Journal of Advanced Research in Medical Science & Technology
Volume 8, Issue 4 - 2021, Pg. No. 1-6
Peer Reviewed & Open Access Journal

Research Article

Effect of N-95 Mask on Headache among Healthcare Workers in Phase 2 of COVID-19 Pandemic

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DOI: https://doi.org/10.24321/2394.6539.202113

I N F O

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How to cite this article:
Jaleel G, Malhotra D, Khan SA, Khan AR, Parveen S. Effect of N-95 mask on Headache among Healthcare Workers in Phase 2 of COVID-19 Pandemic. J Adv Res Med Sci Tech. 2021;8(4):1-6.

Date of Submission: 2021-12-07
Date of Acceptance: 2021-12-29

A B S T R A C T

Background: During a pandemic, N-95 face masks are the most commonly used respirators by healthcare workers and the general public. The sustained wearing of the N-95 mask has led to physical distress and negative impacts on health, such as dizziness, shortness of breath, and headache. It is hypothesized that the headache severity of HCWs who wear the N95 mask for a lengthy period would change over time.

Methodology: Between February and April 2021, the preliminary study surveyed 112 health care providers according to the inclusion and exclusion criteria. The survey questionnaire includes four parts: (1) demographic information; (2) information about N95 use (6 questions); (3) headache-related information (10 questions); and (4) perceptions of the effect of face masks on their headache condition.

Results: A total of 112 healthcare workers (HCWs) took part in the study, including 38 men (33.9%) and 74 women (66.1%) with an average age of 28 years. N-95-related discomfort was experienced in 87 (77.7%) HCWs, and 82 (73.2%) had headaches. Only 13 (11.6%) HCWs had a headache more than three times a week, while 33 (29.5%) had it twice or more often. The Spearman correlation was used to evaluate the relationship between headache severity at the beginning and present, and there is a positive correlation in both stages.

Conclusion: The current study has shown that the frequency and severity of headaches in healthcare workers has increased significantly after wearing an N95 facemask in the second wave of the Covid 19 pandemic that originated in December 2019.

Keywords: N-95, Headache, COVID-19, PPE

Introduction

In late December 2019, reports emerged from Wuhan, in Hubei Province, China, of a cluster of severe acute respiratory illnesses.[1,2] By January 2020, the condition now known as coronavirus disease 2019 (COVID-19), attributed to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), had rapidly spread from Wuhan to other regions.[3] As of December 2021, worldwide, 283,237,912 has reported confirmed cases of COVID-19.[4]

It spread rapidly throughout the world in a single year. Because respiratory droplets spread the virus, healthcare professionals must wear Personal Protective Equipment (PPE) while caring for patients. PPE includes gowns, gloves, respirator masks, face shields, goggles, mop caps, and shoe covers. During an ongoing pandemic, N-95 face masks are the most commonly used respirators by health care workers and public civilians. Prolonged use of the N95 mask causes mild discomfort, physiological and psychological burdens, and decreased work efficiency. Wearing the N-95 mask for an extended period has resulted in physical distress, including dizziness, shortness of breath, and headaches.[5,6] Several studies have confirmed that headache is a common health issue due to the prolonged use of N95 masks.[7]

Scientific studies worldwide have revealed that headache is the sixth leading cause of disability worldwide. Headache interferes with personal, professional, and social activities. Headache impairs concentration at work and in daily life. It may impair work and time productivity and result in abnormal scalp sensitivity and pain. Additionally, it might become a source of sleep disturbances.[6,8]

Hypoxemia and hypercapnia are the primary causes of N-95-related headaches. According to the study, hypoxemia and hypercapnia recover when the mask is doffed. As a result, the headache associated with N-95 will not intensify with time. Additionally, external compression headache occurs when a strap injures the soft skull tissues.[9,10] Due to the tightness of mask straps, the skin might be under a considerable measure of strain, and if headaches are due to compression, the pattern of the headaches will vary over time. It is hypothesized that the headache severity of Healthcare Workers (HCWs) who wear the N95 mask for a lengthy period would change over time (on average 4 to 8 hours a day). Thus, the objective is to determine the effect of the N-95 mask on the frequency, intensity, and severity of headaches in Phase II.

