

# Personal protective equipment-related occupational dermatoses during COVID-19 among health care workers: A worldwide systematic review



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**Background:** Occupational dermatoses caused by personal protective equipment (PPE) in the ongoing COVID-19 pandemic are emerging occupational health challenges that must be promptly and effectively addressed to ease burden on our health care workers.

**Objective:** A systematic review was conducted to determine common PPE-related dermatoses, affected body sites, and implicated occupational contactants. We further proposed solutions to mitigate this problem.

**Methods:** Online databases were searched for articles on PPE-related dermatoses in health care workers during the COVID-19 pandemic written in English and published from January 1, 2020, to January 30, 2021.

**Results:** Sixteen studies, including a total of 3958 participants, were included. The most common dermatoses were xerosis, pressure-related erythema, and contact dermatitis, mainly affecting the face and hands. The most widely implicated contactants were increased frequency of hand hygiene, gloves, N95 masks, and goggles. Proposed solutions were categorized as individual self-care, protection of the workforce, and long-term preventive measures.

**Conclusion:** Through measures such as regular basic skin care education, early access to specialty clinics via telemedicine, and designing of better-fit PPE, the challenges posed by PPE-related occupational dermatoses can be significantly reduced. (JAAD Int 2021;5:85-95.)

**Key words:** COVID-19; health care workers; occupational dermatoses; personal protective equipment.

## INTRODUCTION

COVID-19 has taken the world by storm and drastically affected the practice of virtually all health care workers (HCWs) across the globe. It was first declared a public health emergency of international concern by the World Health Organisation on January 30, 2020, and has since resulted in over 180 million reported cases and almost 4 million deaths worldwide.<sup>1</sup> In many countries, HCWs have had to adapt to constantly changing policies, including strict

regulations on the use of personal protective equipment (PPE). The use of PPE—measures such as wearing of gloves, N95 respirators, and protective suits and increased frequency of hand hygiene—institutes precautions to minimize the risk of viral transmission via respiratory droplets, aerosols, and excessive contact between individuals.<sup>2-4</sup>

It is well known that PPE usage, especially over prolonged periods, may result in occupational skin diseases.<sup>5-8</sup> Studies have shown that high incidences

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of PPE-related dermatoses, such as facial pressure injuries and hand dermatitis, occur during the ongoing COVID-19 pandemic.<sup>9-12</sup> These skin lesions can be a severe detriment to HCWs' morale, workability, and quality of life, with increased risk of subsequent psychologic burden.<sup>13</sup> Seeking relief from such symptoms may cause inadvertent breaches of PPE, thereby increasing the risk of COVID-19 transmission.<sup>14,15</sup>

Therefore, there is a pressing need to find ways to facilitate the prevention and effective management of these skin conditions. However, to the best of our knowledge, few systematic reviews critically examining pooled data from the above-mentioned studies, especially in the Asian population, have been conducted to date.

Our study aimed to address this unmet need via a comprehensive systematic review of the impact and burden of PPE-related dermatoses on HCWs worldwide. We reported the incidences of various skin lesions concerning increased PPE usage and proposed solutions to minimize the adverse skin reactions faced by our HCWs during this ongoing pandemic.

## MATERIALS AND METHODS

The study protocol was registered with the PROSPERO register of systematic reviews.

The PubMed, OVID, EMBASE, MEDLINE, and Google Scholar databases were searched for relevant articles written in English and published from January 1, 2020, to January 30, 2021. The keywords "healthcare workers," "rash," "skin," and "occupational," in conjunction with the words "COVID-19" and "SARS-CoV-2," were used. This initial search in the aforementioned databases yielded 174 articles. The number of articles included in our final analysis was scoped by removing duplicates, articles without original data, or articles that lacked direct relevance to HCWs, PPE, or cutaneous diseases (Fig 1).

The selection of articles for inclusion and data extraction was performed independently by 2 authors (Drs Keng and Oh). The following information was extracted from the included studies (where available): authors, region, age, site and type of skin conditions, occupational contactants, and proposed solutions. Any disagreements were resolved

by a third independent author (Author Tam). A risk-of-bias assessment of all included studies was performed (Supplemental Material link on Mendeley: <https://doi.org/10.17632/rddp6w27wf.1>.) This systematic review was performed following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.

