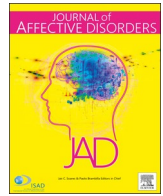




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Research paper

Depressed, anxious, and stressed: What have healthcare workers on the frontlines in Egypt and Saudi Arabia experienced during the COVID-19 pandemic?



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ABSTRACT

Introduction: As the Novel Corona Virus Disease (COVID-19) was declared by the world health organization a pandemic in March 2020, thousands of healthcare workers (HCWs) worldwide were on the frontlines fighting against the pandemic. Herein, we selected two Middle East countries; Egypt and Saudi Arabia to investigate the psychological impacts of the COVID-19 pandemic on their HCWs.

Methods: In this cross-sectional study, a Google survey was used to access HCWs in many hospitals in Egypt and Saudi Arabia between the 14th and 24th of April 2020. The survey assessed HCWs regarding their socio-demographic and occupational features, sleeping hours, and psychological impacts of the COVID-19 pandemic using the Depression Anxiety Stress Scale-21 (DASS-21).

Results: This study included 426 HCWs (48.4% physicians, 24.2% nurses, and 27.4% other HCWs). Of them, 69% had depression, 58.9% had anxiety, 55.9% had stress, and 37.3% had inadequate sleeping (<6 h/day). Female sex, age ≤30 years, working in Egypt, attending emergency and night shifts, watching/reading COVID-19 news ≥2 h/day, and not getting emotional support from family, society, and hospital were associated with a high likelihood of depression, anxiety, stress, and inadequate sleeping.

Limitations: the cross-sectional design restricted our ability to distinguish between preexisting and emerging psychological symptoms.

Conclusion: HCWs on the frontlines in Egypt and Saudi Arabia experienced depression, anxiety, stress, and inadequate sleeping during the COVID-19 pandemic.

1. Introduction

With more than 110 countries affected, the World Health Organization (WHO) declared, on the 11th of March 2020, the Novel Corona Virus Disease (COVID-19) a pandemic (WHO 2020a). As of the 1st of May 2020, 3175,207 confirmed COVID-19 cases and 224,172 related deaths have been reported worldwide (WHO, 2020b). In response to the COVID-19 pandemic, a state of lockdown in several countries has been set to prevent the spread of infection which resulted in huge economic losses, breaks in the global supply chains, wide media coverage, political division, disrupted travel plans, school closures, and

future uncertainty. These consequences led to a global atmosphere of psychological distress (Ebrahim et al., 2020; Ho et al., 2020; Peng et al., 2020).

Healthcare workers (HCWs) on the frontlines are, however, more vulnerable to traumatization and psychological deficits during the COVID-19 pandemic (Roy et al., 2020; Lai et al., 2020; Cai et al., 2020; de Pablo et al., 2020). In addition to the previous factors, the fear of getting infected or infecting family and friends, the hefty workload, the intermittent shortage of personal protective equipment (PPE), and the need to take stressful precautions during the medical examination and in the operative fields can add enormous psychological burdens to

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HCWs (Joob and Wiwanitkit, 2020; Montemurro, 2020). These burdens do not only undermine the health-related quality of life of HCWs but also diminish their caring behaviors and increase practice errors leading to worse outcomes and additional costs (Sarafis et al., 2016; Wagner et al., 2018).

Reports emerging from China, where the COVID-19 was first detected, showed a high prevalence of depression, anxiety, and insomnia among HCWs (Du et al., 2020; Lai et al., 2020; Zhang et al., 2020a, 2020b; Liu et al., 2020; Xiao et al., 2020). In Arab countries, where surveillance and infection control programs, laboratory capacity, and public health resources are limited (Jabbour, 2013; Asbu et al., 2017), the response of HCWs to the COVID-19 pandemic would be challenging and, as a result, the psychological impacts of the pandemic on HCWs in Arab countries could be augmented. Egypt and Saudi Arabia, in particular, are among the most afflicted Arab countries on the human and financial levels (WHO, 2020b; Al-Tawfiq and Memish, 2020). Living in severely hit areas by the COVID-19 was shown to be associated with psychological distress (Tang et al., 2020). Hence, we conducted this cross-sectional study to evaluate psychological disturbances among HCWs on the frontlines in Egypt and Saudi Arabia during the COVID-19 pandemic and to investigate the potential associations with these disturbances. We hope that our study can help in detecting HCWs at high risk of psychological disturbances and determining potential associations for possible interventions during this pandemic or future waves of infection in both countries.

2. Methods

2.1. Subjects

HCWs in Egypt and Saudi Arabia were invited to participate in this cross-sectional survey during the period between the 14th and 24th of April 2020. Because of the lockdown in both countries, a non-probability snowball sampling technique was used. A Google survey was created and the link to the survey was sent by e-mails to HCWs with recorded contact details in Beni-Suef University Hospital and Beni-Suef General Hospital in Egypt and Taibah Teaching Hospital in Al-Madinah Al-Munawwarah in Saudi Arabia. The e-mails were sent on the 14th of April 2020 and reminders were sent 5 days later. We also shared the survey link to the social network groups that include HCWs from both countries. HCWs were asked to forward the link to other HCWs from their contact e-mail and social network lists. Social network use is widespread among HCWs in Egypt (Abdel Wahed et al., 2020) and Saudi Arabia (Almaiman et al., 2015). Our eligibility criteria included: 1) HCWs working in Egypt and Saudi Arabia, 2) aged ≥ 18 years old, and 3) currently working in a hospital managing patients infected or could be infected with COVID-19. HCWs included physicians, nurses, pharmacists, technicians, and paramedics. HCWs who reported working in academic and research but not in hospitals managing COVID-19 were excluded.

