, on the GAD-7 anxiety measure, a score of 10 or more showed the optimum cut-off in the literature and in previous studies on Saudi populations (Alosaimi et al., 2014; Spitzer et al., 2006).

Finally, worries about getting the COVID-19 disease were measured with a 5-point Likert-scale question, rated from 1 (*not worried at all*) to 5 (*extremely worried*).

#### 2.6. Statistical analysis

Prevalence data were weighted to equal the adult population in Saudi Arabia, according to the General Authority of Statistics Census Report. Quantitative variables are presented by mean and SD if they have a normal distribution or by median and range, as appropriate, and are compared using a t-test. Qualitative variables are presented as percentages and CIs and compared using Pearson's  $\chi^2$  test. Logistic regression adjusted for age and sex as the main non-modifiable demographical variables and non-adjusted was used for multivariate analysis to explore risk factors associated with being at risk of MDD or GAD. As this study used automated electronic data collection, there are no missing values; the QPlatform® also includes a data integrity check to prevent users from entering invalid data (BinDhim, 2012).

#### 2.7. Ethical considerations

The ethics committee of the Sharik Association for Health Research approved this research project

**Table 1.** Participant demographics.

	Wave 1 n (%)	Wave 2 n (%)	Wave 3 n (%)	Wave 4 n (%)	All Waves n (%)
<b>Sex</b>					
Male	1989 (49.7)	2083 (49.8)	2058 (49.6)	2092 (50.1)	8222 (49.8)
Female	2015 (50.3)	2097 (50.2)	2095 (50.4)	2084 (49.9)	8291 (50.2)
<b>Education Level</b>					
High school or less	1444 (36.1)	1457 (34.9)	1465 (35.3)	1548 (37.1)	5914 (35.8)
Undergraduate diploma	484 (12.1)	456 (10.9)	466 (11.2)	443 (10.6)	1849 (11.2)
Bachelor's degree	1846 (46.1)	2022 (48.4)	1955 (47.1)	1955 (46.8)	7778 (47.1)
Postgraduate degree (Master's/PhD)	230 (5.7)	245 (5.9)	267 (6.4)	230 (5.5)	972 (5.9)
<b>Income Level</b>					
Less than 5000 SAR	629 (15.7)	604 (14.4)	689 (16.6)	678 (16.2)	2600 (15.7)
Between 5001 and 8000 SAR	687 (17.2)	595 (14.2)	668 (16.1)	709 (17.0)	2659 (16.1)
Between 8001 and 11000 SAR	619 (15.5)	610 (14.6)	664 (16.0)	652 (15.6)	2545 (15.4)
Between 11001 and 13000 SAR	486 (12.1)	551 (13.2)	502 (12.1)	539 (12.9)	2078 (12.6)
Between 13001 and 16000 SAR	542 (13.5)	628 (15.0)	559 (13.5)	603 (14.4)	2332 (14.1)
More than 16000 SAR	1041 (26.0)	1192 (28.5)	1071 (25.8)	995 (23.8)	4299 (26.0)
<b>Regions</b>					
Asir	321 (8.0)	322 (7.7)	321 (7.7)	321 (7.7)	1285 (7.8)
Baha	316 (7.9)	311 (7.4)	314 (7.6)	320 (7.7)	1261 (7.6)
Eastern region	314 (7.8)	322 (7.7)	323 (7.8)	324 (7.8)	1283 (7.8)
Hail	293 (7.3)	326 (7.8)	320 (7.7)	322 (7.7)	1261 (7.6)
Jazan	312 (7.8)	321 (7.7)	324 (7.8)	321 (7.7)	1278 (7.7)
Al Jouf	288 (7.2)	318 (7.6)	320 (7.7)	326 (7.8)	1252 (7.6)
Madinah	321 (8.0)	325 (7.8)	316 (7.6)	321 (7.7)	1283 (7.8)
Makkah	325 (8.1)	325 (7.8)	323 (7.8)	320 (7.7)	1293 (7.8)
Najran	303 (7.6)	322 (7.7)	321 (7.7)	320 (7.7)	1266 (7.7)
Northern border	318 (7.9)	318 (7.6)	321 (7.7)	318 (7.6)	1275 (7.7)
Qassim	309 (7.7)	328 (7.8)	320 (7.7)	320 (7.7)	1277 (7.7)
Riyadh	301 (7.5)	323 (7.7)	320 (7.7)	324 (7.8)	1268 (7.7)
Tabuk	382 (7.1)	319 (7.6)	310 (7.5)	319 (7.6)	1231 (7.5)
<b>Marital Status</b>					
Never married	1548 (38.7)	1641 (39.3)	1611 (38.8)	1582 (37.9)	6382 (38.6)
Married	2196 (54.8)	2269 (54.3)	2279 (54.9)	2327 (55.7)	9071 (54.9)
Divorced/Separated	169 (4.2)	165 (3.9)	152 (2.7)	163 (3.9)	649 (3.9)
Widowed	91 (2.3)	105 (2.5)	111 (2.7)	104 (2.5)	411 (2.5)
<b>Work Status</b>					
Employed	1579 (39.4)	1723 (41.2)	1638 (39.4)	1678 (40.2)	6618 (40.1)
Self-employed	179 (4.5)	189 (4.5)	170 (4.1)	178 (4.3)	716 (4.3)
Unemployed	1121 (28.0)	1081 (25.9)	1117 (26.9)	1166 (27.9)	4485 (27.2)
Student	816 (20.4)	853 (20.4)	907 (21.8)	849 (20.3)	3425 (20.7)
Retired	309 (7.7)	334 (8.0)	321 (7.7)	305 (7.3)	1269 (7.7)
<b>Grand Total</b>	<b>4004</b>	<b>4180</b>	<b>4153</b>	<b>4176</b>	<b>16513</b>

