NEW DIGITAL OPPORTUNITIES IN DIAGNOSIS AND PREVENTION OF STUDENTS' MENTAL HEALTH

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The article deals with new digital opportunities in diagnosis and prevention of health and well-being of students that also create principally new conditions for getting education. Use of digital traces, big data, machine learning and computer modelling in diagnosis results in obtaining important data about mental health of students to examine their behavior, physical activity, emotional condition and a wide specter of personal traits in detail. Quantitative methods combined with big data and artificial intelligence (AI) technologies are utilized to anticipate certain neurological and mental diseases. They allow to overcome limitations of traditional research methods and expand the opportunities of modern education by changing the educational process based on the analysis results and adapting them to the student's current state and development. When digital technologies are moderately used under certain conditions, they (chat-bots, applications and other online resources) can be utilized as preventive activities, estimating one's health, improving social and psychological well-being and interactions by transforming the educational process.

Key words: students, digital environment, diagnosis, prevention, health, well-being

НОВЫЕ ВОЗМОЖНОСТИ ЦИФРОВЫХ ТЕХНОЛОГИЙ В ДИАГНОСТИКЕ И ПРОФИЛАКТИКЕ ПСИХИЧЕСКОГО ЗДОРОВЬЯ ОБУЧАЮЩИХСЯ

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В статье раскрываются новые возможности цифровых технологий в вопросах диагностики и профилактики здоровья и благополучия обучающихся, которые также создают принципиально новые условия для получения образования. Использование в диагностике методов цифровых следов, больших данных, машинного обучения и компьютерного моделирования позволяет получить важные сведения о психическом здоровье обучающихся для детального изучения поведения, физической активности, эмоционального состояния, широкого спектра личностных характеристик. Количественные методы в сочетании с технологиями больших данных и искусственного интеллекта используются для прогнозирования определенных неврологических и психических расстройств, которые позволяют преодолевать ограничения традиционных исследовательских методов и расширять возможности современного образования, меняя сам процесс обучения по результатам такого анализа и адаптировать их под текущее состояние и развитие обучающегося. При умеренном использовании цифровых технологий в определенных условиях они (чат-боты, приложения и другие онлайн-ресурсы) могут использоваться в качестве профилактических мероприятий, помогая оценивать свое состояние здоровья, повышать социально-психологическое благополучие и взаимоотношения, трансформируя процесс обучения.

Ключевые слова: обучающиеся, цифровая среда диагностика, профилактика, здоровье, благополучие

Development of digitalization and active implementation of digital technologies into the daily life occurs in any sphere, including medicine, education, economics, production, transportation, construction, etc., expanding the opportunities of education, communication, implementation of brand-new scientific developments of AI that result in global transformation of the reality.

A modern generation widely uses the opportunities of the Internet, navigator, smart house, and interactive helpers such as the simplest mobile applications like distance recorders, calorie calculators or gadgets used to determine the condition of a system, electronic medical record, convenient IT-navigation system and telemedicine.

Such new developments as digital medical cards, IT management of personnel and time of appointment, etc. constitute a comfortable environment. Development of telemedicine enables distant consultation with medical experts, whereas the individual approach using the brand-new scientific developments becomes increasingly human-oriented.

Digitalization of education acquires importance due to the steady growth of mental health disorders in children and adolescents. They are primarily represented by depressive and anxiety disorders that are the most frequently occurring manifestations of mental disturbances in a younger generation. According to the results of a number of trials, the prevalence of depressive symptoms varies from 7.5% to 11% among those aged 18 years, and the upward trend is observed [1, 2].

The data dependent pathology and emotional stress are on the rise. They can also be risk factors for diseases (mental, cardiovascular, gastrointestinal diseases, etc.) and new pathologies such as a computer syndrome, various addictions (pathological dependence), etc. [3].

Inevitable informatization, digitalization of Russian education and creation of high-tech educational environment make the issue of diagnosis, prevention and health-saving technologies more pressing. This is how the negative effect of the factors on the mental health and social-psychological well-being of students is reduced.

MATERIALS AND METHODS

The science data presented in Russian and foreign trials using RSCI- and PUBMED-based digital technologies that concern

the issues of diagnosis and prevention of mental health and social and psychological well-being of students were analyzed following the principles of scientific objectivity and complexity.

