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Facial Skin Injury Related to Personal Protective Equipment Among Healthcare Workers: Single Center Cross-Sectional Study



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ABSTRACT

Objective: Our study aimed to learn the phenomenon of facial skin injuries related to PPE use, their characteristics, as well as risk and protective factors.

Methods: We conducted a single-center cross-sectional study. Samples was collected consecutively by disseminating self-filled questionnaire to all departments in Sanjiwani General Hospital, Gianyar, Bali, Indonesia. Variables studied included demographic, characteristics of PPE usage, characteristics of facial skin injuries suffered, and preventive measures practiced by healthcare workers. We conducted multivariate analysis for independent determinants of more severe skin injuries and any injuries located on the nasal bridge, cheekbones, and behind the ears.

Results: Final analysis included 161 respondents. Male make up 26.7% of respondents, mean age was 35.00 (\pm 8.91). The majority was nurses (78.3%). Prevalence

of skin injury was 90.7%, 39.1% of them being partial or full thickness skin injuries. Only 27.4% respondents practiced preventive measures, including application of polyester tape layering and emollient. The most frequently reported location of skin injury was nasal bridge (77%), followed by behind the ears (57.1%), and on the cheekbones (47.2%). Multivariate analyses discovered that KN95 respirator poses less risk for more severe injuries compared to N95. Protective measures were found effective to prevent skin injuries in all locations, including for more severe injuries.

Conclusions: We found high prevalence of facial skin injuries among healthcare workers accompanied by inadequate practice of preventive behaviors. These preventive behaviors have been found effective in other study as well and existing evidence support its promotion for more widespread practice.

Keywords: COVID-19, skin injuries, personal protective equipment, N95, health workers.

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INTRODUCTION

COVID-19 has infected more than 100 million people worldwide,¹ causing extreme burden to the healthcare system in many countries. This extreme burden was also observed in Indonesia, with over 1 million confirmed infected and more than 100 thousand remain under treatment.² Even though there has been indications that these figures was an underestimation,^{3,4} it has caused healthcare systems in several Indonesian provinces near collapse. By January 2021, occupancy rate for COVID-19 treatment facilities in Jakarta has reached 87% with more cases pouring in.⁵

Healthcare workers were one of

the most impacted community during the pandemic, both physically and mentally.⁶ They wear personal protective equipment (PPE) in their everyday duties, including face masks. Although WHO recommended only surgical mask for routine use by healthcare workers,⁷ they routinely wears other respirators such as N95 and KN95.^{6,8} More than 85% of healthcare workers routinely use face masks more than 4 hours per day.⁹

Routine use of PPEs, including face masks, have its toll on the wellbeing of healthcare workers. PPE use caused substantial discomfort, causing mental distress to healthcare workers.¹⁰ Moreover, PPE use has also been associated with physical adverse effects ranging from dry

skin, itching, and rashes.¹¹ Face masks in particular has been associated with more severe adverse effect in the form of actual skin injuries including pressure wounds, erosion, and scarring.⁹

While there have been numerous reports on facial injuries associated with use of face mask by healthcare workers during COVID-19 pandemic, more evidence was still warranted to better understand the phenomenon. It is imperative to identify risk and protective factors related to this phenomenon to provide better comfort in protecting the healthcare workers manning our frontline against the pandemic. Thus, we conducted this study with the objective of learning more on facial injury related to face mask

use among healthcare workers in a single tertiary healthcare center.

METHODS

Study design and data collection

We conducted cross-sectional study among healthcare workers in Sanjiwani General Hospital, Gianyar, Bali, Indonesia. Data collection was conducted by self-filled questionnaire in the period of 24th to 29th January 2021. Respondents was recruited consecutively by disseminating the questionnaire to all wards and departments in the hospital. Inclusion criteria was evaluated by a series of questions in the questionnaire and included healthcare workers who have worked in Sanjiwani General Hospital for at least 3 months prior to filling the questionnaire.

Variables of interests included demographics, characteristics of PPE use, potential risk and protective factors, and characteristics of facial injuries sustained. Characteristics of PPE used included types of face mask most frequently worn, average duration of wearing PPE, and whether said duration was divided by breaks.

Facial injury characteristics studied included degree of severity and location. Severity was measured based on criteria for erosion and burn injuries, classified into superficial, partial thickness, and full thickness erosions with the following explanation: 1) superficial injuries included sore redness in the skin with no break of the skin surfaces; 2) partial thickness injuries included shallow erosion with breaks of the skin surfaces, may include light bleeding; and 3) full thickness injuries included deep erosion of the skin reaching subcutaneous or deeper tissues, may include scarring.

Facial injury location investigated included nasal bridge, cheekbones, and behind the ears. Respondents was also asked on protective behaviors they adopted to prevent such injuries with several options and a fill-in field.

Data analysis

For analyses, facial injury severity was dichotomized into light injuries and moderate-severe injuries. Light injuries included respondents who reported

no injury and superficial injuries while moderate-severe injuries included those who reported partial and full thickness injuries. Afterwards, we conducted binomial multivariate logistic analysis to identify risk and protective factors for moderate-severe injuries and for each location of facial injuries. All analyses were conducted by IBM SPSS 23.0.

