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ISSN: 2642-0147

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The Risk Factors of COVID-19 Transmission in Health Workers: A Literature Review

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Received Date: April 11, 2021; **Published Date:** April 24, 2021

Abstract

The transmission of COVID-19 among health personnel was a significant problem occurring around the world. The study's purpose was to explain the risk factors for transmission and prevention of transmission of COVID-19 to health workers.

Methods: A literature review searched four databases (Scopus, Science Direct, Proquest, and PubMed) searches were conducted in July and August 2020. The Prisma checklist guided this review. Data tabulation and narrative analysis of the study was performed. Title, abstract, full text, and methodology were assessed for the eligibility of the studies.

Results: We found seventeen studies that matched the research criteria. The study was divided into two themes, namely risk factors for transmission of COVID-19 to health workers (n=8) and prevention of transmission (n=3) and the study of both (n=6). Risk factors for transmission of COVID-19 to health workers included age, improper hand washing, comorbidities, lack of sleep quality, lack of knowledge and training, work stress, close contact or exposure to positive COVID-19 patients, lack of PPE, workload, climate, temperature, and humidity. Whereas ways to prevent are keeping hand hygiene, physical distancing, using PPE, traffic control bundling, adhering to standard precautions, providing education and training, changing hospitals or health facilities operations, and conducting rapid tests and PCR tests to all staff and patients.

Conclusion: It can be concluded that there are 9 risk factors for transmitting COVID-19 to health workers, and 6 ways to prevent transmission of COVID-19 to health workers.

Keywords: COVID-19; Risk Factors; the Factor of Transmission; Prevention; Health Worker; Literature Review

Abbreviations: PPE: Protective Equipment; PPI: Infection Prevention and Control; COPD: Chronic Obstructive Pulmonary Disease; TCB: Traffic Control Bundling.

Introduction

The COVID-19 is quickly spreading because of its human-to-human transmission through droplets of coughs and sneezes and aerosols. Close contact is one of the risk factors for transmission of COVID-19 to health workers [1] another cause of transmission of COVID-19 is the lack of availability of personal protective equipment (PPE) or improper use and removal of PPE [2] of the various factors of transmission of COVID-19 to health workers, it is necessary to carry out a literature study to resolve the risk factors for transmission of COVID-19 and ways to prevent the transmission.

Transmission to health workers in America reached 370 people per 10,000 cases with the mortality rate for health workers reaching 5% [3]. Case reporting on September 22nd, 2020 the number of positive cases of COVID-19 worldwide reached 30,949,804 cases with a CFR of 3.1% while in Indonesia the total number of confirmed cases of COVID-19 was 248,852 cases with a CFR of 3.9%. There were 25,000 cases of COVID-19 among health workers worldwide, consisting of doctors, nurses, midwives, analysts, pharmacies, and others [4]. The Indonesian COVID-19 Task Force reported that for every 100 deaths, around 6-8 of the deaths were number fatalities from the health workers. Data entered on August 1st, 2020; the number of deaths of health workers in Indonesia due to COVID-19 was 153 cases.

The cause of transmission of COVID-19 to health workers does not only occur when contacting positive COVID-19 patients but also occurs due to contact between colleagues and contacts outside of hospital regulations, for instance during lunch breaks and meetings. Also, health workers work in confined spaces that do not allow physical distancing, [5] health workers also gather without wearing masks and remove the PPE improperly [3]. The virus entering the respiratory tract if a person touches the face and nose without prior washing hand [6]. The impact of COVID-19 transmission on health workers including increased anxiety, fear of negative community stigmatization, increased workloads with insufficient resources and substandard implementation of infection prevention and control (PPI) [7] and inadequacy of health facilities and health workers that accommodate and provide care [8]. Besides, health workers are concerned that the infection will not be limited to their selves but also their colleagues and family members [9].

The increase in transmission of COVID-19 to health workers continues to increase from time to time even though prevention efforts have been made. According to the results of previous research conducted in South Africa, the risk factors for transmission of COVID-19 to health workers are age, immunity of health workers, and comorbidities such as hypertension, diabetes mellitus, cardiovascular disease, and chronic obstructive pulmonary disease (COPD) [10]. Transmission of COVID-19 to health workers can be prevented or minimized. Therefore, the author was interested in conducting literature reviews to analyse the risk factors for transmission of COVID-19 to health workers and prevent or minimize transmission to protect health workers from COVID-19 infection.