Methodology

A total of 112 participants were recruited from different hospitals in Delhi NCR based on the inclusion and exclusion criteria. Health care workers who were wearing N-95 masks, both male and female subjects, aged between 20 to 60 years, N-95 masks worn for a minimum of 4 hrs were included in the study. Participants with a history of any mental or psychiatric illness, recent trauma leading to headache, any previous surgery leading to headache or any deformity which may have compromised the results were excluded from the study. Between February and April 2021, the preliminary study surveyed 112 health care providers, including physicians, physiotherapists, occupational therapists, and nurses. Permission was obtained verbally from the hospital and nursing home. The objective and scope of the study were communicated to subjects. Each participant signed a consent form.

Additionally, each participants' email address was requested. A screening list was implemented, and participants were considered for the study only if they fulfilled the inclusion and exclusion criteria. The questionnaire was sent to participants' email addresses, and they were asked to complete the questionnaire and submit it. If the subject did not respond, three reminders were given at a one-week interval, and the subject was dropped if he or she did not respond after three reminders. The questionnaire was divided into four sections: Part A contains demographic information (6 questions); Part B contains information about N95 use (6 questions); Part C contains headache-related information (10 questions), and Part D contains the participants' perceptions of the effect of face masking on their headache condition.

Data Analysis

Statistical analysis was done using SPSS software. Descriptive statistics was used to analyze subjects' demographic characteristics and study variables.

Spearman rank correlation test was used to find the relationship between severity of headache in-between phase I and II and between frequency and severity of headache at present. Statistical significance was set at $P < 0.05$.

Result

A total of 112 HCWs took part in the study (Table 1), including 38 men (33.9%) and 74 women (66.1%), with an average age of 28 years. Out of 112, 42 (37.5%) HCWs used the N-95 mask for more than a year, and 52 (46.4%) used it for approximately a year. As a daily routine, N-95 length was 4 hours in 46 (41.1%) HCWs, 8 hours in 32 (28.6%), and >8 hours in 15 (13.4%).

N-95-related discomfort was experienced in 87 (77.7%) HCWs, and 82 (73.2%) had headaches. Only 13 (11.6%) HCWs had headaches more than three times a week, while 33 (29.5%) had it two or three times a week. Among 112 HCWs, 56 (50%) reported headache at the beginning of Phase 1, and 95 (75.9%) in Phase 2, with moderate (31.3%) to severe (10.7%) intensity of pain on VAS at 2-5 and 5-8 respectively (Figure 1).

ISSN: 2394-6539
DOI: https://doi.org/10.24321/2394.6539.202113

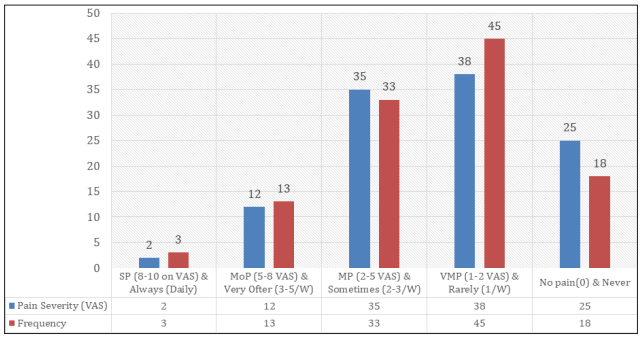

Figure 1.Pain Severity and Frequency of Headache in Phase II

Only 23 (20%) HCWs reported a sudden onset of pain, whereas 60 (54%) reported a gradual onset, and 29 (26%) had a varied onset of headache (Figure 2).

