



UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

FACULTAD DE MEDICINA

DIVISIÓN DE ESTUDIOS DE POSGRADO

Instituto Nacional de Ciencias Médicas y Nutrición “Salvador Zubirán”

Departamento de Neurología y Psiquiatría

Cefalea asociada a uso de equipo de protección personal en trabajadores de la salud que atienden a pacientes con COVID-19.

TESIS

PARA OBTENER EL TÍTULO DE

ESPECIALISTA EN NEUROLOGÍA

Alumno: Rogelio Dominguez Moreno.

Asesor de Tesis: Carlos Gerardo Cantú Brito.

Ciudad de México, México, Diciembre 2020.



Universidad Nacional
Autónoma de México

Dirección General de Bibliotecas de la UNAM

Biblioteca Central



UNAM – Dirección General de Bibliotecas
Tesis Digitales
Restricciones de uso

DERECHOS RESERVADOS ©
PROHIBIDA SU REPRODUCCIÓN TOTAL O PARCIAL

Todo el material contenido en esta tesis esta protegido por la Ley Federal del Derecho de Autor (LFDA) de los Estados Unidos Mexicanos (México).

El uso de imágenes, fragmentos de videos, y demás material que sea objeto de protección de los derechos de autor, será exclusivamente para fines educativos e informativos y deberá citar la fuente donde la obtuvo mencionando el autor o autores. Cualquier uso distinto como el lucro, reproducción, edición o modificación, será perseguido y sancionado por el respectivo titular de los Derechos de Autor.

INDICE

Título	3
Autores	3
Resumen (abstract)	3
Palabras clave	3
Autores de correspondencia	4
Introducción	5
Material y métodos	6
Resultados	7
Discusión	9
Conclusiones	11
Referencias	12
Tablas	14

Headache associated with personal protective equipment in healthcare workers during COVID-19 outbreak in a referral centre in Mexico

Authors:

Rogelio Domínguez Moreno¹, Venny Alberto Venegas Gómez^{1,2}, Luis Asdrual Zepeda-Gutiérrez^{1,2}, Juan José De La Rosa Cuevas¹, Jorge Humberto Hernández Félix¹, Edgar Omar Martos Armendariz¹, Felipe Vega Boada¹, Fernando Flores-Silva¹, Erwin Chiquete¹, Carlos Cantú Brito¹.

¹ Department of Neurology. National Institute of Medical Sciences and Nutrition "Salvador Zubirán", México.

² Department of Internal Medicine. Department of Neurology. National Institute of Medical Sciences and Nutrition "Salvador Zubirán", México.

Abstract

Background: The covid19 pandemic made it necessary to use personal protective equipment, but this has been related to a type of headache of which we do not know its characteristics, and due to the prolongation of this pandemic we require better knowledge

Methods: We developed an analytical, longitudinal, prospective observational study. In a referral centre for COVID19 in Mexico, from May 22 to June 19, 2020. We invited healthcare workers regardless of whether they had headaches to avoid selection bias and they signed informed consent to then answer an online questionnaire designed for this purpose.

Results: 268 health workers answered the questionnaire, were female 181 (67.5%), aged 28 (25-34) years, occupation nurse 177 (66%). The frequency of headache associated to PPE was 210(78.4%) and the risk factors were age (>30 years) 2.43 (1.17-5.06, p 0.018), sex (woman) 3.50 (1.76-6.98, p <0.001), occupation (other than physician) 3.40 (1.69-6.81, p <0.001) and eye protection use (>7 days) 5.40 (2.0-14.5, p <0.001) in the model 1 (headache), and age (>30 years) 2.18(1.29-3.68, p 0.003), occupation (other than physician) 2.27(1.21-4.26, p 0.011), Migraine 2.80(1.33-5.92, p 0.007) and eye protection use (\geq 2 hours) 2.37(1.20-4.67, 0.012) in the model 2 (moderate to severe headache).

Conclusion: The frequency of headache associated to PPE is high, and the moderate to severe headache and the bothersome symptoms (nauseas or vomiting) too and that could have significant repercussions. We need more epidemiological studies to improve the knowledge and try to work in modifiable risk factors (PPE) or others preventives strategies.

