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Depression among Health Care Workers in Khartoum State, Sudan, 2022

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Abstract

Introduction: Depression is a serious issue affecting healthcare workers and is a leading cause of disability for both genders. Furthermore, it is one of the leading causes of mortality and morbidity, responsible for 4.4 percent of global disability. An estimated 350 million people are currently living with depression worldwide. **Objectives:** to estimate the prevalence of depression among healthcare workers in Khartoum State in 2022 and determine the associated factors. **Methods:** A cross-sectional survey was conducted among healthcare workers in Khartoum State, Sudan, in 2022 using a self-administered electronic questionnaire. Depression was screened using the self-reporting questionnaire (PHQ-9). Descriptive statistics in the form of frequencies and percentages were used to display the data. Odds ratios (ORs) with a 95% confidence interval were estimated using bivariate and multivariate logistic regression analysis to determine associations between depression and related factors. **Results:** A total of 341 valid responses were received, with a mean age of 33.91. The overall prevalence of depression (PHQ-9 > 8) was 258 (75.6%). The prevalence was significantly associated with marital status (single and divorced), occupation (psychologist), and working department (Emergency Department), showing a p-value of <0.041. **Conclusion:** Depression is a serious mental health disorder that affects all people, including healthcare workers, and is a growing problem in Sudan. To address this, healthcare organizations must implement policies and strategies to reduce inequality and protect healthcare workers. A multidisciplinary approach that includes mental health professionals, the Ministry of Health, and universities is needed to prioritize mental health issues and ensure quality care and the overall well-being of both healthcare workers and patients.

Keywords

Depression, Health Care Workers, Self-Reporting Questionnaire (PHQ-9),

Sudan, Khartoum State

1. Introduction

Depression is a common mental condition characterized by low energy, a sad mood, a loss of pleasure or interest, sleep and food disturbances, and trouble concentrating. According to the World Health Organization (WHO) reports depression is the leading cause of disability for both genders furthermore; it is one of the leading causes of mortality and morbidity worldwide, responsible for 4.4% of global disability, and an estimated 350 million people are currently living with depression worldwide. Depression among healthcare workers is a major public health challenge globally [1].

The Sudanese government has been subject to sanctions for the past fifteen years. These sanctions were put in place in 2004 in response to the Sudanese government's response to a humanitarian crisis and widespread human rights violations, which led to decades of economic and political instability and made the country's health system fragile. Sudan's health system has been unstable as a result of protracted economic sanctions, which have led to low health indices and disparities between urban and rural areas. This has led to political and economic turmoil [2]. According to the Centers for Disease Control and Prevention, depression is also the main contributor to disability among Americans aged 15 to 44 (CDC) [3]. Depression among medical workers is a complicated problem that is brought on by several social, psychological, and physical reasons, genetics, biological factors, a family history of illness, and medical diseases like diabetes, and heart disease. People of all ages, from all walks of life, and in all nations are susceptible to depression, which is a prevalent mental condition. Depression can result in severe pain, a decline in life expectancy, and disability [4].

In Khartoum, the Sudanese capital, 66.7% of healthcare workers have depressive symptoms, according to a 2018 survey [5].

A study conducted in Khartoum State, Sudan showed that the overall prevalence of depression among healthcare workers was 26.8% [6]. Another study conducted among nursing staff in 2021 showed 26.4% mild to severe depression [7].

Increased risk of depression was associated with heavy smoking, hazardous drinking, moderate to high physical activity, and sleep problems among healthcare workers [8]. Patient care can be significantly impacted by depression among healthcare personnel. Depression has been demonstrated to have a major negative influence on productivity, absenteeism, and patient care quality [9].

Depression is a serious mental illness that can harm both individual and patient care, and healthcare professionals are at risk of developing severe depression. Several types of research published recently address depression among healthcare workers (HCW), but As far as the researcher is aware few similar published studies in Sudan address the prevalence of depression in Sudan. This

study aims to update and extend existing knowledge about the prevalence, factors, and correlates to fill the gap in the literature and serve as baseline data for program planners and strategic developers.

2. Methods and Materials

2.1. Study Area

Khartoum State is one of the eighteen states of Sudan. Although it is the smallest state by area (22,142 km^2), it is the most populous a population of 6,112,545 in 2022 It contains the country's largest city by population, Omdurman, and the city of Khartoum, which is the capital of the state as well as the national capital of Sudan. The capital city contains offices of the state, governmental and non-governmental organizations, cultural institutions, and the main airport. The city is located in the heart of Sudan at the confluence of the White Nile and the Blue Nile, where the two rivers unite to form the River Nile. The confluence of the two rivers creates a unique effect.

2.2. Study Population

Based on Sudan Ministry of Health Data, the total number of health care workers (HCWs) in Khartoum State (including dentists and pharmacists) is 8273, as shown in the table (source: Annual Health Statistical Report 2019), of which 2563 are doctors and 3673 are nurses and technicians, respectively.