## CAPSULE SUMMARY

- COVID-19–related occupational dermatoses present occupational health challenges that affect many health care workers (HCWs) worldwide.
- Regular basic skin care education, early access to specialty clinics using telemedicine, and designing of better-fit PPE are feasible ways to mitigate the challenges faced by our frontline HCWs in the COVID-19 pandemic.

## RESULTS

Sixteen articles were found suitable for inclusion in our review.<sup>9-13,16-26</sup> These were largely cross-sectional studies with cohort sizes ranging from 7 to 542. A total of 3958 participants were described in these studies. The relevant findings are detailed in Tables I-V.

Table I summarizes the 16 studies included in our review.

Notably, one of the main findings across multiple articles<sup>9,11,20,25</sup> was that a longer exposure duration to PPE showed a statistically significant positive association with adverse cutaneous reactions. Guertler et al<sup>18</sup> performed a subgroup analysis between HCWs working directly with COVID-19 patients in an intensive care unit setting and those who did not, finding that hand hygiene practices and rates of hand dermatitis were largely comparable between the 2 groups. Chernyshov et al<sup>21</sup> divided participants into 3 groups, 2 of which received different hand care products (gels and emollients), whereas the remaining group did not. Their findings were that participants in the intervention groups reported significantly enhanced dermatology life quality index scores and subjective improvement in symptoms after 1 month compared with the controls.

When the entire cohort was analyzed as a whole, the most commonly affected body sites included the face and hands (Table II). The trunk and legs were the least affected. Xerosis (27.6%), pressure-related erythema (22.1%), and irritant contact dermatitis (ICD) (14.8%) were the most common dermatologic manifestations (Table III). Of note, a few studies<sup>10,12</sup> did not specifically describe the site or type of dermatosis encountered; 14.5% of the total study population did not report the affected body site.

Table IV shows that increased frequency of hand hygiene (48.4%) and use of gloves (34.2%), N95 masks (26.9%), and goggles or face shields (21.1%) were the most commonly implicated occupational contactants.

*Abbreviations used:*

ACD: allergic contact dermatitis  
 HCW: health care workers  
 ICD: irritant contact dermatitis  
 PPE: personal protective equipment

Some papers<sup>10,16,17</sup> did not directly specify the types of PPE used by HCWs in the study cohort.

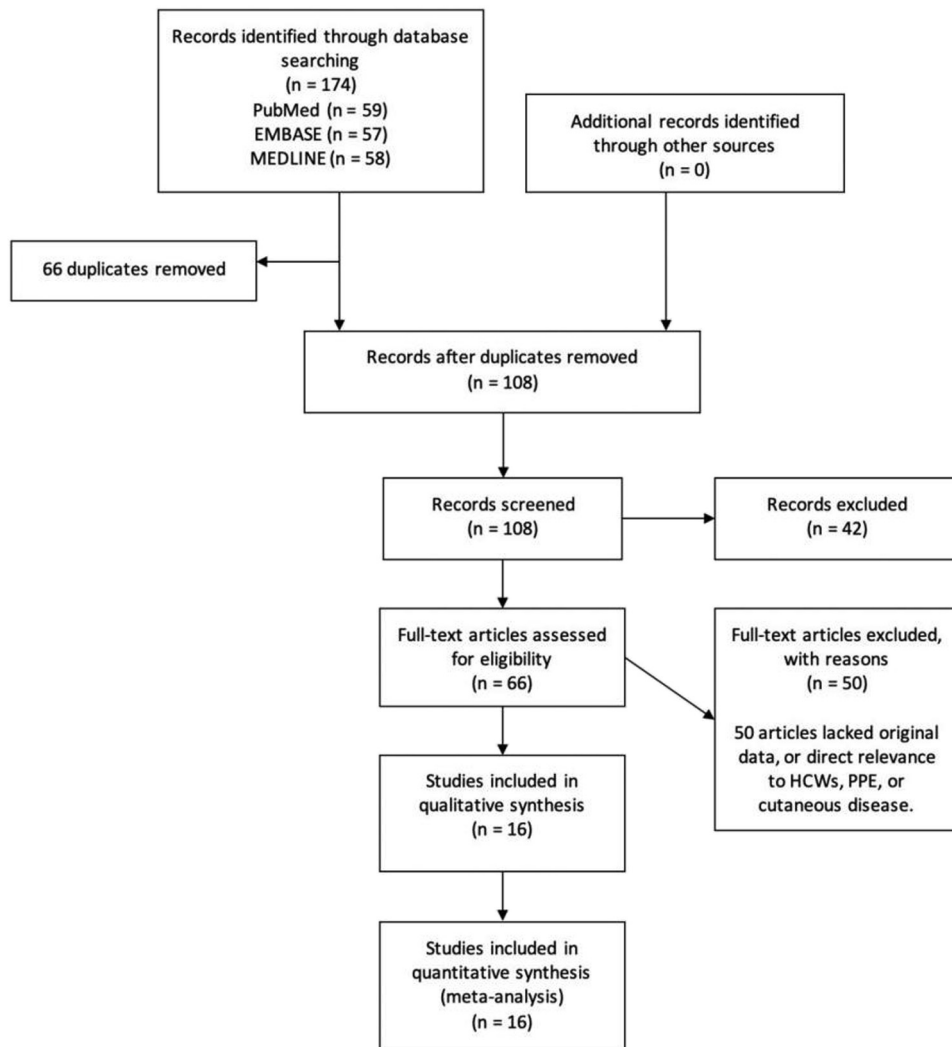
Table V shows our proposed solutions to mitigate the effects of PPE-related occupational dermatoses on our HCWs. These were broadly divided into 3 categories: individual self-care, protection of the HCW workforce, and long-term preventive measures.

