



# Epidemiology of occupational dermatoses associated with personal protective equipment use in the COVID-19 pandemic: Risk factors and mitigation strategies for frontline health care workers

Wen Yang Benjamin Ho, MBBS, MRCP, MMed,<sup>a</sup> Llewelyn Yi Chang Tan, MBChB, MRCP,<sup>b</sup>  
Xiahong Zhao, BSc (Hons), PhD,<sup>a</sup> Dingyuan Wang, MBBS, MRCP,<sup>a</sup> and  
Hua Liang Joel Lim, MBBS, MRCP, MMed<sup>a</sup>  
*Singapore*

**Background:** Personal protective equipment (PPE)-related occupational dermatosis (PROD) represents a significant occupational burden to health care workers (HCWs), and understanding its epidemiology is imperative in formulating mitigation strategies.

**Objectives:** To determine the prevalence of PROD in HCWs, characterize its manifestations, identify its risk factors, and evaluate behavioral modifications of HCW.

**Methods:** A cross-sectional study using an online questionnaire was conducted from July to September 2020. HCWs who had direct contact with COVID-19 patients for a minimum of 2 weeks cumulatively were invited to participate.

**Results:** The prevalence of PROD among 416 valid respondents was 73.8% (307/416), with face masks being the most common cause (93.8% [ $n = 288$ ]). The most common PROD associated with face masks, protective eyewear, hairnets, gowns, and gloves were acne (71.5% [206/288]), pressure-related injuries (70.7% [99/140]), scalp itch (53.3% [16/30]), itch/rash (78.8% [26/33]), and xerosis (75.0% [27/36]), respectively. Exposure to PPE beyond an hour increased the odds of PROD by 4.8-fold. The majority of HCWs made behavioral modifications to mitigate PROD.

**Conclusions:** We underscore evidence-based recommendations for HCWs to be (1) scheduled hourly breaks from PPE wear, (2) fitted to various PPE models, (3) screened for preexisting dermatoses before deployment, and (4) educated on mitigation strategies and avenues for help should they encounter PROD. (JAAD Int 2022;8:34-44.)

**Key words:** COVID-19; SARS-CoV-2; personal protective equipment; occupational dermatoses; contact dermatitis; protective clothing.

## INTRODUCTION

Health care workers (HCWs) are a crucial resource worldwide in the fight against COVID-19. It is well recognized that frequent, prolonged

donning of personal protective equipment (PPE) by HCWs engenders a significant occupational health burden.<sup>1</sup> We sought to determine the prevalence of PPE-related occupational dermatoses

From the National Skin Center<sup>a</sup> and Tan Tock Seng Hospital.<sup>b</sup>

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Correspondence to: Wen Yang Benjamin Ho, MBBS, MRCP, MMed, National Skin Center, 1 Mandalay Road, Singapore 308205, Singapore. E-mail: [benjaminhowy@nsc.com.sg](mailto:benjaminhowy@nsc.com.sg).

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(PROD) among HCWs in this pandemic, characterize its manifestations, identify predisposing risk factors, evaluate resultant behavioral modifications adopted, and thereby, formulate recommendations moving forward.

## METHODS

### Study design

This cross-sectional study was conducted between July and September 2020 via an online questionnaire administered in English. HCWs from a Singaporean health care conglomerate (National Healthcare Group), including doctors, nurses, and allied health care professionals, who had direct physical interaction with COVID-19 patients for a cumulative duration of at least 2 weeks, were invited to participate.

HCWs were required to don full PPE comprising individual components as shown in [Figs 1 to 3](#). The duration of PPE wear was variable and depended on work location. Some locations were characterized by “constant and continuous” PPE exposure as HCWs had to don PPE for the entire shift on those premises. Other locations featured “incident and episodic” PPE exposure, whereby HCWs donned PPE per patient encounter. Work locations belonging to each category are further elaborated in [Table I](#).

Demographic data of the HCWs and workplace information were collected. Details on the type of PPE used, phenotype and anatomical distribution of the PROD experienced, presence of preexisting dermatoses predisposing to PROD, and mitigation strategies used by the HCWs in response to PROD were captured. Local ethics approval was obtained (reference: 2020/00826).

### Statistical analysis

Variables were summarized using count and percentage for nominal variables and mean with SD for interval/ratio variables. Bivariate analyses were conducted using Fisher’s exact test and 2-sample Student *t* test for nominal and interval/ratio variables, respectively. To control for confounding, multivariable logistic regressions were conducted to examine the factors associated with PROD. The independent variables included were occupation, duration of

PPE use, intermittent/continuous PPE use, age, gender, and ethnicity. Adjusted and unadjusted odds ratios (OR) with 95% confidence intervals (CI) were reported.  $P < .05$  was considered statistically significant. Statistics were generated using R software v3.5.3.<sup>2</sup>

## RESULTS

### Demographics

Of 441 survey participants, 416 were included in the analysis, with 25 incomplete responses. Sample characteristics are summarized in [Table I](#). Respondents were predominantly women (321/416 [77.2%]) and Chinese (274/416 [65.9%]), with a mean age of 32.8 years (SD, 8.0 years). Most respondents were nurses (218/416 [52.4%]), followed by doctors (136/416 [32.7%]) and allied HCWs (62/416 [14.9%]). More than seven-tenths of respondents reported PROD (307/

416 [73.8%]). No significant difference in the prevalence of PROD with regard to gender, ethnicity, or occupation was demonstrated on multivariate analysis.