2.3. Recruitment and Sampling Technique

All healthcare workers in Khartoum State at the time of the study were included, including general practitioners working in private hospitals and private health centers. They belong to national and international non-governmental organizations in Khartoum 2022.

All participants were contacted through one Google form, translated from English to Arabic, and sent as a WhatsApp message to eligible participants. A convenient, non-randomized, and voluntary response was taken.

With a confidence level of 95%, a margin of error of 5, a population proportion of 33%, and a study population of 8273, the sample size was calculated at 327 HCWs.

2.4. Inclusion Criteria

Health care workers (HCWs), working in public or private health facilities currently in Khartoum State, and full part-time.

2.5. Exclusion Criteria

Healthcare workers not working in Khartoum State were not included.

2.6. Study Design and Setting

This is a web-based cross-sectional study carried out among healthcare workers

(HCWs) currently in Khartoum. It includes various categories of HCWs in private and public universities in Khartoum, Sudan. An electronic questionnaire to determine the prevalence of depression among healthcare workers and associated factors was created using Google Forms. The questionnaire was introduced by explaining the purpose of the study and obtaining informed consent. The questionnaire was introduced by explaining the purpose of the study, and the informed consent study is a cross-sectional survey carried out in public and private healthcare facilities in Khartoum State.

2.7. Study Period

Data collection started between May 2022 and December 2022.

2.8. Data Collection Method and Tool

Using probability proportion to size the sample size was calculated according to the percentage of each class. The total populations from which the sample size was drowned are 8273 healthcare workers in Khartoum State.

Physicians (Medical Doctors 82, Dentists 8, and Pharmacists 12), with a total of 102; Paramedics (Nurses 146, Psychologists 4, Laboratory 52 Technicians, X-ray Technicians 17, and Optics Technicians 6), with a total of 341.

A self-administered questionnaire was used which has different subunits and questionnaires to assess socio-demographic factors, clinical related factors, psychosocial factors, and substance-related factors. The questionnaire for a tentative diagnosis of depression is based on The Patient Health Questionnaire-9 (PHQ-9) is a nine-item instrument used to make criteria-based diagnoses for depressive symptoms. The Patient Health Questionnaire (depression module) consists of nine questions about how you've felt in the past two weeks. It has nine criteria, each with a score ranging from "Not at All", to "Almost Every Day" [10] Personal data and data related to risk factors will also be collected.

The questionnaire was introduced by explaining the purpose of the study and making it clear that participation is voluntary. Follow-up emails will be sent to increase the response rate.

Answers are on a 4-point scale, ranging from not at all to nearly every day. Each answer has a score, and the total score is calculated. A score of 1 - 4 indicates minimal depression. A score of 5 - 9 indicates mild depression. A score of 10 - 14 indicates moderate depression. A score of 15 - 19 indicates moderately severe depression. A score of 20 - 27 indicates severe depression [10].

2.9. Data Analysis

The data was cleaned up, checked, coded, and entered in IBM SPSS version 21 for analysis. Descriptive statistics in the form of frequencies and percentages were used to display socio-demographic data and the prevalence of depressive symptoms. A Chi-square test was used to compare differences in proportions between groups. A p-value less than 0.05 were considered statistically significant.

Odds ratios (ORs) with a 95% confidence interval (95% CI) were estimated using bivariate and multivariate logistic regression analysis to determine associations between depression and related factors. Variables in the bivariate analysis that showed a significant association with the dependent variable were included in the multivariate analysis. The odds ratios (ORs) and corresponding 95% confidence intervals (CIs) and p-values were tabulated. Statistical analysis was performed using the SPSS version 22 statistical package, and all the variables were entered as continuous data in the final model.

2.10. Ethical Considerations

The study protocol was submitted and approved by the Ministry of Health in Khartoum State and the Department of Innovation Development and Scientific Research.

A written informed consent with an introduction about the purposes of the study was attached to the electronic questionnaire. Being a voluntary and anonymous study, no written informed consent was required, and the participants were informed that clicking on the first page of the questionnaire was equivalent to giving their consent to participate. All participants were assured that confidentiality would be maintained in this study, no names or personal information would be disclosed, and all information collected would be used only for the study. The data was saved strictly confidentially for research purposes. All selected participants were informed that they had the right to accept or refuse to participate in the study, to withdraw at any time, and the right to benefit from the knowledge and skills of the researcher.

