

Physical and Psychological Problem of COVID-19 Infection in Healthcare Workers: A Systematic Review and Meta-analysis

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Received: 01 April 2022

Revised: 02 May 2022

Accepted: 06 June 2022

Abstract

Background: Coronavirus is among the pathogens that primarily target the respiratory system. Given the importance of Health Care Workers (HCWs) in the fight against COVID-19, their infection with the virus and death can cause irreparable damage to public health. The present systematic review and meta-analysis aimed to investigate the physical and psychological implications of COVID-19 among HCWs.

Methods: In this systematic review and meta-analysis, some well-known databases were searched for the studies published before 26 June 2020 using the following search strategy: “Novel coronavirus pneumonia”, “Nurses”, “Physicians”, “Medical Staff, Hospital”, “Health Personnel”, and “Community Health Workers”. Finally, 101 out of the 2234 primary screened articles were assessed.

Results: Of the total studies included, 54 were related to Physical problems, and 47 were related to Psychosocial Stress. Skin damage (54.48%), Nasal bridge (58.79%), and Dryness tightness (58.57%) were the most common Physical Problems, and Insomnia (32.03%) and Distress (29.34%) were the most common psychosocial problems among HCWs.

Conclusion: Training and awareness of the treatment staff about the unwanted side effects of these diseases should be considered in educational programs in different countries because patient care depends on their availability.

Please cite this article as: Vali M, Mirahmadizadeh AR, Maleki Z, Afrashteh S, Abedinzade A, Kasraei F, Ghaem H. Physical and Psychological Problem of COVID-19 Infection in Healthcare Workers: A Systematic Review and Meta-analysis. *J Health Sci Surveillance Sys.* 2022;10(3):250-256.

Keywords: COVID-19, Health personnel, Physical problems, Psychosocial stress, Systematic review

Introduction

Coronavirus is among the pathogens that primarily target the respiratory system. In late December 2019, hospitalized patients were with an early diagnosis of pneumonia for an unknown reason.¹

² Thereafter, corona disease became a public health threat to people worldwide in late 2019.²⁻⁵ The disease spread to other parts of China and other countries⁵⁻⁷ from Hubei Province in 30 days due to rapid transmission.⁸ By 26 February 2020, the disease had spread to 46 countries, and by 10 April

2020, the number rose to 209.⁸⁻¹¹ This emerging and evolving situation is threatening the health of all people, and World Health Organization (WHO) has put the danger of COVID-19 at “very high” level.^{6,9,12} Considering the hospital transmission of the virus, contamination of Health Care Workers (HCWs) is one of the severe problems in this disease.¹³ Additionally, HCWs are more likely to develop COVID-19 and become infected due to their increasing workload.¹⁴ Up to now, various risk factors have been reported for disease transmission to HCWs, including tracheal intubation, manual ventilation, non-invasive ventilation,

nasal cannula, bronchoscopic examinations, suctioning, and patient transport.¹³ In 1932, HCWs in Wuhan, China, became infected, overshadowing the local healthcare system and resulting in the highest mortality rate at 4.42%.¹⁵ A systematic review and meta-analysis found that at least one in five health professionals reported one symptom of depression and anxiety.¹⁶

Given the importance of the presence of HCWs in the fight against COVID-19, their infection with the virus and death can cause irreparable damage to public health. Also, psychological problems are among the complications of COVID-19 disease in affected HCWs. Their quality of life and social conditions can be affected, as well.^{1, 8} Moreover, depression, anxiety, insomnia, distress, and obsessive-compulsive symptoms can be some of the coronavirus's psychological complications among HCWs.^{1, 3, 17} At present, HCWs are the most valuable resource in all countries. Also, several studies^{5, 6, 18-21} showed that the healthcare staff comprised the first line of the fight against epidemics. Therefore, it is essential to support them and keep them healthy. The present systematic review and meta-analysis aim to investigate the physical and psychological problems induced by COVID-19 among HCWs.

