

EXPLOSION OF THE NUMBER OF HEALTHCARE WORKERS' DEATHS DUE TO COVID-19 IN INDONESIA: WHAT HAPPENED?

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Abstract

Background: The number of healthcare workers in Indonesia who died due to COVID-19 infection has been increasing. The present study aims to calculate the case fatality rate (CFR) of healthcare workers in Indonesia who are exposed to COVID-19 compared with that in other countries. The present study also aims to identify and describe the main causes of the large number of healthcare workers exposed to COVID-19. **Methods:** The number of healthcare workers who are exposed to COVID-19 and died, confirmed positive cases, and the total number of deaths in 12 countries were collected and processed to calculate the healthcare workers safety index (HSWI). Several reports were used as sources to identify the factors causing healthcare workers to be exposed to COVID-19 and death. **Results:** The COVID-19 CFR calculation for all confirmed positive cases of healthcare workers in Indonesia was 0.517. The proportion of healthcare worker deaths to the number of all deaths due to confirmed positive COVID-19 cases was 6,144, and the HSWI was 3,331. The calculation results of these three parameters in Indonesia are the highest among those in the 12 countries studied. Some factors that caused the high CFR of COVID-19 in the present study include the inadequate protection of healthcare workers, prolonged direct contact in exhaustion conditions due to workload and psychological pressure, lack of standard personal protective equipment (PPE), and lack of knowledge and practice of Infection Prevention and Control among healthcare workers. **Conclusion:** Healthcare workers in Indonesia are at the highest risk of exposure to COVID-19 and death worldwide, due to lack of available PPE that meets the standard.

Keywords: COVID-19, PPE, WHO, Plague, Pandemic, Healthcare Workers, Death.

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic outbreak that was sweeping the world has become a nightmare and a dark period for human civilization in the early 21st century. Based on the data that was last updated on April 30, 2020, at 03:32 AM, there were already 3,179,494 confirmed cases of the pandemic in 185 countries with a total of 226,173 deaths [1]. In Indonesia, based on the official data from the Task Force for the Acceleration of COVID-19 Handling on April 29, 2020, there were 9,771 confirmed cases with a total of 784 deaths [2]. The official data publication also showed that 7,596 cases are still being treated and 1,391 cases have recovered. The high number of treated cases, i.e., 77.74% of all confirmed cases, should be given particular attention [2]. This number is very important as it shows the loads of services that hospitals and other healthcare facilities have to bear. One important element of in-hospital services is the availability and readiness of human resources, i.e., healthcare workers. Loads of services in hospitals will be linear with the workload of healthcare workers. No official data have been published by the National Task Force for the Acceleration of COVID-19 Handling in Indonesia, a special team organized by the president in early March 2020, regarding the number of healthcare workers exposed to or died due to COVID-19, but it

is estimated to be very large. Every day, a spokesman of the special team updates on the latest developments of confirmed positive cases, deaths, and recoveries. The data on the number of healthcare workers exposed to and died due to COVID-19 were mixed with other data. However, the data regarding exposure of healthcare workers to the disease can be obtained from the regional health authorities (Regional Government and Regional Task Forces).

Official data from the Jakarta Provincial Government on April 10, 2020, stated that 161 healthcare workers in Jakarta were exposed to COVID-19 [3]. In Bogor City Hospital, 51 healthcare workers were exposed to COVID-19; hence, the hospital had to be temporarily closed [4]. The same condition occurred in Cirebon City Hospital, which temporarily stopped its emergency services after nine healthcare workers were tested positive for COVID-19 [5]. Another case also occurred at Dr. Kariadi Hospital, Semarang, Central Java, with 57 healthcare workers who were tested positive for COVID-19 after having close contact with a dishonest patient. The healthcare workers eventually had to undergo isolation in a hotel owned by the Government of Central Java Province [6]. Similarly, the results of tracing conducted until April 15, 2020, in East Java Province, found that 46 healthcare workers have been exposed to COVID-19 [7]. Data from various sources collected show the high number of healthcare workers exposed to COVID-19. Furthermore, the data are still dynamic, so cases are still very likely to increase.