Key Words: Headache, Personal Protection Equipment, COVID-19, Health Careworkers, Migraine.

Corresponding Author:

Erwin Chiquete Anaya. Departamento de Neurología y Psiquiatría, Instituto Nacional de Ciencias Médicas y Nutrición “Salvador Zubirán”, México.

Correo electrónico: erwinchiquete@hotmail.com

Rogelio Domínguez Moreno. Departamento de Neurología y Psiquiatría, Instituto Nacional de Ciencias Médicas y Nutrición “Salvador Zubirán”, México.

Correo electrónico: rogelio_dm@hotmail.com

Introduction

In December 2019, a number of cases of pneumonia of unknown etiology were reported in Wuhan City, Hubei Province of China¹. The SARS-CoV-2 virus was identified as being responsible for the disease designated as COVID-19². On February 28, the first case of COVID-19 was confirmed in our country, later on March 11, 2020 the World Health Organization (WHO) declared a pandemic of this new disease⁴. Until July 2020, in Mexico there have been reports.... cases of SARS-CoV-2 and in that same month alone,...% of the total infections^[5].

As part of the strategies to decrease the risk of transmission in health workers, recommendations were established for the use of personal protective equipment (PPE) during the COVID-19⁶ pandemic. This PPE includes, among other things, eye protection and the use of n95 masks that are used throughout the workday.

Symptoms related to the use of PPE equipment can affect job performance in health workers, Rebmann et al., Evaluating the physiological effects of PPE use, found that 22% of nurses in the intensive care unit PPE had to be withdrawn due to disabling symptoms, where headache was highlighted as one of the main causes⁷. Headache caused by external physical compression is well described in the medical literature. It has been identified above all in workers who require personal protection, as in the case of the police and military, as well as it has been reported in swimmers due to the requirement of the use of goggles⁸⁻¹⁰.

The international headache society establishes as headache external compression headache that headache resulting from sustained compression or traction on pericranial soft tissues¹¹. This must occur at least two different times within the first hour of sustained compression and resolve within the first hour after removal of external compression. There are few studies that identify the frequency of headache associated with PPE in health workers. In a first report, Lim et al.¹², during the severe acute respiratory syndrome (SARS) pandemic in 2006 reported a prevalence of 37.3%. Recently, in the year 2020 during the COVID-19 pandemic, Ong et al, reported a prevalence of 81%¹³. Currently there are no reports of headache associated with PPE in the western population.

In Mexico, from the beginning of the contingency, our hospital was converted to be a national center of reference for patients with COVID-19, this conditioned the adoption of the recommendations for the use of PPE to reduce the risk of infection among workers in the Health. In the present study, our objective is to determine the prevalence of headache associated with PPE, as well as the risk factors associated with its occurrence within our population.

Methods:

The present study is of an analytical, longitudinal and prospective observational type. It was carried out in the National Institute of Medical Sciences and Nutrition "Salvador Zubirán" (INCMNSZ), in the emergency and hospitalization departments. The study was approved by the Ethics and Research Committee of the INCMNSZ on May 15, 2020 (Ref. 3395), effective from this date to May 15, 2021.

For the present study, 268 patients were selected, all of them are part of the health personnel of the National Institute of Medical Sciences and Nutrition "Salvador Zubirán", in Mexico City. The total of the selected patients met the inclusion criteria, which were: being over 18 years of age, Health personnel who have worn PPE in the last month, with/without a history of primary headache. All signed a written informed consent. Exclusion criteria were: secondary headache (known or determined during the evaluation), positive test for COVID-19 in the last 3 months, steroid use in the past 2 weeks and patients who have decided to leave the study at any time. For the sample size, due to the descriptive nature of the study, no formula was determined to calculate the sample size. All subjects meeting the inclusion criteria and in the absence of exclusion criteria were included, avoiding selection risk. To select subjects, all doctors, nurses and other health personnel who are caring for patients with COVID-19 were invited to participate (with an emphasis on including the largest number of participants and not only those with headaches, to avoid selection bias) who are working in the emergency room, intensive care, semi-critical, observation unit and hospitalization where they use the complete personal protective equipment (N95 mask and / or Goggles).