(Approval no.2020–1) according to the national research ethics regulations. Consent to participate was obtained verbally during the phone interviews with the participants and recorded on the data collection system.

### 2.8. Role of the funding source

This project is funded by King Abdulaziz City for Science and Technology (KACST); grant number (5–20-01-000-0001). The funder of the study had no role in data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

## 3. Results

### 3.1. Demographics

Across the four waves (May, June, July, August 2020), 16,513 participants completed the interviews, with an overall response rate of 81.3%

(16,513/20,294). Table 1 shows the distribution of the sample across the waves by the main demographic variables. The mean age was 36.5, and the median age 36 (range between 18 and 90).

### 3.2. Health status and risk factors

Table 2 shows the distribution of health status and other risk factors by waves.

### 3.3. Mental health risks

The weighted national prevalence of people at risk of MDD (PHQ-9 – Cut-Off above 10) was 14.9% overall and 13.8%, 13.6%, 16.8%, and 15.3% in waves 1, 2, 3, and 4, respectively. The weighted national prevalence of people at risk of GAD (GAD-7 – Cut-Off above 10) was 11.4% overall and 10.9%, 10.7%, 12.4%, and 11.7% in Waves 1, 2, 3, and 4, respectively. The weighted national proportion of individuals at risk of MDD and GAD at the same time was 7.4% overall and 6.6%, 6.2%, 8.1%, and 8.4% in Waves 1, 2, 3, and 4, respectively. The weighted national proportion of

