

The Relationship Between Headache and Usage of Masks Among Healthcare Workers During COVID-19 Pandemic - A Cross-Sectional Study in a Tertiary Healthcare Centre in South India

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ABSTRACT

Background: Corona virus disease 2019 (COVID-19) has been termed as a pandemic and healthcare workers who are working in high-risk areas have been advised to wear personal protective equipment (PPE) such as N95 face mask and face shields while interacting with patients. This study was done to evaluate the risk factors associated with headache related to the use of PPE and its impact on their day to day activities. Pre-existing conditions and their association with development of headache were also studied.

Methods: A cross-sectional analysis was done at our tertiary institute and the participants were healthcare workers involved actively in management of covid and non-covid patients. An online questionnaire was formulated and circulated amongst the participants.

Results: A total of 81 respondents took part in the survey. Majority of them were males [42/81 (52%)], aged 21 – 35yrs [72/81 (89%)], most of them being doctors [80/81 (99%)]. A total of 22% (18/81) had associated co-morbidities. 79% were using N95 mask with/without 3ply surgical mask. 22% used it coupled with face shield. Masks were used for more than 4hrs/day and more than 15 days a month by 86% of the respondents (70/81). Of the 81 respondents, 42% (34/81) developed headache post usage of mask. 5 of them had pre-existing headache which significantly increased with the usage of mask. Majority of them reported it to be

bilateral (62%) and corresponding to the area of contact of the straps of mask and face shields. Aggravating factors were present in 93% of the cases. Relieving factors included taking rest in form of sleep (85%) or taking analgesics in 37% of the cases. 74% said it impacted their work performance. Headache resolved spontaneously in 81% of the respondents after duration of 30mins. Paracetamol was the most common drug used in acute attacks (73%). Univariate logistic regression analysis of factors showed that none of the factors were significantly associated with development of headache.

Conclusion: COVID – 19 disease might never be completely eliminated. Better strategies are needed for managing workloads along with improved designs of the N95 making them more user friendly.

Keywords: Coronavirus disease 2019; Covid 19; Eyewear; Face shield; Headache; N95; PPE; Personal protection equipment;

INTRODUCTION

Ever since COVID-19 disease, caused by SARS-CoV-2 virus has been first declared as an emergency in China as early as December 2019, it has rampantly spread across the world. As of October 1st, 2022 more than 21.9 crore cases have been diagnosed which has led to 45.5 lakh deaths so far. India stands second in the list of countries most affected by this pandemic

accounting to 3.38 crore cases and 4.49 lakh deaths. Healthcare workers who are working in close proximity of those affected with COVID-19 are mandated to wear personal protective equipment (PPE) to protect them from this airborne disease. PPE include mask, face shield or goggles and a jumpsuit and gloves.

While wearing PPE is ideal in terms of protection, wearing it all the time is not practically feasible. Healthcare workers managing other units of the hospital or non-covid out patient departments, it has been advised to use high filtration face masks such as N95 mask coupled with a face shield. N95 masks have been used widely as they result in filtering out at least 95% with a mean diameter of $>0.3\mu\text{m}^2$ (1).

There have been reports of headache arising from sustained pressure over the pericranial soft tissues due to tight bands related to other activities such as bike riding, swimming or other related sports (2)(3)(4). The same holds true to N95 masks and face shields with or without the entire PPE gear leading to headache (5) (6). As the number of healthcare workers who used N95 masks was comparatively more than those who wore PPEs, we choose to study the prevalence of headache amongst healthcare workers at our tertiary care referral centre in South India.

MATERIALS & METHODS

We conducted a survey amongst healthcare workers at our institute using an online platform. The advantages of an online platform being able to conduct customized surveys, easy paper free access for a wide range of participants and the ability to run basic analysis post survey. We went through similar articles on PubMed and formulated a survey comprising 30 questions. The questions ranged from basic demographic details to more specifics about their occupation, the type of protective equipment used, duration used, details of pre-existing medical history and aggravating factors if any. The entire list of questions is in table 1. The survey was conducted over a period of

6 weeks. In order to reduce material contact, the links were circulated via e-mail and WhatsApp to all the healthcare professionals actively managing covid/non-covid patients at our institute. There was a short introductory note at the beginning of the survey which explained the taker regarding the purpose of the survey and how to go about it. Two reminders were sent at 2 weeks and 4 weeks interval respectively. The survey was closed at 6 weeks. Each question had one right option which the users had to choose from multiple options. Incomplete surveys were excluded from final analysis. For each question, the result with maximum votes has been taken up for discussion as it represents the general consensus.

