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Research Paper

Problems encountered by health care workers while using Personal protective Equipment kits: An Observational Cross sectional study

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Abstract:-
Introduction: *The Centers for Disease Control and Prevention (CDC) of the United States, stated that the virus spreaded through direct contact or respiratory droplets. Gown, face shield, goggles, shoe cover and hair mask are the commonly used personal protective equipment in health care settings.*
Methodology: *This was a cross sectional study included a total of 240 health care workers. The data was collected with a structured questionnaire regarding use of Personal Protective Equipment (PPE) kit and the problems faced during use of PPE kits.*
Result: *The data revealed that fogging was common problem (86.66%) faced by health care workers, 46.66% of the study subjects faced hearing difficulties, 36.66% of the study subjects faced issues related with size and material of PPE kits, 13.33% of the study subjects faced problems with donning and doffing and 3.33% of the study subjects faced tactile sensitivity. 56.66% of the study participant's PPE kit was torned, 86.66% of the study participants faced recognition problem, 20% had slipperiness of shoe cover and 70% of the study subjects had communication problem during the use of PPE kits. 13.3% of the study participants had skin allergies, 63.3% of the study participants had ear pain, 53.3% had nasal root pain, 3.3% had impaired tactile sensation, 60.0% had sweating, 3.33% had headache, 33.3% had suffocation, 56.6% had severe thirst, 30.0% had dehydration, 46.6% had heat related issues, 3.33% had menstrual cycle related problems and 43.33% had problems with voiding with the PPE kit uses.*
Conclusion:
This cross sectional study concluded that, the PPE kits are an important strategy to prevent the cross contamination and to stop the spread of COVID-19 virus, but due to overburden and long duty hours the health care workers are facing many problems related to their physical health and work related.
Key words: COVID-19, *PPE kit, Problems, Challenges, Health care workers.*

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I. Introduction

The Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2), a novel corona virus that results in corona virus disease 2019 (COVID-19), was spreaded worldwide and on 11 March 2020 World Health Organization had declared it a pandemic. Corona virus lead to severe morbidities and mortality worldwide and affected the human lives in every aspects.[1]

COVID-19 was an emerging healthcare challenge worldwide. India was the second most affected country with >4.8 million COVID-19 cases due to high population and highest daily incidence rate, highest daily mortality and had an bad impact on the society in every sector.[2]

The Centres for Disease Control and Prevention (CDC) of the United States, stated that the virus spreaded through direct contact or respiratory droplets. And the virus has transmitted throughout the globe at a

very fast rate.[3] It was a challenge for the healthcare sectors to deal with the situation and to control or stop the further transmission.

As the patients were reported to the hospitals for their treatment, healthcare providers were also infected. Worldwide occupational transmission of virus among healthcare providers was documented. Firstly the transmission among health care personals was reported in California in February 2020.[2] As in the initial stages of transmission of virus, personal protective equipment use was inadequate among healthcare providers. Afterwards the healthcare providers followed the strict practices of using PPE kit to control the spread of virus in the healthcare settings.

Gown, face shield, goggles, shoe cover and hair mask are the commonly used personal protective equipment in health care settings. The use of PPEs creates a barrier in transmission of the various communicable diseases and cross contamination. Similarly various studies in the literature have demonstrated that the use of PPEs has reduced the contamination or transmission of COVID-19 among healthcare providers during patient care. And to prevent the transmission of virus, it became mandatory to use the PPEs while providing care to the COVID-19 patients.[4]

During COVID-19 era the healthcare providers were over burdened and had long duty hours. Although the use of PPE was essential, but the health care providers faced various problems / challenges due to longer use of PPE kit in their duty timings.

It was reported by various researches that the healthcare providers faced various difficulties i.e. inappropriate size of PPE kit, design of PPE kit, lack of knowledge regarding donning and doffing, lack of resources, discomfort, poor communication, sweating in summer weather, physical health problems (including headache, dehydration, holding bladder for longer duration, difficulty in breathing, skin irritation, fatigue, etc.), fogging of goggles, difficulty in doing some procedures, which put an extra pressure on the healthcare providers.[5,6,7,8]

Hence, the present study aimed to determine the problems encountered by health care workers while using Personal protective Equipment kits.

