ACCEPTED MANUSCRIPT

Accepted manuscripts are the articles in press that have been peer reviewed and accepted for publication by the Editorial Board of the Vojnosanitetski Pregled. They have not yet been copy edited and/or formatted in the publication house style, and the text could still be changed before final publication.

Although accepted manuscripts do not yet have all bibliographic details available, they can already be cited using the year of online publication and the DOI, as follows: article title, the author(s), publication (year), the DOI.

Please cite this article **THE EFFECT OF COMPUTER USE ON THE OCCURRENCE OF MIGRAINE**

**UTICAJ PRIMENE RAČUNARA NA POJAVU MIGRENE**

Authors Ljiljana Radmilo*, Milan Cvijanović†‡, Vojnosanitetski pregled (2021); Online First March, 2021.

UDC:

DOI: [https://doi.org/10.2298/VSP191209023R](https://doi.org/10.2298/VSP191209023R)

When the final article is assigned to volumes/issues of the Journal, the Article in Press version will be removed and the final version appear in the associated published volumes/issues of the Journal. The date the article was made available online first will be carried over.
THE EFFECT OF COMPUTER USE ON THE OCCURRENCE OF MIGRAINE

UTICAJ PRIMENE RAČUNARA NA POJAVU MIGRENE

Ljiljana Radmilo*, Milan Cvijanović†‡

* General Hospital „Dr Radivoj Simonović“, Department of Neurology, Sombor, Serbia;
† University of Novi Sad, Faculty of Medicine, Department of Neurology, Novi Sad, Serbia;
‡ Clinical Centre of Vojvodina, Clinic for Neurology, Novi Sad Serbia

Correspondence to:

Ljiljana Radmilo, MD, PhD, General Hospital „Dr Radivoj Simonović“, Department of Neurology, Vojvodanska 75, 25 000 Sombor, Serbia.

E-mail: ljiljanardml@gmail.com
Abstract

Background/Aim. Risk factors concerning computer use related migraine onsets are still unknown. Study aims: determine prevalence of headaches in computer users; and effects of computer use and behavior on prediction of migraine presence. Methods. A cross-sectional study included 1500 subjects from the general population who were asked a questionnaire to assess the presence and type of headache and questions regarding computer-assisted behavior. Results. 67.9% of the subjects had a headache, of which 23.9% had a migraine. Results of multinomial regression analysis showed that significant predictors of migraine group, compared to group without headache, were sex (female) and family anamnesis, positive for migraine as well as spending more time on computer, making shorter and rare pauses in which physical activities are less included. Furthermore, members of migraine group, compared with group with other types of headache, were younger and had family anamnesis, rarely make pauses during computer use and their pauses were shorter. Conclusion. Improper and overlong computer use could be considered as a risk factor for migraine occurrence particularly in young people who have positive family anamnesis for migraine.

Key words: headache, migraine, computer use

Apstrakt

Uvod/Cilj. Faktori rizika za nastanak migrene usled rada na računaru su još uvek nepoznati. Ciljevi studije: utvrditi prevalenciju glavobolja kod korisnika računara i efekte načina upotrebe i ponašanja pri radu na računaru u predikciji prisustva migrene. Metod. U studiji preseka uključeno je 1500 ispitanika iz opšte populacije kojima je zadat upitnik za procenu prisustva i tipa glavobolje i pitanja u vezi sa ponašanjem prilikom rada na računaru. Rezultati. Glavobolju je imalo 67.9% ispitanika, od čega njih 23.9% je imalo migrenu. Rezultati multinomalne regresione analize pokazali su da pol (ženski), porodična anamneza kao i više vremena provedenog za računarom, ređe i kraće pauze u toku kojih su često fizički neaktivni, čine značajne prediktore u grupi kod obolelih od migrene, u odnosu na grupu bez glavobolje. Štaviše, pripadnici grupe obolelih od migrene u poređenju sa grupom ispitanika obolelih od drugih vrsta glavobolja, su mladi i imaju pozitivnu porodičnu anamnezu na migrenu, ređe prave pauze u toku rada sa računarom, i te pauze su kraće. Zaključak. Nepravilna i prekomerna upotreba računara može se smatrati faktorom...
Introduction

The number of people suffering from frequent headaches is increasing every day. Headache is the most common neurological symptom today, which can have a significant impact on reducing quality of life. This also affects work life, as headaches can reduce productivity at work, and pupils and students may experience learning disabilities.