3. Result

3.1. Socio-Demographic Characteristics of Enrolled Participants

A total of 341 valid responses were received; the calculated sample size was 327, and the response rate was 100%. Most of the 238 respondents (69.7%) were female. The mean age of the respondents was 33.91 (SD = 10.37 years), with a minimum and maximum age of 18 and 73 years, respectively; the highest response rate was 171 (50.3%) among the younger groups (18 - 30 years), and the lowest response rate was among the older groups (51 - 73 years), at 30 (9.0). Nearly half of the respondents, 183 (53.7%), were unmarried, and the rest of the participants, 158 (46.3%), were married. University degrees were the most common, at 172 (50.4%), while post-graduated participants were 159 (44.6%). Most of the respondents work in government hospitals (144, or 42.2%), while 97 (28.5%) work in private institutions. Doctors (physicians) were 90 (26.4%), nurses were 84 (24.6%), and optics technicians were the lowest participants at 7 (02.1%). 44.6% of the participants have higher postgraduate degrees. The vast majority of the participants (307) (90.0%) reported no chronic illnesses. Most of the participants (275, or 80.6%) reported no family history of mental illness. The vast majority of the 307 participants (90.0%) stated that they do not smoke. Re-

garding work experience, the majority of participants, 165 (46.4%), have experience ranging from 1 to 5 years, while 38 (11.1%) have experience ranging from 21 to 45 years. According to the participant's responses, approximately two-thirds of 230 (67.5%) respondents earned monthly income between the ranges of 500,000 and 5,000,000 SDG. More than fifty percent of 186 (54.6) were fully vaccinated against the COVID-19 disease. The socio-demographic characteristics of respondents are summarized in Table 1.

3.2. Prevalence of Depression among Health Care Workers (HCWs)

Level of depressive symptoms among participants; the overall prevalence of depressive symptoms was 75.7% among 258 participants (95% CI: 22.6 - 33.7). Whereas 83 (24.3% of those interviewed reported no symptoms. The most frequent level of depressive symptoms was mild (score of 5 - 9) depressive symptoms 102 (29.9%), followed by moderate (score of 10 - 14) 78 (22.9%), and then moderately severe (score of 15 - 19) 51 (15.1%). The last degree of depression was severe depression (score of 20 - 27), or 27 (7.9%) (Table 2).

3.3. Depressive Symptoms Status of Participants

Multiple responses are allowed to assess depressive symptoms. The vast majority, 299 (87.7%) of respondents, did not complain of any symptoms of thinking that they would be better off dead or of hurting themselves in some way. Approximately two-thirds of 210 (61.6%) of the respondents did not feel like Moving or speaking so slowly that other people could have noticed. Or the opposite—being so fidgety or restless that you have been moving around a lot more than usual. 168 (49.5%) of the respondents did not complain of any symptoms of trouble concentrating on things, such as reading the newspaper or watching television. 150 (44.0%) had no trouble falling or staying asleep or sleeping too much, and 130 (38.1%) did not feel like they had a poor appetite or were overeating. 97 (28.4%) of respondents didn't show any little interest or pleasure in doing things, and 89 (26.1%) had bad feelings about themselves or thought he was a failure or had let themselves or their family down. One-fourth of the respondents (79, or 23.2%) did not report feeling down, depressed, or hopeless, and 36, or 10.6%, did not report any symptoms related to tiredness or low energy (Table 3).

3.4. Depression among Health Care Workers (HCWs) According to Their Degree of Severity

The classification of depression among health care workers according to the degree of severity was: 27 (7.9%) have severe depression, 51 (15.0%) have moderately severe depression, 78 (22.8%) have moderate depression, 102 (29.9%) have mild depression and 83 (24.3%) have no depression (Table 3). On the other hand, the classification of depression according to the occupation was significantly higher among nurses (9; 33.3%), then doctors and laboratory technicians

Table 1. Socio-demographic characteristics distribution of depressive symptoms among healthcare workers (N = 341).

N	Variable	Category	Frequency (%)	Prevalence of Depression	Mean	S.D	P-value
1	Gender	Male	103 (30.2)	70 (68.0%)	1.70	0.460	0.022
		Female	238 (69.8)	188 (79.0%)			
2	Age	18 - 30 y	171 (50.3)	143 (83.6%)	33.91	10.375	<0.001
		31 - 40 y	84 (24.6)	65 (77.3%)			
		41 - 50 y	52 (15.8)	30 (57.7%)			
		51 - 73 y	30 (9.0)	19 (63.3%)			
3	Marital stats	Married	158 (46.3)	103 (65.2%)	1.59	0.614	<0.001
		Unmarried	183 (53.7)	155 (84.5%)			
4	Children	0 - 2	259 (76)	208 (80.3%)	1.24	1.765	<0.001
		3 - 5	76 (22.2)	48 (63.2%)			
		6 - 10	06 (1.8)	2 (33.3%)			
5	Work place	Governmental Sector	157 (46.0)	10 (74.3%)	1.79	.822	0.232
		Private Sector	97 (28.4)	30 (81.1%)			
		Others	87 (25.5)	06 (46.2%)			
6	Occupation	Doctor	90 (26.4)	68 (75.6%)	3.90	2.437	0.040
		Dentist	16 (04.7)	15 (93.8%)			
		Pharmacist	28 (08.2)	20 (71.4%)			
		Nurse	84 (24.6)	64 (76.2%)			
		laboratory technician	62 (18.2)	45 (72.6%)			
		Radiology technician	20 (05.9)	16 (80.0%)			
		Optics technician	07 (02.1)	05 (71.4%)			
		Anesthesia technician	11 (03.2)	09 (81.8%)			
		Psychologist	08 (02.3)	02 (25.0%)			
		Other	15 (04.4)	14 (93.3%)			
7	Service years	0 - 5	165 (48.4)	136 (82.4%)	8.99	8.465	<0.001
		6 - 10	62 (18.2)	50 (80.6%)			
		11 - 20	76 (22.3)	53 (69.7%)			
		21 - 45	38 (11.1)	19 (50.0%)			
8	Working department	Medicine Department	22 (05.5)	16 (72.7)	5.04	1.487	.227
		Surgery Department	14 (04.1)	9 (64.3%)			
		Pediatrics Department	13 (03.5)	11 (84.6%)			
		Obstetrics Department	30 (08.8)	23 (76.7%)			
		Emergency Department	67 (19.6)	15 (78.9%)			
		Others	196 (57.5)	05 (35.7%)			
9	Degree	Post-Graduate	159 (46.6)	111 (69.8%)	1.57	0.573	0.081
		University Degree	172 (50.4)	140 (81.4%)			
		Diploma	8 (2.3)	6 (75.0%)			
		Others	2 (0.6)	1 (50.0%)			
10	Chronic illnesses	Yes	43 (10)	21 (61.8%)	1.90	0.300	0.042
		Nor	307 (90)	237 (77.2%)			
11	Monthly income SDG	0 - 99,999	46 (13.5)	35 (76.1%)	483758.36	3940809.103	0.540
		100,000 - 499,999	65 (19.0)	52 (80.0%)			
		500,000 - 999,999	92 (27.0)	72 (78.3)			
		1,000,000 - 50,000,000	138 (40.5)	99 (71.7%)			

