

# Dermatological morbidity induced by the use of personal protective measures in frontline doctors during COVID-19 pandemic

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## Abstract

**Background** Frontline doctors performing duties during Covid-19 pandemic have to use the personal protective equipment to avoid exposure and decrease the risk of Covid-19 infection. These protective measures can lead to various cutaneous manifestations and problems which affect their working.

**Objective** To assess dermatological morbidity due to use of personal protective equipment (PPE).

**Methods** This descriptive observational study was conducted on 220 doctors performing duties on frontline in Covid-19 pandemic. Data was collected through e- questionnaire regarding demography, daily duty, daily PPE wearing time, cutaneous manifestation, their type and site. Participants voluntarily allowed and submitted the questionnaire through cell phones.

**Results** 52% of frontline doctors using PPEs while performing duties in Covid-19 pandemic showed dermatological morbidity. Most of them belonged to the age group >35 years, males, married, having postgraduate qualification. Most of the frontline doctors having dermatological manifestation were performing regular OPD duties for > 4 hours. Presence of comorbidities and hand washing for more than 10 times were also associated factors.

**Conclusion** There is 52% dermatological morbidity in frontline doctors using PPEs while performing duties in Covid-19 pandemic and it was statistically significantly associated with male gender, postgraduate qualification, >4 hours/ day OPD duty, presence of comorbidities and hand washing >10 times per day.

## Key words

Dermatological morbidity, Covid-19, doctors, frontline, personal protective equipment (PPE), cutaneous manifestations.

## Introduction

Covid-19 pandemic broke out in Wuhan, China infecting more than 80,000 and more than 3000 succumbed to it, making it the largest public health emergency. <sup>1</sup> Since then its rise has remarkably affected 216 countries and WHO has declared it a pandemic due to the large morbidity and mortality worldwide. Combating Covid-19 has affected health care system

throughout the world and it is even more challenging when health workers especially frontline doctors encounter Covid-19.<sup>2</sup>

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Covid-19 has infected millions of people worldwide and has greatly impacted frontline doctors performing tough duties day and night. Personal protective equipment (PPE) is an important component of protecting them against Covid-19. Benefits of PPE bring along a lot of cutaneous manifestation and pressure injuries.<sup>3,4</sup>

Facing the big challenge of this pandemic, thousands of medical staff have volunteered to help and have used PPE (i.e. masks, goggles, gloves, face shields, protective gowns and hand sanitizers) to protect themselves from getting infection. 80 percent (80%) of the health care staff has developed skin problems because of increased use of PPE.<sup>5-7</sup>

Protective products should be chosen according to guidelines and prophylactic measures should be taken to avoid such injuries to the doctors in time of this global pandemic.<sup>8</sup> We developed a questionnaire and surveyed for the very first time among doctors working in two teaching hospitals of Bahawalpur City, South Punjab. We found a higher prevalence of skin injuries with related factors and insufficient prevention status of doctors. This study may provide useful data for protecting frontline doctors performing duties in this global pandemic.

### **Material and methods**

We conducted a descriptive observational study on frontline doctors of Bahawalpur city performing duties during Covid-19 pandemic through e-questionnaire from October 2020 to March 2021. Our inclusion criteria included doctors taking care of Covid-19 infected or suspected patients, use of PPEs, (N-95 masks, gloves, gowns or PPE) and age >24 years while doctors not encountering Covid-19 patients were excluded.

An online semi structured questionnaire was

sent through Google, email, WhatsApp messages, and Facebook messenger to the eligible doctors. Doctors voluntarily participated knowing that their provided information will be used for publication. The confidentiality of their responses was assured.

The questionnaire consisted of two parts. The first part consisted of sociodemographic details like age, gender, marital status, educational qualifications and place of work. The second part consisted of type of duty (OPD, isolation ward, critical care unit), duty hours, use of PPEs, duration of PPE wear, number of gloves, heavy sweating after work, frequency of hand washing and development of recent dermatological manifestations like dryness, itching, burning (symptoms) and signs like peeling of skin, redness, erosion, ulceration, boils, and maceration.

