

PHYSIOLOGICAL DISORDERS DUE TO THE USE OF PERSONAL PROTECTIVE EQUIPMENT ON NURSES IN THE ERA OF THE COVID-19 PANDEMIC: LITERATURE STUDY

Erika Nurwidiyanti¹, Teguh Santoso^{2*)} & Dwi Afriyanti³

^{1,2,3} Bachelor Nursing Study Program of STIKES Guna Bangsa, Jl. Ring Road Utara, Condong Catur, Depok, Sleman, Yogyakarta

Abstract

The use of personal protective equipment (PPE) is important for nurses when providing services to patients to avoid infectious diseases including COVID-19. However, continuous use of PPE can cause physiological problems such as headache, facial dermatitis, difficulty breathing, irritation, and discomfort. This study aims to determine various physiological disorders due to the use of PPE on nurses during the COVID-19 pandemic based on the results of a critical review of scientific articles. The search for scientific articles was carried out through the search engines Google Scholar, Pubmed, and EBSCO with the keywords personal protective equipment, physiological disorders, nurses, and the COVID-19 pandemic. The search is limited to 2020-2021, which is accessible in full text for free. The results of the literature study found 13 suitable articles. It is known that the use of PPE has effects such as headache, dermatitis, itching, rash, difficulty breathing, irritation, reactions to body skin tissue, acne and discomfort when used continuously for an indefinite period of time. It can be concluded that the use of PPE has a negative impact on the physiological condition of nurses if PPE is used continuously without regard to safety management in the use of PPE.

Keywords: Nurses; The COVID-19 Pandemic; Personal Protective Equipment; Physiological Disorders

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*) Corresponding author:
Email: tg.santoso21@gmail.com

1. Introduction

Coronavirus disease is a disease that attacks the respiratory system caused by coronavirus disease 2019 (COVID-19). This disease causes mild to severe infections of the lungs, and can even lead to death. Globally, there were 118,268,575 positive confirmed cases of COVID-19, and 2,624,677 deaths were recorded (World Health Organization, 2020). In Indonesia, as many as 1,403,722 confirmed positive cases with a death toll of 38,049 cases (Kementrian Kesehatan RI, 2021). In Yogyakarta, the number of positive confirmed cases reached 31,452 cases and 757 cases were reported to have died (Pemda DIY, 2021).

Nurses are one of the health workers who are at the forefront in providing services to patients with various diseases including the infectious disease COVID-19 (PERSI, 2020). So that the use of personal protective equipment (PPE) is important for nurses in providing

services to avoid various infectious diseases (Kementrian Kesehatan RI, 2020). PPE are tools that are able to provide protection against the dangers of accidents or work risks to maintain the safety of workers and those around them (World Health Organization, 2020).

According to the Indonesian Ministry of Health (2020), there are 3 levels of PPE that are most recommended; namely, the first level of PPE consists of surgical masks, gowns, and gloves used by nurses working in general practice settings that do not pose a high risk and do not generate aerosols. The second level of PPE, used by nurses who work in patient care rooms and in non-respiratory sampling rooms or in laboratory rooms, consists of headgear, goggles, surgical masks, gowns, and disposable gloves. The third level of PPE is used by nurses who are in direct contact with suspected or confirmed COVID-19 patients and will perform aerosol-generating actions, which consist of a

head covering, face shield, glasses, N-95 mask, cover all, surgical gloves, and shoes waterproof boots that must be worn in full (Kementrian Kesehatan RI, 2020).

Nurses on duty in hospitals must pay attention to the correct use of PPE because hospitals are areas where the risk of COVID-19 transmission is quite high (Kementrian Kesehatan RI, 2020). Therefore, nurses must use level 3 PPE to avoid COVID-19 (PERSI, 2020). However, continuous use of PPE can cause physiological impacts such as headaches, facial dermatitis, tired breathing, irritation or reactions to the body's skin, discomfort, and sweating (World Health Organization, 2020). The results of Rosyanti and Hadi's research (2020) also explained that nurses had difficulty maintaining their physical health conditions due to work and prolonged use of PPE while providing care to COVID-19 patients.

