Open Peer Review on Qeios

Skin related health issues among health care workers due to utilizing of personal protective equipment during COVID-19 pandemic in Pakistan

Shahzad Bashir

Funding: The author(s) received no specific funding for this work.

Potential competing interests: The author(s) declared that no potential competing interests exist.

Abstract

Introduction: In December 2019, another COVID was found in Wuhan, Hubei Province, China, on that time it spread quickly the nation over, drawing in worldwide consideration.[1][2] Current epidemiological information about COVID-19 transmission of speed is altogether quicker than that of SARS, in any case, its pathogenicity is strikingly more vulnerable than that of MERS and SARS[3] Due to the COVID-19 solid transmission and the vulnerability of the contamination status of patients, HCWs should use of personal protective equipment (PPE)[4]. The study aim is to determine skin related issues in health care workers due to utilizing of personal protective equipment during COIVD-19 pandemic.

Methods: The quantitative descriptive cross-sectional study conducted to determine the skin related issues in Karachi-Pakistan from May to October 2021. Data were collected via, structured questionnaire from 52 health care workers (Doctors, Registered Nurses & Health Care Assistant) children through purposive sampling technique studying. The validity and reliability of the questionnaire was established thoroughly. Participants were approached after taking verbal consent. Data were collected online through google forms, and WhatsApp groups.

Results: Out of 52 majority (53.8%) of the participant's age group is 26-35 years. Similarly, majority of the study participants were nurses (94.2%). Most of the participants did not used any type of skin care related products or materials and majority respond "no" 45 (86.5%). Most 37 (71.1%) of the participants feel comfortable wearing PPE. However, 38 (73.0%) responded "yes" skin broken where the PPE applied.

Conclusion: The study revealed that several approaches have been adopted to investigate skin adverse events after periods of PPE use. The increase in reported adverse events was associated with the mean time per day wearing PPE and the duration of unrelieved PPE use. The trend of skin adverse events was also related to the number of consecutive days of PPE use and the type and model of PPE.

Keywords: COVID-19, Skin related issues, PPEs, Health Care Workers, Pandemic, Pakistan.

1. Introduction

From the start of the 21st century, the flare-up of COVID has carried genuine misfortunes to society, the most genuine of

which are extreme intense diseases are SARS and MERS. In December 2019, another COVID was found in Wuhan, Hubei Province, China, on that time it spread quickly the nation over, drawing in worldwide consideration.[1][2] Current epidemiological information about COVID-19 transmission of speed is altogether quicker than that of SARS, in any case, its pathogenicity is strikingly more vulnerable than that of MERS and SARS[3] Due to the COVID-19 solid transmission and the vulnerability of the contamination status of patients, HCWs should use of personal protective equipment (PPE) [4]. Because of the exceptionally infectious and cross country spread of COVID19, HCWs are needed to wear PPE in across China who volunteers in Hubei Province., like N95 masks, latex gloves, and protective clothing[4]. It has been accounted for that through contact COVID-19 can be transmitted, for that hand hygiene is very necessary to prevent from COVID-19 transmission[4]. SARS-CoV-2 measurement is somewhere in the range of 80 and 120 nm, in any case, when the infection is discharged from a contaminated individual, it will be enclosed by spit to shape bigger beads. Since the N95 veil can adequately sift through particles ≥300 nm in size, N95 can successfully hinder the spread of SARS-CoV-2[5]. PPE will regularly be worn for quite a long time at a time. There are fewer cases that instances of adverse skin reaction identified with the utilization of PPE by HCWs[5]. Arrangement of investigates have investigated the connected unfavorable responses of HCWs wearing N95 veil[5]. Latex gloves wearing can successfully forestall the opportunity of contact contamination among HCWs. Dry skin, itching and rash were the most common adverse reactions to wearing latex gloves in this study. Skin adverse reactions of wearing gloves during SARS was similar[5]. Respiratory tract infections can be prevented with use of medical masks which a kind of PPE which can cover the mouth and nose, whenever worn appropriately, may successfully help forestall the spread of respiratory infections and microscopic organisms [6]. In 2003 during the outbreak of SARS, preventive measures in the care of SARS patients gave by the WHO and the Centers for Disease Control, recommending that the hour of openness to air ought to be diminished to diminish the likelihood of airborne bead transmission[6].