2.2. Data collection

We designed an Arabic questionnaire composed of 4 sections to collect the data. Section I included a detailed explanation of the steps, aims, and eligibility criteria of the study. Section II included questions about the sociodemographic and occupational features of HCWs including age (18–30, 31–45, or >45 years), sex (man or woman), country (Egypt or Saudi Arabia) and city where he/she works (type the name), living with children (yes or no), living with older adults (yes or no), profession (physician, nurse, pharmacist, technician, paramedic, or others and specify), department (internal medicine: general and specialties, surgery: general and specialties, emergency, radiology, or others and specify), and years of experience (1–5, 6–15, or >15 years). Section III included questions related to occupation during the previous month only and included the following: average daily working hours

(1–6, 7–12, or >12 h/day), average daily sleeping hours (<6 , 6–9, or >9 h/day), attending emergency shifts (never, 1–2, or >2 shifts/week), attending night shifts (never, 1–2, or >2 shifts/week), watching or reading news about COVID-19 (<1 , 2–4, or >4 h/day), getting enough emotional support from family (yes or no), getting enough emotional support from the society (yes or no), and getting enough emotional support from the hospital where he/she works (yes or no). Section IV included the Arabic version of the Depression Anxiety Stress Scale-21 (DASS-21). The DASS-21 is a quantitative measure of depression, anxiety, and stress symptomatology (7 statements each) during the past week. The depression statements evaluate hopelessness, dysphoria, self-deprecation, devaluation of life, lack of interest and involvement, anhedonia, and inertia. The anxiety statements evaluate skeletal muscle effects, autonomic arousal, situational anxiety, and subjective experience of anxious affect. The stress scale evaluates nervous arousal, difficulties in relaxation, and being easily upset or over-reactive. Participants should decide how much the statements apply for them using a scale from 0 to 3 where 0 refers to “did not apply to me at all”, 1 refers to “applied to me to some degree or some of the time”, 2 refers to “applied to me to a considerable degree or a good part of the time”, and 3 refers to “applied to me very much or most of the time”. The score of each axis is multiplied by 2 to lie within a 0 to 42 scale where higher scores indicate worse outcomes (Lovibond and Lovibond, 1995). The Arabic version of the DASS-21 was validated in a previous study and the Cronbach's alpha for its subscales was 0.81, 0.76, and 0.67, respectively (Ali et al., 2017). In this study, depression, anxiety, stress, and sleeping <6 h/day were considered outcomes. Sleeping <6 h/day was referred to in this article as “inadequate sleeping”. We programmed the Google survey to make all questions but one (the name of the city where subject works) mandatory.

2.3. Statistical analyses

The adopted cut-off values for the DASS-21 scales were the following: 1) Depression: normal (0–9), mild to moderate (10–20), and severe to extremely severe (≥ 21), 2) Anxiety: normal (0–7), mild to moderate (8–14), and severe to extremely severe (≥ 15), and 3) Stress: normal (0–14), mild to moderate (15–25), and severe to extremely severe (≥ 26) (Lovibond and Lovibond, 1995).

The logistic regression analyses were used to calculate the unadjusted and adjusted odds ratios (ORs) and their 95% confidence intervals (CIs) of different sociodemographic factors for HCWs with mild to moderate and severe to very severe depression, anxiety, and stress, and inadequate sleep compared with HCWs without the corresponding psychological conditions. The following variables were included in the regression models: age, sex, profession, and country. HCWs other than physicians and nurses were assigned to one group referred to as “other HCWs”. Data were analyzed using the Statistical Package for Social Science (SPSS) released in 2013 (IBM SPSS Statistics for Windows, Version 22.0, IBM Corporation, Armonk, New York).

2.4. Ethical considerations

We conducted the study in full accordance with the guidelines for Good Clinical Practice and the Declaration of Helsinki. The conditions and eligibility criteria of the study were described in section I and respondents had to agree to proceed to the upcoming sections and to submit their answers after filling out the survey which was considered approval of participation.

3. Results

This study included 426 HCWs (275 from Egypt and 151 from Saudi Arabia) distributed as follows: 206 (48.4%) physicians, 103 (24.2%) nurses, and 117 (27.4%) other HCWs. Of them, 47.2% were aged ≤ 30 years, 50.2% were men, 65% were living with children, and 51.6%

Table 1
Sociodemographic and occupational characteristics of HCWs deployed in facing COVID-19 pandemic in Egypt and Saudi Arabia.

Characteristics	Study population n = 426 (%)	
Age (years)	18–30	201 (47.2)
	31–45	172 (40.4)
	>45	53 (12.4)
Sex	Men	214 (50.2)
	Women	212 (49.8)
Country	Egypt	275 (64.6)
	Saudi Arabia	151 (35.4)
Profession	Physician	206 (48.4)
	Nurse	103 (24.2)
	Others	117 (27.4)
Department	Internal & ICU	84 (19.7)
	Emergency	84 (19.7)
	Others	258 (60.6)
Years of experience	1–5	189 (44.4)
	6–15	153 (35.9)
	>15	84 (19.7)
Working hours per day	1–6	153 (35.9)
	7–12	211 (49.5)
	>12	62 (14.6)
	Emergency shifts per week	Never
Night shifts per week	≤2	90 (21.1)
	>2	147 (34.5)
	Never	207 (48.6)
Watching/reading COVID-19 news hours per day	≤2	96 (22.5)
	>2	123 (28.9)
	<2	187 (43.9)
Living with children	2–4	159 (37.3)
	>4	80 (18.8)
Living with older adults	277 (65.0)	
Emotional support from family	220 (51.6)	
Emotional support from society	336 (78.9)	
Emotional support from hospital	190 (44.6)	
		150 (35.6)

were living with older adults. More than half of HCWs reported attending emergency shifts (55.6%) and night shifts (51.4%) and watching or reading COVID-19 news ≥ 2 h/day (56.1%) during the previous month. Getting enough emotional support from family during the pandemic was higher than that from society and hospital; 78.9%, 44.6%, and 35.6%, respectively (Table 1).

