



## ORIGINAL ARTICLE

# Research for the factors effecting the headache experienced by the health-care personnel in COVID-19 pandemic: A monocentric survey study

*COVID-19 pandemisinde görevli sağlık personelinin yaşadığı baş ağrısında etkili faktörlerin araştırılması: Tek merkezli bir anket çalışması*

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## Summary

**Objectives:** The aim of this study is to determine the factors that may be related to the headache experienced by health-care professionals in the coronavirus disease 2019 (COVID-19) pandemic.

**Methods:** The target population of the study consisted of the health-care professionals working in the COVID-19 pandemic. The questionnaire form consisted of 40 questions. The demographic information of the participants, the presence of contact with the COVID-19 patient, they used which personal protective equipment (PPE) and how often, the effect of the pandemic process on the lifestyle, the presence of visual defects, the effect of the pandemic process on water consumption, the presence of old or *de novo* headaches, the factors that may affect this headache, and the factors that reduce the pain were questioned in the survey.

**Results:** A total of 177 health-care professionals participated in the study. About 93.8% of the participants use masks daily for more than 4 h. About 62.7% of the participants stated that their water consumption increased on the days when they used PPE. About 72.3% of the participants reported disruption in sleep patterns, 83.1% of them reported increase in their stress and anxiety. About 65.5% of the participants experienced headaches during the pandemic process. They reported that the most likely causes of headache were excessive sweating and difficulty in breathing due to the use of PPE.

**Conclusion:** During the pandemic, a substantial portion of health-care professionals experiences headaches. Besides the physical difficulties caused by the use of PPE, the stress caused by the pandemic process should not be ignored.

Keywords: Headache; pandemic; personal protective equipment.

## Özet

**Amaç:** Bu çalışmada amaç COVID-19 pandemisinde görevli sağlık personelinin pandemi sürecinde yaşadığı baş ağrısının hangi faktörlere bağlı olabileceğini tespit etmektir.

**Gereç ve Yöntem:** Çalışmanın evrenini COVID-19 pandemisinde görev alan sağlık personeli oluşturdu. Anket formu 40 adet sorudan oluşturuldu. Ankette katılımcıların demografik bilgileri, COVID-19 hastası ile temas varlığı, hangi kişisel koruyucu ekipmanı hangi sıklıkta kullandığı, pandemi sürecinin yaşam tarzına etkisi, görme kusuru varlığı, pandemi sürecinin su tüketimine olan etkisi, eski veya *de novo* baş ağrısı varlığı, bu ağrıya etkili olabilecek faktörler ve ağrıyı azaltan faktörler sorgulandı.

**Bulgular:** Çalışmaya 177 sağlık çalışanı katıldı. %93,8'inin günlük maske kullanımı 4 saatin üzerindedir. Kişisel koruyucu ekipman kullandıkları günlerde katılımcıların %62,7'si su tüketimlerinin arttığını bildirmişlerdir. %72,3'ü uyku düzeninde bozulma, %83,1'i stres ve endişelerinde artış bildirmiştir. Katılımcıların %65,5'i pandemi sürecinde baş ağrısı yaşamıştır. Baş ağrısının muhtemel nedenleri olarak en çok kişisel koruyucu ekipman kullanımına bağlı aşırı terleme ve nefes alıp vermenin zorlaşmasını bildirmişlerdir.

**Sonuç:** Pandemi sürecinde sağlık çalışanlarının önemli bir bölümü baş ağrısı yaşamaktadır. Baş ağrısı oluşumu üzerinde kişisel koruyucu ekipman kullanımının oluşturduğu fiziksel zorluklar yanında pandemi sürecinin oluşturduğu stres de göz ardı edilmemelidir.

Anahtar sözcükler: Baş ağrısı; pandemi; kişisel koruyucu ekipman.

