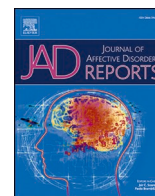




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## Review Article

# The global Prevalence of Depression among Health Workers during the COVID-19 pandemic: a Systematic review and Meta-analysis



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## ABSTRACT

**Background:** This study was designed to conduct a systematic review and meta-analysis of existing literature examining the prevalence of depression among hospital staff and the impact of various factors with a view to organize related programs for reducing the complications of this mental disorder.

**Method:** A total of 24 studies were extracted from a literature search conducted through electronic databases including PubMed, EMBASE, Scopus, and Web of Science from January 2019 to February 2021.

**Findings:** Following the extraction of data, the total number of hospital staff was reported to be 42,010. Based on the results, depression prevalence among them was 26% (95% CI, 0.18–0.35). Furthermore correlation coefficients revealed a significant relationship between the rate of depression and variables including type of career, age, and gender ( $P$ -value < 0.05). The highest and lowest prevalence of depressive disorder among hospital staff was in Africa 82% (95% CI, 0.35–0.97) and Asia 19% (95% CI, 0.11–0.29).

**Conclusion:** Our findings affirmed that female workers who aged between 29 and 35 and worked as administrative and support staff in hospitals were among the population being at higher risk of developing mental health problems during the COVID-19 pandemic.

## 1. Background

The epidemic of novel coronavirus pneumonia called 2019-nCoV was first recognized in Wuhan, China on 31st December 2019. Within a short space of time, the disease has spread to most of the countries and caused several health issues and socio-economic challenges (Mekonen

et al., 2020). The outbreak of the disease has also led to adverse psychosocial consequences among people particularly health professionals as a higher-risk group of workers (Amin et al., 2020). In fact the mental health of health workers is subjected to an excessive negative effects that is mainly due to the fear of having exposure to COVID-19 cases and the risk of being infected when caring patients, being separated from

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families and loved persons, and being under overwhelming pressure of heavy workload during the outbreak (Salari et al., 2020; Organization, 2020). Given the high contagiousness and rapid spread of the disease from the early stage of the pandemic most of the healthcare staff felt uncertainty, weakness and cognitive symptoms of anxiety and depression (Al Omari et al., 2020; Vilagut et al., 2016). After reviewing the prevalence of health disorders in 150 stressful jobs by the National Institutes of Health (NIH), nursing was ranked 27th due to mental health problems (Noorbala et al., 2002). Among the studies conducted on the prevalence of depression among nurses during the COVID-19 pandemic, the results showed that out of 203 Chinese nurses, 103 were depressed (An et al., 2020). Furthermore the prevalence of depression among 416 doctors, nurses and other healthcare workers in Turkey revealed that more than half of them were affected by this mental disorder. In a survey conducted in Africa, out of 170 Egyptian health workers, about 140 of them had depression symptoms (Balsamo and Carlucci, 2020). The European continent has not been spared from this crisis and reported major depression rates raised the most among healthcare workers. A study conducted by Azoulay et al. (2020) in France in 2020 also confirmed a large number of depression cases out of 1058 physicians and nurses. According to the World Health Organization (WHO), depression has mentioned as the most common behavioral disorder which consequently leads to distress, boredom, impassivity, worthlessness, insomnia, and decreased concentration. A depressed person loses self-confidence, feels embarrassed, and stressed at work resulting in poor performance and low productivity in the workplace (Al Maqbali et al., 2020; Zhu et al., 2020; Xiao et al., 2020). Under these embarrassing conditions, the ability of health staff to cope with stressful situations declines and the incidence of medical malpractice increases dramatically.

Due to the adverse psychological impact of the COVID-19 pandemic on healthcare providers it is critically important to provide appropriate and timely mental health interventions through the early assessment for diagnosing mental health symptoms among the staff (Azizi et al., 2010; Liu et al., 2020). Assessment at this level provides information that enables health policymakers on adopting mental health promotion policies for these high-risk occupational groups. To date, a few studies have evaluated the depression prevalence among hospital staff amid the COVID-19 pandemic. Thus, this study was designed to conduct a systematic review and meta-analysis of existing literature examining the prevalence of depression and the impact of various factors among hospital staff with a view to organize related programs for reducing the complications of these disorders.

## 2. Methodology

### 2.1. Registration and reporting

This systematic review and meta-analysis was registered in PROSPERO database at the University of York (PROSPERO 2021 CRD42021236395 Available from: [https://www.crd.york.ac.uk/prospero/display\\_record.php?ID=CRD42021236395](https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42021236395)).