Methods

Source of Information

The author searched for articles in four databases, namely Scopus, Science Direct, Proquest, and PubMed with the research topic being risk factors for transmission and prevention of COVID-19 to health workers. Article searches were conducted from July to August 2020.

Search Term in Survey

Literature search used keywords and Boolean operators (AND, OR NOR or AND NOT). The keywords used in the literature search namely “Risk factors” OR “Factors” OR “Causa *” AND “Transmission” OR “Disease transmission” OR “Infection transmission “AND” Preventive “OR” Prevention and control “OR” Universal precaution “AND” COVID-19 “OR” 2019-nCOV “OR” Sars Cov-2 “OR” Novel Coronavirus “AND” Health care workers “OR” Health care professional “OR” Medical Staff “.

Selection Criteria

Inclusion criteria were according to the PICOS framework. Based on the results of literature searches through publications in four databases and using keywords that have been determined by MeSH, the authors obtained 939 journals that matched the keywords. There were 458 duplicated articles hence excluded from the list and the remaining 481 articles were screened and found that as many as 17 articles matched the research objectives to be reviewed.

Results of the Search for Source Material

This literature review study included 17 journals that passed the screening according to predetermined criteria. The journals were following the problems and specific research objectives, namely discussing the transmission and prevention of transmission of COVID-2019 to health workers.

No	First Author & Country	Title	Design and Sample	The Result of Factor Analysis	Database
1	Steensels, et al. [19] Belgia	Hospital –Wide SARS-Cov Antibody Screening in 3056 Staff in a Tertiary Center in Belgium	**Design**: Cross-sectional Study Sample 3065 Medical Staff in Belgium	Close contact, insufficient PPE availability, Prevention was carried out by screening with a rapid test	Science Direct Q1-indexed Journal
2	Al-zoubi, et al. [2] Jordania	Prevalence of positive COVID-19 among asymptomatic health care workers who care for patients infected with the novel coronavirus	**Design**: Retrospective Study and prevalence Sample: 370 Health care workers at King Abdullah University Hospital	Close contact Prevention was carried out using a PCR test on all staff	Scopus Q3-indexed Journal
3	Tabah, et al [30]. Australia	Personal protective equipment and intensive care unit healthcare worker safety in the COVID-19 era	**Design**: International Survey dan prevalence Sample: 2711 Health care worker	Lack of Knowledge and Training. Prevention can be done by providing education and training	Scopus Q1-indexed Journal
4	Haberman, et al. [14] USA	COVID-19 in Patients with Inflammatory Arthritis: A Prospective Study on the Effects of Comorbidities and DMARDs on Clinical Outcomes	**Design:** Prospective cohortSample:103 patients in New York	Age, autoimmune and comorbid diseases.	Science Direct Q1-indexed Journal
5	Barrett, et al [1]. USA	Prevalence of SARS Cov-2 Infection in previously undiagnosed health care workers at the onset of the U.S. COVID-19epidemic	**Design**: Prospective cohortSample:829 HCW in the USA	Close contact	Science Direct Q1-indexed Journal
6	Dioscoridi L, et al. [15] Italy	COVID-19 exposure risk for family members of healthcare workers	**Design**: Observational Study dan Case Report Sample: 38 Health workers and 81 Family Health workers	Insufficient availability of PPE, exposed to many undiagnosed cases.	Scopus Q1-indexed Journal
7	Sikkema, et al. [12] Netherlands	COVID-19 in health-care workers in three hospitals in the south of the Netherlands: a cross-sectional study	**Design**: Cross-sectional Study Sample: 12.022 Health workers	Close contact, foreigners with travel history, community contacts/ mass gatherings, prevention can be done by carrying out screening for Sars Cov-2 to patients and health workers.	PubMed Q1-indexed Journal
8	Ran, et al. [20] China	Risk Factors of Healthcare Worker with Corona Virus Disease 2019	**Design**: Retrospective Cohort Study Sample: 72 health workers	Lack of hand hygiene, improper use of PPE, excessive workload. Prevention can be carried out by having a high level of hand hygiene and reducing working hours.	PubMed Q1-indexed Journal

