PUBLIC HEALTH

# Prevalence of anxiety and depression of health care workers during COVID-19 – a systematic review and meta-analysis

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## Abstract

**Introduction.** During the COVID-19 pandemic, the workload of healthcare workers managing the disease, increased significantly. The objective of this review is to determine the anxiety and depression prevalence among healthcare workers during the pandemic period.

**Methods.** We searched systematically the literature in five electronic databases such as PubMed, CINAHL, ScienceDirect, MEDLINE, and Cochrane COVID-19 study register. The last online research was performed in May 2022. We included only cross-sectional studies and performed a meta-analysis of pooled prevalence. Publication bias was assessed with a funnel plot and Egger's and Begg's tests. A random effect was applied and heterogenicity I2 was calculated. Quality assessment of included studies was performed using the Joanna Briggs Institute tool.

**Results.** In this review, we included 14 cross-sectional studies comprising 7780 healthcare workers. Participants were from the whole spectrum of healthcare workers. The pooled prevalence of depression was 33.8% (95% CI: 24.6 – 43.6), heterogenicity $I^2$: 98.69% . The pooled prevalence of anxiety was 41.3% (95% CI: 30.2 – 52.9), heterogenicity $I^2$: 99.01%.

**Conclusion.** One-third of healthcare workers suffered from depression, and more than one-third suffered from anxiety during the COVID-19 pandemic. Increased measures of surveillance of mental health should have been taken, as well as the support of healthcare workers running a high risk of psychological distress during the COVID-19 pandemic.

**Keywords:** depression, anxiety, burn-out, emotional distress, fear, health care workers, nurses, resident, doctor, physician, coronavirus, COVID-19, SARS-COV-2

## Introduction

The COVID-19 pandemic was a unique challenge, and, as in any disaster, effective communication is of great importance [1]. The risk of COVID-19 infection may cause significant psychosocial stress for medical staff [2]. Furthermore, during critical situations like flu pandemics, Health Care Workers (HCWs) are at risk of developing psychological distress with an impact on their health [3]. Residents stated that COVID-19 influenced their surgical training in 85.2% of responders and only 5% of the residents answered that the COVID-19 pandemic did not affect their surgical training in the operative room (OR). Moreover, residents subjectively received less education and believed they needed an extension of their surgical training [4].

## Methods

This study adheres to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2009 checklist [5].

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***Inclusion and exclusion criteria***

The inclusion criteria were the following: 1. Studies are designed as cross-sectional. 2. The studies must include health care workers (HCW). 3. Studies in the English language. 4. Studies have as objective the impact of the COVID-19 pandemic on HCWs (anxiety, depression) based on appropriate measurement tools. The exclusion criteria were set as follows: 1. Case reports, review studies, intervention studies. 2. Studies that include professions other than health care workers. 3. Studies that are not in the English language. 4. Studies that do not have an emotional impact on HCWs.

***Information resources and search strategy***

We searched the electronic databases PubMed, ScienceDirect, MEDLINE, CINAHL, and Cochrane Library. The last date of online research was in May2022.

We used the keywords 'depression',' anxiety, 'burn-out', 'emotional distress', 'fear', 'health care workers', 'nurses', 'resident', 'doctor',' physician', 'coronavirus', 'COVID-19', 'SARS-COV-2'

***Selection process and data extraction process***

The screening of the studies was performed independently by two authors. First, one author screened the abstracts. Another author screened the abstracts independently.