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## Introduction

Severe acute respiratory diseases were reported from Wuhan City, Hubei Province, China, in late December 2019. In a short time, it was understood that the disease was caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus and it was named as coronavirus disease 2019 (COVID-19) and declared as a pandemic by the World Health Organization.<sup>[1]</sup> The first case in our country was reported in mid-March, and the pandemic process started to be managed by taking measures by the Ministry of Health after that date. One of the most important steps among these measures is the use of personal protective equipment (PPE) to protect health-care personnel from contamination. The long-term use of this equipment causes some disturbing results on the person using it.<sup>[2]</sup> Headache caused by PPE was reported with a rate of 37% in the SARS epidemic, especially due to the use of N95 mask and protective goggles.<sup>[3]</sup> It has been known for many years that anxiety, stress, and lifestyle changes are also etiological factors in different types of headache.<sup>[4]</sup>

In this study, the factors, which might cause the headache experienced by health-care professionals who took charge in the COVID-19 pandemic during the pandemic process, especially the share of the negative impact of PPE use and the pandemic process on lifestyle, and the characteristics of the pain, were investigated. We anticipate that the results of the study will contribute to the measures to be taken to reduce the headache frequency experienced by health-care personnel during the pandemic period and to the treatment process.

## Material and Methods

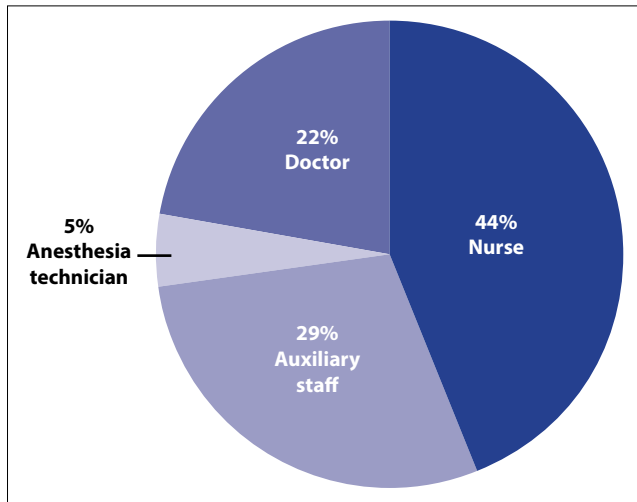
The study was carried out on a monocentric basis in Necmettin Erbakan University Meram Medical Faculty Hospital in line with the principles stated in the Declaration of Helsinki, with the approval of the local ethics committee (Decision No: 2020-2674). The population of the study consisted of the health-care professionals working in the COVID-19 pandemic. The questionnaire forms were introduced to all participants, the participants were informed about the purpose of the study, and their approvals were obtained. The study was carried out on a voluntary basis. The questionnaire

form consisted of 40 questions prepared in accordance with the purpose and scope of the study. Sixteen closed-ended questions, four open-ended questions, and 20 multiple-choice questions were asked. Demographic information of the participants, the presence of contact of the healthcare personnel with the COVID-19 patient, which PPE and how often the participants used, the presence of chronic disease of participants, the effect of the lifestyle of participants and pandemic process on their lifestyle, the presence of visual defects of the participants and the effect of PPE on using goggles, the water consumption of the participants and the effect of the pandemic process on consumption, the presence of *de novo* headache that occurred before the pandemic process or that occurred during the pandemic process and the factors that may affect this pain, the characteristics of the headache experienced by the participants during the pandemic process, and the factors that reduce pain were questioned with the forms.

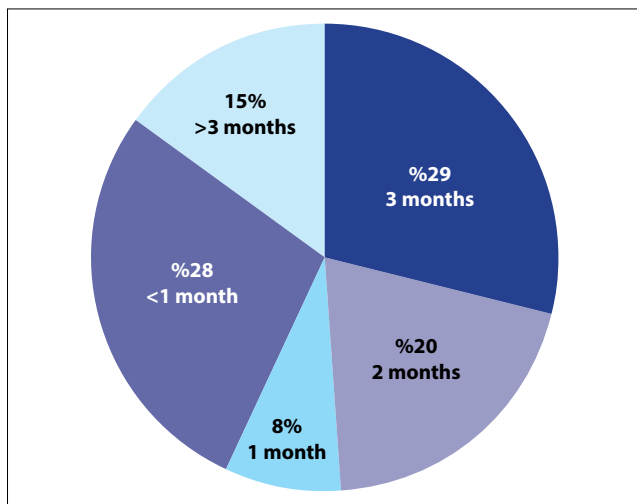
Descriptive analysis (percentage, mean±standard deviation) was performed for all data using the SPSS 21.0 program. The Chi-square test was used to evaluate the effects of different variables on headache.  $p < 0.05$  was considered statistically significant.