II. MATERIAL AND METHODS

This cross sectional study was done in the department of pharmacology of Government Medical College, Jammu, during the period March 2020 to February 2021 after obtaining approval from the Institutional Ethics Committee.

All the health care workers including doctors, nurses, paramedics, support staff working in wards, laboratory, ICUs, OPD, triage level 1, triage level 2, high dependency unit, control room, oxygen plant and isolation ward were included.

Total 240 health care workers were included in the study. The data was collected with a structured questionnaire regarding use of PPE kit and the problems faced during use of PPE kits.

Data was organized, tabulated, analyzed and interpreted in both descriptive and inferential statistics i.e. frequency and percentage distribution, mean by using statistical package for social science software (SPSS), version 21. Categorical variables were expressed as number and percentage.

III. Observations and results

Table 1

Profession of health care workers

Profession	No.	%age
Doctor	128	53.33
Paramedic	40	16.67
Nursing	48	20
Support staff	24	10.00

Majority of the study participants included in the present study were doctors 53.33%, followed by nurses 20%, paramedics 16.67% and support staff 10% as depicted in table 1.

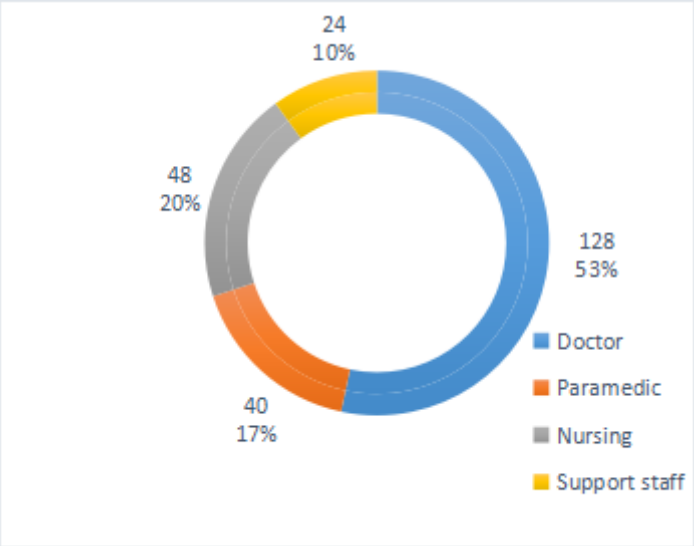

Figure 1
Profession of health care workers

Table 2
Working area

Area	No.	%age
Ward	136	56.6
Laboratory	8	3.33
ICU	48	20.0
OPD	8	3.33
Triage Level 1	64	26.6
Triage Level 2	24	10.0
High Dependency Unit	56	23.3
Control Room	32	13.3
Oxygen Plant	0	0
Isolation Ward	32	13.3

In the present study majority of the health care workers were working in wards 56.6%, followed by 26.6 % in triage level 1, 23.3% in HDU, 20.0% in ICU, 13.3 in control room and isolation ward respectively, 10.0% in triage level 2, 3.33% in laboratory and OPD respectively as depicted in table 2.

Table 3
Number of days of COVID duty

Number of days	No	%age
7	48	20.00
14	72	30.00
28	40	16.66
31	80	33.33

Most of the participants have performed the COVID duty for 31 days (33.33%) followed by 14 days (30%), 7 days (20%) and 28 days (16.66) as depicted in table 3.

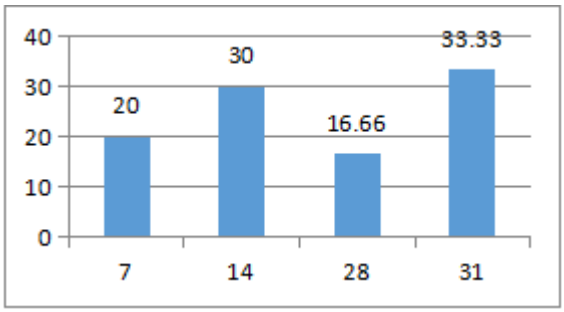

Figure 2
Number of days of COVID duty

Table 4
Daily average duty hours

Number of Hours	Number	%age
6	88	36.66
9	16	6.66
12	136	56.66

In the present study majority of the participants (56.66%) had 12 hours daily average duty hours followed by 06 hours daily duty hours (36.66%) as depicted in table 4.