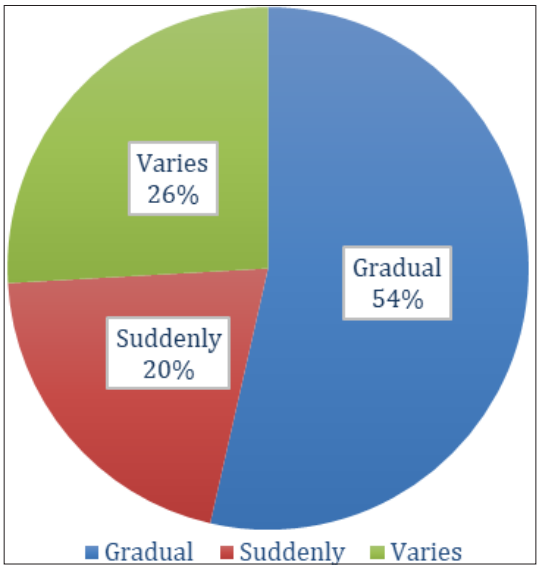

Figure 2.Onset of Headache

In 45 (40.2%) HCWs, the pain lasted for 1-4 hours, whereas 24 (21.4%) had ≤ 30 minutes and the frequency of headache also changes as most of the HCW has 2-3 times per week (Figure 3).

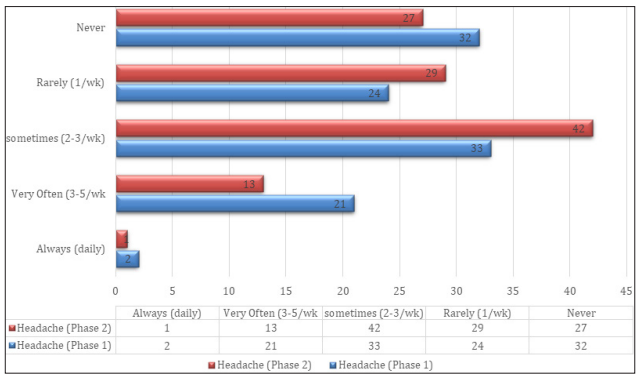

Figure 3.Change in Headache Frequency in Last one year

Among the respondents who had headaches associated with N-95, 54 (48%) HCWs preferred or desired to lie down, and among them, 18 (16%) always lie down, and 36 (32%) sometimes lie down. While 43 (38%) HCWs preferred medicine, and among them, 19 (17%) always took medicines, and 24 (21%) sometimes took medicines. 15 (14%) HCWs used both the methods to relieve the pain, 41 (36.6%) had limited usual activities at work, 47 (41.9%) felt tired at work, 35 (31.2%) felt irritated, and 46 (41%) complained of limited ability to concentrate at work (Figure 4 and 5).

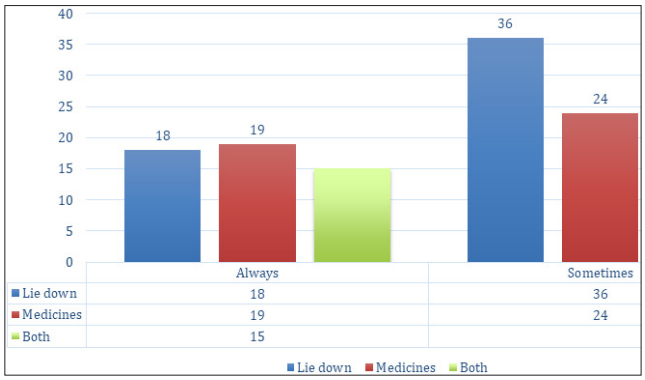

Figure 4.Pain-relieving Methods used for N-95 Associated Headache

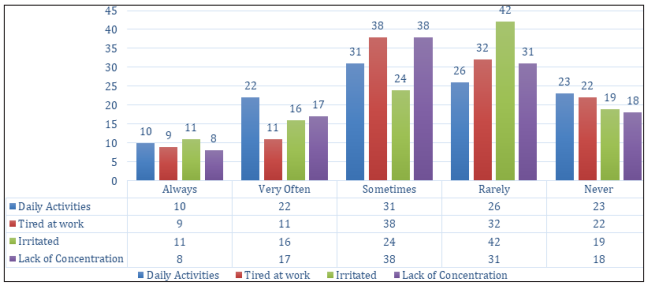

Figure 5.Effect of Headache on Physical and Mental Health

Table 1.Summary of Key Feature of N-95 Associated Headache among HCWs

Categories	Frequency (%)
Age, years	
Mean	28 ± 2
Range	20-30
Gender	
Male	38 (33.9%)
Female	74 (66.1%)
Longevity of N-95	
>1 year	42 (38%)
≈ 1 year	52 (47%)
6 M	9 (8%)