### Working hours and PPE usage

Respondents were deployed for a mean duration of 13.7 weeks (SD, 12.5 weeks), with a mean of 5.7 work shifts/week (SD, 5.2 work shifts/week). The mean duration of each work shift was 8.3 hours (SD, 1.7 hours), and PPE was worn for a mean of 4.8 hours/work shift (SD, 2.1 hours/work shift). More than half (217 [52.2%]) of the respondents were exposed to PPE in a “constant and continuous” fashion, while 199 (47.8%) had “incident and episodic” exposures to PPE. There was no difference in the prevalence of PROD between both groups ( $P = .80$ ).

### Duration of PPE use relative to PROD

Exposure time to PPE increased HCWs’ risk of developing PROD ( $P = .001$ ; [Fig 4](#)). By using cut-off analysis, time-based thresholds beyond which a statistically significant increase in the prevalence of PROD occurred were derived ([Fig 5](#)). Overall, PPE usage beyond 1 hour is associated with an increase in the prevalence of PROD (76.6% vs 40.6%; OR, 4.8; 95% CI, 2.3-10.0;  $P < .001$ ). Subanalysis of the various components of PPE confirmed this 1-hour threshold

### CAPSULE SUMMARY

- PPE-related occupational dermatoses affected 70% of health care workers. Exposure beyond 1-hour increases the odds 5-fold. Face masks are the most common culprit, and complications include pressure injuries and contact dermatitis.
- We recommend screening for preexisting dermatoses, considering limiting PPE use duration, facilitating access to occupational health/dermatology services, and fitting staff to different PPE models.

**Abbreviations used:**

PPE:	personal protective equipment
HCW:	health care worker
PROD:	personal protective equipment-related occupational dermatosis
OR:	odds ratio
CI:	confidence interval

for face masks (71.6% vs 40.6%; OR, 3.7; 95% CI, 1.8-7.7;  $P = .001$ ) and protective eyewear (35.2% vs 15.6%; OR, 2.9; 95% CI, 1.1-7.8;  $P = .03$ ). Comparatively, the prevalence of PROD was increased beyond 2 hours of using hairnets (8.6% vs 0%; OR, 13.1; 95% CI, 0.8-217.2;  $P = .01$ ), and beyond 4 hours of wearing gowns (11.2% vs 3.8%; OR, 3.2; 95% CI, 1.4-7.5;  $P = .01$ ), respectively. There was no significant difference in the rates of PROD to gloves across all time points.

### PROD specific to the individual PPE components

Face masks accounted for the majority of PROD (288/307 [93.8%]), followed by protective eyewear (140/307 [45.6%]), gloves (36/307 [11.7%]), gowns (33/307 [10.7%]), and hairnets (30/307 [9.8%]). Most HCWs (167/307 [54.4%]) developed PROD to 2 or more components of PPE. Specific manifestations of PROD for individual PPE components, and their respective median time to onset, are detailed in [Table II](#).

**Face masks/protective eyewear.** Various models of 3M face masks were used by 91.1% (271/288) of HCWs and were responsible for most of the mask-related dermatosis (94.1% [379/416]). When evaluating protective eyewear use, UVEX goggles were most frequently used (291/416 [70.1%]) and accounted for the majority of HCWs with eyewear-related dermatosis (126/140 [90%]). The various models of face mask and eyewear used by HCWs and the corresponding prevalence of PROD from these PPE components are shown in [Table III](#).

Facial acne (occurring underneath the site of use) was the most common face mask-related dermatosis (206/288 [71.5%]), while pressure-related injuries were the most common complication (99/140 [70.7%]) from protective eyewear use ([Table II](#)). The anatomical distribution and frequencies of dermatoses arising from face mask and eyewear use are illustrated in [Figs 6](#) and [7](#), respectively.

**Hairnets/gowns/gloves.** Among HCWs who experienced problems with hairnets, the most common manifestation was scalp itch (16/30 [53.3%]). Other reactions include scalp folliculitis (9/30 [30.0%]), scalp seborrhea (8/30 [26.7%]), and

dandruff (5/30 [16.7%]). An itch/rash accounted for the majority of skin reactions from gown use (26/33 [78.8%]). Hand xerosis (27/36 [75.0%]) or a rash/itch (26/36 [72.2%]) were predominant complications from glove use, arising at a median time to onset of 1 week.