DISCUSSION OF RESULTS

Owing to modern technologies, researchers come across new opportunities. Distribution of digital technologies resulted in occurrence of such a new scientific area as 'computational social science' [4].

Due to the use of digital traces, big data, methods of machine education and computer modeling, computational social sciences overcome the limitations of traditional research methods. The digital traces, the vast amount of which are left by people, can be used to study their owners' behavior in detail. For instance, fitness bands and mobile phones trace where we move, measure our physical activity and sleep patterns; social networks and telephone conversations can be used to examine social interactions. Data about social interactions can be obtained using mobile device sensors [5] or through the history of interactions, presenting new sources of data for the research. New methods also allow to conduct researches on a large scale. The opportunity was not previously available.

For instance, examination of the effect produced by the news feed on the emotional state of users included a sample of 700,000 thousand people [6]; researches of a similar scale were conducted on a sample of VKontakte users [7]. The largest experiment was carried out on the platform of one of the social networks and included 61 million people [8]. A large sample enables to find effects that are less strong, but more significant for a human well-being. This is especially important when examining a human emotional well-being influenced by many factors. However, their effect in small samples is difficult to prove. Due to a larger coverage, participants can be distributed into groups of different age and gender, examine the effect of the same factors on those educated depending on various indicators, etc.

Machine learning methods permit to restore various characteristics using digital traces (prediction of such demographic indicators as gender, nationality, income, etc.) according to tweets [9], photos in the profile [10], user's posts [11]. A wide specter of personal traits (from temperament to the level of intelligence) can be predicted based on how users behave in social networks, including academic progress [12, 13].

Moreover, digital traces can be used to predict depression effectively: based on certain social networks, depression can be predicted three months before the official diagnosis, and the predictive accuracy is comparable with a standard screening interview [14].

We can compose an individual human profile using the artificial intelligence (AI), and Internet resources can be used to collect data about one's mental health. AI can analyze such data as age, gender, ethnicity, blood group, weight, body mass index, and chronic diseases that constitute a higher risk for a human's health [15, 16].

Digital platforms can serve as environment for instant distribution of emotions and allow to study collective reactions to terror attacks [6] or celebrity suicides [17], which is important to take into account due to possible imitations [18]. The researchers are currently using quantitative methods to predict certain mental health problems such as depression, suicidality and anxiety [19].

Digital safety technologies including control and observance of hygienic conditions based on sanitary rules and standards of educational institutions can help solve health promoting school issues [20].

In accordance with the National Strategy for the Development of Artificial Intelligence over the period extending up to the year 2030 (Presidential Decree of the Russian Federation dated 10.10.2019 No. 490), fundamental research to create conditions for human life improvement is developed due to an increased level of education, healthcare, including preventive examinations, prediction of disease occurrence and progress, etc. New methods of optimization of mental and educational activity occur on the basis of technologies of cognitive cyber physical systems, artificial intelligence, distribution, perception and storage of data preserving mental, and social and psychological well-being of those educated [3].

According to the 'balanced approach' hypothesis, moderate use of digital technologies can positively affect physical and mental health, and social and psychological well-being of children, adolescents and young population in the high-tech sphere [21].

The factors producing a negative influence on well-being of those educated in high-tech environment include effects of electromagnetic fields, screen light, peculiarities of visual data presentation, ways and mode of operation (multitasking), etc. [22].

The role of information hygiene and development of optimal levels of visual information, light output, sound, criteria of data relevance and complexity, epidemiology of risk groups and incidence of information overload has been increasing [3].

It is well-known that a part of those educated needs long-distance learning due to health reasons (health limitations and disability), as they can't visit educational institutions on a constant basis.

The main value of long-distance learning for people with health limitations is that long-distance learning is frequently the only way to implement their potential and be successful in life just like their healthy peers. Students educated long-distance, including those with health limitations and disability, are not limited by space or time, they work where they want, when they want and as fast as they want without any overstressing.

Every teacher takes into account a student's opportunities and can determine how long it takes for the student to understand the program. When the program is completed, knowledge is always tested. Clearly, long-distance learning is a great advantage for students with health limitations. The learning process can be adapted to their needs. The students can interact with virtual teachers and peers without inconvenience, constraints or feeling disabled. Thus, the people with limited health capacities are integrated into the society owing to telecommunication and information technologies.

