



Shortage of Personal Protective Equipment and Nurse Safety in the Coronavirus Disease-19 Pandemic: A Cross-sectional Study in Indonesia

Sr Anita Sampe^{1*}, P. M. M. Sumarti Endah², Mery Sambo¹, Siprianus Abdu¹

¹Department of Nursing, Stella College of Health Sciences, Makassar, Indonesia; ²Health Polytecnic Karya Husada Jogjakarta, Yogyakarta, Indonesia

Abstract

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***Correspondence:** Sr Anita Sampe, Jl. Maipa No.19, Losari, Kec. Ujung Pandang, Kota Makassar, Sulawesi, 90113, Selatan. E-mail: sranithasjm@gmail.com
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BACKGROUND: There has been a substantial scarcity of personal protective equipment (PPE) in several countries during the ongoing pandemic of Coronavirus disease-19 (COVID-19). Nurses in Indonesia also experience a shortage of PPE as the number of COVID-19 patients in Indonesia continues to increase. There is no accurate data yet regarding the exact number of PPE scarcity for nurses.

AIM: This study aimed to describe the availability of PPE and adverse consequences long-term used off the PPE and examine the relationship between shortage PPE and nurse behavior response in Indonesia.

METHODS: An online-based survey was used to collect data on the nurse, regardless of their discipline, training background, or degree of experience, who are directly involved in managing COVID-19 patients. In this study, a total of 211 questionnaires were gathered. The survey was conducted using the Google form. This study employs univariate and bivariate analysis.

RESULTS: Most of the mask N95 provision reaches up to 80%. The second is the hazmat (71%) and the lowest in the gloves (30%). Around 71% of respondents generally resist removing their PPE until the shift is complete. Then, 62% of the respondents are ready to propose to the leaders of the PPE, and 51% show that they are modifying the PPE. Nasal blisters are the most prevalent type of injury sustained by nurses while wearing PPE (86%), followed by headaches and dehydration. This study found that most respondents (60.7%) with insufficient PPE had a positive behavior reaction, whereas just 18% had a poor behavior reaction.

CONCLUSION: Most nurses have difficulties accessing N95 and experience some adverse effects of prolonging PPE use. Policymakers should take urgent action to tackle these concerns.

Introduction

The Coronavirus disease-19 (COVID-19) epidemic was declared a significant worldwide crisis by the World Health Organization [1]. About 115.056 cases have been recorded daily in Indonesia, with nearly 1000 recent cases and a 4.7 death rate, making Indonesia the second largest associated COVID-19 country in the Asia-Pacific area. The proportion of confirmed COVID-19 cases among nurses has risen to as high as 11% in some countries, with a growing number of occupationally attributable deaths being documented [2], [3]. Between February 12 and April 9, 2020, it was announced that 19% of medical workers in the United States and 20% in Italy were infected with COVID-19 [4]. In Indonesia, the number of medical personnel who died of COVID-19 infection on July 12, 2020, was 61 doctors and 39 nurses. The risks posed by COVID-19 to nurses are substantial but mainly avoidable [4]. Many nurses were not allowed to return home (to remain with their families) due to close interaction with confirmed COVID-19.

Using personally protected equipment (PPE) is one effort to reduce virus transmission to hospital nurses. 5 According to the Directorate General of Health (2020), nurses' PPE must adhere to a risk-based standard. The standard for PPE includes gowns, gloves, N95 or surgical masks, headgear, eye protection (goggles), protective footwear (boots), and a face shield. The usage of PPE must conform with the protocols for putting on and taking off both disposable and reusable PPE. There seems to be little data to suggest which PPE provides the best prevention; nevertheless, education in wearing and doffing, simulation, and face-to-face directions are all likely to be advantageous [5]. Due to proper teaching, the accessibility of fitness tests, and distribution limitations [6], nurses cannot use PPE following the suggested recommendations [7].

There has been a substantial scarcity of PPE in several countries during the ongoing pandemic of COVID-19 [7], [8], [9]. It has posed a problem in delivering health-care services that can significantly avoid the possibility of being infected

with COVID-19 [10]. In addition to the concern of accessibility, the PPE packages given should also contain formal application requirements. The simplicity of the process, thermal convenience and ventilation, and visibility, and long-term concerns such as cervical discomfort, backache, and unpleasant allergic reactions are all included [11], [12], [13]. Nurses' faces injured from prolonged use of helmets were utilized to show the severe working situations involved in caring for such patients. While discomfort, heat strain, and water losses were anticipated by scientific evidence utilizing Powered Air-Purified Respirators [13], PPE for the nurses does not provide real-life information.