Although there were no official publications or press releases from the healthcare authorities regarding the number of healthcare workers exposed to and those who died due to the disease, data can be obtained officially from professional organizations of healthcare workers. Three professional organizations in Indonesia actively provide official data publications, namely, the Indonesian Doctors Association (Ikatan Dokter Indonesia, IDI), the Indonesian Dental Association (Perhimpunan Dokter Gigi Indonesia, PDGI), and the Indonesian National Nurses Association (Perhimpunan Perawat Nasional Indonesia, PPNI).

The only official statement from the government was obtained from the Chairperson of the National Task Force in a working meeting forum with Indonesian Parliament commission VIII on April 6, 2020, which stated that more than 20 doctors, who all worked at the forefront to serve COVID-19 patients, died [8]. The Chairperson of the Indonesian Doctors Association (IDI) in an interview with Tempo Magazine, April 18, 2020, edition, stated that 24 doctors died until April 17, 2020. The IDI's Chairperson acknowledged that such data were obtained verbally from a colleague or healthcare facility institution and then performed tracking to determine the connections of the doctors who died due to COVID-19. IDI then forms an audit team to finally verify the accuracy of the data obtained to confirm that the doctors died due to COVID-19 [9]. Twenty-five doctors died until April 30, 2020.

As per the official announcement by the Chairperson of the Indonesian Dental Association (PDGI) on April 7, 2020, six dentists died due to COVID-19 [10]. The Chairperson of the Indonesian National Nurses Association (PPNI) provided official data that, until April 20, 2020, 16 nurses died due to COVID-19, of whom 11 are women [11]. Based on the data from professional organizations of each healthcare worker, until April 30, 2020, there were 47 confirmed cases, consisting of doctors, dentists, and nurses.

Based on health protocols issued by WHO, to prevent transmission of the virus to healthcare workers, they need to be provided with standard (medical grade) personal protective equipment (PPE) and have regular hand washing, and they should strictly observe various standards in accordance with the Infection Prevention and Control (IPC). However, the implementation in Indonesia faces obstacles in terms of the availability of standard PPE. Similarly, increasing knowledge and skills based on the IPC programs for healthcare workers continue to be done intensively through various associations of their respective professions.

The high number of healthcare workers' deaths needs to be highlighted, and the factors that cause healthcare workers as front-line services to fall one by one needs to be observed. The present study aims to calculate the mortality rate (case fatality rate [CFR]) of healthcare workers exposed to COVID-19 in Indonesia, which will be used to calculate the healthcare workers safety index (HWSI) and compared with 12 other countries. The present study will also describe the factors causing the high number of healthcare workers who died due to COVID-19 in Indonesia.

METHODS

A qualitative study was conducted by collecting the data of healthcare workers exposed to COVID-19, healthcare workers who have died due to COVID-19, confirmed cases, and the total number of deaths. The data were obtained from 12 countries, namely, Indonesia, Malaysia, Thailand, Philippines, India, China, South Korea, Japan, the United States, England, Italy, and Spain. Data on the number of healthcare workers exposed and died were obtained from publications of the local health authority, and data on the total deaths and confirmed cases for each of the countries studied were obtained from the WHO Situation Update Report on the same date as the number of healthcare workers exposed and died due to COVID-19 in each of the countries studied.

Data of cases in Indonesia were taken from the IDI Chairperson's interview with Tempo Magazine on April 18, 2020 [9], the PDGI Chairperson's statement on April 7, 2020 [10], and the PPNI Chairperson's official statement on April 20, 2020 [11]. Data of cases in Malaysia were taken from the official statement of the Minister of Health on April 23, 2020, quoted by The New Straits Time Malaysia [12]. Data of cases in Thailand were obtained from the released statement of Human Rights Watch on its official page on April 15, 2020 [13]. Data of cases in the Philippines were taken from the official data of the Ministry of Health on April 22, 2020 [14], and those in India were taken on April 19, 2020 [15] and April 21, 2020 [16].