Continued

12	Family history of mental illness	Yes	41 (12.6)	38 (92.7%)	1.95	0.438	005
		No	275 (80)	198 (72.0%)			
		Don't know	25 (7.4)	22 (88.0%)			
13	Covid-19 vaccination	Fully vaccinated	186 (54.6)	138 (74.2%)	1.79	0.915	0.749
		Partially vaccinated	41 (12.9)	31 (75.6%)			
		Not vaccinated	114 (33.4)	89 (78.1%)			
14	Smoking	Yes	43 (10)	26 (76.5%)	1.90	0.300	0.549
		No	307 (90)	23 (75.6%)			

Table 2. Health care workers in Khartoum State 2022, according to their degree of depression (N = 341).

Degree of Depression					
		Frequency	Percent	Valid Percent	Cumulative Percent
(Minimal Depression)	0 - 4	83	24.3	24.3	24.3
(Mild Depression)	5 - 9	102	29.9	29.9	54.3
(Moderate Depression)	10 - 14	78	22.9	22.9	77.1
(Moderately Severe Depression)	15 - 19	51	15.0	15.0	92.1
(Severe Depression)	20 - 27	27	7.9	7.9	100.0
	Total	341	100.0	100.0	

Table 3. Depressive symptoms status of health care workers in Khartoum State 2022 (N = 341).

Depression symptoms	Not at all	Several days	More than half the days	Nearly every day	P-value
Little interest or pleasure in doing things?	97 (28.4%)	139 (40.8%)	35 (10.3%)	70 (20.5%)	0.654
Feeling down, depressed, or hopeless?	79 (23.2%)	70 (20.5%)	120 (35.2%)	72 (21.1%)	0.359
Trouble falling or staying asleep, or sleeping too much?	150 (44.0%)	125 (36.7%)	22 (6.5%)	44 (12.9%)	0.041
Feeling tired or having little energy?	36 (10.6%)	147 (43.1%)	43 (12.6%)	115 (33.7%)	0.013
Poor appetite or overeating?	130 (38.1%)	110 (32.3%)	28 (8.2%)	73 (21.4%)	0.315
Feeling bad about yourself—or that you are a failure or have let yourself or your family down?	89 (26.1%)	123 (36.1%)	24 (7.0%)	105 (30.8%)	0.487
Trouble concentrating on things, such as reading the newspaper or watching television?	168 (49.3%)	72 (21.1%)	36 (10.6%)	65 (19.1%)	0.055
Moving or speaking so slowly that other people could have noticed or the opposite—being so fidgety or restless that you have been moving around a lot more than usual?	210 (61.6%)	67 (19.6%)	24 (7.0%)	40 (11.7%)	0.485
Thoughts that you would be better off dead, or hurting yourself in some way?	299 (87.7%)	34 (10.0%)	3 (0.9%)	5 (1.5%)	0.981

(6; 22.2%), and anesthesia technicians (2; 7.4%). Of all participants, 175 (68.4%) described themselves as being depressed, and this was correlated with the levels

of depression as determined using the PHQ-9 scale. Self-reported depression was found in 47.6% of participants with minimal depression (PHQ-9 scores of 1 - 4) and 92.1% of those with moderately severe depression (PHQ-9 scores of 15 - 19) (Table 4).

