

Personal protective equipment and adverse dermatological reactions among healthcare workers: Survey observations from the COVID-19 pandemic

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Survey observations from the COVID-19 pandemic

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Introduction

The recent pandemic of the 2019 novel coronavirus disease (COVID-19) has caused an unprecedented mobilization of the United States' healthcare workforce. In addition to working extended hours under increased duress, healthcare professionals (HCP) of all stations have been making use of various types of personal protective equipment (PPE) with greatly increased frequency and duration. While the use of PPE is critical for preventing HCP infection, these preventive measures can also cause acute and chronic dermatitis, secondary infections, and aggravation of existing skin diseases¹. Consequently, unintended damage to the dermis and epidermis can increase the personal risk for secondary infection and, perhaps just as importantly, decrease compliance with necessary PPE protocol moving forward.

Prior to this study, there have been no data in the literature available regarding adverse effects of PPE use and increased handwashing/sanitizing in the United States during the pandemic. While several studies have been conducted in China, they offer only limited analysis of the various risk factors that can contribute to skin reactions. In one recent study, conducted at the pandemic epicenter of Wuhan, researchers found that, of 367 HCP respondents, 74.5% reported some form of adverse skin reaction². A similar survey recently conducted in Hubei, China reported an overall prevalence of skin damage among 542 HCP respondents at 97%, with workers wearing their PPE for more than 6 hours per day or washing their hands more than 10 times per day at greater risk³.

In light of the COVID-19 pandemic and the strain that it, and future pandemics, can place on supply chains of critical PPE, it is more important than ever that decision-makers have access to pertinent data. The goal of this study was to collect and provide substantive data from American hospital workers of all professional roles about the prevalence and severity of adverse dermatological health effects attributable to overuse of personal protective equipment, so that healthcare workers and the administrators that form clinical health policies can make informed decisions.

Methods

The research vehicle employed by this study was a cross-sectional survey distributed to hospital healthcare workers currently employed by a 5-hospital healthcare network in central and western Kentucky. Survey participants were considered eligible if they were currently employed by a hospital and worked primarily in Kentucky. 4366 invitations were distributed via email to hospital workers, and 879 responses (20.1%) were collected between the dates of 5/29/2020 and 6/11/2020. Completion of all 25 items was required for survey submission.

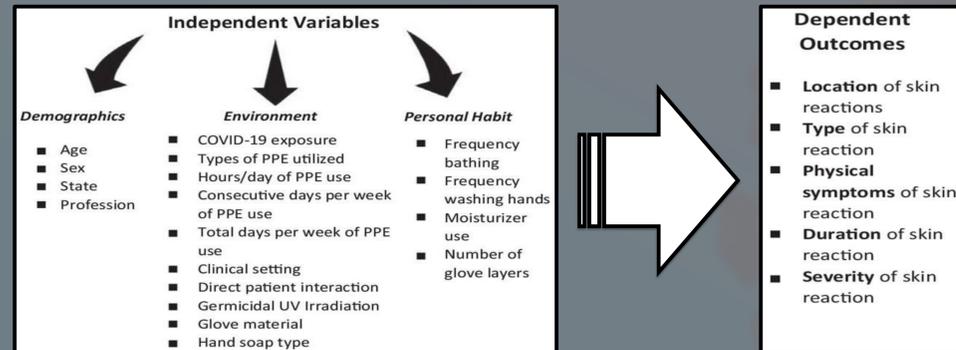


Table 1 - Data collected from respondents, with independent factors split into three categories

All statistical analyses were conducted using SYSTAT, version 13. Differences in the incidence of adverse skin reaction among groups tested for significance using Chi-Squared tests of association. Differences in mean severity and total days of irritation were tested for significance using Mann-Whitney U tests. The relationship between the dependent variables of severity and total days of irritation and patterns of PPE and disinfectant use were examined using stepwise linear regression.

Results

Demographic data and selected response data are summarized in Table 2 and broken down by professional role in Figure 1. Of these, 478 (54.4%) respondents reported some type of skin irritation reaction; the vast majority of these cases (401, 84.0%) were among respondents who worked directly with patients versus those in administrative or nonmedical support roles.