9	Wang, et al. [8] China	Super factors associated with the transmission of occupational COVID-19 infection among healthcare staff in Wuhan, China	**Design**: Cross-Sectional Study Sample: 92 Health care staff	Using the mask improperly, touching the cheeks, nose, and mouth while working, wearing incorrect or damaged PPE, being exposed to COVID-19 patients	Science directQ1-indexed Journal
10	Lahner, et al. [13] Italy	Prevalence of Sars-Cov-2 infection in health workers (HWs) and diagnostic test performance: the experience of a teaching hospital in central Italy	**Design**: Cross-Sectional Study Sample: 2.057 Health workers in Italy	Age, exposure to Sars Cov-2 patients, and longer working hours The prevention are by reducing working hours.	Proquest Q1-indexed Journal
11	Bhagavathula, et al. [33] India	Novel Coronavirus (COVID-19) Knowledge and Perceptions: A Survey of Healthcare Workers in India	**Design:** Cross-Sectional Study Sample: 453 Health workers	Low level of knowledge and perception of COVID-19.	PubMed Q1-indexed Journal
12	Powell-Jackson, et al. [21] Tanzania	Prevention and control compliance in Tanzanian outpatient facilities: a cross-sectional study with implications for the control of COVID-19	**Design:** Cross-sectional study Sample : 734 outpatient health workers in Tanzania	Prevention can be carried out bythe implementation of standard precautions	Science direct tQ1-indexed Journal
13	Celebi, et al. [16] Turkey	Specific risk factors for SARS-CoV-2 transmission among health care workers in a university hospital in turkey	**Design:** Case-Control StudySample:703 Health care workers	Improper use of PPE, failure to maintain physical distance.	Science directQ1-indexed Journal
14	Schwartz, et al. [7] Taiwan	Protecting Health Care Workers during the COVID-19 Coronavirus Outbreak -Lessons from Taiwan's SARS response	**Design:** Quasi-experimentSample:18 hospitals as a treatment group and 33 hospitals as a control group	The prevention is by implementing Traffic Control Bundling (TCB) and physical distancing.	PubMed Q1-indexed Journal
15	Bai, et al. [8] China	SARS Cov-2 Infection in Health care workers	**Design**: Retrospective Study/Case Report Sample: 118 Health workers in Wuhan China	Working night shift (low sleep quality) and working under pressure (work stress), working in a COVID-19 isolation room.	ProquestQ1-indexed Journal
16	Altamimi, & Ahmed et al. [17] Saudi Arabia	Climate factors and incidence of Middle East respiratory syndrome coronavirus	**Design:** Retrospective/ Cohort Study Sample: 712 cases of Mers Cov in Riyadh, Saudi Arabia	Climate, temperature, and humidity.	Science DirectQ2-indexed Journal
17	Gonzalez-Ciccarelli, et al. [22] USA	Surgery Cases Reducing the transmission of COVID-19 using a continuous negative pressure operative field barrier during oral maxillofacial surgery	**Design:** A case report Sample: patient suffering left maxillary sinus lesion and positive COVID-19	Prevention can be carried by placing COVID-19 patients in rooms with negative pressure	ScopusQ4-indexed Journal

Table 1: The Result of the Literature Search.

These seventeen journals were divided into 2 major themes, namely risk factors for transmission of COVID-19 and factors for the prevention of transmission of COVID-19 to health workers, 8 studies discussed risk factors for transmission of COVID-19, 3 studies discussed factors for preventing transmission and 6 studies addressed both. The results of a literature search can be seen in Table 1.

Seventeen articles found by the author in four databases were all published in 2020 with different study designs, namely cross-sectional study, prevalence study, cohort study, case report, case-control study, and quasi-experimental study.

Results

Risk Factors for Transmission of COVID-19 to Health Workers

Optimal nursing care services are influenced by man, material, method, money, and quality factors [11]. The risk factors that affect the transmission of COVID-19 to health workers are influenced by human, material, and method factors. The risk factors for transmitting COVID-19 to health workers can be seen in Table 2. Based on Table 2, the risk factors for transmitting COVID-19 to health workers are age, lack of hand hygiene, comorbidities and autoimmune, low sleep quality, work stress, lack PPE, climate, temperature, and humidity, workload, and close contact and exposure to a positive patient with COVID-19.