Table 5
Number of PPE kits used per duty

PPE kits used	Number	%age
1	46	19.16
2	70	29.16
3	78	32.50
4	46	19.16

Most of the study subjects (32.50%) have used 3 PPE kits per duty, 29.16% study subjects had used 2 PPE kits per duty and 19.16 % study subjects has used 4 and 1 PPE kits respectively as depicted in table 5.

Table 6
Free availability of PPE kits

Availability	Number	%age
Yes	220	91.66
No	20	8.33

In present study the majority (91.66%) study subjects had free availability of PPE kits and 8.33% study subjects did not have free availability of PPE kits as depicted in table 6.

Table 7
Duration of wearing one PPE kit

Duration	Number	%age
3hrs	96	40.00
6hrs	136	56.66
12hrs	8	3.33

Most of the study participants (56.66%) have used one PPE kit for 6 hours and 40.00% study participants have used one PPE kit for 03 hours and 3.33% participants for 12 hours as depicted in table 7.

Table 8
Component of PPE kit used normally

PPE kit component	Number	%age
Gown	216	90.00
Face shield	176	73.33
Goggles	168	70.00
Shoe cover	208	86.66
Hair mask	192	80.00

Majority of the study participants (90.0%) used gown, 86.66% of the study participants used shoe covers, 80.00 % of the study participants used hair mask, 73.33 % of study participants used face shield and 70.00% study subjects normally used goggles as depicted in table 8.

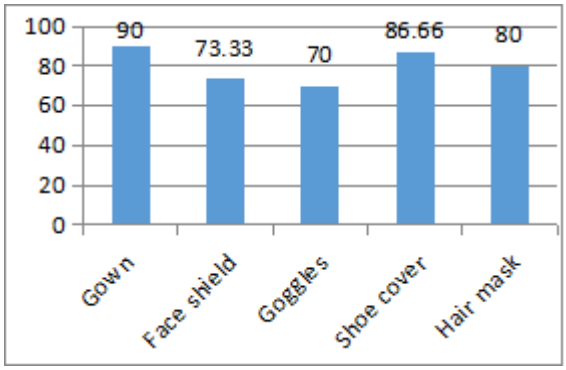

Figure 3
Component of PPE kit used normally

Table 9
Component of PPE kit avoided normally

PPE kit component	Number	%age
Faceshield	96	40.0
Hairmask	40	16.6
Shoecover	0	0
Goggles	80	33.3
Gown	0	0
None	24	10.0

In the present study majority of the study participants (40%) avoided face shield, 33% of the study participants avoided goggles, 16.6% of the study participants avoided hair mask normally as depicted in table 9.

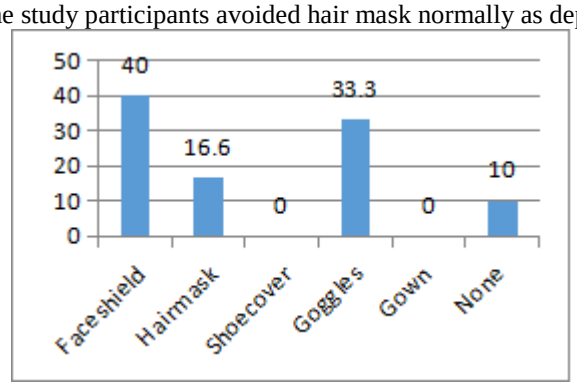

Figure 4
Component of PPE kit avoided normally

Table 10
Any Co morbidity

Co-morbidity	Number	%age
Respiratory	64	26.66
Diabetes	0	0
Hypertension	0	0
Thyroid issues	8	3.33
Kidney Problems	0	0
None	168	70

In the present study the majority (70%) of the study subjects didn't reported any co-morbidity. 26.66% of the study subjects had respiratory problems and 3.33% of the study subjects had thyroid issues as depicted in table 10.

