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Abstract. Background. *The number of digital device users (i.e., mobile phones, tablets, laptops, etc.) has been increasing in recent years. During wartime, a phone or laptop serves not only for communication but also as a primary tool of information search. Many researchers have described the negative impact of constant mobile device use on different organ systems. However, existing studies do not provide a certain conclusion about the influence of this factor on sleep duration. The purpose of this research was to define the correlation between constant use of mobile devices during wartime and the sleep duration of young people. Materials and methods.* One hundred and twenty-five participants aged 18 to 25 years, 95 females and 30 males, were enrolled. Descriptive and sociological methods were used with creation of a specialized questionnaire, which was distributed via Google Forms in the most popular social networks. **Results.** *The data analysis showed that constant use of mobile devices had the most negative consequences for female participants. They exhibited more significant somatic and psychological changes compared to males. This trend may be associated with gender-specific responses of the female body to such factors, as well as the duration and origin of its impact. Conclusions.* Based on data obtained, it was concluded that constant mobile device use affects the nervous system altering sleep duration and quality. Additionally, females were found to be more vulnerable to mentioned factor.

Keywords: mobile devices; prolonged exposure; sleep disorders; young people

Introduction

In recent decades, the use of various mobile devices (such as mobile phones, tablets, etc.) has increased significantly. Statistical data tells that every second person on the planet uses a mobile phone, tablet, laptop, or another similar device. Nowadays, most people cannot imagine their lives without these devices, as they use them not only for communication but also as a tool for information search and for stress relief as well [1–3]. The development of modern technologies and applications has made phones, laptops, and similar devices indispensable in everyday activity [4]. According to research [5], young people spend approximately 4 hours per day browsing the internet. This statistic allows hypothesizing the potential impact of mobile devices on the

nervous system. Researchers have found that constant use of phones, tablets, and laptops can lead to vision deterioration and headaches [6, 7]. Studies [8] have identified electromagnetic radiation as a harmful factor affecting the body. The primary target organs for electromagnetic exposure are brain, auditory analyzer, vestibular apparatus, and retina. It has also been shown [9] that prolonged mobile phone use contributes to impaired cerebral circulation (such as stroke), likely due to cerebral vasospasm. Furthermore, constant exposure to electromagnetic waves disrupts blood supply to the eyes, which affects accommodation, causing lens clouding, and reducing visual acuity. There is also evidence [10–12] suggesting that not only the device user but those around them could be also affected.



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Despite the available research results of mobile devices' impact on the human body, there is still no certain conclusion regarding their effects on brain functions and sleep duration. Thus, our investigations aimed at establishing such facts are extremely relevant, important, and useful both for individuals and society.

The purpose of this research was to define the correlation between constant use of mobile devices during wartime and the sleep duration in young people.

Materials and methods

The research involved 125 respondents (aged from 18 to 25), 95 females and 30 males. They represented various categories, including medical college and university students, medical interns, middle and junior medical staff of clinics, graduate students. Descriptive and sociological methods were used to carry out the investigations. Articles published in specialized domestic and international journals were reviewed and analyzed. The total number of sources studied was 30 (27 English-language and 3 Ukrainian-language publications). Most of them were indexed in Scopus, PubMed, and Google Scholar databases.

The sociological study was conducted through telephone interviews and a specially designed questionnaire. At the beginning of the survey, all participants were informed about the purpose and content of the questionnaire, their consent for processing the data was collected. A questionnaire consisted of three sections: 1) general impersonalized information about the respondent; 2) data on the factor under investigation; and 3) repeating the questions to assess respondents' understanding of the previous section. Questions included identifying the types of mobile devices, frequency of using mobile phones, tablets, laptops, the reasons for frequent mobile device use, any self-reported health deterioration over the past three years, common symptoms experienced by respondents, and the perceived influence of mobile devices on health in combination with other factors.

During the interviews, respondents were asked to assess the impact of prolonged use of mobile devices (phones, laptops, and tablets) on sleep duration, quality, phases. The questionnaire was distributed via Google Forms on the most popular social networks among young people, including Viber, Telegram, Facebook, and Instagram.

