

Original article

**Dermatological manifestations in the healthcare force due to personal protective gears and vigorous hand hygiene practices during COVID-19 saga –  
A cross-sectional study in Dubai with recommendations to prevent them**

Dr.Piyu Parth Naik\*

**\*Corresponding Author:** Dr.Piyu Parth Naik, M.D.(Skin & VD), Dermatologist. Affiliation: Specialist dermatologist, Saudi German Hospitals & clinics, Dubai, UAE.  
<https://orcid.org/0000-0002-6499-4062>

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**Abstract**

*COVID-19 has truly lived by its name of “Global Pandemic”<sup>1</sup> since its inception on 31st December 2019. Dubai, the center of the world, though had reported the first confirmed case of the middle east, has fought this endgame with utmost bravery. Valiant soldiers of healthcare have been using multiple personal protective gears like N95 mask, face shield, whole-body gown, goggle, face shield, cap, hand gloves, and surgical face mask. They have also been performing exponential handwashing tasks and hand rubbing to protect themselves, colleagues, and patients.*

*Our goal was to study the prevalence of dermatological manifestations in Dubai's healthcare workers due to protective gear and hand hygiene practices during the COVID-19 saga. The author has also focused on providing recommendations to prevent these adverse effects.*

*COVID-19 core-team in Adam Vital Hospital Dubai was surveyed with a paper questionnaire. 82 workers out of 100 selected granted our request to put answers on paper. Nurses were the largest group of respondents, with 32.92 %, while healthcare assistants were 15.85 % of the responding group. Doctors and house-keeping staff were 25.60 % of the respondents. Females were at the majority with 70 %.*

*Facial marks/skin depression was a standalone complaint in 90 % of respondents, while rash was reported by 8 %. The itching was also on the high end, reported by 66 (80.48%) workers, including itching at mask margins and goggles. 62 (75.60%) persons wrote excessive perspiration, ear cartilage pain, and erythema were documented by 73.17% of respondents specifically. Two persons (2.43%) reported worsening of eczema, while dryness of skin was reported on the other end by 80 (97.56 %) people. Allergic contact dermatitis was reported by two persons (2.43 %) using hand rub. The quality department came up with a list of recommendations to manage these manifestations.*

**Keywords:** *N95 mask, COVID-19, Facial marks due to mask, Earache with the mask, Allergy due to sanitizer.*

## Introduction

World Health Organization (WHO), the peak global healthcare body's satellite offices in China, picked up a media statement of Wuhan Municipal Health Commission regarding a cluster of "Viral pneumonia" cases in Wuhan on 31st December 2019. Though it was reported by Chinese officials as viral pneumonia of unknown cause initially, soon it was concluded that novel coronavirus is the culprit behind this evolving outbreak; after a month and half of the rapid on-going efforts, WHO labeled that disease as COVID-19.

Deadly COVID-19 has crossed almost all boundaries since then to infect 15 million people with almost six hundred thousand deaths, converting this world into lock-down with the label of pandemic (1). COVID-19 is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a coronavirus strain.

COVID-19 presents with systemic and/or respiratory manifestations. Some patients also experience mild gastrointestinal or cardiovascular symptoms. Others may present solely with a gastroenteritis-like illness, which will not be recognized to be COVID-19.

A significant minority of individuals infected with SARS-CoV-2 remain asymptomatic throughout their illness, acting as carriers. The full spectrum of clinical manifestations of COVID-19 is vast. Symptoms and signs are non-specific. At the time of writing this paper, WHO has suggested that COVID-19 spreads between people through direct, indirect (contaminated surface or objects) or close contact with infected people via mouth and nose secretions. WHO has also mentioned suggestions to investigate aerosol transmission as a potential transmission route considering global feedback during this semiannual period.

The global healthcare taskforce, which has worked tirelessly during this pandemic, is at a higher risk of getting and transmitting this disease. They all need extra-care and precautions in any set-up, which deals with COVID-19 cases and any healthcare delivery system worldwide. Though healthcare workers were vigilant for centuries, COVID-19 has undoubtedly put an accelerator on the use of personal protective gear (PPG) and vigorous hand hygiene practices (HHP). Valiant soldiers of healthcare have been using multiple personal protective gears like N95 masks, face shields, whole-body gowns, goggles, face shields, caps, hand gloves, and surgical face masks. They have also been performing exponential tasks of hand washing and hand rubbing during this COVID-19 saga. Considering the highly infectious nature of COVID-19, healthcare staff were bound to wear these PPGs for their entire duty period of long hours and perform aggressive hand hygiene practices multiple times. Resilient staff had many skin manifestations on account of these PPG and HHP.

Nevertheless, they have stayed strong in this tiring fight without giving a noticeable burden of these complaints on global healthcare. Our goal was to study the prevalence of dermatological manifestations in Dubai's healthcare workers due to protective gear and vigorous hand hygiene practices during the COVID-19 period. Authors have also focused on providing recommendations with quality departments and local health authorities to prevent these adverse effects of PPG and HHP.

