Acıbadem Univ. Sağlık Bilim. Derg. 2023; 14 (3): 477-487
https://doi.org/10.31067/acusaglik.1181891

REVIEW / DERLEME

Psychiatry / Psikiyatri

Depression Prevalence of Healthcare Workers During the First Wave of the COVID-19 Pandemic and Its Affecting Variables: A Meta-Analysis

Emel Kaya[1], **Tuğba Öztürk Yıldırım**[2]

[1]Çankırı Karatekin University, Faculty of Health Sciences, Nursing Management Department, Çankırı, Turkey

[2]Istanbul Doğuş University, Nursing Department, Istanbul, Turkey

ABSTRACT

Purpose: This meta-analysis aimed to systematically review the affecting variables regarding the prevalence of depression in healthcare workers during the COVID-19 pandemic.

Method: MedLine, PubMed, Web of Science (Wos), and GoogleScholar databases were searched until June 19, 2020. The quality of studies included was evaluated with The Newcastle-Ottawa Scale. Data were analyzed using Comprehensive Meta-Analysis Version 3.0. The pooled prevalence of depression was interpreted according to the random-effects model. The heterogeneity of the studies was evaluated with Cochran's Q test and I^2 statistics.

Results: A meta-analysis of depression prevalence in healthcare workers was carried out with 8 studies. Studies with high-quality assessments were analyzed. In this study, which was conducted with a total of 9,841 healthcare workers, the overall depression rate was 40.8% (95% confidence interval [CI] 33.5-48.6; I^2=96.48%). In the subgroup analysis to determine the influencing variables, the rate of depression in female healthcare workers was 24.5% (95% CI: 17.4–33.3) and the rate of depression in male healthcare workers was 8.5% (95% CI: 5.5–12.7). In addition, the depression rate was 43.6% (95% CI: 35.9–51.7) in studies conducted in China and 18.5% (95% CI: 7.5–38.7) in a study conducted in Korea. No statistically significant difference was found as a result of the subgroup analysis in terms of profession, the measurement tool and the period of time (p>0.05).

Conclusion: This meta-analysis provides evidence that 4 out of 10 healthcare workers experience depression during the COVID-19 pandemic, with country and gender as the most influencing variable, respectively.

Keywords: COVID-19, depression, healthcare workers, meta-analysis, prevalence

Emel KAYA

Tuğba ÖZTÜRK YILDIRIM

COVID-19 Pandemisinin Birinci Dalgasında Sağlık Çalışanlarında Görülen Depresyon Prevelansı ve Bu Prevelansı Etkileyen Değişkenler: Bir Meta-Analiz

ÖZET

Amaç: Bu meta-analiz, COVID-19 pandemisi sırasında sağlık çalışanlarında görülen depresyon prevalansına ilişkin etkileyen değişkenleri sistematik olarak gözden geçirmeyi amaçladı.

Yöntem: Meta-analiz için MedLine, PubMed, Web of Science (Wos) ve GoogleScholar veri tabanlarında 19 Haziran 2020'ye kadar tarama yapıldı. Dahil edilen çalışmaların kalitesi The Newcastle-Ottawa Scale ile değerlendirildi. Comprehensive Meta-analysis version 3.0 kullanılarak veriler analiz edildi. Genel depresyon oranı rasgele etkiler modeline göre yorumlandı. Çalışmaların heterojenliği Cochran's Q test ve I^2 istatistiği ile değerlendirildi.

Bulgular: Sağlık çalışanlarında görülen depresyon prevalansının meta analizi 8 çalışma ile gerçekleştirildi. Yüksek kalite değerlendirilmesine sahip olan çalışmalar analiz edildi. Toplam 9,841 sağlık çalışanı ile yapılan bu çalışmada genel depresyon oranı %40.8 (%95 güven aralığı [GA] 33.5-48.6; I^2=%96.48) olarak bulundu. Etkileyen değişkenleri belirlemek için yapılan alt grup analizinde kadın sağlık çalışanlarında depresyon oranı %24,5 (%95 GA: 17,4–33,3) ve erkek sağlık çalışanlarında depresyon oranı %8,5 (%95 GA: 5,5–12,7) olarak belirlendi. Ayrıca Çin'de yapılan çalışmalarda depresyon oranı %43.6 (%95 GA: 35.9–51.7), Kore'de yapılan bir çalışmada ise %18.5 (%95 GA: 7.5–38.7) depresyon oranı belirlendi. Yapılan alt grup analizi sonucunda meslek, ölçüm aracı ve zaman dilimi açısından istatistiksel olarak anlamlı fark bulunmadı (p>0.05).