The most common complaint was dryness/scaling of the skin (306 out of 439, 69.7%), and the most common location was the facial cheeks (305 out of 516, 59.1%). More serious experiences of fissures and maceration were found to be relatively uncommon, reported by only 27 (6.2%) and 60 (13.7%) of 439 affected respondents, respectively; macerations were more common among those working in dedicated COVID unit (20.2% vs 11.5%, $\chi^2=5.22$, $df=1$, $P=.02$). Skin discoloration (91 of 439, 20.7%) was also significantly more frequent among those working in the dedicated COVID unit (31.2% vs 17.3%, $\chi^2=9.66$, $df=1$, $P=.002$), while acne (75 of 439, 17.1%) was significantly less reported in this group (10.1% vs 19.4%, $\chi^2=5.00$, $df=1$, $P=.025$).

	Total respondents (%)	Prevalence of skin reaction (%)	Mean severity of reaction	Mean days per month of irritation	Mean hours per day PPE Use	Mean consecutive days per week PPE use
Sex		(N=879)				
Male	142 (16.1)	46 (32.4)	1.63±0.89	10.51±8.31	6.24±3.23	4.53±1.42
Female	737 (83.8)	432 (58.6)	1.97±0.97	11.55±8.72	8.05±3.34	3.77±1.4
Age						
0-29	163 (18.5)	116 (71.2)	1.9±0.96	11.7±8.84	9.11±3.23	3.55±1.34
30-39	231 (26.3)	144 (62.3)	1.9±0.96	11.39±8.83	7.74±3.24	3.82±1.42
40-49	204 (23.2)	113 (55.4)	2.05±0.94	12.12±8.36	7.72±3.21	3.88±1.42
50-59	199 (22.6)	81 (40.7)	1.93±1.01	10.83±8.87	6.94±3.46	4.16±1.47
60-69	81 (9.2)	24 (29.6)	1.81±1.01	10.03±8.37	7.05±3.66	4.22±1.47
Professional role						
Nursing (APRN/RN/NP)	276 (31.4)	183 (66.3)	1.95±0.9	11.28±8.62	9.37±3.18	3.30±1.25
Nonmedical support (Coding/Billing/Records/Security/Kitchen)	171 (19.4)	55 (32.2)	1.76±0.89	10.16±8.62	5.42±3.27	4.53±1.5
Medical support (Technician/Pharmacy/Lab)	124 (14.1)	76 (61.3)	1.87±0.96	11.46±8.83	7.10±2.93	4.09±1.39
Therapist/other medical assistant	120 (13.6)	66 (55)	1.81±0.91	10.4±8.28	7.31±3.02	4.28±1.22
Medical assistant (PA/CNA)	79 (9)	56 (70.9)	2.24±1.13	13.61±9.04	9.87±2.62	3.36±1.35
Clinical management (Registration/Clerk/Manager)	62 (7)	22 (35.5)	2.07±1.05	13±9.38	6.93±2.11	4.38±1.35
Physician (DO/MD)	47 (5.3)	20 (42.5)	1.95±1.16	12.61±8.04	6.12±2.79	4.27±1.55
Unit						
Medical unit	194 (22.1)	130 (67)	1.88±0.97	10.8±8.81	9.06±3.31	3.51±1.39
Outpatient	178 (20.2)	90 (50.6)	1.85±0.91	11.34±8.9	6.76±2.18	4.52±1.15
I Don't work with patients	174 (19.8)	42 (24.1)	1.7±0.96	9.69±7.96	5.24±3.07	4.51±1.63
Emergency department	89 (10.1)	60 (67.4)	2.15±1.06	11.64±8.43	8.22±3.8	3.21±1.31
Intensive care unit	54 (6.1)	33 (61.1)	2.18±0.93	13.63±7.78	10.29±2.49	3.2±0.98
Dedicated COVID-19 unit	51 (5.8)	39 (76.5)	2.12±1.05	12.02±8.9	9.92±3.04	3±1.08
Surgical unit	50 (5.7)	25 (50)	1.93±0.89	13.83±10.84	8.12±2.93	4.02±1.44
Multiple-unit support	37 (4.2)	23 (62.2)	1.92±0.86	8.84±7.61	6.32±3.07	4.31±1.04
Long-term care	28 (3.2)	20 (71.4)	2.1±0.97	14.2±8.37	9.36±2.41	3.93±1.44
Imaging/Laboratory	24 (2.7)	16 (66.7)	1.65±0.86	12.25±7.58	7.79±3.28	3.91±1.19

