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ORIGINAL ARTICLE

LEVEL OF KNOWLEDGE AND COMPLIANCE WITH PERSONAL PROTECTIVE EQUIPMENT USE IN HEALTHCARE WORKERS

Tingkat Pengetahuan dan Kepatuhan Penggunaan Alat Pelindung Diri pada Tenaga Kesehatan

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ABSTRACT

Background: The effort to control and prevent COVID-19 in health facilities is to optimize the use of Personal Protective Equipment (PPE) according to guidelines set by the government. The compliance of healthcare workers using the specified PPE will affect the control and prevention of the COVID-19 pandemic. **Purpose**: The study aims to measure the prevalence of COVID-19 in healthcare workers and to find out an overview of knowledge level and compliance with the use of PPE among healthcare workers in East Java Province during the COVID-19 pandemic. **Methods**: This research was an observational study with a descriptive cross-sectional design. The study population was around 183,501 healthcare workers in East Java Province, with criteria of healthcare workers who worked during the COVID-19 pandemic and were willing to be respondents. This study used a probability sampling method with a simple random sampling technique consisting of 129 healthcare workers. The variables used were knowledge level, compliance with the use of PPE, and the history of COVID-19 infection. Primary data have collected by an online questionnaire platform from September 3rd, 2020 to September 12th, 2020. **Results**: The prevalence of COVID-19 among healthcare workers in East Java was 6.20%, and all the healthcare workers infected with COVID-19 have a good level of knowledge and

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compliance with the use of PPE in health facilities. **Conclusion**: Most healthcare workers have good knowledge and compliance with using PPE.

ABSTRAK

Latar Belakang: *Upaya pengendalian dan pencegahan COVID-19 di fasilitas kesehatan adalah dengan penggunaan Alat Pelindung Diri (APD) sesuai pedoman yang telah ditetapkan pemerintah. Kepatuhan tenaga kesehatan terhadap penggunaan APD yang telah ditetapkan akan berpengaruh terhadap pencegahan dan pengendalian pandemi COVID-19.* ***Tujuan:*** *Penelitian ini bertujuan untuk pengukur prevalensi COVID-19 pada tenaga kesehatan dan untuk mengetahui gambaran tingkat pengetahuan dan kepatuhan penggunaan APD pada tenaga kesehatan di Provinsi Jawa Timur pada masa pandemi COVID-19.* ***Metode:*** *Jenis penelitian ini merupakan penelitian observasional dengan desain deskriptif cross sectional. Populasi dalam penelitian ini adalah tenaga kesehatan di provinsi Jawa Timur yaitu sebanyak 183,501 tenaga kesehatan dengan kriteria inklusi bekerja selama pandemi COVID-19 di fasilitas kesehatan dan bersedia menjadi responden. Teknik sampling yang digunakan adalah probability sampling dengan teknik simple random sampling, yaitu sebanyak 129 tenaga kesehatan. Variabel yang digunakan adalah tingkat pengetahuan, kepatuhan penggunaan APD, dan riwayat infeksi COVID-19. Data primer diperoleh dengan menggunakan platform kuesioner online yang disebar secara pada 3 September-12 September 2020.* ***Hasil:*** *Prevalensi COVID-19 pada tenaga kesehatan di Jawa Timur sebesar 6.20%, dimana seluruh tenaga kesehatan yang pernah terinfeksi COVID-19 mempunyai tingkat pengetahuan yang baik dan tingkat kepatuhan yang baik/ patuh dalam penggunaan APD di fasilitas kesehatan selama pandemic COVID-19.* ***Kesimpulan:*** *Mayoritas tenaga kesehatan mempunyai tingkat pengetahuan dan kepatuhan yang baik mengenai penggunaan APD.*

INTRODUCTION

Coronavirus Disease 2019 (COVID-19) was first detected in Indonesia on March 2nd, 2020, and until December 10th, 2020, the number of positive patient confirmation cases reached 598.933 people, and 18.336 deaths were reported in 34 provinces (Kemenkes RI, 2020a). Without treatment or vaccines, Indonesia and many other countries rely on physical distancing, masks use, and handwashing to slow the spread of COVID-19 (UNICEF, 2020). Since Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is transmitted through direct contact and droplets and the increasing transmission of COVID-19 cases in all age groups, so that people, especially those at risk of infection, must carry out health protocols. These efforts are in accordance with infection prevention and control standards in each work unit in health facilities, both for COVID-19 and non-referral COVID-19 (Giri et al., 2021). It is because the healthcare workers have a higher risk of infection due to contact with both the suspect's patient COVID-19 and the confirmed COVID-19 (Giri et al., 2021; Suzuki et al., 2021).