### 2.2. Databases and search terms

EMBASE, Google Scholar, Scopus, PubMed and Web of Science were systematically searched from the beginning of 2020 to February 2021. The search terms included (((Emotional Depression [Title/Abstract] OR Depression [Title/Abstract] OR Depressive Symptom [Title/Abstract]) AND (COVID-19 [Title/Abstract] OR COVID 19 [Title/Abstract] OR COVID-19 Virus Disease [Title/Abstract] OR COVID 19 Virus Disease [Title/Abstract] OR COVID-19 Virus Diseases [Title/Abstract] OR COVID-19 Virus Infection [Title/Abstract] OR COVID 19 Virus Infection [Title/Abstract] OR COVID-19 Virus Infections [Title/Abstract] OR 2019-nCoV Infection [Title/Abstract] OR 2019 nCoV Infection [Title/Abstract] OR 2019-nCoV Infections [Title/Abstract] OR Coronavirus Disease-19 [Title/Abstract] OR Coronavirus Disease 19 [Title/Abstract]

OR 2019 Novel Coronavirus Disease [Title/Abstract] OR 2019 Novel Coronavirus Infection [Title/Abstract] OR 2019-nCoV Disease [Title/Abstract] OR 2019 nCoV Disease [Title/Abstract] OR 2019-nCoV Diseases [Title/Abstract] OR COVID19 [Title/Abstract] OR Coronavirus Disease 2019 [Title/Abstract] OR SARS Coronavirus 2 Infection [Title/Abstract] OR SARS-CoV-2 Infection [Title/Abstract] OR SARS CoV 2 Infection [Title/Abstract] OR SARS-CoV-2 Infections [Title/Abstract] OR COVID-19 Pandemic [Title/Abstract] OR COVID 19 Pandemic [Title/Abstract] OR COVID-19 Pandemics [Title/Abstract])) AND (Community Health Worker [Title/Abstract] OR Community Health Aides [Title/Abstract] OR Health Worker [Title/Abstract] OR Health Workers [Title/Abstract] OR Health Staff [Title/Abstract] OR Health employee [Title/Abstract])). In an initial searching of electronic databases 1041 records were identified. Then the records were imported to EndNote software and after removing the duplicates, 745 articles remained to be screened through the review of title/ abstracts by two research team members. Studies which included quantitative data on the prevalence of depression among healthcare workers and its main determinants were included in the review. The references of included articles were also searched to find any relevant data.

### 2.3. Inclusion and exclusion criteria

Descriptive, prospective, cross-sectional, case-control, case-series and cohort studies published in English from 2020 to February 2021 with the purpose of determining the prevalence of depression or examining its main determinants among healthcare workers during the COVID-19 pandemic were included. The articles in languages other than English, or published before 2020 or after February 2021 were excluded. Furthermore, papers with the study designs of review, brief reports, letter to the editor, expert opinions, editorials, books, book chapters, commentaries, thesis and randomized controlled trials were not included in the research. Regarding the study objectives, those assessing clinical approaches, treatment effects, medication side-effects, and clinical decision-makings were also excluded from the review.

### 2.4. Selection process

In an initial searching of electronic databases 1041 records were found. After removing duplicates 745 articles remained; of which 224 articles were published in PubMed, 317 in SCOPUS, 103 in Web of Science and 101 articles were retrieved from EMBASE. Reviewing title/ abstracts of the papers resulted in 151 relevant records. Finally, after considering inclusion/ exclusion criteria, 24 articles were included in the review (Fig. 1).

### 2.5. Data extraction

A data extraction form including name of author/ authors, publication date, research setting, study design, a summary of study results in terms of reported score of depression among healthcare workers, and quantitative data on depression determinants was used to extract data by two independent investigators.

### 2.6. Quality assessment

The quality of included articles was evaluated by using Newcastle-Ottawa Scale (NOS) for assessing observational studies. In order to reduce bias, the quality of articles was assessed by two independent evaluators; in the case of any disagreement, the issue was discussed in the presence of third evaluator to reach the consensus. The NOS uses a star system with a maximum of 9 points which can be assigned to each article. This quality assessment tool includes three main perspectives including the ascertainment of either the exposure or outcome of interest for case-control or cohort studies respectively, selection of study groups, and their comparability. The scoring system mentions three