Methods

Search Strategy

In the present systematic review, EMBASE

(Elsevier, 2018), MEDLINE (National Library of Medicine, 2018), Scopus, ProQuest, Web of Science (Clarivate Analytics, 2018b), and Google Scholar databases in the English language were searched for the studies published on the consequences of coronavirus infection among HCWs before 30 March 2020 and then updated to 23 June 2020 using the search strategy presented in Supplement1. The selected keywords for international databases included “Novel Coronavirus Pneumonia”, “Nurses”, “Physicians”, “Medical Staff, Hospital”, “Health Personnel”, and “Community Health Workers”. Supplementary Appendix 1 presents the search strategy of this study. The collected data were entered into the EndNote X7 software, and duplicate articles were automatically deleted. Two authors (M V and FK) conducted the search and data extraction, and no publication date restrictions were imposed. Consultation with the corresponding author (HGh) solved discrepancies and doubts about the sources' relevance. Information such as Positive COVID-19 test percentage, Death COVID-19, Skin damage, Nasal Bridge, Dryness tightness, Papules or erythema, Desquamation, Maceration, Prurigo, Blisters, Rhagades, Exudation crust, Lichenification, Eczema, Rash, Itching, Depression, Anxiety, Insomnia, Distress, Somatization, Obsessive-compulsive symptoms, and PTSD were Extracted and entered Excel software. Figure 1 presents the corresponding PRISMA flowchart.

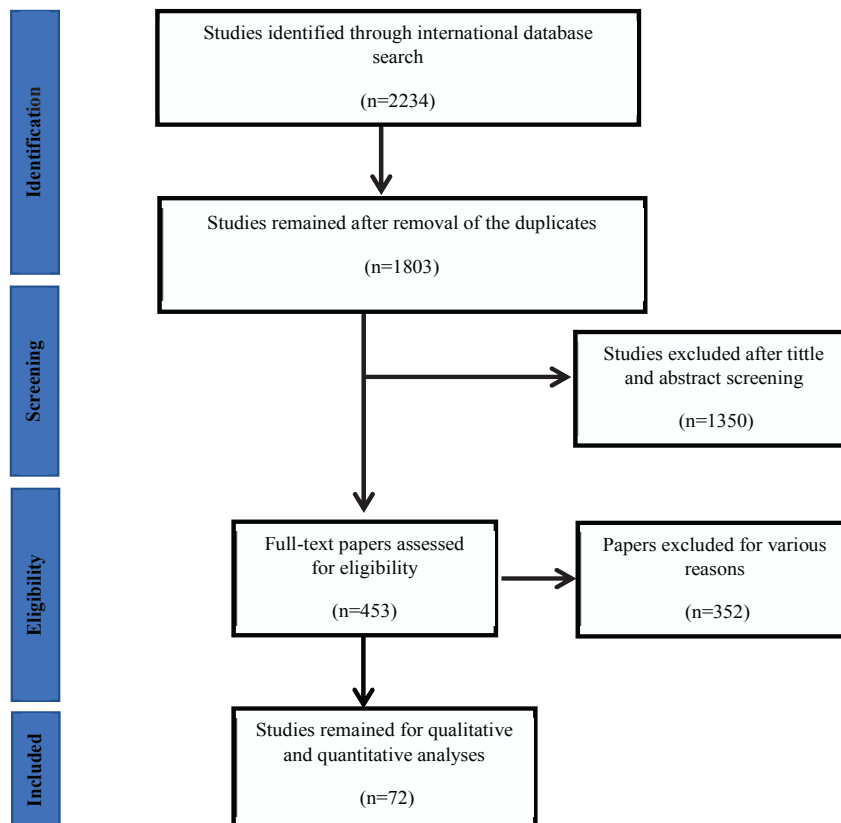


Figure 1: The process of deleting the articles obtained from the search in scientific bases and selecting 72 articles in question.

Inclusion and Exclusion Criteria

All observational studies (cross-sectional, case-control, and cohort) included Physical problems and Psychological stress in this study. The authors excluded reviews reporting no new data, studies investigating one aspect of COVID-19, and studies not available in English. They categorized the remaining studies as longitudinal or cross-sectional for qualitative synthesis (Supplementary Appendix2). It should be noted that the systematic review protocol was not registered due to the urgency of the issue and because minimal available evidence on the topic was anticipated.

Quality Assessment

The authors used The Newcastle-Ottawa checklist to check and control the quality of the articles. This tool consisted of three different sections, namely selection (four questions), comparability (one question), and outcome (three questions). As a result, the final scores could be divided into three categories: good (three or four stars in the selection domain, one or two stars in the comparability domain, and two or three stars in the outcome/exposure domain), fair (two stars in the selection domain, one or two stars in the comparability domain, and two or three stars in the outcome/exposure domain), and poor (zero or one star in the selection domain, zero stars in the comparability domain, and zero or one star in the outcome/exposure domain).⁴ Supplementary Appendix 2 presents the quality assessment results.