Author	Transmission Factor		
	Man	Material	Method
Steensels, et al. [19] 2020	Age, inappropriate use of PPE	Exposure to co-workers who are positive for COVID-19, insufficient availability of PPE	Weak implementation of PPI.
Al-zoubi, et al. [2] 2020	-	Contact with COVID-19 patients or coworkers.	High workload, incorrect use, and removal of PPE.
Tabah, et al. [30] 2020	Lack of knowledge and training	-	-
Haberman, et al. [14] 2020	Age, autoimmune and comorbid diseases	-	-
Barrett, et al. [1] 2020	-	Close contact with COVID-19 patients	Work as a health worker.
Dioscoridi L & Carrisi C, 2020	-	Exposure to many undiagnosed cases	Lack PPE
Sikkema, et al. [15] 2020	-	Through unknown people with travel history, contact with communities/ mass gatherings, nosocomial infections	-
Ran,et al. [1] 2020	Lack of hand hygiene before and after patient contact	-	Improper use of PPE, risk of contracting the disease when working 15 hours per day.
Wang, et al. [8] 2020	Improper use of masks, close contact, touching cheeks, nose, and mouth while working	Exposure to Sars Cov-2 patient	Incorrect use of PPE, using damaged PPE.
Lahner, et al. [13] 2020	Age, improper hand washing before or after patient contact.	Exposure to Sars Cov-2 patient	Longer working hours.

Bhagavathula, et al. [33] 2020	Low level of knowledge and perception of COVID-19	-	-
Celebi, et al. [16] 2020	-	-	Incorrect use of PPE when treating patients with COVID-19 infection and unable to maintain physical distancing.
Bai, et al. [8] 2020	Low quality of sleep, working under pressure (work stress)	-	Workload and work in COVID-19 isolation rooms.
Altamimi, Asmaa & Ahmed, Anwar E, et al. [17] 2020	-	Climate, temperature, and humidity	-

Table 2: Risk Factor of Transmission of COVID-19 on Health Workers.

Age, an older people have comorbid that make them fall into an immunocompromised condition that is very susceptible to contracting COVID-19 [12]. Lack of hand hygiene, one of the risk factors for being infected with COVID-19 is less than optimal hand washing before and after contact with patients [13]. Comorbidities and autoimmune, patients with arthritis and taking oral glucocorticoids were more likely to be treated for COVID-19 [14]. Low sleep quality, Health workers who test positive for COVID-19 have a significantly higher total PSQI score than the PSQI for uninfected [8].

Work stress, the stress level of health workers is also a risk factor for the transmission of COVID-19 [8]. Lack PPE, the use of PPE is not appropriate because it has low PPE availability [15,16]. Climate, temperature, and humidity, is associated with increased viral activity in the Mers Cov incidence [17]. Workload, excessive or high workload results in fatigue of the health worker [18]. Close contact and exposure to a positive patient with COVID-19, health workers are exposed to positive co-workers who don't know they are positive for COVID-1919and are exposed to many undiagnosed cases [15].

Prevention Factors of Transmission of COVID-19 to Health Workers

Prevention of transmission of COVID-19 to health workers is influenced by man, material, and method factors. Based on the study results found by the author, these factors can be seen in Table 3. Based on Table 3, the factors for preventing the transmission of COVID-19 to health workers are hand hygiene, PPE, standard precaution, physical distancing, provision of education and training, and negative pressure room.

Author	Preventive Factor		
	Man	Material	Method
Steensels, et al. [19] 2020	Using PPE	-	Implementation of a rapid test on all patients and staff.
Al-zoubi, et al. [2] 2020	Using PPE	Availability of PPE	Screening by carrying out a PCR test.
Tabah, et al. [30] 2020	Using PPE level 3	Availability of PPE	Providing education and training on the use of PPE, PPI training.
Sikkema, et al. [15] 2020	Using PPE level 3	-	Screening of Sars Cov-2 in patients and healthcare workers.
Ran, et al. [1] 2020	Hand hygiene	-	Reducing working hours, removing health workers with comorbid from serving patients but working as administrative officers.
Wang, et al. [8] 2020	Wearing a mask, keeping physical distance, avoiding the mass gathering	Availability of PPE	-
Lahner, et al. [13] 2020	-	-	Decreasing the working hours.

Jackson, et al. [19] 2020	Hand hygiene	Using hand gloves	Implementation of PPI or standard precautions, disinfection of equipment, sewage treatment.
Schwartz, et al. [7] 2020	Self-isolation		Implement Traffic Control Bundling (TCB) and Physical distancing.
Gonzalez-Ciccarelli, et al. [22] 2020	-	Negative pressure room	-

Table 3: Factors for Preventing the Transmission of COVID-19 to Health Workers.

Hand Hygiene, maintain hand hygiene by washing hands frequently and not touching the nose, mouth, and eyes before washing hands, covering mouth when sneezing or coughing [18,19]. Adhere to hand hygiene and the use of gloves [20]. PPE, one of the steps to prevent infection transmission is to provide and wear PPE [2,21]. Standard precaution, perform high touch point disinfection throughout the hospital at least 3 times a day, wearing PPE according to the procedure to be performed [21]. Disinfection of reusable equipment, sewage treatment [20].