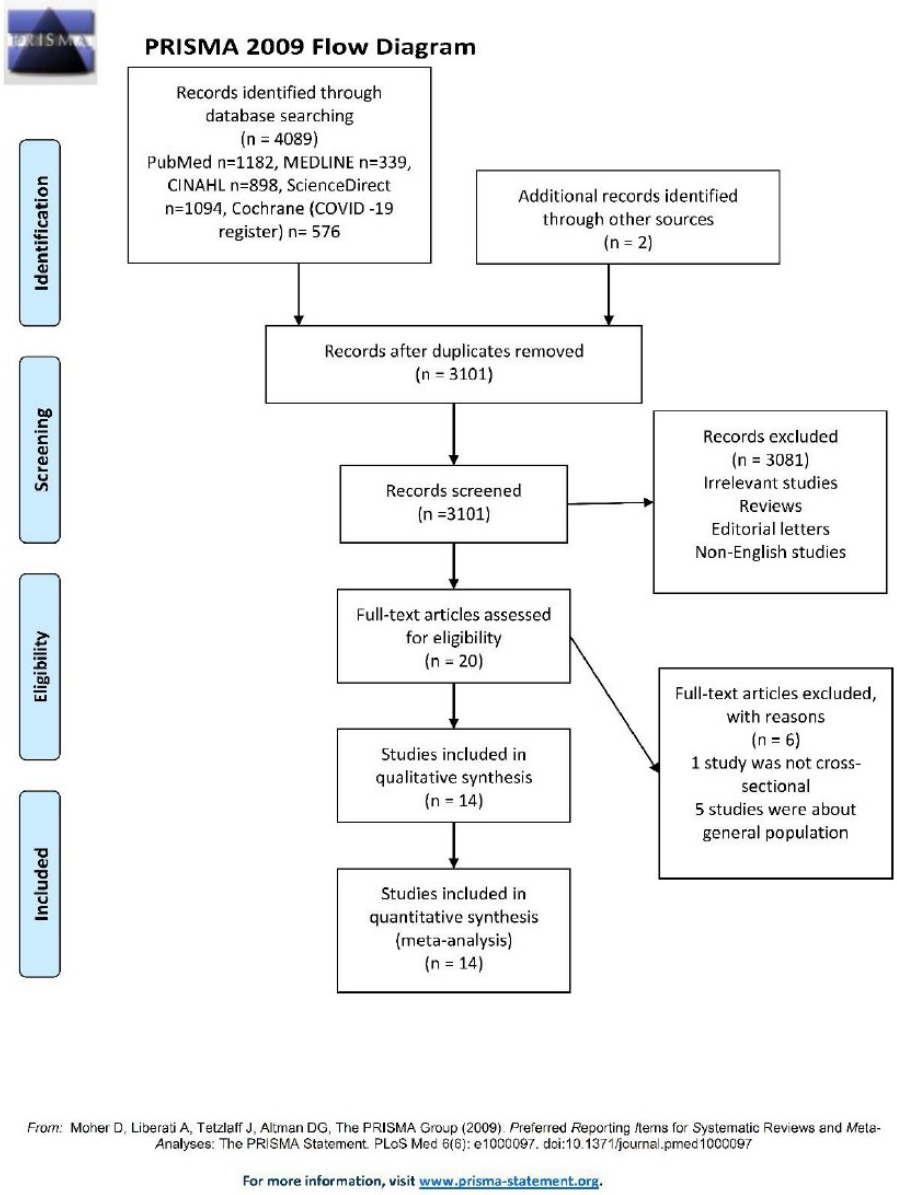


**Figure 1.** PRISMA Flow Diagram.

Any disagreement was resolved by discussion. Data collected were about 1. Study design. 2. Country of the study. 3. Study population characteristics (age, size of studyarms, the position of health providers.

***Effect measures***

In this review, we measured two outcomes. 1. The prevalence of anxiety among healthcare workers caused by COVID-19 and 2. The prevalence of depression among healthcare workers caused by COVID-19. We used the Freeman-Tukey transformation [6] to pool the results.

***Evaluation of the quality of the included studies***

Two authors worked independently on the quality assessment of the included studies. We used the Joanna Briggs Institute tool [7]. The Joanna Briggs Institute tool consists of 8 items, and it is suitable for a cross-sectional study's quality assessment. Any disagreement in the assessment process was resolved by discussion.

