


# Depression among physicians and other medical employees involved in the COVID-19 outbreak

## A cross-sectional study

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### Abstract

Health care employees are the front liners whom are directly involved in the management of COVID-19 at high risk of developing psychological distress and other mental health illness. We aim to assess the burden of depression during this pandemic on health care employees treating COVID-19 in Saudi Arabia. We also will shed the light on the best solutions of how to encounter depression.

A cross-sectional, hospital-based survey conducted via a region-stratified, 2-stage cluster sample was conducted for 554 participants in >15 hospitals from April 29, 2020, to June 30, 2020. Depression is measured using the established PHQ9 score system. We grade PHQ9 depression scores as: normal, 0 to 4, mild, 5 to 9, significant (moderate or severe), 10 to 27.  $\chi^2$ /Fisher exact test was used; significant association between level of depression and survey characteristics were made. *P* value <0.05 was considered statistically significant.

A total of 554 participants completed the survey. A total of 18.9% (*n*=105) were aged <29 years, 51.2% (*n*=284) were between 30 to 39 years and female represent 70% of all participants. Of all participants, 53.7% (*n*=298) were nurses, and 38.6% (*n*=214) were physicians; 68.5% (*n*=380) worked in central area hospitals in Saudi Arabia. No significant (*P* = .432, 95% confidence interval [CI]) association was observed between sex and depression classifications. However, female had high proportion of significant depression 75.0% (*n*=76) was observed as compared to male 24.8% (*n*=25). Depression was significant in Saudis 61.4% (*n*=62) (*P* < .001, 95% CI) and medical staff who encountered corona patients 51.5% (*n*=52) (*P* < .002, 95% CI). Hospital preparedness associated with more freedom of depression symptoms 69.1% (*n*=199/288) (*P* < .001, 95% CI).

Frontline young health care workers especially physician in Saudi Arabia reported a high rate of depression symptoms. Countermeasures for health care workers represent a key component for the mental and physical well-being as part of public health measures during this pandemic. Attention to hospital preparedness and adequacy of personal protective equipment contributed to milder depression symptoms. Further studies need to be conducted on crisis management and depression.

**Abbreviations:** COVID = Corona virus disease, SARS = Sever acute respiratory syndrome, WHO = World Health Organization.

**Keywords:** corona impact, COVID-19, depression, impact

### 1. Introduction

In the late 2019, Wuhan authorities have reported a novel pneumonia caused by coronavirus disease 2019 (COVID-19), which is spreading to the entire globe.<sup>[1]</sup> The virus took its name

from severe acute respiratory syndrome coronavirus (SARS-CoV-2) then it was referred to COVID-19.<sup>[2]</sup> According to data released by the World Health Organization (WHO), the number of confirmed cases in world has increased to 2,626,321 as of April

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25<sup>th</sup>, 2020 and death raised to 181,938 in >213 countries.<sup>[2]</sup> Moreover, person-to-person transmission has been recorded outside China.<sup>[3]</sup> On March 12<sup>th</sup>, 2020, the WHO held an emergency meeting and declared the global COVID-19 outbreak as Pandemic.<sup>[4]</sup>

Health care employees are the front liners whom are directly involved in the management of COVID-19 are at risk of developing psychological distress and other mental health symptoms. The fast growth of the disease number of confirmed and suspected cases are overwhelming workload with wide-spread media coverage, lack of treatment, and social taboo may all contribute to the mental burden. Few studies Have reported adverse psychological reactions to SARS outbreak among health care workers.<sup>[5–8]</sup> Lai et al showed health care workers responding to the spread of COVID-19 reported high rates of symptoms of depression, anxiety, insomnia, and distress.<sup>[9]</sup>

Psychological assistance services, including telephone-, internet-, and application-based counseling or intervention, have been widely deployed by local and national mental health institutions in response to the COVID-19 outbreak. On February 2, 2020, the State Council of China announced that it was setting up nationwide psychological assistance hotlines to help during the epidemic situation.<sup>[9]</sup> However, evidence-based evaluations and mental health interventions targeting front-line health care workers are relatively scarce.

The aim from our study was to evaluate the effect of corona on health care employees and to address gap in the literature about depression among them. Our objective was to quantify the magnitude of symptoms of depression, potential risk factors, and analyzing health management and administrative plans in Saudi Arabia.