Nowadays, working on a computer is becoming more and more common within the professional as well as in the private sphere of life. In addition to the many benefits that use of a computer can bring, it can also lead to numerous damage to the health of users, of which, in the past research, besides spinal pain, shoulder pain, visual impairment, fatigue, depression, obesity, headache has become the most mentioned. Some studies show that the use of computers can be considered as a significant risk factor for migraines. Although the use of computers has recently been increasingly associated to the onset of headache attack, not all the risk factors for working on a computer that contribute to its occurrence are known yet.

Consequently, all strategies for preventing computer harm are not yet well known, and further research is needed. Objectives of the study: To determine the prevalence of headaches in computer users, to determine the use and behavior of computer users in order to affirm the risk factors for migraine.

Methods

This cross-sectional study was approved by the Ethics Committee of the Faculty of Medicine in Novi Sad (No 01-39/81/1). The study was conducted over a one-year period in primary, secondary schools, pre-schools, colleges and enterprises in the municipalities of Sombor, Apatin, Novi Sad and Mali Idjos, with prior approval of the management of these institutions.

The minimum number of subjects was calculated on the basis of G-power software, with an a priori set test power of 0.95. The baseline for initial values were the headache prevalence results from a previous study, as this is the only study in these areas that...
presents headache prevalence results. Consistent with the prevalence of headaches in the aforementioned study, it was calculated that the minimum sample size should be 1040 subjects to control the type II error. A total of 1506 subjects that use a computer were included in the survey. The respondents in the study were adult pupils, students, teaching and non-teaching staff in schools and colleges, workers in firms. The exclusion criteria were as follows: persons with poor mental development and dementia, severe and life-threatening acute and chronic illnesses, which excluded 6 subjects.

Data collection was performed using a set of questions that was modeled after other studies \(^\text{2,6,8,13-15}\). Immediately before the questionnaire was distributed, the study participants were introduced to the method of filling in correctly, the meaning of certain terms and were informed about the objectives of the test and after receiving their written consent for voluntary participation in the study, a survey lasted about 45 minutes. The questionnaire consisted of a total of three parts. The first part contained questions about general demographic data (gender, age, place of residence, educational level, occupation, and employment), data on the health status of the respondents (about the presence of headache in the previous year, about the presence of chronic diseases, about the existence of neck pain and so on) and information about the presence of headaches in the family. The second part contained questions about computer use and behavior while working on the computer (time spent on the computer during the day, whether pauses were made while working on the computer, and if so, how long, and of what content, as well as if the subject occupied the correct position while operating the computer). The third part was filled in exclusively by the respondents who answered that they had at least one headache attack in the last year. It contained questions about the characteristics of headaches and was partly taken from previous research \(^\text{13}\). This set of questions follows the criteria of the International Classification of Headaches \(^\text{16}\).

Data analysis

Multinominal regression analysis was used in order to test the prediction of belonging to the migraine group, compared to the controls and other headaches (non-migraine) group. Category predictors were sex, employment, family anamnesis and if participants make pause during the computer use, and continuous predictors were age, pause frequency (on a scale from 1 = \textit{after 30 min} to 5 = \textit{never}), pause duration (on a scale from 1 = \textit{never} to 5 = 2 \textit{hours and more}), correct position during computer use (on a scale from 1 = \textit{never} to 4 =
always), and total hours of computer use per day. Due missing data on some questions, the total number of answers was not the same across variables. Using the chi-square test, the difference in the prevalence of migraine and other types of headaches between school children and adults was determined. Analysis was performed in SPSS v.23 for Windows.