### Preexisting dermatoses in relation to PROD

A sizable proportion of HCWs afflicted by mask-related complications had preexisting dermatoses. Overall, 44.2% (91/206) of HCWs with mask-related acne had previous facial acne, while 37.5% (6/16) and 20.5% (25/122) of those with mask-related urticaria and itch had a history of hives and facial eczema, respectively. Similarly, 19.4% (7/36) of HCWs affected by facial itch to protective eyewear had preexisting facial eczema.

When evaluating glove-related dermatoses, 40.0% (2/5) of HCWs who developed hives had a history of urticaria, while hand eczema existed in 23.1% (6/26) of those affected by rash/itch. A third of HCWs who developed urticaria (3/9 [33.3%]) from gowns had preexisting urticaria, while close to a fifth with an itch/rash (5/26 [19.2%]) from gown use suffered from eczema. Overall, 40.0% (2/5) of HCWs with hairnet-induced dandruff had previous dandruff. Antecedent scalp itch and scalp folliculitis affected 31.2% (5/16) and 22.2% (2/9) of HCWs, respectively, who developed similar symptoms from hairnets.

### Behavioral modifications

Most HCWs made adaptations to mitigate PROD related to face masks (182/288 [63.2%]), protective eyewear (94/140 [67.1%]), gloves (25/36 [69.4%]), and gowns (18/33 [54.5%]). In contrast, more than half (17/30 [56.7%]) of those with hairnet-related problems did not. Usage of topical medications to minimize PROD was the most frequent strategy employed for dermatoses related to face mask (105/288 [36.5%]), gloves (18/36 [50.0%]), and gowns (12/33 [36.4%]). Changing the model of eyewear was the most common adjustment (49/140 [35.0%]) among HCWs afflicted with dermatoses related to protective eyewear. Details of these behavioral modifications adopted are shown in [Table IV](#).

### DISCUSSION

The spectrum of PROD is as diverse as their underlying pathomechanisms. Acneiform eruptions induced by PPE involve a combination of etiologic factors, including mechanical trauma, pilosebaceous duct occlusion, and a hot, humid microclimate created beneath the PPE.<sup>3,4</sup> The latter can also



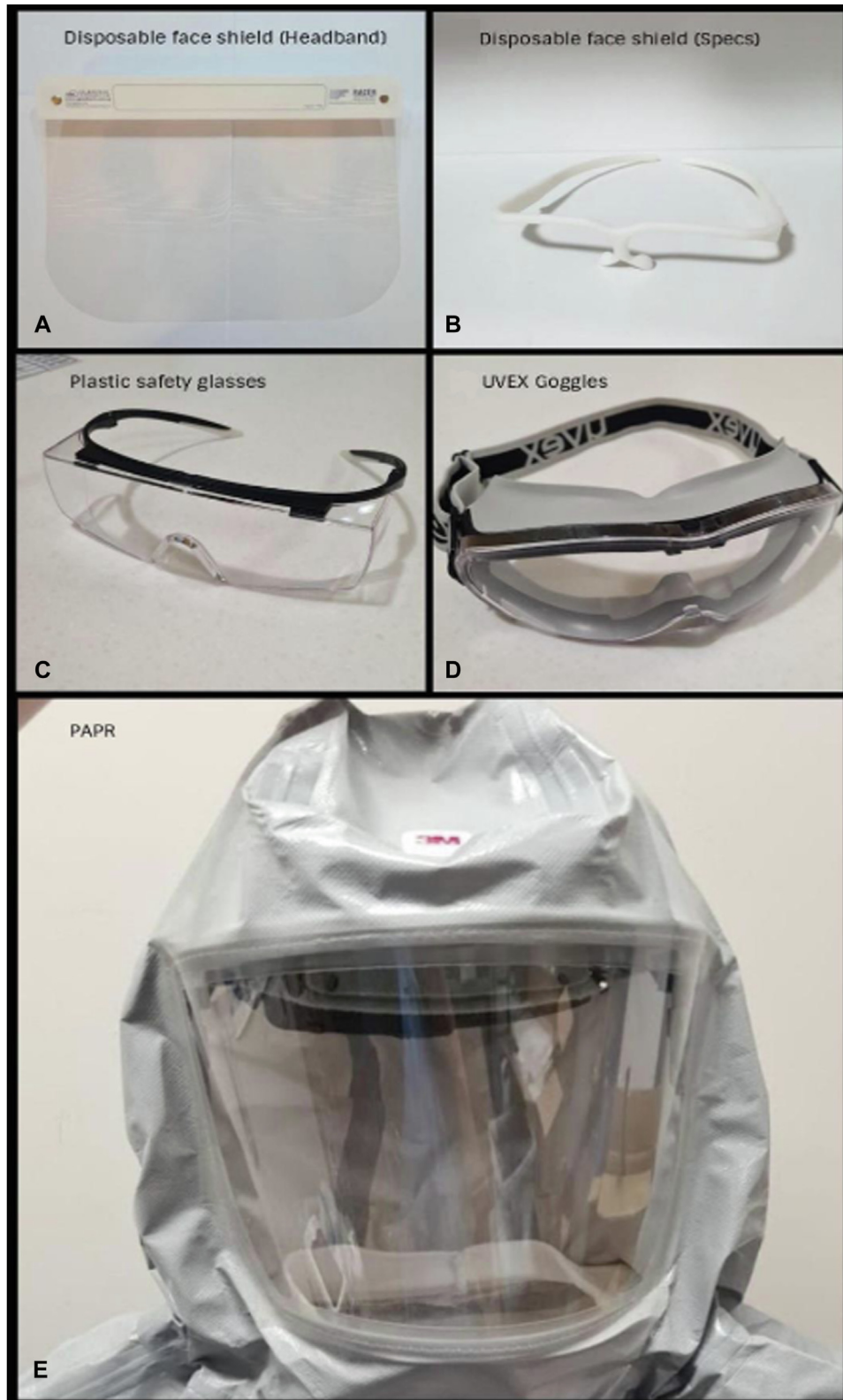
**Fig 1.** Face masks used by health care workers.