## Results

In the period that the study was carried out, questionnaires were distributed to 177 people who agreed to participate in the study from 300 health-care personnel who took charge in the COVID-19 pandemic. About 59% of the study population was reached. Missing data were not detected in the questionnaire forms and all of them were put into statistical evaluation. One hundred and three (58.2%) of the participants were male and 74 (41.8%) were female. The occupational distribution of the participants, whose average age is  $32.38 \pm 7.36$ , is given in Figure 1. Thirty-five (19.8%) of the participants were working in the intensive care unit, 68 (38.4%) in the operating room, 26 (14.7%) in the emergency service, and 48 (27.1%) in other services. All of the participants had contact with COVID-19-positive or suspected patients, and all of them used PPE in their departments. The duration that the participants worked in the area with COVID-19-positive or suspected patient care is given in Figure 2.



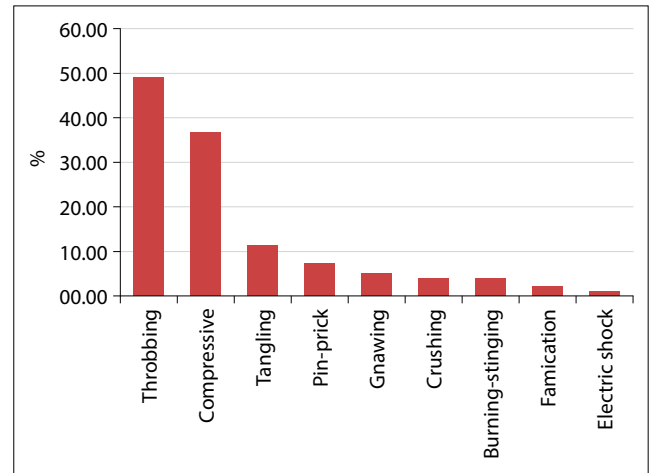
**Figure 1.** Occupational distribution of the participants.



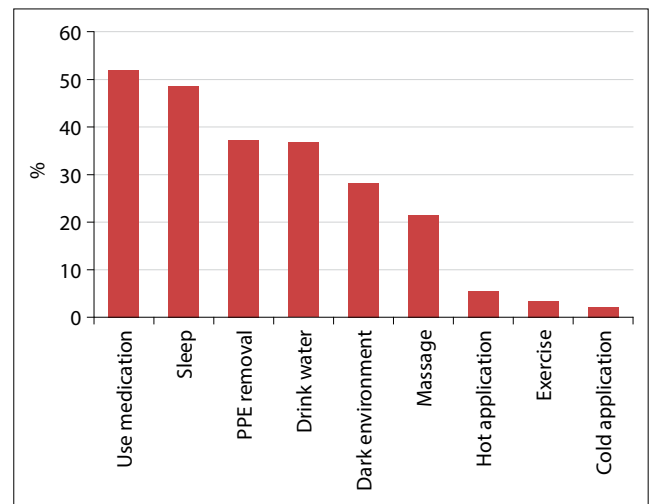
**Figure 2.** Working duration of participants in COVID services.

One hundred and forty-one (79.7%) of the participants gave the answer (mask, gloves, protective goggles, face shield, and protective coveralls) to the question of which PPE they use. To the question of “What type of mask did you use?” 15 (8.5%) of the participants answered only surgical mask, 40 (22.6%) N95 or FFP2 equivalent mask, and 122 (68.9%) both. Frequency of PPE use of participants is given in Table 1.

Considering the health backgrounds of the participants, 29 (16.4%) had a history of chronic disease. The most common accompanying chronic disease was asthma with 9 (5.1%). Seventy-four (41.8%) of the participants had a visual defect and 61 (34.4%) were wearing goggles. Whereas 35 (19.8%) of the goggles wearers wore their goggles that they use due to their visual defects while wearing PPE, 26 (14.7%) of them did not wear.