***Statistical methods***

In this review, we used the MedCalc [8] statistical software to perform a meta- analysis. Data used from the included studies was about sample size and population of HCWs affected in each study. To pool the prevalence of studies included in the meta- analysis, we used the Freeman-Tukey transformation method [6]. We used a random-effects model (DerSimonian and Laird method) [9] to calculate the pooled prevalence from multiple studies.

***Publication bias***

For publication bias, we used Begg's test [10] and Egger's test [11]. Begg's test [10] assesses the significant correlation between the ranks of the effect estimates and the ranks of their variances. Egger's test [11] assesses the relationship between the standardized effect estimates and the standard error (SE) using linear regression. Funnel plots were used also to assess any publication bias [12].

## Results

In this review, 14 studies were included (Table I). The flow diagram in figure 1 shows the screening process and the study selection.

**Table I.** Characteristics of included studies.

| Author/Year | Country | Study Design/ Participants | Sample size | Male (%) | Mean age | Depression % (n) | Anxiety % (n) |
|---|---|---|---|---|---|---|---|
| Barua et al., 2020 [13] | Bangladesh | Cross-sectional / Frontline doctors | 370 | 60.3% | 30.5 | 38.3% (142) | 36.4% (135) |
| Chatterjee et al., 2020 [14] | India | Cross-sectional / Medical doctors | 152 | 78.3% | 42.05 | 34.8% (53) | 39.4% (60) |
| Dal'Bosco et al.,2020 [15] | South America | Cross-sectional / Nurse | 88 | 10.2% | 21-30 (42%)<br>31-40 (36.4%)<br>> 40 (21.6%) | 25% (22) | 48.8% (43) |
| Holton et al., 2020 [16] | Australia. | Cross-sectional / Nurses n=391; Doctors, n=138, AH staff n=139 | 668 | 14% | 40 | 20.6% (138) | 20.6% (138) |
| Khanal et al., 2020 [17] | Nepal | Cross-sectional / Doctor n = 161, Nurses n = 167, Other n = 147 | 475 | 47.4% | 28.2 | 37.4% (178) | 41.8% (199) |
| Mathur et al., 2020 [18] | India | Cross-sectional / Doctors = 174, Nurses=26 | 200 | 69% | 42.1 | 17% (34) | 19.5% (39) |
| Nasrullah et al., 2021 [19] | Indonesia | Cross-sectional / Not specified | 644 | 24.8% | 20-29 (32.3%)<br>30-39 (39.1%)<br>40-49 (23.9%)<br>>50 (4.7%) | 23.4% (151) | 65.6% (423) |
| Ning et al., 2020 [20] | China | Cross-sectional / Doctors n = 317, Nurses n = 295 | 612 | 27.1% | > 40 (20.1%)<br><40 (79.9%) | 25% (153) | 16.3% (100) |
| Pan et al., 2020 [21] | China | Cross-sectional / Doctor n = 42, Nurses n = 148, Other n=4 | 194 | 18.6% | < 30 (44.8%)<br>>30 (33.3%)<br>>50 (21.9%) | 37.6% (73) | 32.4% (63) |
| Pouralizadeh et al., 2020 [22] | Iran | Cross-sectional / Nurses | 441 | 4.8% | 36.34 | 70.9% (313) | 73.4% (324) |
| Prasad et al., 2020 [23] | USA | Cross-sectional / Nurses=248, administrative staff=63, practice providers=36 | 347 | 9.2% | 26-30 (34.3%)<br>31-35 (21.3%)<br>36-40 (9.5%)<br>>40 (34.9%) | 22.7% (79) | 69.4% (241) |
| Que et al., 2020 [24] | China | Cross-sectional /Physicians n=860, Medical residents n=913, Nurses n=208, Other n=304 | 2285 | 30.9% | 31.06 | 44.3% (1014) | 46.3% (1052) |
| Si et al., 2020 [25] | China | Cross-sectional / Doctor=377, Nurse=211, Other=275 | 863 | 29.3% | ≤ 29 (32.1%)<br>30–39 (45.2%)<br>40–49 (16.8%)<br>≥ 50 (5.9%) | 13.5% (117) | 13.9% (120) |
| Wankowicz et al., 2020 [26] | Poland | Cross-sectional / Not otherwise specified | 441 | Frontline HCWs: 43.69%<br>Second-line HCWs: 51.49% | Frontline HCWs:40.47<br>Second-line HCWs:40.05 | 70.7% (312) | 64.3% (284) |