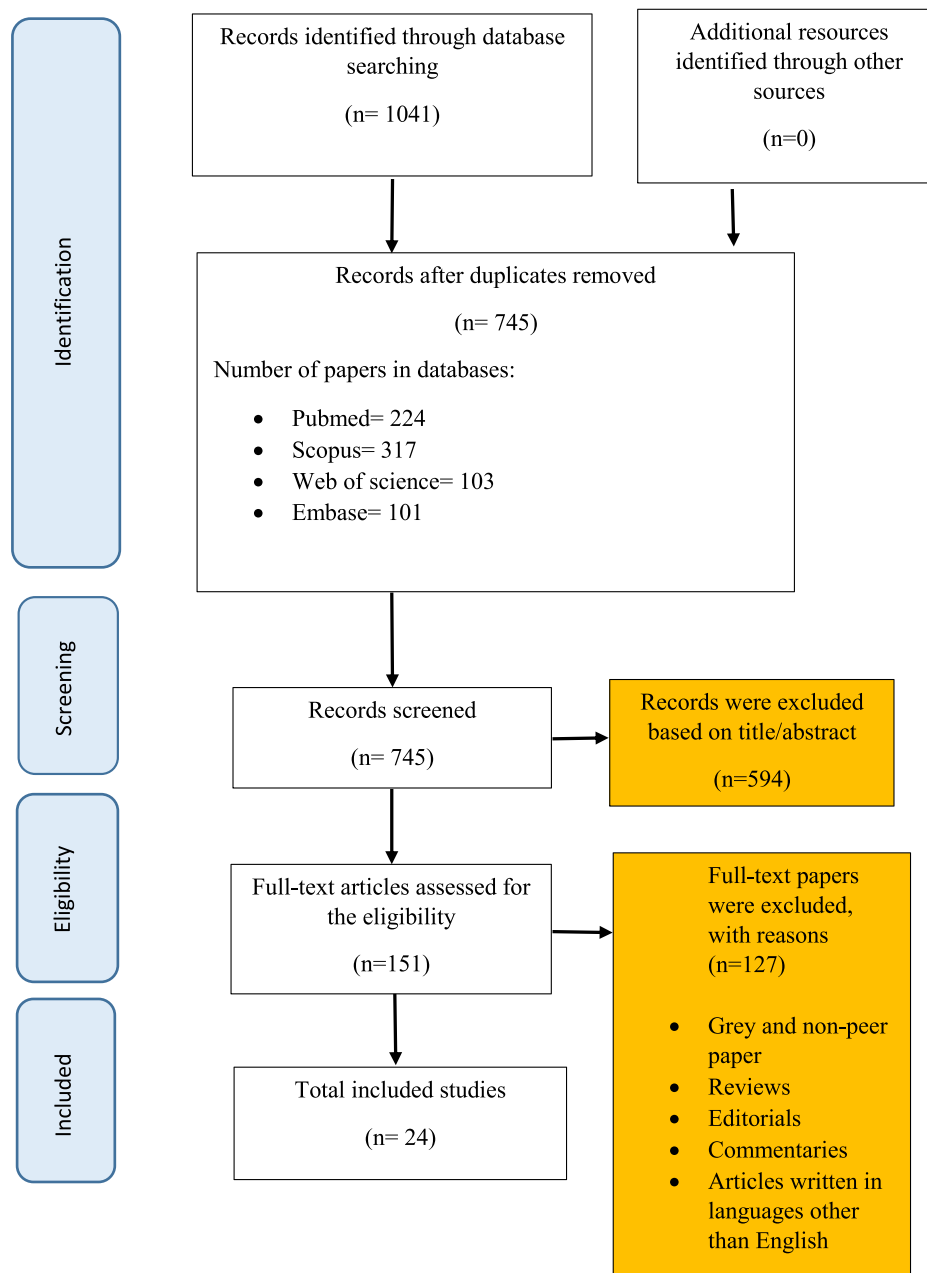


Fig. 1. Flow diagram of our review process (PRISMA).

points for the first perspective, four points for the second, and two points for the last perspective. Studies with a total score of  $\geq 7$  were mentioned as high quality and those with a score below 4 were considered as low quality articles (Wells et al., 2000).

### 2.7. Statistical analysis

To estimate the mean and variability of effect size across different studies random-effect analysis was used and the results were reported on a forest plot at a 95% confidence interval. In addition, I<sup>2</sup> test was used to assess the statistical heterogeneity between included studies. In case of heterogeneity in the areas of data collection tool, age, gender, occupations, continent and WHO regions, we performed subgroup analysis. To measure publication bias, Egger test was used and the data was analyzed by R software.

## 3. Findings

Our findings are reported based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist. (Moher et al., 2010) After extracting data from 24 articles, the total number of hospital staff was 42,010 and the depression prevalence among them was reported to be 26% (95% CI, 0.18–0.35) (Fig. 2).

### 3.1. Meta regression for age

As findings revealed the prevalence of depression in hospital workers increased with age. In other words, a unit of increase in the age of worker group increased the depression prevalence by 9%. Furthermore the highest rate of depressive symptoms was among individuals aged between 29 and 35years old (Fig. 3).