Table 11
Problems faced by health care workers

Problem faced	Number	%age
Fogging	208	86.66
Hearing	112	46.66
Size/Material related	88	36.66
Tactile Sensitivity	8	3.33
Donning and doffing	32	13.33

The present study revealed that fogging was common problem (86.66%) faced by health care workers, 46.66 % of the study subjects faced hearing difficulties, 36.66 % of the study subjects faced issues related with size and material of PPE kits, 13.33% of the study subjects faced problems with donning and doffing and 3.33% of the study subjects faced tactile sensitivity as depicted in table 11.

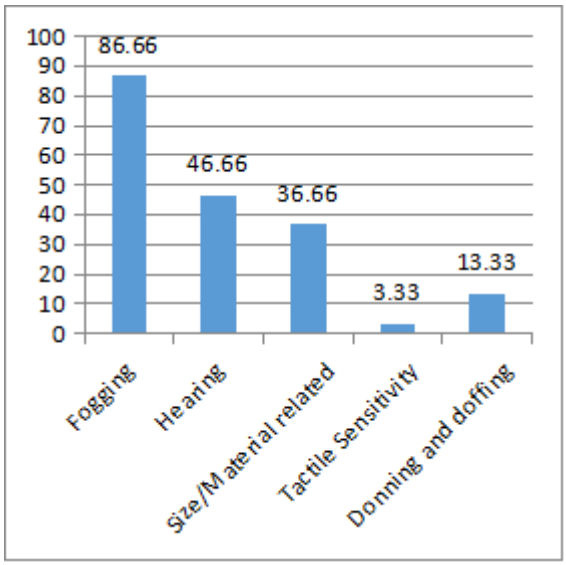

Figure 4
Problems faced by health care workers

The present study further reported that 56.66% of the study participant's PPE kit was torned, 86.66% of the study participants faced recognition problem, 20% had slipperiness of shoe cover and 70% of the study subject had communication problem during the use of PPE kits as shown in the figure 5.

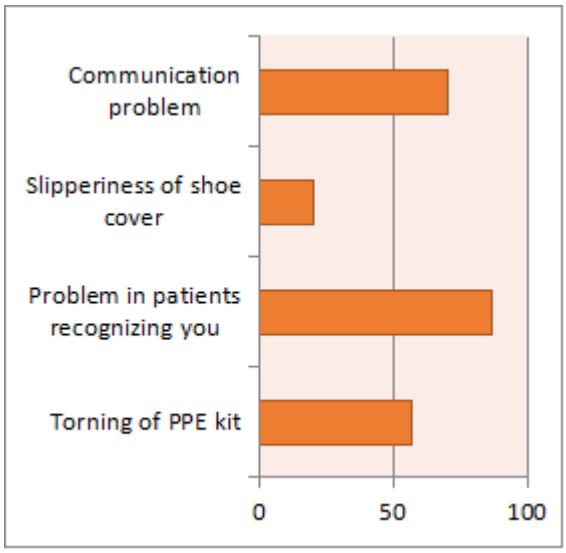

Figure 5
Other common problems faced by health care workers

Table 12
Difficulties in doing procedures with PPE kit

Procedure	Number	%age
I/V line	120	50.0
Inj.I/M	32	13.3
Inj.I/V	40	16.6
Pulse oximeter use	8	3.33
Catheter insertion	40	16.66
Ryles tube insertion	40	16.66
ABG/VBG sampling	48	20
CPR	112	46.66
Intubation	40	16.66

It was reported that while the PPE kit was on, most of the study participants (50%) had difficulty in inserting I/V line and 46.6% of the study subjects had difficulty in performing CPR, 20% of the study subjects had difficulty in ABG/VBG sampling, 16.6 % of the study subjects had difficulty in administering I/V injection, inserting catheter, insertion of ryles tube, intubation respectively,13.3% of the study subjects had difficulty in administering the I/M injection and 3.33% of the study subjects had difficulty in using pulse oximeter as depicted in table 12.

