PATTERNS OF INFLUENCE OF ELECTRONIC DEVICES ON LIFESTYLE AND HEALTH OF YOUNG ADULTS

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High demand for electronic devices used both for educational purposes and during leisure time among the representatives of younger generation is reported. Inadequate development of skills related to the safe use of electronic devices results in impaired daily routine and eating pattern, impairs the quality and duration of sleep, contributes to the development of internet addiction, determines the risk of health problems in users, and provides the basis for the development of prevention programs to be used at the population, group, and individual levels. The paper summarizes the data on the influence of electronic devices on the lifestyle and health of young adults. The review of scientific papers published in the international and Russian databases (E-Library, PubMed, Cyberleninka) in 2019–2023 is provided. The accumulated knowledge about the adverse effects of electronic devices on health will make it possible to use the findings to search for effective preventive measures and plan further scientific research.

Keywords: electronic devices, mobile electronic devices, smartphones, tablets, health problems, lifestyle

Author contribution: Milushkina OYu, Skoblina NA — academic advising, manuscript writing; Markelova SV — data acquisition, literature review, manuscript writing, preparing the article for publication.

Compliance with ethical standards: the study was approved by the Ethics Committee of the Pirogov Russian National Research Medical University (protocol № 203 dated 20 December 2020).

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Received: 22.12.2023 **Accepted:** 06.04.2024 **Published online:** 08.05.2024

DOI: 10.24075/rbh.2024.094

ЗАКОНОМЕРНОСТИ ВЛИЯНИЯ ЭЛЕКТРОННЫХ УСТРОЙСТВ НА ОБРАЗ ЖИЗНИ И ЗДОРОВЬЕ МОЛОДОГО ПОКОЛЕНИЯ

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Отмечают высокую востребованность электронных устройств, используемых как в образовательных целях, так и во время досуга, среди представителей молодого поколения. Недостаточная сформированность навыков безопасного применения электронных устройств приводит к нарушению режима дня и питания, ухудшает качество и продолжительность сна, способствует развитию интернет-зависимости, определяет риск нарушения здоровья пользователей и является основанием для разработки программ профилактики как на популяционном, групповом, так и на индивидуальном уровне. В статье обобщены сведения о влиянии электронных устройств на образ жизни и здоровье молодого поколения. Представлен обзор научных статей, опубликованных в международных и российских базах данных (E-Library, PubMed, Cyberleninka) в 2019–2023 гг. Накопленные сведения о негативном влиянии на здоровье электронных устройств позволят использовать полученные данные для поиска эффективных мер профилактики, планирования дальнейших научных исследований.

Ключевые слова: электронные устройства, мобильные электронные устройства, смартфоны, планшеты, нарушение здоровья, образ жизни

Вклад авторов: О. Ю. Милушкина, Н. А. Скоблина — научное руководство, написание статьи; С. В. Маркелова — сбор материала, анализ литературы, написание статьи, подготовка статьи к публикации.

Соблюдение этических стандартов: исследование одобрено этическим комитетом РНИМУ имени Н. И. Пирогова (протокол № 203 от 20 декабря 2020 г.).

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Статья получена: 22.12.2023 **Статья принята к печати:** 06.04.2024 **Опубликована онлайн:** 08.05.2024

DOI: 10.24075/rbh.2024.094

In today's society, electronic devices (EDs) represent an integral part of daily life, constitute the basis and prospects of the development of multiple industry sectors and spheres of activity. EDs having a significant impact on lifestyle not only contribute to rearrangement of social communications, but also create additional health risk. Young adults constitute a specific group of users using EDs both for educational purposes and during leisure time, having limited experience of offline communication, and vigorously drawn into the space of Internet from an early age [1, 2].

The distance learning ensuring varying contributions to the aggregate training program for students studying at the general, professional, and secondary educational institutions represents the most vivid example of the ED introduction into the educational system.

Scientific literature provides data on the impact of distance learning technologies on the health and lifestyle of schoolchildren and students, describes the risk factors of health problems related to noncompliance with the rules for safe use of EDs during training and leisure activities, shows the relationship between health problems and the conditions and mode of using EDs [3–6].

The analysis of findings can provide the scientific basis for the development of preventive measures aimed to reduce health risks in the younger generation; it will make it possible to identify relevant directions for further research. Our aim was to summarize the acquired knowledge about the influence of EDs on the lifestyle and health of young adults.