A baseline online survey was conducted between May 22, 2020 and June 24, 2020. This questionnaire represents a modified version of the HAPPE study survey, but it was decided to add more characteristics related to the presence of exacerbated primary headache, as well as on the pattern of analgesic use and an additional section on facial pain was included. The sections contemplated in this survey are: identification of the patient by sex, age, nationality, email, occupation and department of the Institute in which he works (it was decided to omit the personal name), digital consent to carry out the survey, demographic characteristics, history including clinically relevant comorbidities (diabetes mellitus, systemic arterial hypertension, hypothyroidism, hyperthyroidism, cerebrovascular disease, ischemic heart disease, anxiety, depression, smoking, and asthma), the presence of pre-existing primary headache, characteristics and changes in the pre-existing primary headache (type of primary headache, monthly frequency and changes in frequency, uncontrolled headache,

duration, intensity, exacerbating agents and type of pain), patterns of use of personal protective equipment (number of days per month and hours per day in wearing N95 mask or equivalent; type of eye protection, number of days per month and hours per day wearing eye protection; number of days per month and hours per day wearing the N95 respirator and eye protection together; presence or absence of new headache associated with PPE), characteristics of the new onset headache (associated with the use of an N95 mask, eye protection or both; time interval between PPE placement and the onset of headache; time interval between removal of PPE and resolution of symptoms; type of pain, most common location, pressure zones identified, severity of pain, associated symptoms, quality of life impairment and use of analgesics to relieve pain), presence and characteristics of facial pain.

The dependent variables were external compression headache and headache associated with PPE. The independent variables were age, sex, occupation (MD, nurse, other), work area (emergency room, ICU, hospitalization floor), comorbidities, history of primary headache, PPE wear pattern, PPE wearing time, characteristics of de novo headache, characteristics of modified primary headache, use of painkillers and characteristics of facial pain.

For statistical analysis we performed with IBM SPSS statistics version 20 software. For the initial analysis a descriptive analysis shall be made, the results shall be presented as central trend and dispersion measures according to the behaviour of each variable. The distribution of variables was analyzed using the Kolmogorov-Smirnov test. The difference between two groups was made by Student T for independent samples if the distribution of the variables is normal or Mann-Whitney U if this premise is not met, the latter will also be used for the comparison of variable distribution continuous dimensional. Analysis with logistic regression was performed to determine independent risk factors.

Results:

A total of 436 healthcare workers we invited to participate and 268 agree to fulfill the questionnaire with an overall response rate of 61.5%, of the responders the majority were female 181 (67.5%), aged 28 (25-34) years, with respect to the occupation the majority were nurse 177 (66%) followed by physician 67 (25%) and laboratory personnel 15 (5.6%), most were from intensive care unit 137 (51.1%) and hospital floor 72 (26.9%). Presence of comorbidity was reported in 57 (21.3%), pre-existing primary headache was present in 69 responders (25.7%) mainly migraine, and COVID-19 in 22 (8.2%) participants.

EPP usage patterns

The 268 healthcare workers reported different patterns according to the area of work, the number of days wearing facial mask were 8 days and 6 hours per day in the last month, the

main type of eye protection was goggles 204 (76.1%) and the 84.7% of responder reported significant increase in the frequency use of EPP.

Characteristics of headache associated to PPE

Of the total number of healthcare workers who revealed they had a headache associated with PPE (n=210), the vast majority claimed to have used mixed personal protective equipment (n=149, 71%). Regarding the time interval between the placement of the PPE and the onset of the headache, most of the participants reported starting with the headache in the first 60 minutes of use (n=128, 60.9%), data that is consistent with the definition of headache related to external compression mechanisms. Analyzing the time between removing the PPE and the resolution of symptoms, it is striking that 57.1% (n=120) resolve in the first hour, while the remaining 41.8% (n=90) resolve in the first 4 hours.