Data obtained from China were from the report of the WHO–China Joint Mission on Coronavirus Disease 2019 (COVID-19) from February 16 to 24, 2020 [17] [18]. For South Korea, the data were taken on April 3, 2020, based on the official press release of the local health authorities [19]; data of cases in Japan were taken on April 6, 2020 [20]. Data of cases in the United States were based on official data from the Centre for Diseases Control and Prevention, the USA, on April 15, 2020 [21]. Data of cases in the United Kingdom was from the National Health Services United Kingdom on April 28, 2020, indicating that up to 100 healthcare workers have been tested positive for COVID-19 [22], and from The University of

Oxford's Centre for Evidence-Based Medicine on April 17, 2020 [23]. Data of cases in Italy were obtained from The ISS Public Health Institute on April 17, 2020 [24] and FNOMCeO, an association of surgeons and dentists in Italy, on April 24, 2020 [25]. Data of cases in Spain were from an official press release from the health authorities on March 25, 2020 [26].

The differences in data retrieval were due to the availability of different documentation and data publications in each country. Regarding the various data sources, there were countries in which cases and deaths of healthcare workers were well documented and officially published by the country's health authorities. However, some of the countries have no official publication about the cases and deaths of healthcare workers. This is one of the limitations of the present study.

This research was conducted to identify and describe the factors that cause the high number of healthcare workers exposed to COVID-19 in Indonesia by studying the results of studies that have been conducted from 12 different countries. Additionally, various opinions or press statements published in print and electronic media from related parties, such as professional organizations, health authorities, national task forces, and academics, have been collected.

To analyze the safety level of healthcare workers in healthcare facilities in the COVID-19 pandemic outbreak situation, the present study uses a parameter, that is, the HWSI, which is calculated based on the COVID-19 CFR of healthcare workers among all confirmed cases and proportion of deaths of healthcare workers to the number of deaths due to COVID-19. The results of these two parameters were then calculated into the HWSI, which describes the safety level of healthcare workers in healthcare facilities who provide services to patients who were tested positive and negative for COVID-19.

RESULTS

Healthcare Workers Safety Index (HWSI)

To establish the diagnosis of COVID-19 in Indonesia, the laboratory tests used are the Polymerase Chain Reaction (PCR) swab and rapid diagnostic test. However, based on the 4th Revised COVID-19 Prevention and Control Guidelines issued by the Ministry of Health, confirmation of cases is determined if the results of the PCR swab check are acquired [27]. Based on this, healthcare workers are declared to be exposed to COVID-19 if they are tested positive, as per PCR swab results.

As explained earlier, in Indonesia, there were no official data regarding the number of healthcare workers who were exposed. Tabulation of data processed by the National Task Force does not separate healthcare workers from non-healthcare workers, although the data comes from Regional Task Force reports and hospitals throughout Indonesia. Thus, the data on the number of healthcare workers exposed to COVID-19 in Indonesia were not available (N/A). The number of healthcare workers who died due to COVID-19 was obtained from the Chairperson of the Indonesian Medical Association (IDI), Chairperson of the Indonesian Dentists Association (PDGI), and Chairperson of the Indonesian National Nurse Association (PPNI), which was updated on April 28, 2020. The total cases were 47 people, consisting of

25 doctors, 6 dentists, and 16 nurses. As per the WHO Update Situation Report (April 28, 2020), there were 9,096 confirmed cases and 765 deaths [28].

Table 1: The number of healthcare workers died and confirmed positive cases, and the number of overall deaths, confirmed positive cases, with the date of data collection in 12 countries

Country	Number of healthcare workers exposed by COVID-19		The number of deaths	Confirmed (+) cases	Collection date
	Died	Confirmed (+)			
Countries with inconclusive health systems					
1. Indonesia	47	N/A	765	9.096	28-Apr-20
2. Malaysia	3	325	93	5.532	23-Apr-20
3. Thailand	1	102	43	2.643	15-Apr-20
4. Philippines	26	1.062	437	6.599	22-Apr-20
5. India	1	200	507	15.712	19-Apr-20
Countries with advanced health systems					
6. China	22	2.055	2.121	74.675	20-Feb-20
7. South Korea	1	121	174	10.062	03-Apr-20
8. Japan	0	44	73	3.654	07-Apr-20
9. The USA	27	9.282	23.476	578.268	15-Apr-20
10. England	100	52.384	21.092	157.153	28-Apr-20
11. Italia	184	17.000	25.549	189.973	24-Apr-20
12. Spain	3	6.500	2.694	39.673	25-Mar-20

