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PREVALENCE OF CONTACT DERMATITIS AMONG HEALTHCARE WORKERS USING PERSONAL PROTECTIVE EQUIPMENT DURING LONG SHIFTS

(*Original Research*)

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Abstract

Background: Contact dermatitis is one of the most frequent occupational skin diseases, particularly among healthcare workers due to the use of personal protective equipment (PPE). The prolonged reliance on gloves, masks, and protective gowns during extended shifts heightens the risk of skin barrier disruption, leading to both irritant and allergic forms of dermatitis. The issue has gained prominence during infectious disease outbreaks but remains underexplored in regional healthcare settings.

Objective: To evaluate the prevalence and severity of contact dermatitis among healthcare workers frequently using PPE during long clinical shifts.

Methods: A cross-sectional study was conducted in Lahore over four months. A total of 240 healthcare workers were recruited through stratified random sampling, including doctors, nurses, paramedics, and ancillary staff. Data on demographics, occupational exposure, and PPE use were collected using structured questionnaires. Clinical dermatological examination confirmed diagnoses, while severity was assessed using the Hand Eczema Severity Index (HECSI) and Visual Analog Scale (VAS). Statistical analysis was performed using SPSS v26, applying chi-square tests, independent t-tests, ANOVA, and Pearson correlation.

Results: The overall prevalence of contact dermatitis was 38.8%. Nurses exhibited the highest prevalence (45.7%), followed by doctors (37.0%), paramedics (34.9%), and ancillary staff (27.3%). Females were more affected (44.1%) than males (32.7%). Gloves were implicated in 74.2% of cases, followed by masks and respirators (51.6%) and gowns (19.4%). The mean HECSI score was 23.5 ± 8.4, with 62.4% of cases classified as mild, 28.0% as moderate, and 9.6% as severe. PPE use duration showed a significant positive correlation with dermatitis severity ($r = 0.34$, $p < 0.001$).

Conclusion: Contact dermatitis was highly prevalent among healthcare workers, particularly among nurses and female staff. Gloves and masks were the most common sources of dermatitis, and longer PPE use significantly increased severity. Preventive interventions, including skin-friendly PPE, barrier creams, and occupational health policies, are essential to reduce this burden.

Keywords: Contact Dermatitis, Cross-Sectional Studies, Face Masks, Gloves, Healthcare Workers, Occupational Diseases, Personal Protective Equipment.

Introduction

Contact dermatitis is a common occupational skin disease that affects individuals exposed to irritants and allergens in their working environment. Healthcare workers, because of their constant exposure to gloves, disinfectants, and protective clothing, are particularly vulnerable to this condition (1). The increasing reliance on personal protective equipment (PPE) during long clinical shifts, especially in the context of infectious disease outbreaks such as COVID-19, has intensified this problem, making contact dermatitis an emerging occupational health concern in modern healthcare (2). The skin, serving as the first line of defense, is often compromised by repeated friction, occlusion, moisture accumulation, and exposure to harsh cleaning agents, all of which contribute to irritation and barrier dysfunction (3). When combined with the prolonged and frequent use of PPE, the risk of developing contact dermatitis rises considerably (4). The pathophysiology of contact dermatitis in healthcare settings can be attributed to both irritant and allergic mechanisms. Irritant contact dermatitis results from direct chemical or physical damage to the skin barrier, often caused by alcohol-based hand rubs, frequent washing, or occlusion under gloves and masks (5). Allergic contact dermatitis, on the other hand, is mediated by delayed-type hypersensitivity to allergens such as rubber accelerators in gloves, preservatives in sanitizers, or adhesives used in medical tapes and masks (6). The clinical manifestations range from dryness and erythema to painful fissures and vesicular eruptions, which may impair the ability of healthcare workers to perform essential tasks efficiently (7). Importantly, these conditions are not only physically distressing but also psychologically burdensome, as they may reduce compliance with PPE use, increase absenteeism, and negatively affect patient safety.