AH: Allied health; HCW: Health Care Workers.

### **Risk of bias assessment** (Table II)

**Table II.** Risk of bias assessment of included studies according to Joanna Briggs Institute tool [7].

| | Were the criteria for inclusion in the sample clearly defined? | Were the study subjects and the setting described in detail? | Was the exposure measured in a valid and reliable way? | Were objective standard criteria used for the measurement of the condition? | Were confounding factors identified? | Were strategies to deal with confounding factors stated? | Were the outcomes measured in a validating reliable way? | Was appropriate statistical analysis used? |
|---|---|---|---|---|---|---|---|---|
| Barua et al., 2020 [13] | Y | Y | Y | Y | Y | N | Y | Y |
| Chatterjee et al., 2020 [14] | Y | Y | Y | Y | N | N | Y | Y |
| Dal'Bosco et al., 2020 [15] | Y | Y | Y | Y | N | N | Y | Y |
| Holton et al., 2021 [16] | Y | Y | Y | Y | N | N | Y | Y |
| Khanal et al., 2020 [17] | Y | Y | Y | Y | Y | N | Y | Y |
| Mathur et al., 2020 [18] | Y | Y | Y | Y | N | N | Y | Y |
| Nasrullah et al., 2021 [19] | Y | Y | Y | Y | Y | N | Y | Y |
| Ning et al., 2020 [20] | Y | Y | Y | Y | N | N | Y | Y |
| Pan et al., 2020 [21] | Y | Y | Y | Y | Y | N | Y | Y |
| Pouralizad et al., 2020 [22] | Y | Y | Y | Y | Y | N | Y | Y |
| Prasad et al., 2020 [23] | Y | Y | Y | Y | Y | N | Y | Y |
| Que et al., 2020 [24] | Y | Y | Y | Y | Y | N | Y | Y |
| Si et al., 2020 [25] | Y | Y | Y | Y | N | N | Y | Y |
| Wankowicz et al., 2020 [26] | Y | Y | Y | Y | Y | N | Y | Y |