## Materials and Methods

Adam Vital Hospital, Dubai, started receiving patients with positive nasopharyngeal swab PCR tests in the first week of March 2020. Adam Vital Hospital, Dubai was an official COVID-19 healthcare facility designated by the Dubai Health Authority (DHA). Hospital's quality and infection control departments were in action even before the arrival of their first case in the form of written policy and video demonstration on PPG and HHP. Hospital made the "Core Covid-19 Care team" to manage these patients effectively. Doctors from internal medicine, infection disease, anesthesia, critical care, radiology were included to head their respective groups. In-patient nurses, healthcare assistants and house-keeping staff were also added to this COVID-19 Care team.

Our method of the study was descriptive and cross-sectional. We decided to print 100 hard-paper questionnaires and give them to the selected (On duty) members of the Covid-19 Care Team on 25th July. It is prudent to note that both hospitals became covid-19 free in the first week of July. Staff who had worked in in-patient wards, emergency areas, and intensive care units were given a hard-copy paper questionnaire to respond to.

The entire target population had actively worked during the COVID-19 patients' care. Numbered questions were utilized to get information regarding post held, age, and gender. A set of questions were aimed at the duration of use of PPG and the frequency of HHP.

Specific questions were also asked regarding dermatological features related to PPGs and HHP after leading questions about skin-related complaints. The noteworthy point is that all used the same methods and layers of protection, giving uniformity in the dataset.

Data were segregated in MS-Excel sheets, and scilab.org performed the statistical analysis. A Chi-square test was used to compare differences between groups and a P value of less than 0.05 was considered significant.

## Results

One hundred healthcare workers from the "Core Covid-19 Care Team" were provided with questionnaires. 82 workers out of 100 selected granted our request to put answers on paper (82%).

Nurses were the largest group among the respondents. Nurses were the largest group of respondents, with 32.92 %, while healthcare assistants were 15.85 % of the responding group.

Doctors and house-keeping staff were 25.60 % of the respondents. Females were at the majority with 70 %, with an average age of responding bunch was 30 years.

Serial number	Signs and symptoms in the chief complaint	Number of staff stating the complaint	The proportion of staff stating the complaint	PPE involved
1	Facial pressure mark/skin depression	72	90 %	N95
2	Itch	66	80.48 %	N95, Surgical mask
3	Excessive perspiration	62	75.60 %	Hand gloves and gown
4	Back of ear pain	60	73.17 %	N95, Surgical mask, Goggles
5	Rash	11	13.41 %	Hand gloves
6	Worsened eczema	2	2.43 %	Hand gloves
7	Allergic reaction	2	2.43 %	Gel-based hand rub

## Hand rub

All 82 responding personnel used standard precautions with aggressive hand hygiene practices. 2 nurses stated the immediate appearance of redness in the exposed areas of hands by gel-based hand rub. The on-duty general practitioner made a clinical diagnosis of allergic contact dermatitis and advised a patch test. The preservative in the hand rub was found the culprit in the patch tests.

## N95 masks

Facial marks and depression at the mask margins-skin contact areas with or without abrasion and bruises were reported by 72 (90%) staff. The whole staff was using N95 masks aggressively for their entire duty duration. As all staff was working 8 to 12 hours a day for three months in the dedicated Core Covid-19 Care team and high a proportion of N95 associated pressure changes in the skin was a likely outcome. a 3-layered surgical mask was being worn over the N-95 masks by healthcare warriors as a mean of additional precaution, which in combination ultimately reflects in high incidence reporting of itch. 66 (80.48%) healthcare personnel reported itch over the contact areas of these masks. Redness and ear cartilage pain was attributed by 60 (73.17%) staff in the regions where strings of masks rest. No staff met any hospital doctor for consultations regarding these symptoms. There was no significant difference noted due to age, gender, and job-profile.

## Hand gloves and gown

62 (75.60%) individuals reported excessive perspiration under the hand gloves and gowns. 11 (13.41%) individuals also reported the focal rash in the hands where gloves were in tight contact with skin. Skin – gloves contact area was the same as masks with daily 8 to 12 hours for three consecutive months. 11 personnel were asked to switch to powder-free non-latex gloves from the different manufacturers during their medical consultation for their complaints, which ultimately corroborated with seizing of their symptoms too. There was no significant difference noted due to age, gender, and job-profile. One nurse and one healthcare assistant had pre-existing eczema, who reported worsening of their symptoms after wearing gloves in palmer areas.

## Discussion

World Health Organization (WHO) published the "Infection prevention and control of epidemic – and pandemic-prone acute respiratory infections in healthcare" guidelines in 2014 (2). N95 mask, face shield, whole-body gown, goggle, face shield, cap, hand gloves, and surgical face mask were parts of the entire suite for the "Core COVID-19 Care Team". Generally called N95 mask is an N95 respirator, where "N" stands for NIOSH – National Institute for Occupational Safety and Health of the USA, with at least 95% filtration of large and small particles including microbes.