**Figure 3.** The characteristics of the headache experienced during the pandemic process.



**Figure 4.** Factors reducing headache of the participants.

When the lifestyle of the participants was questioned, it was determined that 66 (37.3%) of participants smoke, 8 (4.5%) of them use alcohol, that 17 (9.6%) of them consume daily water <1 L, 97 (54.8%) of them 1–2 L, 53 (29.9%) of them 2–3 L, and 10 (5.7%) of them more than 3 L. It was determined that the daily water consumption of 111 (62.7%) increased, 32 (18.1%) of them decreased and 34 (19.2%) of them did not change during the days they used PPE. The effects of the pandemic period on the lifestyle of the participants are given in Table 2.

Fifty-five (31.1%) of the participants answered yes to the question of “Did you have a headache before the pandemic period?” 122 (68.9%) answered no. Fifty (28.2%) of those, who had headaches before the pandemic, stated that the frequency and severity of pain increased during the pandemic. Sixty-six (37.3%) of the participants answered that they ex-

**Table 1.** Frequency of PPE use of participants

Frequency of use	Mask		Goggles and/ or face shield		Mask+goggles and/ or face shield+coverall	
	n	%	n	%	n	%
Daily						
I did not use	–	–	4	2.3	35	19.8
<1 h	2	1.1	13	7.3	11	6.2
1–4 h	9	5.1	65	36.7	33	18.6
>4 h	166	93.8	95	53.7	98	55.4
Monthly						
I did not use	–	–	12	6.8	40	22.6
1–6 days	17	9.6	43	24.2	54	30.5
7–14 days	28	15.8	64	36.2	39	22
>15 days	132	74.6	58	32.8	44	24.9

PPE: Personal protective equipment.

**Table 2.** The lifestyle of the participants and the effects of the pandemic period

Answer	Smoking		Alcohol use		Disruption in sleep pattern		Increase in stress and anxiety		Capability to do sports and exercise	
	n	%	n	%	n	%	n	%	n	%
Yes	66	37.3	8	72.3	128	72.3	147	83.1	33	18.6
No	111	62.7	169	95.5	49	27.7	30	16.9	144	81.4

perienced *de novo* headaches during the pandemic period. The reasons to which the participants, who have *de novo* headache or who have an increase in the frequency and severity of the existing headache, attribute this situation, are given in Table 3.

When the characteristics of the pain of 116 (65.5%) participants, who experienced headache during the pandemic process, were questioned, 74 (41.8%) participants answered that they had bilateral pain, 30 (16.9%) of them that they had pain accompanied by nausea and/or vomiting, 67 (37.9%) of them that they had sensitivity to light and/or sound, 71 (40.1%) of them that they had pain for 1–4 h, 27(15.3%) for 4–24 h, 11 (6.2%) <1 h, and 7 (4%) more than 24 h. When the characteristics of the pain were questioned, 87 (49.2%) participants answered that it was “throbbing.” The characteristics of the headache experienced by the participants are given in Figure 3. When the participants were asked to evaluate the severity of their headache over 10 points, 19 (10.7%) answered as 4

and below, 97 (54.8%) answered as 5 and above. Ninety-one (52%) participants answered yes to the question of “Did you take medication for your headache?” The medication takers answered that 44 (24.1%) of them used nonsteroidal anti-inflammatory, (NSAI) 30 (16.9%) of them used paracetamol, and 17 (9.6%) of them used both. When the factors reducing headache experienced during the pandemic process were questioned, 91 (52%) of participants answered as taking medication and 86 (48.6%) as sleeping (Fig. 4).

When the effects of the duration of use of PPE, the working duration in the COVID service, the presence of visual defects, and the change in daily water consumption on the emergence of *de novo* headache during the pandemic process and on the increase in the severity of the existing headache were examined, it was found that only the use of masks for more than 4 h per day and the combined use of masks + goggles/face shield + overalls for <15 days were statistically significant ( $p=0.040$ – $p=0.018$ ) (Table 4).