Sonuç: Bu meta analiz COVID-19 pandemisinde her on sağlık çalışanının dördünde depresyon görüldüğüne ve en çok etkileyen değişkenin sırasıyla ülke ve cinsiyet olduğuna kanıt sağlar.

Anahtar kelimeler: COVID-19, depresyon, sağlık çalışanları, meta analiz, prevelans

Correspondence: Emel Kaya
Çankırı Karatekin University, Faculty of Health Sciences, Nursing Management Department, Çankırı, Turkey
Phone: +903762131702
E-mail: emelgur@karatekin.edu.tr

Received: 29 September 2022
Accepted: 08 June 2023

The high morbidity and mortality caused by the COVID-19 pandemic have led to a global crisis. In this process, where all systems were negatively affected, the biggest load was on healthcare services and healthcare workers (1). Healthcare workers had to deal with many difficulties caused by the pandemic while providing healthcare services to protect public health. This situation has caused healthcare workers to experience mental health problems day by day (2,3). Thus, it has become a focus of researchers as an important factor in reducing the quality of healthcare services. One of the most emphasized issues regarding the psychological effects of the COVID-19 pandemic on healthcare workers was depression (4–10).The changing daily work and life routines of healthcare workers, who are at high risk in the COVID-19 pandemic, were effective in the emergence of depression symptoms (11). First, due to the rapid increase in the number of patients with COVID-19, resources in healthcare institutions were insufficient. When the number of infected and dying patients increased, many nurses could not be sent to their homes due to a lack of personnel. Many healthcare organizations have asked their employee caring for COVID-19 patients to continue working until they show symptoms of the disease to meet their personnel needs (12). This situation created challenges in ensuring the sustainability of qualified healthcare services (1). In addition, adverse effects such as increased workload, long working hours, physical fatigue, difficulty in using personal protective equipment (PPE), and allergies related to the use of PPE were commonly observed (13–17). Healthcare workers had to make critical decisions on testing suspected COVID-19 patients and whether to isolate the patient or employee in patient care units based on a positive test result (18). At the same time, the daily lives of healthcare workers were also deeply affected. Healthcare workers had to be separated from their family members for different periods of time to protect them. Staying at home (or lodging, dormitory, hotel, etc.) or living between work and home without socializing, and not being able to meet their daily basic needs have increased their distance from the world (4,11). In an environment of distance, with the closure of educational institutions, the baby/childcare has created a big problem for families with children (19). Another issue was that healthcare workers were stigmatized or rejected by their neighbors while being declared heroes for their work (19–21). Healthcare workers faced challenges they had never experienced during the COVID-19 pandemic compared to previous outbreaks (18). All these were effective in the emergence of depression symptoms in healthcare workers (11).

Studies have revealed the relationship of the prevalence of depression in healthcare workers in the COVID-19 pandemic with variables such as age (3,10,21–23), gender (3,4,28,29,13,16,21,22,24–27), marital status (21,29), profession (3,8,29), professional title level (29), the status of being a frontline health employee (22,25), years of working (29), stigmatization (24), life-time psychiatric disorder (8,22), past medical history, drinking, exercise habit, parent status, families or relatives with suspected or confirmed COVID-19 (29). Depression is an important mental health problem for healthcare workers, and it is necessary to measure this phenomenon to assess its magnitude. To the best of our knowledge, there has been no systematic review of the variables affecting the prevalence of depression in healthcare workers. This study was conducted to systematically examine the prevalence of depression and affecting variables in healthcare workers during the COVID-19 pandemic.