Statistical Analysis

The heterogeneity of studies was assessed using the Cochran test (significance less than 0.1) and its composition using i-square statistics. In the case of heterogeneity, the inverse effects model with the inverse variance method was used. The publication

bias was not evaluated because the prevalence as a proportion is always a positive number. Therefore, the asymmetry in the funnel design would not be due to publication bias. All analyzes were performed by STATA software (version 16).

Results

Study Selection

This study examined the implications of COVID-19 disease among HCWs. After searching the named international databases, the authors reviewed 1803 studies out of 2234 studies, and deleted 431 duplicate studies. After the title and abstract reviews, they excluded 1350 articles. Four studies were also included via a manual search, leaving 72 studies for review (Figure 1). It should be noted that the referenced of articles were also reviewed to add related studies. In the screening stages of studies, some articles were excluded for a variety of reasons, including the unrelated topic (N=453), the unrelated population (N=280), inadequate information such as sample size, and confidence interval (N=29). Figure 1 outlines the study selection process in. Figure 2 shows the number of each study reported by country.

Results of Quality Assessment

Based on our results, 35 studies had good quality, and 37 had fair quality. Supplementary Appendix 2 presents the result of the Quality Assessment.

Heterogeneity and Synthesis of Results

The result of the chi-squared test and the i-square index indicated considerable between-study heterogeneity. Except for Rash, i-square is greater than 80% for all variables and $P \leq 0.001$. The authors analyzed data using percentages based on the random effect model. The outcomes were divided

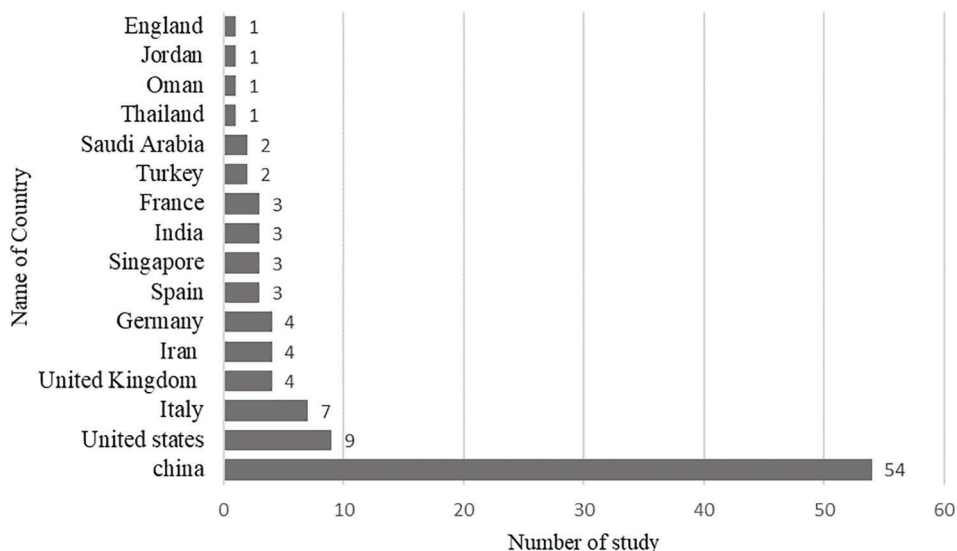


Figure 2: The number of each study reported by country.

Table 1: Result of meta-analysis and heterogeneity of Physical and Psychological Problems of COVID-19 infection in healthcare workers

	Variable	N	Effect estimate (CI)	I ² (%)	P for heterogeneity
Physical problems	Positive COVID-19 test	38	18.47 (10.30-26.63)	100.00	≤0.001*
	Death COVID-19	8	0.35 (0.05-0.64)	99.92	≤0.001*
	Skin damage	15	54.48 (40.54- 68.42)	99.32	≤0.001*
	Nasal bridge	5	58.79 (39.05-78.53)	99.14	≤0.001*
	Dryness tightness	4	58.57 (43.38-73.76)	95.07	≤0.001*
	Papules or erythema	4	40.96 (19.93-61.98)	98.59	≤0.001*
	Desquamation	1	62.2	NR	NR
	Maceration	1	52.9	NR	NR
	Prurigo	1	22.9	NR	NR
	Blisters	1	13.8	NR	NR
	Rhagades	1	13.6	NR	NR
	Exudation crust	1	6.8	NR	NR
	Lichenification	1	5.6	NR	NR
	Eczema	2	32.51 (-2.32-67.35)	97.02	≤0.001*
	Rash	5	20.22 (13.13-27.31)	55.21	0.066*
	Itching	5	44.66 (28.45-60.88)	92.11	≤0.001*
Psychological stress	Depression	22	21.90 (14.70-29.11)	99.59	≤0.001*
	Anxiety	31	20.00 (14.86-25.15)	99.42	≤0.001*
	Insomnia	9	32.03 (22.97-41.09)	98.94	≤0.001*
	Distress	13	29.34 (13.82-44.87)	99.89	≤0.001*
	Somatization	2	0.97 (-0.15-2.11)	84.88	0.0101*
	Obsessive-compulsive symptoms	3	14.79 (-7.09-36.68)	99.84	≤0.001*
	PTSD	4	17.37 (-3.60-38.36)	99.87	≤0.001*