precipitate flares of eczema in predisposed HCWs, leading to “itch/rash,” as reported by our cohort (Table II). Contact dermatitis—another explanation of such symptoms—may arise from allergy to PPE materials or irritant effects of the occlusive/frictional nature of PPE. Other dermatoses related to occlusive microenvironment (eg, Grover’s disease, miliaria) or even heightened hygiene measures of frequent washing/bathing may also be contributory to “itch/rash.” Urticaria has been attributed to delayed

pressure effect or contact urticaria to PPE materials.<sup>3,4</sup>

Our study reflects the immense burden of PROD, afflicting beyond 70% of HCWs. Preventative measures recommended until now include adequate work-rest cycles and using dressings or pressure-relieving appliances prophylactically.<sup>4</sup> These are largely anecdotal or based on expert opinion. Based on our findings, we hereby provide data-driven recommendations to reduce PROD.





**Fig 2.** Protective eyewear used by health care workers.



**Fig 3.** Protective gloves, hairnets, and protective gowns used by health care workers.

Firstly, compared with previous recommendations of restricting working shifts to 6 hours with mandatory breaks of 2 to 3 hours between PPE wear,<sup>4</sup> we advocate for scheduled hourly breaks where possible, as our data demonstrate a 4.8-fold increase in the odds of PROD beyond an hour's use of PPE. The same time limit applies for PPE components like face masks (OR, 3.7) and protective

eyewear (OR, 2.9). Hairnets and gowns were more forgiving, with significantly increased rates of PROD observed beyond 2 and 4 hours of usage, respectively.

Secondly, we demonstrate that the frequency of PROD from face masks and protective eyewear differed depending on the model used. This is likely due to varying ergonomics between products

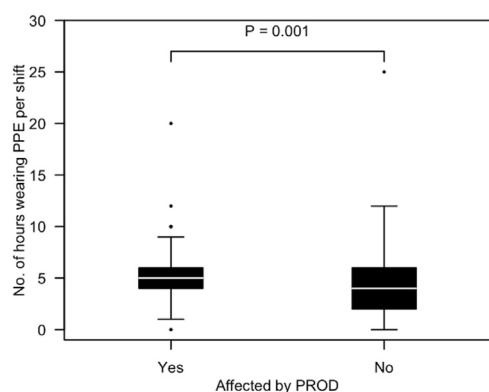
**Table I.** Demographic data, working hours, and pattern of PPE use of study participants

Characteristics	All (N = 416) N (%)	Affected by PROD		Unadjusted odds ratio (95% CI)	P value	Adjusted odds ratio (95% CI)	P value
		Yes (N = 307) N (%)	No (N = 109) N (%)				
Age (y), mean (SD)	32.8 (8.0)	32.2 (7.7)	34.4 (8.7)	0.97 (0.94-0.99)	.01	0.96 (0.93-0.99)	.004
Gender							
Female	321 (77.2%)	248 (80.8%)	73 (67.0%)	Reference	-	Reference	-
Male	95 (22.8%)	59 (19.2%)	36 (33.0%)	0.48 (0.30-0.79)	.004	0.68 (0.39-1.20)	.18
Occupation							
Nurse	218 (52.4%)	173 (56.4%)	45 (41.3%)	Reference	-	Reference	-
Doctor	136 (32.7%)	90 (29.3%)	46 (42.2%)	0.51 (0.31-.83)	.01	0.66 (0.36-1.23)	.19
Allied health professional	62 (14.9%)	44 (14.3%)	18 (16.5%)	0.64 (0.34-1.22)	.17	0.55 (0.28-1.11)	.09
Ethnicity							
Chinese	274 (65.9%)	199 (64.8%)	75 (68.8%)	Reference	-	Reference	-
Malay	29 (7.0%)	20 (6.5%)	9 (8.3%)	0.84 (0.37-2.01)	.68	0.75 (0.31-1.95)	.54
Indian	44 (10.6%)	37 (12.1%)	7 (6.4%)	1.99 (0.90-5.05)	.11	1.67 (0.70-4.47)	.27
Others	69 (16.6%)	51 (16.6%)	18 (16.5%)	1.07 (0.60-1.99)	.83	0.93 (0.48-1.86)	.84
Pattern of PPE use							
"Incident & episodic"*	199 (47.8%)	148 (48.2%)	51 (46.8%)	Reference	-	Reference	-
"Constant & continuous"†	217 (52.2%)	159 (51.8%)	58 (53.2%)	1.06 (0.68-1.64)	.80	1.43 (0.85-2.42)	.18
No. of weeks on duty, mean (SD)	13.7 (12.5)	14.9 (12.9)	10.3 (10.6)	1.04 (1.01-1.06)	.001	n/a‡	-
No. of shifts per week, mean (SD)	5.7 (5.2)	5.7 (5.2)	5.6 (5.3)	1.00 (0.96-1.05)	.93	n/a‡	-
No. of hours per shift, mean (SD)	8.3 (1.7)	8.4 (1.7)	8.3 (1.7)	1.04 (0.91-1.18)	.55	n/a‡	-
No. of hours wearing PPE per shift, mean (SD)	4.8 (2.1)	5.0 (2.0)	4.2 (2.3)	1.22 (1.10-1.36)	<.001	1.24 (1.09-1.41)	.001