The use of PPE is very important to protect nurses who work in hospitals, but on the other hand, the use of PPE can cause various physiological problems. Of course, this creates a dilemma in the use of PPE. This literature study is important to do with the aim of knowing the physiological disorders that can be experienced by nurses due to the use of PPE in the era of the COVID-19 pandemic.

2. Method

The literature study was conducted in April 2021 using secondary data obtained from indirect observation but obtained from the results of research conducted by previous researchers in the form of scientific articles of national and international reputation obtained through Google Scholar, Pubmed, and EBSCO databases. Article searches were conducted using the keywords nurse, COVID-19 pandemic, personal protective equipment, and physiological disorders. The process of searching for articles with keywords is also carried out with boolean operators (AND and OR) to expand and specify the appropriate search articles.

Based on the results of a literature search using keywords through 3 predetermined databases, the researchers found 7,117 suitable articles. The search results that have been obtained are then checked for duplication; there are 3,125 similar articles that were removed and the remaining 4,130 articles. The researcher then screened based on title (n=126), abstract (n=47), and full text (n=13) which were adjusted to the theme of the literature study. The assessment was carried out based on inclusion and exclusion criteria. The inclusion criteria in this study are articles that explain the

physiological impact of using personal protective equipment for nurses during the COVID-19 pandemic. While the exclusion criteria are articles that explain the impact of using personal protective equipment on other health workers (doctors, pharmacists, analysts, midwives, etc.), articles that do not explain the physiological impact of using personal protective equipment clearly, and articles that use other than Indonesian and English languages. Based on literature study results, 13 articles were found that matched. The results of article selection are illustrated in Figure 1.

3. Results and Discussion

The 13 articles in this literature study explain the physiological impact of using personal protective equipment on nurses working on the front lines in handling COVID-19. Respondents were nurses from various countries who worked with COVID-19, aged 18-59 years, most of them were female, and the last education is registered nurses was 6,249 people.

Nurses who work in hospitals must pay attention to the use of PPE properly because hospitals are areas with a fairly high risk of COVID-19 transmission. The use of Personal Protective Equipment is one of the efforts to break the chain of infection transmission and self-protection for health workers in providing health services. During this COVID-19 pandemic, nurses must use PPE every day for approximately 8 hours per day or even more to provide services to patients. The use of PPE that is too long can cause uncomfortable reactions, and cause physiological problems for nurses (Ministry of Health of the Republic of Indonesia, 2020; Duan et al. 2021; Sinaga, Sijabat, & Pardede, 2021).

The study by Jose, Cyriac, & Dhandapani (2021) reported other physiological effects of using PPE such as headaches (73.4%), excessive sweating (59.6%), difficulty breathing (36.7%) and foggy glasses (91.7%), there is scar tissue on the bridge of the nose (76.64%), pain behind the ear (66.42%), excess sweating on the skin of hands (70.07%), cracked skin (19%), and sweating body (71.53%). The results of this research are supported by Tabah et al (2020), namely if the use of PPE is excessive for a long duration it will harm nurses in the form of feeling hot (51%), thirst (47%), headaches (28 %), cannot use the bathroom (27%), and extreme fatigue (20%).

Halid & Aini's research (2019) states that the physiological effects are in the form of adverse skin reactions that occur in nurses due to the

uncontrolled use of personal protective equipment, including dry skin, and the appearance of reddish spots. This is in line with the results of research by Malik et al (2020), the use of PPE for a long time can cause acne (56.8%), ear pain (54.9%), bruises due to pressure (32.3%), friction dermatitis (26.4%), contact dermatitis (22.5%), excessive sweating (82.3%), folliculitis (6.8%), miliaria (3.9%),

and intertrigo (1.96%). Similar results were also delivered by Hadjieconomou, Hughes & Kamath (2020) including 62.5% of respondents experiencing irritant dermatitis on hand due to the use of PPE, 4% of side effects of masks, and 23.6% worsening of preexisting dermatological conditions.