Data of healthcare workers exposed and died as well as all deaths and confirmed COVID-19 cases in all countries used in the present study are shown in Table 1. Although other countries besides Indonesia were exposed to COVID-19 first, the number of deaths in Indonesia was relatively high (765 cases), with confirmed 9,096 cases as of April 28, 2020. Compared with other inconclusive health systems such as Malaysia, Thailand, the Philippines, and India, deaths in these countries were still lower than those in Indonesia, with a varying number of confirmed cases. India reached up to 15,712 confirmed cases with 507 deaths, which is still lower than those in Indonesia.

Table 2: Case fatality rate (CFR) on confirmed cases of COVID-19 in healthcare workers

Country	Number of healthcare workers exposed by COVID-19		CFR I (%)
	Died	Confirmed (+)	
Countries with inconclusive health systems:			
1. Indonesia	47	N/A	N/A
2. Malaysia	3	325	0.923
3. Thailand	1	102	0.980
4. Philippines	26	1.062	2.448
5. India	1	200	0.500
Countries with advanced health systems:			
6. China	22	2.055	1.071
7. South Korea	1	121	0.826
8. Japan	0	44	0.000
9. The USA	27	9.282	0.291
10. England	100	52.384	0.191
11. Italia	184	17.000	1.082
12. Spain	3	6.500	0.046

Table 2 shows the mortality in the form of COVID-19 CFR, which is the number of healthcare workers who died due to COVID-19 compared with the number of those who were tested positive for COVID-19 in all countries used in the study. The CFR number on this parameter for Indonesia cannot be measured because of the lack of data on the number of healthcare workers who were tested positive for COVID-19. The available data were the total number of deaths due to COVID-19, including the healthcare workers who have died and were tested positive for COVID-19. The Philippines, which is included in developing countries with inconclusive health systems, has a CFR number of 2.448%. Ironically, CFRs above 1% also occur in Italy, i.e., 1.082%, which is considered as a developed country with advanced health systems. China suffered the most ever since the COVID-19 outbreak began, although the health system in this country is well established, due to the fact that this is where the pandemic originated.

Table 3: Case fatality rate (CFR) of COVID-19 in healthcare workers among all confirmed positive cases

Country	Total		CFR II (%)
	Number of deaths in health workers	Number of confirmed cases	
Countries with inconclusive health systems			
1. Indonesia	47	9.096	0.517
2. Malaysia	3	5.532	0.054
3. Thailand	1	2.643	0.038
4. Philippines	26	6.599	0.394
5. India	1	15.712	0.006
Countries with advanced health systems			
6. China	22	74.675	0.029
7. South Korea	1	10.062	0.010
8. Japan	0	3.654	0.000
9. The USA	27	578.268	0.005
10. England	100	157.153	0.064
11. Italia	184	189.973	0.097
12. Spain	3	39.673	0.008

Table 3 lists the mortality in the form of CFR, which is the number of healthcare workers who died due to COVID-19 compared with the total number of confirmed cases of COVID-19 in all countries used in the study. Data show that Indonesia was the country with the highest CFR of 0.517%, followed by the Philippines with 0.394%. The remaining three other countries, namely, Malaysia, Thailand, and India, considered as developing countries with the inconclusive health system, have managed to reduce the CFR to be below 0.1%. Table 3 also shows that all developed countries with advanced health systems yield CFR value below 0.1%.