The review of scientific papers published in the international and Russian databases (E-Library, PubMed, Cyberleninka) in 2019–2023 was conducted.

The majority of papers are focused in assessing the features of lifestyle and health of individuals using EDs. This research area is complex due to multifactorial effects of EDs.

The ED type (stationary, mobile) and model can be considered the risk factors of health problems, along with the duration and frequency of using ED, type of activity (using mobile telephony, social media, visiting websites, watching videos, screen reading, gaming). Working conditions (luminance level, workplace ergonomics, presence of background noise, using headphones, etc.) are additional risk factors that are not directly related to EDs. The user's personal preferences (place and time of operation, applications and ED settings used, etc.), awareness of the rules for safe use, and the development of useful skills have a significant effect. All the above create a hard-to-predict model for determination of the health risk associated with the use of EDs [7–12].

Numerous studies are focused on assessing the impact of using EDs on the emergence of eye disorders and their prevalence among young adults.

Deterioration of vision in students attending educational institutions throughout 20 years is observed. A significant decrease in visual acuity ($p \leq 0.05$) is observed in today's schoolchildren during their middle grades; the decrease in the reserve of relative accommodation is observed in the first-years just starting their systematic school training. This suggests depletion of adaptation. The structure of myopia and its prevalence among students have been studied [13–16].

The ED technical characteristics, specifically the features of use affecting visual perception of information from the screen, that result in eye fatigue, development of functional impairment and eye disorders, have been identified [17–18].

Information has been obtained about the significant effect ($p \leq 0.05$) of the conditions and mode of using mobile EDs (MEDs) on the development of computer vision syndrome (CVS): use at night, less than 40 min before sleep, with local lighting, at a distance less than 30 cm from the eye. It has been shown that the time on ED, insufficient illuminance level, simultaneous use of EDs (two or more), use of ED in an inappropriate location (in transport), as well as noncompliance with the principles of eye care, specifically working without interruptions for rest and eye exercise, inadequate working posture (sitting in a chair, lying), lack of the day "free from smartphone" during the week, have a significant effect on the emergence of functional eye disorders ($p \leq 0.05$) [19].

The correlation ($p \leq 0.05$) between the visual acuity decrease in students and the duration of ED use (total daily and continuous use) has been revealed [20–21].

The duration of continuous MED use significantly increases with the child's age to reach its maximum in his/her student days and exceeds the hygienic standard set for the use of tablet [22] 2-fold in primary school students, 3-fold in high school students, almost 5-fold in senior school students, and 7-fold in university students. The duration of ED use causes untimely organization of breaks for rest and eye exercises, impaired food intake regime, determines the level of physical activity, contributes to the later bedtime, reduced sleep duration, etc. [23].

The online engagement of the youth is a serious problem. Students spend more than 4 h per day on social media, and every second student uses three social media or more. The frequency of browsing social media exceeds 20 times per day in every third student. The lack of access to social media causes stress in every seventh student. Spending large amounts of time on social media and the prolonged lack of access to social media result in the development of psycho-emotional disorders that can be manifested by sleep disorders, increased irritability, and the development of addiction. The relationship between the development of internet addiction and the time on social media exceeding 2 h per day has been demonstrated from the perspective of evidence-based medicine [24–26].

The problem of safe ED use is related to low population awareness of the health risks emerging when using EDs. Only 70% of senior school students, 75% of university students, 80% of parents and teachers adequately estimate or overestimate the risk associated with the ED use. Furthermore, not all of them are aware of the rules for safe use of ED and put these rules into practice [27–31].

The wrong skills of using EDs pose potential health risks. For example, musculoskeletal dysfunction is associated with the prolonged static posture maintained when using smartphones and tablets. The data has been acquired that suggest the relationship between using the ED for two or more hours per day and obesity [32].

Spectral composition of the light emitted by smartphones is recognized as disturbing the process of melatonin secretion, which results in difficulty falling asleep, decreases sleep duration, causes nocturnal awakenings, worsens the overall quality of sleep [33].

Moreover, the light emitted by the ED screens alters accommodation, affects pupil diameter and cognitive functions, changes the sleep-wake pattern, and has a potential toxic effect caused by lipofuscin accumulation on the retina [34].

Multiple reports contain the results of studying the effects of electromagnetic waves on the users' health. However, the emergence of new MED models and data transmission technologies (wired, wireless), improvement of the mobile network generations (3G, 4G, 5G), increase in the number of transmitter units, placement of these units in the zone that is most close to users (in educational institutions, residential areas) determine the need for further research focused on the effects of electromagnetic waves emitted by the new-generation EDs on health. Thus, there is currently no consensus on the health effects of 5G mobile network [1, 34].