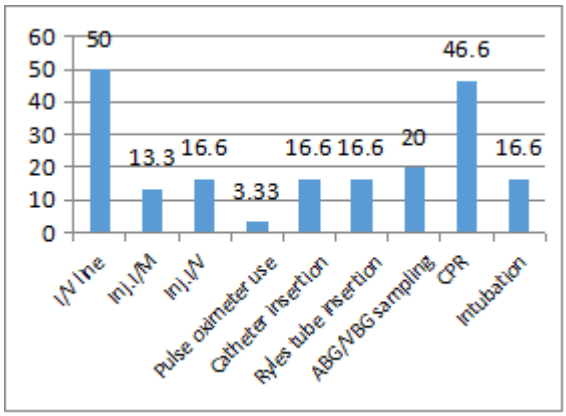

Figure 6
Difficulties in doing procedures with PPE kit

Table 13
Physical health problems while using PPE kit

Problem	Number	%age
Skin allergies	32	13.3
Ear pain	152	63.3
Nasal root pain	128	53.3
Tactile sensations impaired	8	3.3
Sweating	144	60.00
Headache	8	3.33
Suffocation	80	33.3
Severe thirst	136	56.6
Dehydration	72	30.0
Heat	112	46.6
Menstrual Cycle	8	3.33
Bladder voiding	104	43.33

In the present study 13.3 % of the study participants had skin allergies, 63.3% of the study participants had ear pain, 53.3 % had nasal root pain, 3.3% had impaired tactile sensation, 60.00% had sweating, 3.33% had headache, 33.3 % had suffocation, 56.6 % had severe thirst, 30.0 % had dehydration, 46.6 % had heat related issues, 3.33 % had menstrual cycle related problems and 43.3% had problems of bladder voiding with the PPE kit uses as depicted in table 13.

Data further showed that majority (90%) of the study participants had bladder voiding before wearing the PPE kit and no one used the diaper while PPE kit was on as shown in figure 7.

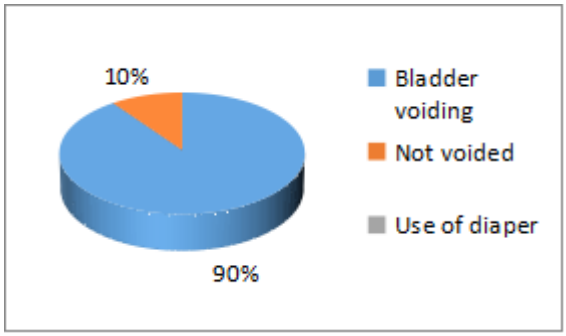

Figure 7
Practices followed by healthcare workers

Table 14
Donning and doffing of PPE kit

Parameter	Number	%age
Trained in donning and doffing	128	53.33
Not trained in donning and doffing	112	46.66
Have separate area for donning and doffing	152	63.33
Don't have separate area for donning and doffing	88	36.66
Helped by someone in donning and doffing	80	33.33
Not helped by someone in donning and doffing	160	66.66

The majority of the participants (53.33%) were trained in donning and doffing, 63.33% of the participants had a separate area for donning and doffing and 66.66% of the participants were not helped by someone in donning and doffing as depicted in table 14.

Table 15
Suggestions to overcome the problems faced by health care workers with the use of PPE kits

Suggestion	Number	%age
Material of PPE kit	160	66.6
Separate Donning and doffing area	24	10.0
Disposal training for Kits	20	8.33
Less duty hours	36	15.0

The present study revealed that majority of the participants (66.6%) suggested that material of the PPE kit should be refined, 15.0% of the study participants suggested that there should be less duty hours, 10.0% of the study participants suggested that there should be a separate area for donning and doffing and 8.33% of the study participants suggested that there should be provision of training for disposal of PPE kits as depicted in table 15.

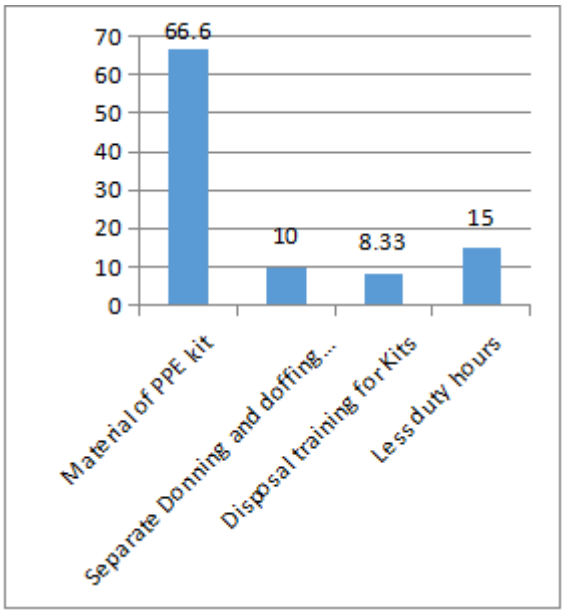

Figure 8
Suggestions to overcome the problems faced by health care workers with the use of PPE kits