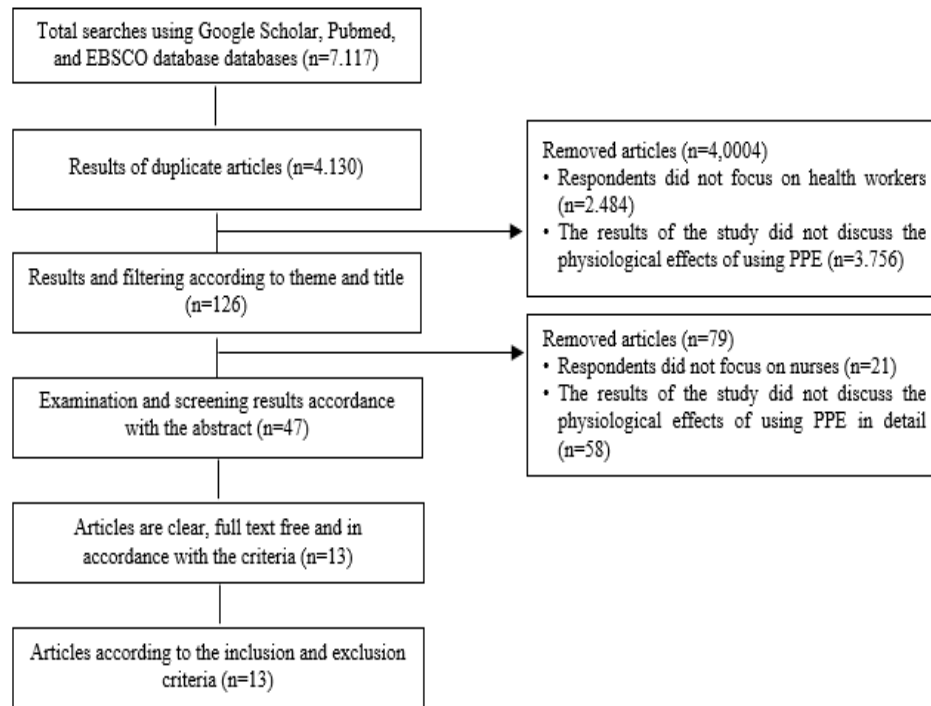


Figure 1. Literature Review Flowchart

Table 1. Literature Search Results

No	Author, year	Title	Design, sample, variable, instrument, analysis	Results	Database
1.	Hu <i>et al</i> (2020)	The Adverse Skin Reactions Of Health Care Workers Using Personal Protective Equipment For COVID-19	Design: Cross-sectional study Sample: 61 Nurses Variables: Personal protective equipment (independent variable), Adverse skin reactions (dependent variable) Instrument: Questionnaire Analysis: Chi-square test	There is a significant relationship between the use of personal protective equipment and adverse skin reactions with a p-value of 0.05.	Pubmed
2.	Choudhury <i>et al</i> (2020)	Physiological Effects Of N95 FFP And PPE In Healthcare Workers Of COVID-19	Design: Cross-sectional study Sample: 75 nurses Variables: N95 FFP and PPE (independent variable), Physiological effect (dependent variable) Instrument: Questionnaire	There is a significant relationship between the use of N95 FFP and PPE and physiological effects with $p < 0.001$.	Google Scholar