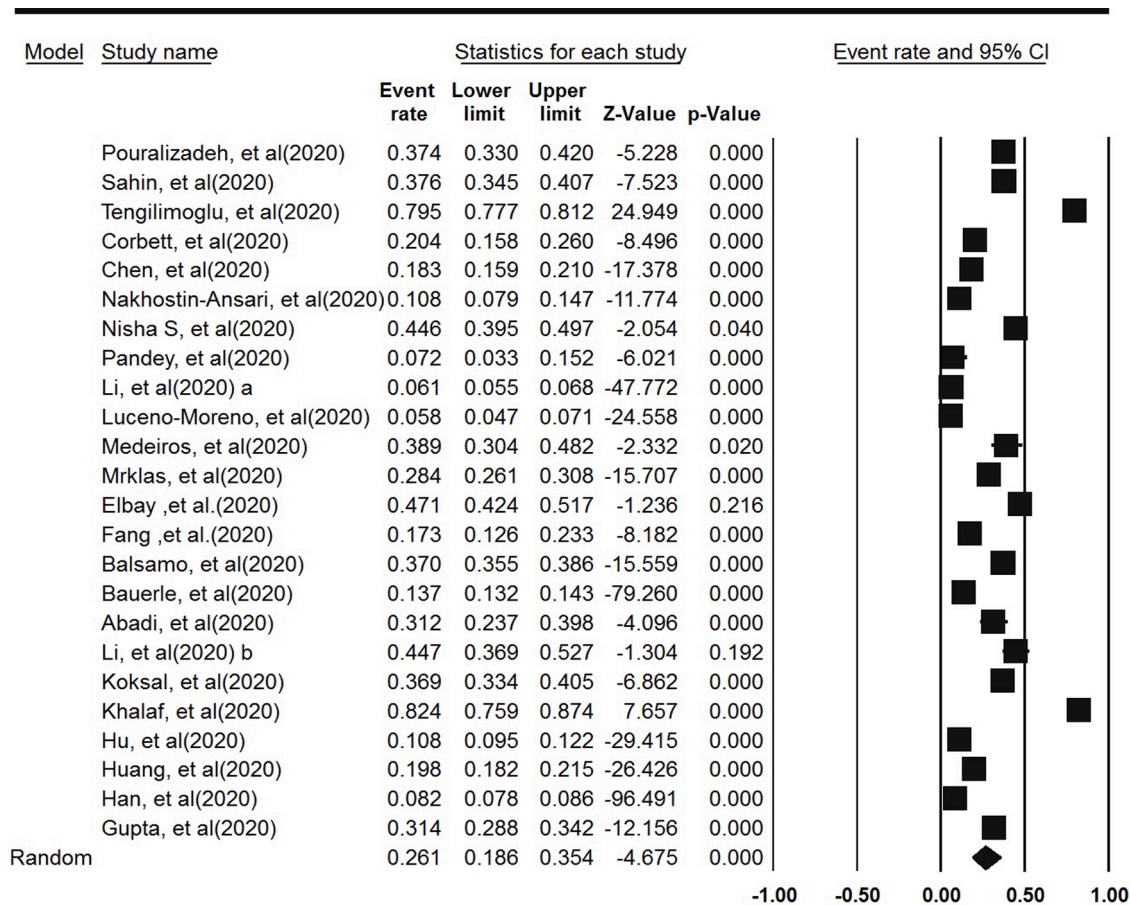


Fig. 2. The forest plot of depression among health workers in COVID-19 pandemic.