Specifically, it is prescribed to utilize defensive covers that meet the certificate of the National Institute of Occupational Safety and Health. 95% of the air particles N95 mask can block and fits intimately with the facial skin to forestall the inward breath of more modest irresistible particles, after and infected person coughs or sneezes that can be travel significant distances through the air. N95 mask also require to use include tuberculosis, chicken pox, SARS, and measles[6]. Acne, facial itching, and rash are the most common adverse skin reactions. Moreover, migraine was featured in Lim research[6]. The participants in Lim research have been wearing N95 mask for >1 year that reported headache due to use of N95 in Lim research and the long-term utilization could result in deficiency of oxygen and retention of carbon dioxide which led to headache. They found most common adverse reaction of the use of N95 mask was nasal bridge scarring in this study, followed by facial pruritus. Since the clinical staff should have sufficient individual protection, ensure the tightness of the mask by squeeze the metal clip hard. Accordingly, excessive pressure of the mask and the hardness of the metal clip on the bridge of the nose may be caused the scar. The wearing of mask for too long a period of a time can cause of itching and discomfort, combined with an excessively humid internal environment. In the result of itching from irritating contact dermatitis attributed to an allergic reaction to the mask material. Due to the excessive binding of the mask skin may be damaged, such that the mask edge is in close contact with the skin, with wearing of mask for a long period of time[6]. Why these situations occur there may be 3 reasons. One is Immunoglobulin E-interceded extreme touchiness to latex[6].

The second allergy to latex; and the third may be contact irritant dermatitis, repeated hand washing with soap and detergent which arises and due to not completely drying the hands. Hence, within the glove won't retain air, bringing about bothering. If glove with dry powder, it is likely to be caused by the stimulation of talcum which in gloves in the form of powder. For this situation, it is important to wash hand with the soap or detergent prior to putting on gloves and dry one's hands prior to wearing gloves. In the event that the gloves are dry, there ought not be an excessive amount of talcum powder inside. Wear a layer of plastic gloves inside the latex gloves is another solution to prevent from reactions. These actions can forestall the event of aggravation dermatitis. On the off chance that the indications of aggravation contact dermatitis can't be settled, latex hypersensitivity testing is important, and latex gloves ought to be kept away from[6].

2. Material and Methods

2.1. Study setting, sample size, and participant's data

The quantitative descriptive cross-sectional study conducted to determine the skin related issues in Karachi-Pakistan from May to October 2021 at private tertiary care hospital. Sample calculated through online software named "OpenEpi" version 3.0. It was calculated by taking 95% C.I, 80% considering the prevalence of skin related health issues ranged from 25%-30%. The calculated sample size was 100 but due to time constrain it was reduced to 52.

2.2. Study Tool, Validity, Reliability

A structured questionnaire was adopted from one of the Chinese researches conducted by "Hu et al" in 2020[6] and translated into Urdu language after taken the expert view. The permission of using this tool has been taken by primary author. Content validity of the tool was done by a panel of six experts, including public health doctors and nurses, master prepared clinical faculty nurses, and a statistician. The relevancy and clarity were calculated 0.72 and 0.91 respectively for all four sections. Moreover, the reliability of the tool was calculated by used Cronbach's alpha and it was found 0.75 and 0.82, respectively.

2.3. Ethical Considerations

Prior to the commencement of this study, formal ethical approval was obtained from the Sohail University-ERC (no. 000156/21) and also verbal permission was sought out from the Participants. During data collection, privacy was maintained for all the participants.

2.4. Sampling Technique

The purposive sampling technique was utilized for recruiting the participants. After filling the eligibility criteria participants were offer to fill the questionnaire.

2.5. Data analysis and management

In this present study, descriptive statistical analysis was used to interpret continuous variables as the mean ± standard deviation, and categorical variables as the count (percentage). The data was entered twice to minimize the chances of

error. For any missing data or to prevent error, data was cross-checked while entering in STATA. Each questionnaire was checked by the principal investigator before entering data for any missing value.

3. Results

This present study was performed on a total 52 health care workers. Brief overview regarding the baseline socio-demographic characteristics such as; age, gender, profession, posting area, and previous history of skin allergy in table 01. It indicated that majority 53.8% of the participant's age group is 26-35 years. More than half of the study participants were nurses 94.2%. Amongst of these, most the participants were female 51.9% whereas 48.1% were male. Respondents with previous history of skin allergy the highest proportions of 94.2 % were "no". With regards to the identified different types of PPE were using and co-related with previous history of skin allergy, in table 02 majority 59.6% participants were used face shield for the protection of eyes; whereas 63.5% used surgical mask for face protection majority. Hence, average duration of wearing PPE per day in hours were noticed 6-8 hours 67.3% through participants respond.