Several studies have highlighted the heightened prevalence of occupational contact dermatitis among healthcare professionals. Reports from the COVID-19 pandemic revealed that between 20% and 50% of healthcare workers experienced some form of skin reaction attributed to PPE use (8). Gloves and face masks were the most frequently implicated items, with reactions ranging from mild irritation to more severe dermatitis requiring medical intervention (9). In particular, long working hours, continuous use of N95 respirators, and double-gloving practices were strongly associated with skin barrier breakdown. Although these studies brought global attention to the issue, the prevalence and determinants of PPE-related dermatitis may vary considerably across regions, institutions, and work practices. The occupational implications of contact dermatitis in healthcare cannot be underestimated (10). Compromised skin integrity increases the risk of secondary infections, reduces manual dexterity, and may compel healthcare workers to modify or abandon protective measures. This in turn raises concerns not only for individual health but also for occupational safety and infection control. While institutional guidelines often emphasize hand hygiene and protective equipment, relatively less attention has been paid to skin health and prevention of dermatitis. Moisturizers, protective barrier creams, and rotation of PPE materials are among the measures shown to reduce incidence, yet compliance remains inconsistent (11). Identifying the magnitude of the problem within a specific population of healthcare workers is therefore crucial for informing preventive strategies and occupational health policies.

Despite the growing awareness of PPE-related dermatitis, there remains a gap in systematic, region-specific data that quantifies its prevalence among healthcare professionals. Many studies have been conducted in high-income countries during pandemic surges, but there is limited literature focusing on low- and middle-income healthcare settings where resource limitations, high patient loads, and extended working hours may exacerbate risks. Furthermore, the majority of studies emphasize anecdotal or hospital-based observations rather than structured prevalence studies with defined methodologies. This gap highlights the need for robust epidemiological research to provide evidence-based insights into the burden of contact dermatitis among frontline healthcare staff. The present study was designed to address this gap by evaluating the prevalence of contact dermatitis among healthcare workers frequently using PPE during long shifts. By adopting a cross-sectional design, the study aims to capture both the magnitude of the problem and its association with the intensity and duration of PPE use. The objective is to provide empirical data that can inform occupational health interventions, encourage preventive practices, and support the development of evidence-based policies to safeguard the dermatological health of healthcare workers.

Methods

The study employed a cross-sectional design to evaluate the prevalence of contact dermatitis among healthcare workers who regularly used personal protective equipment (PPE) during long shifts. The research was carried out in Lahore, Pakistan, over a period of four

months. The target population included doctors, nurses, paramedics, and ancillary staff directly engaged in patient care in hospitals and healthcare facilities where continuous PPE use was mandatory. A sample size of 240 participants was calculated using the World Health Organization sample size calculator, assuming an expected prevalence of 25%, a 95% confidence level, and a 5% margin of error. This sample size was further adjusted to account for a possible non-response rate of 10%, ensuring adequate statistical power. Participants were recruited through stratified random sampling to ensure representation across different cadres of healthcare workers. Inclusion criteria comprised individuals aged 20 to 60 years who had been using PPE for at least six hours per shift and for a minimum of three months prior to the study. Exclusion criteria included healthcare workers with a prior diagnosis of chronic dermatological conditions unrelated to occupational exposure, those on systemic corticosteroids or immunosuppressive therapy, and individuals unwilling to provide informed consent.

Data collection was conducted using a structured, pretested questionnaire that captured demographic information, occupational details, type and duration of PPE use, and self-reported dermatological symptoms. To enhance validity, clinical examination of reported skin lesions was performed by a dermatologist to confirm the presence of contact dermatitis. The diagnosis was based on standard clinical criteria including erythema, pruritus, dryness, fissuring, and vesiculation localized to PPE contact areas. The severity of dermatitis was graded using the validated Hand Eczema Severity Index (HECSI) and a Visual Analog Scale (VAS) for symptom burden, both of which have been widely used in occupational dermatology studies. The primary outcome of interest was the prevalence of contact dermatitis among healthcare workers, expressed as a proportion of the study population. Secondary outcomes included the association between dermatitis and variables such as duration of daily PPE use, type of PPE most commonly worn, and frequency of hand hygiene practices. Data were entered and analyzed using SPSS version 26. Continuous variables such as age, working hours, and HECSI scores were presented as means with standard deviations. Categorical variables such as gender, occupation, type of PPE used, and dermatitis prevalence were summarized using frequencies and percentages.