No	Author, year	Title	Design, sample, variable, instrument, analysis	Results	Database
			Analysis: Wilcoxon signed-rank test		
3.	Daye, Cihan, & Durduran (2020)	Evaluation Of Skin Problems And Dermatology Life Quality Index In Health Care Workers Who Use Personal Protection Measures During COVID-19 Pandemic	Design: Cross-sectional study Sample: 191 nurses Variables: Personal protection (independent variable), Skin problems, and dermatology quality of life index (dependent variable) Instrument: Questionnaire Analysis: Chi-square test	There is a significant relationship between the use of personal protection with skin problems and dermatology life quality index with a value of $p < 0.001$.	EBSCO
4.	Ong <i>et al</i> (2020)	Headaches Associated With Personal Protective Equipment	Design: Cross-sectional study Sample: 102 nurses Variables: Personal protective equipment (independent variable), headache (dependent variable) Instrument: Self-administered Questionnaire Analysis: Mann-Whitney U Test	There is a significant relationship between the use of PPE and the incidence of headaches with a p-value of 0.012.	Pubmed
5.	Jiang <i>et al</i> (2020)	The Prevalence, Characteristics, And Prevention Status Of Skin Injury Caused By Personal Protective Equipment	Design: Cross-sectional study Sample: 4308 nurses Variables: Skin injury (independent variable), personal protective equipment (dependent variable) Instrument: Questionnaire Analysis: Fisher's exact test	PPE significant causes skin damage and skin tears, with a p-value of 0.05.	Pubmed
6.	Malik <i>et al</i> (2020)	Skin Manifestations Associated with Personal Protective Equipment (PPE)	Design: Qualitative study Sample: 102 nurses Variables: Personal protective equipment (independent variable), skin manipulation (dependent variable) Instrument: Questionnaire Analysis: Descriptive Statistics	Common skin manifestations due to the use of masks are acne (56.8%), earache and cracking (54.9%), pressure bruising (32.3%), secondary dermatitis (26.4%), and contact dermatitis (22.5%). Contact dermatitis due to gloves was reported as 33.3%. Problems related to protective clothing for the whole body in the form of excessive sweating (82.3%), folliculitis (6.8%) miliaria (3.9%), and intertrigo (1.96%).	Google Scholar

No	Author, year	Title	Design, sample, variable, instrument, analysis	Results	Database
7.	Tabah <i>et al</i> (2020)	Personal Protective Equipment In The COVID-19 Era (PPE-SAFE): An International Survey	Design: Qualitative study Sample: 744 nurses Variables: Personal protective equipment (independent variable), side effects (dependent variable) Instrument: Questionnaire Analysis: Descriptive Statistics	Adverse effects of using PPE in long hours include heat (51%), thirst (47%), headache (28%), inability to use the bathroom (27%), and extreme fatigue (20%).	Pubmed
8.	Hadjieconomou, Hughes & Kamath (2020)	Occupational Skin Disease During The COVID-19 Pandemic	Design: Qualitative study Sample: 21 nurses Variables: Personal protective equipment (independent variable), skin disease (dependent variable) Instrument: Questionnaire Analysis: Descriptive Statistics	A total of 62.5% had irritant hand dermatitis, 4% had side effects consequence of using masks, and 23.6% had side effects from the preexisting dermatological condition to be worsening.	Pubmed
9.	Moreno (2020)	Mask-Associated 'De Novo' Headache In Healthcare Workers During The COVID-19 Pandemic	Design: Cross-sectional study Sample: 65 nurses Variables: Mask (independent variable), headache (dependent variable) Instrument: Questionnaire Analysis: Chi-square test	The use of PPE such as masks can cause headaches as evidenced by a p-value < 0.05.	Google Scholar
10.	Duan <i>et al</i> (2021)	Personal Protective Equipment In COVID-19	Design: Cross-sectional study Sample: 49 nurses Variables: Personal protective equipment (independent variable), discomfort and injury (dependent variable) Instrument: Questionnaire Analysis: Chi-square test	There is a significant relationship between the use of PPE with discomfort and injury with a p-value of 0.000.	Pubmed
11.	Jose, Cyriac, & Dhandapani (2021)	Health Problems And Skin Damages Caused By Personal Protective Equipment	Design: Qualitative study Sample: 137 nurses Variables: Personal protective equipment (independent variable), Health problems and skin damage (dependent variable) Instrument: Questionnaire of physical problems and adverse skin reactions Analysis: Descriptive statistics	Physical problems: The most common effects expressed by the sample were headache (73.4%), excessive sweating (59.6%), and difficulty breathing (36.7%). Adverse skin reactions: A total of 91.7% complained about foggy glasses, there was scar tissue on the bridge of the nose (76.64%), pain behind the ears (66.42%), the skin of the hands sweated (70.07%), cracked skin (19%), and	Pubmed