## 2. Methods

### 2.1. Study design

This study followed the Alberta ethical screening review Research guidelines (ARECCI). Approval from the clinical research ethics committee of Hail University was received before the initiation of this study. Electronic consent was provided by all survey participants before their enrollment. Participants were allowed to terminate the survey at any time they desired. The survey was anonymous, and confidentiality of information was assured.

A cross-sectional, hospital-based survey conducted via a region-stratified, 2-stage cluster sampling will be conducted from April 29, 2020, to June 30, 2020. During this period, the total confirmed cases of COVID-19 were around 20,000 plus in Saudi Arabia. To compare the regional differences of depression outcomes among health care workers in Saudi Arabia, samples were stratified by their location (ie, North, South, West, East, and so on). Hospitals equipped with fever clinics or wards for COVID-19 were eligible to participate in this survey (2nd stage). All health care workers in the kingdom were asked to participate in this study (1<sup>st</sup> stage). In total, 15 hospitals were involved.

### 2.2. Participants

Work health employees were randomly sampled from each selected hospital, and all health care workers in this department were asked to participate in this study. The target sample size of participants was determined using the formula  $N = Z\alpha 2P(1 P) / d^2$ , in which  $\alpha = 0.05$  and  $Z\alpha = 1.96$ . The acceptable margin of

error for proportion  $d$  was 0.1 as previously estimated at 35% at Lee et al.<sup>[7]</sup> The number of health care workers were 360,000 in the kingdom as per (Mckinsey 2015 report), minimum of 500 participants will be included.

### 2.3. Outcomes and covariates

We emphasized on symptoms of depression for all participants, using English versions of validated measurement tools. Patient Health Questionnaire (PHQ-9; range, 0–27) were used to assess the severity of symptoms of depression. The total score of this tool was interpreted as follows: PHQ-9, normal (0–4), mild,<sup>[15–9]</sup> moderate to severe (10–27). These categories were based on values established in the literature.

All categorical variables such sex, age, profession, and so on, presented as numbers and percentages. Nonparametric tests were used when data were skewed.  $\chi^2$ /Fisher exact test was used according to whether the cell expected frequency is  $<5$ , and it was applied to determine the significant association between level of depression and survey characteristics.  $P$  value  $<0.05$  considered as statistically significant with a 95% confidence level (CI) All data were entered and analyzed through statistical package SPSS 25 (SPSS Inc., Chicago, IL).

## 3. Results

A total of 554 participants completed the survey. Demographic and survey characteristics are presented in (Table 1).

In this study, among the 554 participants, ages were  $\leq 29$  ( $n = 104$ ), 30 to 39 ( $n = 284$ ),  $\geq 40$  ( $n = 165$ ) years. Of all the participants, males were 29.8% ( $n = 165$ ), whereas females were 70.2% ( $n = 389$ ). Majority of the participants were nurses 53.8% ( $n = 298$ ), physicians 38.6% ( $n = 214$ ), other specialties (ie, pharmacists and so on) 7.6% ( $n = 42$ ). Most of the participants were from central area represented by the capital of Saudi Arabia with 68.6% ( $n = 380$ ), Western 14.3% ( $n = 79$ ), Northern 7.9% ( $n = 44$ ), Eastern and Southern with 7.2% and 2%, respectively.

The most common degree was Bachelor degree 52% ( $n = 255$ ), diploma 21.3% ( $n = 118$ ), PhD 20% ( $n = 111$ ), and Masters 6.7% ( $n = 37$ ). Most of participants were Saudis 40.8% ( $n = 226$ ) followed by Filipino 27.6% ( $n = 153$ ) and Indians 20.8% ( $n = 115$ ). Participants who worked  $>40$  hours per week were 86.8% ( $n = 481$ ), whereas those who worked  $<40$  hours were only 13.2% ( $n = 73$ ). Most frequent specialties participated (Emergency/NICU) were nurses under category of others 22.7% ( $n = 126$ ), pediatrics (including both nurses and physicians) 16.4% ( $n = 91$ ), cardiology and surgery with 11.7% and 10.8%, respectively.

No influenza or influenza like symptoms reported with 93.5% ( $n = 518$ ), most of our participant were not diagnosed or suspected as a case of corona infection with 95.8% ( $n = 531$ ), ever having or encountered any patient with corona infection 37.5% ( $n = 208$ ) confirmed. Knowing any health care worker with COVID positive infection 28.5% ( $n = 158$ ) confirmed. Most of participants reported better efficiency of work (38.8%) ( $n = 215$ ) or no change in work efficiency (45.1%) ( $n = 250$ ) and 77.6% ( $n = 430$ ) of participants were afraid to be the source of infection to their families. Severity of depression were reported as 52% ( $n = 288$ ) had insignificant depression result. More demographic data, assignment, and hospital preparedness questions are listed in (Table 1).