3.5. Factors Associated with Depressive Symptoms among Healthcare Professionals

Factors associated with depression among healthcare workers were done using Bivariate and multivariable logistic regression analysis to identify its association with depressive symptoms among healthcare workers. In the bivariate analysis, sex, age group (18 - 30 years), marital status (married), number of children (0 - 2), occupation (psychologist), service years, and working department (Emergency Department) showed a p-value of <0.041 and became candidates for multivariable analysis. In multivariable binary logistic regression, the odds of depressive symptoms were 2.757 as high among Married participants as compared to unmarried [AOR = 2.757; 95% CI 1.233 - 6.161)]. Likewise, those healthcare professionals who working as Psychologists were nearly 73 times more likely to have depressive symptoms as compared with respondents who did not work as Psychologists [AOR = 73.85; 95% CI (2.897 - 1882.149)]. Furthermore, the odds of having depressive symptoms among Participants working in the emergency department were nearly .306 times more likely to be depressed as compared with the referent departments [AOR = 0.306; 95% CI (0.096 - 0.975)] (Table 5).

4. Discussion

The objective of this study was to estimate the incidence of depressive symptoms

Table 4. Disruption of depression among health care workers according to their occupation (N = 341).

Count						
Occupation	Degree of Depression					Total
	0 - 4	5 - 9	10 - 14	15 - 19	20 - 27	
Doctor	22	33	15	14	6	90
Dentist	1	4	5	3	3	16
Pharmacist	8	6	6	7	1	28
Nurse	20	23	17	15	9	84
Laboratory Technician	17	17	18	4	6	62
Radiology technician	4	5	7	4	0	20
Optics Technician	2	3	2	0	0	7
Anesthesia Technician	2	5	1	1	2	11
Psychologist	6	1	0	1	0	8
Other	1	5	7	2	0	15
Total	83	102	78	51	27	341

Table 5. Bivariate and multivariable logistic regression analysis results of depressive symptoms among healthcare professionals at Khartoum State, Sudan, 2022 (N = 341).

N	Variable	Category	Depression symptoms	COR (95% CI) for bivariate	P-value	AOR (95% CI) for multivariate	P-value
1	Gender	Male	70 (68.0%)	1.773 (1.056 - 2976)	0.030	1.397 (0.645 - 3.026)	0.396
		Female	188 (79.0%)	0	0	0	
2	Age	18 - 30 y	143 (83.6%)	0.294 (0.131 - 0.662)	0.003	3.156 (0.448 - 22.215)	0.248
		31 - 40 y	65 (77.3%)	0.427 (0.179 - 1.021)	0.056	2.779 (0.599 - 12.894)	0.192
		41 - 50 y	30 (57.7%)	1.72 (0.438 - 2.622)	0.879	2.151 (0.655 - 7.066)	0.207
		51 - 73 y	19 (63.3%)	0	0	0	
3	Marital stats	Married	103 (65.2%)	2.956 (1.760 - 4.966)	0.000	2.757 (1.233 - 6.161)	0.013
		Un Married	155 (84.5%)	0	0	0	0
4	No. Children	0 - 2	208 (80.3%)	0.123 (0.022 - 0.688)	0.017	0.179 (0.022 - 1.475)	0.110
		3 - 5	48 (63.2%)	0.292 (0.050 - 1.696)	0.170	0.225 (0.030 - 1.675)	0.145
		6 - 10	2 (33.3%)	0	0	0	0
5	Work place	Governmental Sector	157 (46.0%)	1.224 (0.670 - 2.234)	0.511	1.690 (0.742 - 3.850)	0.212
		Private Sector	97 (28.4%)	0.716 (0.352 - 1.456)	0.356	1.335 (0.532 - 3.351)	0.538
		Others	87 (25.5%)	0	0	0	0
6	Occupation	Doctor	68 (75.6%)	4.529 (0.563 - 36.435)	0.156	3.832 (0.349 - 42.061)	0.272
		Dentist	15 (93.8%)	0.933 (0.053 - 16.394)	0.962	0.462 (0.015 - 14.022)	0.658
		Pharmacist	20 (71.4%)	5.600 (0.628 - 49.946)	0.123	3.938 (0.367 - 42.210)	0.257
		Nurse	64 (76.2%)	4.375 (0.541 - 35.370)	0.166	8.490 (0.791 - 91.173)	0.077
		laboratory technician	45 (72.6%)	5.289 (0.645 - 43.367)	0.121	3.858 (0.370 - 40.253)	0.259
		Radiology technician	16 (80.0%)	3.500 (0.349 - 35.110)	0.287	1.647 (0.113 - 23.937)	0.715
		Optics technician	05 (71.4%)	5.600 (0.412 - 76.049)	0.196	2.214 (0.115 - 42.691)	0.599
		Anesthesia technician	09 (81.8%)	3.111 (0.245 - 39.540)	0.382	3.738 (0.233 - 59.922)	0.352
		Psychologist	02 (25.0%)	42.000 (3.170 - 556.476)	0.005	73.847 (2.897 - 1882.149)	0.009
		Other	14 (93.3%)	0	0	0	0
7	Service years	0 - 5	136 (82.4%)	0.213 (0.101 - 0.452)	0.000	0.520 (0.103 - 2.626)	0.428
		6 - 10	50 (80.6%)	0.240 (0.098 - 587)	0.002	0.481 (0.103 - 2.250)	0.352
		11 - 20	53 (69.7%)	434 (0.195 - 968)	0.041	0.609 (0.205 - 1.810)	0.372
		21 - 45	19 (50.0%)	0	0	0	0
8	Working department	Medicine Department	20 (82.4%)	0.986 (0.376 - 2.652)	0.978	0.611 (0.169 - 2.216)	0.454
		Surgery Department	14 (80.6%)	1.461 (0.469 - 4.555)	0.514	1.269 (0.296 - 5.438)	0.748
		Pediatrics Department	13 (69.7%)	0.526 (0.112 - 2.478)	0.417	0.527 (0.081 - 3.425)	0.502
		Obstetrics Department	30 (50.0%)	0.800 (0.325 - 1.973)	0.628	0.565 (0.162 - 1.971)	0.371
		Emergency Department	67 (50.0%)	0.408 (0.189 - 0.880)	0.022	0.306 (0.096 - 0.975)	0.045
		Others	196 (50.0%)	0	0	0	0
9	Degree	Post-Graduate	111 (69.8%)	0.432 (0.026 - 7.057)	0.556	0.051 (0.000 - 21.303)	0.334
		University Degree	140 (81.4%)	0.229 (0.014 - 3.752)	0.301	0.047 (0.000 - 19.197)	0.320
		Diploma	6 (75.0%)	0.333 (0.014 - 8.182)	0.501	0.104 (0.001 - 11.477)	346
		Others	1 (0.50.0%)	0	0	0	0
10	Chronic illnesses	Yes	21 (61.8%)	2.069 (0.999 - 4.3 99)	0.908	1.427 (0.553 - 3.680)	0.462
		No	237 (77.2%)	0	0	0	0
11	Monthly income	0 - 99,999	35 (76.1%)	0.798 (0.369 - 1.727)	0.566	1.502 (0.537 - 4.201)	0.439
		100,000 - 499,999	65 (76%)	0.635 (0.311 - 1.293)	0.211	0.862 (0.330 - 2.250)	0.761
		500,000 - 999,999	20 (20.4)	0.705 (0.496 - 1.309)	0.268	0.994 (0.448 - 2.205)	0.988
		1,000,000 - 50,000,000	80 (71.4%)	0	0	0	0