**DISCUSSION**

Our review of the available literature revealed a few pertinent findings. First, there is a high prevalence of PPE-related occupational dermatoses

affecting HCWs worldwide. The most commonly reported skin conditions are xerosis, pressure-related erythema, and contact dermatitis, and these primarily affect the face and hands of HCWs. The implicated occupational contactants include increased frequency of hand washing and the use of N95 masks, gloves, and goggles.

The PPE-related facial dermatoses include pressure-related skin injuries and mask-related acne. Pressure-related skin injuries are a frequent complication of wearing goggles and N95 masks, especially for long periods. These may initially manifest as erythema and skin indentation. If proper measures are not taken to protect the affected areas, they might progress to fissures, erosions, blisters, or ulcers.<sup>12,27</sup> The sites that are particularly susceptible to pressure include the nasal bridge and cheeks.<sup>9,28</sup> Additionally, skin maceration and abrasions at these sites might compromise the protective barrier and result in a secondary infection.<sup>29</sup>



**Fig 1.** Summary of systematic review performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines.

**Table I.** Characteristics of PPE-related occupational dermatoses in HCWs during the COVID-19 pandemic

Authors	Region/country	Study type, number with skin conditions/cohort size, and demographics (if reported)	Skin conditions	Occupational contactants
Lan et al <sup>9</sup>	China	Cross-sectional study, n = 526/542	Affected site: nasal bridge (83.1%), cheek (78.7%), hands (74.5%), and forehead (57.2%).	N95 masks (100%), goggles (83.2%), face shield (48.9%), and double-layered gloves + hand washing >10 times per day (59.2%)
Pei et al <sup>11</sup>	China	Cross-sectional study, n = 354/484	Symptoms: erythema (38.8%), prurigo (22.9%), blisters (13.8%), rhagades (13.6%), and papule or edema (12.8%). Affected site: face (47.1%), hands (27.5%), limbs (15.7%), trunk (12.6%), and whole body (2.3%).	PPE (100%): divided into biosafety level 1 (18.2%), level 2 (64.1%), and level 3 (17.2%)
Daye et al <sup>13</sup>	Turkey	Cross-sectional study, n = 397/440, median age = 33.5 y, 131 physicians and 191 nurses	Symptoms: dryness (76.6%), itching (51.8%), flaking (40.2%), and tingling (29.8%). Affected site: hand surface (60.7%), nose bridge (40.7%), ears (28.4%), and cheeks (25.7%).	Masks with metal nose bridge (92.7%), gloves (76.1%), goggles (67.0%), and visors (37.0%)
Pourani et al <sup>26</sup>	Iran	Cross-sectional study, n = 280/376, mean age = 32 y	Focused specifically only on hand contact urticaria (8.2%).	Use of PPE, including gloves (percentage not stated)
Lin et al <sup>25</sup>	China	Cross-sectional study, n = 280/376, mean age = 32 y	Symptoms: dryness or scales (68.6%), papules or erythema (60.4%), and maceration (52.9%). Affected site: hands (84.6%), cheeks (75.4%), nasal bridge (71.8%).	Use of PPE (percentage not stated) and increased frequency of hand washing (100%)
O'Neill et al <sup>10</sup>	UK	Cross-sectional study, n = 337/337	Dermatosis determined to be occupational in 315/337 (93.5%). Clinical diagnoses: irritant contact dermatitis (59%), acne or rosacea (17%), atopic eczema (12%), allergic contact dermatitis (7%), and facial pressure injury (3%).	Use of PPE (percentage not stated)