Up to 69% of HCWs had depression (39.4% mild to moderate and 29.6% severe to very severe), 58.9% had anxiety (31.9% mild to moderate and 27.0% severe to very severe), and 55.9% had stress (36.6% mild to moderate and 19.3% severe to very severe). More than a third (37.3%) of HCWs reported inadequate sleeping during the previous month (Table 2).

In the multivariable-adjusted regression model, several personal and occupational factors were associated with depression, anxiety, stress, and inadequate sleeping. Of these factors, age ≤ 30 years was associated with severe to very severe forms of depression (OR 2.88, 95% CI: 1.25, 6.62) and stress (OR 2.49, 95% CI: 1.00, 6.18). Compared with men, women had more severe to very severe depression (OR 2.57, 95% CI: 1.43, 4.61), anxiety (OR 2.68, 95% CI: 1.56, 4.62), and stress (OR 2.39, 95% CI: 1.33, 4.32). HCWs in Egypt were more likely to show, compared with their counterparts in Saudi Arabia, mild to moderate depression (OR 2.19, 95% CI: 1.28, 3.74), anxiety (OR 2.27, 95% CI: 1.32, 3.88), and stress (OR 3.67, 95% CI: 2.13, 6.31) and severe to very severe depression (OR 4.71, 95% CI: 2.45, 9.04), anxiety (OR 3.31, 95% CI: 1.78, 6.15), and stress (OR 2.81, 95% CI: 1.45, 5.45). Also, attending emergency and night shifts was associated with various forms of depression, anxiety, stress, and inadequate sleeping. Watching/reading COVID-19 news ≥ 2 h/day was associated with a high risk of depression, anxiety, stress, and inadequate sleeping. Besides, lack of perceived emotional support from family, society, and

hospital was related to depression, anxiety, stress, and inadequate sleeping. However, depression, anxiety, stress, and inadequate sleeping did not differ between professions or departments (Table 3).

4. Discussion

This study indicated that, during the COVID-19 pandemic, 69% of HCWs in Egypt and Saudi Arabia had depression (39.4% mild to moderate and 29.6% severe to very severe), 58.9% had anxiety (31.9% mild to moderate and 27.0% severe to very severe), 55.9% had stress (36.6% mild to moderate and 19.3% severe to very severe), and 37.3% experienced inadequate sleeping.

In line with our findings, a cross-sectional study reported a high prevalence of depression (50.4%) and anxiety (44.6%) among 1257 Chinese HCWs on the frontlines during the COVID-19 pandemic (Lai et al., 2020). Another study conducted on 134 HCWs from China put the prevalence of anxiety at 20.1% (Du et al., 2020). Similar psychological disturbances were recognized among HCWs during the severe acute respiratory syndrome (SARS) epidemic (Chua et al., 2004; Lee et al., 2005). In contrast, a study on 470 HCWs in Singapore put the prevalence of depression, anxiety, and stress during the COVID-19 pandemic at 8.1%, 10.8%, and 6.4%, respectively. These relatively low rates of psychological distress could be attributed to improved mental health preparedness and rigorous infection control measures in Singapore in the wake of the SARS outbreak epidemic (Tan et al., 2020). Still, a meta-analysis of cross-sectional studies including 11 studies from China in addition to the Singaporean study estimated the pooled prevalence of depression and anxiety among HCWs during the COVID-19 pandemic with 22.8% and 23.2%, respectively (Pappa et al., 2020). However, we cannot claim that the prevalence of psychological disturbances in the current study is higher than the Chinese studies because of the high heterogeneity between studies regarding the socio-demographic characteristics of HCWs and the scales and cut-offs used for psychological assessment.

However, the psychological disturbances among HCWs in Egypt were significantly worse than those among HCWs in Saudi Arabia. This finding may reflect the robustness of the healthcare system in Saudi Arabia compared with the Egyptian one. During the past decade, the Saudi government adopted a long-term plan to improve the healthcare system which was translated into allocating about 15% of the government budgetary expenditures for health services and social development (Al-Hanawi et al., 2019). This plan resulted in significant signs of progress in healthcare human and financial resources and striking improvements in key health indicators such as life expectancy and the availability of health resources (Al-Hanawi et al., 2019). Moreover, the circulation of the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) in Saudi Arabia in 2012 led to significant improvement in infection control preparedness in healthcare institutions across the country (Barry et al., 2020; Temsah et al., 2020). On the other hand, the healthcare system in Egypt faces several challenges related to defective spending and limitations in human resources and infrastructure (Fakhouri, 2016).

Further, this study showed a gender gap of psychological disturbances with a higher prevalence of depression, anxiety, and stress among women than men. In agreement, the Pappa et al. (2020) meta-analysis showed that female HCWs were more likely to suffer depression and anxiety during the COVID-19 pandemic compared with male HCWs.

Moreover, our results showed that watching/reading COVID-19 news ≥ 2 h/day was associated with depression, anxiety, stress, and inadequate sleeping. The COVID-19 pandemic is characterized by wide media coverage with plenty of untrustworthy sources of information. For example, 27% of HCWs in Egypt reported retrieving their information on COVID-19 from the social network, newspapers, and television (Abdel Wahed et al., 2020). Social media can be a source of misinformation of COVID-19 that may result in panic (Cuan-

Table 2
Prevalence of depression, anxiety, stress, and inadequate sleeping among HCWs deployed in facing COVID-19 pandemic in Egypt and Saudi Arabia.

