

# Dermatological Manifestations in Healthcare Workers Due to Use of Personal Protective Equipment During COVID-19 Pandemic

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## ABSTRACT

**Objective:** To evaluate the prevalence and types of dermatological manifestations among healthcare workers (HCWs) due to prolonged personal protective equipment (PPE) usage during the COVID-19 pandemic.

**Methodology:** This cross-sectional study was conducted at Pakistan Air Force (PAF) Hospital, Islamabad, from March 7, 2023, to September 6, 2023. A total of 134 HCWs aged 20–60 years, using PPE for over 6 hours daily, were enrolled. Clinical examination was conducted to document dermatological complications.

**Results:** Of the participants enrolled, 34.3% were males and 65.7% were females (mean age 35.31 ± 10.3 years). Among the reported adverse dermatological signs and symptoms, xeroderma was the most frequently observed, affecting almost 70.1% of participants. Other prominent dermatological manifestations included itching (13.4%), burning sensations (11.2%), skin fissures (2.2%), erythema (1.5%), and scaling (1.5%) were also noted. Notably, xeroderma was particularly prevalent among nursing staff.

**Conclusion:** Healthcare workers faced dermatological adverse effects due to the extended use of personal protective equipment (PPE) during the COVID-19 pandemic. This highlights the need for preventive measures to reduce the adverse cutaneous effects, by improving PPE design and consistent skincare practices.

**Keywords:** COVID-19 Pandemic, Dermatological manifestations, Healthcare workers, Personal Protective Equipment PPE, Xeroderma.

<b>Authors' Contribution:</b> <sup>1,2</sup> Conception; <i>Literature research; manuscript design and drafting;</i> <sup>3,4</sup> Critical analysis and manuscript review; <sup>1,4</sup> Data analysis; <i>Manuscript Editing.</i>	<b>Correspondence:</b> Sajida Bibi Email: <a href="mailto:dr.sj97@gmail.com">dr.sj97@gmail.com</a>	<b>Article info:</b> Received: January 01, 2025 Accepted: September 18, 2025
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## Introduction

The COVID-19 pandemic highlighted the vital importance of personal protective equipment (PPE) in protecting healthcare workers (HCWs) from exposure to SARS-CoV-2.<sup>1,2</sup> PPE such as gloves, masks, gowns, and face shields served as a barrier and primary defense against infection. However, prolonged use of these PPE items has been linked to various adverse cutaneous manifestations, including

dryness (xeroderma), itching, and redness (erythema).<sup>3,4</sup> These conditions not only pose discomfort but also potential occupational hazards. The integrity of the skin as a protective barrier is crucial, and its compromise can lead to secondary infections, impacting the overall health and productivity of HCWs. International studies report that up to 90% of HCWs experienced PPE-induced skin conditions during the pandemic.<sup>5,6</sup>

These complications are attributed to friction, occlusion, and synthetic materials.<sup>7,8</sup> Understanding these factors is critical for developing effective preventive measures. Friction from tight-fitting masks and gloves can cause chafing and irritation, while occlusion traps sweat and moisture, creating a breeding ground for bacteria and fungi. Synthetic materials, often used in PPE, can trigger allergic contact dermatitis in susceptible individuals.

Recent literature has revealed that prolonged use of PPE, especially N95 masks, gloves, and protective gowns, has led to a substantial increase in occupational skin conditions among healthcare workers. Commonly affected areas include the nasal bridge, cheeks, and hands, often presenting with pressure injuries, contact dermatitis, and acneiform eruptions. A cross-sectional study reported that nearly 74% of frontline staff experienced facial dermatoses during extended work shifts due to friction and poor ventilation under protective gear.<sup>9</sup> Additionally, gloves made of synthetic rubber or latex have been linked to irritant and allergic contact dermatitis, especially in individuals with pre-existing skin allergies.<sup>10</sup> Frequent handwashing and excessive use of alcohol-based hand sanitizers further disrupt the skin barrier, increasing susceptibility to dryness, erythema, and fissures.<sup>11</sup> Occlusion from face masks and shields also creates a moist environment that exacerbates acne, rosacea, and seborrheic dermatitis.<sup>12</sup> These skin issues not only cause physical discomfort but can also lead to reduced work efficiency, absenteeism, and increased psychological stress.