Continued

**Table I.** Cont'd

Authors	Region/country	Study type, number with skin conditions/cohort size, and demographics (if reported)	Skin conditions	Occupational contactants
Yan et al <sup>12</sup>	China	Cross-sectional study, n = 234/330	Seventy-one percent of participants reported skin barrier damage. Main symptoms: burning, itch, and stinging. Main types of lesions: dryness or scales, papules, erythema, and maceration.	Hand washing >10 times per d (66.1%), PPE use for >6 h per d (56.7%), and wearing 3 layers of gloves (12.4%)
Kiely et al <sup>16</sup>	Ireland	Cross-sectional study, n = 223/270, 68 physicians and 140 nurses	Affected site: hands (76.5%), nose (13.7%), and cheeks (12.6%). Symptoms: dry skin (75.4%), redness (36.9%), and itching (27.6%).	Use of PPE (percentage not stated) and increased frequency of hand washing (99.3%)
Ferguson et al <sup>17</sup>	UK	Cross-sectional study, n = 231/231, mean age 37 y	Affected site: hands (77.1%) and face (64.1%). Clinical diagnoses: irritant contact dermatitis (77.5%), suspected allergic contact dermatitis (18.6%), and atopic dermatitis (15.6%).	Use of masks, goggles, and gloves (percentage not stated)
Guertler et al <sup>18</sup>	Germany	Cross-sectional study, n = 103/114, mean age = 35 y, 39 physicians and 75 nurses	Hand eczema (90.4%). Related symptoms: dryness (83.2%), erythema (38.6%), itching (28.9%), burning (21.1%), scaling (18.4%), fissures (9.6%), and pain (4.4%).	Hand washing >10 times per d (71.7%)
Erdem et al <sup>19</sup>	Turkey	Cross-sectional study, n = 54/107, mean age = 29.6 y, 47 physicians and 48 nurses	Hand eczema characteristics (54/107): irritant contact dermatitis (96.3%) and morphology erythema-squamatus (75.9%). Localization: dorsum (85.2%), palm (20.4%), and finger webs (18.5%).	Hand washing >10 times per shift (81.2%) and glove use >10 times per shift (73.6%)

Continued

Table I. Cont'd

Authors	Region/country	Study type, number with skin conditions/cohort size, and demographics (if reported)	Skin conditions	Occupational contactants
Mushtaq et al <sup>20*</sup>	India	Cross-sectional study, n = 101/101, mean age = 36.7 y, 46 HCWs	Symptoms: pruritus (45.5%), burning (46.5%), and stinging (6.9%). Morphology: erythema (79.2%), papules (60.4%), vesicles (17.8%), and xerosis (15.8%). Affected site: hands (72.3%), face (22.8%), and trunk (6.9%). Most common diagnosis: contact dermatitis (72.3%).	Culprit agents (not total prevalence of each): soap and water (56.4%), gloves (47.5%), sanitizer (38.6%), and mask (20.8%)
Chernyshov et al <sup>21</sup>	Ukraine	Cohort study, n = 77/96, mean age 34 y, 31 physicians and 65 nurses	Hand-related symptoms: redness (80.2%), itch (75.0%), fissures (62.5%), oozing (20.8%), and vesiculation (10.4%).	Increased frequency of hand disinfection (100%)
Hadjieconomou et al <sup>22</sup>	UK	Cross-sectional study, n = 72/72, mean age 43 y, 10 physicians and 21 nurses	Clinical diagnoses: irritant hand dermatitis (62.5%), worsening of pre-existing skin conditions (eg, eczema) (23.6%), and mask-related lesions (4%).	Increased frequency of hand washing and the use of alcohol-based hand sanitizers (percentage not stated)
Hu et al <sup>23</sup>	China	Cross-sectional study, n = 61, 30 physicians and 31 nurses	Lesions due to N95 masks (58/61): nasal bridge scarring (68.9%), facial itching (27.9%), and skin damage (26.2%). Lesions due to latex gloves (54/61): dry skin (55.7%), itching (31.2%), and rash (23.0%). Lesions due to protective clothing (37/61): dry skin (36.1%), itching (34.4%), and rash (11.5%).	N95 masks (100%), latex gloves (100%), and protective clothing (100%)
Greveling et al <sup>24</sup>	Netherlands	Case series, n = 7/7, mean age = 39 y	Hand eczema (100%). Symptoms: erythema, vesicles, itching, pain, rhagades, papules, desquamation, and bleeding.	Increased frequency of hand washing and the use of gloves (percentage not stated)

HCW, Health care worker; PPE, personal protective equipment; UK, United Kingdom.