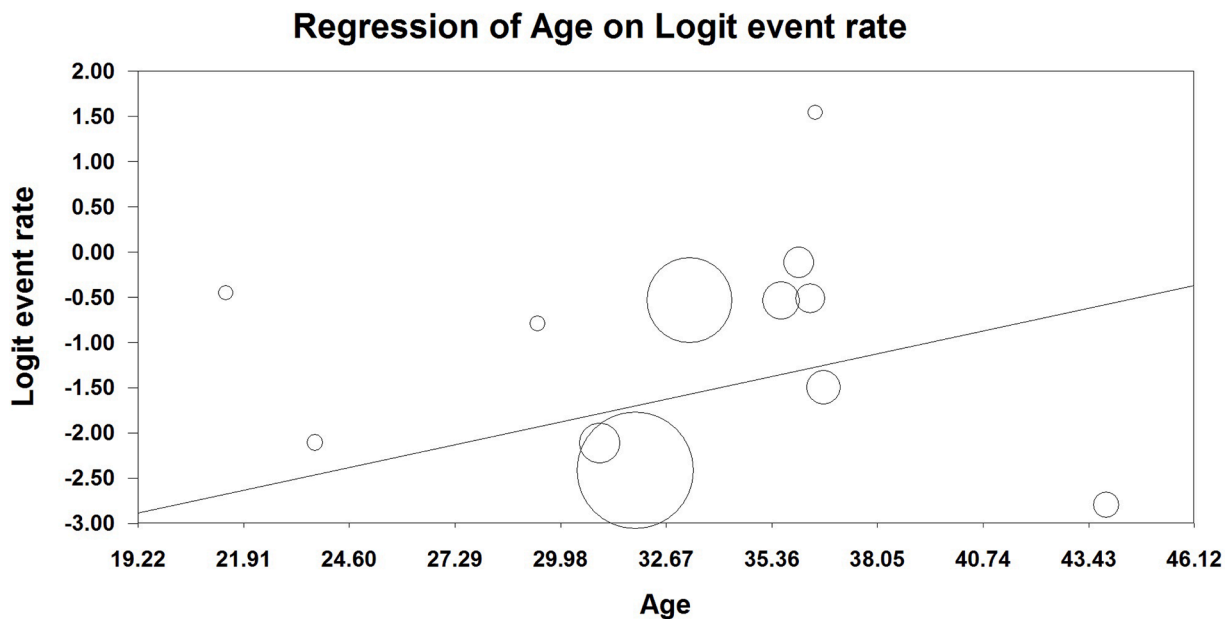


Fig. 3. Meta-regression based on Age.

### 3.2. Meta-analysis for gender

According to the analysis, the prevalence of depression was higher among females 32% (95% CI, 0.23–0.44) compared to males 23% (95% CI, 0.16–0.32) (Table 1).

### 3.3. Meta-analysis for occupation

In this study, hospital staffs in different occupational groups were evaluated. Findings revealed that the highest prevalence of depression was in health technicians 51%(95% CI, 0.18–0.83) and hospital support staff 41%(95% CI, 0.15–0.72) whereas the lowest prevalence was in healthcare students 21%(95% CI, 0.08–0.45). The rate of depression in administrative staff, nurses, doctors and other hospital staff was respectively estimated at 32%(95% CI, 0.55–0.73), 29%(95% CI, 0.18–0.43), 30%(95% CI, 0.15–0.49) and 25%(95% CI, 0.08–0.55) (Table 2).

### 3.4. Meta-analysis by continent and WHO regions

Regarding the distribution of depression statistics among hospital workers in different continents, the highest and lowest depression prevalence was observed in Africa 82%(95% CI, 0.35–0.97) and Asia 19%(95% CI, 0.11–0.29). In addition, the rate of depression in the United States of America and Europe was reported to be 33% (95% CI, 0.1–0.69) and 31% (95% CI, 0.17–0.48) respectively. Findings showed that the relationship between depression and the type of continent was significant only for Africa and Europe (Table 3).

The meta-regression results based on WHO regions demonstrated that the highest and lowest depression prevalence was observed in EMRO 38% (95% CI, 0.18–0.63) and WPRO 15% (95% CI, 0.28–0.77). On the other hand, the depression rate in PAHO, EURO and SEARO was reported to be 33% (95% CI, 0.1–0.67), 31% (95% CI, 0.18–0.48) and 24% (95% CI, 0.09–0.52) respectively (Table 3).

The result of meta-regression based on depression questionnaire shows that, most of the study (37%) used PHQ-9 and it had shown lower prevalence of depression in participants compare to other tools 18% (95% CI, 12%–27%). However, DASS indicated the highest rate of depression among the others 62% (95% CI, 44%–77%) (Table 4).

### 3.5. Publication bias

According to Fig. 4, Funnel plot shows that there is no bias publication and also Egger's test  $P$  value was ( $p = 0/67$ ) which shows that there is no publication bias. (Fig. 4)

## 4. Conclusions and clinical implications

To our best knowledge, this is the first systematic review and meta-analysis conducted to globally examine the prevalence of depression among hospital staff working in different departments. The current review revealed that 26% of hospital staff experienced depression in response to the COVID-19 pandemic. The value of depression prevalence in this study was relatively different from some other literatures. For example a study conducted by Hu et al. (2020) on 2014 nurses in China estimated the prevalence of depression at 10%(95% CI, 0.09–0.12). Whereas, according to Koksai et al. (2020) 36% of 702 healthcare workers in Turkey were depressed and in Gupta study conducted on