**Table 2.** Health status and risk factors.

	Wave 1 n (%)	Wave 2 n (%)	Wave 3 n (%)	Wave 4 n (%)	All Waves n (%)
<b>Have Chronic Health Condition</b>					
Yes	1429 (35.7)	1385 (33.1)	1585 (38.2)	1504 (36.0)	5903 (35.7)
No	2575 (64.3)	2795 (66.9)	2568 (61.8)	2672 (64.0)	10610 (64.3)
<b>Previously Diagnosed with Depression Disorder</b>					
Yes	97 (2.4)	75 (1.8)	116 (2.8)	96 (2.3)	384 (2.3)
No	3907 (97.6)	4105 (98.2)	4037 (97.2)	4080 (97.7)	16129 (97.7)
<b>Previously Diagnosed with Anxiety Disorder</b>					
Yes	61 (1.5)	47 (1.1)	83 (2.0)	50 (1.2)	241 (1.5)
No	3943 (98.5)	4133 (98.9)	4070 (98.0)	4126 (98.8)	16272 (98.5)
<b>Obesity (BMI<math>\geq</math>30)</b>					
Yes	882 (22.0)	889 (21.3)	811 (19.5)	805 (19.3)	3387 (20.5)
No	3122 (78.0)	3291 (78.7)	3342 (80.5)	3371 (80.7)	13126 (79.5)
<b>Cigarette Smoking</b>					
Daily smoker	476 (11.9)	427 (10.2)	398 (9.6)	404 (9.7)	1705 (10.3)
Occasional (social) smoker	386 (9.6)	403 (9.6)	357 (8.6)	388 (9.3)	1534 (9.3)
Non-Smoker	3142 (78.5)	3350 (80.1)	3398 (81.8)	3384 (81.0)	13274 (80.4)
<b>Going Out for Work during COVID-19 pandemic</b>					
Yes, daily	942 (23.5)	1078 (25.8)	1104 (26.6)	1158 (27.7)	4282 (25.9)
Yes, sometimes	416 (10.4)	484 (11.6)	485 (11.7)	477 (11.4)	1862 (11.3)
Not at all	2646 (66.1)	2618 (62.6)	2564 (61.7)	2541 (60.8)	10369 (62.8)
<b>Worries about Getting COVID-19</b>					
1 Not worried at all	1082 (27.0)	918 (22.0)	1048 (25.2)	1110 (26.6)	4158 (25.2)
2	983 (24.6)	902 (21.6)	923 (22.2)	841 (20.1)	3649 (22.1)
3	1046 (26.1)	1189 (28.4)	1165 (28.1)	1105 (26.5)	4505 (27.3)
4	456 (11.4)	541 (12.9)	560 (13.5)	571 (13.7)	2128 (12.9)
5 Extremely worried	437 (10.9)	630 (15.1)	457 (11.0)	549 (13.1)	2073 (12.6)
<b>Healthcare Worker</b>					
Yes	295 (7.4)	357 (8.5)	302 (7.3)	310 (7.4)	1264 (7.7)
No	3709 (92.6)	3823 (91.5)	3851 (92.7)	3866 (92.6)	15249 (92.3)
<b>Living with Children</b>					
Yes	1277 (31.9)	1260 (30.1)	1347 (32.4)	1348 (32.3)	5232 (31.7)
No	2727 (68.1)	2920 (69.9)	2806 (67.6)	2828 (67.7)	11281 (68.3)
<b>Living with Elderly Person</b>					
Yes	1174 (29.3)	1103 (26.4)	1173 (28.2)	1051 (25.2)	4501 (27.3)
No	2830 (70.7)	3077 (73.6)	2980 (71.8)	3125 (74.8)	12012 (72.7)
<b>Number of People Living in Same Home</b>					
0–3	615 (15.4)	630 (15.1)	667 (16.1)	673 (16.1)	2585 (15.7)
4–6	1492 (37.3)	1580 (37.8)	1598 (38.5)	1632 (39.1)	6302 (38.2)
7+	1897 (47.4)	1970 (47.1)	1888 (45.5)	1871 (44.8)	7626 (46.2)
<b>Grand Total</b>	<b>4004</b>	<b>4180</b>	<b>4153</b>	<b>4176</b>	<b>16513</b>

individuals at risk of one or both conditions was 19.0% overall. Table 3 shows the prevalence of people at risk of MDD, GAD, and both disorders by sex in the study sample. Overall, there were significant differences between male and female participants in risk of MDD –  $\chi^2 (1, N = 16,513) = 113.0, p < .001$  – of GAD –  $\chi^2 (1, N = 16,513) = 60.1, p < .001$ . – and of both disorders –  $\chi^2 (1, N = 16,513) = 46.3, p < .001$ .