No	Author, year	Title	Design, sample, variable, instrument, analysis	Results	Database
				the body sweated (71.53%).	
12.	Abiakam et al (2021)	Personal Protective Equipment Related Skin Reactions In Healthcare Professionals During COVID-19	Design: Cross-sectional study Sample: 209 nurses Variables: Personal protective equipment (independent variable), Skin reaction (dependent variable) Instrument: Questionnaire Analysis: Chi-square test	There is a significant relationship between the use of personal protective equipment and skin reactions with a p-value of 0.05.	Pubmed
13.	Battista et al (2021)	Personal Protective Equipment (PPE) In COVID 19 Pandemic	Design: Qualitative study Sample: 185 nurses Variables: Personal protective equipment (independent variable), adverse skin reactions (dependent variable) Instrument: Questionnaire Analysis: Descriptive statistics	The majority of 68.5% of respondents experienced skin lesions due to pressure caused by the use of PPE.	EBSCO

Research by Hu et al (2020) states that there is a significant relationship between the use of personal protective equipment and adverse skin reactions with a p-value of 0.05. These results are like to the study of Daye, Cihan, & Durduran (2020) which stated that there was a significant relationship between the use of personal protection and skin problems and a dermatological quality of life index with a p-value of < 0.001. The results of the research by Jiang et al (2020) also explained that the use of PPE was significantly related to the incidence of skin damage and skin tears with a p-value of 0.05. The results of the study by Abiakam et al (2021) revealed that there was a significant relationship between the use of personal protective equipment and skin reactions with a p-value of 0.05.

The use of PPE not only causes problems on the skin but also causes other problems such as headaches. This statement is supported by research by Ong et al (2020) which states that there is a significant relationship between the use of PPE and the incidence of headaches with a p-value of 0.012. Moreno (2020) also stated that the use of PPE such as masks can cause headaches, as evidenced by a significance value of $p < 0.05$. These results are supported by Choudhury et al (2020), the use of N-95 FFP masks and PPE has a significant relationship with physiological effects ($p\text{-value} < 0.001$).

Based on the results of a literature study, it is known that whatever type of PPE is used, if

it does not pay attention to the duration and safety management regarding the use of PPE, it can cause negative impacts on the wearer. This is supported by research by Duan et al (2021) which states that there is a significant relationship between the use of PPE with discomfort and injury with a p-value of 0.000 if safety management in the use of PPE is not attention.

4. Conclusions and suggestions

All articles state the same result, namely that the use of PPE has a negative impact on the physiological condition of nurses during the COVID-19 pandemic, such as headaches, dermatitis, difficulty breathing, and irritation of the body's skin, discomfort, and disturbances. This impact arises when there is not paid attention to safety management in the use of PPE.

The theme of the articles in this literature study is quite a lot, but the number of articles in Indonesia is still limited, so further research is needed on physiological problems due to using PPE in care for patients during the COVID-19 pandemic and related solutions to these problems.