This headache, for the most part, is described as oppressive (n=130, 61.9%), predominantly frontal (n=70, 33%) or holocranial (n=52, 24.8%), with nausea or vomiting (n=63, 30%). The most important exacerbating factor recorded was stress, reported by 166 participants (79%). It is important to mention that the majority of patients with new-onset headache associated with PPE are not taking any medication to treat their symptoms (n=141, 67.1%), while 20 participants (9.5%) take premedication to prevent it from appearing this headache and 44 patients (21%) confirmed that they are already being treated for it.

Headache moderate to severe

We created three groups, without headache, with headache intensity of 6 or less and headache intensity of 6 or more in the visual analogic scale, with the purpose to define better the group with headache moderate to severe (VAS ≥ 6). The headache moderate to severe was more frequent in older 27 (25-29, CI) in mild headache vs 31 (26-31, CI) in the moderate to severe headache group (p 0.003), more frequent in nurses than the no-nurses group 22 (37.9%) vs 91(74%) (p <0.001), pre-existing primary headache 12 (13.8%) in mild headache vs 43 (35%) in moderate to severe headache group (p 0.002). The characteristics of this moderate to severe headache was intensity of 7 (6-8) vs 4 (4-5) in the mild headache group (p <0.001), the days headache per month was 10 (5-15) vs 5 (3-10) days in the mild headache group (p <0.001), the healthcare workers with headache moderate to severe reported more frequently decrease job performance in the group moderate to severe headache 65 (52.9%) vs 28 (32.2%) in the mild headache (p 0.004).

Risk factor related to headache associated to PPE

In the population with headache associated to PPE, we developed a univariable and multivariable logistic regression analysis to define the independent risk factors for this headache in two models; one for headache associated to PPE and another to moderate to severe headache associated to PPE, this last group because was frequent, with more intensity and with more reported decrease in job performance. In the multivariable analysis for headache associated to PPE (model 1) age (>30 years) 2.43 (1.17-5.06, p 0.018), sex (woman) 3.50 (1.76-6.98, p <0.001), occupation (other than physician) 3.40 (1.69-6.81, p <0.001) and eye protection use (>7 days) 5.40 (2.0-14.5, p <0.001) were associated

as independent risk factors for the development of headache and for the moderate to severe headache (model 2) the associated risk factors were: age (>30 years) 2.18(1.29-3.68, p 0.003), occupation (other than physician) 2.27(1.21-4.26, p 0.011), Migraine as pre-existing primary headache 2.80(1.33-5.92, p 0.007) and eye protection use (≥ 2 hours) 2.37(1.20-4.67, 0.012) were the independent risk factors.

Discussion

In this population-based study, PPE-associated headache in Mexican healthcare workers was a common problem. It was found in 78.4% (n = 210) of the participants, of these, just over 58.6% experienced a headache intensity greater than 6 on the visual analog scale (VAS). Our results are greater than those reported by Lim in the first SARS pandemic in 2003 where they reported headache associated to N95 mask in 37.3% of the healthcare workers, they found that the use of more than 4 hours of the N95 mask (OR = 1.85, 95% CI 0.99–3.43 p = 0.053) and previous primary headache (OR = 1.97 95% CI 1.03–3.77 p = 0.041) increased the risk of new-onset PPE headache¹². At the same our results are similar to those reported in the HAPPE study that evaluated the prevalence of new-onset headache associated with PPE in health workers during the COVID-19 pandemic in Singapore in May 2020. In this work it was found that 81% of health workers had headaches. They found that the pre-existing primary headache (OR = 4.20, 95% CI 1.48-15.40; p = 0.030) and the use of PPE for more than 4 hours a day (OR 3.91, 95% CI 1.35-11.31; p = 0.012) were the factors that were associated with the appearance of headache associated with PPE¹³. The risk factors associated to headache in our population was age (>30 years), female sex, occupation (other than physician, mainly nurses) and eye protection use (>7 days) but if we chose participant with moderate to severe headache (intensity >6 VAS) the independent risk factors were age (>30 years), occupation, migraine and eye protection use (>2 hours). These results are relevant because there is a direct relationship between the time of use of PPE, mainly the use of eye protection (in days for headache and in hours for patients who suffer migraine) and the development of headache, that had not been previously identified, it makes sense when compared the prevalence of headache due to PPE (37.3%) vs the actual reports 81% (HAPPE) and this study (78.4%) where use of Goggles was more used and reported, that had a neurobiological explanation because the pressure over nerves and muscles relevant in headaches and facial pain. In contrast to what was observed in previous studies, our results showed that female sex, age older than 30 years, and occupation other than a doctor were associated with a higher risk of developing headache, this had not been identified in the literature.