**Table 1**  
**Demographic and survey characteristics of 554 participants.**

Characteristics	Descriptions	n (n%)
Sex	Male	165 (29.8%)
	Female	389 (70.2%)
Age	≤29	105 (19.0%)
	30–39	284 (51.3%)
	≥40	165 (29.8%)
What is your profession?	Nurse	298 (53.8%)
	Physician	214 (38.6%)
	Others	42 (7.6%)
Which health care institution area do you work in?	Central area (of the Kingdom)	380 (68.6%)
	Eastern area (of the Kingdom)	40 (7.2%)
	Northern area (of the Kingdom)	44 (7.9%)
	Southern area (of the Kingdom)	11 (2.0%)
	Western area (of the Kingdom)	79 (14.3%)
What is the highest level of school you have completed or the highest degree you have received?	Diploma degree	118 (21.3%)
	Bachelor degree (resident or under-trainee)	288 (52.0%)
	Master degree	37 (6.7%)
	PhD degree/medical board degree (specialists or board certified or fellows or consultants)	111 (20.0%)
Which of the following categories best describes your working hours?	working ≤39 h per wk	73 (13.2%)
	working ≥40 h per wk	481 (86.8%)
What is your nationality?	Arabic nationalities (Non-Saudi)	44 (7.9%)
	Filipino	153 (27.6%)
	Indian	115 (20.8%)
	Saudi	226 (40.8%)
	Others (other nationalities)	16 (2.9%)
What is your specialty?	Anesthesia	17 (3.1%)
	Cardiology.	65 (11.7%)
	Dermatology.	1 (0.2%)
	Emergency medicine	31 (5.6%)
	Family medicine	46 (8.3%)
	Intern	7 (1.3%)
	Internal medicine.	27 (4.9%)
	Neurology	1 (0.2%)
	Obstetrics and gynecology	17 (3.1%)
	Ophthalmology	2 (0.4%)
	Orthopedics.	11 (2.0%)
	Other (please specify)	126 (22.7%)
	Pediatrics	91 (16.4%)
	Psychiatry	28 (5.1%)
Radiology	24 (4.3%)	
Surgery.	60 (10.8%)	
Do you have Flu symptoms (fever, cough, SOB, sore throat?)	Yes	36 (6.5%)
	No	518 (93.5%)
Were you diagnosed or suspected to have corona virus infection?	Yes	23 (4.2%)
	No	531 (95.8%)
Do you have COVID-19 patients, or have you encountered cases or suspected cases?	Yes	208 (37.5%)
	No	346 (62.5%)
Do you know any healthcare worker with a positive COVID-19 infection?	Yes	158 (28.5%)
	No	396 (71.5%)
When you knew about COVID-19 pandemic; did it influence your work efficiency?	My work efficiency improved	215 (38.8%)
	My work efficiency decreased	89 (16.1%)
	My work efficiency is the same as before	250 (45.1%)
Are you happy about isolation precaution, personal protective equipment (PPE), or respirator fit testing in your healthcare institution during this event?	Below expectations	106 (19.1%)

(continued)

**Table 1**  
(continued).

Characteristics	Descriptions	n (n%)
Are you afraid to be the source of infection to your family?	Met expectations	367 (66.2%)
	Exceeded expectations	81 (14.6%)
	Disagree	35 (6.3%)
Depression severity	Neutral/ambivalent feeling	89 (16.1%)
	Agree	430 (77.6%)
	Not significant (normal): score 0–4	288 (52.0%)
If you are assigned to COVID-19 patient; how many days do you cover them or face them?	Mild: score 5–9	165 (29.8%)
	Significant (moderate or severe): 10–27	101 (18.2%)
	Daily (in a week)	37 (6.7%)
How long are you assigned to cover COVID-19 patients?	More than half of days (per week)	21 (3.8%)
	Several days (per week)	59 (10.6%)
	Weekly or less frequent	67 (12.1%)
	Not applicable (not covering)	370 (66.8%)
	1 wk only then change of service or rest	57 (10.3%)
Were offered days off after coverage of corona virus patients (if you are assigned for COVID TEA)	1 mo then change of service or rest	17 (3.1%)
	2–3 wks then change of service or rest	35 (6.3%)
	Not applicable	445 (80.3%)
	Yes	88 (15.9%)
	No	62 (11.2%)
	Not applicable (not COVID TEAM)	404 (72.9%)