**Table 3.** Factors causing increase in headache frequency and severity

Factors that the participants think as having an effect on headache	Those who have headache before the pandemic period		Those who have <i>de novo</i> headache during pandemic period	
	n	%	n	%
Less cigarette consumption	7	4	8	4.5
Less alcohol consumption	1	0.6	2	1.1
Less water consumption	20	11.3	25	14.1
Less tea and coffee consumption	10	5.6	14	7.9
Disruption in sleep patterns	40	22.6	43	24.3
Excessive sweating due to PPE	43	24.3	42	23.7
The fact that wearing PPE makes it hard to see	2	1.1	33	18.6
The fact that wearing PPE makes it difficult for me to breathe	37	20.9	50	28.2
Stress experienced with fear of infection	28	15.8	39	22
Stress experienced due to curfew	18	10.2	25	14.1
Stress experienced by family members	15	8.5	22	12.4

PPE: Personal protective equipment.

**Table 4.** The effect of PPE usage frequency, working duration in COVID service, presence of visual defects, and change in daily water consumption on new and old headaches

Different variables that might have an effect on headache	<i>De novo</i> headache (n)	p	Old headache (n)	p
Working duration in the COVID service <3 months	56	0.977	45	0.494
Working duration in the COVID service > 3 months	10		5	
Daily mask wearing duration <4 h	4	0.5	1	0.04
Daily mask wearing duration >4 h	62		49	
Monthly mask wearing duration <15 days	15	0.525	14	0.573
Monthly mask wearing duration >15 days	51		36	
Daily goggles and/or face shield wearing duration <4 h	32	0.657	22	0.300
Daily goggles and/or face shield wearing duration >4 h	34		28	
Monthly goggles and/or face shield wearing duration <15 days	41	0.264	35	0.645
Monthly goggles and/or face shield wearing duration >15 days	25		15	
Daily mask+goggles/face shield+coverall wearing duration <4 h	29	0.886	18	0.56
Daily mask+goggles/face shield+coverall wearing duration >4 h	37		32	
Monthly mask+goggles/face shield+coverall wearing duration <15 days	43	0.018	39	0.366
Monthly mask+goggles/face shield+coverall wearing duration >15 days	23		11	
Having visual defects	40	0.616	27	0.550
Having no visual defects	26		23	
Daily water consumption increased	40	0.430	34	0.447
Daily water consumption decreased	15		11	
No change in daily water consumption	11		5	

PPE: Personal protective equipment.

## Discussion

The world met the COVID-19 disease that emerged in Wuhan, China, in late December 2019. Since then,

humanity has been struggling with a pandemic, which is impossible to predict its termination. Undoubtedly, health-care professionals are at the fore-

front of this struggle. COVID-19 disease is a viral infectious disease transmitted by the SARS-Cov-2 virus and has many different clinical presentations. Studies investigating how the disease spreads have shown that it is transmitted by droplets, and it is emphasized that especially the use of masks and distance are important in protection.<sup>[5]</sup> However, it is not possible for the health personnel working in the frontline to approach the patient with distance. For this reason, the importance of PPE usage increases even more. As in the COVID-19 pandemic, the use of PPE is recommended during the care of patients with highly infectious diseases.<sup>[6]</sup> Studies have been conducted to investigate the side effects of long-term use of PPE during epidemic diseases such as SARS and MERS, and side effects such as headache and skin reactions that adversely affect working performance have been determined.<sup>[3,7]</sup> Our aim in this study is to determine the factors that cause headaches experienced by health-care professionals in the COVID-19 pandemic.

Long-term use of masks causes side effects such as headache, difficulty in breathing, skin problems, visual and hearing difficulties, and impaired thermal balance. The etiopathogenesis of headache caused by the use of masks has not been fully clarified. Two important factors are emphasized in etiopathogenesis. The first is the formation of hypoxia and hypercapnia and the other is external compression due to the use of PPE. In addition to these, insomnia, irregular eating, and emotional stress are accepted as etiological factors of headache experienced during the pandemic period.<sup>[3,8]</sup>