Nurses in Indonesia also experience a shortage of PPE as the number of COVID-19 patients in Indonesia continues to increase. There is no accurate data yet regarding the exact number of PPE scarcity for nurses. However, the Secretary-General of the Pharmaceutical and Medical Devices Ministry of Health on April 14, 2020, estimates that Indonesia has a shortage of PPE of around 8 million units for the community and medical personnel. Although the government is trying to help distribute PPE to all corners of the country, the amount remains insufficient. This situation prompts the government and various elements of society to produce their PPE and open for donation. This study aimed to describe the availability of PPE and adverse consequences long-term used off the PPE and to examine the relationship between shortage PPE with nurse behavior response in Indonesia.

Methods

An online-based survey was used to collect nurse reports regarding PPE associated with the COVID-19 pandemic. This study was conducted in medical center, private hospital, general public hospital, emergency hospital, BUMN's hospital in only one province of Indonesia, namely, Yogyakarta. It is the capital city of Special Region of Yogyakarta in Indonesia, on the island of Java and the only Indonesian royal city still ruled by a monarchy.

Sample

All nurses who are directly involved in the management of COVID-19 patients were invited to participate in the survey. Participants were chosen using convenience sampling. G-Power Software version 3.1.6 is used to calculate you sample size with $\alpha = 0.05$, effect size = 0.08, and power level = 0.80. In this study, a total of 211 questionnaires were gathered.

Survey instrument

A study-related survey was developed in two parts. The first section is regarding basic demographics, including age, gender, education level, and working unit. The second section included a series of questions about PPE availability and the negative impacts of PPE on the nurse. The survey began with a binary question: If a responder indicated that they were personally caring for COVID-19 patients, the questionnaire was completed, and the answer was classified as valid. In the alternative scenario, the questionnaire was canceled, and the answer was deemed invalid.

PPE availability was measured using a developed questionnaire by the researchers' teams. The questions were consisted of 15 items, with two options (yes [1] and [0]). The questionnaire on limited PPE provision has a validity score of >0.349 and a reliability score of 0.812. We also measure about nurse perception toward PPE using a developed questionnaire by the researchers' teams. The questions were consisted of 15 items, with five options (strongly disagreed [1] to strongly agreed [5]). Insufficient perception was categorized if the score below the means value. The reliability score was 0.698. In addition, nurse behaviors toward PPE were measured using a developed questionnaire by the researchers' teams. The questions were consisted of 15 items, with five options (strongly disagreed [1] to strongly agreed [5]). Good behaviors were categorized if the score below the means value. The reliability score was 0.698.

Survey administration

The survey was conducted using the Google form. The survey was scheduled to be open for 2 weeks beginning March 30. An online survey (through a website application platform) was distributed to all charge nurses at both public and private hospitals. Participants might complete the questionnaire on a laptop or phone, which may result in the questionnaire opening a web-connected or checking a quick response code.

Ethical consideration

This study was approved by the affiliated institutions (727/KEPK/STIKES NHM/EC/XII/2020). Informed permission was gained through checkbox bo on the Google form.

Data analysis

Survey findings have been exported into SPSS version 23.00 and evaluated. This study employs univariate and bivariate analysis. The univariate analysis uses frequency distribution tables to explain all

variables. The bivariate analysis used the Chi-square test to describe the relationship between two variables. $p < 0.05$ was considered to be statistically significant.

Results

The characteristics of the 211 respondents are shown in Table 1, with the majority of respondents being female (57.8%), in their early adulthood (43.6%), pursuing graduate-level education (45.5%), working in hospitals (44.1%), working in general (78.7%), and lived in urban area (58.73%).

Table 1: Characteristics of respondent (n = 211)

Variable	n	%
Gender		
Female	122	57.8
Men	89	42.2
Age		
Late adolescence	92	43.6
Early Adult	79	37.4
Late Adult	21	10.0
Early Elderly	19	9.0
Education		
Diploma	82	38.9
Graduate	19	9.0
Graduate Nurse	96	45.5
Postgraduate	14	6.6
Workplace		
Medical center	16	7.6
Private Hospital	56	26.5
RSUD	93	44.1
Emergency Hospital	2	0.9
BUMN's Hospital	1	0.5
Central hospital	43	20.4
Resident area		
Rural area of Yogyakarta	87	41.27
Urban area of Yogyakarta	124	58.73

The majority of the mask N95 provision reaches up to 80%. The second is the hazmat (71%) and the lowest in the gloves (30%) (Figure 1). Around 71% of respondents generally resist removing their PPE until the shift is complete. Then 62% of the respondents are ready to propose to the leaders of the PPE, and 51% indicate that they are modifying the PPE but still according to the required standard, and just 5% state that they are not working if the PPE is not available (Figure 2).