No significant ( $P=.432$ , 95% CI) association (Table 2) was observed between gender and depression classifications, that is, 30.2% ( $n=87$ ) male participants had insignificant depression, 32.1% ( $n=53$ ) mild, 24.8% ( $n=25$ ) significant depression, whereas 69.8% ( $n=201$ ) female participants had insignificant association, 67.9% ( $n=112$ ) mild, 75.2% ( $n=76$ ) significant depression. However, females had high proportion (75.0%) as compared to male (24.8%) in significant classifications of depression.

Regarding age group of the participants, a significant association were recorded (Table 2) between age group and depression classifications. Participants whom were less than the age of 29 had 25.7% ( $n=26$ ) of significant depression. On the other hand, 50.0% ( $n=144$ ) of the participants from 30 to 39 years of age had insignificant association, 49.1% ( $n=81$ ) had mild and 59% had significant depression in contrast with 50.0% ( $n=144$ ) participants from 30 to 39 years of age group had insignificant association, 49.1% ( $n=81$ ) mild, 59% significant depression and 33.7% ( $n=97$ ) participants from  $\geq 40$  had insignificant association, 31.5% ( $n=52$ ) mild, 15.8% ( $n=16$ ) significant depression, respectively.

Similarly, there was a statistically significant ( $P<.001$ , 95% CI) association between job description (profession) and depression classifications that is 62.2% ( $n=179$ ) nurses had insignificant association, 50.3% ( $n=83$ ) mild, and 35.6% ( $n=36$ ) significant depression, whereas 30.2% ( $n=87$ ) physician had insignificant association, 40.6% ( $n=67$ ) mild, and 59.4% ( $n=60$ ) significant depression. Furthermore, 7.6% ( $n=22$ ) of other health care profession had insignificant association, 9.1% ( $n=15$ ) mild, and 5.0% ( $n=5$ ) significant depression, respectively. In the classifications of significant depression, physician (59.4%) had higher proportion as compared to nurses (35.6%) and other profession (5.0%). There is a significant depression in the central area of the kingdom of Saudi Arabia 49.5% ( $n=50$ ) with

( $P\leq.001$ , 95% CI) and the highest results of significant depression found in bachelors and PhDs with 58.4% ( $n=59$ ), 20.8% ( $n=21$ ), respectively ( $P\leq.05$ , 95% CI). Depression was significant in Saudi nationals 61.4% ( $n=62$ ) ( $P<.001$ , 95% CI) and medical staff who encountered Corona patients 51.5% ( $n=52$ ) ( $P<.002$ , 95% CI) while no significant depression with the medical staff who didn't encounter corona patients 68.4% ( $n=197$ ) ( $P<.002$ , 95% CI).

Not knowing any health care worker with a positive COVID-19 infection positively influencing health care employees as 76.4% ( $n=220/288$ ) reported to be normal ( $P<0.021$ , 95% CI). Hospital preparedness positively influencing health care workers with more freedom of depression symptoms 69.1% ( $n=199/288$ ) ( $P<.001$ , 95% CI). Most of participant who were afraid to be the source of infection to their family had more significant depression 83.2% ( $n=84/101$ ) ( $P<.001$ , 95% CI). No significant association between depression and coverage, length and COVID team assignments with P values ( $P<0.211$ , 95% CI) ( $P<.299$ , 95% CI) ( $P<.704$ , 95% CI), respectively. More characteristics are listed in (Table 2)

The impact of depression on different subspecialties listed on (Table 3). Severe depression are seen with family medicine physicians while psychiatrists had mild depression symptoms.