Assessment of the effects of non-ionizing, non-thermal electromagnetic waves on the body allowed the researchers to draw a conclusion about their effects on the homeostasis, endocrine and reproductive functions, fetal development and embryo survival, sperm quality [1, 35].

The researchers face the challenge of differentiation between the degree of the health effects of electromagnetic fields created by MEDs on the one hand and the nature of the browsed content, conditions and mode of using MED on the other hand [35–36].

The analysis of the characteristics of user's communication with MED (screen time, call duration, evening use) is conducted [37].

The researchers suggest the need for multifactorial analysis of the effects of using MEDs on cognitive performance and the ability to navigate in space as performance indicators of different brain hemispheres [38].

The regulatory and methodological documents that are in force in Russia (p. 3.5.3 of SanPiN 2.4.3648-20) prohibit the use of MEDs for educational purposes [39]. In November 2023, the State Duma accepted amendments to the Federal Law dated 29 December 2012 № 273-FZ "On Education in the Russian Federation" prohibiting the use of mobile phones at school, including during breaks [40]. A similar initiative is being implemented by the Government of Sweden through preparation of the bill on the prohibition of using MEDs by students at school during both lessons and breaks [41].

According to the methodological guidelines on ensuring sanitary and epidemiological requirements in the implementation of educational programs involving the use of e-learning and distance learning technologies approved by the Chief State Sanitary Physician of the Russian Federation on 29 August 2023 (MR

2.4.0330-23), it is recommended to use wired data transmission systems for connection of peripheral devices. It is not recommended to use a wireless data transmission system [42].

CONCLUSION

Thus, the acquired knowledge about the negative effects of electronic devices (EDs) on lifestyle, daily routine, sleep quality, and health of the younger generation makes it possible to use the data obtained to search for effective preventive measures. These should be considered when developing the individual, group and population prevention programs. A special place in prevention programs should be given to hygienic training of the youth aimed at developing the beliefs and skills of safe ED use that are so in demand in the leisure and professional activities of modern humans.