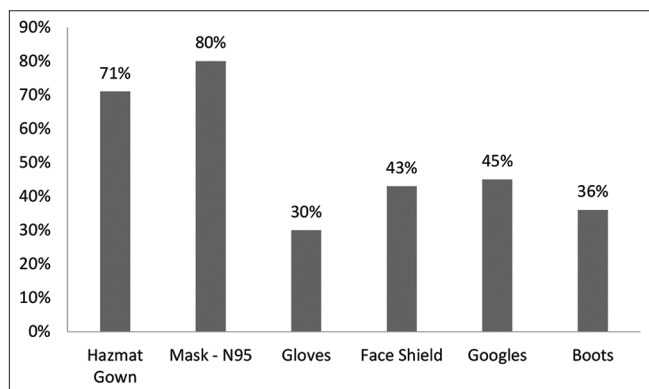


Figure 1: Provision of personal protective equipment in Coronavirus disease-19 services

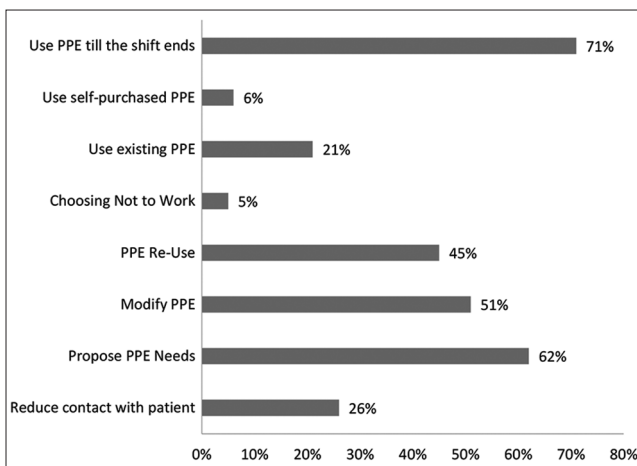


Figure 2: Nurse action during a shortage of personal protective equipment supplies

Figure 3 shows the types of injuries and discomforts caused by prolonged PPE use. Nasal blisters are the most prevalent type of injury sustained by nurses while wearing PPE (86%). Headaches and dehydration are the most common side effects of prolonged PPE use (Figure 3).

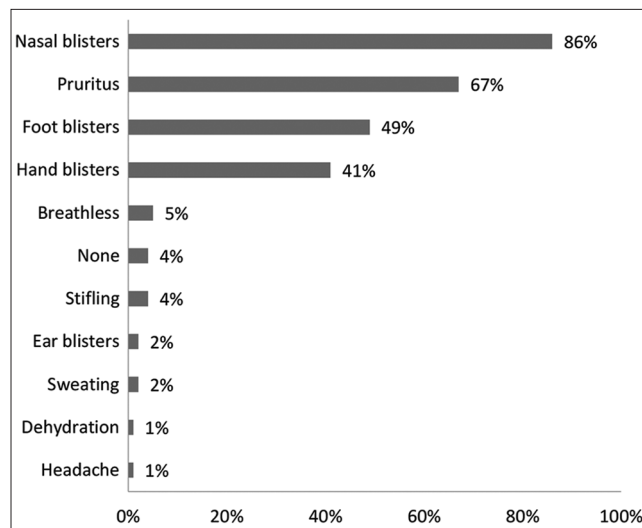


Figure 3: Problems experienced injury due to the use of personal protective equipment

Table 2 depicts the association between PPE shortage and nurse behavior in dealing with PPE shortage. This study found that most respondents (60.7%) with insufficient PPE had a positive behavior reaction, whereas just 18% had a poor behavior reaction. The bivariate analysis found the relationship between PPE shortage and nurse behavior ($p = 0.044$).

Table 2: The relationship between PPE shortage and nurse's behavior in addressing the lack of PPE Provision

PIPE	Nurse behavior				Total	X ²	p-value	
	Good		Poor					
	n	%	n	%				
Sufficient	28	13.3	17	8.1	45	21.3	8.092	0.044
Insufficient	128	60.7	38	18	166	78.7		

Discussion

Almost all nurses reported a lack of PPE, although the number of COVID-19 patients in Indonesia continues to rise. The PPE crisis affects numerous countries worldwide [5]. According to the WHO, the shortage of PPE is caused by rising demand, panic buying, hoarding, and abuse of PPE. [6] Furthermore, many nurses have difficulties obtaining N95, which is like a recent study in which medical masks and 71% of clothing or hazmat are limited [6]. Delgado *et al.* (2020) revealed that medical staff in Latin America had only 67.3% access to gowns/hazmat, 56.1% to N95 masks, and 32.6% to face protection equipment. Medical staff is at a greater risk of becoming contaminated when treating patients due to a lack of PPE supplies.