ISSN: 2394-6539
DOI: https://doi.org/10.24321/2394.6539.202113

3M	9 (8%)
Duration of N-95/Day	
> 8 H	15 (14%%)
≈ 8 H	32 (29%)
4-6 H	46 (41%)
N-95 related discomfort	87 (78%)
N-95 related headache	82 (73%)
Frequency of headache	
>3/W	13 (12%)
2-3/W	33 (30%)
N-95 related Headache (phase 1)	56 (50%)
N-95 related Headache (phase 2)	95 (75.9%)
Pain Severity	
Moderate (2-5)	35 (31%)
Severe (5-8)	12 (11%)
Onset of Pain	
Gradual	60 (54%)
Sudden	23 (20%)
Varies	29 (26%)
Duration of Pain	
1-4 H	45 (40%)
≤ 30 Min	24 (21%)
Pain Relieving methods	
Lie Down	54/112 (48%)
Always	18 (16%)
Sometimes	36 (32%)
Medicines	43/112 (38%)
Always	19 (17%)
Sometimes	24 (21%)
Always Both	15/112 (14%)

The Spearman correlation was used to evaluate the relationship between headache severity at the beginning and present, which revealed a significant positive correlation between the two stages ($r = 0.343$; $p<0.05$ and $r = 0.713$; $p<0.05$, correspondingly). Also, headache frequency and severity are significantly correlated ($r = 0.343$; $p<0.05$). The longevity of N-95 masks and duration of N-95/day also showed a significant relationship with frequency and onset of headache ($r =0.282$ and 0.229, respectively).

Discussion

The purpose of this study was to determine the relationship between headaches and the use of an N-95 face mask by healthcare professionals throughout phases I and II of the ongoing Covid 19 Pandemic.

A total of 112 subjects, including doctors and nurses, participated in this study. Of the total subjects, about 66% were females, and 34% were males. Approximately two-thirds (68%) of healthcare providers surveyed belong to the age category of 20-30 years old, followed by 16 % who belong to 30-40 years of age. N95 masks have been used by nearly half of healthcare providers (46%) in the last year, 38% in the previous year, and 8% in the previous 3 and 6 months. Nearly 29% of the participants wore masks for 8 hours, while 13% wore them for more than 8 hours, 17% for 6 hours, and 42% for 4 hours. 87 (78%) of healthcare workers have reported experiencing discomfort while wearing an N95 mask.

More than half (73%) of the HCWs surveyed in this study reported headaches with the N-95 face mask, and we identified pre-existing headaches and prolonged duration of N95 face mask wear as significant risk factors for developing these headaches. The severity and frequency of headache while wearing an N-95 mask were found to be low positively correlated with statistically significant ($r_s = 0.343$, $p < 0.05$) at the beginning and strong positive at present, which is statistically significant ($r_s = 0.713$, $p < 0.05$). Additionally, it is found that the number of healthcare workers who experienced headaches during Phase I of the pandemic increased during Phase II. The increase in headaches among HCWs in Phase II might be due to the constant compression from the straps, which is well-documented in the literature as there are conflicting views about the causative role of hypoxemia and hypercapnia in developing PPE-associated headaches.[9,11] Pressure or tractional force exerted from the straps of the N95 mask may lead to local tissue damage and exert an irritative effect on the underlying superficial sensory nerve, particularly in the trigeminal or occipital nerve branches innervating the cervical and head region.