References

1. Davis D, Birnbaum L, Ben-Ishai P, Taylor H, Sears M, Butler T, et al. Wireless technologies, non-ionizing electromagnetic fields and children: Identifying and reducing health risks. Curr Probl Pediatr Adolesc Health Care. 2023; 53 (2): 101374. DOI: 10.1016/j.cppeds.2023.101374.
2. Makarova LV, Lukjanec GN. Gadzhety i ih ispol'zovanie uchashhimisja vo vneshkol'noj dejatel'nosti. Novye issledovanija. 2019; 1 (57): 15–24 (in Rus.).
3. Milushkina OY, Popov VI, Skoblina NA, Markelova SV, Sokolova NV. The use of electronic devices by students, parents and teachers before and after the transition to distance learning. Bulletin of RSMU. 2020; (3): 77–82. DOI: 10.24075/brsmu.2020.037.
4. Kuchma VR, Sedova AS, Stepanova MI, Rapoport IK, Polenova MA, Sokolova SB, et al. Osobennosti zhiznedejatel'nosti i samochuvstvija detej i podrostkov, distancionno obuchajushhihsja vo vremja jepidemii novoj koronavirusnoj infekcii COVID-19. Voprosy shkol'noj i universitetskoj mediciny i zdorov'ja. 2020; (2): 4–19 (in Rus.).
5. Popov VI, Milushkina OJu, Skoblina NA, Markelova SV, Sokolova NV, Dementev AA. Povedencheskie riski zdorov'ju studentov v period provedenija distancionnogo obuchenija. Gigiena i sanitarija. 2020; 99 (8): 854–60 (in Rus.).
6. Ievleva OV. Hygienic assessment of the mode of using mobile electronic devices by medical students. Russian Bulletin of Hygiene. 2021; (3): 17–21. DOI: 10.24075/rbh.2021.023.
7. Eeftens M, Shen C, Sönksen J, Schmutz C, van Wel L, Liorni I, et al. Modelling of daily radiofrequency electromagnetic field dose for a prospective adolescent cohort. Environ Int. 2023; (172): 107737. DOI:10.1016/j.envint.2023.107737.
8. Druzhilov SA. Gigienicheskie aspekty informacionno-tehnologicheskoj zavisimosti cheloveka v novoj real'nosti. Gigiena i sanitarija. 2019; 98 (7): 748–53 (in Rus.).
9. Lukjanec GN, Makarova LV, Paranicheva TM, Tjurina EV, Shibalova MS. Vlijanie gadzhetov na razvitie detej. Novye issledovanija. 2019; 1 (57): 25–35 (in Rus.).
10. Milushkina OY, Skoblina NA, Markelova SV, Tatarinchik AA, Melikhova EP, Libina II, et al. The impact of electronic devices on the physical growth and development of modern youth and recommendations on their safe use. Bulletin of RSMU. 2019; (4): 83–9. DOI: 10.24075/brsmu.2019.046.
11. Milushkina OJu, Skoblina NA, Markelova SV, Tatarinchik AA, Bokareva NA, Fedotov DM. Ocenka riskov zdorov'ju shkol'nikov i studentov pri vozdejstvii obuchajushhih i dosugovyh informacionno-kommunikacionnyh tehnologij. Analiz riska zdorov'ju. 2019; (3): 135–43 (in Rus.).
12. Dvorjankin OA. Igry v internete — novye informacionnye tehnologii. Vostochnoevropejskij nauchnyj zhurnal; 2021; 10 (74): 14–23(in Rus.).
13. Rapoport IK, Camerjan AP. Osobennosti formirovanija nervno-psihicheskih rasstrojstv i narushenij zrenija u moskovskih uchashhihsja v processe obuchenija v shkole. Zdorov'e naselenija i sreda obitanija — ZNiSO. 2019; (5): 20–7 (in Rus.).
14. Setko NP, Korshunova RV. Rasprostranennost' i struktura miopii sredi studentov-medikov. Orenburgskij medicinskij vestnik. 2020; 8 (2): 58–61 (in Rus.).
15. Skoblina NA, Milushkina OJu, Popov VI, Markelova SV, Bokareva NA, Tatarinchik AA, et al. Ot tradicionnogo k distancionnomu obucheniju: gigienicheskie problemy ohrany zrenija obuchajushhihsja. Gigiena i sanitarija. 2021; 100 (4): 373–9 (in Rus.).