METHODS

Research Strategy

In this study, "Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)", a protocol used for systematic review and meta-analysis (30) was used. Researches on depression in healthcare workers during the pandemic, which were published before the date of ethical approval on June 19, 2020, were included in the study. Using the database of the library of their university, one of the researchers identified the records of publications related to depression in healthcare workers during the COVID-19 pandemic period in MedLine, PubMed, Web of Science (Wos), and GoogleScholar. The keywords and combinations of "Coronavirus" OR "COVID-19" OR "Sars-Cov-2" AND "healthcare workers" OR "healthcare professions" OR "medical staff" AND "depression" OR "mental health" OR "psychological effect" were used for scanning (see Table S1). There was no language restriction.

Inclusion and Exclusion Criteria

Studies on depression in healthcare workers during the pandemic were evaluated. Inclusion criteria were identified as 1) study design cross-sectional, case-control, cohort 2) health care worker(s) only 3) depression (prevalence) rate given 4) references of 3 previously published systematic reviews and meta-analysis studies that met the criteria. The exclusion criteria were determined as 1) case reports, comments, editorials, review articles, guideline, qualitative, gray literature 2) studies written in a language other than English and Turkish 3) studies with unavailable full text 4) other healthcare personnel working with

healthcare workers (administrator, technician, etc.) as well as non-healthcare workers (retired, student, etc.)

Quality Assessment

Twenty-one studies were coded in Excel independently by two researchers using a standard form: prevalence of a total number of participants, the rate of participation, number of female-male participants, number of physicians and nurses, number of married-unmarried employees, mean age, duration of the study, year of study, study design, clinic, education level, title, position, country of study, depression scale and depression scores of the participants. Then, the Newcastle-Ottawa scale (NOS), which is used for non-randomized studies to assessed the risk of bias and the quality of the study, was used by the two researchers independently. NOS was developed in 2009 by Wells et al. as an easy and convenient tool to evaluate the quality of non-randomized studies, including case-control and cohort studies (31). NOS consists of 8 items and three dimensions. One star is awarded for each item. Two stars are given only for comparability (32). It is rated from zero to nine stars. Seven to nine stars are rated as high quality, five to six stars as medium quality, and four stars or below as low quality (31). In our study, the research design consists of cross-sectional studies and NOS was used for quality evaluation of cross-sectional studies. The quality assessment of the studies was carried out independently by two researchers. Studies were analyzed using inter-rater reliability: the kappa statistics.

Data Analysis

Statistical Package Program Comprehensive Meta-Analysis Version 3 (CMA V.3) was used for meta-analysis of the data. Cochran's Q test and I-square (I^2) statistics were used to determine inter-study heterogeneity (33). The magnitude of Cochran's Q value was evaluated based on the degrees of freedom (df) value in the chi-square table and if Cochran's Q>df, it can be said that the studies forming the meta-analysis have a heterogeneous structure. A p-value of <0.10 was interpreted as significant heterogeneity (34,35). For the I^2 value, <30% indicates little concern; 30% to 75% indicates moderate heterogeneity; >75% indicates substantial heterogeneity (33).

Funnel plot, Egger's regression intercept, and Begg and Mazumdar rank correlation were used to determine the publication bias (36).

Sensitivity analysis was evaluated by using fixed-effect models and using the difference after subtracting the study with the highest sampling and the study with the lowest sampling.

Subgroup Analysis

To determine the source of heterogeneity, subgroup analysis was performed. As a subgroup analysis, the gender, occupation, type of scale used in the study, and the country of the study were evaluated. In addition, since all of the studies were conducted in 2020, the data collection period was divided into two categories as before March and after March (Table 1). In the variables of marital status, education level, and position of the healthcare workers in the table, the depression rate of the data included in this subgroup could not be analyzed since it was not included in the article itself. In addition, the age variable, which is a continuous variable and planned as a meta-regression, could not be analyzed because it was not included in a sufficient number of studies. All results were evaluated according to the random-effects model.

RESULTS

Search Results

The PRISMA flowchart shows the selection criteria for the study (Figure 1). As a result of the first screening, a total of 470 studies were reached. The full text and abstracts of the records obtained were determined with the other researcher. Sixty five duplication studies were determined by individual researchers and then removed by consensus. The remaining 405 studies were examined. The authors were contacted for the unavailable full texts. Fifty eight records were not suitable for analysis such as unavailable full texts, bulletins and comments were excluded. From the remaining 347 studies, 21 studies included mainly due to they reported the outcome of depression prevalence of healthcare workers. The quality of each included study was assessed using the quality scale. Finally, 8 studies were included in the meta-analysis (Figure 1).