STATISTICAL ANALYSIS

Descriptive analyses were used to study baseline characteristics. Chi-square analyses were used to compare nominal demographic data and N95 usage patterns across 2 groups (respondents with and without de novo PPE-associated headaches). Statistical significance was set at $P < .05$. All analyses were 2-tailed. All statistical analyses were performed using the SPSS statistical package program version 25.0 for Windows (SPSS Inc, 2003, Chicago, IL, USA).

RESULT

A total of 81 respondents took part in the survey. Majority of them were males [42/81 (52%)], aged 21 – 35yrs [72/81 (89%)], most of them being doctors [80/81 (99%)] (Table 2). A total of 22% (18/81) had associated co-morbidities (Table 3).

Usage pattern of protective gear (Table 4) - 79% were using N95 mask with/without 3ply surgical mask. 22% used it coupled with face shield. Masks were used for more than 4hrs/day and more than 15 days a month by 86% of the respondents (70/81). Of the 81 respondents, 42% (34/81) developed headache post usage of mask. 5 of them had pre-existing headache which significantly increased with the usage of mask. In those with de-novo headache,

slight to significant increase has been reported in 60% of the respondents. Majority of them reported it to be bilateral (62%) with the most common area being frontal (55%) and temporal (37%) corresponding to the area of contact of the straps of mask and face shields. 37% developed headache within 1 hour of usage and 41% developed between 1-6 hours of usage. The intensity was reported as mild to moderate in 88% of the respondents. It was associated with other symptoms such as nausea, vomiting, photophobia, phonophobia, shortness of breath, light headedness, confusion or congestion of eyes. Aggravating factors were present in 93% of the cases. Relieving factors included taking rest in form of sleep (85%) or taking analgesics in 37% of the cases. 74% said it

impacted their work performance, but 93% continued to work without availing any sick leaves due to headache. Average fluid intake was less than 1 litre in 26% of the respondents while 40% had intake between 1-2 litres and 30% between 2-4 litres. Headache resolved spontaneously in 81% of the respondents after duration of 30mins. Paracetamol was the most common drug used in acute attacks (73%) and slight to significant increase in usage was reported in 54% of the respondents, with 45% reporting no change in frequency. Univariate logistic regression analysis of factors (Demographic variables, pre-existing primary headache diagnosis and N95 usage) in respondents with and without denovo PPE-associated headache did not give a significant p value (<0.05) (Table 5).

Table 1 – List of questions circulated on the online platform

1.	Gender Male Female
2.	Age 21 – 25 26 – 30 31 – 35 36 – 40 41 – 45 46 – 50 51 – 55 56 – 60 >61
3.	Occupation Doctor Nurse Allied health care worker Others
4.	Past medical history Hypertension Hyperlipidaemia Diabetes Mellitus Asthma/COPD Eczema Ischemic heart disease Stroke Depression Anxiety Cigarette smoking Others None
5.	Which type of mask is most frequently used by you? 3ply surgical mask N95 with/without 3ply surgical mask
6.	Whether the mask is ised Continuously Intermittent
7.	Average number of hours mask used per day? 1-4hrs >4hrs
8.	Average number of days mask used per month? 3 – 15 days >15 days

9.	What other protective equipment do you use along with your mask? Mask alone Mask + Face shield
10.	With the usage of mask, are you experiencing headache? Yes No
11.	If yes, Headache is New onset Pre-existing
12.	If its pre-existing, describe the changes in frequency of headache Significant increase in frequency Slight increase in frequency No change in frequency Slight decrease in frequency Significant decrease in frequency
13.	If pre-existing, describe the changes in duration of headache Significant increase in duration Slight increase in duration No change in duration Slight decrease in duration Significant decrease in duration
14.	If pre-existing, describe the changes in frequency of usage of medications Significant increase in frequency Slight increase in frequency No change in frequency Slight decrease in frequency Significant decrease in frequency
15.	Duration of new onset headache <1 day per month (i.e no monthly attacks) 1-4 days per month 5-9 days per month 10-14 days per month >15 days per month
16.	If its new onset headache, describe the changes in frequency of headache Significant increase in frequency Slight increase in frequency No change in frequency Slight decrease in frequency Significant decrease in frequency
17.	Laterality of headache Unilateral / One sided Bilateral / Two sided Others
18.	Severity of headache Mild intensity Moderate intensity Severe intensity
19.	Anatomical location of headache Frontal Temporal Occipital Holocranial
20.	Associated symptoms Nausea/Vomiting Photophobia (Light sensitivity) Phonophobia (Sound sensitivity) Shortness of breath Light headedness Confusion Congestion of eyes/nose None
21.	Aggravating factors Sleep deprivation Physical stress Emotional stress Irregular meal times Inadequate hydration None
22.	Relieving factors Sleep Lying down or reclining in bed (using more pillows than usual) Using symptomatic medications
23.	Time interval between wearing of mask to onset of headache <30mins