Long-distance E-learning can be extremely effective due to the possibility to analyze the students' data and alter the learning process based on the analysis results [23]. In this case, distance-learning of students, including people with health limitations, is the basis for the new paradigm of the educational process. It is not the content of educational material, subjects, forms and methods of education, but rather the student's personality, individuality, self-actualization during the educational process that occupy a central position. The personal approach is associated with educational individualization as it takes into account personal, psychophysiological and cognitive abilities, values and individual needs of every student [24].

It is also important to pay careful attention to those with hampered adaptation to use of distance educational technologies and formation of competencies associated with wellness and adherence to healthy lifestyle in students [25, 26].

Under certain conditions, a moderate use of digital technologies can promote formation of good habits associated

with a healthy way of life, nutrition, sleeping and physical activity. Examples of the use include different chat bots, applications and other online resources that estimate somebody's health and improve the social and psychological well-being and interrelations in the younger generation [27, 28].

An element of such preventive technologies can include the use of digital means improving well-being of the students in an unfavorable or vulnerable condition of health or a social situation. This is because online communities and social networks provide support and assist in coping with difficult life situations, emotions and stress [17, 28].

A set of different preventive activities must be primarily aimed at prevention of any negative effect and/or elimination of risk factors associated with the use of digital and information and communication technologies in high-tech educational environment that result in visual, locomotor and digestive diseases. It is necessary to reduce a stress factor and its consequences, and hypodynamia resulting in the development of mental health in students. Increasing popularity of social networks attracts the younger generation and promotes their active use [29]. Social networks enable students to develop and support relations by chatting with friends who are off-line using messengers, E-mail, etc. Internet offers great chances to make new friends, urges young people to unite in groups with similar ideas and interests. Online communication is important for development of identity, self-confidence, stable positive self-estimation and self-understanding [30, 31].

Examination of digital technologies requires a differentiated approach with a need in big data. Information from social media can be used here as well. For instance, online activity helps predict health-related issues.

It is shown [32] that social online integration is associated with a reduced mortality due to cardiovascular diseases, drug overdose and suicide. Big data analysis allows to predict depression using posts from social networks [33, 34, 35]. This offers great opportunities. Thus, it is now possible to search for factors of risk and protection in relation to depression and other diseases in large samples. However, the opportunity couldn't be previously utilized by investigators.

CONCLUSION

Active development of global networks and digital technologies resulted in principally new conditions for getting education using the corresponding methods. Big data add new quality to the process.

Long-distance learning can be more effective when the content is expanded, and new scenarios are created. The use of AI technologies enables significant complementation and expansion of modern educational opportunities, including for people with health limitations. They include the following activities: to collect and analyze data about the students and their activity, analyze their digital traces, i. e., alter the process of education based on the analysis results and adapt to their current condition and development. The shortest way from a digital trace to transformation of the educational process is paved by AI technologies.

Students with health limitations acquire equal educational opportunities owing to transition to multi-media and AI technologies in learning.

Digital technologies can be used during such preventive activities as consultation and educational activities, monitoring of mental health problems, physical and social-psychological well-being, cognitive and other psychophysiological functions, examination of the effect produced by information technologies and peculiarities of education in a high-tech environment.

Based on the analyzed data of scientific literature it has been shown that additional detailed and focused trials of health dynamics need to be conducted to examine the influence of digitalization on mental health and well-being of students, paying special attention to differentiation of sampling and analysis of subjects' activity, as the trials require large samples, and big data obtained from social networks and other sources, and weighted income are considered perspective.

References

1. Bochaver AA, Dokuka SV, Sivak EV, Smirnov IB. Ispol'zovanie social'nyh setej v internete i depressivnaja simptomatika u podrostkov [Jelektronnyj resurs]. Klinicheskaja i special'naja psihologija 2019; 8 (3): 1–18. Doi: 10.17759/psyclin.2019080301. Russian.

2. Lavinsky KhKh, Grekova NA, Arbuzov IV, Polyanskaya Yu N. Risks to children's health in the digital environment. Directions for prevention. Napravleniya profilaktiki. Zdorov'e i okruzhayushchaya sreda. 2017; 27: 71–74. Russian.

3. Eremin AL. Informatsionnaya gigiena: sovremennye podkhody k gigienicheskoy otsenke kontenta i fizicheskikh signalov nositeley informatsii. Gigiena i sanitariya. 2020; 99 (4): 351–355. DOI: https://doi.org/10.33029/0016–9900–2020–99–4–351–355. Russian.