About 62% of respondents recommend to national government leaders the best solution to alleviate PPE scarcity. The hospital administration should always communicate with all staff; give transparent information on an accurate picture of what is to come, such as PPE shortage and medical equipment [13]. In addition, the leader should encourage enthusiasm and faith in medical professionals and provide an opportunity for medical personnel to research one of the solutions to this pandemic outbreak. In this survey, almost half of respondents recycled PPE and modified it to meet standards. Some nurses even designed their PPE. Many governments and organizations in North America and Europe have developed their protective equipment. Ireland has even established a national Production Planning-Body for PPE, which has effectively manufactured CPAP helmets, arthroplasty helmets, and ventilators [12], [14]. The central government used the same approach, which has encouraged people to construct their protective equipment (PPE) and increase awareness of the PPE standard and guidelines for utilizing PPE, such as cloth masks, gowns, and gown and face shields. Although it is impossible to produce disposable PPE such as N95 masks or goggles on one's own, specific tools such as coveralls, aprons, surgical hoods, and (cloth) masks can be re-used after decontamination. Recycling of PPE is permitted if the amount of PPE is limited. 17 Some countries have even developed low-cost and highly effective decontamination techniques that allow workers to re-use their PPE [12], [15].

The majority of respondents in this study opted to delay putting on PPE until the shift was complete. This finding is consistent with previous research indicating that nurses wear PPE until they return home due to a limited supply of PPE [11]. The health association recommends extending the usage of PPE to eliminate shortcomings. It can be done if the PPE

is still in good condition, clean, and not contaminated with infectious fluid from the patient. Limiting interaction with patients is another efficient method of reducing PPE usage. The World Health Organization suggests adopting telemedicine to analyze suspected COVID-19 cases, using glass or plastic partitions in the triage area, registration tables in emergency departments and pharmacies, restricting patient visitation, and minimizing bundling care activities. It is also recommended to postpone all elective operations, endoscopic lists, and clinics to avoid transmission [3].

Long-term usage of tight-fitting, double-coated PPE might cause damage. A few of the injuries reported by the responders are nasal and ear blisters, itching, perspiration, overheating, and headache. Similar to the previous study, many medical workers suffered nasal injuries and blisters on their hands and feet due to the usage of PPE during providing Covid-19 care and treatment [16]. PPE also impairs nurses' dexterity while performing their duties; multiple layers of gloves create discomfort; flexible face shields cause sight abnormalities; some nurses complain of back pain, cold, and dehydration [17]. Even though PPE used in industries is constructed of a variety of materials, skin problems produced by PPE used on the same portion of the body have a similar effect [17], [18]. Comprehensive preventative actions, such as enhancing PPE and reducing usage duration, will keep nurses safe [16].

The use of PPE is one of many strategies for reducing infection transmission in hospitals. Since all health facilities require PPE, supplies are scarce, and it is not easy to obtain. The research showed that the respondents were well-behaving concerning the restrictions on PPE access. There is a relationship between the availability of PPE and nurse behavior response. It is similar to the previous research, in which medical staff responded positively when they were unable to access PPE [19]. It should be highlighted that nurses respond favorably to this approach because there is no more effective or efficient method of providing PPE than changing and recycling it. The report can be used as a reference for determining how and when this PPE is applied, especially when it has to be decided or when there is strong demand for the usage of the PPE.

This study has certain limitations that should be acknowledged. First, a voluntary survey and answers represent views and perspectives only. This study was only conducted in one province of Indonesia, which is Indonesia has 35 provinces; thus, generalizability may be limited to the specific context on this study. However, this province included in metropolitan city which consist of many Indonesian nurses' representative to all nurses in Indonesia. They may not always represent actual procedures, as this is not audited. Second, instead of using a systematic

sample approach, we created the survey readily accessible. Therefore, there is no denominator to compute a rate of response. As a result, our findings may only represent a small part of the actual thoughts of all nurses, and they may be biased.

Conclusion

The majority of nurses have difficulties accessing N95, and nurses' response to the most severe PPE restrictions is to refrain from putting off PPE until the time shift begins. Nasal blisters are the most common PPE-related injury among nurses. Although the supply of PPE is limited, nurses demonstrate appropriate behavior in this situation. Protecting the PPE supply chain will ensure the continuation of critical healthcare services and contribute to reducing mortality. Policymakers should take urgent action to tackle these concerns. Future study could explore in others province regarding nurse behaviors toward PPE as PPE is an important protect of COVID-19 during their professional practices.

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