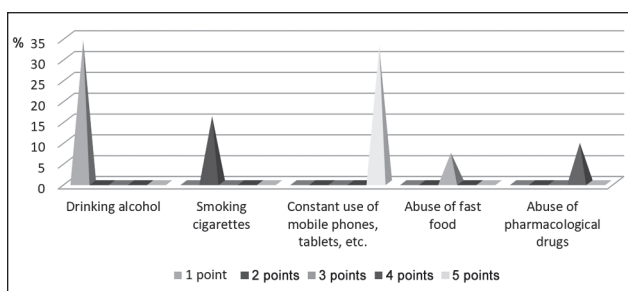


Figure 2. The impact of exogenous factors on the health of respondents

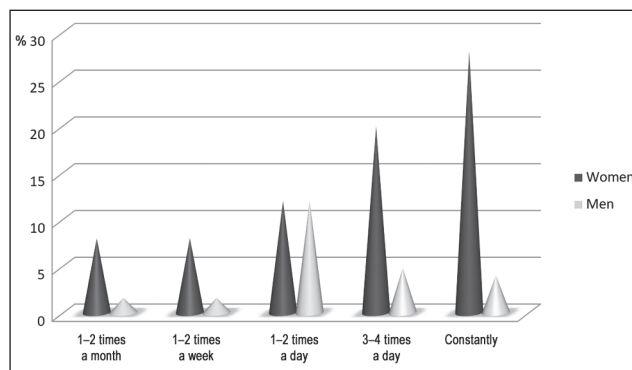


Figure 1. Frequency of using mobile devices by respondents

Results and discussion

The presented research revealed interesting and somewhat unexpected data. For example, it was found that the largest percentage of women (44 %) primarily used mobile phones, with nearly equal use of laptops and tablets, and the least used device was PC (8 %). Women were 34.4 % more likely to use mobile phones compared to men, 6.4 % more likely to use laptops and tablets, and 4.8 % more likely to use PCs. This suggests that women tend to use mobile devices more frequently than men, which could be due to professional activity and type of personality.

Analysis of the type of mobile phone used showed that 60 % of female respondents used smartphones, while only 16 % used feature phones. Additionally, women compared to men were 41.6 % more likely to use smartphones and 10.4 % more likely to use feature phones.

The frequency of mobile phones, tablets, and laptops use by respondents was also assessed (Fig. 1).

The analysis of the data obtained during the study showed that most female respondents used mobile phones and other devices constantly (28 %), 20 % used them 3–4 times a day, and nearly equal smaller part used them 1–2 times per month or week. For male respondents, it was found that the largest group (12 %) used mobile devices 1–2 times per day. A clear trend was observed indicating that women use mobile phones, tablets, and laptops more frequently than men; women were 24 % more likely to use mobile devices constantly, 15.2 % more likely to use them 3–4 times per day, and 6.4 % more likely to use them 1–2 times per month or week.