16. Skoblina NA, Milushkina OJu, Obrubov SA, Tatarinchik AA, Camerjan AP, Markelova SV. Gigienicheskie faktory formirovanija funkcional'nyh otklonenij i hronicheskih zabolevanij glaza u shkol'nikov i studentov v sovremennyh uslovijah. Rossijskaja detskaja oftal'mologija. 2019; (1): 22–7 (in Rus.).
17. Stepanova MI, Sazanjuk ZI, Aleksandrova IJe, Laponova ED, Shumkova TV. Gigienicheskie aspekty ispol'zovanija noutbuka v obuchenii mladshih shkol'nikov. Voprosy shkol'noj i universitetskoj mediciny i zdorov'ja. 2012; (1): 47–50 (in Rus.).
18. Janushanec OI, Petrova NA. Vlijanie kachestva vizual'nyh materialov, podavaemyh na jelektronnye ustrojstva obuchenija, na risk formirovanija narushenij funkcional'nogo sostojanija organizma. Saratovskij nauchno-medicinskij zhurnal. 2022; 18 (3): 516–21 (in Rus.).
19. Milushkina OJu, Skoblina NA, Pivovarov JuP, Markelova SV, Mettini Je, Ievleva OV, et al. Rezhim ispol'zovanija mobil'nyh jelektronnyh ustrojstv obuchajushhimisja i ego korrekcija sredstvami gigienicheskogo vospitanija. Analiz riska zdorov'ju. 2022; (4): 64–71 (in Rus.). DOI: 10.21668/health.risk/2022.4.06.
20. Skoblina NA, Popov VI, Eremin AL, Markelova SV, Milushkina OJu, Obrubov SA, et al. Riski razvitija boleznej glaza i ego pridatochnogo apparata u obuchajushhihsja v uslovijah narushenija gigienicheskih pravil ispol'zovanija jelektronnyh ustrojstv. Gigiena i sanitarija. 2021; 100 (3): 279–84 (in Rus.).
21. Obrubov SA, Markelova SV. Impact of life activity in conditions of digital environment on the students' organ of sight. Russian Bulletin of Hygiene. 2021; (2): 4–9. DOI: 10.24075/rbh.2021.014.
22. SanPiN 1.2.3685-21 Gigienicheskie normativy i trebovanija k obespecheniju bezopasnosti i (ili) bezvrednosti dlja cheloveka faktorov sredy obitanija. (In Rus.).
23. Ushakov IB, Popov VI, Skoblina NA, Markelova SV. Dlitel'nost' ispol'zovanija mobil'nyh jelektronnyh ustrojstv kak sovremennyj faktor riska zdorov'ju detej, podrostkov i molodezhi. Jekologija cheloveka. 2021; (7): 43–50 (in Rus.).
24. Popov MV, Libina II, Melihova EP. Ocenka vlijanija gadzhetov na psihojemocional'noe sostojanie studentov. Molodezhnyj innovacionnyj vestnik. 2019; 8 (2): 676–8 (in Rus.).
25. Popov VI, Milushkina OJu, Skoblina NA, Tarasov AV, Markelova SV, Lovkis AA, et al. Vlijanie ispol'zovanija social'nyh setej na formirovanie internet-zavisimostej u studentov-medikov. Zdorov'e naselenija i sreda obitanija — ZNiSO. 2022; (8): 51–6 (in Rus.).
26. Setko NP, Bulycheva EV. Osobennosti psihojemocional'nogo sostojanija studentov medicinskogo universiteta v uslovijah distancionnogo obuchenija. Medicinskoe obrazovanie i professional'noe razvitie. 2021; 12 (1): 109–16 (in Rus.).
27. Markelova SV. Rol' roditelej, uchitelej, medicinskih rabotnikov v formirovanii znanij, umenij i navykov bezopasnogo ispol'zovanija jelektronnyh ustrojstv starshimi shkol'nikami. Zdorov'e naselenija i sreda obitanija — ZNiSO. 2020; (8): 50–7 (in Rus.).
28. Skoblina NA, Milushkina OJu, Markelova SV, Fedotov DM, Dobruk IV, Cepljaeva KV, et al. Osvedomlennost' pedagogov ob osnovah zdorovogo obraza zhizni i gigienicheskih principah ohrany zrenija. Zhurnal mediko-biologicheskih issledovanij. 2020; 8 (3): 269–76 (in Rus.).
29. Skoblina NA, Shpakov AI, Markelova SV, Obelevskij AG, Kuznecov OE. Subektivnaja ocenka studentami vlijanija faktorov riska na zrenie pri ispol'zovanii jelektronnyh ustrojstv. Zdorov'e naselenija i sreda obitanija — ZNiSO. 2020; (4): 48–51 (in Rus.).