Characteristics		Depression			Anxiety			Stress			Sleeping hours/day	
		Normal	Mild to moderate	Severe to very severe	Normal	Mild to moderate	Severe to very severe	Normal	Mild to moderate	Severe to very severe	≥ 6	< 6
Overall		31.0	39.4	29.6	41.1	31.9	27.0	44.1	36.6	19.3	62.7	37.3
Age (years)	18–30	29.2	39.9	30.9	39.4	23.7	27.9	42.4	37.5	20.1	63.5	36.5
	>30	43.4	35.8	20.8	52.8	26.4	20.8	56.6	30.2	13.2	56.6	43.4
Sex	Men	40.6	36.0	23.4	51.4	30.4	18.2	54.7	30.8	14.5	65.9	34.1
	Women	21.2	42.9	35.9	30.7	33.5	35.8	33.5	42.5	24.0	59.4	40.6
Profession	Physicians	26.2	35.4	38.4	39.3	31.6	29.1	39.8	37.4	22.8	67.5	32.5
	Nurses	35.0	46.6	18.4	40.8	35.0	24.3	46.6	37.9	15.5	57.3	42.7
	Others	35.9	40.2	23.9	44.4	29.9	25.7	49.6	34.2	16.2	59.0	41.0
Country	Egypt	21.5	40.7	37.8	31.6	34.9	33.5	23.7	44.4	22.9	63.3	36.7
	Saudi Arabia	48.3	37.1	14.6	58.3	26.5	15.2	64.9	22.5	12.6	61.6	38.4
Department	Internal, ICU & Emergency	34.5	38.1	27.4	41.1	34.5	24.4	47.0	38.1	14.9	62.5	37.5
	Others	28.7	40.3	31.0	41.1	30.2	28.7	42.2	35.7	22.1	62.8	37.2
	Experience (years)	1–5	33.3	36.0	30.7	45.5	30.2	24.3	49.7	36.5	13.8	61.9
Working hours/day	>5	29.1	42.2	28.7	37.6	33.3	29.1	39.7	36.7	23.6	63.3	36.7
	1–6	21.6	44.4	34.0	39.9	32.0	28.1	39.9	42.5	17.6	70.6	29.4
Emergency shifts	>6	36.3	36.6	27.1	41.8	31.9	26.3	46.5	33.3	20.2	58.2	41.8
	Yes	28.3	40.5	31.2	34.6	36.3	29.1	40.9	38.8	20.3	59.9	40.1
Night shifts	No	34.4	38.1	27.5	49.2	26.5	24.3	48.1	33.9	18.0	66.1	33.9
	Yes	32.9	36.5	30.6	37.0	33.8	29.2	42.9	35.6	21.5	58.0	42.0
Watching/reading COVID-19 news (hours/day)	No	29.0	42.5	28.5	45.4	30.0	24.6	45.4	37.7	16.9	67.6	32.4
	<2	20.5	43.5	36.0	30.1	35.1	34.8	33.5	41.0	25.5	59.0	41.0
Living with children	≥2	44.4	34.2	21.4	55.1	27.8	17.1	57.8	31.0	11.2	67.4	32.6
	Yes	27.8	40.4	31.8	39.4	31.0	29.6	41.2	37.2	21.6	61.4	38.6
Living with older adults	No	36.9	37.6	25.5	44.3	33.6	22.1	49.7	35.6	14.7	65.1	34.9
	Yes	21.8	39.5	38.7	35.0	33.6	31.4	39.1	39.1	21.8	58.2	41.8
Emotional support from family	No	40.8	39.3	19.9	47.6	30.1	22.3	49.5	34.0	16.5	67.5	32.5
	Yes	34.8	40.2	25.0	45.2	30.7	24.1	48.2	35.7	16.1	64.9	35.1
Emotional support from society	No	16.7	36.7	46.6	25.6	36.7	37.7	28.9	40.0	31.1	54.4	45.6
	Yes	51.1	37.9	11.0	59.5	26.3	14.2	61.6	28.9	9.5	67.4	32.6
Emotional support from hospital	No	14.8	40.7	44.5	26.3	36.4	37.3	30.1	42.8	27.1	58.9	41.1
	Yes	49.3	36.7	14.0	58.7	28.7	12.6	64.7	27.3	8.0	69.3	30.7
	No	20.3	41.3	38.4	31.4	33.2	35.4	32.1	42.1	25.8	59.0	41.0

Baltazar et al., 2020). Dong and Zheng (2020) described “headline stress disorder” among the general public due to COVID-19 news. Therefore, HCWs should be advised to cautiously select their sources of health information during public health crises. The WHO and governments should exert more efforts to provide reliable sources of information and force the social network platforms, newspapers, and television channels to take down misinformation of the COVID-19. However, it is worth pointing out that the cross-sectional design of this study cannot imply a temporal association between watching/reading COVID-19 news and psychological disturbances. It could be suggested that depressed, anxious, and stressed HCWs have resorted to COVID-19 news to look for hopeful news of COVID-19 medications and vaccines to alleviate their psychological distress. One study, for instance, showed that COVID-19 anxiety could lead to excessive internet use (Elhai et al., 2020).

Furthermore, we could detect that HCWs who lacked emotional support from family, society, and hospital showed worse psychological disturbances compared with their counterparts who were offered emotional support. A study on medical students from China showed that social support correlated negatively with their level of anxiety (Cao et al., 2020). One study discussed the need for providing mental healthcare services to HCWs on the frontlines to alleviate their psychological distress and improve their physical health (Kang et al., 2020). These findings, therefore, highlight the importance of psychological counseling.

Also, attending night shifts was associated with psychological

distress and inadequate sleeping. Previous research conducted on HCWs under normal circumstances reached also the same conclusion (Jehan et al., 2017), thus, we cannot assume that working the night shifts during the COVID-19 pandemic, *per se*, increased the psychological distress. However, increased psychological distress and disturbed sleep during the COVID-19 pandemic alongside attending night shifts could have worsened the situation.

It should be noted that this study had several strengths such as including HCWs representing different professions of healthcare, limiting the inclusion criteria to HCWs currently serving on the frontlines during the COVID-19 pandemic, using a validated assessment tool to measure the outcomes, and avoiding the chronic problems of online surveying such as lurking, dropping out, and item non-response by making the questions mandatory.