4. Lazer D, Pentland A, Adamic L, Aral S, Barabasi AL, Brewer D, Jebara T. Computational social science. Science. 2009; 323 (5915): 721–723.

5. Mastrandrea R, Fournet J, Barrat A. Contact patterns in a high school: a comparison between data collected using wearable sensors, contact diaries and friendship surveys. PloS One. 2015; 10 (9). e0136497.

6. Garcia D, Rime B. Collective Emotions and Social Resilience in the Digital Traces after a Terrorist Attack. Psychological Science. 2018.

7. Sivak E, Smirnov I. Parents mention sons more often than daughters on social media. Proceedings of the National Academy of Sciences. 2019; 116 (6): 2039–2041.

8. Bond RM, Fariss CJ, Jones JJ, Kramer AD, Marlow C, Settle J E, Fowler JH. A 61-million-person experiment in social influence and political mobilization. Nature. 2012; 489 (7415): 295.

9. Ann J, Weber I #greysanatomy vs. # Yankees: Demografics and hashtag use on tweeter. Tenth International AAAI Conference on Web and Social Media. 2016.

10. Preotiuc-Pietro D, Volkova S, Lampos V, Bachrach Y, Aletras N. Studying user income through language, behavior and affect in social media. PloS One. 2015; 10 (9). e0138717.

11. Rao D, Paul M, Fink C, Yarovsky D, Oates T, Coppersmith G. Hierarchical Bayesian models for latent attribute detection in social networs. Proceedings of the International Conference on Weblogs and Social Media (ICWSM), 2011.

12. Kosinski M, Stillwell D, Grapel T. Private traits and attributes are predictable from digital records of human behavior. Proceedings of the National Academy of Sciences. 2013; 110 (15): 5802–5805.

13. Smirnov I. Predicting PISA Scores from Students'ital Traces. Twelfth International AAAI Conference on Web and Social Media. Dig. 2018.

14. Eichstaedt JC, Smith RJ, Merchant RM, Ungar LH, Crutchley P, Preotiuc-Pietro D, Asch DA, Schwartz HA. Facebook language predicts depression in medical records. Proceedings of the National Academy of Sciences. 2018; 115 (44): 11203–11208.

15. Rushing SC, Stephens D. Use of media technologies by Native American teens and young adults in the Pacific Northwest: exploring their utility for designing culturally appropriate

technology-based health interventions. Journal Prime Preview. 2011; 32 (3–4): 135–145.

16. Milushkina OJu, Skoblina NA, Markelova SV, Tatarinchik AA, Bokareva NA, Fedotov DM. Otsenka riska zdorov'ju shkol'nikov i studentov pri vozdejstvii obuchajushhih i dosugovyh informacionno-kommunikacionnyh tehnologij. Analiz riska zdorov'ju. 2019; (3): 135–143. Russian

17. Niederkrotenthaler T, Till B, Garcia D. Celebrity suicide on Twitter: Activity, content and network analysis related to the death of Swedish DJ Tim Bergling alias Avicii. Journal of affective disorders. 2019; 245: 848–855.

18. Polozhenie detej v mire, 2017 god: deti v cifrovom mire [Jelektronnyj resurs]. Doklad JuNISEF. URL: http://www.uncef.org/eca/media/ 4926/file (data obrashhenija: 29.04.2020).

19. Chancellor S, De Choudhury M. Methods in predictive techniques for mental health status on social media: a critical review. npj Digit. Med. 3, 43 (2020). https://doi.org/10.1038/s41746–020–0233–7.

20. Kuchma VR, Suhareva LM, Stepanova MI, Hramcov PI, Aleksandrova IJe, Sokolova SB. Nauchnye osnovy i tehnologii obespechenija gigienicheskoj bezopasnosti detej v «cifrovoj shkole». Gigiena i sanitarija. 2019; 98(12): 1385–1391. DOI: http://dx.doi.org/10.18821/0016–9900–2019–98–12–1385–1391. Russian.

21. Hooft Graafland JH. New technologies and 21st centure children: Recent trends and outcomes. OECD Education Working Papers, 179. Paris: OECD Publishing. 2018; 60 c.