In several studies, healthcare workers with adequate Personal Protective Equipment (PPE) still have a risk of contracting COVID-19, but using PPE according to standard and proper management of HCWs can reduce the risk of

COVID-19 spread. Although, they still have a risk of being infected with COVID-19. It can be caused by a lack of training in using PPE (Hoernke et al., 2021). A new study in Lancet Public Health stated that healthcare workers with adequate PPE had a three times higher risk of infection from SARS-Cov-2 than the general population. Healthcare workers with inadequate PPE have further increased risk (Beusekom, 2020). Adequate training and availability of PPE can reduce the risk of COVID-19 infection in healthcare workers (Karlsson & Fraenkel, 2020). The secondary data analysis stated that forefront healthcare workers with inadequate PPE and caring for coronavirus patients had a higher risk of infection (aHR, 5.91; 95% CI, 4.53 to 7.71) compared to those who adequate PPE that did not treat infected patients. Besides, healthcare workers who cared for COVID-19 patients and did not use disposable PPE were also at higher risk of contracting COVID-19 (aHR, 5.06; 95% CI, 3.90 to 6.57) compared to healthcare workers with appropriate PPE who are not treating coronavirus patients (Beusekom, 2020).

Data in Indonesia on June 3rd, 2020, stated that 2.20% of healthcare workers had confirmed positive COVID-19 (Kemenkes RI, 2020b). One of the factors suspected to be the cause of many healthcare workers contracting COVID-19 was the inadequate use of PPE (Hussen & Alemu, 2021). It was in line with the research by Nguyen et al., (2020) that healthcare workers with inadequate PPE caring for COVID-19 patients had a higher risk of COVID-19 than healthcare workers with adequate PPE and did not treat suspected patients or COVID-19. The study aims to measure the prevalence of COVID-19 infection and determine the knowledge level and compliance with the use of PPE among healthcare workers during the COVID-19 pandemic. The managers of health service organizations could better control this problem. The results of the study were expected to contribute to a compliance enhancement of the use of PPE by healthcare workers in the context of pandemic control by preventing transmission and reducing the death rate due to COVID-19.

METHODS

This research was observational research with a cross-sectional descriptive method. This research had also received approval from the Ethics Commission of the Faculty of Dentistry, Universitas Airlangga, under number 391/HRECC.FODM/VIII/2020. The variables used were the level of knowledge, compliance with the use of personal protective equipment) and history of COVID-19 infection.

The population in this study were healthcare workers in East Java Province, as many as 193,979 healthcare workers (Dinas Kesehatan Provinsi Jawa Timur, 2020), with inclusion criteria being healthcare workers who worked during the COVID-19 pandemic in health care facilities and were willing to be respondents. The sample size was 129 healthcare workers from the total population, which is the calculation of the sampling formula using the Sample Size 2.0 application. The confidence level used in this study was 95%, with a standard error of 5%. The sampling technique in this study used probability sampling with a simple random sampling technique because all healthcare workers had the same opportunity to become respondents in this study. The inclusion criteria that were sampled in this study were individuals who worked in health facilities (government or private) during the COVID-19 pandemic, those who handled COVID-19 or not, all ages and genders, and those who were willing to be the research sample.

Data collection was carried out from September 3, 2020, to September 12, 2020, by distributing questionnaires in the form of a Google form. Questionnaires were distributed randomly on personal social media to social media groups related to healthcare workers who met the inclusion criteria. Every healthcare worker who received the questionnaire link and was included in the inclusion criteria could have filled out the questionnaire. After that, they submitted the completed questionnaire. Finally, the results of the questionnaire will be accepted by the author. The first section of the questionnaire was about characteristic respondents that consisted of questions about sex, age, occupations, agency, the status of agency, contact status with patients (handling COVID-19 patient or not), and history of COVID-19 infection to know the prevalence of COVID-19 in HCW. If COVID-19 had infected respondents, there were three additional questions about status characteristics of covid-19 infection that consist questions about symptoms, comorbidity, and latest status of infection (Positive/Infected/Sick or after isolation or cured). The second section was about the level of knowledge about PPE, and the third section was about PPE compliance. All of the variables were measured by the distribution frequency table.