**Results**

The total sample was first divided into two groups. The first group consisted of respondents who had a headache (1019 or 67.9%). The second group consisted of subjects who did not have a headache (control group), which consisted of 481 or 32.1% of respondents. The headache group was divided into two subgroups. The first subgroup consisted of the subjects with migraine (243, or 23.9%), and the second group the subjects with other types of primary and secondary headaches (776, or 76.1%).

Table 1 shows the demographic characteristics, usage patterns, and behavior while working on a computer.

Using the chi-square test, it was determined that there are statistically significant differences in the prevalence of migraine and other types of headaches between school children and adults (χ² (4) = 10.55, p = 0.032). The prevalence of migraine and other types of primary and secondary headaches is significantly higher in school children than in adults. Results of multinominal regression analysis showed that model is significant (χ² (20) = 1044.93, p < 0.001), with R² ranged from 0.59 (Cox & Snell) to 0.68 (Nagelkerke) and 77.3% of overall correct classification. Significant prediction of membership to migraine group compared to controls showed sex (with more females in the migraine group) and family anamnesis (with more participant with family anamnesis in the migraine group) from the demographics characteristics (Table 2). Regarding variables about computer use, results showed that migraine group compared to controls spend more total hours per day, rarely make pauses during computer use (after 3 hours or never), and make shorter pauses (up to 10 min), and they are more relaxing in pauses than engaging in physical activity. Compared to participants with other headshakes, participants from the migraine group are younger and had family anamnesis more often, while there is no significant sex differences nor differences in employment (Table 2). Furthermore, although there are no differences in spent total hours per day, participants with migraine rarely make pauses during computer use and make shorter pauses, again. However, they report that they seat more correct
During computer use, compared to the participants with other headaches. There are no differences in type of activity during pause between migraine and other headaches group. Most of the subjects with both migraine and other types of headaches reported having a headache after 2 to 6 hours of computer work (Table 3).

**Discussion**

Due to the increasing number of people suffering from headaches, many studies conducted so far have focused on discovering significant triggers for headache attacks \(^{17-19}\). One of the triggers analyzed, which has recently become increasingly significant, is the use of computers \(^{4-6,8,11,14,15,17,18-20}\). As in many other studies \(^{6,9,11,21}\), our study also has a high prevalence of headaches among computer users. In our study, as many as 67.9% of respondents who are computer users, experienced a headache in the previous year. A similar prevalence of headache among computer users (64.5%) was observed in a study conducted in Sweden \(^{11}\). Also, in a survey conducted in Iceland, 65.2% of computer users had a headache \(^{11}\). A slightly higher prevalence of headaches (74.9%) among computer users was observed in a study conducted in Finland \(^{11}\) and in a study conducted in Brazil, where 80.6% had a headache \(^{6}\). A significantly lower prevalence of headache (26%) in computer users has been observed in a study conducted in Australia \(^{8}\). In our study, 23.9% of the subjects were affected by migraine. Slightly lower prevalence of migraine, 19.3% is observed in a study on the prevalence of headache in adolescents and its association with the use of computers and video games \(^{6}\). The prevalence of migraine, 30.2% is observed in the study by Saueressig et al \(^{9}\). These differences in the prevalence of headaches among computer users between the different surveys may be due primarily to different demographic characteristics of the respondents (due to differences in gender and age structure), different methodology, since it is observed that the inclusion criteria for determining the presence of headaches differ from study to study (from three months to one year). Given that, headache prevalence is expected to be higher in studies where the inclusion criterion for headache was the presence of headache for at least the previous year.