To evaluate associations between categorical variables, the chi-square test was applied. Independent sample t-tests and one-way ANOVA were used to compare mean HECSI scores across groups defined by hours of PPE use and type of PPE worn, as the data were normally distributed. Pearson correlation coefficients were calculated to assess the relationship between daily PPE use duration and dermatitis severity scores. A p-value of less than 0.05 was considered statistically significant. Participants with severe dermatitis were counseled and referred for dermatological care in accordance with ethical principles of beneficence and nonmaleficence. The methodological rigor of this study lay in the combination of self-reported data with clinical confirmation, thereby minimizing misclassification bias. The use of standardized severity indices allowed objective quantification of outcomes, while stratified sampling improved representativeness of different healthcare groups. The statistical approach was selected to align with the study's objective of assessing prevalence and determining associations, thus providing robust and reproducible findings.

Results

The study enrolled 240 healthcare workers from tertiary care hospitals in Lahore, with a response rate of 95.4%. The mean age of participants was 32.8 ± 7.1 years, ranging from 21 to 58 years. Among the study population, 127 (52.9%) were female and 113 (47.1%) were male. Nurses represented the largest occupational group with 94 participants (39.2%), followed by doctors with 81 (33.8%), paramedics with 43 (17.9%), and ancillary staff with 22 (9.1%). The average daily working hours were 9.6 ± 2.4, with 68.7% of participants reporting more than eight hours of continuous duty. These demographic characteristics are presented in Table 1. The overall prevalence of contact dermatitis among the study cohort was 38.8% (n = 93). Stratification by gender revealed that dermatitis was more common among females (44.1%) than males (32.7%). With respect to occupation, nurses exhibited the highest prevalence (45.7%), followed by doctors (37.0%), paramedics (34.9%), and ancillary staff (27.3%). The mean duration of PPE use per day was significantly higher among participants with dermatitis (10.4 ± 2.2 hours) compared to those without dermatitis (9.1 ± 2.3 hours). The distribution of dermatitis prevalence across occupational and gender groups is summarized in Table 2.

Assessment of PPE-related factors showed that gloves were the most frequently implicated item, with 74.2% of affected individuals reporting hand dermatitis. Face masks and N95 respirators accounted for 51.6% of facial dermatitis cases, while protective gowns were linked to 19.4% of trunk-related lesions. Prolonged glove use beyond six hours was strongly associated with higher dermatitis prevalence. The relationship between PPE type and dermatitis distribution is detailed in Table 3. The severity of dermatitis was evaluated

using the Hand Eczema Severity Index (HECSI) and the Visual Analog Scale (VAS) for symptom burden. The mean HECSI score among affected individuals was 23.5 ± 8.4, with 62.4% of cases classified as mild, 28.0% as moderate, and 9.6% as severe. The mean VAS score was 5.6 ± 1.7, with higher values noted among participants using double gloves or continuous mask wear exceeding eight hours. The severity profile is outlined in Table 4.

Correlation analysis demonstrated a significant positive relationship between duration of PPE use and dermatitis severity. Pearson's correlation coefficient between daily PPE use hours and HECSI score was $r = 0.34$ ($p < 0.001$). One-way ANOVA confirmed significant differences in mean HECSI scores across groups categorized by PPE duration (<8 hours, 8–10 hours, >10 hours; $p = 0.002$). Figure 1 illustrates the prevalence of dermatitis across occupational groups, while Figure 2 shows the correlation between PPE use duration and HECSI scores. In summary, the results revealed a notable prevalence of contact dermatitis among healthcare workers, with higher rates in nurses and female participants. Gloves and facial masks were the most common sources of dermatitis, and longer PPE use was significantly associated with both increased prevalence and greater severity. The comprehensive distribution of outcomes across demographic, occupational, and exposure-related variables highlights the occupational risk burden in this cohort.