Y: Yes; N: No

## **Meta-Analysis**

### ***Depression*** (Table III)

**Table III.** Meta-analysis of depression prevalence among HCWs.

| Study | Sample size | Proportion (%) | 95% CI | Weight (%) | |
|---|---|---|---|---|---|
| | | | | Fixed | Random |
| Barua et al., 2020 [13] | 370 | 38.378 | 33.399 to 43.546 | 4.76 | 7.17 |
| Chatterjee et al., 2020 [14] | 152 | 34.868 | 27.328 to 43.012 | 1.96 | 6.99 |
| Dal' Bosco et al., 2020 [15] | 88 | 25.000 | 16.378 to 35.368 | 1.14 | 6.78 |
| Holton et al., 2021 [16] | 668 | 20.659 | 17.649 to 23.930 | 8.58 | 7.23 |
| Khanal et al., 2020 [17] | 475 | 37.474 | 33.105 to 41.999 | 6.11 | 7.20 |
| Mathur et al., 2020 [18] | 200 | 17.000 | 12.070 to 22.937 | 2.58 | 7.06 |
| Nasrullah et al., 2021 [19] | 644 | 23.447 | 20.225 to 26.915 | 8.28 | 7.23 |
| Ning et al., 2020 [20] | 612 | 25.000 | 21.615 to 28.628 | 7.87 | 7.22 |
| Pan et al., 2020 [21] | 194 | 37.629 | 30.791 to 44.851 | 2.50 | 7.05 |
| Pouralizadeh et al., 2020 [22] | 441 | 70.975 | 66.495 to 75.172 | 5.67 | 7.19 |
| Prasad et al., 2020 [23] | 347 | 22.767 | 18.459 to 27.545 | 4.46 | 7.16 |
| Que et al., 2020 [24] | 2285 | 44.376 | 42.326 to 46.441 | 29.33 | 7.28 |
| Si et al., 2020 [25] | 863 | 13.557 | 11.343 to 16.024 | 11.09 | 7.25 |
| Wankowicz et al., 2020 [26] | 441 | 70.748 | 66.260 to 74.956 | 5.67 | 7.19 |
| **Total (fixed effects)** | 7780 | 35.003 | 33.943 to 36.074 | 100.00 | 100.00 |
| **Total (random effects)** | 7780 | 33.820 | 24.660 to 43.637 | 100.00 | 100.00 |
| **Test for heterogeneity** | | | | | |
| Q | 993,0064 | | | | |
| DF | 13 | | | | |
| Significance level | P < 0,0001 | | | | |
| $I^2$ (inconsistency) | 98.69% | | | | |
| 95% CI for $I^2$ | 98.38 to 98.94 | | | | |
| **Publication bias** | | | | | |
| Egger's test | | | | | |
| Intercept | -2,2943 | | | | |
| 95% CI | -16,0003 to 11,4118 | | | | |
| Significance level | P = 0.7217 | | | | |
| Begg's test | | | | | |
| Kendall's Tau | 0,1547 | | | | |
| Significance level | P = 0.4409 | | | | |

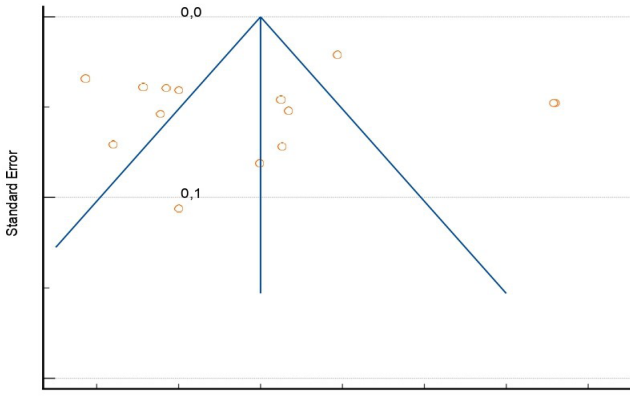


**Figure 2.** Funnel plot of HCWs depression prevalence.

The vertical line represents the pooled prevalence. The Egger's test is P = 0.7217 and Begg's test is P = 0.4409 indicating no publication bias. Heterogeneity $I^2$ was 98.69% (Figure 2).

The squares indicate the event rate of each study. The diamond indicates the pooled prevalence and 95% confidence intervals. The pooled prevalence of depression among healthcare workers was 33.82% (95% CI: 24.66 to 43.63) applying random effects DerSimonian-Laird method [9] (Figure 3).