Methodological Quality Assessment

The quality assessment of 21 studies was evaluated with NOS (see Table S2). Since all studies were cross-sectional, the focus was on the dimensions of selection, comparability, and outcome. For the quality evaluation made by two independent researchers, analysis of inter-rater agreement between researchers was performed (Cohen's k=0.704; p<0.001). It was observed that there was a good level of compliance between researchers (37). As a result, 2 studies were found to be high quality, 6 studies were found to be moderate quality, and 13 studies were found to be low quality and at high risk of bias (<3 points). Thus, Eight studies with high and moderate-quality scores were included in the analysis (Table 1).

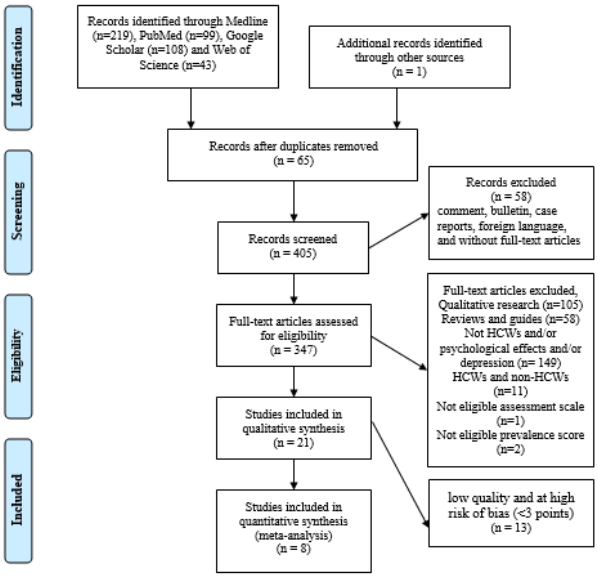

Figure 1. *PRISMA flowchart presenting the literature search process*

Characteristics of Included Studies

All studies included in the research were conducted in 2020 involving a total of 9,841 people. Table 1 presents information on the variables included in the meta-analysis. In this context, of the participants in the study, 7,191 are females and 2,660 are males. Except for the study of Chen et al., 4,637 are physicians and 5,099 are nurses (5). Seven studies (5,10,25,38–40) were conducted in China, and 1 study (23) was conducted in the Republic of South Korea. While 5 studies used the Patient Health Questionnaire (PHQ-9) (23,25,38–40) as a depression assessment scale, 3 studies used the Self-rating Depression Scale (SDS) (5,10,41). The research design of all studies was cross-sectional. Finally, the data collection date of the studies conducted before March was between January 29 - February 03, 2020 in J. Lai et al study, between January 30 - February 07, 2020 in Wang et al study, between February 01-29, 2020 in the study of J. Zhu et al., and between January-February 2020 in the study of Zhpu et al. The data collection dates of the studies conducted after March were between April 6-10, 2020 in the Tian et al.'s study and on April 10, 2020 in the study of Yang et al.