#### 4. Discussion

This cross-sectional survey enrolled 554 respondents and revealed a high prevalence of depression symptoms among health care workers treating patients with COVID-19 in Saudi Arabia. Overall, 48% and 18% of all participants reported symptoms of depression and significant depression, respectively. Participants were divided into 5 health institutional areas (North, South, East, West, and Central area) to compare interregional differences. Most participants were females, nurses aged 30 to

**Table 2****Effect and association of depression classification with respect to survey characteristics.**

Variables	Descriptions	Not significant (normal) (n=288)	Mild (n=165)	Significant (moderate and severe) (n=101)	P
Sex	Male	87 (30.2%)	53 (32.1%)	25 (24.8%)	.432
	Female	201 (69.8%)	112 (67.9%)	76 (75.2%)	
Age	≤29	47 (16.3%)	32 (19.4%)	26 (25.7%)	*.010
	30–39	144 (50.0%)	81 (49.1%)	59 (58.4%)	
	≥40	97 (33.7%)	52 (31.5%)	16 (15.8%)	
What is your profession?	Nurse	179 (62.2%)	83 (50.3%)	36 (35.6%)	* <.001
	Physician	87 (30.2%)	67 (40.6%)	60 (59.4%)	
	Others	22 (7.6%)	15 (9.1%)	5 (5.0%)	
Which health care institution area do you work in?	Central area (over the Kingdom)	221 (76.7%)	109 (66.1%)	50 (49.5%)	* <.001
	Eastern area (over the Kingdom)	18 (6.3%)	10 (6.1%)	12 (11.9%)	
	Northern area (over the Kingdom)	18 (6.3%)	14 (8.5%)	12 (11.9%)	
	Southern area (over the Kingdom)	7 (2.4%)	1 (0.6%)	3 (3.0%)	
	Western area (over the Kingdom)	24 (8.3%)	31 (18.8%)	24 (23.8%)	
What is the highest level of school you have completed or the highest degree you have received?	Diploma degree	76 (26.4%)	27 (16.4%)	15 (14.9%)	.050
	Bachelor degree (resident or under-trainee)	144 (50.0%)	85 (51.5%)	59 (58.4%)	
Which of the following categories best describes your working hours?	Master degree	20 (6.9%)	11 (6.7%)	6 (5.9%)	.665
	PhD	48 (16.7%)	42 (25.5%)	21 (20.8%)	
	working ≤39 h per week	37 (12.8%)	20 (12.1%)	16 (15.8%)	
What is your nationality?	Working ≥40 h per wk	251 (87.2%)	145 (87.9%)	85 (84.2%)	* <.001
	Arabic nationalities (Non Saudi)	23 (8.0%)	14 (8.5%)	7 (6.9%)	
	Filipino	87 (30.2%)	49 (29.7%)	17 (16.8%)	
	Indian	80 (27.8%)	22 (13.3%)	13 (12.9%)	
	Saudi	89 (30.9%)	75 (45.5%)	62 (61.4%)	
	Others (other nationalities)	9 (3.1%)	5 (3.0%)	2 (2.0%)	
Do you have Flu symptoms (fever, cough, SOB, sore throat?)	Yes	7 (2.4%)	16 (9.7%)	13 (12.9%)	* <.001
	No	281 (97.6%)	149 (90.3%)	88 (87.1%)	
Were you diagnosed or suspected to have corona virus infection?	Yes	9 (3.1%)	11 (6.7%)	3 (3.0%)	.154
	No	279 (96.9%)	154 (93.3%)	98 (97.0%)	
Do you have COVID-19 patients, or have you encountered cases or suspected cases?	Yes	91 (31.6%)	65 (39.4%)	52 (51.5%)	*.002
	No	197 (68.4%)	100 (60.6%)	49 (48.5%)	
Do you know any health care worker with a positive COVID-19 infection?	Yes	68 (23.6%)	53 (32.1%)	37 (36.6%)	*.021
	No	220 (76.4%)	112 (67.9%)	64 (63.4%)	
When you knew about COVID-19 pandemic; did it influence your work efficiency?	My work efficiency improved	116 (40.3%)	64 (38.8%)	35 (34.7%)	*.001
	My work efficiency decreased	30 (10.4%)	31 (18.8%)	28 (27.7%)	
	My work efficiency is the same as before	142 (49.3%)	70 (42.4%)	38 (37.6%)	
	Below expectations	42 (14.6%)	30 (18.2%)	34 (33.7%)	
Are you happy about isolation precaution, personal protective equipment (PPE), or respirator fit testing in your health care institution during this event?	Met expectations	199 (69.1%)	117 (70.9%)	51 (50.5%)	* <.001
	Exceeded expectations	47 (16.3%)	18 (10.9%)	16 (15.8%)	
	Disagree	27 (9.4%)	3 (1.8%)	5 (5.0%)	
Are you afraid to be the source of infection to your family?	Neutral/ambivalent feeling	58 (20.1%)	19 (11.5%)	12 (11.9%)	.211
	Agree	203 (70.5%)	143 (86.7%)	84 (83.2%)	
If you are assigned to COVID-19 patient; how many days do you cover them or face them?	Daily (in a wk)	18 (6.3%)	9 (5.5%)	10 (9.9%)	.299
	More than half of days (per wk)	10 (3.5%)	3 (1.8%)	8 (7.9%)	
	Several days (per wk)	28 (9.7%)	22 (13.3%)	9 (8.9%)	
	Weekly or less frequent	34 (11.8%)	20 (12.1%)	13 (12.9%)	
How long are you assigned to cover COVID-19 patients?	Not applicable (not covering)	198 (68.8%)	111 (67.3%)	61 (60.4%)	.704
	1 wk only then change of service or rest	30 (10.4%)	19 (11.5%)	8 (7.9%)	
	1 mo then change of service or rest	6 (2.1%)	5 (3.0%)	6 (5.9%)	
	2–3 wks then change of service or rest	16 (5.6%)	9 (5.5%)	10 (9.9%)	
Were offered days off after coverage of corona virus patients (if you are assigned for COVID TEAM)	Not applicable	236 (81.9%)	132 (80.0%)	77 (76.2%)	.704
	Yes	44 (15.3%)	24 (14.5%)	20 (19.8%)	
	No	35 (12.2%)	16 (9.7%)	11 (10.9%)	
	Not applicable (not COVID TEAM)	209 (72.6%)	125 (75.8%)	70 (69.3%)	