Centers for Disease Control and Prevention, along with NIOSH, clearly states in the document, explaining the difference between N95 respirator and surgical masks, that N95 is having a "Tight-fitting" face seal fit with the mandatory requirement of fit test. Only the tight-fitting characteristic of the N95 respirator prevents the leakage around the edges (3). THE average COVID-19 virus particle size is 0.125 microns, while the range is 0.06 micros to 0.14 microns. Though the N95 respirator filters down to 0.3 microns size only, COVID-19 generally attaches to water droplets or aerosols generated by breathing, coughing, to present with 1-micron size and Brownian motion of these particles increases the possibility of snaring of these particles by respirator filter.

The most frequent dermatological manifestation stated by the Core Covid-19 Care team was facial marks and skin depression (at the mask margins - skin contact areas) with or without abrasion and bruises. To date, the primary spread of COVID-19 is droplet infection, considering that healthcare staff was vigilant and aware of the requirement of "tight-fitting" for N95 respirators. Along with that, prolonged duty hours and overlying surgical mask, shield, goggles, and whole-body gown precluded any rest to skin contact areas, resulting in marks. Associated pain was also reported by all those, who stated skin marks with abrasions as a sole complaint.

A few healthcare staff mentioned scars over the nose and peri-oral areas in the description of skin marks, but authors did not see any scar over the face on calling those same staff for a visit. On further oral inquiry, those staff elaborated skin marks rather than a scar. We determined that these staffs were describing skin marks with skin depression only as "scars." An exceedingly high proportion of healthcare personnel reported itching over masks' contact areas, likely due to irritant contact dermatitis. The itching was predominantly over nasal and peri-auricular areas. Ear cartilage was resting areas of N-95 respirator bands, surgical mask strings, and goggles. High performing cartilage was bound to get pain and redness over contact areas with this PPE due to prolonged contact and drag. Posterior "over-working" ear cartilage areas were sites of these skin manifestations in a high number of respondents.

Hyperhidrosis, i.e., excessive perspiration, is relatively common under hand gloves and gowns. A closed area with increased temperature is the scientific explanation for this. However, prolonged duration of wearing those PPG leads to many respondents labeling excessive perspiration as dermatological manifestation. Type-I hypersensitivity is a known mechanism manifesting as a rash against rubber glove material. Latex sensitization, a known phenomenon (4) in many previously conducted studies, could be the sole reason behind rash appearance in our rash cases. Our rash cases were changed to powder-free non-latex gloves (7), leading to the cessation of their symptoms. 2 staff, who were having already having pre-existing dermatological

conditions in the form of hand eczema, also showed aggravation of their symptoms, also points to latex hypersensitivity as the culprit.

Allergic urticaria, IgE mediated hypersensitivity reaction, is relatively common in middle-east. Allergy to the preservative in hand rub leads to an immediate release of histamine in the skin in response to hand rub in previously sensitized and allergic individuals. Staff who presented to the emergency general practitioner for their palm redness and itching were clinical diagnosed as allergic contact dermatitis and advised patch tests for the same. Patch tests were diagnostic of preservative as the culprit for urticaria. Both staff were asked to change hand hygiene practices with an alternate form of hand rub exclusive of that preservative. These staffs were free of symptoms in their next duty.

## Conclusion

Our study clearly states the high occurrence of dermatological manifestations in Core COVID-19 Care team staff due to PPG and aggressive HHP. In a hospitals'-controlled environment, neither staff reported the appearance of any skin manifestation after the dissolution of the Core Covid-19 Care team nor of the continuation of any skin manifestation. No life-threatening emergency was reported or stated during the COVID-19 team tenure. Though a few staff did a consultation for their adverse skin manifestations, it was evident that most of the dermatological manifestations were of mild severity. This study provides the real picture of the use of PPG and HHP and associated dermatological features. COVID-19 pandemic threat is still red in many parts of the world and new viruses are on the horizon; this study information will provide bases for creating prevention strategies.

This Dubai-based hospital's quality department came with local recommendations to prevent dermatological manifestations due to PPG and HHP. The correct fitting N95 respirator is recommended for the prevention of skin marks. A less known fact is that N95 comes in two sizes. However, one needs extra caution to select the size as over-size can lead to leakage of air. The quality team also recommended artificial buckles to hold the elastic taut behind the mask wearer's head to prevent painful pressure on ears (6). Non-latex powder-free gloves were also recommended as first-line use to counter hyperhidrosis, irritant contact dermatitis, and allergic contact dermatitis (7). Non-gel-based alcohol-containing hand rubs were advised to be used in HHP to prevent the staff from allergic urticaria. These small preventive actions will undoubtedly help the health care diaspora worldwide fight COVID-19 with healthy skin without or reduced rated adverse dermatological manifestations.

## Declarations

- **Ethical approval:** was taken from Adam Vital hospital, Dubai.
- **Consent for publication:** All consents are taken.
- **Availability of supporting data:** All data and references present.
- **Competing interests:** No competing interests.
- **Funding:** This article was self-funded and no other source of funding present.

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