22. Vjatleva OV. Vlijanie ispol'zovanija smartfonov na samochuvstvie, kognitivnye funkcii i morfofunkcional'noe sostojanie central'noj nervnoj sistemy u detej i podrostkov (nauchnyj obzor). Voprosy shkol'noj i universitetskoj mediciny i zdorov'ja. 2020; 1: 4–11. Russian.

23. Nasyrova JeF, Muller OJu. Tehnologii raboty s det'mi s OVZ i det'mi-invalidami v uslovijah distancionnoj formy realizacii dopolnitel'nyh obshherazvivajushhih programm: uchebno-metodicheskoe posobie. Surgut, 2019; 57 s. Russian.

24. Johnson KR, Fuchs E, Horvath KJ, at al. Distressed and looking for help: Internet intervention support for arthritis self-management. Journal of Adolescent Health. 2015; 56 (6): 666–671. DOI:: 10.1016/j.jadohealth.2015.02.019.

25. Milushkina OJu, Popov VI, Skoblina NA, Markelova SV, Fedotov DM, Ievleva OV. Gotovnost' obuchajushhihsja medicinskogo VUZa k ispol'zovaniju distancionnyh obrazovatel'nyh tehnologij. Rossijskij Vestnik gigieny. 2021; (1): 6–10. Russian.

26. Pivovarov JuP, Skoblina NA, Milushkina OJu, Markelova SV, Fedotov DM, Okol'nikov FB. et al. Ispol'zovanie internet-oprosov v ocenke osvedomlennosti ob osnovah zdorovogo obraza zhizni. Sovremennye problemy zdravoohranenija i medicinskoj statistiki. 2020; (2): 398–413. Russian

27. Christensen H. Social media: the new e-mental health tool. In Psych: The Bulletin of Australian Psychological Society Ltd. 2014; 36 (3): 12–13.

28. Hides L, Kavanagh DJ, Stoyanov SR, et al. Mobile application rating scale (MARS): a new tool for assessing the quality of health mobile applications [Jelektronnyj resurs]. Young and Well Cooperative Research Centre, Melbourne, 2014. URL: https://eprints. qut.edu.au/71733/ (data obrashhenija 14.05.2020).

29. Goncharova G. A. Nervno-psihicheskoe zdorov'e detej — aktivnyh pol'zovatelej cifrovyh sredstv. Rossijskij vestnik gigieny. 2021; (3): 33–35. DOI: 10.24075/rbh.2021.017. Russian.

30. Rapoport IK, Sokolova SB, Chubarovskij VV. Zabolevaemost' shkol'nikov i problemy sozdanija profilakticheskoj sredy v obshheobrazovatel'nyh organizacijah. Voprosy shkol'noj i universitetskoj mediciny. 2014; 3: 10–16. Russian.

31. Burke M, Kraut RE. The Relationship between Facebook Use and Well-Being Depends on Communication Type and Tie Strength. Journal of Computer-Mediated Communication. 2016; 21 (4): 265–281. DOI: 10.1111/jcc4.12162.

32. Bochaver AA, Dokuka SV, Novikova MA, et al. Blagopoluchie detej v cifrovuju jepohu: dokl. k XX apr. mezhdun. nauch. konferencii po problemam razvitija jekonomiki i obshhestva, Moskva, 9–12 aprelja 2019 g..; Nac. issled. Un-t «Vysshaja shkola jekonomiki». M.: Izd. Dom Vysshej shkoly jekonomiki, 2019. 34 s. Russian.

33. Barry CT, Sidoti CL, Briggs SM, et al. Adolescent social media use and mental health from adolescent and parent perspectives. Journal of Adolescence. 2017; 61: 1–11. DOI: 10.1016/j.adolescence.2017.08.005.

34. Twenge JM, Cooper AB, Joiner TE, et al. Age, period, and cohort trends in mood disorders indicators and suicide-related outcomes in a nationally representative dataset, 2005–2017. Journal of Abnormal Psychology. 2019; 128 (3): 185–199. DOI: 10.1037/abn0000410.

35. Twenge JM, Joiner TE, Rogers ML, Martin GN. Increases in Depressive Symptoms, Suicide-Related Outcomes, and Suicide Rates Among U. S. Adolescents After 2010 and Links to Increased New Media Screen Time. Clinical Psychological Science. 2017; 6 (1): 3–17.