The questionnaire used in this study was adapted from several questions from a document prepared by the Indonesian Ministry of Health regarding guidelines for prevention and control of COVID-19 and technical instructions for personal protective equipment in dealing with COVID-19. The questionnaire about the level of knowledge about PPE consists of six questions, and the result was categorized as less (score of 0-10) and good (score of 11-20). The questionnaire about PPE compliance was divided into two different parts for HCWs who have direct contact with patients (5 questions) and HCWs who did not have direct contact with patients (5 questions). HCWs who have direct contact with patients were categorized as non-compliant (score of 0-8) and classified as compliant (score of 9-16), and also, HCWs who did not have direct contact with patients were categorized as non-compliant (score of 0-5) and categorized as compliant (score of 6-9). Data measurement using the scoring method must first test the validity and reliability. Validity and reliability tests in this study were carried out at the beginning before conducting research or distributing questionnaires. The results of testing the validity and reliability of the questionnaire in this study are shown in Table 1.

Table 1.
The results of the validity and reliability of the questionnaire

Variable	*Corrected Item-Total Correlation*	*Cronbach's Alpha*
Infected History	0.55	0.72
Knowledge level	0.50	
Compliance Rate	0.60	

Table 1 shows that the questionnaire in this study is valid and reliable because the corrected item value of the total correlation of all variables is above 0.20. Meanwhile, the Cronbach alpha value is above 0.70. Data were analyzed univariably. Univariable analysis was carried out to see the description of respondents, the prevalence of COVID-19 infection in healthcare workers, and the frequency distribution of the level of knowledge about PPE and PPE compliance among officers.

RESULTS

Respondent Characteristics

Respondents in this study consisted of various backgrounds distinguished by a characteristic. The respondent characteristics consist of age, sex, occupation, agency, agency status, and contact status with patients. The respondent characteristics are shown in the following table (see table 2). Based on the survey results of 129 healthcare workers. We can see that the respondents were majority females (85.30%), and the majority of the respondents (26.40%) were in the 31-40 years age category. Most respondents (30.20%) worked as medical laboratory technology experts, and (34.90%) worked in health centers. More than half of the respondents worked in government agencies (60.50%), and more than half of the respondents were healthcare workers who had direct contact with patients (treating/examining suspected patients or confirming COVID-19 patients) (60.50%). Meanwhile, a few respondents (6.20%) have a history of COVID-19 infection.

Level of Knowledge and Compliance of PPE Use

Table 3 shows that as many as 11.60% of healthcare workers have less knowledge of PPE and 88.40% have good knowledge of PPE. It is also known that 7% of healthcare workers are not compliant with PPE use, and 93% of healthcare workers are compliant with PPE use. From that percentage, it is known that most healthcare workers know the importance of using PPE and using PPE with the proper procedure.

Prevalence and Status Characteristics of COVID-19 Infection

Based on the survey results, it is known that the prevalence of COVID-19 in HCW is 6.20%. There are 8 from 129 HCWs infected with COVID-19 or positive confirmation of COVID-19, where half of the respondents (50%) experienced clinical symptoms, and 50% of respondents did not experience any symptoms (PWS). The majority of respondents (75%) did not have comorbidities, and all respondents (100%) confirmed positive cases of COVID-19 had been declared cured and had completed the isolation process (See Table 4).

Table 2.
Frequency Distribution of Respondent Characteristics

Variable	n	%
Sex		
Male	19	14.70
Female	110	85.30
Age (years)		
18-25	33	25.60
26-30	29	22.50
31-40	34	26.40
>40	33	25.60
Occupations		
Medical Personnel (Doctor and Specialist)	10	7.80
Nurse	32	24.80
Midwife	13	10.10
Public Health Personnel	17	13.20
Medical Laboratory Technologist	39	30.20
Others	18	14.00
Agency		
Public Health Centre	45	34.90
COVID-19 Referral General Hospital	36	27.90
COVID-19 Non-Referral General Hospital	24	18.60
Special Hospital	8	6.20
Clinic	7	5.40
Independent Clinic	2	1.60
Others	7	5.40
Agency Status		
Government	78	60.50
Private	51	39.50
Contact Status with The Patients		
Direct Contact	78	60.50
Indirect Contact	51	39.50
History of COVID-19 Infections		
Positive Confirmation	8	6.20
Negative	121	93.80
Total	129	100.00

Cross Tabulation Analysis

Based on the result, it can be seen that all HCWs (8 respondents) who COVID-19 has infected have a good level of knowledge and compliance with using PPE in health facilities during the COVID-19 pandemic (See Table 5).