Table 4: The proportion of healthcare workers deaths to total number of confirmed positive COVID-19 deaths

Country	Number of deaths by COVID-19		Proportion (%)
	Health workers	Total	
Countries with inconclusive health systems			
1. Indonesia	47	765	6.144
2. Malaysia	3	93	3.226
3. Thailand	1	43	2.326
4. Philippines	26	437	5.950
5. India	1	507	0.197
Countries with advanced health systems			
6. China	22	2.121	1.037
7. South Korea	1	174	0.575
8. Japan	0	73	0.000
9. The USA	27	23.476	0.115
10. England	100	21.092	0.474
11. Italia	184	25.549	0.720
12. Spain	3	2.694	0.111

Table 4 shows the ratio between the deaths of healthcare workers due to COVID-19 compared with the deaths of all confirmed cases of COVID-19 in one country used in the study. Indonesia contributed the highest proportion of 6.144%, followed by the Philippines with 5.950%, and then Malaysia and Thailand, respectively, at 3.226% and 2.326%. In developed countries with advanced health systems, only China has a proportion of healthcare workers' deaths above 1%, i.e., 1.037%. The rest of the countries were all below 1%, and so was India, although included in the developing country group with inconclusive health systems, which had only 0.197% of the death proportion of healthcare workers in the country.

Table 5: Healthcare workers safety index (HWSI) in 12 countries studied

Country	Parameter		HWSI
	CFR II (%)	Proportion (%)	
Countries with inconclusive health systems			
1. Indonesia	0.517	6.144	3.331
2. Malaysia	0.054	3.226	1.640
3. Thailand	0.038	2.326	1.182
4. Philippines	0.394	5.950	3.172
5. India	0.006	0.197	0.102
Countries with advanced health systems			
6. China	0.029	1.037	0.533
7. South Korea	0.010	0.575	0.293
8. Japan	0.000	0.000	0.000
9. The USA	0.005	0.115	0.060
10. England	0.064	0.474	0.269
11. Italia	0.097	0.720	0.409
12. Spain	0.008	0.111	0.060

Table 5 shows the processed data for calculating the HWSI. The HWSI parameter indicators in the present study were calculated based on the COVID-19 CFR of healthcare workers among all confirmed cases and death proportion of healthcare workers against deaths due to COVID-19. The results of these two parameters were then calculated using the averages to illustrate the safety level of healthcare workers in healthcare facilities who serve patients who have been or yet confirmed positive for COVID-19. Indonesia certainly provides the highest HWSI value (3.331%) due to the highest value of CFR and proportion among the countries studied, followed by the Philippines with a thin difference with Indonesia, i.e., up to 3.172%. Two countries included in the developing countries with inconclusive health systems are Malaysia and Thailand, with the HWSI of 1.640% and 1.182%, respectively. India, together with all the countries in the developed countries with advanced health systems, has an overall HWSI yield of under 1%.

Figure 1: COVID-19 case fatality rate (CFR) of healthcare workers among all confirmed cases

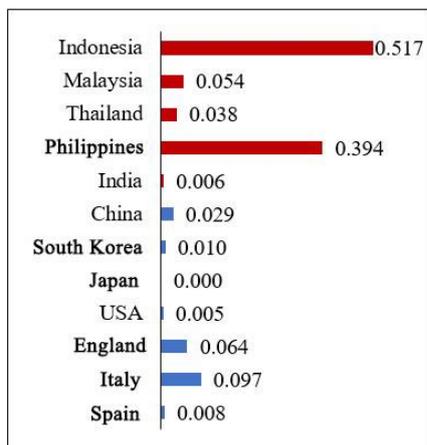


Figure 2: The death proportion of healthcare workers against the deaths due to COVID-19