n/a, Variables labeled as "n/a" in the table were excluded from multivariate analysis to avoid collinearity; PPE, personal protective equipment; PROD, PPE-related occupational dermatosis.

\*Work locations characterized by "Incident and episodic" PPE use are (1) isolation wards for patients with confirmed COVID-19 infection; (2) intensive care units for patients with confirmed COVID-19 infection; and (3) "enhanced pneumonia surveillance wards" where patients with respiratory symptoms are isolated and screened for COVID-19 infection.

†Work locations characterized by "Constant and continuous" PPE use are (1) community isolation facilities that housed asymptomatic or mildly symptomatic COVID-19 patients; (2) screening centers that screened patients that met national case definition for COVID-19 infection or those flagged up by contact-tracing; and (3) emergency department.



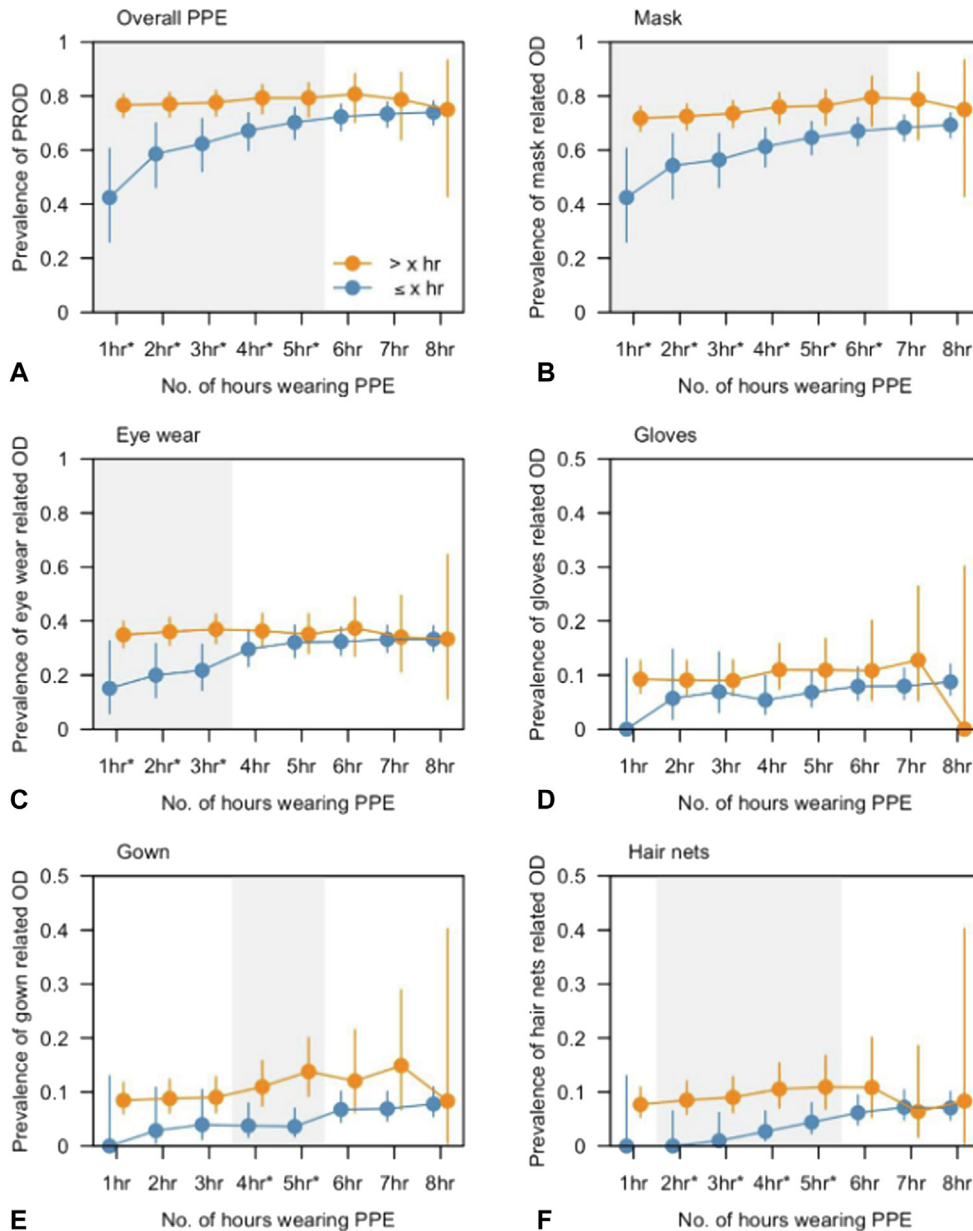
**Fig 4.** The median duration of PPE usage in HCWs affected by PROD was significantly greater than in HCWs who were unaffected (5 hours vs 4 hours;  $P = .001$ ). HCW, Health care worker; PPE, Personal protective equipment; PROD, PPE-related occupational dermatosis.