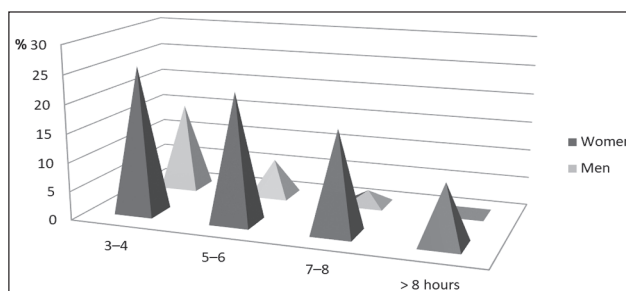


Figure 3. Sleep duration in conditions of constant use of mobile devices

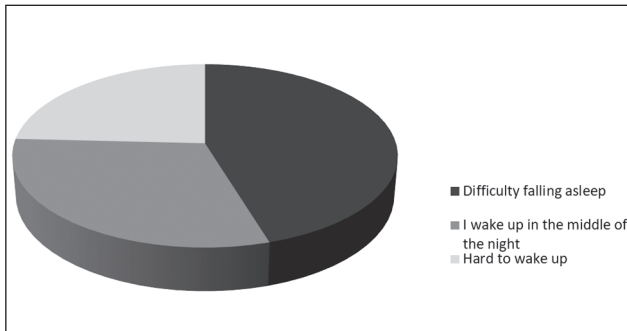


Figure 4. Sleep quality changes among female respondents

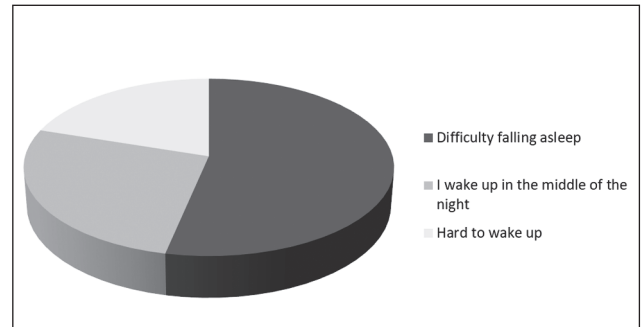


Figure 5. Sleep quality changes among male respondents

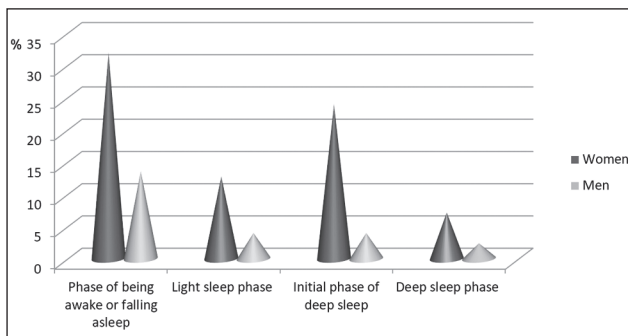


Figure 6. Change in sleep stages under continuous use of mobile devices

An assessment of respondents' health status over the past 3 years revealed that most of them, both male and female, noticed changes in it. However, the highest percentage of positive responses was among females.

The most significant complaints among female respondents included headaches (16 %), weakness and fatigue (15.2 %), vision deterioration (1.6 %), chest pain (0.8 %), digestive disorders (3.2 %), nausea (8 %), vomiting (4.8 %), diarrhea (0.8 %), increased and/or lack of appetite (2.4 %), constipation (0.8 %), sweating (0.8 %), menstrual cycle disorders (16 %), increased blood pressure (2.4 %), thirst (0.8 %), increased body temperature (0.8 %), and high blood sugar (1.6 %). Male respondents reported about headaches (4.8 %), weakness and fatigue (4 %), vision deterioration (3.2 %), irregular heartbeat (0.8 %), digestive disorders (1.6 %), nausea (0.8 %), burning feelings in heart (0.8 %), stomach pain (0.8 %), constipation (0.8 %), increased blood pressure (4 %), thirst (1.6 %), and elevated blood sugar (0.8 %).

The data indicate similarity in somatic complaints for men and women; however, the number of cases among female respondents was higher. At the same time, men reported additional specific symptoms, such as irregular heartbeat, burning feelings in heart, and stomach pain.

In addition to somatic health complaints, respondents had symptoms of mental health disturbances. Among females, 18.4 % reported being unrelated over the past three months, 16 % reported about irritability, 14.4 % about apathy, 13.6 % mentioned feelings of shame towards family due to their condition, 7.2 % cases included unmotivated aggression, 5.6 % reported a constant sense of danger and anxiety,

and 0.8 % — obsessive thoughts associated with feelings of hopelessness. Male respondents gave the most frequent reports about feelings of shame towards family (9.6 %), unmotivated aggression (4.8 %), irritability (3.2 %), and obsessive thoughts related to hopelessness and apathy (2.4 %), mood gloom over the last three months and constant feelings of danger and anxiety (0.8 %).

The ratios described above indicate a nearly the same range of mental health complaints among both genders, though the severity was greater among females.

The data about the impact of harmful exogenous factors on respondents' health appeared to be quite unexpected (Fig. 2). They rated alcohol as the least significant factor, with 34.4 % assigning it 1 point out of a maximum of 5, and 16 % rated smoking cigarettes at 2 points out of 5.

The harm from fast food abuse was estimated at grade 3 by 7.2 % of respondents, medicine abuse was graded 4 by 9.6 %. Furthermore, the adverse influence of gadget use was graded as 5 by 32.8 % of participants.

The data regarding the adverse impact of mobile devices showed that there is a considerable influence on duration and quality of sleep (Fig. 3–6).