Table 2 – Selected respondent data

There was a significant relationship between both severity of skin reaction ($F_{5,472}=6.27$, $P<.0001$) and total days of irritation ($F_{6,471}=5.24$, $P<.0001$) and use of PPE and disinfecting agents. More severe reactions were linked to:

1. more hours per day of PPE use ($b=0.06$, $t=3.98$, $P<.0001$),
2. more consecutive days of PPE use ($b=0.08$, $t=2.51$, $P=.012$), and female gender ($b=0.36$, $t=2.35$, $P=.019$).

By contrast, total days of adverse reaction reported in a month increased with:

1. more total days of PPE use per month ($b=1.22$, $t=3.70$, $P=.0002$),
2. greater frequency of handwashing ($b=0.14$, $t=268$, $P=.007$), and
3. more hours of PPE use per day ($b=0.29$, $t=2.04$, $P=.042$), but
4. less use of ultraviolet germicidal irradiation (UVGI) as a disinfecting agent ($b=-1.87$, $t=-2.38$, $P=.017$).

While significant, these relationships only account for a small proportion of the variation in skin reactions (adjusted $R^2=0.05$ for both); the great majority (95%) of the variation among individuals in severity and duration of skin irritation is either random or due to factors not accounted for in this study.

Discussion

In addition to the lack of clinical data regarding skin reactions, there has been significant uncertainty surrounding the appropriate use of PPE in both public and clinical settings, particularly regarding facial masks. With this in mind, the results presented here identify several predictable trends between patterns of PPE use and associated dermatologic side-effects, but also offer several unexpected insights.

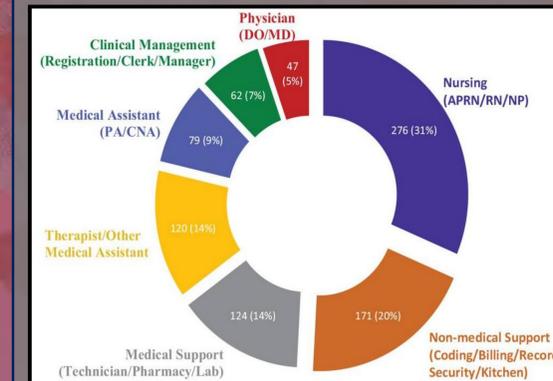


Figure 1 – Respondent by professional role

Perhaps unexpectedly, age was found to have no effect on the risk of experiencing adverse skin reactions due to PPE use, which runs contrary to the well-established relationship between skin irritation, dermatitis, and breakdown with increasing age^{4,5}. Further research would be required in order to delineate and clarify this particular finding.

Conclusions

The data collected by this study represent the largest and most comprehensive description of PPE-related adverse reactions among American HCP and possess significant relevance in the context of the COVID-19 pandemic. In the context of resistance to public mask use from certain quarters, perhaps the most relevant and valuable aspect of this study is the data that may help ameliorate concerns that prolonged facial mask usage contributes to significant dermatologic morbidity among both medical professionals and public citizens.

These results represent the experiences of professional hospital workers who, on average, wear their extensive PPE for 7.7 hours per day, and under more demanding conditions than the average nonmedical worker. Generalizing these findings to the non-HCP public, it can be reasonably inferred that casual everyday wearers of facial masks have relatively little to fear in the way of dermatological side effects.

The low levels of reaction severity and similarly low incidence of serious symptoms associated with PPE usage are reassuring and may provide some ancillary support for the most recent arguments from some public health experts that public facial mask should continue well after widespread COVID-19 vaccination⁶, or that society should adopt regular seasonal mask use in order to decrease influenza infection rates⁷.

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