Continued

12	Family history of mental illness	Yes	38 (92.7%)	0.579 (0.107 - 3.120)	0.525	0.823 (0.133 - 5.103)	0.834
		No	198 (72.0%)	2.852 (0.830 - 9.802)	0.096	3.220 (0.826 - 12.556)	0.092
		Don't know	22 (88.0%)	0	0	0	0
13	Covid-19 vaccination	Fully vaccinated	186 (54.6)	1.238 (0.713 - 2.150)	0.448	1.023 (0.508 - 2.058)	0.949
		Partially vaccinated	41 (12.9)	1.148 (0.496 - 2.659)	0.747	1.126 (0.415 - 3.059)	0.816
		Not vaccinated	114 (33.4)	0	0	0	0
14	Smoking	Yes	43 (10)	0.952 (0.413 - 2.192)	0.908	767 (0.281 - 2.089)	0.603
		No	307 (90)	0	0	0	0

among healthcare workers at Sudan's public and private healthcare facilities in Khartoum and to determine correlations. The findings revealed that 258 healthcare professionals, or 75.7% (95% CI: 22.6, 33.7), had depressive symptoms. Several research studies carried out in agreement with this outcome, like a study conducted in Kenya, reported that 53.6% of healthcare workers experienced depression [11]. A study in China showed depressive symptoms among health care workers at 50.4% [12], however, compared to other studies, a lower prevalence of depression symptoms was reported in more developed countries, for instance, a study in Muscat, Oman, showed 39.2% [13] and that 31.5% of respondents reported symptoms of depression [14]. Another study identified a high rate of depression in all categories of HCWs [15]. A study in Jordan showed a prevalence of 28.3% [16], and in Italy during COVID-19, HCWs reported a prevalence of depression of 24.73% [17]. Many factors may be contributing to this discrepancy, including the different study settings, instruments used, sample size, participant cultures, and the increased workload due to low health system indicators in Sudan's health system [18]. Moreover, study participants, time variations, working environments, and most likely differences in a medical setting could all be factors.

Nonetheless, the proportion of depressive symptoms shown in our study was lower when compared to other studies conducted in Egypt, which found the prevalence of depression at 94% [19]. This might be due to enormous pressure, including a high risk of infection and inadequate protection from contamination, overwork, frustration, exhaustion, and most importantly, the COVID-19 pandemic.