\*Photographs of the dermatoses are included in this article.

**Table II.** Most commonly affected body sites (total cohort size n = 3958)

Site	Specific area	n (%)
Face	Nose or nose bridge	978 (24.7)
	Cheeks	845 (21.3)
	Forehead	407 (10.3)
	Others or not specified	707 (17.9)
Hands	Palm	109 (2.8)
	Dorsum	46 (1.2)
	Interdigital spaces	104 (2.6)
	Others or not specified	1853 (46.8)
Trunk		44 (1.1)
Legs		3 (0.1)
Not specified		573 (14.5)

**Table III.** Types of dermatosis (total cohort size n = 3958)

Specific type of dermatosis	n (%)
Xerosis	1094 (27.6)
Erythema	876 (22.1)
Irritant contact dermatitis	587 (14.8)
Maceration	439 (11.1)
Fissures or erosions	436 (11.0)
Vesicles or pustules	205 (5.2)
Allergic contact dermatitis	67 (1.7)
Others or not specified*	1700 (43.0)

\*May contain overlaps (double counting) within the same article.

Another commonly seen cutaneous manifestation is mask-related acne. The use of masks and goggles tends to cause excessive accumulation of sweat and sebum on the face due to increased heat and humidity. This effect may be even more pronounced in countries with tropical climates.<sup>30</sup> Furthermore, friction and pressure due to repetitive mask wearing can also result in mechanical trauma, leading to rupture of microcomedones and occlusion of sebaceous ducts.<sup>9,31</sup> Overall, this may exacerbate pre-existing acne vulgaris and result in the development of mechanical acneiform eruptions in those without a prior history.

It is widely known that hand hygiene is a critical measure for minimizing bacterial and viral spread. However, frequent hand hygiene also exposes the skin to friction and chemicals, which may cause loss of moisture and result in skin barrier damage,<sup>32</sup> which manifests as xerotic changes in a large proportion of HCWs.<sup>9,12,25</sup> This is true for both hand washing with soap and water as well as alcohol-based hand rubs.<sup>33</sup>

Occupational contact dermatitis affects not only HCWs but also other professionals who perform wet work, such as cleaners, dhobis, and plumbers. It can

**Table IV.** Commonly implicated occupational contactants or PPE (total cohort size n = 3958)

Occupational contactant	n (%)*
Increased frequency of hand hygiene <sup>†</sup>	1915 (48.4)
Gloves	1353 (34.2)
N95 masks	1064 (26.9)
Goggles or face shields	837 (21.1)
Gowns	143 (3.6)
PPE use, but not specified	2170 (54.8)

PPE, Personal protective equipment.

\*Refers to the total number of health care workers using PPE, not limited to those with dermatoses.

<sup>†</sup>Inclusive of soap and water as well as alcohol-based hand rubs.

be largely divided into ICD and allergic contact dermatitis (ACD) and may be caused by glove materials (commonly rubber), hand cleansers, or inadequate hand drying before donning gloves.<sup>5,34-37</sup> ICD accounts for nearly 80% of cases, featuring predominant symptoms of burning, stinging, and soreness, whereas ACD is more uncommon and usually presents as pruritus. The management of ICD involves selecting less irritating hand hygiene products and the consistent use of emollients, whereas the cornerstone of ACD treatment is the identification and avoidance of the contact allergen.<sup>38</sup> The incidence of contact dermatitis is significantly associated with the duration and intensity of contact with the agent in question.<sup>39</sup>

### Proposed solutions

We broadly classified our proposed solutions into 3 categories (Table V). The first is self-care measures that HCWs may consider for their protection and comfort. The second is organizational-level recommendations targeted at improving the welfare of the workforce as a whole. Finally, the third category includes longer-term measures, which may require further research efforts or logistical planning before being put into practice.