against one's unique facial anthropometry. An adequate seal is often the sole determinant of PPE compatibility when undergoing fit tests. We

propose that comfort and tolerability in an extended-use setting be assessed during fit testing and fit HCWs with several brands/models of PPE to allow for alternatives.

Thirdly, an appreciable proportion of HCWs with PROD had preexisting dermatoses. It is imperative that HCWs must be screened for such before deployment and be assigned to facilities that require less intensive PPE use to mitigate their risk of PROD. Where there is a history of suspected contact dermatitis, predeployment evaluation by dermatologists for patch-testing should be considered so that allergens are avoided and suitable alternatives prescribed.

Valuable insights to better support HCWs during deployment can be gleaned from our data on adaptive measures against PROD. The use of topical preparations and/or padding was a commonly employed strategy. Hospitals can consider procuring such products for the staff. However, between 30.6% and 56.7% of affected HCWs undertook no



**Fig 5.** The graphs show the prevalence of PPE-related occupational dermatoses (PROD) from exposure to overall PPE (A) and its individual components (B-F) for more than (orange plot) or less than or equal to (blue plot) a certain number of hours. The time threshold (ie, cut off) is determined by the shortest time of PPE exposure resulting in a statistically significant difference in the prevalence of PROD. The time points (in hours) along the x-axis that show a statistically significant difference in the prevalence of PROD are marked with an asterisk (\*). This is also depicted by the gray shaded area in each graph.

intervention; while this may reflect PROD of a mild/transient nature, ignorance toward the availability of assistance or reluctance to seek help cannot be excluded. Ensuring easy access to occupational health or teler dermatology services will be beneficial. Supervisors should be vigilant for susceptible individuals and periodically reiterate the availability of assistance.

There are several limitations to our study. Firstly, the use of a self-administered questionnaire is subject to recall bias. As the prevalence of preexisting dermatoses was assessed only in HCWs afflicted by PROD but not in unaffected individuals, we cannot assess the influence of preexisting dermatoses on the risk of PROD. Lastly, potential confounders such as ambient temperature/humidity in our tropical



**Table II.** Clinical manifestations of PROD caused by individual PPE components\*

Clinical manifestation	Number of respondents affected (%)	Median time (wk) to onset of dermatosis (IQR)
Face mask-related PROD, <i>n</i>	288	-
Facial itch/rash	122 (42.4)	1 (1, 2)
Pressure injury (abrasion/pressure sores)	196 (68.1)	1 (1, 2)
Hyperpigmentation	79 (27.4)	2 (1, 3)
Acne	206 (71.5)	1 (1, 2)
Urticaria	16 (5.6)	2 (1, 4)
Protective eyewear-related PROD, <i>n</i>	140	-
Facial itch/rash	36 (25.7)	1 (1, 2)
Pressure injury (abrasion/pressure sores)	99 (70.7)	1 (1, 1.25)
Gloves related PROD, <i>n</i>	36	-
Itch/rash	26 (72.2)	1 (1, 2.75)
Xerosis	27 (75.0)	1 (1, 2)
Urticaria	5 (13.9)	1 (1, 1)
Gown related PROD, <i>n</i>	33	-
Itch/rash	26 (78.8)	1 (1, 3)
Urticaria	9 (27.3)	1 (1, 2)
Hairnet-related PROD, <i>n</i>	30	-
Scalp itch	16 (53.3)	2.5 (1.75, 5.5)
Dandruff	5 (16.7)	4 (3, 10)
Scalp seborrhea	8 (26.7)	2 (1.75, 3.5)
Folliculitis	9 (30.0)	2 (2, 5)

PPE, Personal protective equipment; PROD, PPE-related occupational dermatosis.