Table 3.
Distribution of Healthcare Workers' Knowledge about PPE Use and PPE Use compliance by Healthcare workers

Variable	n	%
The Knowledge of PPE Use		
Less	15	11.60
Good	114	88.40
PPE Compliance		
Non-Compliant	9	7.00
Compliant	120	93.00
Total	129	100.00

Table 4.
Distribution of COVID-19 Exposure Status

Status of COVID-19 Exposure	n	%
Clinical Symptoms		
Accompanied by Clinical Symptoms	4	50.00
People Without Symptoms (PWS)	4	50.00
Comorbidity		
Accompanied by Comorbidities	2	25.00
No Comorbidity	6	75.00
Latest Status		
Positive/Infected/Sick	0	0.00
After isolation/Cured	8	100.00
Total	8	100.00

DISCUSSION

Univariate Analysis

PPE Knowledge

The study found that 11.60% of healthcare workers still have less PPE knowledge. The results of this study are not much different from the results of the study of Izhar, Husain, Tahir, & Husain (2021). It stated that as many as 15% of Pakistani healthcare workers have poor knowledge about PPE. In contrast, according to research by Hossain et al. (2021), as many as 0.50% of healthcare workers in Bangladesh have poor knowledge. It is different from the results of a study by Amanya et al. (2021) that found that 30.70% of healthcare workers at Regional Referral Hospitals in Northern Uganda had insufficient knowledge about COVID-19 IPC. Meanwhile, PPE knowledge is needed by healthcare workers. Healthcare workers are not only at high risk of contracting the infection but also serve as a host to spread the disease rapidly in a short time to patients (Alao, Durodola, Ibrahim, & Asinobi, 2020).

Table 5.
Cross-tabulation between Knowledge and Compliance with History of COVID-19 Infection

Variable	History of COVID-19 Infection				Total	
	Infected		Uninfected			
	n	%	n	%	n	%
PPE Knowledge						
Less	0	0.00	15	100.00	15	100.00
Good	8	7.00	106	93.00	114	100.00
PPE Compliance						
Non-Compliant	0	0.00	9	100.00	9	100.00
Compliant	8	7.00	112	93.00	120	100.00
Total	8	7.00	121	93.00	129	100.00

Based on a results, 64% of respondents can correctly choose what PPE is recommended on the second level of protection. More than half of respondents (56%) are aware of the standards for the appropriate attire, and 54% are aware of why PPE removal must follow the guidelines. Only 13% can correctly choose the specifications of the 3ply mask, and 64% respond to the N95mask.

Research by Ojha, Debnath, Sharma, & Niraula (2021) stated that about 67.80% of healthcare workers gave correct responses regarding wearing and removing PPE, while 25.20% gave wrong responses, and 7% answered maybe. Research by Moodley et al. (2021) of doctors in South Africa stated that 78.60% agreed that medical masks should be used during the routine care of COVID-19 patients, 95.20% agreed that N95 respirators should be used for procedures on COVID-19 patients that produce aerosols, and 97.60% agreed that healthcare workers should wear gloves during routine care of COVID-19 patients. The lack of knowledge of healthcare workers on PPE shows the need to focus on training and retraining, audits, and feedback methods to increase knowledge about PPE (Nguyen et al., 2020).

PPE Compliance

The study showed that 7.00% of healthcare workers were still not compliant with PPE use. It is different from the research of Amanya et al. (2021) that 32% of healthcare workers had poor adherence to COVID-19 IPC, while based on research by Neuwirth, Mattner, & Otchwemah (2020), it was found that 15% of healthcare workers who handle direct contact with COVID-19 patients have low adherence. Lack of healthcare workers' compliance with the use of PPE is related to having attended IPC Covid-19 training, having IPC guidelines, and feeling strong institutional support (Amanya et al., 2021). According to Nguyen et al. (2020) regarding the experience of previous viruses that have attacked the respiratory tract, PPE use is important to reduce nosocomial transmission so that healthcare workers can provide safe care. They need adequate protection and training in the use of PPE. If health facilities fail to provide adequate PPE, safe health care cannot be provided. It creates a moral and ethical dilemma for patient-focused healthcare professionals, creating a sense of inadequacy and under-appreciation, resulting in workforce stress (Herron, Hay-David, Gilliam, & Brennan, 2020).