### Individual self-care

The consistent application of emollients is an often-cited and easily attainable way of minimizing skin damage due to xerosis caused by frequent hand hygiene<sup>12,13,18,19</sup> but is still severely lacking in practice. Kiely et al<sup>16</sup> reported that over 99% of HCWs in their study increased their hand hygiene frequency in response to COVID-19, but 45% did not use any moisturizers. Indeed, it has been shown that emollients are critical for repairing skin barrier damage and do not compromise the efficacy of hand washing or alcohol-based hand rubs.<sup>40,41</sup> In severe

**Table V.** Proposed solutions

Category	Specific solutions*
Protection and self-care of individuals	Regular use of emollients <sup>12,13,18,19,22-24</sup> Proper mask and PPE fitting <sup>12,13,17</sup>
Protection of the HCW workforce	Application of gauze at pressure areas before donning N95 mask <sup>12,22</sup> Revision of working hours to allow skin rest <sup>9,13,24,25</sup> Education on common skin symptoms, basic treatment, and the importance of consistent skin care <sup>13,20,24</sup> Early consultation with a dermatologist or occupational health specialist for persistent or severe cases <sup>12,24,25</sup> Performance of patch testing in suspected cases of contact dermatitis <sup>17</sup>
Long-term protection and prevention	Telemedicine for quick and convenient consultations Improved design of N95 masks to better fit Asian facial features and, hence, reduce facial pressure injuries Combination of moisturizers with alcohol-based hand rubs Use of less allergenic materials to make gloves <sup>23,24,26</sup> Development of more situation-specific and comfortable PPE <sup>20</sup> Use of QoL scores (such as DLQI) in evaluating the impact of interventions <sup>13,21</sup>

DLQI, Dermatology life quality index; HCW, health care worker; PPE, personal protective equipment; QoL, quality of life.

\*Numbers specify the references in which each solution was suggested, if any.

or refractory cases, topical and, sometimes, oral glucocorticoid agents may even play a role in reducing inflammation, and ample time should be given for damaged skin to recover before the resumption of clinical duties. Furthermore, the study by Chernyshov et al<sup>21</sup> indicated that direct the provision of emollients to HCWs, as opposed to simply advising them on skin care education, may be far better in encouraging the diligent use of such products. We, therefore, recommend that health care institutions consider providing emollients to HCWs, especially those who face prolonged working hours in PPE.

Proper mask and PPE fitting is another key way of minimizing skin damage, in particular, pressure injuries, while maintaining adequate protection against viral transmission. Many studies have cited facial pressure injuries due to the use of overly tight-fitting N95 masks or goggles.<sup>12,13,17</sup> Gowns should also not be too restrictive to cause friction-related injuries during movement. Furthermore, practices such as double-gowning or double-gloving may further trap moisture and, hence, increase skin exposure to heat and sweat, causing epidermal injury and worsening dermatitis.<sup>42,43</sup>

Related to the aforementioned pressure injuries, the application of gauze or hydrocolloid dressings over pressure areas before donning N95 masks may help relieve symptoms.<sup>12,22</sup> Research to develop better methods of incorporating these protective measures into the N95 mask design is ongoing.<sup>44,45</sup> We suggest that proper PPE fitting be accorded priority to protect the occupational health of the health care workforce. HCWs also have the option of

applying hydrocolloid dressings as necessary to minimize pressure injuries, but the use of this may require another N95 mask fitment test to ensure the continued efficacy of PPE protection.

The constant contact pressure and friction due to PPE, such as N95 masks and goggles, can cause or aggravate pre-existing acne vulgaris.<sup>27</sup> HCWs should take regular breaks from masks and goggles in order to minimize friction and pressure on the facial skin.<sup>27</sup> For HCWs in whom comedogenic acne develops because of PPE, topical retinoids can be prescribed.<sup>46</sup> HCWs with papulopustular acne due to PPE can be prescribed a combination of topical therapy, including retinoids, benzoyl peroxide, and topical antibiotic therapy, followed by a systemic antibiotic combination as a second-line treatment.<sup>46</sup> For HCWs with moderate nodular acne due to PPE, oral retinoids can be prescribed if the aforementioned combination therapy fails.<sup>46</sup>

### Protection of the health care workforce

Moderating the duration of time in PPE and allowing sufficient skin rest are critical for reducing the incidence of occupational dermatoses. Associations between long working hours in PPE and adverse cutaneous reactions have been demonstrated in multiple studies.<sup>9,11,20</sup> Lan et al<sup>9</sup> found that HCWs wearing N95 masks and goggles for more than 6 hours had significantly increased prevalence of skin damage on the cheeks and nasal bridge ( $P < .01$ ) compared with their counterparts who donned this equipment for less than 6 hours. Prolonged exposure to irritant substances, sweat, and humidity exacerbates many forms of skin



disease, including acne, folliculitis, and contact dermatitis.<sup>30,42,47</sup> We suggest that shift work in full PPE be limited to 6 hours or fewer wherever possible and that HCWs be allowed breaks in well-distanced and well-ventilated areas where they can remove their PPE and rest.