The first descriptions of compression headache were found with the use of swimming goggles, curiously described by neurologists who were affected^{14,15}. Part of the mechanisms that may be involved in the pathophysiology of this entity is the direct compression of the

nerves that are located in the area where the EPP is placed¹⁶, although hypoxia and hypercapnia have also been proposed as probable triggers. The nerves located in the EPP pressure sites that may be more frequently involved due to their anatomical location are the terminal branches of the trigeminal nerve (supraorbital, supratrochlear, nasociliary, nasociliary nerve) and of the cervical nerves (greater occipital and lesser occipital nerves, Branch of C2 root).

The most important characteristics of the new-onset headache associated with PPE we found that the most common presentation was frontal and holocraneal location and of an oppressive nature around the 60% that reminds type tensional headache. But, nausea and vomiting were the most frequent associated symptoms, found in 30% of the participants, as well as symptoms such as photophobia and sonophobia that reminds migraine or nerve mediated headache, as is reported in occipital neuralgia.

Women reported greater frequency and severity of headache than men. Progesterone and estrogens have been seen to have a direct effect on neurotransmission systems, directly intervening in the pathophysiology of some primary headaches¹⁷⁻¹⁹, this could be an important factor that explains that women had a higher prevalence of headache in Our results, however, it is important to note that about 67% of our study population were women.

The International Headache Society (IHS) establishes the diagnostic criteria for external compression headache¹¹. It is noteworthy that in our study we found that of the patients who presented compression headache associated with PPE, 39% of the participants presented it after one hour of PPE placement and up to 41% persisted beyond the hour of the PPE. Withdrawal of the stimulus, leaving the time limits established in the diagnostic criteria. This differs from the HAPPE study where the diagnostic criteria for external compression headache were met in more than 80% of the individuals studied¹³. More epidemiological studies will be required to establish with greater precision the time cutoff of the diagnostic criteria.

We recognize some limitations of our study. First, we do not periodically perform nasopharyngeal swab tests at the time and after having applied the survey, so positive personnel for COVID could have been included and therefore, this is the cause of their reported headache, but we compare the frequency of COVID19 positives healthcare workers and were not difference in the group without headache, with headache <6 and headache >6 in VAS. Second, given that the data was collected through the application of surveys, the

recall bias may be presented when informing the participants about the presence or absence of symptoms in previous days.

Conclusion

The frequency of headache associated to PPE is high, and the moderate to severe headache and the bothersome symptoms (nauseas or vomiting) too and that could have significant repercussions on job performance, quality of life and disability in short and long time, specially if the outbreak continues. We need more epidemiological studies to improve the knowledge of this headache but we must try to work in modifiable risk factors (PPE).

References:

- 1.- World Health Organization. Coronavirus disease 2019 (COVID-19): situation report—1. January 20, 2020. January 21, 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200121-sitrep-1-2019-ncov.pdf?sfvrsn=20a99c10_4.
- 2.- Zhu N, Zhang D, Wang W, et al; China Novel Coronavirus Investigating and Research Team. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med*. 2020;382(8):727-733.
- 3.- Dirección General de Epidemiología. Aviso Epidemiológico Enfermedad COVID-19 por SARS-CoV-2. <https://www.gob.mx/salud/documentos/aviso-epidemiologico-casos-de-infeccion-respiratoria-asociados-a-nuevo-coronavirus-2019-ncov>.
- 4.- World Health Organization. Coronavirus disease 2019 (COVID-19): situation report—51. March 21,2020. March 21,2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200311-sitrep-51-covid-19.pdf?sfvrsn=1ba62e57_10.
- 5.- Unidad de Inteligencia Epidemiológica y Sanitaria. Comunicado Técnico Diario COVID-19. <https://www.gob.mx/salud/documentos/coronavirus-covid-19-comunicado-tecnico-diario-238449>.
- 6.- Centers for Disease Control and Prevention (CDC). Using Personal Protective Equipment (PPE). <https://www.cdc.gov/coronavirus/2019-ncov/hcp/using-ppe.html>.
- 7.- Rebmann T, Carrico R, Wang J. Physiologic and other effects and compliance with long-term respirator use among medical intensive care unit nurses. *Am J Infect Control*. 2013;41(12):1218-1223.
- 8.- Rahmani Z, Kochanek A, Astrup JJ, Poulsen JN, Gazerani P. Helmet-induced headache among Danish military personnel. *Scand J Public Health*. 2017;45(8):818-823.
- 9.- Krymchantowski A, Barbosa JS, Cvaigman M, et al. Helmet-related, external compression headache among police officers in Rio de Janeiro. *MedGenMed*. 2004; **6**: 45.
- 10.- O'Brien JC Jr. Swimmer's headache, or supraorbital neuralgia. *Proc (Bayl Univ Med Cent)*. 2004; **17**: 418- 419.
- 11.- Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition. Cephalalgia 2018;38:1-211.