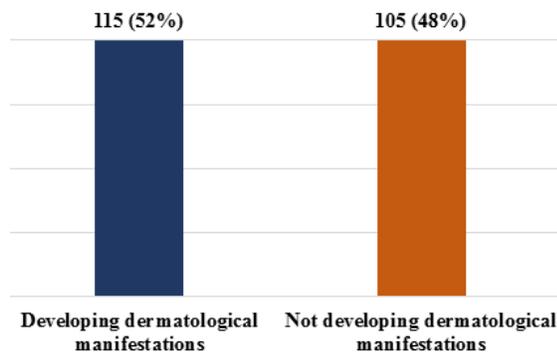
Incomplete responses were discarded. Confidentiality of the participants was maintained. Data collected was entered and analysed in SPSS version 24. Dependant variables were various dermatological manifestations and independent variables were age >35 or <35, gender, marital status, educational qualifications, type of duty, daily duty hours <4 or >4, presence of comorbidities and hand washing >10 times a day or less. Simple frequencies and percentages were calculated for qualitative data and presented in the form of tables and figures. Chi square test was used as test of significance for the qualitative data. P value of <0.05 was considered significant.

### **Results**

We sent e-questionnaires to 250 frontline doctors of Bahawal Victoria Hospital and Civil Hospital, Bahawalpur. We received responses from 224 frontline doctors performing duties in

**Table 1** Demographic distribution of participants/ frontline doctors performing duties during COVID-19 pandemic using PPE's (n=220)

Parameter	Frontline doctors having dermatological manifestations due to use of PPE (n=115) (52%)	Frontline doctors not having dermatological manifestations due to use of PPE (n=105) (48%)
Age Group		
25-35	35 (30.43%)	37 (35.2%)
36-45	59 (51%)	47 (44.76%)
46-55	10 (8.69%)	11 (10.47%)
>55	11 (9.56%)	10 (9.52%)
Gender		
Male	60 (52.1%)	75 (71.4%)
Female	55 (47.82%)	30 (28.5%)
Marital Status		
Married	69 (60%)	76 (72.38%)
Unmarried	46 (40%)	29 (27.62%)
Educational Qualification		
Graduate	41 (35.65%)	24 (22.85%)
Post-graduate	74 (64.35%)	81 (77.15%)
Type of Duty		
Regular OPD	70 (60.86%)	40 (38.09%)
Isolation ward	17 (14.78%)	25 (23.80%)
Flu Clinic	15 (13.04%)	25 (23.80%)
Intensive Care Unit	13 (11.30%)	15 (14.28%)
Daily Duty Hours		
<4 hours	33 (28.69%)	61 (58.09%)
>4 hours	82 (71.31%)	44 (41.90%)
Co-morbidities		
Present	34 (29.56%)	18 (17.14%)
Absent	81 (70.44%)	87 (82.86%)



**Figure 1** Dermatological morbidity among frontline doctors using PPE (n=220).

COVID-19 pandemic. 04 questionnaires were incompletely filled so they were not included in the analysis. Out of 220, 115 (52%) participants reported development of at least one recent dermatological manifestation owing to the use of PPE (**Figure 1**).

Our study showed that most 51% frontline doctors developing skin problems due to use of PPE belonged to age group 36-45 (**Table 1**). Almost half (52%) doctors with skin problems were males and out of 115, 69 (60%) of the frontline doctors were married (**Table 1**).

Our study concluded that out of 115 doctors with dermatological morbidity, 74 (64.35%) were post graduate in qualification (**Table 1**).

Regarding type of duty, out of 115 frontline doctors showing manifestations 70 (60.86%) were performing duties in regular OPD and 82 (71.31%) for more than 4 hours (**Table 1**). As far as comorbidities are concerned, out of 115, 81 (70.44%) frontline doctors with skin problems had no comorbid condition (**Table 1**).

**Table 2** Signs and symptoms and affected sites among frontline doctors developing dermatological manifestations/ skin damage due to use of PPE's (n=115).

Symptoms	
Dryness	87 (75.6%)
Itching	63 (54.7%)
Burning	35 (30.4%)
Signs	
Peeling of skin	80 (69.5%)
Redness/ Erythema	39 (33.9%)
Erosion/ Ulceration	24 (20.86%)
Boils/ Furuncles	15 (13.04%)
Affected Sites	
Hands	92 (80%)
Nose/ nasal bridge	67 (58.2%)
Cheeks	51 (44.34%)
Behind the ears	27 (23.4%)
Feet	12 (10.4%)
Neck	6 (5.2%)
Periocular	14 (12.11%)
Perioral	5 (4.3%)

Our study showed that out of 115 frontline doctors having skin manifestations, most reported 87 (75.6%) symptom was dryness

followed by itching 63 (54.7%) and burning 35 (30.4%) (**Table 2**).