Table 1. Features of included studies

Study	Year	Country and Study Location	Sample size	Respond rate	Type of study	Occupation		Gender		Marital Status		Education		Age (mean)	Position		Survey Time Period	Scale type	Depression rate
						Doctor	Nurse	Female	Male	Married	Unmarried	Under-graduated	Post-graduated		Front-line	Second-line			
Chen Y., Zhou H. et al	2020	Guiyang, China	105	84,7	Cross-sectional	*NA	*NA	95	10	*NA	*NA	*NA	*NA	32,6 ±6,50	*NA	*NA	*NA	SDS	29,5
Lai J.et al	2020	Wuhan, Hubei and outside Hubei, China	1257	68,7	Cross-sectional	493	764	964	293	839	418	953	304	*NA	522	735	29 January-03 February 2020	PHQ-9	50,4
Lv Y.et al	2020	24 provinces, China	7071	87,5	Cross-sectional	3693	3378	5034	2037	5069	2002	*NA	*NA	*NA	2549	4522	NA	PHQ-9	36,97
Tian et al	2020	Beijing, China	845	79,94	Cross-sectional	196	649	714	131	*NA	*NA	*NA	*NA	35,5 ±6,70	*NA	*NA	6-10 April 2020	PHQ-9	45,56
Wang et al	2020	Wuhan, Hubei and outside, China	123	50	Cross-sectional	48	75	111	22	37	86	72	51	33,75 ±8,41	*NA	*NA	30 January-07 February 2020	SDS	25,2
Yang et al	2020	NA, South Korea	65	89	Cross-sectional	65	0	31	34	*NA	*NA	*NA	*NA	*NA	*NA	*NA	10 April 2020	PHQ-9	18,46
Zhu J., Sun L. et al	2020	Gansu, China	165	100	Cross-sectional	79	86	137	28	39	126	153	12	34,16 ±8,06	165	*NA	01-29 February 2020	SDS	44,24
Zhpu et al	2020	Hubei, China	210	95,4	Cross-sectional	63	147	105	105	112	98	194	14	30,47 ±4,53	*NA	*NA	January-February 2020	PHQ-9	71,9

**NA: Not Available*

Depression Prevalence of Health Care Workers

The rate of depression in the 8 studies included in the analysis was 18.5%-71.9%, and the overall effect size of the depression rate was 40.8% (95% CI 33.5-48.6) (Figure 2). The values of I^2=96.48, Q=199.03 and p=0.000 indicate the heterogeneity of the study. The study was evaluated according to the random-effects model.

Subgroup Analysis

When the depression rate in healthcare workers is analyzed by gender, the overall depression rate in male healthcare workers was 8.5% (95% CI: 5.5%–12.7%; p=0.000), and the depression rate in female healthcare workers was 24.5% (95 %CI: 17.4%–33.3%; p=0.000), and the rate of depression was found to be higher in female healthcare workers (Q_B=15.541; df=1; p=0.000; see Table S3).

According to the results obtained from 6 studies in which the depression rate of physicians and nurses was determined, the depression rate of physicians was 19.3% (95% CI: 13.2% – 27.3%; p=0.000), and the depression rate of nurses was 24% (95% CI: 16,7%–33.2%; p=0.000) and no statistically significant difference was found in the effect size (Q_B=0.745; df=1; p=0.388; see Table S3).

Five of the 8 studies included to measure the rate of depression in healthcare workers used PHQ-9 (23,25,38–40) and 3 used SDS (5,10,41) measurement tool. According to the results of the subgroup analysis, the PHQ-9 scale was 45.5% (95% CI: 35.8%-55.5%; p=0.376), the SDS scale was 32.8% (95% CI: 22.2%- 45.6%; p=0.009) and no statistically significant difference was found in the effect size (Q_B=2,406; df=1; p=0.121; see Table S3).

When the depression rate in healthcare workers is analyzed by country, it was 43.6% (95% CI: 35.9%-51.7%; p=0.119) in China (5,10,25,38–41), 18.5% (95% CI: 7.5%-38.7%; p=0.005) in Korea (23), and the rate of depression in China was determined to be higher (Q_B=4.999; df=1; p=0.025; see Table S3).

The period of time in which the studies were conducted was classified by the researchers as before March (5,10,25,38,41) and after March (23,39). The depression rate before March was 48% (95% CI: 32.8%-63.7%; p=0.811), and the depression rate after March was 31.8% (95% CI: 15.5%-54.3%; p=0.109). According to these results, no statistically significant difference was found in the effect size (Q_B=1,403; df=1; p=0.236; see Table S3).

Publication Bias

Publication bias was analyzed with a funnel diagram (Figure 3). It was observed that 8 studies included in the study were not distributed symmetrically on the right and left of the diagram and some studies were not included in the slope line. In addition, studies with large sample sizes were clustered at the top of the funnel and near the mean effect size. However, the interpretation of the funnel diagram is subjective and is not sufficient to assess publication bias. Therefore, it is necessary to evaluate the study with other publication bias statistics. Other statistics used to test publication bias are Egger's regression intercept and Begg and Mazumdar rank correlation. According to the results of the analysis, we can say that there is no publication bias in the study (see Table S4). The results of the meta-analysis were also found to be strong using the sensitivity analysis (see Table S5).