Physical Distancing, provide health services without direct contact with patients [7]. Provision of education and training; educate health workers about how to care for COVID-19 patients, about hand hygiene, how to put on and take off the correct PPE and the types of PPE used [2]. Negative pressure room, the negative pressure chamber will clean the aerosol particles of the room with negative pressure circulating 33 cubic feet will remove 99.999% of 0.1 μm particles or larger [22].

Discussion

Risk Factors for Transmission of COVID-19 to Health Workers

Based on the results of the review of articles conducted by the author, it was found that the human factors that affected the transmission of COVID-19 to health workers are age, lack of hand hygiene, low quality of sleep, and stress. Age affects the transmission of COVID-19 to health workers [13,14]. The infection progresses faster in older age due to decreased endurance, for instance, due to comorbidities [23]. The difference in the morbidity of infectious disease in various age groups, apart from being influenced by immune factors, is also influenced by other factors such as employment, education, and population migration [24,25]. Following this statement, age affects the transmission of COVID-19. The impact of COVID-19 on people of older age with comorbid and autoimmune symptoms is a more severe condition and a greater risk of death. Health facility management should understand the age structure and comorbid status of their health workers, to obtain the data of health workers included in the vulnerable group during the pandemic.

Most of the research states that hand hygiene is a factor affecting the transmission of COVID-19 to health workers. This is expressed in their respective researches [13,19]. Based on the results of the study, it is shown that the transmission of disease through the hands orally can be prevented by washing hands using soap and running water before or after carrying out activities.

The low sleep quality of health workers leads to a greater risk of being infected with COVID-19 [8]. Sleep quality can be described by the length of sleep and the complaints felt during sleep or after waking up [26]. Sleep quality was assessed using the PSQI [8]. The study did not include data on the immunity and health status of respondents, therefore it is necessary to conduct research. Furthermore the stress level of health workers is also a risk factor for the transmission of COVID-19 [8]. Stress is the body's response or the body's reaction in the face of a threat and pressure [27]. Based on the results of the review of the article, it is stated that the high level of stress for health workers treating patients confirmed positive for COVID-19 is due to the stigmatization that health workers are carriers of the virus, therefore optimal support is needed from the management of health facilities, the community, as well as family.

Based on the results of the review of the article, material factors that affect the transmission of COVID-19 are exposure to COVID-19 patients, the environment, temperature, climate, and humidity. The environment referred to in the research is the patient care room and the community environment. The environment that is suspected of contributing to the transmission of COVID-19 includes temperature in the air, air pollution, particulates, humidity, and weather [17]. The family environment is a factor in the transmission of COVID-19, if one of the family members is infected, other family members may also be infected [28]. Based on the results of the review of the article, the authors state that health workers are already proper in wearing and removing PPE following the SOP and existing protocols, but health workers are at risk of infection or exposure in the family environment or outside health facilities because they do not wear PPE.

Method factors that affect the transmission of COVID-19 are the lack of PPE availability and workload. Based on research conducted by Valdivia-Granda & Richt (2020) that states many doctors contracted COVID-19 due to errors in using PPE. But this is not entirely proven, indicated by the presence of health workers infected with COVID-19 from their family environment, and the problem of lack of PPE. Some health workers also wear substitutes that have the same function as PPE, such as raincoats and face shields from plastic covers [29].

The workload is related to working hours and activities carried out [11]. Based on the results of the study, it can be stated that the workload of health workers increases during the pandemic because they have to wear PPE, comply with protocols and SOP in providing care to patients confirmed positive for COVID-19. Deemed monotonous, using PPE and the effects of using it such as heat, stuffiness, tightness, and blurry vision for long periods can be stressful. Based on this statement, it was found that the increasing workload of health workers is due to their duties to provide care to the patient and to protect themselves from exposure to COVID-19. The consideration of working hours and workload is very important as an effort to prevent transmission to health workers.

Factors to Prevent Transmission of COVID-19 to Health Workers

Based on the results of the review of the article, the factors preventing the transmission of COVID-19 in terms of human factors are hand hygiene and physical distancing. Hand hygiene is one way to break the chain of disease transmission [24]. Health workers can bring the virus home and infect the family or spread the virus to the restroom for officers and other patients [9]. Based on the results of the study, it is important to not wear jewellery such as rings and bracelets because the possibility becomes a living spot for microorganisms, therefore hand hygiene procedures can be carried out optimally.