This study, in addition to determining the prevalence of migraine among computer users, was also conducted to identify behaviors during computer use to determine risk factors contributing to the onset of migraine attacks.
In addition to the already known fact that migraines are more common in women and in those with a positive family history of headache, the results of our study also indicate the importance of length of work and certain computer behaviors as a risk factor for the presence of migraines. Specifically, the subjects with migraine in comparison with the control group without headache spend significantly more time during the day working on the computer, rarely take a break, and when they do, they are of shorter duration and more often physically inactive during the break. In comparison with the group of patients with other types of primary and secondary headaches, the subjects with migraine belong to the younger age category and have a positive family history. Although there are no significant differences in daily computer exposure during the day, subjects with migraine compared with subjects with other types of primary and secondary headaches are significantly less likely to take a break, and when they do, they have a significantly shorter duration. However, it is noted that migraine sufferers are more likely to occupy a proper position while working on a computer than those suffering from other types of headaches. The length of computer exposure during the day is the most studied factor to date, which has proven to be significant in the onset of migraine attacks. Specifically, Saueressing et al point out that the chance of a migraine is even 2.54 times higher for computer users who use the computer for more than 3 hours during the day. In their research, Xavier MK et al points out that computer users who used a computer for more than 4 hours a day were more likely to experience primary headaches, especially migraines. Milde-Busch et al warns that even shorter exposure times to computers / the Internet (as little as 30 minutes) may result in an increased risk of migraine attacks in his research. Also, a confirmation of the importance of the length of work on a computer during the day for the onset of migraine is also found in the results of the research conducted by Montagni et al. They cite two potential "scenarios" that could explain the effects of computer screens on migraine. The first is the brightness and frequency of the screen that can directly trigger the attack and the second is the screen exposure time, which can reduce the threshold for headache, which is then induced by other factors. In contrast to our and the results of the aforementioned studies, different results, namely that the length of computer exposure does not play a significant role in the onset of headache attacks, were obtained by Smith et al in the study of the prevalence of neck pain and headache in computer users. However, the results of their study show the importance of length of work...
on the computer for the onset of pain in the cervical spine \(^8\). It is well known that ergonomic recommendations aimed at preventing the harmful effects of a computer on the health of users require the proper positioning of the body while operating the computer \(^{6,18,22,23}\). Prolonged irregular position of the body when working on a computer in an environment that is not designed according to ergonomic rules is thought to be stressful for trapezius muscle, which in addition to pain in the neck and shoulder can lead to headaches \(^{24,25}\). In our study, taking the right position when working on a computer proved to be a significant predictor between migraines and other types of headaches. There may not be a single factor contributing to the presence of migraines, but rather that there are several factors during computer work (prolonged work, irregular position and visual system overload) that jointly lead to headache attacks, as pointed out by Katherine et al \(^6\).

In order to determine how much and if computer users that were suffering from headache were aware of the computer as a trigger in our study, the respondents were asked if the occurrence of a headache attack could be affected by computer work. 85.2% of migraine sufferers and 72.2% sufferers of other primary and secondary headaches reported that the computer could be a trigger. More than half of migraine sufferers and of other primary and secondary headaches reported that the headache usually occurs after 2-6 hours of computer work.

As in other studies \(^4,8\), the results of our study show that computer users with headache generally do not adhere to existing ergonomic recommendations to prevent the harmful effects of computers on health. Given that the number of headache sufferers is increasing every day, there is a need to develop and implement measures to prevent the onset of headache attacks, especially migraines. It is recommended that computer users receive adequate ergonomic training to prevent headache \(^26\).

**Conclusion**

The results of our study indicate a high prevalence of headaches in computer users. In addition to being female and having a positive family history of headache, length of computer work and individual computer behaviors were significant predictors of belonging to the migraine group compared to the headache-free group. Respondents with migraine compared to the group without headache significantly spend more time during the day working on the computer, less often take a break, and when they do, they are of shorter
duration and are more often physically inactive during the break. Respondents with migraine compared to subjects with other types of headaches are younger and have a positive family history of headaches. Although there are no significant differences in the length of work on a computer during the day, subjects with migraine compared to those with other types of headaches are much less likely to take a break, and when they do, they are of a significantly shorter duration. So, the length of time you work on your computer is probably a risk factor for the presence of different types of headache, but the main difference between the types of headache is in the dynamics of working on the computer, that is, taking breaks. Computer users with headaches generally do not adhere to existing ergonomic recommendations for the prevention of the harmful effects of computers on health, and there is a need to develop and implement preventative measures, which can be achieved by training users on ergonomic principles for proper and adequate use of computers.