NR: Not reported; *P.value≤0.05; CI: Confidence interval

into two groups, including physical problems and psychosocial stress which have been listed in Table 1. Skin damage (%54.48), Nasal bridge (%58.79) [see Figure 3] and Dryness tightness (%58.57) as physical problems, Insomnia (%32.03) [see Figure 4] and Distress (%29.34) in Psychological stress had the highest percentage among nurses and health workers. Supplementary Appendix 3 presents the forest figures of the variables.

Discussion

This meta-analysis has identified the most common physical and psychological consequences in health workers, which are listed below:

Physical Problems

Rapid spread of COVID-19 has led to a great

number of patients and the widespread shortage of personal protective equipment, exposing the HCWs involved in curing these patients to the infection.²²

The study results showed that the most common physical problems of HCWs include nasal bridge, skin damage, dryness, tightness, and erythema. This finding was consistent with studies by Jiajia Lan and Yan Y.^{23, 24} P. Lin et al. also reported that the most common skin problems among HCWs and the individuals struggling with drought were papules, erythema, and maceration. These complications were detected among 74% of the study participants. In that study, hands, cheeks, and nose bridge were the most common areas affected with skin problems.²¹ Also, itching, rash, and eczema were other physical problems of HCWs consistent with many studies.^{25, 26} During the struggle of HCWs against COVID-19, their skin is prone to damage, which may cause

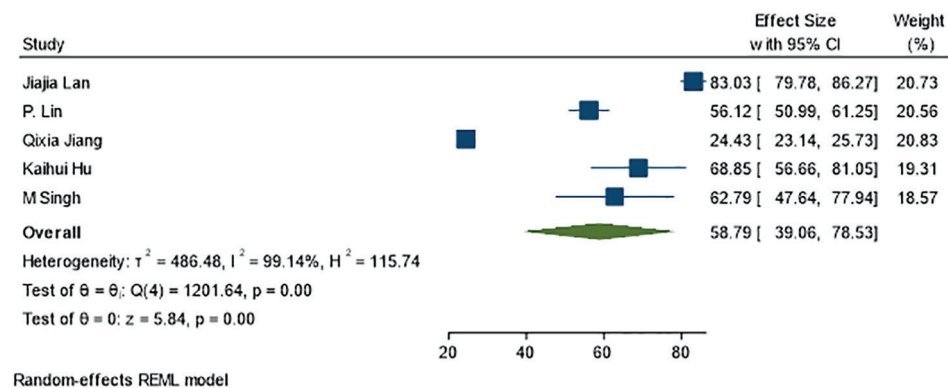


Figure 3: Forest plot nasal bridge percent infection in healthcare workers.

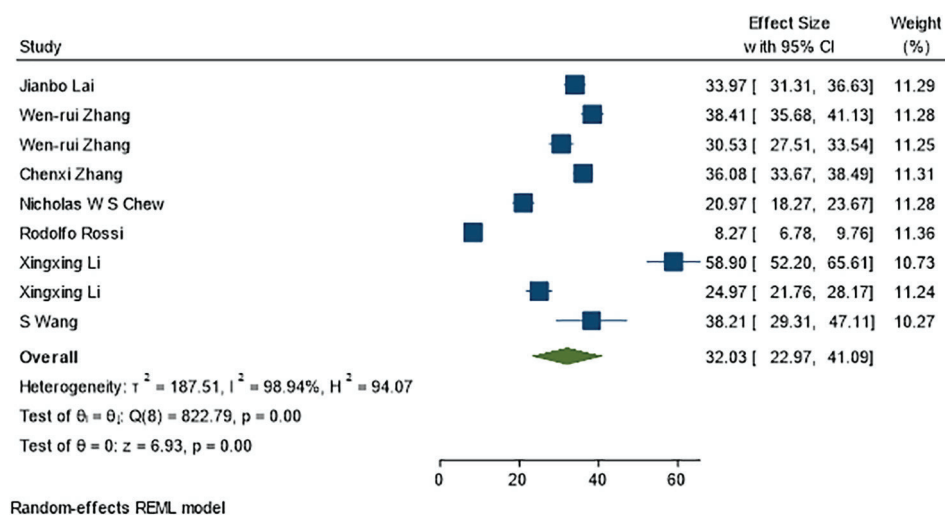


Figure 4: Forest plot insomnia percent infection in healthcare workers.