History of COVID-19 Infection

The results have shown that 8 respondents (6.20%) were infected by COVID-19 or had positive confirmation of COVID-19, where half of the respondents (50.00%) have experienced clinical symptoms, and 50.00% of respondents have experienced no symptoms. Also, the majority of respondents (75%) did not have comorbidities, and all respondents (100%) confirmed positive cases of COVID-19 had been declared cured and had completed the isolation process. This case is in line with Nguyen et al. (2020), which stated that frontline healthcare workers have at least a three times increased risk of becoming infected with COVID-19 than the general population, even after taking other risk factors into account. Research by Felice, Di Tanna, Zanus, & Grossi (2020) also stated that 98 (25%) respondents had recently undergone a COVID-19 test with a nasopharyngeal swab. Among the tested population, 18 (18%) healthcare workers were positive for COVID-19, mostly in the first test (72%), with the possibility of transmission occurring at work (89%). Eleven (61%) required medical therapy, and one was hospitalized.

Cross Tabulation Analysis

Based on the cross-tabulation table, it is known that all of the HCWs (8 respondents) who COVID-19 has infected have a good level of

knowledge and compliance with to use of PPE in health facilities. It can be assumed that there is no relationship between the level of knowledge and PPE compliance with a history of COVID-19 infection. Questionnaires can cause this free distribution by social media (online), so only certain groups can fill out the questionnaire, namely those who have internet access and receive questionnaire links can be filled out the questionnaire. Some HCWs have not been infected by COVID-19 but have less knowledge and do non-compliant use PPE in health facilities. To prevent COVID-19 infection in HCWs, we must ensure proper use of PPE and adherence to other measures such as infection control measures. Further research on the source of transmission of COVID-19 in healthcare workers is needed to support our observational findings.

Level of Knowledge and The History of COVID-19 Infection

Based on the results of the study, it is known that all HCWs who COVID-19 has infected have a good level of knowledge. There is a possibility that healthcare workers who COVID-19 infects can also get the virus from their community, not from the patient that they treated Suzuki et al., (2021), but knowledge still influences compliance. According to Utami, Mose, & Martini (2020), the information obtained will influence a person's knowledge even though a person has low education. It will increase his knowledge if he gets good and proper information from various media such as TV, radio, or newspapers. The research of Wapah & Wijaya (2020) shows that knowledge is related to compliance with the use of PPE. Knowledge and attitudes are consistently related. When the cognitive component (knowledge) changes, a change in attitude will follow. Based on this theory, it can be concluded that a person's knowledge should be related to his attitude. Broadly speaking, the respondents' knowledge is quite good in using PPE. Likewise, the compliance of respondents who supported this aspect of infection prevention. It can be concluded that good knowledge will also lead to a good attitude and vice versa. Therefore, in the current pandemic, guidelines for using PPE to protect health personnel should be published at the earliest stage of the epidemic, not months later (Zhao et al., 2020).

PPE Compliance and History of COVID-19 Infection

Based on the results of the study, it is known that all HCWs who COVID-19 has infected have good compliance with the use of PPE in health facilities. It is because PPE use compliance is not the only risk factor for COVID-19 infection in healthcare workers. This statement is in line with the result of the research by Nguyen et al. (2020) that the availability of sufficient PPE, the quality of PPE, or both could reduce the risk of COVID-19. However, reusing PPE or inadequate PPE can result in a comparable increase in risk. A higher risk of reusing PPE can be caused by self-contamination when healthcare workers reuse and remove PPE or material damage from PPE due to repeated use. Research by Wong, Tan, Leo, Lee, & Toh (2020) stated that the source of COVID-19 transmission that most often occurred in frontline healthcare workers came from social interactions at 19% and the family (household) at 16.70%. According to the Governor of New York, Andrew Cuomo (2020) stated that based on a survey taken from 1200 New Yorkers, who were treated at the hospital, 66% of patients contracted COVID-19 from their households, not from patients with COVID-19 in their hospital. Public Health Experts conclude that family cluster exposure increases highly caused by most patients who live with family or friends who often leave the house and live in crowded apartment buildings, so exposure increases.