In a study investigating the effect of PPE use on *de novo* and existing headaches on 158 health care workers in Singapore, it was found that *de novo* headache developed in 81% of the participants.<sup>[8]</sup> In the same study, the use of combined goggles and masks for more than 4 h a day was associated with the development of *de novo* headache and an increase in existing headache. All participants described their headaches bilaterally, and 87% reported a feeling of pressure and heaviness where the mask and goggles touched. About 72% of those who experienced headaches rated their pain as mild. About 31% of the participants used analgesics and preferred paracetamol firstly and NSAID

medicines secondly. Migraine-like symptoms such as nausea/vomiting, photophobia, phonophobia, and movement sensitivity were observed in one quarter of the participants. About 53% of the participants indicated the use of PPE as a possible cause of headache. They attributed headaches to not only the use of PPE but also to cause that could disrupt internal and external hemostasis, such as insomnia, physical and emotional stress, irregular eating, and insufficient hydration caused by working conditions in the pandemic. These causes are also among the triggers of migraine.<sup>[9]</sup> In a similar survey study with 343 participants, 91.5% of the participants reported one or more side effects due to mask use, and the highest reported side effect was headache. About 71.4% of the participants in this survey did not have a known headache. In most of those, who had headache complaints, after the mask was removed, the pain complaint disappeared, while 28% of them received medical treatment. In addition, the participants of the survey stated that they made applications of frequent shift changes, neck massage at intervals, and hydration increase before the shift to prevent headache.<sup>[10]</sup> In our study, 116 (65.5%) participants experienced headaches during the pandemic period. Fifty (28.2%) of the participants had previous headache complaints, and 66 (37.3%) of them experienced *de novo* headaches. The majority of headaches were reported as throbbing, bilateral, and 5 or over. It often lasted for 1–4 h, 67 (37.9%) were accompanied by light and sound sensitivity, 30 (16.9%) were accompanied by migraine symptoms such as nausea and vomiting. Ninety-one (52%) of those who experienced headache used medication. The first-choice medication was NSAID and the second preferred was paracetamol. In our study, the participants reported that medication usage, sleeping, PPE removal, drinking water, and being in a dark environment were most beneficial for headaches. Possible causes of headache are excessive sweating and difficulty in breathing due to the use of PPE, as well as disruption in sleep patterns, reduction in water consumption, and factors that cause stress. In fact, 111 (62.7%) of the participants in the study reported an increase in water consumption when they wore PPE, but among the possible causes of headache, they reported the decrease in water consumption among the most

common possible reasons. This is an indication that PPE use causes serious fluid loss, and it should not be overlooked that not only mechanical factors such as external compression but also dehydration may be an important factor in the etiopathogenesis of headache associated with PPE use, and care should be taken to ensure adequate hydration of health-care personnel while working in COVID services to prevent headache.

Ramirez-Moreno et al.<sup>[11]</sup> carried out a study on 306 people to show whether there is a relationship between the appearance of *de novo* headache and the mask type and duration of use or not, and the effect of this headache on health care workers. *De novo* headache was detected in 52% of the participants. About 41% of those, who experienced headaches, had headaches such as migraine or tension type. Those who experienced headaches experienced an average of 12 days pain in a month, and their mean VAS score was also 6. In this study, the biggest complaint was the decrease in working concentration with the effect of headache. In addition, female gender, smoking, use of masks, age, shift duration, and anxiety have been identified as independent risk factors for the development of "*de novo*" headache. In our study, we examined the causes that could be independent risk factors such as the duration of PPE use, hydration status, and accompanying visual defect. We determined that the use of masks longer than 4 h increased the severity and frequency of the old existing headache, and the use of combined PPE for <15 days in 1 month was effective in the development of *de novo* headache. As we mentioned in the limitations, the fact that reaching 59% of the study population may have prevented us from determining the risk factors. We attribute the development of *de novo* headache in combined PPE use for <15 days to the fact that dehydration may be higher in combined PPE use, and the inability of metabolism of health-care professionals to compensate for this situation in this short time. It cannot be expected that while using PPE, the health-care professionals work as long and efficiently as before the pandemic period. It is also a necessity to continue using PPE in this process. Therefore, one of the easiest solutions in the short term to reduce the side effects of PPE use seems to be arrangement of working durations.