Study name	Event rate	Lower limit	Upper limit	Z-Value	p-Value	Total	Relative weight
Chen Y., Zhou H. et al	0,295	0,216	0,389	-4,067	0,000	31 / 105	11,45
Lai J.et al	0,504	0,477	0,532	0,310	0,756	634 / 1257	14,12
Lv Y.et al	0,370	0,359	0,381	-21,659	0,000	2614 / 7071	14,33
Tian et al	0,456	0,422	0,489	-2,577	0,010	385 / 845	14,00
Wang et al	0,252	0,183	0,336	-5,238	0,000	31 / 123	11,59
Yang et al	0,185	0,108	0,298	-4,646	0,000	12 / 65	9,16
Zhu J., Sun L. et al	0,442	0,369	0,519	-1,476	0,140	73 / 165	12,64
Zhpu et al	0,719	0,654	0,776	6,121	0,000	151 / 210	12,71
	0,408	0,335	0,486	-2,307	0,021		

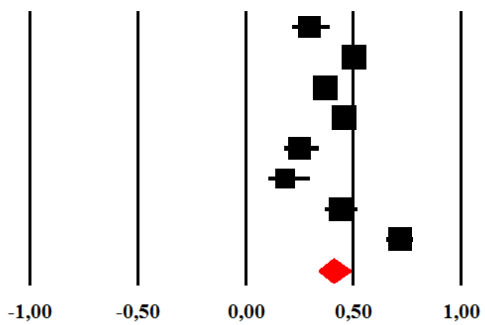

Figure 2. *Forest plot showing the prevalence of depression*

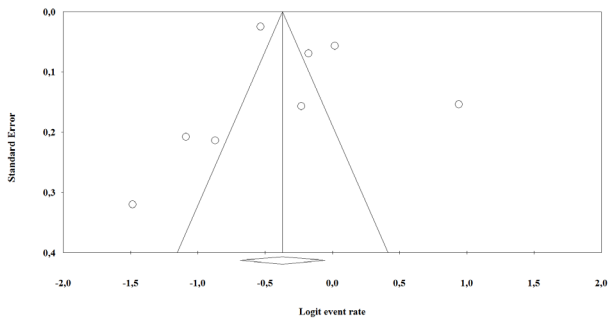

Figure 3. *Funnel plot of the studies*

DISCUSSION

In this study, the rate of depression seen in healthcare workers during the COVID-19 pandemic was found to be 40.8%. This depression rate is higher than the studies of Sahebi et al (2021) (24.83%), Salari et al. (2020) (24%) and Pappa et al. (2020) (%22.8), who are engaged in similar meta-analysis studies (15,42,43). Among the studies included in the meta-analysis, the highest rate of depression was in the study of Zhpu et al (2020) with 71.9% and the lowest was reported in the study of Yang et al (2020) with 18.5% (23,38). All eyes were turned to healthcare professionals with the rapid impact of the COVID-19 pandemic in the world. The fact that healthcare workers in the community are in the high-risk group who come into contact with patients caused them to have mental health problems that may have a negative impact on their daily life and work life (28,40). Depression is the most common mental illness in society. In a survey of 3904 participants who had COVID-19 disease, it was determined that 52.4% of the participants showed symptoms of major depression (51). COVID-19 has impacted psychiatric disorders, and studies have shown an increase in the severity of psychiatric symptoms through mechanisms common to oxidative stress, inflammation, and neuroinflammation (52). The World Health Organization (WHO) reported in 2001 that depression will take second place among the global diseases by 2020 (44). In the WHO 2017 report, it was announced that 322 million people in the world suffer from depression, and almost half of these people are those living in the highly populated South-East Asia and Western Pacific region (45). Today, we see that the load in the world is increasing due to depression and in other mental health diseases (46). In the meta-analysis study of Lim et al. conducted with 1,112,573 adults covering 30 countries between 1994 and 2014, the pooled depression rate was found to be 12.9% (47). In addition, in the first study reporting the psychological symptoms of frontline healthcare workers during the pandemic, the rate of depression was found to be 12.7% (7). In later studies, it has been reported that the depression rate is 50% and above during the pandemic (6,20,22). The results of our meta-analysis show that the mental health of healthcare workers is greatly affected.