However, some limitations should be addressed. First, the cross-sectional design restricted our ability to distinguish between preexisting and new symptoms and to study whether the psychological symptoms of HCWs have been worsening or not, therefore, a longitudinal study is warranted. Second, because of the lockdown, we had to solely rely on the online survey to access HCWs. This method of data collection can be accompanied by non-response bias that could undermine the generalizability of the study because non-respondents might carry different characteristics compared with the respondents (Arafa et al., 2019). To avoid this bias, we did not ask the respondents to unveil their identities or include any sensitive questions related to income or availability of PPE. We also forwarded the link to the Google survey via different

Table 3
Odds ratios and confidence intervals of the associations with depression, anxiety, stress, and inadequate sleeping among HCWs deployed in facing COVID-19 pandemic in Egypt and Saudi Arabia.

Characteristics	Regression models		Depression		Anxiety		Stress		Sleeping hours/day			
	Model I	Model II	Mild to moderate	Severe to very severe	Normal	Mild to moderate	Severe to very severe	Normal	Mild to moderate	Severe to very severe	≥ 6	< 6
Age: 18–30 vs. > 30 years (ref)	1	1	1.66 (0.86, 3.19)	2.21 (1.03, 4.74)	1	1.66 (0.84, 3.29)	1.80 (0.86, 3.78)	1	1.66 (0.87, 3.18)	2.03 (0.86, 4.84)	1	0.75 (0.42, 1.34)
Sex: Women vs. men (ref)	1	1	1.95 (0.97, 3.93)	2.88 (1.25, 6.62)	1	1.81 (0.88, 3.71)	2.03 (0.92, 4.48)	1	1.90 (0.95, 3.81)	2.49 (1.00, 6.18)	1	0.68 (0.37, 1.24)
Country: Egypt vs. Saudi Arabia (ref)	1	1	2.29 (1.43, 3.66)	2.94 (1.77, 4.88)	1	1.85 (1.17, 2.91)	3.30 (2.01, 5.40)	1	2.25 (1.46, 3.47)	2.71 (1.59, 4.63)	1	1.32 (0.89, 1.95)
Profession: Physicians vs. others (non-physicians, non-nurses) (ref)	1	1	2.05 (1.21, 3.48)	2.57 (1.43, 4.61)	1	1.54 (0.93, 2.54)	2.68 (1.56, 4.62)	1	1.74 (1.07, 2.83)	2.39 (1.33, 4.32)	1	1.30 (0.84, 2.01)
Profession: Nurses vs. others (non-physicians, non-nurses) (ref)	1	1	2.48 (1.55, 3.96)	5.85 (3.30, 10.38)	1	2.43 (1.51, 3.90)	4.05 (2.35, 6.98)	1	3.91 (2.43, 6.29)	3.61 (2.01, 6.50)	1	0.93 (0.62, 1.40)
Department: Internal medicine, ICU, and emergency vs. others (ref)	1	1	2.19 (1.28, 3.74)	4.71 (2.45, 9.04)	1	2.27 (1.32, 3.88)	3.31 (1.78, 6.15)	1	3.67 (2.13, 6.31)	2.81 (1.45, 5.45)	1	0.92 (0.57, 1.47)
Experience: 1–5 vs. > 5 years (ref)	1	1	1.21 (0.70, 2.08)	2.19 (1.22, 3.96)	1	1.19 (0.70, 2.04)	1.28 (0.73, 2.25)	1	1.36 (0.82, 2.27)	1.75 (0.93, 3.29)	1	0.69 (0.43, 1.11)
Working hours: > 6 vs. 1–6 h/day (ref)	1	1	1.00 (0.54, 1.86)	1.50 (0.75, 3.00)	1	0.93 (0.51, 1.70)	0.89 (0.46, 1.70)	1	0.91 (0.50, 1.65)	1.32 (0.65, 2.69)	1	0.66 (0.40, 1.11)
Emergency shifts: Yes vs. no (ref)	1	1	1.19 (0.65, 2.17)	0.79 (0.38, 1.65)	1	1.27 (0.69, 2.36)	1.03 (0.53, 2.01)	1	1.18 (0.66, 2.11)	1.02 (0.47, 2.19)	1	1.07 (0.63, 1.83)
Night shifts: Yes vs. no (ref)	1	1	0.70 (0.35, 1.38)	0.36 (0.16, 0.82)	1	0.83 (0.42, 1.63)	0.53 (0.25, 1.12)	1	0.63 (0.32, 1.22)	0.57 (0.25, 1.31)	1	0.98 (0.55, 1.73)
Watching/reading COVID-19 news: ≥ 2 vs. < 2 hour/day (ref)	1	1	0.79 (0.49, 1.25)	0.73 (0.45, 1.21)	1	1.14 (0.72, 1.80)	0.85 (0.52, 1.39)	1	0.96 (0.62, 1.48)	0.61 (0.35, 1.05)	1	1.01 (0.68, 1.51)
Living with children: Yes vs. no (ref)	1	1	0.92 (0.56, 1.51)	0.94 (0.54, 1.64)	1	1.32 (0.81, 2.14)	1.12 (0.66, 1.90)	1	1.15 (0.72, 1.84)	0.75 (0.42, 1.35)	1	1.06 (0.70, 1.61)
Living with older adults: Yes vs. no (ref)	1	1	0.75 (0.47, 1.18)	0.93 (0.57, 1.52)	1	0.75 (0.48, 1.17)	0.69 (0.43, 1.11)	1	0.79 (0.52, 1.21)	0.46 (0.27, 0.80)	1	1.06 (0.72, 1.58)
Emergency shifts: Yes vs. no (ref)	1	1	0.77 (0.45, 1.34)	1.18 (0.65, 2.14)	1	0.71 (0.42, 1.19)	0.72 (0.42, 1.25)	1	0.81 (0.49, 1.34)	0.46 (0.25, 0.85)	1	1.10 (0.71, 1.71)
Emergency shifts: Yes vs. no (ref)	1	1	0.49 (0.30, 0.81)	0.48 (0.28, 0.81)	1	0.95 (0.60, 1.52)	0.90 (0.55, 1.46)	1	0.67 (0.43, 1.05)	0.98 (0.56, 1.70)	1	1.72 (1.13, 2.63)
Emergency shifts: Yes vs. no (ref)	1	1	1.35 (0.88, 2.07)	1.32 (0.78, 2.24)	1	1.52 (0.88, 2.65)	2.20 (1.21, 4.02)	1	1.28 (0.75, 2.18)	2.27 (1.17, 4.39)	1	2.03 (1.25, 3.28)
Emergency shifts: Yes vs. no (ref)	1	1	1.63 (0.98, 2.70)	2.04 (1.15, 3.64)	1	1.95 (1.23, 3.08)	1.70 (1.06, 2.74)	1	1.35 (0.88, 2.07)	1.32 (0.78, 2.23)	1	1.31 (0.88, 1.95)
Night shifts: Yes vs. no (ref)	1	1	0.76 (0.48, 1.20)	0.95 (0.58, 1.54)	1	1.39 (0.88, 2.17)	1.46 (0.91, 2.34)	1	1.00 (0.65, 1.53)	1.34 (0.80, 2.27)	1	1.49 (0.97, 2.27)
Night shifts: Yes vs. no (ref)	1	1	0.95 (0.57, 1.57)	1.57 (0.87, 2.81)	1	1.82 (1.09, 3.02)	2.69 (1.53, 4.75)	1	1.38 (0.84, 2.25)	2.13 (1.16, 3.89)	1	1.51 (1.02, 2.25)
Night shifts: Yes vs. no (ref)	1	1	2.75 (1.72, 4.41)	3.64 (2.18, 6.10)	1	2.31 (1.46, 3.66)	3.71 (2.24, 6.16)	1	2.28 (1.48, 3.52)	3.92 (2.21, 6.96)	1	1.81 (1.17, 2.80)
Night shifts: Yes vs. no (ref)	1	1	2.62 (1.60, 4.29)	2.95 (1.68, 5.16)	1	2.24 (1.39, 3.62)	3.32 (1.94, 5.70)	1	2.07 (1.30, 3.30)	3.41 (1.87, 6.23)	1	1.44 (0.96, 2.14)
Night shifts: Yes vs. no (ref)	1	1	1.43 (0.89, 2.29)	1.65 (0.99, 2.77)	1	1.04 (0.66, 1.66)	1.51 (0.91, 2.50)	1	1.26 (0.81, 1.96)	1.77 (1.00, 3.13)	1	1.52 (1.00, 2.30)
Night shifts: Yes vs. no (ref)	1	1	1.25 (0.76, 2.07)	1.43 (0.80, 2.53)	1	0.91 (0.56, 1.48)	1.32 (0.76, 2.28)	1	1.07 (0.66, 1.73)	1.55 (0.85, 2.84)	1	1.17 (0.78, 1.78)
Night shifts: Yes vs. no (ref)	1	1	1.88 (1.18, 3.00)	3.63 (2.17, 6.07)	1	1.52 (0.97, 2.38)	1.91 (1.18, 3.08)	1	1.46 (0.95, 2.23)	1.67 (0.99, 2.83)	1	1.23 (0.80, 1.89)
Night shifts: Yes vs. no (ref)	1	1	1.38 (0.83, 2.29)	2.39 (1.35, 4.24)	1	1.07 (0.65, 1.75)	1.14 (0.67, 1.94)	1	0.85 (0.52, 1.38)	1.02 (0.57, 1.82)	1	1.49 (1.00, 2.22)