30. Skoblina N, Shpakou A, Milushkina O, Markelova S, Kuzniatsou A, Tatarinchik A. Eye health risks associated with the use of electronic devices and awareness of youth. Klinika Oczna/ Acta Ophthalmologica Polonica. 2020; 122 (2): 60–5. DOI: 10.5114/ko.2020.96492.
31. Milushkina OJu, Eremin AL, Popov VI, Skoblina NA, Markelova SV, Sokolova NV, et al. Gigienicheskaja ocenka i optimizacija uslovij truda pedagogov v period provedenija distancionnogo obuchenija. Medicina truda i promyshlennaja jekologija. 2020; 60 (7): 424–34 (in Rus.). DOI: 10.31089/1026-9428-2020-60-7-424-434.
32. Domoff SE, Borgen AL, Foley RP, Maffett A. Excessive use of mobile devices and children's physical health. Hum Behav & Emerg Tech; 2019; (1): 169–75.
33. Dejnego VN, Kapcov VA, Balashevich LI, Svetlova OV, Makarov FN, Guseva MG, et al. Profilaktika glaznyh zabolevanij: svetobiologicheskaja bezopasnost' i gigiena jenergosberegajushhih istochnikov sveta. Glaz. 2016; 1 (107): 18–33 (in Rus.).
34. Bandara P, Carpenter DO. Planetary electromagnetic pollution: it is time to assess its impact. Lancet Planet Health; 2018; 2 (12): e512–e514. DOI: 10.1016/S2542-5196(18)30221-3.
35. Kim S, Han D, Ryu J, Kim K, Kim YH. Effects of mobile phone usage on sperm quality — No time-dependent relationship on usage: A systematic review and updated meta-analysis. Environ Res. 2021; (202): 111784. DOI: 10.1016/j.envres.2021.111784.
36. Schoeni A, Roser K, Röösli M. Memory performance, wireless communication and exposure to radiofrequency electromagnetic fields: A prospective cohort study in adolescents. Environ Int. 2015; (85): 343–51. DOI: 10.1016/j.envint.2015.09.025.
37. Eeftens M, Pujol S, Klaiber A, Chopard G, Riss A, Smayra F, et al. The association between real-life markers of phone use and cognitive performance, health-related quality of life and sleep. Environ Res. 2023; 231 (Pt 1): 116011. DOI: 10.1016/j.envres.2023.116011.
38. Benke G, Abramson MJ, Zeleke BM, Kaufman J, Karipidis K, Kelsall H, et al. The effect of long-term radiofrequency exposure on cognition in human observational studies: A protocol for a systematic review. Environ Int. 2022; (159): 106972. DOI: 10.1016/j.envint.2021.106972.
39. SP 2.4.3648-20 Sanitarno-jepidemiologicheskie trebovanija k organizacijam vospitanija i obuchenija, otdyha i ozdorovlenija detej i molodezhi (In Rus.).
40. Sazonova M. Zakonoproekt o zaprete ispol'zovanija mobil'nyh telefonov v shkolah prinjat v pervom chtenii. Informacionno-pravovoj portal Garant.ru [Internet]. 17.11.2023 [cited 20.12.2023]. Available from: https://www.garant.ru/news/1658430/.
41. Nilsson J. Grundskolan ska bli helt mobilfri. SVT Nyheter [Internet]. 2023 Dec [cited 2023 Dec 20]. Available from: https://www.svt.se/nyheter/inrikes/grundskolan-ska-bli-helt-mobilfri--rnjsht.
42. MR 2.4.0330-23 Metodicheskie rekomendacii po obespecheniju sanitarno-jepidemiologicheskih trebovanij pri realizacii obrazovatel'nyh programm s primeneniem jelektronnogo obuchenija i distancionnyh obrazovatel'nyh tehnologij. M., 2023; 24 p. (In Rus.).