acute and chronic dermatitis, secondary infections, and exacerbation of underlying skin diseases. Thus, Chinese experts agreed that employees should follow the standards for wearing protective equipment, especially sterile materials. Insufficient or excessive protection can adversely affect the skin and mucous membranes. Hence, moisturizing products have been highly recommended to achieve better protection.²⁷ One study showed that 98% of the medical staff suffered from a skin lesion, the most common nose bridge, dryness and stiffness of the skin, and the skin’s desquamation.⁷ Therefore, the results of these studies were similar to the current study’s findings.

Psychological Stress

The results showed that the most common psychological problems among HCWs are insomnia, distress, depression, anxiety, and PTSD. This finding was consistent with studies by Lai J and Zhang W-r.^{28,29} Lu et al. reported that the medical staff working in the respiratory, emergency, mental illness, and intensive care units were more psychologically susceptible and more likely to experience fear and anxiety,³⁰ similar to the present study. A study performed among nurses and nursing students in China revealed that females were more anxious and fearful than males. Another research showed that COVID-19 had adverse psychological effects in addition to the risk of mortality. Studies in other parts of the world also indicated that the increasing prevalence and limitations enhanced anxiety.³¹⁻³⁴ These studies were similar to the findings of the present study. Understanding the psychological impacts of the outbreak of these diseases on HCWs, especially in hospitals, is important in planning for emerging epidemics. The previous studies demonstrated that the outbreaks of SARS and MERS were stressful for HCWs. In these studies, HCWs showed considerable psychological distress, stress, and burnout.³⁵⁻³⁷ Maunder R et al. also found that 29-35% of the hospital

staff experienced high distress levels. This disorder’s underlying causes were nursing, contact with SARS patients, having children, and longer shifts.³⁸ A study carried out during the MERS outbreak showed that 28.1% of the physicians experienced the symptoms of depression, and 7.8% showed the symptoms of stress even if the MERS infection was controlled. Working in a hospital with MERS cases had adverse consequences for physicians.³⁹ In another study conducted in Taiwan during the SARS outbreak, an improvement was observed in the nursing staff’s anxiety, depression, and sleep quality two weeks after the epidemic. In that study, nurses were anxious and depressed and could not sleep during the SARS epidemic. However, higher family support was associated with lower anxiety levels.¹¹

Different communities’ lack of compliance with health guidelines leads to an increase in the number of patients who impose a lot of work pressure on HCWs, making them infected. Therefore, Conducting these types of studies to prepare appropriate instructions is necessary.

Strengths and Limitations of the Study

This study used all previous studies that addressed this issue directly and indirectly. In addition, we simultaneously examined the physical and psychological effects on health workers. One of the disadvantages of this study was its high heterogeneity due to the wide range of studies.

Conclusion

The current study demonstrated that the treatment staff was prone to multiple outcomes, including physical problems and psychological stress, during the COVID-19 pandemic. Moreover, personal protective equipment could expose them to skin damage, such as dryness, stiffness, numbness, papules, and erythema. COVID-19

also caused psychological problems and increased stress and anxiety. Therefore, the treatment staff's awareness and training about the unwanted side effects of these diseases should be considered in educational programs in different countries because the continuity of control and patient care depends on the treatment staff's availability.

Suggestion

Do not use high-percentage alcohol for frequent hand washing because it causes skin damage.

Follow continuous training to prevent physical and psychological complications in health workers.

Acknowledgment

The authors would like to thank Ms. A. Keivanshekouh at the Research Improvement Center of Shiraz University of Medical Sciences for English language edition of the manuscript. The present study was financially supported by Shiraz University of Medical Sciences (grant No.99-01-106-22190 and Approval Number Ethics IR.SUMS.REC.1399.063).

Authors' Contributions

HG is the leading author and guarantor. MV, AA, ZM, and FK planned the study and carried out the manuscript's drafting and revising. MV, SA, AM contributed to interpreting the data and drafting and revising the manuscript. All authors approved the submitted version of the manuscript.

Conflicts of interest: None declared.

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