### 3.3.1. Comparison among waves

Chi-square analysis showed no significant differences in the proportions of participants at risk of MDD  $\chi^2 (1, N = 8,176) = 0.059, p = .808$  and of participants at risk of GAD  $\chi^2 (1, N = 8,176) = 0.069, p = .793$  between Wave 1 and Wave 2. However, there were significant differences in the proportions of participants at risk of MDD  $\chi^2 (1, N = 8,289) = 16.90, p < .001$  and of participants at risk of GAD  $\chi^2 (1, N = 8,289) = 5.84, p = .016$  between Wave 2 and Wave 3. The differences between Wave 3 and Wave 4 were not significant, risk of MDD  $\chi^2 (1, N = 8,273) = 3.45, p = .063$  and of participants at risk of GAD  $\chi^2 (1, N = 8,273) = 1.22, p = .268$ .

### 3.4. Comparison with pre-COVID-19 trends

In 2018, based on PHQ-2, the weighted prevalence of participants at risk out of 3,698 participants (their mean age was 36.9 years and 51.2% were males) was 12.5% (Althumiri et al., 2018). In this study, the weighted national prevalence of people at risk of MDD (PHQ-2 – Cut-Off 3 and above) was 21.4% overall, and 21.5%, 20.3%, 22.3%, and 21.3% in Waves 1, 2, 3, and 4, respectively.

### 3.5. Risk factors associated with being at risk of MDD and GAD

As shown in Table 4, having a chronic health condition, working completely from home, obesity, cigarette smoking, having worries about getting COVID-19, and living with an elderly person were significantly associated with being at risk of MDD and GAD.

## 4. Discussion

This study presents the results of the Saudi Arabia Mental Health Surveillance System during the

**Table 3.** Prevalence of people at risk of MDD, GAD, and both disorders by sex in the study sample.

	Wave 1 n (%)			Wave 2 n (%)			Wave 3 n (%)			Wave 4 n (%)			All Waves n (%)		
	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total
PHQ-9 (Cut-Off above 10)															
At risk of MDD	321 (15.9)	249 (12.5)	570 (14.2)	333 (15.9)	225 (10.8)	558 (13.3)	351 (16.8)	248 (12.1)	599 (14.4)	346 (16.6)	213 (10.2)	559 (13.4)	1351 (16.3)	935 (11.4)	2286 (13.8)
Not at risk of MDD	1694 (84.1)	1740 (87.5)	3434 (85.8)	1764 (84.1)	1858 (89.2)	3622 (86.7)	1744 (83.2)	1810 (87.9)	3554 (85.6)	1738 (83.4)	1879 (89.8)	3617 (86.6)	6940 (83.7)	7287 (88.6)	14227 (86.2)
<b>GAD-7 (Cut-Off above 10)</b>															
At risk of GAD	269 (13.3)	222 (11.2)	419 (12.3)	279 (13.3)	184 (8.8)	463 (11.1)	281 (13.4)	219 (10.6)	500 (12.0)	298 (14.3)	191 (9.1)	489 (11.7)	1127 (13.6)	816 (9.9)	1943 (11.8)
Not at risk of GAD	1746 (86.7)	1767 (88.8)	3513 (87.7)	1818 (86.7)	1899 (91.2)	3717 (88.9)	1814 (86.6)	1839 (89.4)	3653 (88.0)	1786 (85.7)	1901 (90.9)	3687 (88.3)	7164 (86.4)	7406 (90.1)	14570 (88.2)
<b>Combined Risk of MDD and GAD</b>															
Yes	260 (12.9)	125 (6.3)	290 (7.2)	274 (13.1)	107 (5.1)	276 (6.6)	268 (12.8)	132 (6.4)	314 (7.6)	206 (9.9)	117 (5.6)	323 (7.7)	722 (8.7)	481 (5.9)	1203 (7.3)
No	1755 (87.1)	1864 (93.7)	3714 (92.8)	1823 (86.9)	1976 (94.9)	3904 (93.4)	1827 (87.2)	1926 (93.6)	3839 (92.4)	1878 (90.1)	1975 (94.4)	3853 (92.3)	7569 (91.3)	7741 (94.1)	15310 (92.7)
<b>Grand Total</b>	<b>2015</b>	<b>1989</b>	<b>4004</b>	<b>2097</b>	<b>2083</b>	<b>4180</b>	<b>2095</b>	<b>2058</b>	<b>4153</b>	<b>2084</b>	<b>2092</b>	<b>4176</b>	<b>8291</b>	<b>8222</b>	<b>16513</b>