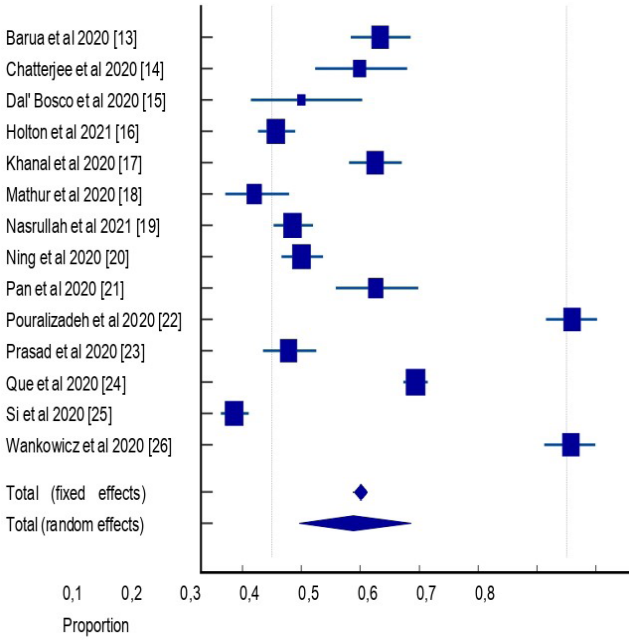


**Figure 3.** Forest plot of HCWs depression prevalence.

***Anxiety*** (Table IV)

**Table IV.** Meta-analysis of anxiety prevalence among HCWs.

| Study | Sample size | Proportion (%) | 95% CI | Weight (%) | |
|---|---|---|---|---|---|
| | | | | Fixed | Random |
| Barua et al., 2020 [13] | 370 | 36.486 | 31.572 to 41.619 | 4.76 | 7.16 |
| Chatterjee et al., 2020 [14] | 152 | 39.474 | 31.650 to 47.716 | 1.96 | 7.03 |
| Dal'Bosco et al., 2020 [15] | 88 | 48.864 | 38.052 to 59.754 | 1.14 | 6.86 |
| Holton et al., 2021 [16] | 668 | 20.659 | 17.649 to 23.930 | 8.58 | 7.21 |
| Khanal et al., 2020 [17] | 475 | 41.895 | 37.415 to 46.476 | 6.11 | 7.19 |
| Mathur et al., 2020 [18] | 200 | 19.500 | 14.249 to 25.679 | 2.58 | 7.08 |
| Nasrullah et al., 2021 [19] | 644 | 65.683 | 61.873 to 69.349 | 8.28 | 7.21 |
| Ning et al., 2020 [20] | 612 | 16.340 | 13.497 to 19.512 | 7.87 | 7.20 |
| Pan et al., 2020 [21] | 194 | 32.474 | 25.941 to 39.552 | 2.50 | 7.08 |
| Pouralizadeh et al., 2020 [22] | 441 | 73.469 | 69.087 to 77.534 | 5.67 | 7.18 |
| Prasad et al., 2020 [23] | 347 | 69.452 | 64.311 to 74.259 | 4.46 | 7.16 |
| Que et al., 2020 [24] | 2285 | 46.039 | 43.980 to 48.109 | 29.33 | 7.25 |
| Si et al., 2020 [25] | 863 | 13.905 | 11.665 to 16.395 | 11.09 | 7.22 |
| Wankowicz et al., 2020 [26] | 441 | 64.399 | 59.732 to 68.872 | 5.67 | 7.18 |
| **Total (fixed effects)** | 7780 | 40.608 | 39.515 to 41.709 | 100.00 | 100.00 |
| **Total (random effects)** | 7780 | 41.359 | 30.272 to 52.908 | 100.00 | 100.00 |
| **Test for heterogeneity** | | | | | |
| Q | 1312,1849 | | | | |
| DF | 13 | | | | |
| Significance level | P < 0.0001 | | | | |
| $I^2$ (inconsistency) | 99.01% | | | | |
| 95% CI for $I^2$ | 98.80 to 99.19 | | | | |
| **Publication bias** | | | | | |
| Egger's test | | | | | |
| Intercept | 0.8572 | | | | |
| 95% CI | -14.9762 to 16.6907 | | | | |
| Significance level | P = 0.9081 | | | | |
| Begg's test | | | | | |
| Kendall's Tau | 0.1105 | | | | |
| Significance level | P = 0.5820 | | | | |