Skin related characteristics of the study participants. (Table.3)

Table 03 depicts that majority participants did not used any type of skin care related products or materials and majority respond "no" 45 (86.5%). Therefore, majority participants were comfortable in wearing PPE in the respond of "yes" 45 (86.5%). Similarly, majority participants were responding "no" 37 (71.1%) related skin broken where the PPE applied but majority participants had responded "yes" 38 (73.0%) related red spots where the PPE were placed. Table 03 reveals that majority participants were using PPE for consecutive days 35 (67.3%) and majority removed the PPE equipment regularly to relieve their skin 41 (78.8%).

Table.04. Different problems were identified while using of PPE.

Among the 52 HCWs who regularly used PPE majority were respond physical problems felt while working with PPE were excessive sweating 33 (63.5%). Similarly, majority respond adverse skin reactions from respirator/ N95 mask/ surgical mask and goggle were pain on the back of ear 31 (59.6%), adverse skin reactions of double gloving majority respond dry skin 26 (50%) and adverse skin reactions of protective clothing majority were excessive sweating and soaking 28 (53.8%).

Table.05. The distribution of adverse skin reactions at different anatomical sites on facial skin.

Table 05 reveals that adverse skin reactions at different anatomical sites on facial skin majority were redness blanching at nose bridge 26 (50%), Itchiness at Cheeks 17 (32.6%), Rash at Cheeks 14 (26.9%), Pressure damage at Ears 14 (26.9%), Spots 6 at chin (11.5%), Dry skin at cheeks 5 (9.6%) and No reaction at forehead 17(32.6%).

Table.01. Demographic characteristic of participants

Study variables	Categories	N	%
Gender	Male	25	48.1%
	Female	27	51.9%
Profession	Doctors	3	5.8%
	Nurses	49	94.2%
Age Range in Years	18-25	19	36.5%
	26-35	28	53.8%
	36-45	5	9.6%
Posting Area	COVID	30	57.7%
	Non COVID	22	42.3%
Previous History of Skin Allergy	YES	3	5.8%
	NO	49	94.2%

Table.02. Identified different types of PPE were using and co-related with previous history of skin allergy.

Usage of PPE	Categories	N	%
Types of Eye Protection	General safety glasses	19	36.5%
	Chemical splashing goggles	23	44.2%
	Face shield	31	59.6%
	None	3	5.7%
Types of Face Protection	Cardinal mask	2	3.8%
	N95 mask	21	40.4%
	surgical mask	33	63.5%
	3M respirator mask	21	40.4%
	Alpha respirator mask	9	17.7%
	Valmy respirator mask	1	1.9%
Average duration of wearing PPE per day in hours	4-6 hours	12	23.1%
	6-8 hours	35	67.3%
	8-12 hours	5	9.6%

Table.03. Skin related characteristics of the study participants.

STUDY VARIABLES	CATEGORIES	YES		NO	
		N	%	N	%
Skin Care When Using PPE	Do you normally use cosmetic products on your face?	9	17.3%	43	82.6%
	Do you apply any specific cream or moisturizer before wearing PPE	11	21.1%	41	78.8%
	Do you use any dressing material between your face and this protective equipment?	7	13.4%	45	86.5%
How Comfortable Is The PPE	Do you feel comfortable wearing this protective equipment?	28	53.8%	24	46.1%
	Are you able to breathe easily when wearing this protective equipment?	29	55.7%	23	44.2%
	Do you feel safe and in control when wearing this protective equipment?	45	86.5%	7	13.4%
Face Skin Health	Do you have any red marks where the protective equipment is placed?	38	73.0%	14	26.9%
	Do you have any indentation marks where the protective equipment is placed?	25	48.0%	27	51.9%
	Is your skin broken on the area where the protective equipment is placed?	15	28.8%	37	71.1%
PPE Were Using for Consecutive Days		35	67.3%	17	32.7%
Remove the PPE Equipment Regularly to Relieve Your Skin		41	78.8%	11	21.2%

Table.04. Different problems were identified while using of PPE.