1124 medical staff in Indonesia the rate was 31%(95% CI, 0.28–0.34). The possible reason for these different values might be due to the dissimilarities in infrastructural facilities of healthcare systems, and the level of attention given to the mental well-being of healthcare workers by policymakers and health authorities. Other plausible justifications might be due to the differences in data collection tools, and sample size of study population. Despite a variety of rating scales used in research surveys which possibly acts as a source of variability among study findings, it is evident that the majority of healthcare workers experienced moderate symptoms of depression worldwide. In fact the global pandemic of COVID-19 might be a source of major concern among hospital staff who are mostly vulnerable of becoming infected or even transmit the disease to their family members (Dimitriu et al., 2020; Sharif et al., 2020; Huang et al., 2020; Lai et al., 2020; Abdulah and Musa, 2020; Huang et al., 2020). On the other hand, an increasing trend of infected and hospitalized patients leads to a heavier workload threatening the psychological health of hospital staff. Furthermore, the shortage of personal protective equipment worsen the condition and leads to stress reactions of health workers during the COVID-19 pandemic (Dai et al., 2020; Liu and Wang, 2020). This highlights the necessity of empowering hospital staff to successfully deal with the emotions rising from such difficult circumstances.

According to the subgroup analysis, the prevalence of depression in health technicians was higher than other groups of hospital staff. Similarly in a study conducted by Awano et al. (2020) findings revealed a higher proportion of depression among laboratory technicians due to having a heavy workload, while having little control over their job and the allocation of resources. One recent study also mentioned low decision latitude and low social support as main contributing factors associated to the technicians' depression (Brailovskaia et al., 2020; Chen et al., 2020; Dozois, 2020; Frank et al., 2020). Furthermore, our review found a similar incidence rate of depression among doctors, nurses and administrative staff. Consistent with our findings, Bhat et al. (2020) affirmed that the prevalence of depression was not significantly different between these career groups. The researchers explained the reason for this similarity and mentioned working in a life-threatening workplace, having fear of being infected and worrying about family members as similar stressors affecting both healthcare and non-healthcare workers (Medina-Jimenez et al., 2020). Of note, our review revealed that nonmedical healthcare workers including health technicians, administrative and support staff had higher prevalence of depression. Reasons for this finding may include less access to first-hand specialized information on COVID-19, lack of access to personal protective equipment, inadequate knowledge of infection control guidelines and unavailability of mental health promotion programs among these career groups. Thus, as the pandemic continues, policy strategies are needed to identify vulnerable groups of hospital workers who are mainly susceptible to psychological distress and organize supporting programs to improve their mental health condition.

Our review also suggested that being female and older in age may be potential risk factors for depression. A possible explanation for this finding may be the greater number of female workers employed globally in lower status roles within healthcare systems which put them in greater risk of exposure to COVID-19 patients and bring them adverse effects on mental well-being (Boniol et al., 2019). In a study conducted on 703 anesthetic technicians (493 males and 210 females), the depression prevalence was higher among females 78% (95% CI, 0.72–0.83). In another research by Han et al. (2020) on 21,194 nurses the prevalence of depression in women was estimated to be 45% higher than men. Literature also affirmed that women had higher incidence rates of mental health problems such as depression than men partially due to the changing attitudes over the last decades toward the role of women in the workplace that introduced them as primary drivers of the labor force. This change has put a double psychological burden on female healthcare workers during the COVID-19 pandemic as they have to take on family affairs with the maximum possible safety while they are

**Table 1**  
Meta-regression based on gender.

	Model	Prevalence	Lower limit	Upper limit	Z-value	P-value
Gender	Male	0.233	0.161	0.326	-5.05	<0.001
	Female	0.327	0.230	0.442	-2.90	<0.001

**Table 2**  
Meta-regression based on occupation.

	Model	Prevalence	Lower limit	Upper limit	Z-value	P-value
Occupation	Administrative staff	0.324	0.131	0.604	-1.24	0.21
	Doctor	0.300	0.156	0.497	-1.99	0.05
	Health Technicians	0.517	0.184	0.836	0.09	0.93
	Nurse	0.296	0.185	0.437	-2.77	0.01
	Other	0.258	0.087	0.558	-1.61	0.11
	Student	0.215	0.082	0.457	-2.26	0.02
	Support staff	0.410	0.156	0.723	-0.54	0.59

**Table 3**  
Meta-regression based on Continent and WHO regions.

	Model	Prevalence	Lower limit	Upper limit	Z-value	P-value
Continent	Africa	0.824	0.357	0.975	1.42	0.16
	America	0.334	0.101	0.690	-0.91	0.36
	Asia	0.191	0.116	0.298	-4.83	<0.001
	Europe	0.313	0.178	0.489	-2.08	0.04
WHO	EMRO	0.384	0.183	0.634	-0.90	0.37
	EURO	0.313	0.182	0.482	-2.16	0.03
	PAHO	0.334	0.106	0.679	-0.94	0.35
	SEARO	0.246	0.090	0.520	-1.83	0.07
	WPRO	0.153	0.077	0.280	-4.37	<0.001

at high exposure risk. Previous studies also demonstrated that women aged over 50 had the greatest depression symptoms due to considerable changes in hormonal levels, and their reproductive ability in addition to their responsibilities of taking care of family members and organizing their work affairs (McBride, 1990; Seib et al., 2016). Perhaps, elderly women have poorer access to social support, and more economic concerns which put psychological pressure on them.