Another important aspect of protecting our workforce would be educating HCWs on identifying cutaneous symptoms, basic skin care, and seeking further treatment if indicated.<sup>13,20,24</sup> Because of busy schedules and heavy workloads, many HCWs tend to ignore early warning signs, such as mild erythema, or neglect daily skin care practices. This is further exacerbated by the current climate of stress and anxiety due to COVID-19, which may even cause feelings of depression or burnout.<sup>48,49</sup> We must remind our workforce to care for their well-being even while serving others. Such information can be disseminated on virtual platforms, such as webinars, and subsequently reinforced via physical cues, such as placing bottles of moisturizers at areas where PPE is donned or doffed.

Consultation with a dermatologist or occupational health specialist should be readily available for severe or recalcitrant cases.<sup>12,24</sup> These specialists may be able to diagnose and prescribe individualized treatments for certain dermatoses—for instance, topical retinoids and benzoyl peroxide for mild cases of acne vulgaris and systemic therapy for severe acne vulgaris<sup>46</sup> or antihistamines for pressure urticaria.<sup>50</sup> Patch testing may also be a consideration, especially to exclude cases of ACD; in glove-related cases of ACD, a contact allergy to rubber additives is the most common.<sup>51</sup> Patch testing allows the identification of the culprit allergen in a structured manner.<sup>52</sup>

### Long-term prevention

One of the ways to minimize the incidence of occupational dermatoses in the long term is to improve the design and functionality of our current PPE. Discomfort caused by ill-fitting PPE is known to cause inadvertent breaches of PPE, putting HCWs at increased risk of exposure to pathogens.<sup>15</sup> To combat this, the research and development of more fit-for-purpose, customized, and comfortable PPE can be explored.<sup>20</sup> These include using less allergenic materials, such as cotton or plastic to make gloves,<sup>23,24</sup> adapting N95 mask designs to better conform to facial structures in specific populations, and combining moisturizers with cleansing hand rubs into a single formulation.

Telemedicine is a burgeoning field that may be able to assist in facilitating timely consultations for occupational skin issues.<sup>53,54</sup> The benefits of

telemedicine in this regard are twofold. First, it may be more convenient for time-strapped HCWs to seek such consultations as opposed to physical face-to-face clinic visits. Second, in this pandemic era of social distancing and minimizing physical contact, it would be seen as a welcome avenue to seek medical aid. In select disciplines and patient populations, studies have shown that telemedicine does not compromise the quality of consultations and may even reduce wait times while improving patient satisfaction.<sup>55,56</sup> A recent systematic review further demonstrated that the use of telemedicine in dermatology has been on the rise during the current pandemic and that a majority of studies found tele dermatology to be a useful and convenient tool for managing common ambulatory dermatoses.<sup>57</sup>

Finally, health care institutions can consider using quality-of-life measures, such as the dermatology life quality index, to evaluate the burden caused by occupational skin disease. The dermatology life quality index, in particular, has been validated and used in multiple studies, providing an alternative dimension to assess the impact on function.<sup>13,21,58-60</sup> Furthermore, it may be longitudinally used to evaluate the impact of controlled interventions. Exploring the impact of dermatologic disease on aspects such as choice of clothing, participation in recreational activities, and relationships with others allows a more holistic assessment.<sup>61,62</sup>

### CONCLUSION

As the campaign against COVID-19 continues to rage on across the globe, our health care policies and practices must continually adapt. There is a likelihood that PPE regulations such as the mandatory donning of N95 masks may become the new normal. Therefore, seeking sustainable solutions to mitigate the burden of PPE-related occupational dermatoses is an endeavor that should not be neglected. With proper guidelines in place and a concerted effort by various stakeholders, this challenge can be overcome.

### Conflicts of interest

None disclosed.

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