Литература

1. Davis D, Birnbaum L, Ben-Ishai P, Taylor H, Sears M, Butler T, et al. Wireless technologies, non-ionizing electromagnetic fields and children: Identifying and reducing health risks. Curr Probl Pediatr Adolesc Health Care. 2023; 53 (2): 101374. DOI: 10.1016/j.cppeds.2023.101374.
2. Макарова Л. В., Лукьянец Г. Н. Гаджеты и их использование учащимися во внешкольной деятельности. Новые исследования. 2019; 1 (57): 15–24.
3. Милушкина О. Ю., Попов В. И., Скоблина Н. А., Маркелова С. В., Соколова Н. В. Использование электронных устройств участниками образовательного процесса при традиционной и дистанционной формах обучения. Вестник РГМУ. 2020; (3): 85–91. DOI: 10.24075/vrgmu.2020.037.
4. Кучма В. Р., Седова А. С., Степанова М. И., Рапопорт И. К., Поленова М. А., Соколова С. Б. и др. Особенности жизнедеятельности и самочувствия детей и подростков, дистанционно обучающихся во время эпидемии новой коронавирусной инфекции COVID-19. Вопросы школьной и университетской медицины и здоровья. 2020; (2): 4–19.
5. Попов В. И., Милушкина О. Ю., Скоблина Н. А., Маркелова С. В., Соколова Н. В., Дементьев А. А. Поведенческие риски здоровью студентов в период проведения дистанционного обучения. Гигиена и санитария. 2020; 99 (8): 854–60.
6. Иевлева О. В. Гигиеническая оценка режима использования мобильных электронных устройств студентами-медиками. Российский вестник гигиены. 2021; (3): 18–22. DOI: 10.24075/rbh.2021.023.
7. Eeftens M, Shen C, Sönksen J, Schmutz C, van Wel L, Liorni I, et al. Modelling of daily radiofrequency electromagnetic field dose for a prospective adolescent cohort. Environ Int. 2023; (172): 107737. DOI:10.1016/j.envint.2023.107737.
8. Дружилов С. А. Гигиенические аспекты информационно-технологической зависимости человека в новой реальности. Гигиена и санитария. 2019; 98 (7): 748–53.
9. Лукьянец Г. Н., Макарова Л. В., Параничева Т. М., Тюрина Е. В., Шибалова М.С. Влияние гаджетов на развитие детей. Новые исследования. 2019; 1 (57): 25–35.
10. Милушкина О. Ю., Скоблина Н. А., Маркелова С. В., Татаринчик А. А., Мелихова Е. П., Либина И. И. и др. Влияние электронных устройств на физическое развитие современной молодежи и рекомендации по регламенту их использования. Вестник РГМУ. 2019; (4): 87–94. DOI: 10.24075/vrgmu.2019.046.
11. Милушкина О. Ю., Скоблина Н. А., Маркелова С. В., Татаринчик А. А., Бокарева Н. А., Федотов Д. М. Оценка рисков здоровью школьников и студентов при воздействии обучающих и досуговых информационно-коммуникационных технологий. Анализ риска здоровью. 2019; (3): 135–43.
12. Дворянкин О. А. Игры в интернете — новые информационные технологии. Восточноевропейский научный журнал. 2021; 10 (74): 14–23.
13. Рапопорт И. К., Цамерян А. П. Особенности формирования нервно-психических расстройств и нарушений зрения у московских учащихся в процессе обучения в школе. Здоровье населения и среда обитания — ЗНиСО. 2019; (5): 20–7.
14. Сетко Н. П., Коршунова Р. В. Распространенность и структура миопии среди студентов-медиков. Оренбургский медицинский вестник. 2020; 8 (2): 58–61.
15. Скоблина Н. А., Милушкина О. Ю., Попов В. И., Маркелова С. В., Бокарева Н. А., Татаринчик А. А. и др. От традиционного к дистанционному обучению: гигиенические проблемы охраны зрения обучающихся. Гигиена и санитария. 2021; 100 (4): 373–9.
16. Скоблина Н. А., Милушкина О. Ю., Обрубов С. А., Татаринчик А. А., Цамерян А. П., Маркелова С. В. Гигиенические факторы формирования функциональных отклонений и хронических заболеваний глаза у школьников и студентов в современных условиях. Российская детская офтальмология. 2019; (1): 22–7.
17. Степанова М. И., Сазанюк З. И., Александрова И. Э., Лапонова Е. Д., Шумкова Т. В. Гигиенические аспекты использования ноутбука в обучении младших школьников. Вопросы школьной и университетской медицины и здоровья. 2012; (1): 47–50.
18. Янушанец О. И., Петрова Н. А. Влияние качества визуальных материалов, подаваемых на электронные устройства обучения, на риск формирования нарушений функционального состояния организма. Саратовский научно-медицинский журнал. 2022; 18 (3): 516–21.
19. Милушкина О. Ю., Скоблина Н. А., Пивоваров Ю. П., Маркелова С. В., Меттини Э., Иевлева О. В. и др. Режим использования