STUDY VARIABLES	CATEGORIES	N	%
Physical problems felt while working with PPE	headache/dizziness	22	42.3%
	excessive sweating	33	63.5%
	dry mouth/ extreme thirstleg	22	42.3%
	Cramps	1	1.9%
	weakness restlessness	5	9.6%
	difficulty in breathing	26	50%
	Difficulty in reading due to foggy goggles	31	59.6%
	difficulty in walking	9	17.3%
	nausea and vomiting	6	11.5%
	None	4	7.7%
	Others (some time fever)	1	1.9%
Adverse skin reactions from respirator/ N95 mask/ surgical mask and goggle	blistering of the mouth	5	9.6%
	acne /skin allergic dematosis	17	32.7%
	nasal bridge scar	23	44.2%
	skin friction erosion	12	23.1%
	facial itching/rashes	27	51.9%
	dry skin	18	34.6%
	pain on the back of ear	31	59.6%
	None	5	9.6%
	Others (Surgical mask occurs moist with the breath steam)	1	1.9%
	Others (Redness only for short time)	1	1.9%
Adverse skin reactions of double gloving	skin soaking in sweat	20	38.5%
	skin chapping	6	11.5%
	skin dermatosis	6	11.5%
	skin itching/rashes	22	42.3%
	dry skin	26	50%
	None	8	15.4%
	Others (Not using double gloves)	1	1.9%
	Others (I have Allergy with Latex Gloves)	1	1.9%
Adverse skin reactions of protective clothing	contact dermatitis	4	7.7%
	itching/rashes	13	25%
	dry skin	18	34.6%
	excessive sweating and soaking	28	53.8%
	isolated pyoderma	0	0%
	lichen formation	1	1.9%
	None	13	25%
	Others (Not using)	1	1.9%

Table.05. The distribution of adverse skin reactions at different anatomical sites on facial skin.

Using the face diagram, please annotate the sites of your skin presenting with redness, itchiness, rash or pressure damage due to the use of PPE

Anatomical sites	Redness blanching		Itchiness		Rash		Pressure damage		Spots		Dry skin		No reaction	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Site A	19	36.5%	12	23.0%	5	9.6%	2	3.8%	3	5.7%	1	1.9%	17	32.6%
Site B	26	50%	16	30.7%	12	23.0%	10	19.2%	4	7.6%	2	3.8%	4	7.6%
Site C	18	34.6%	17	32.6%	14	26.9%	7	13.4%	5	9.6%	5	9.6%	8	15.3%
Site D	14	26.9%	15	28.8%	5	9.6%	6	11.5%	6	11.5%	3	5.7%	16	72.7%
Site E	20	38.4%	10	19.2%	9	17.3%	14	26.9%	2	3.8%	3	5.7%	7	13.4%

KEYS: Site A = Forehead, **Site B** = Nose bridge, **Site C** = Cheeks, **Site D** = Chin, **Site E** = Ears

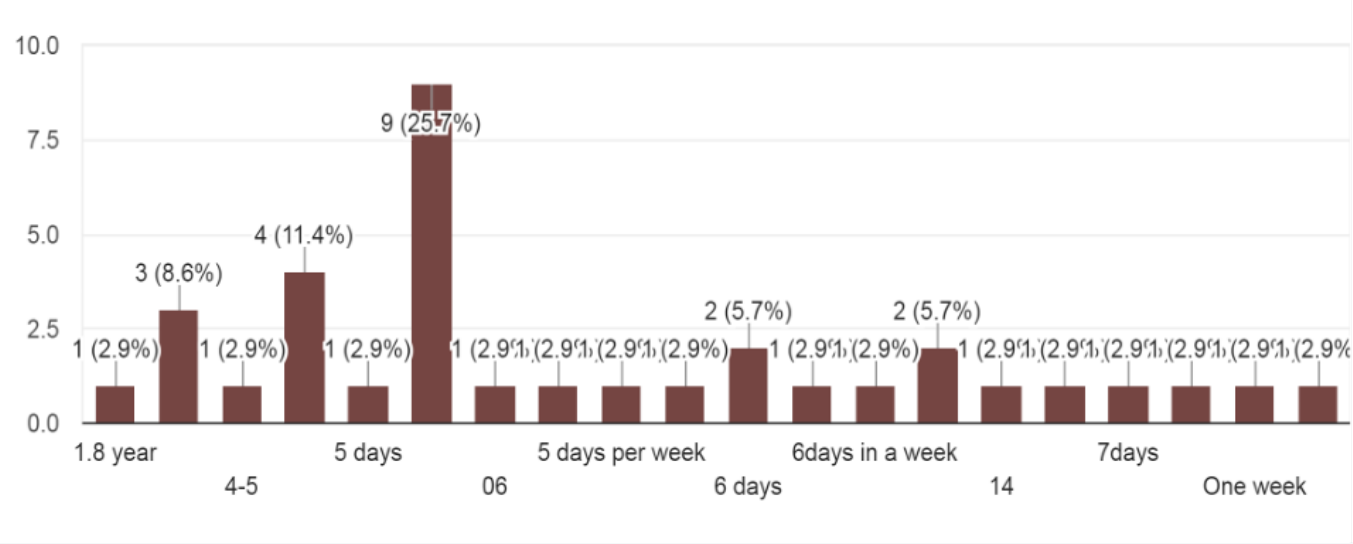

Figure.01. Maximum numbers of consecutive days were for PPE wearing?