The result is also not in line with Kim et al. (2021) who state that greater access to PPE reduces the risk of contracting COVID-19 and is associated with reduced disease severity in frontline healthcare workers. Healthcare workers who report limited access to masks, gowns, gloves, and face shields have an almost 2.50 times higher likelihood of COVID-19 symptoms lasting more than 14 days and a 3.50-fold higher chance of reporting symptoms moderate to severe compared to using disposable PPE. Other research by Wang, Pan, & Cheng (2020) states that the use of N95 respirator masks, disinfection, and handwashing helps reduce the risk of 2019-nCoV infection in doctors and nurses. Other studies have also stated that healthcare workers who develop COVID-19 have a more extended period to be exposed to index patients; exposures during nebulizer treatment and BiPAP were also more common among HCPs who grew COVID-19. These findings underline the increased risk of COVID-19 transmission associated with prolonged and

unprotected patient contact and the importance of ensuring that HCP is exposed to patients with suspected or suspected COVID-19 using PPE (Heinzerling et al., 2020).

Providing adequate PPE and good quality PPE can reduce the risk of COVID-19 to healthcare workers, but reusing PPE can raise a relative risk. The more significant risks associated with reusing PPE can be attributed to self-contamination during repeated application and removal of PPE or material damage due to prolonged wear. It was shown in Wuhan that lack of hand hygiene increases the risk of transmission of SARS-CoV-2 from patients to healthcare workers after hand contamination (Neuwirth et al., 2020).

Each health facility has an Infection Prevention and Control (IPC) committee which is tasked with identifying and reducing the risk of acquired and transmitted infections among patients, staff, health professionals, contractors, volunteers, students, and visitors. Handling COVID-19, the IPC committee also has a role in it, one of which is by making SPO (Standard Operating Procedures) for the use of PPE in health facilities. The SOP was made to aim that healthcare workers provide services directly by using PPE, following the guidelines for using PPE at every health facility in East Java. Standard operating procedures made by PPI contain stages or procedures that apply to all units in each health facility that discuss the stages of using PPE and releasing PPE after use. Table 4 shows that the SOP for the use of PPE made by the PPI committee at every health facility in East Java has been carried out correctly.

This research has strengths and weaknesses that distinguish it from other studies. The strength of this research is time-efficient research because data collection is done online. Therefore, people do not have to adjust the time between the author and the respondent. The next one is data collection using a questionnaire that refers to the Covid-19 control guidelines of the Ministry of Health. The guidelines here use the scoring method that the researcher has determined and make it easier for respondents to measure their knowledge and compliance in the use of PPE. In addition to making an SOP for the use of PPE, the IPC committee should also hold training related to the correct use and disposal of PPE and evaluate the use of PPE for healthcare workers.

Research Limitations

The weakness in this study is that data collection is done by distributing online questionnaires without direct interviews and observations, so the information obtained by the author is limited, namely only based on the answers from respondents to the online questionnaire.

CONCLUSION

The prevalence of COVID-19 among healthcare workers in East Java is low, and most healthcare workers have good knowledge and compliance with the use of PPE.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest in this study.

AUTHOR CONTRIBUTIONS

All authors participated actively in the implementation of this research. The first author (RF) and the second author (NW) participated actively in the questionnaire making, data collection, data analysis, and article writing. The third author (RDW) and the fourth author (ND) participated actively in questionnaire making, and article writing and was responsible for the content writing, including research method, research design, analysis, and revision of the article. The fifth author (A) is also responsible for implementing this research, including preparation, facilitation, and support.