IV. Discussion

In the present study, the majority of the study participants included were doctors 53.33%, followed by nurses 20%, paramedics 16.66% and support staff 10%. Findings are consistent with the study conducted by Agarwal A et al. (2020), reported that majority of the study subjects were doctors (55%), followed by nursing personnel and other technical staff (28%), and ancillary staff (17%).[2] Similarly Deshpande S. H. et al. (2020), found that 74% study subject were doctors, 21.7% nurses and 4.3% paramedical staff. [6]

In the present study majority of the health care workers were working in wards 56.6%, followed by 26.6 % in triage level 1, 23.3% in HDU, 20.0% in ICU, 13.3 in control room and isolation ward respectively, 10.0% in triage level 2, 3.33% in laboratory and OPD respectively. Similarly Agarwal A et al. (2020), documented that 79.05% respondents had done their duty in COVID/suspect ward, 27.66% in ICU settings, 15.01% in screening area or sample collection centre, 7.9% in COVID/suspect operation theatre, and one in reverse transcription-polymerase chain reaction (RT-PCR) lab.[2]

The present study further found that most of the participants have performed the COVID duty for 31 days (33.33%) followed by 14 days (30.00%), 7 days (20.00%) and 28 days (16.16%). Majority of the study participants (56.66%) had 12 hours daily duty, 36.66% study subjects worked for 6 hours and 6.66% study participants worked for 9 hours daily. The majority (91.66%) study subjects had free availability of PPE kits, most of the study participants (56.66%) have used one PPE kit for 6 hours, 40.00% of the study participants

used PPE kit for 3 hours and 3.33% study participants has used one PPE kit for 12 hour. Findings are consistent with the study conducted by Agarwal A et al. (2020), reported that (40%) respondents had completed more than 28 days of COVID duty, 33% had done 7-14 days, 19% had done 15-28 days, while 8% HCWs had done up to seven days of COVID duty, 52% HCWs had done 8-12 hours of duty, 19% had 12 hours or more duty, 17% had six to eight hours, 12%) had up to six hours of COVID duty per day. 41% had used a single PPE kit per shift, 36% had used mostly two PPE kits, 15% used three PPE kits, 8% used four PPE kits, and 0.4% used more than four PPE kits. 36% used PPE kit for four hours, 23% used PPE kit for > six hours, 17% used for three hours, 13% used for five hours, 10% used for approximately two hours, and 1used PPE kit for one hour. [2]

Further the majority of the study participants (90%) used gown, 86.66% of the study participants used shoe covers normally, 80% of the study participants used hair mask normally, 73.33 % of study participants used face shield normally and 70.00% study subjects normally used goggles and 40% avoided face shield normally, 33.3% of the study participants avoided goggles normally, 16.6% of the study participants avoided hair mask normally. Finding are in accordance with the study conducted by ZA Sari A F et al. (2021), reported that 55% of the study subjects didn't used the PPE kits completely and 45% used completely as well as PPE surgical masks (99%) were used commonly, gloves (94%) were used commonly, gowns (88%) were used commonly, and face shields (86%) were used commonly. And head protectors (66%) were used rarely, goggles (51%) were used rarely and protective shoes (20%) were used rarely.[9]

In the present study the majority (70%) of the study subjects didn't had any co-morbidity. 26.66% of the study subjects had respiratory problems and 3.33% of the study subjects had thyroid issues. Similarly Deshpande S. H. et al. (2020), reported that 40% of the study subjects had migraine.[6]