	30mins – 1hour 1 – 6 hours 6 – 12 hours 12 – 24 hours 1 – 2 days
24.	Impact of work performance due to headache? Yes No
25.	Any sick leave attributed to headache were taken? 0 days 1-4 days 5 – 9 days 10 – 14 days 15 – 20 days 21 – 24 days 25 – 30 days
26.	Average fluid intake per day <1liter 1 – 2 litres 2 – 4 litres >4 litres
27.	How does the headache resolve? Spontaneously With usage of abortive agents
28.	Time taken to resolve headache spontaneously <30mins >30mins
29.	Class of abortive medications used during attack(s) Paracetamol NSAIDS Triptans (Eg: Sumatriptan, Zolmitriptan) Opioids (Eg: Tramadol, Codeine) None
30.	Frequency of usage of above medications Significant increase in frequency Slight increase in frequency No change in frequency Slight decrease in frequency Significant decrease in frequency

Table 2 — Baseline Characteristics of Healthcare Workers in COVID-19.

<i>Characteristics</i>	<i>Categories</i>	<i>Healthcare workers (%)</i>
Gender		
	<i>Female</i>	39(48.1%)
	<i>Male</i>	42(51.9%)
Age		
	<i>>61</i>	1(1.2%)
	<i>21-25</i>	31(38.3%)
	<i>26-30</i>	30(37%)
	<i>31-35</i>	11(13.6%)
	<i>36-40</i>	5(6.2%)
	<i>41-45</i>	1(1.2%)
	<i>51-55</i>	1(1.2%)
<i>56-60</i>	1(1.2%)	
Occupation		
	<i>Doctor</i>	80(98.8%)
	<i>Others</i>	1(1.2%)

Table 3 — Pre-Existing Primary Headache Diagnosis and Other Co-Morbidities Among Healthcare Workers

Variable	Categories	Healthcare workers (%)
Past medical history		
	Anxiety	3(3.7%)
	Asthma/COPD	4(4.9%)
	Cigarette smoking	3(3.7%)
	Depression + Anxiety	1(1.2%)
	Diabetes Mellitus	1(1.2%)
	Hypertension	1(1.2%)
	Hypertension + DM	2(2.5%)
	Nil	63(77.8%)
	Others	3(3.7%)

Table 4 — PPE Usage Patterns Among Healthcare Workers During COVID-19 Outbreak

Characteristics	Categories	Healthcare workers (%)
Which type of mask is most frequently used by you?	3 ply surgical mask	17(21%)
	N95 with/without triply surgical mask	64(79%)
Whether the mask is used	Continuously	53(65.4%)
	Intermittent	28(34.6%)
Average number of hours mask used per day?	>4hrs	70(86.4%)
	1-4 hrs	11(13.6%)
Average numbers of days mask used per month?	>15 days	69(85.2%)
	3-15 days	12(14.8%)
What other protective equipment do you use along with your mask?	Mask + face shield	18(22.2%)
	Mask alone	63(77.8%)

Table 5 — Univariate Logistic Regression Analysis of Factors (Demographic Variables, Primary Location of PPE Usage, Pre-Existing Primary Headache Diagnosis, and PPE Usage) in Respondents With and Without De Novo PPE-Associated Headaches