Table 1: Demographic characteristics of participants (n = 240)

Variable	Mean ± SD / n (%)
Age (years)	32.8 ± 7.1
Gender (Male/Female)	113 (47.1%) / 127 (52.9%)
Occupation (Doctor/Nurse/Paramedic/Ancillary)	81 (33.8%) / 94 (39.2%) / 43 (17.9%) / 22 (9.1%)
Working hours/day	9.6 ± 2.4

Table 2: Prevalence of contact dermatitis by gender and occupation

Variable	n	Prevalence (%)
Male	113	32.7
Female	127	44.1
Doctors	81	37.0
Nurses	94	45.7
Paramedics	43	34.9
Ancillary	22	27.3

Table 3: PPE type and distribution of dermatitis (n = 93 affected)

PPE Type	Frequency (n)	Percentage (%)
Gloves (hands)	69	74.2
Masks/Respirators	48	51.6
Gowns/Aprons	18	19.4

Table 4: Severity of dermatitis among affected participants (n = 93)

Severity (HECSI classification)	Frequency (n)	Percentage (%)
Mild	58	62.4
Moderate	26	28.0
Severe	9	9.6
Mean HECSI ± SD	23.5 ± 8.4	
Mean VAS ± SD	5.6 ± 1.7	

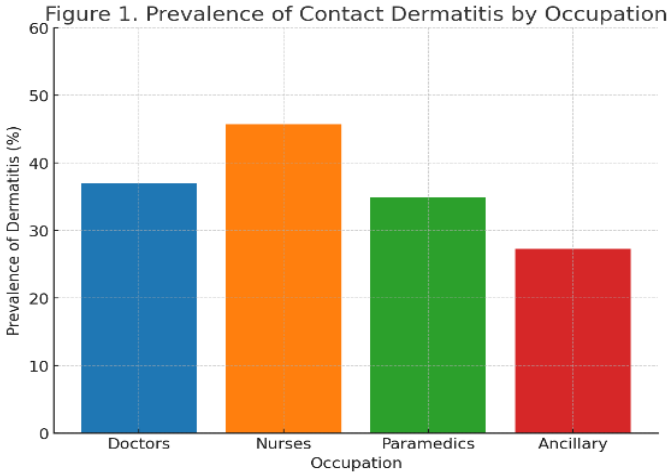

Figure 2Prevalence of Contact Dermatitis by Occupation

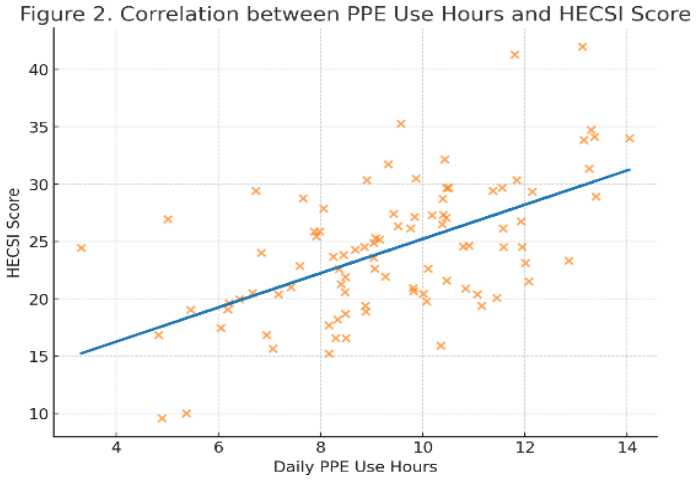

Figure 2 Correlation Between PPE use Hours and HECSI Scores

Discussion

The findings of this study demonstrated that nearly two out of five healthcare workers developed contact dermatitis associated with the prolonged use of personal protective equipment during long clinical shifts. The prevalence observed aligns with international reports, particularly those emerging during the COVID-19 pandemic, where similar rates ranging from 30% to 50% were recorded among frontline medical staff (12). The higher prevalence among nurses compared to other healthcare groups was consistent with prior evidence, as nursing staff often engage in prolonged patient contact, more frequent glove use, and repeated hand hygiene, all of which compromise the skin barrier (13). The gender difference, with females more frequently affected, also mirrored findings from occupational dermatology literature, where hormonal influences, differences in skin sensitivity, and PPE fit have been implicated as contributing factors (14).