The data indicated that changes in sleep duration were observed primarily among female respondents, who showed a tendency towards its reduction. 25.6 % of them reported sleeping for 3–4 hours, 22.4 % — 5–6 hours, 17.6 % managed to keep sleep duration within normal range (7–8 hours), and 10.4 % reported sleeping for more than 8 hours. Male respondents also had a slight reduction in sleep duration, with 15.2 % sleeping for 3–4 hours and 6.4 % for 5–6 hours.

Women mostly complained of falling asleep complications (34.4 %), 23.2 % of cases were about spontaneous sleep interruption, and the remaining part of female respondents mentioned the problems with waking up.

The general mode of sleep quality changes among men was similar to that among women. Falling asleep complications prevailed, and respondents reported about sleep interruption as well. Changes in sleep course when using mobile devices showed the following results (Fig. 6).

It was found that mostly women experienced disturbances in the wakefulness or falling asleep phases and the initial stage of deep sleep, whereas men mostly had issues with the wakefulness or falling asleep phase. When comparing the types of sleep phase disturbances depending on gender, it

was noted that women experienced problems in the initial sleep phase 18.4 % more frequently than men. Light sleep phase disturbances occurred 8.8 % more often in women, and the initial stage of deep sleep was 20 % more frequently affected in women compared to men, while deep sleep phase disturbances were 4.8 % more common among women.

This study complements the existing knowledge about the impact of exogenous artificial harmful factors, particularly mobile phones, tablets, laptops, and similar devices. The data illustrates an increase in the percentage of people using mobile devices, which is conditioned by the wartime, as mobile phones serve both as communication and information searching tool [13, 14]. Moreover, the time spent using these devices has increased, especially since higher education students mainly have studied remotely [15–17], and that gives even greater probability of adverse effects occurrence.

Additionally, it was found that women were more vulnerable to the negative impact of constant use of mobile devices [18], as evidenced by a broader range of somatic and psychological symptoms compared to men [19, 20]. The severity of manifestations was also higher in women. This could be related to gender-specific differences in the nervous system response to various factors, as well as the duration of exposure to them. Overall, these findings set the base for a further study of the mechanisms of these effects on the human body.

Conclusions

Based on the results of our investigations, it can be concluded that addiction to various gadgets (mobile phones, tablets, laptops, etc.) has increased among young people during the war that manifested in the development of somatic disorders and psychological symptoms. Additionally, a wider range of complaints was reported by women compared to men. The data obtained in this research points out that prolonged exposure to mobile devices can potentially lead to serious organic damage that affects not only the nervous system but also the entire body.

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Вплив постійного користування мобільними пристроями під час війни на тривалість сну та стан здоров'я української молоді

Резюме. Актуальність. Останніми роками постійно зростає кількість користувачів різних цифрових пристроїв (мобільні телефони, планшети, ноутбуки та ін.). Під час війни телефон чи ноутбук є не тільки засобом зв'язку, але й основним джерелом інформації. У багатьох роботах визначено негативний вплив постійного використання мобільних пристроїв на різні системи організму. Водночас існуючі дослідження не дають чіткої відповіді щодо впливу цього чинника на тривалість сну. **Мета:** встановити взаємозв'язок між постійним використанням мобільних пристроїв під час війни й тривалістю сну в молоді. **Матеріали та методи.** У дослідження було залучено 125 осіб віком від 18 до 25 років: 95 жіночої статі та 30 — чоловічої. Використано описовий та соціологічний методи зі створенням спеціального опитувальника, який поширювали через Google Forms у найпо-

пулярніших соціальних мережах. **Результати.** При аналізі отриманих даних встановлено, що найбільш негативні наслідки тривале використання мобільних пристроїв має в жінок. У них виявлено найбільш значущі соматичні й психічні зрушення порівняно з чоловіками. Ця тенденція може бути пов'язана з гендерними особливостями реакції жіночого організму на вплив подразника, а також його тривалістю й характером. **Висновки.** Отже, засновуючись на даних проведеного дослідження, можна дійти висновку про негативний вплив постійного використання мобільних пристроїв на нервову систему, що проявлялось змінами тривалості та якості сну. Також встановлено, що найбільш вразливими до впливу зазначених чинників були особи жіночої статі.

Ключові слова: мобільні пристрої; тривалий вплив; порушення сну; молоді люди