Литература

1. Бочавер А. А., Докука С. В., Сивак Е. В., Смирнов И. Б. Использование социальных сетей в интернете и депрессивная симптоматика у подростков [Электронный ресурс]. Клиническая и специальная психология 2019; 8 (3): 1–18. DOI: 10.17759/psyclin.2019080301

2. Лавинский Х. Х., Грекова Н. А., Арбузов И. В., Полянская Ю. Н. Риски здоровью детей в «цифровой среде». Направления профилактики. Здоровье и окружающая среда. 2017; 27: 71–74.

3. Еремин А. Л. Информационная гигиена: современные подходы к гигиенической оценке контента и физических сигналов носителей информации. Гигиена и санитария. 2020; 99 (4): 351–355. DOI: https://doi.org/10.33029/0016–9900–2020–99–4–351–355.

4. Lazer D, Pentland A, Adamic L, Aral S, Barabasi AL, Brewer D, Jebara T. Computational social science. Science. 2009; 323 (5915): 721–723.

5. Mastrandrea R, Fournet J, Barrat A. Contact patterns in a high school: a comparison between data collected using wearable sensors, contact diaries and friendship surveys. PloS One. 2015; 10 (9). e0136497.

6. Garcia D, Rime B. Collective Emotions and Social Resilience in the Digital Traces after a Terrorist Attack. Psychological Science. 2018.

7. Sivak E, Smirnov I. Parents mention sons more often than daughters on social media. Proceedings of the National Academy of Sciences. 2019; 116 (6): 2039–2041.

8. Bond RM, Fariss CJ, Jones JJ, Kramer AD, Marlow C, Settle J E, Fowler JH. A 61-million-person experiment in social influence and political mobilization. Nature. 2012; 489 (7415): 295.

9. Ann J, Weber I. #greysanatomy vs. # Yankees: Demografics and hashtag use on tweeter. Tenth International AAAI Conference on Web and Social Media. 2016.

10. Preotiuc-Pietro D, Volkova S, Lampos V, Bachrach Y, Aletras N. Studying user income through language, behavior and affect in social media. PloS One. 2015; 10 (9). e0138717.

11. Rao D, Paul M, Fink C, Yarovsky D, Oates T, Coppersmith G. Hierarchical Bayesian models for latent attribute detection in social networs. Proceedings of the International Conference on Weblogs and Social Media (ICWSM). 2011.

12. Kosinski M, Stillwell D, Grapel T. Private traits and attributes are predictable from digital records of human behavior. Proceedings of the National Academy of Sciences. 2013; 110 (15): 5802–5805.

13. Smirnov I. Predicting PISA Scores from Students'ital Traces. Twelfth International AAAI Conference on Web and Social Media. Dig. 2018.

14. Eichstaedt JC, Smith RJ, Merchant RM, Ungar LH, Crutchley P, Preotiuc-Pietro D, Asch DA, Schwartz HA. Facebook language predicts depression in medical records. Proceedings of the National Academy of Sciences. 2018; 115 (44): 11203–11208.

15. Rushing SC, Stephens D. Use of media technologies by Native American teens and young adults in the Pacific Northwest: exploring their utility for designing culturally appropriate

technology-based health interventions. Journal Prime Preview. 2011; 32 (3–4): 135–145.

16. Милушкина О. Ю., Скоблина Н. А., Маркелова С. В., Татаринчик А. А., Бокарева Н. А., Федотов Д. М. Оценка риска здоровью школьников и студентов при воздействии обучающих и досуговых информационно-коммуникационных технологий. Анализ риска здоровью. 2019; (3): 135–143.

17. Niederkrotenthaler T, Till B, Garcia D. Celebrity suicide on Twitter: Activity, content and network analysis related to the death of Swedish DJ Tim Bergling alias Avicii. Journal of affective disorders. 2019; 245: 848–855.

18. Положение детей в мире, 2017 год: дети в цифровом мире [Электронный ресурс]. Доклад ЮНИСЕФ. URL: http://www.uncef.org/eca/media/ 4926/file (дата обращения: 29.04.2020).

19. Chancellor S, De Choudhury, M. Methods in predictive techniques for mental health status on social media: a critical review. npj Digit. Med. 3, 43 (2020). https://doi.org/10.1038/s41746–020–0233–7.