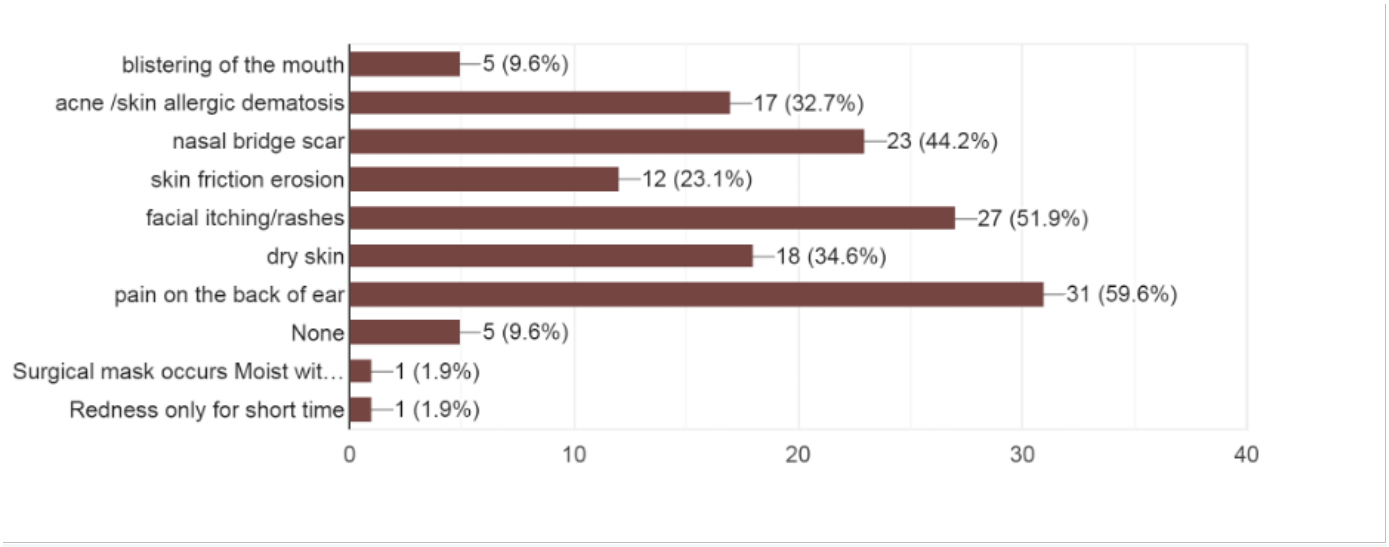

Figure.02. Adverse skin reactions from PPE were?

Discussion

Coronavirus disease 2019 (COVID19) is a highly contagious infectious disease that can be transmitted through the respiratory tract through contact with inanimate surfaces as well as airborne droplets. Asymptomatic patients another sources of infection.[7] Therefore, the global spread of COVID-19 has placed a significant burden on healthcare systems and professionals alike who must take strict protective measures to ensure the safety of patient care.[1] Reasonable use of systemic PPE in addition to other infection control measures can reduce the risk of infection for front-line caregivers. The availability of PPE created a sense of self-defense, which helped build self-esteem, resulting in a constructive work environment among frontline staff.[8]

In this study the majority participants were in the age group of (26-35), 28 (53.8%). Therefore, similar one of study was conducted at China in 2020 and their majority age group was (30-39), 41 (67.2%).[6]

Furthermore, in this study found that the most common skin adverse reactions among nurses using PPE were redness blanching at nose bridge 26 (50%), at forehead 19 (36.5%), at cheeks 18 (34.6%) and at ears 20 (38.4%), (Table.05). Therefore, similar study was conducted at “Skin Health Research Group, from the University of Southampton, UK” and their findings was relatively same to this study findings.[9]

Additionally, it was found that only a small number of participants were 11 (21.1%) took protective measures in the form of moisturizers and/or prophylactic dressings to ensure skin health (Table 3) and these findings also relatively same to one of previous same study. This may be due to insufficient training of staff in skin care or lack of information on appropriate preventive dressings.[9]