COVID-19 pandemic between May and August 2020. The results showed that the risks of MDD and GAD are relatively high. Considering that this study and a prior study used almost identical methodology, the risk of MDD on PHQ-2 increased by 71.2%, from 12.5% in 2018 to 21.4% in 2020, although PHQ-2 is less accurate than PHQ-9 in measuring the risk of depression. As found in most literature around the world, female participants in this study were significantly more likely to be at risk of MDD and GAD than male participants. The study identified some risk factors associated with increased likelihood of being at risk of MDD and GAD, including having a chronic health condition, working completely from home, obesity, cigarette smoking, having worries about getting COVID-19, number of people living in same home, and living with an elderly person. To our knowledge, this is one of the first national general population studies to emerge that uses a reliable measure of mental health with pre-pandemic baseline data and monthly long-term tracking of population mental health during the COVID-19 pandemic.

Unfortunately, there were no scientifically published data about the prevalence of MDD and GAD or their risk at the national level in Saudi Arabia, although some national projects have been initiated over the last few years. The only published peer-reviewed scientific article that includes national-level data from MDD risk screenings was published in 2018, with a national weighted prevalence of 12.5% using PHQ-2. No national-level data have been published about GAD for the general population in Saudi Arabia. However, a recent large study targeting healthcare professionals during the COVID-19 period in Saudi Arabia found that 32.3% of 4920 healthcare practitioners have high anxiety levels (Alenazi et al., 2020). However, the WHO released the international report ‘Depression and Other Common Mental Disorders: Global Health Estimates’ in 2017, which showed that the prevalence of depression in the Eastern Mediterranean region was around 5% and the prevalence of anxiety was around 4% (World Health Organization, 2017). Nevertheless, the current prevalence of risk of MDD and GAD found in this screening study is relatively high, at 14.9% and 11.4% overall for risk of MDD and GAD, respectively. The CDC used PHQ-9 in the National Health and Nutrition Examination Survey (NHANES) to screen for depression in the USA and found that, during 2013–2016, 8.1% of Americans aged 20 and over had depression (depression was defined as a score of 10 or higher) (Brody, Pratt, & Hughes, 2018). The same report also showed significant differences between men and women (Brody et al., 2018).

Until the time of this report’s writing, three international studies had looked at differences in mental health between the pre-COVID-19 period