(continued on next page)

Table 3 (continued)

Characteristics	Regression models		Depression		Anxiety		Stress		Sleeping hours/day			
			Mild to moderate	Severe to very severe	Normal	Mild to moderate	Severe to very severe	Normal	Mild to moderate	≥ 6	< 6	
Emotional support from family: No vs. yes (ref)	Model I	1	1.91 (0.99, 3.68)	3.90 (2.03, 7.49)	1	2.12 (1.18, 3.81)	2.77 (1.53, 5.02)	1	1.87 (1.07, 3.26)	3.23 (1.74, 5.98)	1	1.55 (0.97, 2.48)
	Model II	1	1.77 (0.89, 3.54)	3.26 (1.60, 6.67)	1	1.89 (1.02, 3.49)	2.36 (1.25, 4.46)	1	1.53 (0.85, 2.77)	2.70 (1.40, 5.23)	1	1.70 (1.04, 2.78)
Emotional support from society: No vs. yes (ref)	Model I	1	3.70 (2.26, 6.05)	13.86 (7.55, 25.44)	1	3.14 (1.97, 5.00)	5.94 (3.49, 10.10)	1	3.03 (1.95, 4.71)	5.86 (3.22, 10.68)	1	1.44 (0.97, 2.15)
	Model II	1	3.07 (1.76, 5.38)	9.81 (4.96, 19.42)	1	2.54 (1.49, 4.33)	4.44 (2.42, 8.18)	1	1.85 (1.11, 3.08)	4.25 (2.14, 8.44)	1	1.94 (1.20, 3.13)
Emotional support from hospital: No vs. yes (ref)	Model I	1	2.74 (1.70, 4.41)	6.66 (3.71, 11.95)	1	2.17 (1.35, 3.47)	5.23 (2.94, 9.30)	1	3.10 (1.96, 4.91)	6.50 (3.30, 12.80)	1	1.57 (1.03, 2.40)
	Model II	1	2.39 (1.45, 3.94)	5.20 (2.78, 9.74)	1	1.83 (1.12, 2.99)	4.28 (2.34, 7.85)	1	2.50 (1.54, 4.07)	5.38 (2.66, 10.86)	1	1.74 (1.11, 2.72)

Model I: Unadjusted.

Model II: Adjusted for age, sex, profession, and country.