Material factors that can prevent the transmission of COVID-19 are the use of PPE, placing patients in negative pressure rooms, and implementing Traffic Control Bundling (TCB). The use of PPE is important in efforts to prevent transmission. Personal protective equipment commonly used by health workers consists of surgical masks, white or green cotton gowns, headgear, protective goggles, gloves, and disposable protective gowns, for low-risk patients [2,12,21,30]. The use of gloves is highly recommended to prevent transmission by touch [31]. Based on the results of the analysis, it can be shown that PPE at health facilities is readily available and health workers already understand the importance of its use.

The room used in the care of patients with COVID-19 must have special standards such as negative pressure and open to free air [22]. Method factors in preventing COVID19 are changes in health facilities operations, implementation of PPI or standard precautions, implementation of rapid tests and mass PCR tests, and providing education and training to health workers. The government has made various efforts to prevent the transmission of COVID-19 by providing PPE according to standards, implementing infection prevention and control, providing training to health workers on how to provide care to COVID-19 patients, clean hands, use and remove the PPE and types of PPE used, implementation of rapid and PCR tests on health workers with close contact with patients confirmed positive for COVID-19. The government also has made policies on the health and protection of health workers. Health workers that experience illness may take sick leave. Working time is set with a maximum of 40 hours a week with a daily work time of 7-8 hours and not exceeding 12 hours. There should be a monitoring of the health aspects of workers and a feasibility assessment work for officers with comorbidities and special conditions. Finally, there is banning for visitors and watchmen for COVID-19 patients [32].

Knowledge plays a role in the transmission and prevention of COVID-19 [30,33]. The knowledge expressed in the research includes knowledge of transmission, proper and correct use of PPE, and negative perceptions of COVID-19. Health workers that handle COVID-19 only rely on the experience of handling patients with infectious diseases by using PPE and washing hands as a preventive measure [30]. Based on the results of the review of articles, there is a need to increase the knowledge of health workers by conducting education and training related to COVID-19 through an online system. The COVID-19 pandemic has resulted in changes in the use of PPE. COVID-19 is a new disease for which until now there has been no detailed explanation regarding the most effective mechanisms and handling. This situation affects the knowledge of health workers therefore it is necessary to train all staff, not only health workers about hand hygiene and the use of PPE. Based on the results of the review of the articles found by the author, the factor that shows the greatest urgency for the transmission of COVID-19 to health workers is due to exposure or close contact with positive COVID-19 patients outside of health facilities in which health workers do not wear PPE.

Study Limitation

The limitation associated with this review is the potential for publication bias because the studies included only limited to those found by the author, therefore it was lacking factors studied and other factors were not found by the authors. Besides, the studies conducted not in all countries with most

of them were from countries that discovered the virus much earlier, namely in Wuhan, China and in a country with a high number of COVID-19, namely the United States. More specific aspects related to policies for preventing the transmission of COVID-19 to health workers need to be considered for the application of interventions in health facilities and much more research is needed to determine the most appropriate steps in efforts to prevent COVID-19 transmission [34].

Conclusion

The risk factors for transmission of COVID-19 to health workers namely age, comorbidities, autoimmune, lack of hand hygiene, and lack of PPE availability, close contact or exposure to patients positive for COVID-19, sleep quality, lack of knowledge and training, stress, workload, climate, temperature, and humidity. The factors for preventing the transmission of COVID-19 to health workers are hand hygiene, maintaining physical distance, wearing PPE, traffic control bundling, implementing PPI or standard precautions, providing education and training, changing health facilities operations, and implementing rapid tests and PCR tests on all health facilities staff and patient and placing the patient in a negative pressure room.

Based on the conclusion, two things can be suggested:

- For health workers to better comply with health protocols, increase immunity by consuming nutritious foods, vegetables, and fruit, have adequate rest, and perform regular exercise
- For the government and management of health facilities, it is important to provide PPE according to the implementation standards for infection prevention and control, provide training to health workers, reducing workload by reducing working hours, providing vaccines to health workers with to close contact with COVID-19 patients, and conducting PCR tests on all staff working in health facilities.

Acknowledgment

The authors would like to thank the Faculty of Nursing, Universitas Airlangga Surabaya, for allowing the reworking of this manuscript to be published in the form of scientific articles.

Conflict of Interest

No potential conflict of interest was reported by the authors. The authors alone are responsible for the views expressed in this publication, and they do not necessarily represent the views, decisions or policies of their institutions.

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