In the current survey we found that headaches developed gradually, suddenly, and with varying intensity in 54%, 20%, and 26% of the HCWs. 54 (48%) HCWs preferred or desired to lie down, and among them, 18 (16%) always lie down, and 36 (32%) sometimes lie down. While 43 (38%) HCWs preferred medicine, and among them, 19 (17%) always took medicines, and 24 (21%) sometimes took medicines. While 15 (14%) HCWs used both methods to relieve the pain. The percentage of HCWs who used the medicine always for headaches is nearly half in our study compared to Ong et al.[9] who found that about 32% of HCWs took medicine. The reason for less use of medicine could be that most of the HCWs wish to lie down to relieve the pain instead of taking medicines.

This study also accounted for the impact of headaches on daily activities while wearing an N-95 mask in HCWs. A large

ISSN: 2394-6539
DOI: https://doi.org/10.24321/2394.6539.202113

proportion of respondents, 41 (37%) HCWs, reported that the headache induced by the N-95 face mask limits their everyday activities, whereas 46 (41%) and 47 (41.9%) HCWs felt a lack of concentration and being too tired at work, respectively, as a result of headaches. Ramirez-Moreno et al. (10) had a similar finding comprising 67% of respondents had limited physical ability and lacked the concentration to do usual work activity. The factor behind the lack of concentration and limited activity could be because of the level of anxiety or stress the HCWs faced as multiple ways of relating stress and headache have been described as 'de novo' headache. In the SARS-CoV-2 pandemic, healthcare workers may be affected by critical incident stress (CIS). Critical incidents are events in which people witness or experience tragedy, death, serious injury or threatening situations, which can have a substantial emotional impact. The signs and symptoms of CIS can be physical, cognitive, emotional, and behavioural.[10] In the present study, the difference in limited physical activity and other associated side effects due to the N-95 mask could be because of fewer subjects or the accommodation of N-95 mask usage for an extended time.

Not many studies have been done previously to study the phenomena of headaches associated with the N-95 facemask during Covid 19. However, Lim et al.[7] have conducted a similar study comprising 212 HCWs, including 22% males and 78% females with a mean age of 31 years. They reported that 37% had headaches associated with an N-95 face mask, of which 41% of HCWs wore a mask for more than or equal to 4 hours. In the present study, most of the HCWs (47%) wore the mask for ≥ 8 hours while 46 (42%) wore it for 4 hours. In the current study, however, daily use of a mask for 4 hours or more did not affect headache frequency, duration, or severity, but it did have a minor impact on the onset of the headaches ($r = 0.229$, $p < 0.05$). Ramirez-Moreno et al. discovered a similar result, with 47% of HCWs wearing masks for 1 to 4 hours. The minimal time could be 3-4 hours of N-95 mask to cause headaches as physiological changes such as increased respiratory resistance were observed after 3 hours of use (10). The duration of headaches was between 1-4 hours in 45 (40.2%) of HCWs, and 24 (21%) had it ≤ 30 minutes, as in total 69 (67%) had pain ≥ 30 minutes while approximately 95% of HCWs reported headaches of more than 30 minutes in the study by Ong et al.[9]

The participants who were using the N-95 mask for over one year showed a significant impact on the frequency of headaches ($rs=0.282$, $p<0.05$), and the onset of pain affected the severity of headaches ($r = 0.409$, $p<0.05$). The pain onset is gradual, mainly in most HCWs (54%); only 23 (20%) subjects complain of sudden onset of pain. It shows that the pain is slowly increasing in nature over time.

Conclusion

In summary, we found that the frequency and intensity of headaches experienced by healthcare professionals in Delhi increased significantly when they used an N-95 face mask during the Covid 19 Pandemic, which began in December 2019. While we have established this, the results may vary with the passage of time and the introduction of fresh updates.

Limitations

We acknowledge some limitations of our study. First, the sample size (n = 112) of the study may be considered minor, and the survey is of concise duration. However, the restriction imposed by infection control and the outbreak of COVID-19 was at a peak during that period, which made it difficult to approach the HCWs working in hospitals. Second, our study did not account for BMI, sleep disorders, nutrition, and psychological stress factors. Similarly, other factors like ambient room temperature, humidity, duty hours were not assessed. Third, our study did not assess the efficacy of the analgesics and other methods used to treat N-95 caused headaches.

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ISSN: 2394-6539
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DOI: https://doi.org/10.24321/2394.6539.202113