Subgroup analyzes were performed in the study. First, the rate of depression was found to be higher in female healthcare workers (24.5%). In the studies included in the meta-analysis, the level of depression was higher in females (10,25,40). Similar results were obtained in the meta-analysis by Lim et al. (2018), in the WHO reports and other studies (28,40,44–47). During this period, women's long hours of work under difficult conditions, increased workload, and fear of infecting their relatives, as well as the responsibilities of being a woman (child care, home care) may have caused them to experience depression. Considering the subgroup analysis according to the country where the data was collected, another variable, the depression rate in healthcare workers living in China was found to be higher than the healthcare workers living in Korea. The result of the analysis may have been affected by the fact that only one country other than China was included and the data obtained from Korea was the least number of samples. However, meta-analysis results may have been affected by the fact that China was the first country to be exposed to the virus, and health workers were experiencing depression due to lack of knowledge about COVID-19, psychological unpreparedness, inability to help patients, lack of family support, and fears of the risk of death due to exposure to the disease (7,41). In the analysis based on profession, there was no statistically significant difference in the depression rate of physicians and nurses. However, in the meta-analysis study by Pappa et al. (2020), a higher rate of depression was found in nurses, while Sahebi et al. (2021) found a higher rate of depression in physicians in their meta-analysis study (15,42). In general, the fact that nurses constitute the majority in the health system and that they are directly and intensely involved in patient care as the closest occupational group to the patient shows that the depression levels are higher than the physicians (3,13,40,46,48,49). No statistically significant difference was found in the subgroup analysis based on the period of time. A similar result was found by Pan et al. (2020) in the meta-analysis study (50). The fact that this study was conducted with data obtained during the high course of the pandemic may have rendered this variable meaningless. Finally, there was no statistically significant difference according to the depression assessment scales, PHQ-9 and SDS. These results provide evidence that the source of heterogeneity is not related to

these variables. Although this study shows that the source of heterogeneity is due to insufficient data, we can say that the results are statistically significant with the sensitivity analysis and the study is still robust.

Limitations

The most important limitation of our study is that, as researchers, we aimed to conduct a meta-analysis with more studies, while 8 studies were analyzed as a result of quality evaluation. Including studies with high quality evaluation in our study caused us to face a decrease in the number of studies. This situation caused subgroup analysis to be conducted with limited data and we were unable to perform meta-regression analysis with the number of existing studies. In addition, the lack of analysis results regarding the variables in the study (age, education level, clinic, psychological assessments in self-report tools), also limited our results. Finally, the data of our study to include mostly Asian healthcare workers limited the generalizability of the results.

CONCLUSION

These results clearly demonstrated the high prevalence of depression among the 9,841 healthcare workers caring for patients with COVID-19. It is necessary to provide psychological support to healthcare workers who are struggling with the pandemic. In addition, these results require policymakers and healthcare authorities to develop contingency plans to support the psychological health of healthcare workers.

DECLARATIONS

Funding

The authors declared that this study has received no financial support.

Conflict of Interests

The authors have no conflicts of interest to declare.

Ethical Approval

İstanbul Yeni Yüzyıl University Ethics Committee (Approval number: 2020/07-485)

The Turkish Ministry of Health (Approval number: 2020-06-14T01_28_22).

Availability of Data and Material

All data and material are available on request from the authors.

Author Contributions

Study conception and design: All authors; Data collection: All authors; Data analysis and interpretation: EK; Drafting of the article: All authors; Critical revision of the article: All authors.