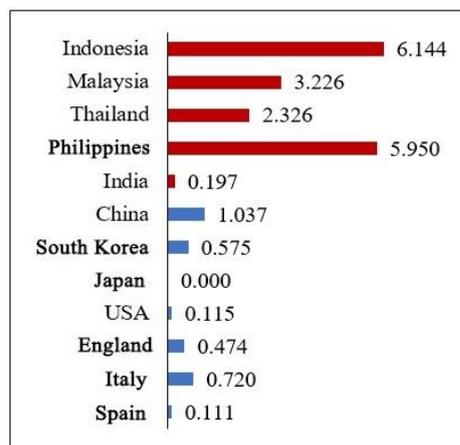
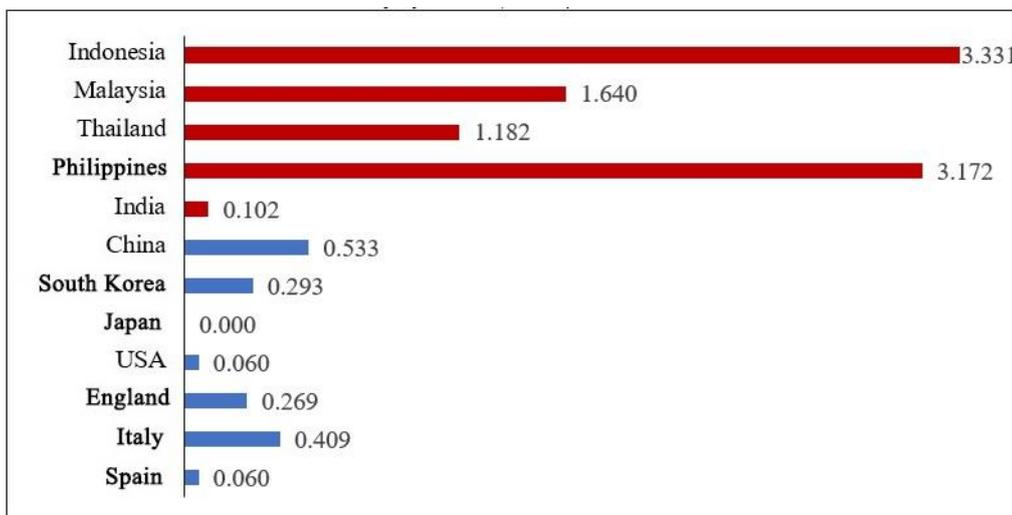


Figure 3: Health worker safety index (HWSI) in 12 countries studied



b. Causal Factors

The first causal factor was the inadequate protection of healthcare workers. Health workers who provide services must be protected from exposure to COVID-19 because the risk of contact is high. The interview results with the Chairperson of the IDI stated that the high risk of exposure from asymptomatic “carrier” patients made healthcare workers unaware of the exposure risk, so they did not wear standard PPE. People who are asymptomatic “carrier” are those who do not show clinical symptoms of COVID-19 even though they have the SARS-CoV2 virus. Especially, now that the clinical symptoms of COVID-19 have become non-

specific, it has become difficult for healthcare workers to identify COVID-19 basing only on clinical findings. The number of asymptomatic patients in the community caused the possibility of contact with healthcare workers to increase, so the risk of exposure is also increasing. The Directorate General of Services, Ministry of Health, has finally issued an appeal for healthcare workers to reduce elective services and operations except for emergencies.

The risk of exposure to healthcare workers from asymptomatic “carriers” can also be due to the patient’s dishonesty in relaying information about their records such as 1) PCR swab has been tested with positive, but because it is asymptomatic, so it is sufficient to self-isolation; 2) have been in contact with a confirmed positive patient; or 3) have been in or visited an area designated by the government as a red zone with local transmission. Their dishonesty was due to fear and the negative stigma in the community that those who are infected with COVID-19 are a disgrace that must be ostracized or expelled and that even their dead bodies will be rejected to be buried somewhere. Dishonest asymptomatic “carrier” patients with positive PCR swab results are very dangerous when they come into contact with healthcare workers because they have the potential to transmit the virus to healthcare workers.

Recently, the news reported that 34 doctors were infected with COVID-19 and had to be quarantined due to a dishonest patient in Indonesia [29]. In Yogyakarta, as many as 53 medical workers have been exposed to COVID-19 because a patient’s family was dishonest about their medical records [30]. Many patients who are dishonest or lie about their status made many healthcare workers to be exposed and collide one by one. In the Philippines, a COVID-19 patient who lied about his status caused nine doctors to be exposed and to eventually die due to COVID-19 [31]. A woman in Malaysia went to the hospital to deliver her baby but was dishonest, thus infecting 15 healthcare workers, causing the hospital to be temporarily closed [32] [33].