Our review results regarding the depression prevalence across different continents mentioned depression disorder as a reality for many healthcare workers in Africa 82%(95% CI, 0.35–0.97) highlighting an urgent need for a serious action to better control this mental illness during the COVID-19 pandemic. To prove this, according to Khalaf et al., (2020) 82% of 170 physicians, nurses and surgeons in the Egypt were depressed which represented high prevalence of depression in this

**Table 4**  
Meta-regression based on Questionnaire.

	Model	Number Studies	Prevalence	Lower limit	Upper limit	Z-value	P-value
Questionnaire	DASS	4	0.623	0.440	0.776	1.323	0.186
	HADS	5	0.277	0.165	0.426	-2.849	0.004
	PHQ-9	9	0.187	0.123	0.274	-5.808	0.000
	SDS	2	0.094	0.036	0.226	-4.300	0.000
	Other	4	0.259	0.143	0.421	-2.805	0.005

**Funnel Plot of Standard Error by Logit event rate**

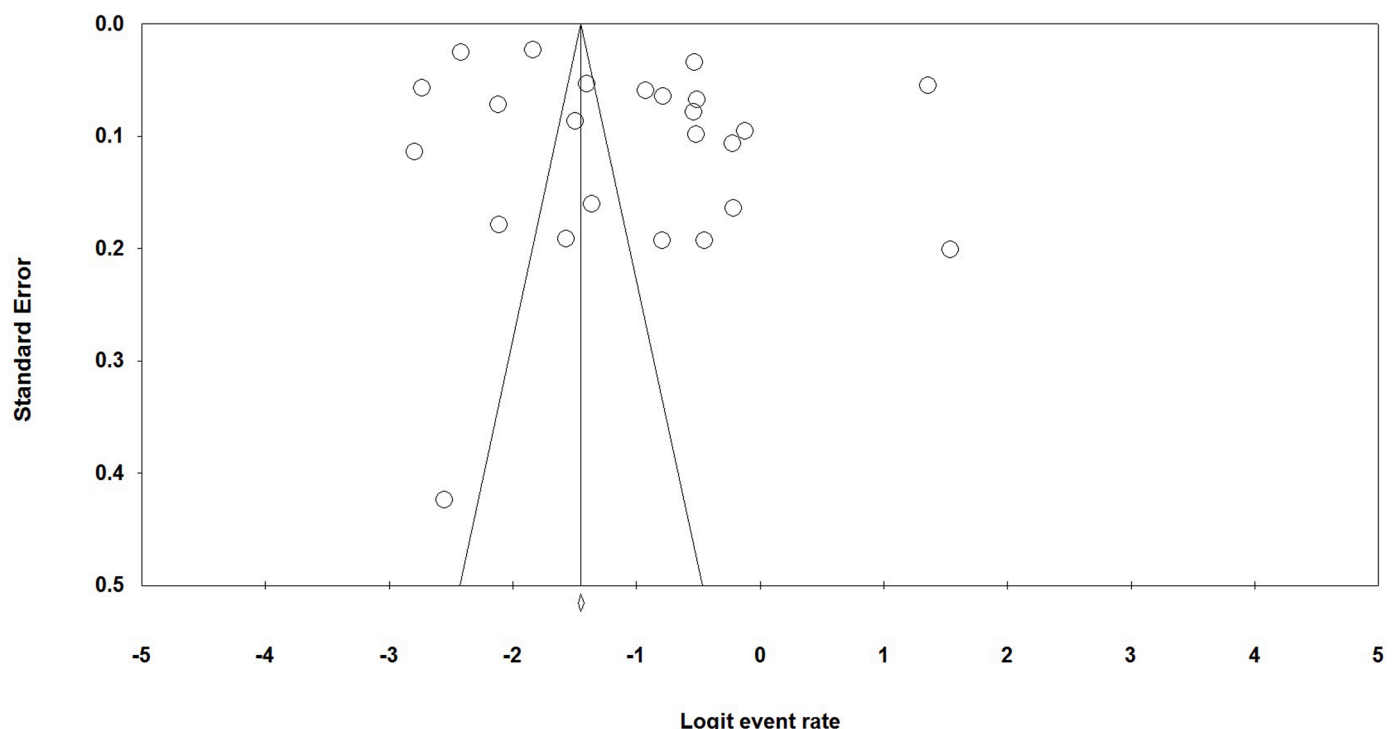


Fig. 4.