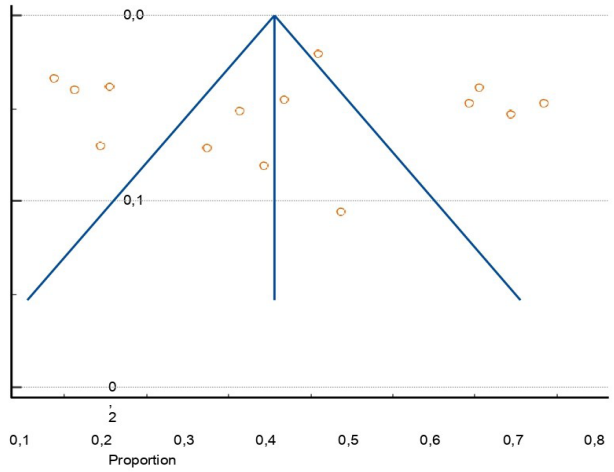


**Figure 4.** Funnel plot of HCWs anxiety prevalence.

The vertical line represents the pooled prevalence. The Egger's test is P = 0.9081 and Begg's test is P = 0.5820 indicating no publication bias. Heterogeneity $I^2$ was 99.01% (Figure 4).

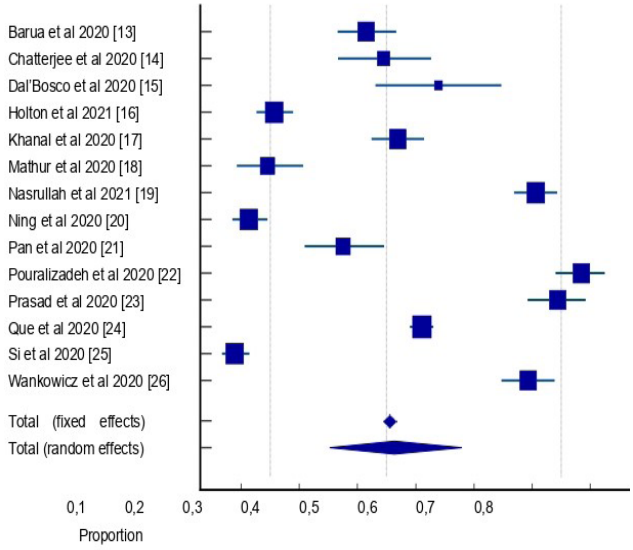


**Figure 5.** Forest plot of HCWs anxiety prevalence.

The squares indicate the event rate of each study. The diamond indicates the pooled prevalence and 95% confidence intervals. The pooled prevalence of anxiety among healthcare workers was 41,35% (95% CI: 30.27 to 52.90) applying random effects DerSimonian-Laird method [9] (Figure 5).

## Discussion

In this review, we included 14 cross-sectional studies comprising 7780 healthcare workers. The population of participants covers the whole spectrum of healthcare professionals (medical doctors, trainees, nurses, administrative staff). Among the studies included, 10 were from Asia, 1 from USA, 1 from Europe, 1 from Australia and 1 from South America. A comprehensive search strategy was applied in five electronic databases such as PubMed, Cochrane COVID-19 study register, CINAHL,MEDLINE, and ScienceDirect. After the selection of relevant studies, we proceeded to quality and risk of bias assessment using the Johana-Biggs [7] tool. We did not observe a serious risk of bias in the included studies. We proceeded to statistical analysis to pool the results. MedCalc statistical software [8] was used to perform prevalence pooling. Our results are comparable to other published reviews. Anxiety was higher, with a prevalence of 41.3% (95% CI: 30.2 – 52.9) and depression of 33.8% (95% CI: 24.6 – 43.6). We used the random effect DerSimonian-Laird method [9] in our results due to high heterogeneity to extract a generalized conclusion.

Heterogenicity was high in our review, like in other meta-analyses. Possible explanations are the different characteristics of participants, work environment, and screening tools.