\* P value &lt; 0.05.



**Table 3**  
**Impact and association between different medical subspecialties and their level of depression (n=214).**

Specialty	Mild (n=87)	Moderate (n=67)	Significant (n=60)	P
Anesthesia	6 (6.9%)	7 (10.4%)	4 (6.7%)	.993
Cardiology	5 (5.7%)	5 (7.5%)	1 (1.7%)	.682
Dermatology	0 (0.0%)	1 (1.5%)	0 (0.0%)	.698
Emergency medicine	1 (1.1%)	3 (4.5%)	0 (0.0%)	.423
Family medicine	17 (19.5%)	4 (6.0%)	23 (38.3%)	* <.001
Intern	3 (3.4%)	3 (4.5%)	0 (0.0%)	.635
Internal medicine	6 (6.9%)	11 (16.4%)	6 (10.0%)	.459
Neurology	1 (1.1%)	0 (0.0%)	0 (0.0%)	.833
Obstetrics and gynecology	1 (1.1%)	3 (4.5%)	1 (1.7%)	.733
Ophthalmology	1 (1.1%)	0 (0.0%)	0 (0.0%)	.833
Orthopedics	0 (0.0%)	3 (4.5%)	3 (5.0%)	.371
Other (please specify)	6 (6.9%)	9 (13.4%)	11 (18.3%)	.342
Pediatrics	10 (11.5%)	5 (7.5%)	2 (3.3%)	.515
Psychiatry	16 (18.4%)	3 (4.5%)	1 (1.7%)	*.005
Radiology	9 (10.3%)	8 (11.9%)	5 (8.3%)	.282
Surgery	5 (5.7%)	2 (3.0%)	3 (5.0%)	.955

\* P value < 0.05.

39 years, nurses those who are working in the central area of the kingdom, and frontline workers reported more severe symptoms on all measurements. Our study further indicated that being a woman, either a nurse or physician, with age 30 to 39 years poses an intermediate to high risk for depression. Working in the front line was an independent risk factor for worse depression outcomes in all dimensions of interest. Together, our findings present concerns about the psychological well-being of physicians and nurses involved in the COVID-19 outbreak.

In this study, a significant proportion of participants experienced depression of >50%. In a previous study during the acute SARS outbreak, 89% of health care workers who were in high-risk situations reported psychological symptoms.<sup>[8]</sup> The fact that COVID-19 is human-to-human transmissible may intensify the perception of personal danger.<sup>[1,3]</sup>

The first confirmed case of Covid-19 outbreak has been reported in Saudi Arabia on March 2nd, 2020. As in the rest of the world, a rapid transformation and adaptation process started in the health care system and immediate steps were taken in our country, as well. To expand bed capacity for Covid-19 patients, many inpatient units have been converted to Covid-19-related wards. Physicians from different specialties were assigned to work in frontline positions. It is surely beyond doubt that this acute and unprecedented crisis had an inevitable impact on health care workers. Our study confirms the concerns about mental wellbeing (depression) of HCWs.