- 12.- Lim EC, Seet RC, Lee KH, et al. Headaches and the N95 face-mask amongst healthcare providers. Acta Neurol Scand. 2006;113:199-202.
- 13.- Ong JJY, Bharatendu C, Goh Y, et al. Headaches Associated With Personal Protective Equipment - A Cross-Sectional Study Among Frontline Healthcare Workers During COVID-19. *Headache*. 2020;60(5):864-877.
- 14.- Jacobson RI. More "goggle headache": supraorbital neuralgia. *N Engl J Med* 1983; 308: 13.
- 15.- Pestronk A, Pestronk S. Goggle migraine. *N Engl J Med* 1983;308:226– 227.
- 16.- Lance J, Goadsby PJ: Miscellaneous headaches unassociated with a structural lesion. In *The Headaches*, edn 2. Edited by Olesen J, Tfelt-Hansen P, Welch KM. Philadelphia: Lippincott Williams & Wilkins; 2000:752–753.
- 17.- Bethea CL, Lu NZ, Gundlach C, Streicher JM. Diverse actions of ovarian steroids in the serotonin neural system. *Front Neuroendocrinol*. 2002;23:41- 100.
- 18.- Herbison AE, Simonian SX, Thanky NR, Bicknell RJ. Oestrogen modulation of noradrenaline neurotransmission. *Novartis Found Symp*. 2000;230:74-85; discussion 85–93.
- 19.- Silberstein S, Merriam G. Sex hormones and headache 1999 (menstrual migraine). *Neurology*. 1999;53(4 suppl 1):S3-S13.

Table 1.- Characteristics of healthcare workers attending patients with COVID19.

Characteristics	Frecuency
	N=268
Headache associated to PPE, n (%)	210 (78.4)
Female gender (female), n (%)	181 (67.5)
Age, median (CI), years	28 (25-34)
Occupation, n (%)	
-Nurse	177 (66)
-Physycian	67 (25)
-Laboratory Personnel	15 (5.6)
-Cleaning Staff	4 (1.5)
-Other	5 (1.9)
Department, n (%)	
-Intensive care unit	137 (51.1)
-Hospitalization	72 (26.9)
-Emergency room	55 (20.5)
-Other	4(1.5)
Comorbidities, n (%)	57 (21.3)
-Smoking	18 (6.7)
-Anxiety	12 (4.5)
-Depression	2 (0.7)
-Asthma	5 (1.9)
-Hyperthyroidism	5 (1.9)
-Hypertension	1 (0.4)
-Diabetes mellitus	1 (0.4)

-Not specified	13 (4.9)
Primary headache, n (%)	69 (25.7)
-Migraine	50 (58)
*With aura	21 (27.5)
*Without aura	19 (30.5)
-Type tensional	29 (42)
COVID19	22 (8.2)

Table 2.- PPE usage patterns amongst healthcare workers attending COVID19.