\*A total of 307 respondents reported PROD to  $\geq 1$  PPE component (ie, face masks, protective eyewear, gloves, gowns, and/or hairnets). 140 (45.6%) respondents reported PROD to 1 PPE component and 121 (39.4%) reported PROD to 2 PPE components. 40 (13.0%) reported PROD to 3 PPE components, 5 (1.6%) reported PROD to 4 PPE components, and 1 (0.3%) reported PROD to all 5 PPE components.

**Table III.** Prevalence of PROD based on various models of face masks and protective eyewear

Face mask model	Number of study participants, <i>N</i> (%)		
	All ( <i>N</i> = 416)	Affected by PROD ( <i>N</i> = 288)*	Unaffected by PROD ( <i>N</i> = 128)
3M-1860S	131 (31.5%)	104 (79.4%) <sup>†</sup> <sub>a</sub>	27 (20.6%) <sup>†</sup>
3M-1860	35 (8.4%)	25 (71.4%) <sup>†</sup> <sub>a,b</sub>	10 (28.6%) <sup>†</sup>
3M-8210S	85 (20.4%)	71 (83.5%) <sup>†</sup> <sub>a</sub>	14 (16.5%) <sup>†</sup>
3M-8210	40 (9.6%)	29 (72.5%) <sup>†</sup> <sub>a,c</sub>	11 (27.5%) <sup>†</sup>
3M-1870	88 (21.2%)	42 (47.7%) <sup>†</sup> <sub>b,d</sub>	46 (52.3%) <sup>†</sup>
Drager Piccola FFP3	13 (3.1%)	5 (38.5%) <sup>†</sup> <sub>b,c</sub>	8 (61.5%) <sup>†</sup>
Kimberly Clark 46727	23 (5.5%)	12 (52.2%) <sup>†</sup> <sub>b,c</sub>	11 (47.8%) <sup>†</sup>
Powered air-purifying respirator	1 (0.2%)	0 (0%) <sup>†</sup> <sub>a,c,d</sub>	1 (100%) <sup>†</sup>

*P* value for comparing all models of face mask: .05.

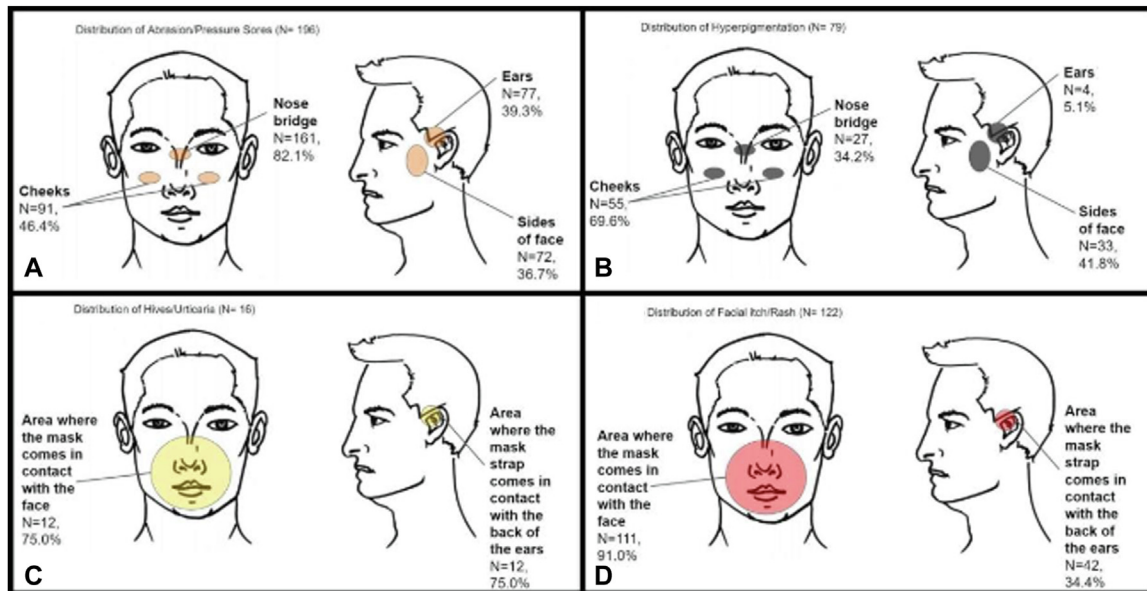
Protective eyewear model	Number of study participants, <i>N</i> (%)		
	All ( <i>N</i> = 416)	Affected by PROD ( <i>N</i> = 140)	Unaffected by PROD ( <i>N</i> = 276)
Disposable face shield (Headband)	24 (5.8%)	2 (8.3%) <sup>†</sup> <sub>a</sub>	22 (91.7%) <sup>†</sup>
Disposable face shield (Spectacles)	9 (2.2%)	1 (11.1%) <sup>†</sup> <sub>a,b</sub>	8 (88.9%) <sup>†</sup>
UVEX goggles	291 (70.0%)	126 (43.3%) <sup>†</sup> <sub>b</sub>	165 (56.7%) <sup>†</sup>
Plastic safety glasses	90 (21.6%)	11 (12.2%) <sup>†</sup> <sub>a,c</sub>	79 (87.8%) <sup>†</sup>
Powered air-purifying respirator	1 (0.2%)	0 (0%) <sup>†</sup> <sub>a,b</sub>	1 (100%) <sup>†</sup>
Unknown (unspecified)	1 (0.2%)	0 (0%) <sup>†</sup> <sub>a,b</sub>	1 (100%) <sup>†</sup>

*P* value for comparing all models of protective eyewear: .05.