Study contributions

In addition to confirming the results of previous research that the length of work on the computer is probably a risk factor for the presence of different types of headaches, this study found that the main difference between the types of headaches is the dynamics of work at the computer, that is, the key is to take a break.

Disadvantages of the study

This research has several limitations. One of them refers to the way data was collected which is a survey, and therefore not the best way to obtain reliable data. The limited time of 45 minutes provided for completing the survey questionnaire conditioned the limited number of questions. Therefore, questions about the diagnosis, the use of drugs in case of a headache, whether drugs are used on the recommendation of a doctor or independently, what is the effect of these drugs, and the like, would have give additional weight to the study and indicated the complexity of this problem.
References

1. GBD 2015 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet 2016; 388(10053): 1545-602.

2. Jomoah IM. Work-related health disorders among Saudi computer users. Sci World J 2014; 2014: 723280.

3. Moloney MF, Aycock DM, Cotsonis GA, Myerburg S, Farino C, Lentz M. An Internet-based migraine headache diary: issues in Internet-based research. Headache 2009; 49(5): 673-86.

4. Shantakumari N, Eldeeb R, Sreedharan J, Gopal K. Computer use and vision-related problems among university students in Ajman, United Arab Emirate. Ann Med Health Sci Res 2014; 4(2): 258–63.

5. Hassan HMJ, Ehsan S, Arshad HS. Frequency of Computer Vision Syndrome & Ergonomic Practices among Computer Engineering Students. IJSR 2016; 5(5): 121-5.

6. Xavier MK, Pitangui AC, Silva GR, Oliveira VM, Beltrão NB, Araújo RC. Prevalence of headache in adolescents and association with use of computer and videogames. Cien Saude Colet 2015; 20(11): 3477-86.

7. Robertson MM, Huang YH, Larson N. The relationship among computer work, environmental design, and musculoskeletal and visual discomfort: examining the moderating role of supervisory relations and co-worker support. Int Arch Occup Environ Health 2016; 89(1): 7-22.

8. Smith L, Louw Q, Crous L, Grimmer-Somers K. Prevalence of neck pain and headaches: impact of computer use and other associative factors. Cephalalgia 2009; 29(2): 250–7.

9. Saueressig IB, Xavier MKA, Oliveira VMA, Pitangui ACR, Araújo RC. Primary headaches among adolescents and their association with excessive computer use. Rev Dor 2015; 16(4): 244-8.
10. Iannotti RJ, Kogan MD, Janssen I, Boyce WF. Patterns of adolescent physical activity, screen-based media use, and positive and negative health indicators in the U.S. and Canada. J Adolesc Health 2009; 44(5): 493-9.

11. Torsheim T, Eriksson L, Schnohr CW, Hansen F, Bjarnason T, Välimaa R. Screen-based activities and physical complaints among adolescents from the Nordic countries. BMC Public Health 2010; 10: 324.

12. Jahanimoghadam F, Abdolalizadeh M. Ergonomics, Musculoskeletal Disorders, and Computer Work. Journal of Health and Biomedical Informatics 2016; 3(2): 145-54.

13. Simić S. The impact of migraine and tension-type headache on the life and work of the working population [dissertation]. Faculty of Medicine: University of Novi Sad; 2009. (Serbian)

14. Montagni I, Guichard E, Carpenet C, Tzourio C, Kurth T. Screen time exposure and reporting of headaches in young adults: A cross-sectional study. Cephalalgia 2016; 36(11): 1020-7.

15. Milde-Busch A, Kries R, Thomas S, Heinrich S, Straube A, Radon K. The association between use of electronic media and prevalence of headache in adolescents: results from a population-based cross-sectional study. BMC Neurol 2010; 10: 12.

16. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition (beta version). Cephalalgia 2013; 33(9): 629–808.

17. Bener A, Uduman SA, Qassimi EMA, Khalaily G, Sztriha L, Kilpelainen H, et al. Genetic and environmental factors associated with migraine in schoolchildren. Headache 2000; 40(2): 152-7.