country. In our review, the United States of America ranked second for depressive disorders among healthcare providers. A similar study conducted among 1414 health workers in the U.S. reported the rate of depression to be 28% (95% CI, 0.26–0.3). Europe ranked number 3 among regions of the world in terms of psychological disorders particularly among front-line health workers. In a study conducted on 15,704 health staff in Germany the depression rate was reported to be 13% (95% CI, 0.13–0.14) (Ozamiz-Etxebarria et al., 2020). In another research conducted among front-line health workers findings revealed that out of 1058 nurses and medical students 322 of them were depressed. In our review, Asia ranked fourth with a 19 percent prevalence of depression among health workers. Similarly Huang et al. conducted a research among Asian health staff and reported depression prevalence to be 19% (95% CI, 0.18–0.21) (Huang and Zhao, 2020). In another research conducted in Iran the depression rate was 31% (95% CI, 0.23–0.39) (Hosseinzadeh-Shanjani et al., 2020). In fact, shock of COVID-19 had several disastrous impacts on different continents. Africa was the least prepared region in the world to successfully manage the adverse effects of the COVID-19 pandemic, and thus considerable resource mobilization strategies are needed to support its delicate health system.

Findings also showed a moderate variation around the global rate of depression prevalence in WHO regions. For depression, rates varied from 38% in EMRO to 15% in WPRO. Furthermore, rates of depression across the regions of in PAHO, EURO and SEARO were reported to be 33% (95% CI, 0.1–0.67), 31% (95% CI, 0.18–0.48) and 24% (95% CI, 0.09–0.52) respectively. In a study by Pouralizadeh et al. (2020) among 441 nurses in Iran the depression prevalence was estimated at 34% (95% CI, 0.33–0.42). Similarly Mrklas et al. (2020) assessed the rate of prevalence in PAHO region and reported the rate to be 28% (95% CI, 0.26–0.3). In a survey conducted in EURO region, the depression prevalence among health workers was 13% (95% CI, 0.13–0.14) (Oskovi-Kaplan et al., 2020). The possible reason for these different values might be due to the differences in cultural, socioeconomic, and infrastructural factors such as the adherence to COVID-19 guidelines, availability of adequate personal protective equipment and resources needed to manage the psychological crisis of the pandemic.

## 5. Conclusion

Our study revealed that the prevalence of depression in hospital staff was moderately high. Findings also provided evidence-based information for health policy makers and psychologists to effectively improve the mental health of hospital staff via the identification of high-risk career groups based on their demographic and occupation characteristics (e.g. gender, age, and type of hospital career) and provision of emotional supporting programs. Findings also affirmed that female workers who aged between 29 and 35 and worked as administrative and support staff in hospitals were among the population being at higher risk of developing mental health problems during the pandemic. These findings are much supportive to provide necessary information for the hospital staff on depression symptoms and types of preventive interventions in order to control this mental disorder in a timely manner. In fact, proactive supporting strategies for these groups could lead to timely diagnosis and appropriate management of depression particularly during the COVID-19 pandemic.

## 6. Limitations

There are some limitations regarding this review. First, as we only included the studies published in English there might be a language bias in the study. Second, mental disorders other than depression such as anxiety, distress and insomnia were not included in the current research which limited our findings. Third, as the COVID-19 pandemic was first recognized in China, most of the included articles were from this country, which affected the generalization of our results. Finally, the use

of different data collection tools to assess depression was another major source of heterogeneity.

## CRedit authorship contribution statement

**Sepide Rezaei:** Conceptualization, Visualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Zahra Hoseinipalangi:** Funding acquisition. **Sima Rafiei:** Writing – review & editing. **Yasamin Dolati:** Funding acquisition. **Hossein Hosseinifard:** Data curation, Formal analysis, Writing – review & editing. **Mahsa Tohidi Asl:** Writing – original draft. **Zahra Noorani Mejareh:** Data curation, Formal analysis. **Sama Deylami:** Funding acquisition. **Bahare Abdollahi:** Funding acquisition. **Mohadeseh Fadavi Ardakani:** Funding acquisition. **Nashmil Ghadimi:** Funding acquisition. **Afsaneh Dehnad:** Conceptualization, Visualization, Funding acquisition, Writing – review & editing, Writing – review & editing. **Fatemeh Pashazadeh Kan:** . **Samira Raoofi:** Funding acquisition. **Ahmad Ghoshghaee:** Conceptualization, Visualization, Writing – original draft, Writing – review & editing.

## Declaration of Competing Interest

The authors declare that they have no competing interests.

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## Availability of data and materials

Not applicable

## Ethics approval and consent to participate

Not applicable

## Consent for publication

Not applicable

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