The predominance of glove-related dermatitis underscores the impact of occlusion, sweating, and exposure to glove materials, including latex and rubber accelerators, which have long been recognized as occupational sensitizers (15). Similar observations have been documented in European and Asian cohorts, reinforcing the universal burden of hand dermatitis among healthcare workers. Facial dermatitis associated with mask and respirator use was also notable, reflecting increased friction, pressure, and moisture retention, particularly with N95 respirators (16). Comparable findings have been reported in studies from China and Italy, where prolonged mask wear correlated with facial erythema and erosions. These similarities across diverse healthcare systems highlight that PPE-related skin damage is not confined to a single geographic or institutional setting but represents a broader occupational health challenge (17). The analysis of severity revealed that while most cases were mild, a significant proportion of moderate and severe cases was present, which is clinically important as these levels of dermatitis can impair work performance, reduce compliance with PPE protocols, and increase

the risk of secondary infections (18). The positive correlation between PPE use duration and severity of dermatitis provided robust evidence that cumulative exposure is a central determinant of skin barrier breakdown (19). This relationship has been repeatedly highlighted in occupational dermatology studies, and the present findings confirm its applicability in the local healthcare context.

The implications of these findings extend beyond individual health. Contact dermatitis among healthcare workers compromises occupational efficiency, increases absenteeism, and can indirectly impact patient safety by reducing compliance with infection control protocols (20). Preventive strategies, such as rotation of PPE materials, scheduled breaks, use of barrier creams, and provision of skin-friendly gloves, therefore assume critical importance. Institutional policies should integrate dermatological health into broader occupational safety frameworks, especially in contexts of high patient load and extended working hours (21). The strengths of this study include its structured cross-sectional design, the use of standardized clinical tools such as the HECSI and VAS, and the combination of self-reported symptoms with clinical confirmation, which minimized misclassification bias. The stratified sampling approach ensured representation across occupational categories, adding to the reliability of prevalence estimates (22). The study also provided locally relevant data, addressing the gap in literature from low- and middle-income healthcare settings. Nevertheless, certain limitations must be acknowledged (23). Being cross-sectional, the study captured prevalence at a single point in time and could not establish causality. Recall bias may have influenced self-reported data on PPE use duration and hand hygiene frequency. Additionally, patch testing was not performed, limiting differentiation between irritant and allergic contact dermatitis. The study was confined to healthcare facilities in Lahore, which may restrict generalizability to other regions with differing resources and work conditions. Despite these limitations, the study contributes valuable evidence that can guide both local occupational health interventions and broader comparative research. Future research should adopt longitudinal designs to capture the incidence and persistence of dermatitis over time, as well as intervention-based studies evaluating the effectiveness of preventive measures such as barrier creams, PPE modifications, and skin health education programs. Expanding research to include biochemical assessments of skin barrier function and patch testing could help clarify the relative contribution of irritant versus allergic mechanisms. Multicenter studies across different regions and healthcare systems would also strengthen external validity and provide a more comprehensive understanding of the occupational burden of PPE-related dermatitis.

Conclusion

This study established that prolonged use of personal protective equipment significantly contributed to contact dermatitis among healthcare workers, particularly nurses and female staff. Gloves and facial masks were the most common sources of skin damage, and longer PPE use was strongly correlated with greater severity. The findings highlight the necessity of integrating dermatological protection into occupational health strategies, including provision of skin-friendly PPE, preventive skin care measures, and institutional support. Addressing this issue is vital for preserving workforce well-being and maintaining the integrity of infection prevention practices.

AUTHOR'S CONTRIBUTIONS

Author	Contribution
Zarina Naz*	Designed the study, performed data collection and analysis, and prepared the manuscript. Approved the final draft for submission.
Muhammad Dawood	Contributed to study design, data acquisition, interpretation of findings, and performed critical review and editing of the manuscript. Approved the final draft for submission.
Shabeer Haider	Significantly contributed to data collection and analysis. Reviewed and approved the final manuscript for publication.

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