While such findings are well documented in international literature, there is very limited evidence from low- and middle-income countries, particularly Pakistan. Differences in healthcare settings, long working shifts, and variable availability of protective equipment make it important to generate local evidence. This gap underscores the need for context-specific research to better understand the burden and risk factors of PPE-

related skin conditions among Pakistani healthcare workers.

The aim of this study was to evaluate the adverse cutaneous manifestations associated with PPE prolonged use within healthcare settings in Pakistan and to identify preventive and protective measures that can reduce their dermatological impact. The study also specifically evaluates the most common adverse skin conditions among Pakistani healthcare workers and the associated risk factors. By addressing this knowledge gap, the findings can share with hospital administration to device policies that protect frontline staff, improve performance, and support their well-being in future health crises.

## Methodology

This cross-sectional study was conducted at Dermatology department of Fazaia affiliated teaching Hospital, Islamabad, over six months (March 7, 2023–September 6, 2023). In total one hundred thirty-four healthcare workers (HCWs) aged 20 to 60 years. They were enrolled using non-probability consecutive sampling after fulfilling sufficient inclusion criteria. Participants included HCWs who used PPE for over six hours daily, six days a week, and were directly involved in COVID-19 patient care.

Individuals with pre-existing dermatological conditions (e.g., eczema, psoriasis) or chronic systemic illnesses affecting skin health were excluded. Dermatological assessments were conducted through structured clinical examinations by a trained dermatologist. Data were collected on demographic characteristics, PPE usage duration, and dermatological manifestations.

**Ethical approval** was obtained from the Pakistan Air Force Hospital Ethics Review Committee (RTMC# DER-2020-258-1247) and also by Research Evaluation Unit of CPSP (Ref No. CPSP/REU/DER-2020258-1247) on 6<sup>th</sup> March 2023. Data were analyzed using SPSS version 22. Descriptive

statistics, including frequencies and percentages, were calculated for categorical variables, and chi-square tests were applied to assess associations ( $p < 0.05$ ).

## Results

A total of 134 HCWs participated in the study, with a mean age of  $35.31 \pm 10.3$  years. Among the participants, 34.3% ( $n=46$ ) were male, and 65.7% ( $n=88$ ) were female. Nurses constituted the majority followed by doctors, paramedics and janitorial staff (Table I).

Characteristics	Frequency (%)
Male	46 (34.3)
Female	88 (65.7)
Nurses	68 (50.7)
Doctors	34 (25.4)
Paramedics	19 (14.2)
Janitorial staff	13 (9.7)

Dermatological Manifestation	Frequency (%)
Xeroderma	94 (70.1)
Itching	18 (13.4)
Burning Sensation	15 (11.2)
Skin Fissures	03 (2.2)
Erythema	02 (1.5)
Scaling	02 (1.5)

The most common dermatological manifestation observed was xeroderma, affecting 70.1% ( $n=94$ ). Other reported conditions included itching, burning sensation, skin fissures, and erythema and scaling (Table II). Participants reported a mean PPE usage duration of  $9.27 \pm 1.8$  hours daily. Nurses experienced the highest prevalence of xeroderma, which was significantly associated with prolonged PPE use ( $p < 0.01$ ).<sup>13</sup> (Table III)

Dermatological Manifestation	Doctors (n=34)	Nurses (n=68)	Paramedical (n=19)	Janitorial (n=13)	$\chi^2$ (p-value)
Xeroderma (n=94)	28 (82.4%)	56 (82.4%)	10 (52.6%)	0 (0.0%)	<b>40.59 (&lt;0.001)</b>
Erythema (n=02)	0 (0.0%)	2 (2.9%)	0 (0.0%)	0 (0.0%)	1.97 (0.579)
Itching (n=18)	2 (5.9%)	0 (0.0%)	6 (31.6%)	10 (76.9%)	<b>62.66 (&lt;0.001)</b>
Burning sensation (n=15)	4 (11.8%)	10 (14.7%)	1 (5.3%)	0 (0.0%)	3.17 (0.367)
Scaling (n=02)	0 (0.0%)	0 (0.0%)	2 (10.5%)	0 (0.0%)	<b>12.29 (0.006)</b>
Skin fissures (n=03)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (23.1%)	<b>28.56 (&lt;0.001)</b>