It has also been shown that the use of PPE causes problems with vision. In the study conducted by Biçen and Ertürk, it was found that as the duration increases, complaints such as haze, inability to see clearly, and pain behind the eyes increased both in the use of surgical masks and in the use of FFP2.<sup>[12]</sup> In the study conducted by Zuo et al.,<sup>[13]</sup> problems with vision were found in 6% of the participants, regardless of the type of mask used and the duration. In a study in which PPE ergonomics were questioned, it was found that the adaptation problem, which was 34% in protective goggles, increased to 62% in prescribed goggle wearers.<sup>[14]</sup> In our study, 61 (34.4%) of the participants were wearing goggles due to visual defects. Only 26 (14.7%) of these participants did not use these goggles while using PPE. As a matter of fact, the participants who developed *de novo* headache stated that among the possible reasons, the use of PPE makes it difficult to see, with a rate of 18.6%. To solve problems related to vision, masks with improved ergonomics are needed for use with goggles. Until reaching such masks, the most viable solution for now seems to be shortening the usage durations.

Although the headache associated with the use of PPE is a fact, the anxiety, depression, and personal characteristics of health-care professionals, who are in an extremely stressful work environment, should not be ignored, especially during the pandemic period, and studies should be carried out accordingly. There may be a misleading relationship between headache experienced in a work environment with such negative external stimuli and the use of PPE.<sup>[15]</sup> Many recent studies have shown that the pandemic process significantly leads to depression, anxiety, and post-traumatic stress disorder in health care workers.<sup>[16]</sup> Many factors such as the prevalence of infection among health-care personnel, excessive workload, and excessive working hours have been shown as the causes of negative psychological consequences in health care workers during pandemic periods. Significant stress, anxiety, depression, and insomnia are also observed in health care workers in charge of the COVID-19 pandemic.<sup>[17]</sup> In our study, 147 (83.1%) of the participants reported an increase in their stress and anxiety, and 128 (72.3%) of them reported that their sleep patterns were disrupted. Apart from the stress caused by all these heavy working conditions,

the concern of infecting their families is also an important stress factor for health-care professionals. The way to prevent this is social distance. However, it is a fact that social distancing deprives the individual of an important buffer against stress in such times.<sup>[18]</sup> Many countries, including our country, apply some restrictions in social life to control viral transmission during the pandemic process. Although social isolation practices such as reducing mobility, closing many businesses and schools, and working at home instead of offices are very effective in preventing the spread of infection, they negatively affect people's mental health.<sup>[19]</sup> As a matter of fact, 144 (81.4%) of the participants stated that they could not do sports and exercise. In addition, they reported the negative effects of the stress they experienced due to restrictions and the stress experienced by other members of the family are among the possible causes of their headache. In these days when we cannot predict how long the pandemic process will continue, we think that it is necessary to carry out studies to improve the mental and social lives of health-care professionals.

In addition to all these, it should be kept in mind that one of the common non-respiratory symptoms of COVID-19 is headache. In the study investigating the spectrum of headache caused by COVID-19 in health-care professionals, 74% of the participants did not have a history of primary headache. Researchers found in this study that infection could trigger headache in those who do not have frequent headaches.<sup>[20]</sup> For this reason, headache should not be considered solely as a result of PPE use or stress, and COVID-19 infection should definitely be investigated in new-onset persistent headache, especially for health-care professionals working in a high-risk group for infection.<sup>[21]</sup>

Our study had some limitations. First, only 59% of the study population was reached. This low rate may have prevented from reaching statistically significant results. Conducting the survey study under heavy working conditions during working hours may have affected the answers given to the survey questions. The effect of physical conditions such as temperature and humidity of the working environment was not questioned. Not questioning when headache started after wearing PPE and when it passed after removal, and not questioning the number of epi-

sodes of pain is also a limitation. Whether the used N95 mask has an exhalation valve or not may also be effective on headache. Therefore, not questioning the existence of the valve and not questioning the relationship between the experienced headache and the COVID-19 infection are other limitations.

## Conclusion

As a result, a substantial portion of health care workers struggling at the forefront of the pandemic process experiences headaches. In addition to the physical difficulties caused by the use of PPE on the development of headache, the effect of stress, anxiety, sleep disorders, and restrictions caused by the pandemic process should not be overlooked. We believe that more comfortable working conditions can be provided to health-care professionals with solutions such as reorganization of working hours, and more comprehensive studies should be carried out on the health problems and underlying causes experienced by health-care professionals during the pandemic process.

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**Peer-review: Externally peer-reviewed.**

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