18. Oksanen A, Metsähonkala L, Anttila P, Aromaa M, Jäppilä E, Viander S, et al. Leisure activities in adolescents with headache. Acta Paediatr 2005; 94(5): 609-15.

19. Radmilo Lj, Simić S. Frequency of certain triggers in patients suffering from headaches. TMG 2016; 41(1): 27-32. (Serbian)
20. Wang L, Su Z, Chi B, Yang Y, Yin C, Zhou J, et al. Computer Use among Different Gender Medical Students in Inner Mongolia Medical University in China. OJEpi 2016; 6(1): 23-7.

21. Basnet A, Basnet P, Karki P, Shrestha S. Computer Vision Syndrome Prevalence and Associated Factors Among the Medical Student in Kist Medical College. NMJ 2018; 1: 29-31.

22. Kozeis N. Impact of computer use on children’s vision. Hippokratia 2009; 13(4): 230-1.

23. Karas-Friedrich B. Health risks when working with a computer. Safety 2008; 50(4): 377-84. (Croatian)

24. Woo EH, White P, Lai CW. Impact of information and communication technology on child health. J Paediatr Child Health 2016; 52(6): 590-4.

25. Jacobs K, Kaldenberg J, Markowitz J, Wuest E, Hellman M, Umez-Eronini, et al. An ergonomics training program for student notebook computer users: preliminary outcomes of a six-year cohort study. Work 2013; 44(2): 221-30.

26. Pereira M, Comans T, Sjøgaard G, Straker L, Melloh M, O’Leary S, et al. The impact of workplace ergonomics and neck-specific exercise versus ergonomics and health promotion interventions on office worker productivity: A cluster-randomized trial. Scand J Work Environ Health 2019; 45(1): 42-52.
Table 1

Demographic characteristics, usage patterns, and behavior while working on a computer

| Demographics characteristics | Migraine n=243 | Other headaches n=776 | Control n=481 |
|------------------------------|----------------|-----------------------|----------------|
| Sex                          |                |                       |                |
| male                         | 47 (19.3)      | 228 (29.4)            | 226 (47.0)     |
| female                       | 196 (80.7)     | 547 (70.6)            | 255 (53.0)     |
| Employment                   |                |                       |                |
| yes                          | 88 (36.2)      | 311 (40.1)            | 234 (48.6)     |
| no                           | 155 (63.8)     | 465 (59.9)            | 247 (51.4)     |
| Age                          |                |                       |                |
| X ± SD                       | 26.66 ± 10.82  | 28.69 ± 12.7          | 31.38 ± 14.46  |
| school children              | 110 (45.3)     | 347 (44.7)            | 184 (38.3)     |
| adults                       | 133 (54.7)     | 429 (55.3)            | 297 (61.7)     |
| Family anamnesis             |                |                       |                |
| yes                          | 114 (46.9)     | 228 (29.4)            | 48 (10.0)      |
| no                           | 129 (53.1)     | 548 (70.6)            | 433 (90.0)     |
| Characteristics of computer use |            |                       |                |
| Total hours per day          | 6.85 ± 3.43    | 6.23 ± 2.88           | 2.91 ± 2.06    |
| Pause                        |                |                       |                |
| yes                          | 185 (76.1)     | 620 (79.5)            | 390 (81.1)     |
| no                           | 55 (22.6)      | 156 (20.5)            | 49 (10.2)      |
| Pause frequency       | after 30 minutes | after 1 hour | after 2 hours | after 3 or more | never |
|-----------------------|------------------|--------------|---------------|-----------------|-------|
|                       | 15 (6.3)         | 121 (15.9)   | 261 (59.5)    | 18 (7.5)        | 55 (23.0) |
|                       | 18 (7.5)         | 246 (32.3)   | 94 (21.4)     | 246 (32.3)      | 156 (20.5) |
|                       | 47 (19.7)        | 181 (23.8)   | 27 (6.2)      | 58 (7.6)        | 49 (11.2) |
|                       | 104 (43.5)       | 58 (7.6)     | 8 (1.8)       | 8 (1.8)         | |