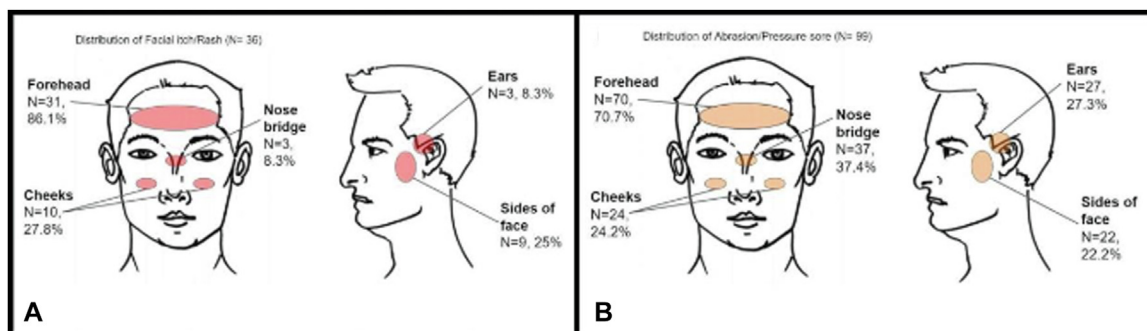
PPE, Personal protective equipment; PROD, PPE-related occupational dermatosis.

\*Each subgroup of PPE is further assigned 1 or more subscripts (a-d). PPE subgroups sharing 1 or more subscripts do not have a statistically significant difference in the prevalence of PROD ( $P > .05$ ). PPE subgroups that do not have a subscript in common between them have a statistically significant difference in the prevalence of PROD ( $P \leq .05$ ). For example, the prevalence of PROD among those wearing disposable face shields (headband) was significantly different from those wearing UVEX goggles (as their subscripts are dissimilar, ie, "a" vs "b"). Conversely, there is no statistically significant difference when comparing the prevalence of PROD between disposable face shield and other protective eyewear subtypes as they all contain "a" in their assigned subscripts.

<sup>†</sup>Percentages are expressed as a proportion of the number of HCWs using the same model of PPE constituent.



**Fig 6.** Diagrammatic representation of the anatomical sites affected by mask-related occupational dermatoses, including abrasions/pressure sores (A), hyperpigmentation (B), urticaria (C), and facial itch/rash (D).



**Fig 7.** Diagrammatic representation of the anatomical sites affected by protective eyewear-related occupational dermatoses, including facial itch/rash (A) and abrasion/pressure sores (B).

**Table IV.** Behavioral modifications adopted by health care workers in response to PROD from various PPE components

Behavioral modification	Face mask-related OD (N = 288)	Protective eyewear-related OD (N = 140)	Glove-related OD (N = 36)	Gown related OD (N = 33)	Hairnet-related OD (N = 30)
None	106 (36.8%)	46 (32.9%)	11 (30.6%)	15 (45.5%)	17 (56.7%)
Changed model of face mask/ protective eyewear	55 (19.1%)	49 (35.0%)	-	-	-
Used topical creams/ moisturizers before donning PPE	105 (36.5%)	29 (20.7%)	18 (50.0%)	12 (36.4%)	3 (10.0%)
Used padding before donning PPE	32 (11.1%)	8 (5.7%)	-	-	-
Reduced work hours	17 (5.9%)	2 (1.4%)	2 (5.6%)	1 (3.0%)	0 (0.0%)
Changed deployment	8 (2.8%)	2 (1.4%)	1 (2.8%)	0 (0.0%)	0 (0.0%)
Sought medical attention	15 (5.2%)	4 (2.9%)	1 (2.8%)	2 (6.1%)	0 (0.0%)
Used oral steroids	15 (5.2%)	1 (0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Used oral antihistamines	19 (6.6%)	4 (2.9%)	5 (13.9%)	5 (15.2%)	0 (0.0%)
Not wear the hairnets	-	-	-	-	1 (3.3%)
Others	29 (10.1%)	20 (14.3%)	4 (11.1%)	4 (12.1%)	11 (36.7%)

PPE, Personal protective equipment; PROD, PPE-related occupational dermatosis.

climate and frequent hand-hygiene measures were not assessed.

To the best of our knowledge, this is the only contemporaneous study to quantify a time-based threshold beyond which the prevalence of PROD is substantially increased. Furthermore, we prescribe strategies and measures to mitigate PROD based on qualitative findings from our study. We hope that all this will contribute toward safe-keeping our HCWs from preventable complications like PROD as they continue with their noble cause.

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#### Conflicts of interest

None disclosed.

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