Our results are comparable to other reviews. In the meta-analysis of Ching et al [27], the prevalence of healthcare workers affected by depression was 37.5% (95% CI: 33.8–41.3) and anxiety was 39.7 (95% CI: 34.3–45.1). Furthermore, in the same study [27] the prevalence of stress was 36.4% (95% CI: 23.2–49.7), fear was 71.3% (95% CI: 54.6–88.0), and burnout was 68.3% (95% CI: 54.0–82.5). The authors recommend urgent actions to support healthcare workers to reduce the psychological distress during the COVID-19 pandemic. In another meta-analysis, by Saragih et al [28], the prevalence of anxiety was 40% (95% CI: 29–52%) and the prevalence of depression was 37% (95% CI: 29–45%). The prevalence of post-traumatic stress was 49% (95% CI: 22–75%), and distress was 37% (95% CI: 25–50%). The authors recommend to all relevant policymakers and stakeholders act to reduce the psychological impact on healthcare workers' mental health. In the meta-analysis of Li et al [29] overall prevalence depression was 21.7% (95% CI, 18.3%-25.2%), of anxiety 22.1% (95% CI, 18.2%-26.3%) and of post-traumatic distress 21.5% (95% CI, 10.5%-34.9%). The authors recommend urgent measures to support the psychological well-being of health care workers.

There are many factors that can explain anxiety and depression. According to Saragih et al [28], several factors related to anxiety, such as the fear of becoming infected by COVID-19 and spreading the virus to their relatives, and the lack of confidence to cope with stress. Moreover, the possibility to be stigmatized by society, change work duties, and overtime work exacerbated the risk of anxiety.

Furthermore, factors related to depression were working in a high-risk environmentand again the possibility to get infected and spreading the infection.

It is important to consider that healthcare providers are under constant pressure to provide high-quality healthcare services, and this becomes another challenge for all healthcare workers [30].

### Limitations of evidence included and the review process

In this review, we faced several limitations. First, although we performed a meta- analysis about psychological stress on healthcare workers, included studies were not specific to nurses, physicians, residents, or other personnel. We did not perform analysis specifically for any working group, rather we included all working groups of health care workers in a united statistical analysis. Second, confounding factors may have an unspecified impact on the psychological stress percentage measured in included studies. Third, high heterogenicity was observed among included studies.

Three of the studies had a population of more than a thousand participants, in contrast to seven studies that included less than five hundred participants. Fourth, even if we performed a research with a comprehensive search strategy on five electronic databases, we may have missed several relevant studies. Fifth, most of the studies included were performed in Asia, thus it is difficult to generalize the results.

### Implications of the results for practice, policy, and future research

Our review shows that COVID 19 had a significant psychological impact on healthcare workers. The analysis of the situation indicates that healthcare workers are under psychological stress that reduces the quality of their life. The increased workload, the critical care of the patients as well as the increased number of night shifts, are major factors that caused burn-out, anxiety, depression, and post-traumatic distress to the healthcare workers. Furthermore, the fear of infection was another factor of stress, not only for the frontline but also for all healthcare workers.

Healthcare workers must be protected from psychological stress and its impact on their working efficiency and the quality of their life. We suggest continuous monitoring, especially of those working in the critical care of patients. Monitoring should be concentrated on the assessment of the psychological wellness of healthcare workers at regular time points and the early recognition of signs of exhaustion, burn- out, depression, anxiety, and post-traumatic distress. Dialogue and consulting between healthcare workers and supervisors should be established discretely, to achieve psychological wellness and psychological stress reduction.

Future research should concentrate on integrated tools creation of mental surveillance during periods of increased psychological stress, such as the COVID 19 era. Regular questionnaires for psychological assessment, personal or group dialogue, and psychological support, should be part of an integrated tool in the future.

## Conclusion

We conclude that the COVID-19 pandemic affected the mental health of healthcare workers. The prevalence of anxiety was higher, with more than one-third of healthcare workers affected, and one-third affected by depression. We strongly suggest continuous mental health surveillance of healthcare workers during the COVID-19 pandemic to take the necessary measures to protect and support them. Interventions from all policy makers are needed in this direction.

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