It was found in this study that out of 115, most common sign 80 (69.5%) was peeling of skin followed by redness 39 (33.9%), erosion 24 (20.86%) and boils 15 (13.04%) (**Table 2**).

Out of 115, hand 92 (80%) was most affected site followed by nasal bridge 67 (58.2%) and cheeks 51 (44.3%) (**Table 2**).

Regarding relationship of age with dermatological morbidity, our study proved that there is statistically insignificant association of age with dermatological morbidity (**Table 3**).

Our study showed association between gender and dermatological morbidity and it was statistically significant (**Table 4**).

**Table 3** Relationship of age with dermatological morbidity among frontline doctors using PPE's (n=220).

Age Groups	Frontline doctors having dermatological manifestations due to use of PPE	Frontline doctors not having dermatological manifestations due to use of PPE	Total
25-35	35	37	72
36-45	59	47	106
46-55	10	11	21
>55	11	10	21
	115	105	220

P<0.05, x2 value= 1.0569 (insignificant).

**Table 4** Relationship of gender with dermatological morbidity among frontline doctors using PPE's (n=220).

Gender	Frontline doctors having dermatological manifestations due to use of PPE	Frontline doctors not having dermatological manifestations due to use of PPE	Total
Male	60	75	135
Female	55	30	85
	115	105	220

P< 0.05, x2 value= 8.58 (significant).

**Table 5** Relationship of marital status with dermatological morbidity among frontline doctors using PPE's.

Marital Status	Frontline doctors having dermatological manifestations due to use of PPE	Frontline doctors not having dermatological manifestations due to use of PPE	Total
Married	69	76	145
Unmarried	46	29	75
	115	105	220

P< 0.05, x2 value= 3.7445 (not significant).

**Table 6** Association of educational qualification with dermatological morbidity among frontline doctors using PPE's (n=220).

<i>Educational qualification</i>	<i>Frontline doctors having dermatological manifestations due to use of PPE</i>	<i>Frontline doctors not having dermatological manifestations due to use of PPE</i>	<i>Total</i>
Graduate	41	24	65
Post Graduate	74	81	155
	115	105	220

P<0.05, x2 value= 4.3167 (significant).

**Table 7** Association of type of duty with dermatological morbidity among frontline doctors using PPE's (n=220).

<i>Type of Duty</i>	<i>Frontline doctors having dermatological manifestations due to use of PPE</i>	<i>Frontline doctors not having dermatological manifestations due to use of PPE</i>	<i>Total</i>
Regular OPD	70	40	110
Isolation ward	17	25	42
Flu Clinic	15	25	40
Intensive care Unit	13	15	28
	115	105	220

P<0.05, x2 value= 11.9186 (highly significant).

**Table 8** Association of duty hours with dermatological morbidity among frontline doctors using PPE's (n=220).

<i>Duty Hours/ Day</i>	<i>Frontline doctors having dermatological manifestations due to use of PPE</i>	<i>Frontline doctors not having dermatological manifestations due to use of PPE</i>	<i>Total</i>
<4	33	61	94
>4	82	44	126
	115	105	220

P<0.05, x2 value= 19.38 (highly significant).

**Table 9** Association of comorbidities with dermatological morbidity among frontline doctors using PPE's (n=220).

<i>Co-morbidity (any)</i>	<i>Frontline doctors having dermatological manifestations due to use of PPE</i>	<i>Frontline doctors not having dermatological manifestations due to use of PPE</i>	<i>Total</i>
Present	34	18	52
Absent	81	87	168
	115	105	220

P<0.05, x2 value= 4.6925 (significant).

Regarding relationship of marital status with dermatological morbidity, an insignificant association was found between them (**Table 5**).

It was concluded in our study that a statistically significant association exists between educational qualification and dermatological morbidity in frontline doctors using PPE while performing duties in COVID-19 pandemic (**Table 6**).