| Pause duration        | up to 10 minutes | between 15 and 30 minutes | between 31 minutes and 1 hour | about 2 hours and more |
|-----------------------|------------------|---------------------------|--------------------------------|------------------------|
|                       | 103 (56.3)       | 62 (33.9)                 | 14 (7.7)                       | 4 (2.2)                |
|                       | 252 (41.7)       | 232 (38.3)                | 85 (14.0)                      | 36 (6.0)               |
|                       | 52 (13.3)        | 147 (37.6)                | 98 (25.1)                      | 94 (24.0)              |

| Activity during pause | mobile/tablet | relaxing | physical activity, other |
|-----------------------|---------------|----------|--------------------------|
|                       | 47 (25.5)     | 77 (41.8)| 60 (32.6)                |
|                       | 158 (26.1)    | 262 (43.2)| 186 (30.7)              |
|                       | 72 (18.4)     | 109 (27.9)| 210 (53.7)              |

| Correct position      | never          | sometimes  | often       | always       |
|-----------------------|----------------|------------|-------------|--------------|
|                       | 32 (13.3)      | 129 (53.8) | 68 (28.3)   | 11 (4.6)     |
|                       | 421 (55.1)     | 277 (36.3) | 51 (6.7)    | 15 (2.0)     |
|                       | 62 (14.2)      | 199 (45.6) | 141 (32.3)  | 34 (7.8)     |

n – number of subjects
Table 2

Prediction of the migraine group based on demographics and characteristics of computer use

|                                | Migraine vs. controls | Migraine vs. other headaches | Migraine vs. other headaches |
|--------------------------------|-----------------------|-------------------------------|-----------------------------|
|                                | Exp(B) | p     | CI     | Exp(B) | p     | CI     | Exp(B) | p     | CI     | Exp(B) | p     | CI     | Exp(B) | p     | CI     |
| Sex (male)                     | 2.45   | 0.003 | 1.35   | 4.45   | 1.59   | 0.075 | 0.96   | 2.64   |
| Age                            | 1.01   | 0.537 | 0.97   | 1.05   | 1.05   | 0.003 | 1.02   | 1.09   |
| Employment (no)                | 1.36   | 0.521 | 0.53   | 3.49   | 0.75   | 0.492 | 0.34   | 1.69   |
| Family anamnesis (no)          | 0.13   | 0.000 | 0.07   | 0.24   | 0.47   | 0.000 | 0.30   | 0.71   |
| Total hours per day            | 0.69   | 0.000 | 0.62   | 0.77   | 1.06   | 0.145 | 0.98   | 1.13   |
| Pause frequency                | 0.15   | 0.000 | 0.11   | 0.21   | 0.32   | 0.000 | 0.25   | 0.41   |
| Pause duration                 | 3.54   | 0.000 | 2.56   | 4.91   | 1.77   | 0.000 | 1.33   | 2.36   |
| Correct position               | 0.90   | 0.544 | 0.65   | 1.25   | 0.29   | 0.000 | 0.22   | 0.38   |
| Activity during pause (mobile/tablet) | 0.53   | 0.076 | 0.26   | 1.07   | 0.80   | 0.454 | 0.45   | 1.42   |
| Activity during pause (relaxing) | 0.38   | 0.002 | 0.21   | 0.70   | 0.75   | 0.266 | 0.46   | 1.24   |

p – value for statistical significance defined as $p < 0.001$
Table 3

Presence of computer use as a headache trigger

| Computer as a headache trigger | Migraine  | Other primary and secondary headaches |
|--------------------------------|-----------|---------------------------------------|
|                                | n (%)     | n (%)                                 |
| Computer as a headache trigger | yes       | 207 (85.2)                            |
|                                |           |                                       |
| After how many hours of        | 1-2 h     | 31 (15.1)                             |
| computer work the headache     | 2-6 h     | 116 (56.6)                            |
| occurs                         | > 6 h     | 58 (28.3)                             |
|                                |           |                                       |
| n – number of subjects         |           |                                       |

Received on December 9, 2019.
Revised on March 3, 2021.
Accepted March 5, 2021.
Online First March, 2021.