5. References

Abiakam et al. (2020). *Personal Protective Equipment Related Skin Reactions Inhealthcare Professionals During COVID-19*. DOI: 10.1111/iwj.13534

- Battista et al. (2021). *Personal Protective Equipment (PPE) In COVID 19 Pandemic*. doi: 10.1097/JOM.00000000000002100
- Choudury et al. (2020). *Physiological Effects Of N95 FFP And PPE In Healthcare Workers In COVID*. doi: 10.5005/jp-journals-10071-23671
- Daye, M., Cihan, F. G., & Durduran, Y. (2020). *Evaluation Of Skin Problems And Dermatology Life Quality Index In Health Care Workers Who Use Personal Protection Measures During COVID-19 Pandemic*. DOI: 10.1111/dth.14346
- Duan et al. (2021). *Personal Protective Equipment In COVID-19*. doi: 10.1097/JOM.00000000000002123
- Hadjieconomou, S., Hughes, J., & Kamath, S. (2020). *Occupational Skin Disease During The COVID-19 Pandemic*. DOI: 10.1111/jdv.16754
- Halid, I & Aini. (2019). <http://www.lppm.poltekrmfh.ac.id/index.php/mmls/article/view/197>.
- Hu et al. (2020). *The Adverse Skin Reactions Of Health Care Workers Using Personal Protective Equipment For COVID-19*. doi: 10.1097/MD.00000000000020603
- Jiang et al. (2020). *The Prevalence, Characteristics, And Prevention Status Of Skin Injury Caused By Personal Protective Equipment*. DOI: 10.1089/wound.2020.1212
- Jose, S., Cyriac, M. C., & Dhandapani, M. (2021). *Health Problems And Skin Damages Caused By Personal Protective Equipment*. <https://www.ijccm.org/doi/pdf/10.5005/jp-journals-10071-23713>
- Kementerian Kesehatan RI. (2020). *Petunjuk Teknis Alat Pelindung Diri (APD) Dalam Menghadapi Wabah COVID-19*. Jakarta: Direktorat Jenderal Pelayanan Kesehatan Kementerian Kesehatan Republik Indonesia.
- Kementerian Kesehatan RI. (2021). *Situasi Terkini Perkembangan Coronavirus Disease (COVID-19)*. <https://infeksiemerging.kemkes.go.id/situasi-infeksi-28-emerging/situasi-terkini-perkembangan-coronavirus-disease-covid-19-12-februari-2021>.
- Malik et al. (2020). *Skin Manifestations Associated With Personal Protective Equipment (PPE)*. <https://esculapio.pk/wpcontent/uploads/2020/10/v16isspa13.pdf>.
- Moreno et al. (2020). *Mask-Associated 'De Novo' Headache In Healthcare Workers During The COVID-19 Pandemic*. <https://oem.bmj.com/content/oemed/early/2020/12/29/oemed-2020-106956.full.pdf>.
- Ong et al. (2020). *Headaches Associated With Personal Protective Equipment*. DOI: 10.1111/head.13811
- Pemda DIY. (2021). *Yogyakarta Tanggap COVID-19*. <https://corona.jogjaprovo.go.id/data-statistik>.
- PERSI. (2020). *Penggunaan APD Level 3*. <https://www.antaranews.com/berita/1721998/persi-lampung-sarankanpenggunaan-apd-level-3-bagi-petugas-igd>.
- Sinaga, J., Sijabat, F., & Pardede, J. A. (2021). *Keterbatasan APD terhadap Kesiapan Mental Perawat Dalam Merawat Pasien COVID-19*. <http://journal.ppnijateng.org/index.php/jikj/article/view/1056>.
- Rosyanti, L. dan Hadi, I. (2020). *Dampak Psikologis dalam Memberikan Perawatan dan Layanan Kesehatan Pasien COVID-19 pada Tenaga Profesional Kesehatan*. *Health Information : Jurnal Penelitian*, 12(1), hlm. 107–130. doi: 10.36990/hijp.vi.191.
- Tabah et al. (2020). *Personal Protective Equipment In The COVID-19 Era (PPE-SAFE): An International Survey*. <https://doi.org/10.1016/j.jcrc.2020.06.005>
- World Health Organization. (2020). *Penggunaan Rasional Alat Perlindungan Diri Untuk Penyakit Coronavirus (COVID-19) Dan Pertimbangan Jika Ketersediaan Sangat Terbatas*. <https://www.who.int>.