Chi-square test:  $\chi^2 = 111.14$ ,  $df = 15$ ,  $p < 0.001$

## Discussion

This study highlights the significant burden of dermatological complications caused by prolonged PPE use among HCWs during the COVID-19 pandemic. Xeroderma was the most common issue, consistent with findings from international research in China and Germany.<sup>13,14</sup> These findings underscore the global nature of PPE-related skin problems, irrespective of geographical location or healthcare setting. The consistency of these findings across diverse populations and healthcare systems emphasizes the need for universal guidelines and preventive strategies. Extended use of PPE can cause skin irritation, trap moisture, and disrupt the skin's natural barrier, effects that are often worsened by synthetic fabrics and tightly fitted designs.<sup>7,10,15</sup> One of the major contributing factors is the occlusive nature of PPE, which traps sweat and limits airflow,

thereby hindering the skin's ability to recover. In addition, the absence of uniform PPE standards and inconsistencies in material quality can worsen skin-related problems, resulting in unexpected effects and higher risks for healthcare workers. Research indicates that the microenvironment within PPE can increase both skin temperature and humidity, making the skin more vulnerable to irritation and breakdown.<sup>16</sup> When the skin's natural barrier function is compromised, it not only results in discomfort but also increases the risk of secondary infections, posing an additional threat to overall well-being and performance.

These dermatological manifestations also carry financial consequences, such as increased medical expenses and lost workdays. There is a clear need for further research to assess these costs and to determine which preventive strategies offer the most cost-effective solutions.

Addressing these issues requires a multi-faceted approach. This includes designing ergonomic PPE made from breathable and skin-friendly materials, encouraging healthcare professionals to adopt consistent skincare routines with moisturizers and barrier creams, and ensuring the implementation of structured protocols for PPE use that allow periodic skin relief and minimize continuous exposure.<sup>9,17</sup>

Recent advances in PPE design focus on using breathable fabrics and moisture-wicking materials to help minimize skin irritation. Some manufacturers are experimenting with advanced options such as cellulose-based textiles and re-engineered designs that improve ventilation and enhance overall comfort.<sup>18</sup> In addition, ongoing research is exploring the use of antimicrobial coatings on the surfaces of PPE to help reduce the risk of secondary skin infections.<sup>19</sup> Emerging cutaneous issues like mask-related acne (maskne) and pressure-induced skin injuries highlight the need for further research into PPE designs that maintain infection control while protecting skin integrity.<sup>11,14</sup> Offering customized PPE options along with personalized skincare

guidance can greatly enhance both comfort and adherence. Furthermore, the advancement and usage of tele-dermatology services introduce a practical and effective approach to managing PPE-related skin issues.<sup>20</sup> Factors such as a regulated indoor climate and frequent exposure to disinfectants and cleaning chemicals within the hospital may have additional effects on skin health. Moreover, the accessibility of skincare resources and institutional support plays a pivotal role in how PPE-related skin conditions are addressed. Future investigations should consider these factors when evaluating dermatological outcomes. A comprehensive understanding of these influences is essential for formulating well-informed, targeted strategies and healthcare policies. Qualitative research can also highlight the personal experiences and perspectives of healthcare workers who face dermatological challenges due to prolonged PPE use. The limitations of this study include its single-center design, which may limit generalizability. Future multi-center studies are recommended to validate these results across diverse healthcare settings and populations. Additionally, the cross-sectional nature of the study does not allow for establishing causality between PPE use and dermatological manifestations; longitudinal studies are needed to explore the temporal relationship between these variables. Recall bias may also be a limitation, as participants may not accurately remember details of their PPE use or dermatological symptoms. Objective measures of skin health, such as transepidermal water loss (TEWL) assessments, could enhance the accuracy of future studies.

## Conclusion

This study demonstrates that prolonged PPE use places a considerable dermatological burden on healthcare workers, with xeroderma and related conditions being most prevalent. These findings emphasize the importance of balancing infection

control with user comfort and skin health. Hospitals and policymakers should prioritize access to high-quality, ergonomic PPE, promote consistent skincare routines, and implement structured usage protocols to minimize skin complications. Addressing these issues not only safeguards the well-being of frontline staff but also enhances their efficiency and resilience during ongoing and future health emergencies.

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