**Table 4.** Risk factors associated with risk of MDD and GAD.

Variables	Crude OR (95% CI) (p-value)	Adjusted OR (95% CI) (p-value)*
<b>Risk of MDD (PHQ-9 Cut-Off above 10)</b>		
<b>Have Chronic Health Condition (Without Depression &amp; Anxiety)</b>	Reference	Reference
No	1.29 (1.17–1.41) (<0.001)	1.66 (1.50–1.84) (<0.001)
Yes		
<b>Going Out for Work during COVID-19 **</b>	Reference	Reference
Yes, daily	0.97 (0.82–1.14) (0.743)	1.04 (0.88–1.232) (0.598)
Yes, sometimes	1.55 (1.38–1.74) (<0.001)	1.22 (1.07–1.38) (0.002)
Not at all		
<b>Healthcare Worker</b>	Reference	Reference
No	0.83 (0.70–0.98) (0.034)	0.84 (0.71–1.00) (0.051)
Yes		
<b>Obesity (BMI≥30)</b>	Reference	Reference
No	1.11 (1.01–1.23) (0.031)	1.22 (1.10–1.35) (<0.001)
Yes		
<b>Cigarette Smoking</b>	Reference	Reference
Non-Smoker	1.11 (0.97–1.28) (0.109)	1.52 (1.31–1.77) (<0.001)
Daily smoker	1.22 (1.06–1.42) (0.005)	1.50 (1.29–1.74) (<0.001)
Occasional (social) smoker		
<b>Worries about Getting COVID-19</b>	Reference	Reference
1 Not worried at all	0.95 (0.83–1.08) (0.484)	0.91 (0.80–1.04) (0.208)
2	1.04 (0.92–1.18) (0.445)	0.99 (0.88–1.13) (0.988)
3	1.41 (1.22–1.63) (<0.001)	1.40 (1.21–1.62) (<0.001)
4	1.89 (1.64–2.18) (<0.001)	1.84 (1.59–2.12) (<0.001)
5 Extremely worried		
<b>Living with Children</b>	Reference	Reference
No	0.88 (0.80–0.97) (0.013)	0.87 (0.79–0.96) (0.010)
Yes		
<b>Living with Elderly Person</b>	Reference	Reference
No	1.31 (1.19–1.44) (<0.001)	1.30 (1.18–1.43) (<0.001)
Yes		
<b>Number of People Living in Same Home</b>	Reference	Reference
0–3	1.38 (1.20–1.57) (<0.001)	1.37 (1.20–1.57) (<0.001)
4 – 6	1.30 (1.14–1.40) (<0.001)	1.26 (1.11–1.44) (<0.001)
7+		
<b>Risk of GAD (GAD-7 Cut-Off of 10)</b>		
<b>Have Chronic Health Condition (Without Depression &amp; Anxiety)</b>	Reference	Reference
No	1.42 (1.28–1.57) (<0.001)	1.55 (1.38–1.74) (<0.001)
Yes		
<b>Going Out for Work during COVID-19 **</b>	Reference	Reference
Yes, daily	0.91 (0.76–1.09) (0.352)	0.94 (0.79–1.13) (0.560)
Yes, sometimes	1.30 (1.14–1.48) (<0.001)	1.17 (1.02–1.35) (0.025)
Not at all		
<b>Healthcare Worker</b>	Reference	Reference
No	0.80 (0.66–0.97) (0.025)	0.82 (0.67–0.99) (0.048)
Yes		
<b>Obesity (BMI≥30)</b>	Reference	Reference
No	1.14 (1.02–1.27) (0.020)	1.15 (1.03–1.29) (0.013)
Yes		
<b>Cigarette Smoking</b>	Reference	Reference
Non-Smoker	1.39 (1.20–1.60) (<0.01)	1.84 (1.57–2.15) (<0.001)
Daily smoker	1.21 (1.03–1.43) (0.018)	1.49 (1.25–1.76) (<0.001)
Occasional (social) smoker		
<b>Worries about Getting COVID-19</b>	Reference	Reference
1 Not worried at all	0.71 (0.61–0.84) (0.001)	0.70 (0.60–0.82) (<0.001)
2	0.96 (0.83–1.10) (0.562)	0.92 (0.80–1.06) (0.300)
3	1.60 (1.36–1.87) (<0.001)	1.56 (1.34–1.83) (<0.001)
4	2.30 (1.98–2.68) (<0.001)	2.22 (1.91–2.58) (<0.001)
5 Extremely worried		
<b>Living with Children</b>	Reference	Reference
No	0.92 (0.82–1.03) (0.152)	0.92 (0.83–1.03) (0.177)
Yes		
<b>Living with Elderly Person</b>	Reference	Reference
No	1.22 (1.10–1.36) (<0.001)	1.21 (1.09–1.34) (<0.001)
Yes		
<b>Number of People Living in Same Home</b>	Reference	Reference
0–3	1.36 (1.17–1.58) (<0.001)	1.34 (1.15–1.56) (<0.001)
4 – 6	1.42 (1.22–1.65) (<0.001)	1.38 (1.19–1.61) (<0.001)
7+		