Bold (Statistically significant).

social networks to access HCWs who did not have professional e-mails. Moreover, we extended the survey collection period to 10 days so that HCWs were able to choose when to respond according to their busy schedule, and reminders were sent after the first 5 days. Third, we had to merge HCWs other than physicians and nurses in one group to obtain statistical power, despite some professions such as paramedics and radiology technicians could be more vulnerable than pharmacists. Fourth, some potential confounders that can be associated with the mental health of HCWs such as the history of chronic diseases and practicing leisure activities were not collected. Fifth, we did not collect data on the availability of PPE and infection control training. Such information could have spotted another risk factor for deteriorated psychological conditions. Sixth, the results of our study might not be extrapolated to other HCWs in countries that showed adequate pandemic response and preparedness.

In conclusion, the psychological impacts of COVID-19 were enormous among the HCWs, particularly, in Egypt. Intervention programs targeting HCWs should prioritize young women. Providing psychological support and counseling for HCWs should be encouraged.

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Declaration of Competing Interest

Authors declare no conflict of interest.

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References

Abdel Wahed, W., Hefzy, E., Ahmed, M., Hamed, N., 2020. Assessment of knowledge, attitudes, and perception of health care workers regarding COVID-19, a cross-sectional study from Egypt. *J. Community Health* 7, 1–10.

Ali, A., Ahmed, A., Sharaf, A., Kawakami, N., Abdeldayem, S., Green, J., 2017. The Arabic version of the Depression Anxiety Stress Scale-21: cumulative scaling and discriminant-validation testing. *Asian J. Psychiatry* 30, 56–58.

Almaiman, S., Bahkali, S., Al Farhan, A., Bamuhair, S., Househ, M., Alsurimi, K., 2015. The prevalence of using social media among healthcare professionals in Saudi Arabia: a pilot study. *Stud. Health Technol. Inform.* 213, 263–266.

Al-Hanawi, M., Khan, S., Al-Borie, H., 2019. Healthcare human resource development in Saudi Arabia: emerging challenges and opportunities—a critical review. *Public Health Rev* 40, 1.

Al-Tawfiq, J., Memish, Z., 2020. COVID-19 in the Eastern Mediterranean Region and Saudi Arabia: prevention and therapeutic strategies. *Int. J. Antimicrob. Agents*, 105968.

Arafa, A., Anzengruber, F., Mostafa, A., Navarini, A., 2019. Perspectives of online surveys in dermatology. *J. Eur. Acad. Dermatol. Venereol.* 33, 511–520.

Asbu, E., Masri, M., Kaissi, A., 2017. Health status and health systems financing in the MENA region: roadmap to universal health coverage. *Glob. Health Res. Policy* 2, 25.

Barry, M., Al Amri, M., Memish, Z., 2020. COVID-19 in the Shadows of MERS-CoV in the Kingdom of Saudi Arabia. *J. Epidemiol. Glob. Health* 10, 1–3.

Cai, Q., Feng, H., Huang, J., Wang, M., Wang, Q., Lu, X., Xie, Y., Wang, X., Liu, Z., Hou, B., Ouyang, K., Pan, J., Li, Q., Fu, B., Deng, Y., Liu, Y., 2020. The mental health of frontline and non-frontline medical workers during the coronavirus disease 2019 (COVID-19) outbreak in China: a case-control study. *J. Affect. Disord.* 275, 210–215.

Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., Zheng, J., 2020. The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res* 287, 112934.

Chua, S., Cheung, V., Cheung, C., McAlonan, G., Wong, J., Cheung, E., Chan, M., Wong, M., Tang, S., Choy, K., Wong, M., Chu, C., Tsang, K., 2004. Psychological effects of the SARS outbreak in Hong Kong on high-risk health care workers. *Can. J. Psychiatry* 49, 391–393.

Cuan-Baltazar, J., Muñoz-Perez, M., Robledo-Vega, C., Pérez-Zepeda, M., Soto-Vega, E., 2020. Misinformation of COVID-19 on the Internet: infodemiology study. *JMIR Public Health Surveill* 9, 18444.

de Pablo, G., Vaquerizo-Serrano, J., Catalan, A., Arango, C., Moreno, C., Ferre, F., Shin, J., Sullivan, S., Brondino, N., Solmi, M., Fusar-Poli, P., 2020. Impact of coronavirus syndromes on physical and mental health of health care workers: systematic review and meta-analysis. *J. Affect. Disord.* 275, 48–57.

Dong, M., Zheng, J., 2020. Letter to the editor: headline stress disorder caused by Netnews during the outbreak of COVID-19. *Health Expect* 23, 259–260.