RESULTS

From 200 questionnaires disseminated, 189 was returned to the research team. Of these, 28 was excluded due to being incomplete with 161 respondents included for analysis, an 80.5% response rate. From included respondents visible in Table 1, the majority was female (73.3%) and nurses (78.3%). Mean age was 35 (\pm 8.91) years old. Almost all respondents (95.7%) wear PPE, including face mask, for less than 8 hours per day with N95% respirator being the most frequently worn face mask (50.3%).

Few respondents took protective measures to prevent facial injuries with only 19.3% reported using polyester tape layering under their face mask and 8.1% reported to applied emollient lotions. The majority of respondents (91.9%) also

reported they took no break from wearing their PPE while on duty while only 4.3% reported heavy sweating, a potential risk factor.

Only 9.3% of respondents reported never has been injured related to their use of face mask at work (Table 2). From those who reported injury, superficial injury was the most frequently reported severity level (51.6%) while 30.4% reported partial thickness injuries and 8.7% reported to have suffered full thickness skin injuries.

By location, nasal bridge was the most frequently reported location for facial injuries related to face mask use, with 77% respondents. Behind the ears was the second most frequently reported (57.1%) and cheekbones least frequently (47.2%). Some respondents reported to have suffered facial injuries in more than one location, thus the total percentage did not adds up to 100%.

Multivariate analyses results, visible in Table 3, type of face masks and protective measures was the independent determinants for risk of more severe injuries. KN95 respirator was found to be associated with lower risk of partial to full thickness facial injuries compared to N95 respirator with aOR of 0.29 (95% CI 0.14

Table 1. Characteristics of demographics and PPE use among respondents.

Variables		
Sex, n (%)		
	Male	43 (26.7)
	Female	118 (73.3)
Age, mean (\pm SD)		35.00 (\pm 8.91)
Profession, n (%)		
	Nurses	126 (78.3)
	Doctors	35 (21.7)
PPE duration, n (%)		
	\leq 8 hours	154 (95.7)
	> 8 hours	7 (4.3)
Types of face mask, n (%)		
	N95 respirator	81 (50.3)
	KN95 respirator	72 (44.7)
	Surgical mask	8 (5.0)
Breaks during PPE use, n (%)		
	Yes	13 (8.3)
	No	148 (91.9)
Heavy sweating, n (%)		
	Yes	7 (4.3)
	No	154 (95.7)
Protective measures, n (%)		
	None	117 (72.7)
	Polyester tape layer	31 (19.3)
	Emollient lotion	13 (8.1)

– 0.62). Polyester tape layering was also associated with lower risk of partial to full thickness facial injuries with aOR of 0.27 (95% CI 0.10 – 0.76).

Protective measures were also the independent determining factors for all locations of facial injuries. Polyester tape layering was found associated with lower risk of injuries on the nasal bridge, cheekbones, and behind the ears with aOR of 0.02 (95% CI 0.01 – 0.07), 0.20 (95% CI 0.08 – 0.52), and 0.05 (95% CI 0.02 – 0.17) respectively. Similarly, emollient application was associated with lower risk of injuries on all three locations with aOR of 0.02 (95% CI 0.01 – 0.10), 0.06 (95% CI 0.01 – 0.52), and 0.08 (95% CI 0.01 – 0.41) respectively. Additional protective factor was identified for nasal bridge injuries in the form of taking breaks during shift wearing PPE which lower risk with aOR of 0.12 (95% CI 0.02 – 0.78).

DISCUSSION

Our results revealed high prevalence of facial injuries sustained by healthcare workers related to their routine use of face masks at work. Although the most frequently reported injury was only superficial, only 9.3% respondents reported to never been injured since the pandemic. Furthermore, most respondents also reported to have not took preventive measures. Only 8.3% reported to take breaks in wearing PPE during shift and a combined 27.4% reported to applied polyester tape or emollient in order to prevent facial injuries.

Further analysis identified N95 respirator to be associated with higher risk of more severe facial injuries compared to KN95 respirator. Protective measures, including polyester tape layering and emollient, was found effective in

preventing more severe injuries as well as facial injuries on the nasal bridge, cheekbones, and behind the ears.

The prevalence level found in this study was much higher than similar studies conducted in China earlier in the pandemic which reported 42.8% overall prevalence and 2% severe skin injuries prevalence.⁹ More similar figures, albeit higher, was reported by another Chinese study which reported 97% prevalence of skin damages which included various lesions from maculopapular eruptions to macerations and desquamations.¹² The variation of reported prevalence may be partially attributed to the difference in definition of skin injuries used in different studies. However, multitude of evidence indicated the phenomenon was widespread.^{13,14}

N95 respirator as risk factor for skin injuries has also been previously established¹⁵ due to observation of greater pressure it exerted on the skin.⁹ However, few previous studies, if any, reported the difference in risk compared to KN95 respirator as was observed in our results. The result is interesting given that N95 and KN95 respirators are considered of the same class of respiratory protection.¹⁶ More recent test has also shown that N95 and KN95 was similarly effective in filtering in respiratory particles from wearers.^{17,18}

Protective measures found effective

Table 2. Characteristics of severity and location of facial injury among respondents.