Factor	Categories	Total	With the usage of mask, are u experiencing headache?		P-VALUE
			No	Yes	
Age	>40	4(4.9%)	4(8.5%)	0(0%)	0.135
	21-40	77(95.1%)	43(91.5%)	34(100%)	
Total		81(100%)	47(100%)	34(100%)	
Occupation	Doctor	80(98.8%)	46(97.9%)	34(100%)	>0.999
	Others	1(1.2%)	1(2.1%)	0(0%)	
Total		81(100%)	47(100%)	34(100%)	
Past medical history	No	63(77.8%)	39(83%)	24(70.6%)	0.279
	Yes	18(22.2%)	8(17%)	10(29.4%)	
Total		81(100%)	47(100%)	34(100%)	
Which type of mask is most frequently used by you?	3 ply surgical mask	17(21%)	11(23.4%)	6(17.6%)	0.591
	N95 with/without triply surgical mask	64(79%)	36(76.6%)	28(82.4%)	
Total		81(100%)	47(100%)	34(100%)	
Whether the mask is used	Continuously	53(65.4%)	27(57.4%)	26(76.5%)	0.076
	Intermittent	28(34.6%)	20(42.6%)	8(23.5%)	
Total		81(100%)	47(100%)	34(100%)	
Average number of hours mask used per day?	>4hrs	70(86.4%)	38(80.9%)	32(94.1%)	0.108
	1-4 hrs	11(13.6%)	9(19.1%)	2(5.9%)	
Total		81(100%)	47(100%)	34(100%)	
Average numbers of days mask used per month?	>15 days	69(85.2%)	40(85.1%)	29(85.3%)	>0.999
	3-15 days	12(14.8%)	7(14.9%)	5(14.7%)	
Total		81(100%)	47(100%)	34(100%)	
What other protective equipment do you use along with your mask?	Mask + face shield	18(22.2%)	10(21.3%)	8(23.5%)	0.810
	Mask alone	63(77.8%)	37(78.7%)	26(76.5%)	
Total		81(100%)	47(100%)	34(100%)	

DISCUSSION

Covid-19 being an airborne disease, health authorities across the world has advised the use of N95 masks and face shields while managing those who are not diagnosed covid positive in order to protect themselves from asymptomatic carriers. This lead to

increased stress and fatigue due to headache, dryness of mouth, breathing difficulties and fogging (7).

The incidence of N95 associated headaches post COVID-19 pandemic ranges from 26.5% - 90.7% (7–11). The cause being mechanical compression, hypercarbia and

hypoxemia post usage of masks (5,12,13). Use of mask and face shield for >4 hours per day have increased the likelihood these symptoms. As per our study, 37% developed headache within 1 hour of usage and 41% developed within 6hrs of usage.

Headache was more in the frontal region and temporal region implying a pressure effect from the mask and face shields. This usually led to an irritative effect on the underlying superficial sensory nerves innervating those regions. This caused the activation of trigeminocervical complex which triggered the headaches (14). But in cases where pre-existing headache were reported, this process may lead to aggravation of headache (15). Our study had a lower proportion of respondents with pre-existing headache, so this could not be verified.

Headache is usually developed by tight-fitting N95 which leads to development of de-novo headache. Majority of our respondents who developed de novo headache fulfilled ICHD-3 criteria for external compression headache (ECH) (table). We had almost equal number of respondents who developed headache within 60 mins and beyond 60 mins of use of mask. De novo headaches were associated with migraine related symptoms such as nausea, photophobia, phonophobia and light headedness in more than 80% of the cases. If the external stimulus (mask and face shield) is used for prolonged durations, this can lead to even a full blown migraine attack (16).

As per previously reported data, headache was severe enough to resort to acute analgesic treatment in as many as 60% of the individuals whereas in our study only 37% took analgesics for instant relief signifying mild intensity attacks which were infrequent, different working conditions and varying duty shifts (5). Though they did not need acute analgesics, 74% said it impacted their work performance. So, we might have to consider shorter duty shifts requiring shorter N95 usage in order to avoid the adverse effects.

Our results are slightly different compared to those reported in a similar study (11). Though none of the factors were significant, we could not deny the fact that headache was associated with prolonged use of PPE in majority of the previous studies. Whether this can be attributed to the change in ethnicity and the geographical parameters needs to be further looked up.

Our study is bound with some limitations such as small sample size, targeting only healthcare professionals working at a tertiary care centre who are representative to majority of those working at tertiary care setups in India. Majority of the population being doctors and not taking into account the para medical staff who are also at equal risk due to prolonged working hours. We did not consider other psychological factors such as stress and sleep disturbances, other aspect related to lack of food, water sleep during working hours which could have led to development of de-novo headache should be evaluated in further studies.

CONCLUSION

With the ongoing climate change and urbanization the chances of pathogens jumping from animals to humans is only going to increase and also the risk of encountering a new pandemic in the future. Also the ongoing pandemic means, we have to continue using N95 masks while dealing with high risk patients. So, better strategies are needed for managing workloads along with improved designs of the N95 making them more user friendly while maintaining their protective efficacy.

Declaration by Authors

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