The present study revealed that fogging was common problem (86.66%) faced by health care workers, 46.66% of the study subjects faced hearing difficulties, 36.66% of the study subjects faced issues related with size and material of PPE kits, 13.33% of the study subjects faced problems with donning and doffing and 3.33% of the study subjects faced tactile sensitivity. 56.66% of the study participant's PPE kit was torned, 86.66% of the study participants faced recognition problem, 20% had slipperiness of shoe cover and 70% of the study subject had communication problem during the use of PPE kits. 13.3% of the study participants had skin allergies, 63.3% of the study participants had ear pain, 53.3% had nasal root pain, 3.3% had impaired tactile sensation, 60% had sweating, 3.33% had headache, 33.3% had suffocation, 56.6% had severe thirst, 30% had dehydration, 46.6% had heat related issues, 3.33% had menstrual cycle related problems and 43.33% had problems with voiding with the PPE kit uses. Findings are correlated with the study conducted by Agarwal A et al. (2020), reported common problems associated with the use of PPE kits were excessive sweating (100%), fogging of goggles, spectacles, or face shields (88%), suffocation (83%), breathlessness (61%), fatigue (75%), headache due to prolonged use (28%), and pressure marks on the skin at one or more areas on repeated use (19%). 44% reported torning of PPE kit and 55% had reported problems due to patients were not able to recognize the staff. Similarly Deshpande S. H. et al. (2020), found that the common problems associated with the use of PPE kit were excessive sweating (96%), itching of the nose (56%) and face (51), dehydration (62%), headache (67%).[6]

Similarly Jose S et al. (2021), reported that headache (73.4%), extreme sweating (59.6%), and difficulty in breathing (36.7%), 91.7% fogging of the goggle, nasal bridge scarring (76.64%) and indentation and pain on the back of the ears (66.42%), excessive skin soakage with sweat (70.07%) and skin chapping (19%) were the common problems faced by the study participants.[4]

It was reported that while the PPE kit was on most of the study participants (50%) had difficulty in inserting I/V line and 46.66% of the study subjects had difficulty in performing CPR, 20% of the study subjects had difficulty in ABG/VBG sampling, 16.6 % of the study subjects had difficulty in administering I/V injection, 16.66% had difficulty in inserting catheter, insertion of ryles tube, intubation respectively, 13.3% of the study subjects had difficulty in administering the I/M injection and 3.33% of the study subjects had difficulty in using pulse oximeter. Findings are in accordance with the study conducted by Agarwal A et al. (2020), reported 74% of the study subject faced problem in intubating the patients with PPE kits on, 88% had difficulty in giving effective resuscitation with PPE kits on. [2]

Data further showed that majority (90%) of the study participants voided before wearing the PPE kit and no one used the diaper while PPE kit was on. Similarly Agarwal A et al. (2020), reported that 73% of the study subjects voided before donning. [2]

The majority of the participants (53.33%) were trained in donning and doffing, mostly 63.33% of the participants had a separate area for donning and doffing and 66.66% of the participants were not helped by someone in donning and doffing. Findings are consistent with the study Agarwal A et al. (2020), found that 64% study subjects had formal training of donning and doffing and 7% had separate area for donning and doffing as well as 49% had no help in donning and doffing and 14% reported that no help is required. [2]

The present study revealed that majority of the participants (66.6%) suggested that material of the PPE kit should be refined, 15% of the study participants suggested that there should be less duty hours, 10% of the

study participants suggested that there should be a separate area for donning and doffing and 8.33% of the study participants suggested that there should be provision of training for disposal of PPE kits. Findings are consistent with the study conducted by Jose S et al. (2020), suggested that designing effective PPEs and education of preventive measures among healthcare workers can prevent the problems faced by health care workers while the PPE kit is on.[4] Similarly Agarwal A et al. (2020), documented that full-length mirror should be installed to prevent problem with donning and doffing (18%) and also suggested that there should be a separate area for donning and doffing.[2]

V. Conclusion

This cross sectional study concluded that, the PPE kits are an important strategy to prevent the cross contamination and to stop the spread of COVID-19 virus, but due to overburden and long duty hours the health care workers are facing many problems related to their physical health and work related. Thus, to upgrade the quality of life of the health care workers as well as to improve the patient care levels it is mandatory that the PPE kit should be comfortable for the health care workers and the problems faced by the health care workers should be encountered.

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