Characteristics	Healthcare workers N=268
Facial mask usage	
-Number of days wearing facial mask (N95 or KN95) in the last 30 days; median (IQR)	8 (7-16)
-Number of hours per day wearing facial mask; median (IQR)	6 (5-8)
Eye protection usage	
-Number of days wearing eye protection in the last 30 days; median (IQR)	20 (10-24)
-Number of hours per day wearing eye protection; median (IQR)	6 (5-7)
Type of eye protection, n (%)	
-Goggles	204 (76.1)
-Face shield	25 (9.3)
-Eyeglasses	11 (4.1)
-Complete adapted visor	28 (10.4)
Combination facial mask & Eye protection usage	
-Number of days wearing in combination in the last 30 days; median (IQR)	15.5 (9-22)
-Number of hours per day wearing in combination; median (IQR)	6 (5-7)
Change in the frequency of PPE usage since the COVID-19 outbreak, n (%)	
-Significant increase in frequency	227 (84.7)
-Slight increase in frequency	16 (6)

-No change in frequency.	23 (8.6)
-Significant decrease in frequency	1 (0.4)
-Slight decrease in frequency	1 (0.4)

Table 3.- Characteristics of headache associated to PPE in 210 participants

Characteristic	Frecuency
	N=210
Related to, n (%)	
-Goggles	48 (22.9)
-Facial mask (N95 or KN95)	13 (6.1)
-Both	149 (71)
Time interval between wearing PPE to onset of headache, n (%)	
-<15 min	11 (5.2)
-15-30 min	33 (15.7)
-30-45 min	40 (19)
-45-60 min	44 (21)
-1-4 hrs	79 (37.6)
->4 hrs	3 (1.4)
Time interval from removal of PPE to resolution of headache, n (%)	
-<15 min	18 (8.6)
-15-30 min	33 (15.7)
-30-45 min	33 (15.7)
-45-60 min	36 (17.1)
-1-4 hrs	80 (38.1)
->4 hrs	10 (3.7)
Quality of headache, n (%)	
-Throbbing	30 (14.3)

-Stabbing	50 (23.8)
-Pressure	130 (61.9)
Localization, n (%)	
-Frontal	70 (33.)
-Holocraneal	52 (24.8)
-Pressure sites	39 (18.6)
-Parietotemporal	35 (16.7)
-Occipital	13 (6.2)
-Central	1 (0.5)
Intensity in VAS, median (IQR)	6 (5-7)
Month headache days, median (IQR)	7 (4.7-15)
Months with headache, median (IQR)	2 (1-2)
Analgesic usage, n (%)	
-none	141 (67.1)
-yes, preventive for headache	20 (9.5)
-yes, as treatment for headache	44 (21)
-yes, for other different of headache	5 (2.4)
Analgesic monthly usage, median (IQR)	2 (2-5)
Associated symptom during headache attack, n(%)	
-nausea/vomitting	63 (30)
-none	36 (17.1)
-neck pain	36 (17.1)
-light sensitivity	27 (12.9)
-disability	24 (11.4)

-sound sensitivity	15 (7.1)
-exacerbated with exercise	9 (4.3)
Exacerbating factors associated, n (%)	
-Stress	166 (79)
-Insomnia	28 (13.3)
-Anxiety	26 (12.4)
-Irregular meal times	39 (18.6)
-Insufficient hydration	22 (10.5)
Work affecting, n (%)	
-none	117 (55.7)
-mild	81 (38.6)
-severe	12 (5.7)
Facial pain associated with headache, n (%)	151 (71.9)
Quality of facial pain, n (%)	
-Pressure	112 (74.2)
-Stabbing	32 (21.2)
-Electric	5 (3.3)
-Other	2 (1.3)
Duration of facial pain, n (%)	
-<15 mins	18 (11.9)
-15-30 mins	28 (18.5)
-30-45 mins	25 (16.6)
-45-60 mins	34 (22.5)
-1-4 hrs	43 (28.5)
->4 hrs	3 (2)

Outcome of facial pain, n (%)	
-Resolution	119 (78.8)
-Need of analgesic usage	20 (13.2)
-Constant	12 (8)

Table 4.- Characteristics of Headache according to severity (Attacks with intensity> 6)