мобильных электронных устройств обучающимися и его коррекция средствами гигиенического воспитания. Анализ риска здоровью. 2022; (4): 64–71. DOI: 10.21668/health.risk/2022.4.06.
20. Скоблина Н. А., Попов В. И., Еремин А. Л., Маркелова С. В., Милушкина О. Ю., Обрубов С. А. и др. Риски развития болезней глаза и его придаточного аппарата у обучающихся в условиях нарушения гигиенических правил использования электронных устройств. Гигиена и санитария. 2021; 100 (3): 279–84.
21. Обрубов С. А., Маркелова С. В. Влияние жизнедеятельности в условиях цифровой среды на состояние органа зрения обучающихся. Российский вестник гигиены. 2021; (2): 4–10. DOI: 10.24075/rbh.2021.014.
22. СанПиН 1.2.3685-21 Гигиенические нормативы и требования к обеспечению безопасности и (или) безвредности для человека факторов среды обитания.
23. Ушаков И. Б., Попов В. И., Скоблина Н. А., Маркелова С. В. Длительность использования мобильных электронных устройств как современный фактор риска здоровью детей, подростков и молодежи. Экология человека. 2021; (7): 43–50.
24. Попов М. В., Либина И. И., Мелихова Е. П. Оценка влияния гаджетов на психоэмоциональное состояние студентов. Молодежный инновационный вестник. 2019; 8 (2): 676–8.
25. Попов В. И., Милушкина О. Ю., Скоблина Н. А., Тарасов А. В., Маркелова С. В., Ловкис А. А. и др. Влияние использования социальных сетей на формирование интернет-зависимостей у студентов-медиков. Здоровье населения и среда обитания — ЗНиСО. 2022; (8): 51–6.
26. Сетко Н. П., Булычева Е. В. Особенности психоэмоционального состояния студентов медицинского университета в условиях дистанционного обучения. Медицинское образование и профессиональное развитие. 2021; 12 (1): 109–16.
27. Маркелова С. В. Роль родителей, учителей, медицинских работников в формировании знаний, умений и навыков безопасного использования электронных устройств старшими школьниками. Здоровье населения и среда обитания — ЗНиСО. 2020; (8): 50–7.
28. Скоблина Н. А., Милушкина О. Ю., Маркелова С. В., Федотов Д. М., Добрук И. В., Цепляева К. В. и др. Осведомленность педагогов об основах здорового образа жизни и гигиенических принципах охраны зрения. Журнал медико-биологических исследований. 2020; 8 (3): 269–76.
29. Скоблина Н. А., Шпаков А. И., Маркелова С. В., Обелевский А. Г., Кузнецов О. Е. Субъективная оценка студентами влияния факторов риска на зрение при использовании электронных устройств. Здоровье населения и среда обитания — ЗНиСО. 2020; (4): 48–51.
30. Skoblina N, Shpakou A, Milushkina O, Markelova S, Kuzniatsou A, Tatarinchik A. Eye health risks associated with the use of electronic devices and awareness of youth. Klinika Oczna/Acta Ophthalmologica Polonica. 2020; 122 (2): 60–5. DOI: 10.5114/ko.2020.96492.
31. Милушкина О. Ю., Еремин А. Л., Попов В. И., Скоблина Н. А., Маркелова С. В., Соколова Н. В. и др. Гигиеническая оценка и оптимизация условий труда педагогов в период проведения дистанционного обучения. Медицина труда и промышленная экология. 2020; 60 (7): 424–34. DOI: 10.31089/1026-9428-2020-60-7-424-434.
32. Domoff SE, Borgen AL, Foley RP, Maffett A. Excessive use of mobile devices and children's physical health. Hum Behav & Emerg Tech. 2019; (1): 169–75.
33. Дейнего В. Н., Капцов В. А., Балашевич Л. И., Светлова О. В., Макаров Ф. Н., Гусева М. Г. и др. Профилактика глазных заболеваний: светобиологическая безопасность и гигиена энергосберегающих источников света. Глаз. 2016; 1 (107): 18–33.
34. Bandara P, Carpenter DO. Planetary electromagnetic pollution: it is time to assess its impact. Lancet Planet Health. 2018; 2 (12): e512–e514. DOI: 10.1016/S2542-5196(18)30221-3.
35. Kim S, Han D, Ryu J, Kim K, Kim YH. Effects of mobile phone usage on sperm quality — No time-dependent relationship on usage: A systematic review and updated meta-analysis. Environ Res. 2021; (202): 111784. DOI: 10.1016/j.envres.2021.111784.
36. Schoeni A, Roser K, Röösli M. Memory performance, wireless communication and exposure to radiofrequency electromagnetic fields: A prospective cohort study in adolescents. Environ Int. 2015; (85): 343–51. DOI: 10.1016/j.envint.2015.09.025.
37. Eeftens M, Pujol S, Klaiber A, Chopard G, Riss A, Smayra F, et al. The association between real-life markers of phone use and cognitive performance, health-related quality of life and sleep. Environ Res. 2023; 231 (Pt 1): 116011. DOI: 10.1016/j.envres.2023.116011.
38. Benke G, Abramson MJ, Zeleke BM, Kaufman J, Karipidis K, Kelsall H, et al. The effect of long-term radiofrequency exposure on cognition in human observational studies: A protocol for a systematic review. Environ Int. 2022; (159): 106972. DOI: 10.1016/j.envint.2021.106972.
39. СП 2.4.3648-20 Санитарно-эпидемиологические требования к организациям воспитания и обучения, отдыха и оздоровления детей и молодежи.
40. Сазонова М. Законопроект о запрете использования мобильных телефонов в школах принят в первом чтении. Информационно-правовой портал Гарант.ру [Интернет]. 17.11.2023 [дата обращения 20.12.2023]. URL: https://www.garant.ru/news/1658430/.
41. Nilsson J. Grundskolan ska bli helt mobilfri. SVT Nyheter [Internet]. 2023 Dec [cited 2023 Dec 20]. URL: https://www.svt.se/nyheter/inrikes/grundskolan-ska-bli-helt-mobilfri--rnjsht.
42. МР 2.4.0330-23 Методические рекомендации по обеспечению санитарно-эпидемиологических требований при реализации образовательных программ с применением электронного обучения и дистанционных образовательных технологий. М., 2023; 24 с.