The second causal factor was prolonged direct contact in conditions of fatigue due to workload and psychological pressure. The workload was very heavy due to the high number of patients. Based on data from the COVID-19 Task Force for the Acceleration of Handling on April 29, 2020, of 9,771 positive cases, there were still 7,596 patients that must be treated (77.74%) [2]. this illustrates how heavy the workload of healthcare workers serving COVID-19 patients, especially in the referral hospital. The more COVID-19 patients treated, the greater the chance of direct contact in a long duration. In conditions of fatigue due to high workloads with psychological pressure, there will be a decrease in immunity, so the risk of transmitting the virus from patients to healthcare workers is very high.

On March 19, 2020, the WHO issued interim guidance on occupational safety and health of healthcare workers facing the COVID-19 outbreaks. The official document states that healthcare workers are at the forefront responding to the COVID-19 outbreak, so they have a greater risk of being exposed and getting infected, including exposure to viral pathogens, long working hours, psychological pressure, fatigue, stigmas, and physical and psychological violence [34]. These data support the argument that physical fatigue and psychological stress are factors contributing to the chance of exposure to healthcare workers from COVID-19 patients.

The third causal factor was the lack of standard PPE. Based on interviews with the Chairperson of the IDI, the main factor that causes the high number of healthcare workers exposed to COVID-19 was a lack of standard PPE, forcing them to use a sub-standard PPE. This PPE crisis condition occurs anywhere in all hospitals in Indonesia. The lack of PPE supplies from the government through the National Task Force has made hospitals open to accept PPE donations from the public. Some hospitals even have the initiative to have improvised PPE as a solution, although the quality and raw materials used were not in line with the standards.

The fourth causal factor was the lack of knowledge and practice of IPC among healthcare workers. There was already a universal precaution, in which every healthcare worker must implement the principle of infection prevention by routinely washing hands at five moments and six steps and using masks and gloves following IPC program standards. However, several healthcare workers in Indonesia overlook this protocol, thinking that they are not dealing with COVID-19-infected patients. A study in China stated that at the beginning of the outbreak, there were still many healthcare workers who had not received training from IPC, and when this outbreak spread, they did not have enough time to educate and train them [17].

However, many experts believe that despite the high duration of contact between healthcare workers and COVID-19 patients, the exposure risk can be prevented. The trick is to use a standard PPE and master the IPC. If they implement it diligently, the exposure risk can be reduced. Therefore, the key to reducing the risk of COVID-19 exposure to healthcare workers is to use a standard PPE.

DISCUSSION

The findings of the present study have proven that healthcare facilities and healthcare workers are strongly prone to transmission of the SARS-CoV2 virus that causes COVID-19. This conclusion was supported by Chang et al. (2020), who recommended the importance of providing safety protection to the healthcare workers who are likely to be exposed to the virus. This is not only for the sake of service and care but also for the assurance they have not become agents of virus transmission to others [35]. A study in Michigan, USA, also showed that the circle of virus transmission had occurred in various healthcare facilities between employees who worked at the facility and became more widespread due to one worker who usually worked in various healthcare facilities [36]. Both of these studies also concluded that healthcare workers were not aware of transmission that had been occurred from “carrier” patients with asymptomatic or sub-clinical conditions. According to Diamond and Liana (2020), looking at the 2015 Ebola outbreak case, healthcare workers are 32 times more prone to viral infection than the general population. Two main things must be ensured, namely, rapid testing and the availability of PPE to prevent infection in healthcare workers and its spread to the next patient. In the end, with these uncontrolled conditions, hospitals are considered as “infection incubators” [37].