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Supplementary Tables

Table S1. Search Strategy

Database	
Google Scholar Medline PubMed WoS	((COVID-19) OR (COVID) OR (Coronavirus) OR (Sars-Cov-2) OR (Sars cov 2)) AND ((healthcare workers) OR (health care workers) OR (medical staff) OR (medical workers) OR (nurs*) OR (physician) OR (doctor)) AND ((psychological effect) OR (mental health) OR (depression))

Table S2. The Quality Scores of The Studies

		NOS								
		Selection				Comparability	Outcome			
		1	2	3	4	1	1	2	3	Total
**Chen Y., Zhou H. et al	cross-sectional studies	*	*	…	…..	*	*	*	*b	6
Choudhury et al	cross-sectional studies	*b	*	…	…	*	*	…	*b	4
Du J. et al	cross-sectional studies	….	…	…	….	*	*	…	….	2
Elbay et al	cross-sectional studies	…	…	….	…	*	*	….	….	2
García-Fernández et al	cross-sectional studies	…	…	…	….	*	*	…	…	2
Guo J. et al	cross-sectional studies	…	…	…	…	*	*	…	…	2
Huarcaya-Victoria and Podestá	cross-sectional studies	….	…	…	…	*	*	…	….	2
Khanna et al	cross-sectional studies	…	….	…	…	*	*	…	…	2
**Lai J.et al	cross-sectional studies	*	*	….	…	*	*	*	*b	6
Liu Z., Han B. et al	cross-sectional studies	….	….	….	…	*	*	..	…	2
**Lv Y.et al	cross-sectional studies	*	*	…	…	*	*	*	*b	6
Rossi et al	cross-sectional studies	…	…	…	*	*	*	…	….	3
Salman et al	cross-sectional studies	…	….	….	…	*	*	…	…	2
Song et al	cross-sectional studies	…..	…	….	….	*	*	….	….	2
**Tian et al	cross-sectional studies	*	*	….	*	*	*	*	*b	7
**Wang et al	cross-sectional studies	*b	*	…	….	*	*	….	*b	5
**ang et al	cross-sectional studies	*	*	….	*	*	*	*	*b	7
Zhang, Alimoradi et al	cross-sectional studies	…..	…	….	….	*	*	….	….	2
Zhang, Hou et al	cross-sectional studies	…..	…	….	*	*	*	….	….	3
**Zhu J., Sun L. et al	cross-sectional studies	*	*	…	…	*	*	*	*b	6
**Zhpu et al	cross-sectional studies	*	*	…	…	*	*	*	*b	6

** studies included in meta-analysis

Table S3. Subgroup analysis

Subgroup	Number of studies	Event rate	%95 CI	Z	p	Q_B	df	P
Gender								
Female	4	0.245	0.174-0.333	-5.130	0.000			
Male	4	0.085	0.055-0.127	-10.306	0.000	15,541	1	0.000
Total	8	0.148	0.048-0.373	-2.789	0.005			
Profession								
Doctor	3	0.193	0.132-0.273	-6.195	0.000			
Nurse	3	0.240	0.167-0.332	-4.988	0.000	0.745	1	0.388
Total	6	0.215	0.166-0.275	-7.906	0.000			
Type of scale								
PHQ-9	5	0.455	0.358-0.555	-0.885	0.376			
SDS	3	0.328	0.222-0.456	-2.596	0.009	2,406	1	0.121
Total	8	0.397	0.282-0.525	-1.576	0.115			
Country								
China	7	0.436	0.359-0.517	-1.557	0.119			
South Korea	1	0.185	0.075-0.387	-2.836	0.005	4.999	1	0.025
Total	8	0.316	0.124-0.603	-1.273	0.203			
Period of time								
Before March	4	0.480	0.328-0.637	-0.239	0.811			
After March	2	0.318	0.155-0.543	-1.602	0.109	1.403	1	0.236
Total	6	0.418	0.273-0.578	-1.006	0.314			

Note: weights are from random effects analysis

Table S4. Publication Bias

Outcome	Begg's test				Egger's test			
	Tau	z-value	1 tailed p-value	2 tailed p-value	intercepet	t-value	1 tailed p-value	2 tailed p-value
	-0.25	0.87	0.19	0.39	1.77	0.61	0.28	0.56

Table S5. Depression prevalence of health care workers in sensitivity analyses

	ES [95 %]	Q	p	I^2
Using fixed-effect models	0.40 [0.39-0.41]	199.034	0.000	96,483
*excluding the largest trial (Lv Y.et al)	0.41[0.32-0.51]	106.483	0.000	94.365
*excluding the lowest trial(Yang et al)	0.44 [0.36-0.52]	187.601	0.000	96.802

*random effects model