\*Adjusted for age and sex; \*\*unemployed and retired were excluded.

and period of the COVID-19 pandemic. The three studies found a significant increase from the baseline in 2018 (in the UK, from 18.9% in 2018 to 27.3% in April 2020; in the USA, from 3.9% in

2018 to 13.6% in April 2020) (McGinty et al., 2020; Pierce et al., 2020). The third study used PHQ-2 to compare between data from 2019 and 2020 in the USA and found that the risk increased



from 6.6% in 2019 to 23.5% in April 2020 (Twenge & Joiner, 2020). The overall risk in 2020 in Saudi Arabia is closer to that of the USA than that of the UK, generally. However, this is the first national-level study from a developing non-Western country to report such an increase in mental health risk during the COVID-19 pandemic.

However, the risk of both MDD and GAD increased significantly between Wave 2 (June 2020) and Wave 3 (July 2020), and the increase was sustained in Wave 4. We assume that the cause of this increase is complex, as it may be associated with the latency of mental health symptoms. In addition, the government increased the value-added tax (VAT) by 10%, from 5% to 15% starting from 1st of July 2020, which may also have played a role in the increased risk.

This study found that having a chronic health condition, working completely from home, obesity, cigarette smoking, worries about getting COVID-19, and living with an elderly person were significantly associated with being at risk of MDD and GAD. This information is important to decision makers for understanding the psychological impact and identifying segments of the population who may need support and special help programs. The increase of the proportions of people at risk of MDD and/or GAD must be addressed also in terms of service accessibility, and more importantly, increasing awareness of mental health importance and its related stigma. Decision makers may also implement a periodic mental health screening programmes to capture future trends and build a historical database that may help in future emergencies. Finally, this study focused on the adult general population, and more focus is also needed on the youth, as they, too, are susceptible to developing mental health conditions.

The use of proportional quota (nonprobability) sampling provides more statistical power to detect changes, not only at national but also at regional levels, which further helps to stratify data in relation to the most affected regions and subpopulations to provide a more in-depth picture of the effects of COVID-19. However, we acknowledge that using nonprobability sampling has some risk of bias. Although we strived to obtain a large sample with larger coverage of the population, the quota sampling design may limit generalizability and representativeness. However, the obtained sample fits the national adult age average and sex distribution and was weighted to fit the region's distribution. Currently, the only way to conduct a random representative national survey in Saudi Arabia is via household interviews, but such a method is not possible under COVID-19 restrictions and curfews, and it is also costly to operate on a monthly basis. Therefore, this study also considered the cost of conducting a more cost-effective project

via quota sampling. Finally, to improve the sampling accuracy, 52 strata were used to allow for inclusion of a more diverse sample. Although the sample was weighted to represent the adult population in Saudi Arabia, the generalizability of the results may still be affected by the nonprobability sampling used in this study.

## 5. Conclusion

This study presents the results of the Saudi Arabia Mental Health Surveillance System during the COVID-19 pandemic from May to August 2020. The results showed that the risks of MDD and GAD are relatively high. The results of this study will help decision makers understand the impact of the COVID-19 pandemic on the population's mental health and customize support to the most-impacted subgroups.

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## Disclosure statement

No potential conflict of interest was reported by the authors.

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## Author contributions

All authors provided major contributions to the conceptual design and development of this study protocol. Nora A Althumiri and Mada H Basyouni supervised the data collection process. Nasser F BinDhim conducted the data analysis. All authors reviewed the data analysis process and provided feedback and suggestion for changes and modifications in a live meeting. Nasser F BinDhim wrote the first draft of the manuscript and all authors reviewed and approved the final manuscript.

## Data availability statement

To comply with local regulations all national datasets from Saudi Arabia must be deposited to the National Health Research and Studies Portal. The data that support the findings of this study are available on request for researchers from the National Health Research and Studies Portal at: <https://nhrsp.shc.gov.sa/>

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