The scarcity of standard PPE in Indonesia that occurs evenly in all hospitals was approved by the Directorate General of Pharmaceutical and Medical Devices, Ministry of Health of Indonesia. This happens because the surge in demand was so high that it triggers the scarcity

of standard PPE and causing the high mortality rates for healthcare workers in Indonesia. The scarcity of PPE also occurs in the market, not only in the government. If there is any, the price would be so high because it is allegedly hoarded by the mafia. Government hospitals were also constrained in the process of procuring goods and tax regulations if they have to buy their own. The problem of lack of available PPE, which has not been resolved, forces all hospitals to be open for PPE donations from any willing party. Various attempts were made to meet PPE needs until several hospitals took the initiative to improvise their PPE by optimizing existing raw materials and human resources, but later on, it was constrained by standardization of the quality of raw materials used.

The high PPE needs were recognized by the Director of the Central Infection Hospital (Rumah Sakit Pusat Infeksi, RSPI), Sulianti Soeroso, who stated that one patient needs 20 sets of PPE per day. Thus, if RSPI treats 26 positive COVID-19 patients, at least 520 sets of PPE are needed in a day [38]. Data on PPE daily needs were also justified by the Association of Indonesian Hospitals (Perhimpunan Rumah Sakit Seluruh Indonesia, PERSI), which states that PPE needs for COVID-19 cases are 20 sets per day although they can be suppressed to 18 sets with very strict standards [39]. In Persahabatan Hospital, it takes 900–1,000 sets of PPE in 1 day because presently, the Persahabatan Hospital has treated about 50 COVID-19 patients [40]. According to the Indonesian Doctors Association (PB-IDI), PPE needs for healthcare workers are high because, in all healthcare facilities, that is, government and private hospitals, including clinics and health centers that provide first aid for COVID-19 cases, PPE was needed at various levels. Additionally, because PPE is single use (disposables), it takes three sets of PPE per day as healthcare workers work in three shifts (Republika, 2020).

The scarcity of PPE occurs in almost all countries, and even in the United States, they must use plastic waste as PPE because there was a PPE crisis [41] [42]. PPE shortages that occur in the United States have created very worrying conditions, and they used social media by raising tags such as #GetMePPE and created websites to directly get PPE [43].

Similar conditions also occur in England, which, based on the survey, there were 22% of healthcare workers who did not have the standard PPE as needed [44]. The British Medical Association reports that there was a widespread shortage of PPE that many hospitals had taken the initiative to create PPE themselves because the government was unable to provide it. The government was appealing to do whatever that can be done. However, healthcare workers who risk themselves without adequate protection in treating patients are like being on a battlefield without armor and protection [45]. The lack of PPE that occurred in various parts of the world in the COVID-19 outbreaks was recognized by WHO. The WHO has asked industry parties to increase their PPE production capacity by 40% to meet the increasing global demand. The Director-General of WHO stated that there was a very severe problem of global PPE supply caused by increased demand, panic buying, hoarding, and misusing. PPE scarcity makes doctors, nurses, and other front-line workers unprepared to treat COVID-19 patients, and without a safe supply chain, risks for healthcare workers around the world are real [46].

CONCLUSION

The results of the present study prove that Indonesia has the highest CFR for healthcare workers due to COVID-19 infection among the countries studied. Likewise, the death proportion of healthcare workers to the number of deaths due to COVID-19 in Indonesia was the highest. These results cause Indonesia's HWSI was also the highest compared with 11 other countries studied. This means that healthcare workers in Indonesia were most at risk of COVID-19 exposure. The main factor that causes healthcare workers to be exposed to the SARS-CoV2 virus worldwide was the lack of standard PPE. The scarcity of standard PPE was evenly distributed in almost all countries and has made healthcare workers be not optimal in fortifying themselves, like soldiers who fight an unseen but very deadly enemy and are not equipped with weapons, vests, protective helmets, and all means of personal protection from enemy attacks. Thus, it makes sense why many healthcare workers fall.

The present study has several limitations, namely, 1) not all countries studied have official data on the number of healthcare workers exposed and those who have died due to COVID-19. There were some complete and official data from local health authorities, but some countries do not have even the unofficial information regarding the number of healthcare workers exposed and were difficult to trace, and 2) the data obtained was highly dependent on the time from when the data were published both officially by local authorities and unofficially by other online sources. Therefore, the comparison of mortality between countries with different data acquisition dates must be noted and concerns in concluding.

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