Overall, almost half of all participants in our study reported symptoms of depression, with 18.2% having a significant depressive symptom. Our result is consistent with the study in Wuhan done by Lai et al to investigate the psychological effects of the Covid-19 pandemic in health care workers.<sup>[9-11]</sup> The authors found that among 1257 HCWs working in different hospitals in China, 50.4% reported symptoms of depression, with 6.7% having a significant depressive symptom.

In another study done in Turkey by Elbay et al,<sup>[12]</sup> their results show a higher rate of depression among health care workers as the majority of all participants reported symptoms of depression (64.7%).

Of note, the majority of participants were female (70.2%). Our findings further indicate that female health care workers reported more significant symptoms of depression compared to male, 20%

and 15% consecutively. This is consistent with the study done by Lai et al; they found that women health care workers reported more severe symptoms of depression compared to male, 16.2% and 10.2% consecutively.<sup>[9]</sup>

We found that being a young physician, encountered to cover a COVID-19 patients or suspected cases, and working in western or central region, are associated with more depressive symptoms. Similar to our findings, Lai et al and Elbay et al indicated that frontline workers had a greater risk for developing adverse psychiatric outcomes, during Covid-19 outbreaks.<sup>[9,12]</sup>

Health care workers who have the perception that their work efficiency decreased are having a higher significant depressive symptoms, and this could be explained by the direct effect of depression on motivation and having energy to work efficiently as well as the effect of depression on cognitive ability such as ability to concentrate and information processing speed.

There is a clear association between depressive symptoms and the institution safety measures like isolation precaution, availability of personal protective equipment, and infection control measures. The Hospital preparedness associated with more freedom of depression symptoms 69.1% (n=199/288) (P < .001, 95% CI). Health care workers who see their institution measures as below expectation have more depressive symptoms. Also, health care workers who have flu-like symptoms and those who were afraid to be the source of infection to their families have more PHQ-9 score than those who do not. Shortage of personal protective equipment (PPE), unsafe work environment, poor working conditions, the idea of uncertainty of having the COVID-19 infection, and the fears of harming the family member are stressful thoughts and situations that can be a risk for developing depression disorder and overwhelming guilt feeling.<sup>[13-15]</sup> This highlights the importance of communication between the health institution administration with health care workers to understand their fears, addressing their concerns and provide them with a proper family and psychological support as 77.6% had this fear and most of participant who were afraid to be the source of infection to their family had more significant depression 83.2% (n=84/101) (P < .001, 95% CI).<sup>[16]</sup>

Providing adequate pre-job training on those who will work in the frontline, explaining accurate information on the disease, risk of contagion and ways of protection, establishing systematic

diagnostic and treatment protocols with clear guidelines may help relieve stress and increase occupational confidence.

The majority of health care workers, who have not encountered or known about a colleague having a COVID-19 infection, reported no depression symptoms 76.4% (n=220/288) ( $P < .021$ , 95% CI). This highlights the importance of announcement and crisis management during this pandemic.

## 5. Limitations

To the best of our knowledge, this is the first study in Saudi Arabia and Arab region generally investigating psychological impact of COVID-19 outbreak on health care workers.

This study has several limitations. First, it was limited in scope. Central region of Saudi Arabia represents around 25% of total population and most participants (68.%) in our study were from Central region, and this limiting the generalization of our findings to other regions. Second, the study lacks longitudinal follow-up. Because of the increasingly arduous situation, the mental health symptoms of health care workers could become more severe. Thus, long-term psychological implications of this population are worth further investigation. Third, this study was also unable to distinguish preexisting between mental health symptoms and new symptoms. Fourth, this is a cross-sectional study based on a self-report questionnaire which could be subject to response bias. Furthermore, the voluntary nature of the survey might have led to a selection bias and the respondents may not represent well in the entire population. In this study, we only investigated depression. However, further studies studying the effect of psychosocial intervention would contribute to the current literature.

## 6. Conclusions

Frontline young healthcare workers especially physician in Saudi Arabia reported a high rate of depression symptoms. Physicians were more prone for significant depression than other medical profession. Countermeasures for health care workers represent a key component for the mental and physical well-being as part of public health measures during this pandemic. Attention to hospital preparedness and adequacy of personal protective equipment contributed to milder depression symptoms. Further studies need to be conducted on crisis management and depression.

## Author contributions

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