As far as association of type of duty with dermatological manifestations are concerned, our study proved an association between type of

duty and dermatological morbidity due to use of PPE and it was highly statistically significant (**Table 7**).

Our study also proved an association between duty hours and dermatological morbidity in front-line doctors using PPE and it was found to be highly statistically significant (**Table 8**).

It was also concluded in this study that a statistically significant association exists between comorbidities and dermatological manifestation in front line doctors (**Table 9**).

**Table 10** Association of hand washing >10 times/ day with dermatological morbidity among frontline doctors using PPE's (n=220).

<i>Hand washing</i>	<i>Frontline doctors having dermatological manifestations due to use of PPE</i>	<i>Frontline doctors not having dermatological manifestations due to use of PPE</i>	<i>Total</i>
< 10 times/ day	40	61	101
>10 times/ day	75	44	119
	115	105	220

P<0.05, x2 value= 14.38 (highly significant).

Our study also proved a statistically highly significant relation of hand washing >10 times/ day with dermatological morbidity in frontline doctors.

### Discussion

COVID-19 has spread quickly across the globe since 2020. There is a need to pay more attention to dermatological morbidity found in frontline doctors due to enhanced use of PPE while performing duties in COVID-19 and to create more awareness and protect them in future.

Our study found dermatological morbidity in 52% of the frontline doctors using PPE nearly similar to studies conducted in India (41.5%)<sup>8</sup> and China (42.8% C.I 41.30-44.30).<sup>1</sup> This was also in contrast to studies of Saudi Arabia (97%)<sup>2</sup> and China (74.5%)<sup>9</sup> where frontline doctors reported skin problems.

Fifty one percent (51%) of our frontline doctors having skin manifestations belonged to age group 36-45 years similar to studies of China (mean age of 32.5±7.1 years)<sup>1</sup> and Europe (mean age 32.78±14.51).<sup>10</sup>

Our study concluded that males 52% had more skin problems due to use of PPEs similar to studies of India (50%)<sup>8</sup> and China where males (59.7%)<sup>1</sup> were more affected and contrasting to another study of India where more females 63.9%<sup>11</sup> showed skin problems probably because of differences in socio- demographic profile.

It was proved in this study that most frontline doctors (60%) having dermatological manifestations were married which was quite contrasting to study of India where 47.7%<sup>8</sup> were married.

This study showed that majority 64.35% were postgraduate doctors who reported dermatological manifestations very similar to study of India showing 68.2%<sup>8</sup> postgraduate doctors.

Regarding type of duty, our study showed 60.86% frontline doctors working in regular OPD showed skin problems very similar to study of India (65.9%).<sup>8</sup>

As far as daily duty hours were concerned, our study showed 71.31% frontline doctors having duty more than 4 hours showing skin problems very contrasting to studies of India(PPE wear >6 hours, adjusted odd's ratio 2.9 P=0.005),<sup>8</sup> China (7.7±2.9 hours),<sup>1</sup> Italy(PPE wearing time >6 hours)<sup>12</sup>, Brazil (average PPE wearing time 9.15 h ±3.6/day)<sup>13</sup> and Saudi Arabia (>6 hours/ day)<sup>2</sup> but very similar to study of Europe (duty hours of 4.08±1).<sup>10</sup>

Comorbidities were found in 29.56% of frontline doctors having dermatological problems due to use of PPE which was nearly similar to study of India where 25%<sup>8</sup> of doctors showing skin problems had comorbidities.

Regarding signs and symptoms of frontline doctors with skin manifestations, most common

symptoms (75.6%) was dryness followed by itching (54.7%). This was nearly similar to studies of India (84.1%)<sup>8</sup> and China<sup>9</sup> where dryness or scales were present in 68.6% of frontline doctors using PPE. As far as signs are concerned most frontline doctors (69.5%) reported peeling of skin followed by redness/erythema (33.9%). These were similar to study of India showing peeling of skin in 79.5% of frontline doctors followed by redness/erythema (40.9%)<sup>8</sup> and to study of China where 38.8% showed erythema.<sup>14,15</sup> This was also in contrast to another study of China where redness was found in 1.8% of frontline doctors.<sup>1</sup>