20. Кучма В. Р., Сухарева Л. М., Степанова М. И., Храмцов П. И., Александрова И. Э., Соколова С. Б. Научные основы и технологии обеспечения гигиенической безопасности детей в «цифровой школе». Гигиена и санитария. 2019; 98(12): 1385–1391. DOI: http://dx.doi.org/10.18821/0016–9900–2019–98–12–1385–1391.

21. Hooft Graafland JH. New technologies and 21st centure children: Recent trends and outcomes. OECD Education Working Papers, 179. Paris: OECD Publishing. 2018; 60 с.

22. Вятлева О. В. Влияние использования смартфонов на самочувствие, когнитивные функции и морфофункциональное состояние центральной нервной системы у детей и подростков (научный обзор). Вопросы школьной и университетской медицины и здоровья. 2020; 1: 4–11.

23. Насырова Э. Ф., Муллер О. Ю. Технологии работы с детьми с ОВЗ и детьми-инвалидами в условиях дистанционной формы реализации дополнительных общеразвивающих программ: учебно-методическое пособие. Сургут, 2019; 57 с.

24. Johnson KR, Fuchs E, Horvath KJ, at al. Distressed and looking for help: Internet intervention support for arthritis self-management. Journal of Adolescent Health. 2015; 56 (6): 666–671. DOI: 10.1016/j.jadohealth.2015.02.019.

25. Милушкина О. Ю., Попов В. И., Скоблина Н. А., Маркелова С. В., Федотов Д. М., Иевлева О. В. Готовность обучающихся медицинского ВУЗа к использованию дистанционных образовательных технологий. Российский Вестник гигиены. 2021; (1): 6–10.

26. Пивоваров Ю. П., Скоблина Н. А., Милушкина О. Ю., Маркелова С. В., Федотов Д. М., Окольников Ф. Б. и др. Использование интернет-опросов в оценке осведомленности об основах здорового образа жизни. Современные проблемы здравоохранения и медицинской статистики. 2020; (2): 398–413.

27. Christensen H. Social media: the new e-mental health tool. In Psych: The Bulletin of Australian Psychological Society Ltd. 2014; 36 (3): 12–13.

28. Hides L, Kavanagh DJ, Stoyanov SR, et al. Mobile application rating scale (MARS): a new tool for assessing the quality of health mobile applications [Электронный ресурс]. Young and Well Cooperative Research Centre, Melbourne, 2014. URL: https: // eprints. qut.edu.au/71733/ (дата обращения 14.05.2020).

29. Гончарова Г. А. Нервно-психическое здоровье детей — активных пользователей цифровых средств. Российский вестник гигиены. 2021; (3): 33–35. DOI: 10.24075/rbh.2021.017

30. Рапопорт И. К., Соколова С. Б., Чубаровский В. В. Заболеваемость школьников и проблемы создания профилактической среды в общеобразовательных организациях. Вопросы школьной и университетской медицины. 2014; 3: 10–16.

31. Burke M, Kraut RE. The Relationship between Facebook Use and Well-Being Depends on Communication Type and Tie Strength. Journal of Computer-Mediated Communication. 2016; 21 (4): 265–281. DOI: 10.1111/jcc4.12162

32. Благополучие детей в цифровую эпоху: докл. к XX апр. междун. науч. конференции по проблемам развития экономики и общества, Москва, 9–12 апреля 2019 г. А. А. Бочавер, С. В. Докука, М. А. Новикова и др.; Нац. исслед. Ун-т «Высшая школа экономики». М.: Изд. Дом Высшей школы экономики, 2019; 34 с.

33. Barry CT, Sidoti CL, Briggs SM, et al. Adolescent social media use and mental health from adolescent and parent perspectives. Journal of Adolescence. 2017; 61: 1–11. DOI: 10.1016/j.adolescence.2017.08.005

34. Twenge JM, Cooper AB, Joiner TE, et al. Age, period, and cohort trends in mood disorders indicators and suicide-related outcomes in a nationally representative dataset, 2005–2017. Journal of Abnormal Psychology. 2019; 128 (3): 185–199. DOI: 10.1037/abn0000410.

35. Twenge JM, Joiner TE, Rogers ML, Martin GN. Increases in Depressive Symptoms, Suicide-Related Outcomes, and Suicide Rates Among U. S. Adolescents After 2010 and Links to Increased New Media Screen Time. Clinical Psychological Science. 2017; 6 (1): 3–17.