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REFERENCES

Alao, M. A., Durodola, A. O., Ibrahim, O. R., & Asinobi, O. A. (2020). Assessment of Health Workers' Knowledge, Beliefs, Attitudes, and Use of Personal Protective Equipment for

Prevention of COVID-19 Infection in Low-Resource Settings. *Advances in Public Health*, *2020*(May), 1–10. https://doi.org/10.1155/2020/4619214

Amanya, S. B., Nyeko, R., Obura, B., Acen, J., Nabasirye, C., Nakaziba, R., … Okwir, M. (2021). Knowledge and compliance with Covid-19 infection prevention and control measures among health workers in regional referral hospitals in northern Uganda: a cross-sectional online survey. *F1000Research*, *10*(1), 1–12. https://doi.org/10.12688/f1000research.51333.1

Beusekom, M. Van. (2020). Health workers, especially minorities, at high risk for COVID, even with PPE. Retrieved from Center for Infectious Disease Research and Policy University of Minnesota website: https://www.cidrap.umn.edu/news-perspective/2020/08/health-workers-especially-minorities-high-risk-covid-even-ppe

Dinas Kesehatan Provinsi Jawa Timur. (2020). *Buku profil kesehatan Provinsi Jawa Timur Tahun 2020*. Retrieved from https://dinkes.jatimprov.go.id/userfile/dokumen/PROFIL KESEHATAN 2020.pdf

Felice, C., Di Tanna, G. L., Zanus, G., & Grossi, U. (2020). Impact of COVID-19 Outbreak on Healthcare Workers in Italy: Results from a National E-Survey. *Journal of Community Health*, *45*(4), 675–683. https://doi.org/10.1007/s10900-020-00845-5

Giri, A., Sapkota, B., Shrestha, R., Khatiwada, A. P., Tiwari, R., & Aryal, M. (2021). A Narrative Review of Personal Protective Equipment Uses in Coronavirus Disease 2019 and Its Disposable Practices. *JMA Journal*, *4*(2), 86–90. https://doi.org/10.31662/jmaj.2020-0120

Heinzerling, A., Stuckey, M. J., Scheuer, T., Xu, K., Perkins, K. M., Resseger, H., … Epson, E. (2020). Transmission of COVID-19 to Health Care Personnel During Exposures to a Hospitalized Patient — Solano County, California, February 2020. *MMWR. Morbidity and Mortality Weekly Report*, *69*(15), 472–476. https://doi.org/10.15585/mmwr.mm6915e5

Herron, J. B. T., Hay-David, A. G. C., Gilliam, A. D., & Brennan, P. A. (2020). Personal protective equipment and Covid 19- a risk to healthcare staff? *British Journal of Oral and Maxillofacial Surgery*, *58*(5), 500–502. https://doi.org/10.1016/j.bjoms.2020.04.015

Hoernke, K., Djellouli, N., Andrews, L., Lewis-Jackson, S., Manby, L., Martin, S., … Vindrola-Padros, C. (2021). Frontline healthcare workers' experiences with personal protective equipment during the COVID-19 pandemic in the UK: A rapid qualitative appraisal. *BMJ Open*, *11*(1). https://doi.org/10.1136/bmjopen-2020-046199

Hossain, M. A., Rashid, M. U. Bin, Khan, M. A. S., Sayeed, S., Kader, M. A., & Hawlader, M. D. H. (2021). Healthcare workers' knowledge, attitude, and practice regarding personal protective equipment for the prevention of covid-19. *Journal of Multidisciplinary Healthcare*, *14*(1), 229–238. https://doi.org/10.2147/JMDH.S293717

Hussen, H., & Alemu, Z. A. (2021). Risk of covid-19 infection and associated factors among healthcare workers: A cross-sectional study at eka kotebe treatment center in Ethiopia. *International Journal of General Medicine*, *14*(1), 1763–1772. https://doi.org/10.2147/IJGM.S301518

Izhar, R., Husain, S., Tahir, M., & Husain, S. (2021). Knowledge and practices: Risk perceptions of COVID-19 and satisfaction with preventive measures at workplace among maternity care providers in Pakistan. *European Journal of Midwifery*, *5*(January), 1–9. https://doi.org/10.18332/ejm/131864

Karlsson, U., & Fraenkel, C. J. (2020). Complete Protection from COVID-19 is Possible for Health Workers. *The BMJ*, *370*, 2–3. https://doi.org/10.1136/bmj.m2641

Kemenkes RI. (2020a). *COVID-19 dalam Angka (Kondisi 3 Juni 2020)*. Retrieved from https://www.kemkes.go.id/resources/download/info-terkini/covid dalam angka/covid-dalam-angka-03062020.pdf

Kemenkes RI. (2020b). Info infeksi emerging per 5 September 2020. Retrieved from https://covid19.kemkes.go.id/category/situasi-infeksi-emerging/info-corona-virus/#.XsFze2gzbIW%0Ahttps://covid19.kemkes.go.id/category/situasi-infeksi-emerging/info-corona-virus/%23.Xn65XIgzbIU