The current study results revealed that those who were married were 2.75 times more likely to have depressive symptoms [AOR = 2.757; 95% CI: 1.233 - 6.161] As compared to those who were unmarried (widowed), this result was in line with previous results from Sudan [6] [20], Jeddah [21], Riyadh [22], and China [23] [24], but against studies conducted in Ethiopia [25], Kuwait [26], and Trinidad and Tobago [27]. Research suggests that marital status can have both positive and negative effects on mental health, including depression. On the positive side, marriage can provide emotional support, social connection, and a sense of belonging, which can promote mental well-being and protect against depression. On the negative side, being single, divorced, or widowed can be as-

sociated with a higher risk of depression. This may be due in part to the social isolation, loneliness, and lack of support that can accompany these life circumstances [28]. The high rate of depression among married health professionals may be due to the demands of marriage and family life.

Participants who worked as psychologists were 73.8 times more likely to have depressive symptoms [AOR = 73.85; 95% CI (2.897 - 1882.149)]. As Israel [29], and [30], the study also found that factors such as high job demands, low job control, and poor social support affect the ability to control all of these factors. WHO recommends that Sudan needs at least six mental health care workers per 100,000 people. To accomplish this, Sudan needs to greatly increase its mental health workforce from the current number of just 1.6 per 100,000 population [17].

Participants who worked in an emergency department were 73.8 times more likely to have depressive symptoms [AOR = 73.847; 95% CI (2.897 - 1882.149)] as compared to referent groups. This result was in line with previous results; a study in China found that nearly one-third of emergency physicians suffered from depression [31], and in line with another study in the United Kingdom [32] and the United States [33], this might be due to work overload, long working hours, and irregular schedules, which according to a study in the USA, might lead to a suicide attempt [34]. An evaluation of Sudan's mental health services indicated a lack of funding, untrained staff, and the stigma associated with mental illness in the nation's mental health system. According to the authors, overcoming these obstacles would necessitate a multifaceted strategy that includes boosting funding for mental health services, enhancing professional training for mental health practitioners, and expanding community awareness of mental health problems [35].

Some factors were significantly associated with depression with a P value of less than 0.05 but were not significant predictors for depression, such as age group (18 - 30 years), which was found to be significant in a study in Egypt [36]. Regarding gender, we found that it was significantly associated with depressive symptoms, with male participants having a higher prevalence than female participants (P-value = 0.03, AOR = 1.773 (1.056 - 2976), likewise a study in Bangladesh [37]. The number of children is significantly associated with depression (P-value = P < 0.001), with some variation within groups; the prevalence was high in the younger groups (0 - 2 children) (80.3%), likewise in a study in China [38]. There are mixed findings regarding the association between the number of children and depression among healthcare workers. One study found that a higher number of children were negatively associated with the prevalence of major depression [39].

Working Experience in the years of the participants is significantly associated with depression (P-value = P < 0.001), with some variation within Working Experience groups. The prevalence was high in the junior groups 0 - 05 years and 06 - 10 years (136 (82.4%) and 50 (80.6%), respectively, and low in the senior groups 11 - 20 years and 12 - 45 years (53 (69.7%) and 19 (50.0%). This is in line with a study published in 2022, which found that healthcare workers with less

than 5 years of experience had significantly higher levels of depressive symptoms than those with more than 5 years of experience. Factors associated with depression included job stress, lack of job satisfaction, long working hours with low salaries, burnout, and physical and emotional exhaustion. The majority of studies looking at job characteristics hypothesized by the Maslach Burnout Model among nurses considered workload, job control, and reward, fairness, or values. Several studies covered "supportive factors," including relationships with colleagues and leadership [40]. According to research, there is a connection between working years and depression. This connection might be complicated and depend on several variables. On the one hand, having a consistent job and source of income can provide you with a sense of meaning in life and social connection, both of which can help you fight depression. It can also provide one's life with structure and routine, which can aid in fostering mental well-being. On the other side, persistent and chronic stress at work—caused by things like high demands, little control over one's work, and job insecurity—can raise the risk of depression. This is especially true for people who work in demanding, high-stress jobs or who lose their jobs or become unemployed [41]. Sudan's health system deteriorated over the last thirty years. Access, affordability, and quality of healthcare services all declined; affordability was found to be between 53% and 55%, as opposed to 24% and 16%. The quality of healthcare services was reported to have declined from 47% and 38% to 38% and 28%, respectively [42]. Control over the job was examined in several studies, which revealed that low job control was discovered to be related to a high level of depression in Italy [43] and Nigeria [44]. A study in Thailand discovered that nurses were more likely to utilize emotion-focused coping mechanisms when they experienced higher levels of occupational depression than they were to employ problem-focused coping mechanisms. These results imply that initiatives to lessen workplace stressors and encourage efficient coping strategies can enhance the well-being of nursing personnel [45].