Most affected sites found in our study were hands (80%) followed by nasal bridge (58.2%) and cheeks (44.34%). These findings were very similar to study of India where 77.3% doctors reported hand symptoms followed by nose 63.6% and cheeks 34.1%.<sup>8</sup> These results were different from study of China where most affected site was nose (30.1%) followed by cheeks (28.3%).<sup>1</sup> Also, these findings were same as found in study of China where most affected sites were face, nasal bridge, cheek bones, chin and behind the ears<sup>3</sup> and contrasting to study of Saudi Arabia where 83% frontline doctors reported nasal bridge to be affected most followed by forehead, cheeks and hands.<sup>2</sup> These results of my study also corresponded to study conducted in China where most of the doctors reported hands followed by nasal bridge and cheeks to be most affected sites by extensive use of PPE and also same as another study conducted in China where doctors reported hands (84.6%) to be most affected followed by cheeks (75.4%), nasal bridge (71.8%) and face.<sup>9,14</sup>

Regarding relationship of age with dermatological morbidity in frontline doctors, our study showed statistically insignificant relationship between age and dermatological

morbidity and this was similar to study of china where there was association of age with skin manifestations [ $>35$  (46.3%)  $<35$  (41.2%)  $P=0.034$ ]<sup>1</sup> and to the study of Brazil where age  $< 35$  was statistically significantly associated factor with dermatological morbidity in frontline doctors using PPE while performing duties in COVID-19 pandemic.

Our study proved a statistically significant association between male gender and dermatological morbidity in frontline doctors and this was same as found in studies of China (males 59.7%, females 40.5%  $P<0.001$ )<sup>1</sup> and Europe where significant relation of gender to skin manifestations was found (OR  $1.39\pm 0.5$ )<sup>10</sup> in contrast to study of India where an insignificant association existed in male gender and dermatological morbidity.<sup>8</sup>

Our study showed an insignificant association between marital status and dermatological morbidity which was similar to study of India where statistically insignificant relation existed between marital status and skin morbidity.<sup>8</sup>

A statistically significant relation was proved between higher educational qualification and dermatological morbidity very similar to study of India where significant association was found between post graduate education and dermatological manifestations.<sup>8</sup>

Global epidemic of Covid-19 infected medical staff especially frontline doctors performing heavy duties to combat this pandemic. This study showed a statistically significant association between regular OPD duty with skin manifestation and duty hours per day of  $>4$  hours to the highly statistically significantly associated with dermatological morbidity which was similar to that of study of India,<sup>8</sup> Europe ( $4.08\pm 1$  hour)<sup>10</sup>, Brazil ( $>6$  hours/ day  $P< 0.001$ )<sup>13</sup> and China ( $>4$  hours 47.3% and  $<4$  hour

18.7%,  $P < 0.001$ ).<sup>1</sup>

This study also showed significant association of dermatological morbidity with presence of comorbidities and hand washing > 10 times/ day which was also similar to study of Saudi Arabia which also proved association of hand washing >10 times/ day with skin morbidity.<sup>2</sup>

Health workers especially frontline doctors work tirelessly for long hours to combat COVID-19 pandemic and hence extensive use of PPE has undeniable negative impact on them especially the skin manifestations and injuries. Recognition of dermatological morbidity in these frontline doctors makes it possible to advance in the prevention strategies.

### Conclusion

There is 52% dermatological morbidity in frontline doctors using PPE while performing duties in COVID-19 pandemic. This dermatological morbidity was statistically significantly associated with male gender, post graduate qualification, regular OPD duty, >4 hours/ day duty, presence of comorbidities and hand washing >10 times/ day.

### Recommendations

Simple steps are to be taken to reduce the risk of this skin damage in frontline doctors combating COVID-19 pandemic.<sup>13</sup>

1. Prepare skin before and after wearing PPE by using skin sealants, moisturizers or barrier creams.
2. Frequent offloading of PPE should be done to relieve the pressure on the skin.
3. Visible skin injuries should be immediately treated to minimize future problems and infections.

4. Use of skin protectors like non-porous dressings can be applied.
5. Health education of frontline doctors regarding handling of PPE and personal hygiene is the need of the day.
6. Stress on hand washing practices.
7. Guidelines are necessary for physicians, nurses and allied health care and facility staff who are exposed to patients infected with COVID-19.

Assessment and recognition of dermatological morbidity in frontline doctors using PPE while performing duties and larger multicentric approach to protect them should be the norm for future.

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