Based on the results of this study and previous publication results, it is recommended that medical staff perform frequent PPE relief, especially during longer clinical shifts. Skin checks should be performed both within and during the period of PPE, along with preventive strategies to maintain skin health. If there are signs of side effects, it is advisable to change the appropriate recovery time and choice of PPE equipment to alleviate the fragile areas of the skin.[9]

Conclusion

Several approaches have been adopted to investigate skin adverse events after periods of PPE use. The increase in reported adverse events was associated with the mean time per day wearing PPE and the duration of unrelieved PPE use.The trend of skin adverse events was also related to the number of consecutive days of PPE use and the type and model of PPE. There is an urgent need to improve the structure/materials from which the protective equipment is made and guidelines for the use of personal protective equipment to minimize the risk of skin damage to valuable healthcare workers.

Therefore, the present study found that the incidence of physical health problems and skin lesions was in most cases associated with PPE use by frontline nurses. Furthermore, the amount of time that frontline workers are exposed to PPE should be minimized and preventive dressings may be considered to relieve device-related pressure sores. As the COVID-19 threat has not yet been globally localized, the findings of the study are invaluable in the current scenario, and healthcare providers should keep this in mind when using PPE to prevent these side effects and manage new epidemics

that may arise in the future. . ...

Additional References:

- Honda H, Iwata K. Personal protective equipment and improving compliance among healthcare workers in high-risk settings. Current opinion in infectious diseases. 2016 Aug 1;29(4):400-6.
- Congress TU. Personal protective equipment and Women. 2017. URL https://www.tuc.org.uk/sites/default/files/PPEandwomenguidance.pdf. Accessed June. 2020.
- Gefen A, Ousey K. Update to device-related pressure ulcers: SECURE prevention. COVID-19, face masks and skin damage. Journal of wound care. 2020 May 2;29(5):245-59.

References

1. [a, b, c] *Catrin Sohrabi, Zaid Alsafi, Niamh O'Neill, Mehdi Khan, et al. (2020). World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). International Journal of Surgery, vol. 76 , 71-76. doi:10.1016/j.ijsu.2020.02.034.*
2. [a, b] *Pengfei Sun, Xiaosheng Lu, Chao Xu, Wenjuan Sun, et al. (2020). Understanding of COVID-19 based on current evidence. J Med Virol, vol. 92 (6), 548-551. doi:10.1002/jmv.25722.*
3. [a, b] *Yongshi Yang, Fujun Peng, Runsheng Wang, Kai Guan, et al. (2020). The deadly coronaviruses: The 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China. Journal of Autoimmunity, vol. 109 , 102434. doi:10.1016/j.jaut.2020.102434.*
4. [a, b, c, d] *Yi-Chi Wu, Ching-Sung Chen, Yu-Jiun Chan. (2020). The outbreak of COVID-19: An overview. doi:10.1097/jcma.0000000000000270.*
5. [a, b, c, d] *Chris C. I Foo, Anthony T. J Goon, Yung-Hian Leow, Chee-Leok Goh. (2006). Adverse skin reactions to personal protective equipment against severe acute respiratory syndrome ? a descriptive study in Singapore. Contact Dermatitis, vol. 55 (5), 291-294. doi:10.1111/j.1600-0536.2006.00953.x.*
6. [a, b, c, d, e, f, g, h, i] *Kaihui Hu, Jing Fan, Xueqin Li, Xin Gou, et al. (2020). The adverse skin reactions of health care workers using personal protective equipment for COVID-19. doi:10.1097/md.0000000000020603.*
7. [^] *Fatma Etgu, Sevda Onder. (2021). Skin problems related to personal protective equipment among healthcare workers during the COVID-19 pandemic (online research). Cutaneous and Ocular Toxicology, vol. 40 (3), 207-213. doi:10.1080/15569527.2021.1902340.*
8. [^] *Manju Dhandapani, Sinu Jose, Maneesha C Cyriac. (2021). Health Problems and Skin Damages Caused by Personal Protective Equipment: Experience of Frontline Nurses Caring for Critical COVID-19 Patients in Intensive Care Units. doi:10.5005/jp-journals-10071-23713.*
9. [a, b, c] *Nkemjika Abiakam, Peter Worsley, Hemalatha Jayabal, Kay Mitchell, et al. (2021). Personal protective equipment related skin reactions in healthcare professionals during <scp>COVID</scp> -19. Int Wound J, vol. 18 (3), 312-322.*

doi:10.1111/iwj.13534.