Variables	
Facial injury severity, n (%)	
Uninjured	15 (9.3)
Superficial	83 (51.6)
Partial thickness	49 (30.4)
Full thickness	14 (8.7)
Injury location, n (%)	
Nasal bridge	124 (77.0)
Cheekbones	76 (47.2)
Behind ears	92 (57.1)

Table 3. Adjusted odds ratio (aOR) for determinants of facial injuries and their locations.

Variables	aOR (95% CI)			
	Facial injuries	Nasal bridge	Cheekbones	Behind ears
Sex, female	1.12 (0.51 – 2.66)	0.61 (0.17 – 2.24)	0.58 (0.25 – 1.32)	0.66 (0.26 – 1.70)
Age, 1 year increment	1.00 (0.96 – 1.04)	0.99 (0.93 – 1.05)	1.01 (0.97 – 1.05)	1.02 (0.98 – 1.07)
Profession, doctors	1.28 (0.55 – 2.97)	2.32 (0.55 – 9.81)	0.69 (0.29 – 1.63)	1.89 (0.67 – 5.32)
Types of face mask				
N95 respirator	1	1	1	1
KN95 respirator	0.29 (0.14 – 0.62)*	1.42 (0.42 – 4.83)	0.80 (0.38 – 1.66)	0.90 (0.40 – 2.05)
Surgical mask	0.43 (0.09 – 2.11)	1.05 (0.06 – 17.35)	0.54 (0.11 – 2.62)	4.03 (0.37 – 43.92)
Wears PPE > 8 hours	0.38 (0.41 – 3.53)	0.14 (0.01 – 1.36)	0.65 (0.13 – 3.35)	1.32 (0.18 – 9.88)
Heavy sweating	0.97 (0.15 – 6.24)	1.22 (0.04 – 39.63)	0.85 (0.14 – 5.19)	2.31 (0.22 – 24.03)
Breaks during PPE	0.30 (0.06 – 1.63)	0.12 (0.02 – 0.78)*	0.40 (0.08 – 2.18)	0.30 (0.05 – 1.89)
Protective measures				
None	1	1	1	1
Polyester tape layer	0.27 (0.10 – 0.76)*	0.02 (0.01 – 0.07)*	0.20 (0.08 – 0.52)*	0.05 (0.02 – 0.17)*
Emollient lotion	0.59 (0.14 – 2.45)	0.02 (0.01 – 0.10)*	0.06 (0.01 – 0.52)*	0.08 (0.01 – 0.41)*

*p < 0.05

in our results has also been reported effective previously. In fact, as early as May 2020, the use of repurposed wound dressing as layering for face mask has been proposed.¹⁹ More robust studies have been conducted since. Various types of dressing has been proposed to be repurposed for skin protection for healthcare workers wearing PPE and found both effective at preventing skin injuries while being free of contaminations.^{20,21}

Our result implied the need for robust action to prevent adverse effect of necessary infection preventive measures for our health workers. Despite evidence of effectiveness, we found few healthcare workers practiced preventive behaviors for skin injuries. Evidence supports several recommendations such as replacing N95 respirators with KN95 variants in non-COVID-19 services and promoting the use of repurposed wound dressing and emollient to protect the skin. Healthcare facilities are also encouraged to provide these supplies to healthcare workers under their employment.

While previous similar studies have been published elsewhere, this study was one of the few to report the phenomenon in Indonesia. However, it was not without its limitation. Much are left to be learnt on the adverse effect of COVID-19 pandemic toward healthcare workers' wellbeing and workplace safety. Future studies should explore on the treatment choices and prognosis for healthcare workers suffering from such injuries.

CONCLUSION

We found high prevalence of facial skin injuries related to PPE use, especially on regard to N95 respirator. Preventive behaviors such as using polyester tape layering and application of emollient lotion was found to be effective in preventing skin injuries, including its more severe manifestations despite infrequently practiced. This result, backed by previous evidence, support the promotion of such practices among healthcare workers during the COVID-19 pandemic.

ETHICAL STATEMENT

All respondents were asked for their informed consent through informed

consent form on the first page of the questionnaire. The form explained the purpose of the study as well as respondents' rights and obligations under the study. Respondents was allowed to ask for more information from research team which was reachable through contact information provided on the form. Respondents was free to withdraw their participation by discontinuing completion of the questionnaire or by contacting research teams afterwards. The methods for this study have been reviewed and approved by Sanjiwani General Hospital Ethical Committee with approval letter no. 3/PEPK/I/2020.

AUTHOR CONTRIBUTION

Conceptualization: IGAABJ. Data curation: IGAABJ. Formal analysis: GBSW. Methodology: IGAABJ and GBSW. Project administration: IGAABJ. Visualization: GBSW. Writing – original draft: IGAABJ and GBSW. Writing – review & editing: AANKD, AANBSD, LL, and SNS.

CONFLICT OF INTEREST

None declared.

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