5. Limitations

This study is a cross-sectional design, which means that it is hard to establish a causal relationship between risk factors and the presence of depression level, and the nature of the study, participants may be misclassified due to changes in stress exposure. The study was performed via an online Google form and this might affect randomization. Participated nurses were not equal as the study sample calculated, only 58% of nurses filled out the questionnaire and thus it was not possible to make comparisons between the different occupational categories regarding depression. We highly recommend this in future similar research in other Sudanese states and also at the national level.

6. Conclusion and Recommendations

The current study results revealed that depression is high among healthcare

workers in Khartoum State, those who were married working in the emergency department, and working as psychologists were significantly associated with depressive symptoms among healthcare professionals. Therefore, Healthcare organizations must put policies and procedures into place to address this issue, in addition, a furthermore to encourage economic growth, lessening inequality, and safeguarding healthcare employees from all forms of mental illness. Prioritizing mental health issues and ensuring quality care and the general well-being of both healthcare professionals and patients require a multidisciplinary strategy that involves mental health specialists in the private sector and the Ministry of Health.

By addressing depression among healthcare workers in Khartoum State, we can improve the quality of care and ensure the well-being of both healthcare workers and their patients. Our findings call for future studies and in-depth analyses.

6.1. What Is Known about This Topic?

Depression among healthcare workers is very common worldwide and known to be high compared to the general population. Many studies performed all over the world using the (PHQ-9) to assess the prevalence and factors of depression and to provide valuable insights to health organizations to better address this issue.

6.2. What This Study Adds

Mental health problems, including depression, are a major concern among healthcare workers. This study examines the prevalence, correlation, and severity of depression among healthcare workers in Sudan and how it may affect their work performance. It also updates existing knowledge on the impact of depression on job performance and efficiency in this sector. The findings of this research can help inform policies and interventions designed to reduce the burden of mental health problems among healthcare workers and improve their overall productivity and mental health and well-being.

Conflicts of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Authors' Contributions

Dr. Elsir Abdelmutaal Mohammed contributed significantly to the conceptualization and design of the study, literature search, analysis, and drafting of the article. Dr. Sara Hasan Mustafa and Salma Taha Makkawi contributed significantly to the conceptualization and design of the study, data collection, and critical review of the article. All authors approved the final manuscript.

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Abbreviations

AOR: Adjusted Odds Ratio; CI: Confidence Interval; SDG: Sudanese Currency; HCWs: Healthcare Workers; PHQ-9: Patient Health Questionnaires; SD: Standard Deviation; SPSS: Statistical Package for Social Science; WHO: World Health Organization.

Annexes

Depression among healthcare workers in Khartoum State, Sudan 2022

1) Gender:

Male □ Female □

2) Age……..

3) Marital Status:

Marred □ unmarried □

4) Number of children……

5) Work Place:

Public Sectore □ Private Sectore □ Others □

6) Occupation:

Doctor □ Dentist □ Pharmacist □ Nurse □ Laboratory Technician □

Radiology technician □ Optics technician □ Anesthesia □ Psychologist □

Other □

7) Working Years: ……..

8) Department:

Medicine Department □ Surgery Department □ Pediatrics Department □ Obstetrics Department □ Emergency □ others □

9) Degree:

Post-Graduate □ University Degree □ Diploma □ others □

10) History of Chronic illnesses: Yes □ No □

11) Monthly income SDG: …….

12) Family history of mental illnesses:

Yes □ No □

13) Covid 19 vaccination:

Post-Graduate □ University Degree □ Diploma □

14) Smoking:

Yes □ No □

Patient Health Questionnaire (PHQ-9)

Over the last two weeks, how often have you been bothered by any of the following problems?

1	Little interest or pleasure in doing things?	1) Not at all 2) Several Days 3) More than half the days 4) Nearly every day
2	Feeling down, depressed, or hopeless?	1) Not at all 2) Several Days 3) More than half the days 4) Nearly every day
3	Trouble falling or staying asleep, or sleeping too much?	1) Not at all 2) Several Days 3) More than half the days 4) Nearly every day
4	Feeling tired or having little energy?	1) Not at all 2) Several Days 3) More than half the days 4) Nearly every day
5	Poor appetite or overeating?	1) Not at all 2) Several Days 3) More than half the days 4) Nearly every day
6	Feeling bad about yourself, or that you are a failure or have let yourself or your family down?	1) Not at all 2) Several Days 3) More than half the days 4) Nearly every day
7	Trouble concentrating on things, such as reading the newspaper or watching television?	1) Not at all 2) Several Days 3) More than half the days 4) Nearly every day
8	Moving or speaking so slowly that other people could have noticed? Or the opposite, being so fidgety or restless that you have been moving around a lot more than usual?	1) Not at all 2) Several Days 3) More than half the days 4) Nearly every day
9	Thoughts that you would be better off dead, or of hurting yourself in some way? If yes specify: 1-………………… 2-………………… 3-…………………	1) Not at all 2) Several Days 3) More than half the days 4) Nearly every day

Depression Severity: 0 - 4 none, 5 - 9 mild, 10 - 14 moderate, 15 - 19 moderately severe, 20 - 27 severe.