Kim, H., Hegde, S., Lafiura, C., Raghavan, M., Sun, N., Cheng, S., … Seidelmann, S. B. (2021). Access to personal protective equipment in exposed healthcare workers and

COVID-19 illness, severity, symptoms and duration: A population-based case-control study in six countries. *BMJ Global Health*, *6*(1), 1–9. https://doi.org/10.1136/bmjgh-2020-004611

Moodley, S. V., Zungu, M., Malotle, M., Voyi, K., Claassen, N., Ramodike, J., … Mlangeni, N. (2021). A health worker knowledge, attitudes and practices survey of SARS-CoV-2 infection prevention and control in South Africa. *BMC Infectious Diseases*, *21*(1), 1–9. https://doi.org/10.1186/s12879-021-05812-6

Neuwirth, M. M., Mattner, F., & Otchwemah, R. (2020). Adherence to personal protective equipment use among healthcare workers caring for confirmed COVID-19 and alleged non-COVID-19 patients. *Antimicrobial Resistance and Infection Control*, *9*(1), 1–5. https://doi.org/10.1186/s13756-020-00864-w

Nguyen, L. H., Drew, D. A., Graham, M. S., Joshi, A. D., Guo, C. G., Ma, W., … Zhang, F. (2020). Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study. *The Lancet Public Health*, *5*(9), 475–483. https://doi.org/10.1016/S2468-2667(20)30164-X

Ojha, S., Debnath, M., Sharma, D., & Niraula, A. (2021). Knowledge of Handling the Personal Protective Equipment by Frontline Allied Health Professionals in COVID-19 Outbreak—A Web-Based Survey Study. *Journal of Radiology Nursing*, *30*(1), 1–5. https://doi.org/10.1016/j.jradnu.2020.12.012

Suzuki, T., Hayakawa, K., Ainai, A., Iwata-Yoshikawa, N., Sano, K., Nagata, N., … Ohmagari, N. (2021). Effectiveness of Personal Protective Equipment in Preventing Severe Acute Respiratory Syndrome Coronavirus-2 Infection among Healthcare Workers. *Journal of Infection and Chemotherapy*, *27*(1), 120–122. https://doi.org/https://doi.org/10.1016/j.jiac.2020.09.006

UNICEF. (2020). *COVID-19 dan anak-anak di Indonesia. Agenda tindakan untuk mengatasi tantangan sosial ekonomi*. Jakarta. Retrieved from https://www.unicef.org/indonesia/sites/unicef.org.indonesia/files/2020-05/COVID-19-dan-Anak-anak-di-Indonesia-2020_1.pdf

Utami, R. A., Mose, R. E., & Martini, M. (2020). Pengetahuan, Sikap dan Keterampilan Masyarakat dalam Pencegahan COVID-19 di DKI Jakarta. *Jurnal Kesehatan Holistic*, *4*(2), 68–77. https://doi.org/10.33377/jkh.v4i2.85

Wang, X., Pan, Z., & Cheng, Z. (2020). Association between 2019-nCoV transmission and N95 respirator use. *Journal of Hospital Infection*, *105*(1), 104–105. https://doi.org/10.1016/j.jhin.2020.02.021

Wapah, & Wijaya, L. (2020). Literature review : Hubungan Pengentahuan dengan Kepatuhan Perawat dalam Penggunaan Alata Pelindung Diri Dasar. *Jurnal Ilmiah Multi Science Kesehatan*, *12*(2), 126–139. https://doi.org/https://doi.org/10.36729/bi.v12i2.499

Wong, L. Y., Tan, A. L., Leo, Y. S., Lee, V. J. M., & Toh, M. P. H. S. (2020). Healthcare workers in Singapore infected with COVID-19: 23 January-17 April 2020. *Influenza and Other Respiratory Viruses*, (August), 1–9. https://doi.org/10.1111/irv.12803

Zhao, Y., Liang, W., Luo, Y., Chen, Y., Liang, P., Zhong, R., … He, J. (2020). Personal protective equipment protecting healthcare workers in the Chinese epicentre of COVID-19. *Clinical Microbiology and Infection*, *26*(1), 1716–1718. https://doi.org/10.1016/j.cmi.2020.07.029