- Du, J., Dong, L., Wang, T., Yuan, C., Fu, R., Zhang, L., Liu, B., Zhang, M., Yin, Y., Qin, J., Bouey, J., Zhao, M., Li, X., 2020. Psychological symptoms among frontline healthcare workers during COVID-19 outbreak in Wuhan. *Gen. Hosp. Psychiatry*. <https://doi.org/10.1016/j.genhosppsych.2020.03.011>.
- Ebrahim, S., Ahmed, Q., Gozzer, E., Schlagenhaut, P., Memish, Z., 2020. Covid-19 and community mitigation strategies in a pandemic. *BMJ* 368.
- Elhai, J., Yang, H., McKay, D., Asmundson, G., 2020. COVID-19 anxiety symptoms associated with problematic smartphone use severity in Chinese adults. *J. Affect. Disord.* 274, 576–582.
- Ho, C., Chee, C., Ho, R., 2020. Mental health strategies to combat the psychological impact of COVID-19 beyond paranoia and panic. *Ann. Acad. Med. Singapore* 49, 1–3.
- Fakhouri, S., 2016. Healthcare in Egypt: a synopsis on the system and the anticipated reforms. *World Hosp. Health Serv.* 52, 21–23.
- Jabbour, S., 2013. Public health in the Arab World: at a crossroads. *J. Public Health Policy* 34, 356–360.
- Jehan, S., Zizi, F., Pandi-Perumal, S., Myers, A., Auguste, E., Jean-Louis, G., McFarlane, S., 2017. Shift Work and Sleep: medical Implications and Management. *Sleep Med. Dis.* 1, 00008.
- Joob, B., Wiwanitkit, V., 2020. Traumatization in medical staff helping with COVID-19 control. *Brain Behav. Immun.* 87, 10.
- Kang, L., Ma, S., Chen, M., Yang, J., Wang, Y., Li, R., Yao, L., Bai, H., Cai, Z., Yang, B.-X., Hu, S., Zhang, K., Wang, G., Ma, C., Liu, Z., 2020. Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: a cross-sectional study. *Brain Behav. Immun.* 87, 11–17.
- Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., Wu, J., Du, H., Chen, T., Li, R., Tan, H., Kang, L., Yao, L., Huang, M., Wang, H., Wang, G., Liu, Z., Hu, S., 2020. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Netw Open* 3, 203976.
- Lee, S., Juang, Y., Su, Y., Lee, H., Lin, Y., Chao, C., Facing, S.A.R.S., 2005. Psychological impacts on SARS team nurses and psychiatric services in a Taiwan general hospital. *Gen. Hosp. Psychiatry* 27, 352–358.
- Liu, C., Yang, Y., Zhang, X., Xu, X., Dou, Q., Zhang, W., Cheng, A., 2020. The prevalence and influencing factors in anxiety in medical workers fighting COVID-19 in China: a cross-sectional survey. *Epidemiol. Infect.* 148, 98.
- Lovibond, S., Lovibond, P., 1995. *Manual For the Depression, Anxiety and Stress Scales*, 2nd ed. Psychology Foundation, Sydney, Australia.
- Montemurro, N., 2020. The emotional impact of COVID-19: from medical staff to common people. *Brain Behav. Immun.* 87, 23–24.
- Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V., Papoutsis, E., Katsaounou, P., 2020. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: a systematic review and meta-analysis. *Brain Behav. Immun.* 88, 901–907.
- Peng, M., Mo, B., Liu, Y., Xu, M., Song, X., Liu, L., Fang, Y., Guo, T., Ye, J., Yu, Z., Deng, Q., Zhang, X., 2020. Prevalence, risk factors and clinical correlates of depression in quarantined population during the COVID-19 outbreak. *J. Affect. Disord.* 275, 119–124.
- Roy, D., Tripathy, S., Kar, S., Sharma, N., Verma, S., Kaushal, V., 2020. Study of knowledge, attitude, anxiety & perceived mental healthcare need in Indian population during COVID-19 pandemic. *Asian J. Psychiatr.* 51, 102083.
- Sarafis, P., Rousaki, E., Tsounis, A., Malliarou, M., Lahana, L., Bamidis, P., Niakas, D., Papastavrou, E., 2016. The impact of occupational stress on nurses' caring behaviors and their health related quality of life. *BMC Nurs* 15, 56.
- Tan, B., Chew, N., Lee, G., Jing, M., Goh, Y., Yeo, L., Zhang, K., Chin, H., Ahmad, A., Khan, F., Shanmugam, G., Chan, B., Sunny, S., Chandra, B., Ong, J., Paliwal, P., Wong, L., Sagayanathan, R., Chen, J., Ying, N.-A., Teoh, H., Ho, C., Ho, R., Sharma, V., 2020. Psychological impact of the COVID-19 pandemic on health care workers in Singapore. *Ann. Intern. Med.* 13, 877–882.
- Tang, W., Hu, T., Hu, B., Jin, C., Wang, G., Xie, C., Chen, S., Xu, J., 2020. Prevalence and correlates of PTSD and depressive symptoms one month after the outbreak of the COVID-19 epidemic in a sample of home-quarantined Chinese university students. *J. Affect. Disord.* 274, 1–7.
- Temsah, M., Al-Sohime, F., Alamro, N., Al-Eyadhy, A., Al-Hasan, K., Jamal, A., Al-Maglouh, I., Aljamaan, F., Al Amri, M., Barry, M., Al-Subaie, S., Somily, A., 2020. The psychological impact of COVID-19 pandemic on health care workers in a MERS-CoV endemic country, *J. Infect. Public Health* 13, 877–882.
- Wagner, A., Hammer, A., Manser, T., Martus, P., Sturm, H., Rieger, M., 2018. Do occupational and patient safety culture in hospitals share predictors in the field of psychosocial working conditions? Findings from a cross-sectional study in German University Hospitals. *Int. J. Environ. Res. Public Health* 15, 2131.
- WHO, **Rolling Updates on Coronavirus Disease (COVID-19)**<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen> (2020a).
- WHO, **Coronavirus Disease 2019 (COVID-19) Situation Report – 102**https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200501-covid-19-sitrep.pdf?sfvrsn=742f4a18_2 (2020b).
- Xiao, X., Zhu, X., Fu, S., Hu, Y., Li, X., Xiao, J., 2020. Psychological impact of healthcare workers in China during COVID-19 pneumonia epidemic: a multi-center cross-sectional survey investigation. *J. Affect. Disord.* 274, 405–410.
- Zhang, C., Yang, L., Liu, S., Ma, S., Wang, Y., Cai, Z., Du, H., Li, R., Kang, L., Su, M., Zhang, J., Liu, Z., Zhang, B., 2020a. Survey of insomnia and related social psychological factors among medical staff involved in the 2019 novel coronavirus disease outbreak. *Front. Psychiatry* 11, 306.
- Zhang, W., Wang, K., Yin, L., Zhao, W., Xue, Q., Peng, M., Min, B., Tian, Q., Leng, H., Du, J., Chang, H., Yang, Y., Li, W., Shangguan, F., Yan, T., Dong, H., Han, Y., Wang, Y., Cosci, F., Wang, H., 2020b. Mental health and psychosocial problems of medical health workers during the COVID-19 epidemic in China. *Psychother. Psychosom.* 1–9.