Variable	Without headache n= 58	Headache intensity < 6 n= 87	Headache intensity > 6 n= 123	P value
Age (years)	27 (25-29)	27 (25-35)	31 (26-37)	0.003
Female gender n(%)	23 (39.7)	72 (82.8%)	86 (69.9%)	<0.001
Nurse n(%)	22 (37.9)	64 (73.6)	91 (74)	<0.001
Comorbidities n(%)	9 (15.5)	15 (17.2)	33 (26.8)	0.119
Previous COVID-19 diagnosis n(%)	5 (8.6)	7 (8)	10 (8.1)	0.991
Pre-existing primary headache diagnosis (%)	14 (24.1)	12 (13.8)	43 (35)	0.002
Pre-existing primary headache intensity	5.5 (5-8.25)	4 (2-5)	6 (4-7)	0.096
Current intensity	5 (4-7.5)	5 (4-7)	7 (6-8)	0.009
Hours/day facial mask usage	6 (4-10)	5 (4-7)	6 (5-7)	0.350
Days/month eye protection usage	9.5 (6.7-20)	20 (12-23)	20 (13-26)	<0.001
Hours/day eye protection usage	5.5 (4-8)	5 (5-7)	6 (5-8)	0.200
Days/month combined facial mask & eye protection usage	10 (6.7-20.5)	20 (12-22)	18 (10-23)	0.001
Hours/day combined facial mask & eye protection usage	5.5 (4-8)	5 (5-7)	6 (5-7)	0.463
Headache intensity associated to PPE		4 (4-5)	7 (6-8)	<0.001
Days/month headache associated to PPE		5 (3-10)	10 (5-15)	<0.001
Months headache associated to PPE		1 (1-2)	2 (1-3)	0.007

Days/month PPE-associated headache medication	1 (0-3)	3 (0-7)	0.003
Resolution time > 1 hour n(%)	30 (34.5)	60 (48.8)	0.039
Headache present >15 days per month n(%)	12 (13.8)	42 (34.1)	0.001
Facial pain n(%)	59 (67.8)	91 (74)	0.425
No usage of analgesics prior usage to PPE n(%)	63 (72.4)	78 (63.3)	0.014
Decreased job performance n(%)	28 (32.2)	65 (52.9)	0.004

Table 5.- Univariate logistic regression analysis of factors associated to headaches associated to PPE (n=210)

Variable	Odds ratio (95% CI)*	p value
Age (>30 y)	2.45 (1.13-5.27)	0.023
Sex (woman)	3.62 (1.78-7.35)	<0.001
Occupation (other than physician)	3.65 (1.68-7.95)	<0.001
Comorbidity	1.87 (0.74-4.73)	0.187
Primary headache	0.93 (0.19-4.63)	0.934
Stress	1.05 (0.18-6.03)	0.957
N95 use (>4 h)	0.89 (0.15-5.16)	0.896
Eye protection use (>2 h)	2.81 (0.26-29.83)	0.392
Combination of N95 and eye protection use (>4 h)	0.44 (0.03-5.73)	0.527
N95 use (>7 d)	1.19 (0.35-3.99)	0.782
Eye protection use (>7 d)	9.43 (1.26-70.45)	0.029
Combination of N95 and eye protection use (>7 d)	0.55 (0.08-3.99)	0.557

Table 6.- Multivariable logistic regression analysis of independent factors and PPE usage patterns associated with the development of de novo headache (model 1) and headache with severity moderate to severe (model 2).

Variable	Odds ratio (95% CI)*	p value
Model 1 (headache associated to PPE)		
Age (>30 y)	2.43 (1.17-5.06)	0.018
Sex (woman)	3.50 (1.76-6.98)	<0.001
Occupation (other than physician)	3.40 (1.69-6.81)	<0.001
Eye protection use (>7 d)	5.40 (2.0-14.5)	<0.001
Model 2 (headache moderate to severe)		
Age (>30 y)	2.18 (1.29-3.68)	0.003
Occupation (other than physician)	2.27 (1.21-4.26)	0.011
Migraine	2.80 (1.33-5.92)	0.007
Eye protection use (>2 h)	2.37 (1.20-4.67)	0.012

*Model adjusted for by age, sex, occupation, comorbidities, primary headache, stress, depression and patterns of use of PPE.