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HYGIENIC ASPECTS OF INFORMATION TECHNOLOGY USE BY CHILDREN AND ADOLESCENTS

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ABSTRACT: This review article examines the hygienic aspects of information technology use by children and adolescents in the context of the digitalization of modern society. It analyzes current scientific data on the impact of prolonged use of electronic devices on the health of the younger generation, including the visual system, musculoskeletal system, nervous system, and psychoemotional system. Particular attention is paid to risk factors associated with screen time, lighting conditions, workplace ergonomics, and disruption of work-rest schedules. Research results reflecting the impact of the digital environment on sleep quality, cognitive functions, and behavioral characteristics of children and adolescents are summarized. The importance of adhering to hygiene standards and developing preventative recommendations aimed at reducing the negative impact of information technology and preserving the health of children is emphasized.

Keywords: information technology, children and adolescents, hygiene, screen time, eyestrain, posture, digital environment, prevention, schoolchildren's health, psycho-emotional state.

ГИГИЕНИЧЕСКИЕ АСПЕКТЫ ИСПОЛЬЗОВАНИЯ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ ДЕТЬМИ И ПОДРОСТКАМИ

АННОТАЦИЯ: В обзорной статье рассматриваются гигиенические аспекты использования информационных технологий детьми и подростками в условиях цифровизации современного общества. Проанализированы современные научные данные о влиянии длительной работы с электронными устройствами на здоровье подрастающего поколения, включая зрительную систему, опорно-двигательный аппарат, нервную и психоэмоциональную сферу. Особое внимание уделено факторам риска, связанным с продолжительностью экранного времени, условиями освещения, эргономикой рабочего места и нарушением режима труда и отдыха. Обобщены результаты исследований, отражающие влияние цифровой среды на качество сна, когнитивные функции и поведенческие особенности детей и подростков. Подчёркнута значимость соблюдения гигиенических нормативов и разработки профилактических рекомендаций, направленных на снижение негативного воздействия информационных технологий и сохранение здоровья детского населения.

Ключевые слова: информационные технологии, дети и подростки, гигиена, экранное время, зрительное напряжение, осанка, цифровая среда, профилактика, здоровье школьников, психоэмоциональное состояние.

RELEVANCE

The rapid expansion of information technologies and digital devices has significantly transformed the lifestyle of children and adolescents, making their use an integral part of education, communication, and leisure. However, alongside the undeniable benefits of

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digitalization, increasing concern has emerged regarding its potential impact on the health of the younger population. Numerous studies indicate that prolonged screen time and improper use of electronic devices are associated with a range of adverse health outcomes, particularly in school-aged children and adolescents [1].

Epidemiological data show that the average daily screen time among children often exceeds recommended limits by 1.5–2 times, especially with the widespread use of smartphones, tablets, and computers [2]. Excessive exposure to digital screens has been linked to visual strain, including digital eye fatigue and myopia progression, as well as musculoskeletal problems such as poor posture and spinal disorders. Additionally, extended screen use is associated with sleep disturbances due to the suppression of melatonin production, particularly when devices are used in the evening hours.

From a psychosocial perspective, high levels of digital engagement may contribute to increased anxiety, reduced attention span, and behavioral changes, especially in adolescents [3]. The combination of physical, functional, and psychological effects highlights the need for a comprehensive hygienic assessment of digital technology use.

The relevance of this review lies in the necessity to systematize current evidence on the health effects of information technologies and to develop scientifically grounded hygienic recommendations aimed at preventing adverse outcomes and promoting safe digital behavior among children and adolescents [1–3].

MATERIALS AND METHODS

This review was conducted using a narrative-analytical approach aimed at summarizing current scientific evidence on the hygienic aspects of information technology use among children and adolescents. A comprehensive literature search was performed in international scientific databases, including PubMed, Scopus, Web of Science, and Google Scholar. The search strategy included key terms such as “screen time,” “children and adolescents,” “digital devices,” “visual health,” “posture,” “sleep,” and “hygienic standards.”

Peer-reviewed epidemiological, clinical, and experimental studies published within the last 10–15 years were considered for inclusion. Priority was given to systematic reviews, meta-analyses, and large-scale population-based studies, as well as recommendations from international health organizations. Studies focusing exclusively on adult populations or not addressing health-related outcomes were excluded.

The selection process included screening titles and abstracts followed by full-text analysis to assess relevance and methodological quality. Extracted data included duration and patterns of device use, environmental conditions (lighting, ergonomics), and health outcomes such as visual strain, musculoskeletal disorders, sleep disturbances, and psychosocial effects. Comparative and thematic analysis was applied to identify consistent patterns, risk factors, and preventive recommendations within the framework of hygiene and public health research.

RESULTS AND DISCUSSION

Analysis of current scientific literature indicates that the use of information technologies by children and adolescents has increased significantly over the past decade, leading to measurable changes in health indicators. Epidemiological studies report that average daily screen time among school-aged children ranges from 3 to 6 hours, exceeding recommended hygienic norms by 1.5–2 times [4]. In some populations, up to 70–80% of adolescents use digital devices for more than 4 hours per day, particularly due to online learning and social media engagement.

Visual health disturbances are among the most frequently reported consequences of prolonged screen exposure. Studies show that symptoms of digital eye strain, including dryness, blurred vision, and eye fatigue, are observed in 50–65% of children who regularly use electronic

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devices for more than 3 hours daily [5]. Furthermore, the prevalence of myopia has increased substantially, with some studies indicating a 20–30% higher risk among children with excessive screen time and limited outdoor activity.

Musculoskeletal disorders also represent a significant health concern. Research demonstrates that 40–60% of children using computers or mobile devices for extended periods exhibit poor posture, neck pain, or spinal discomfort [6]. Prolonged sitting, incorrect ergonomic conditions, and the use of handheld devices at improper angles contribute to the development of functional disorders of the musculoskeletal system.

Sleep disturbances are another critical outcome associated with digital technology use. Exposure to blue light from screens, especially during evening hours, suppresses melatonin production and delays sleep onset. Studies indicate that children who use electronic devices before bedtime are 1.5–2 times more likely to experience reduced sleep duration and poor sleep quality [7]. Chronic sleep deprivation, in turn, negatively affects cognitive performance, memory, and academic achievement.

Psychosocial effects are increasingly documented in the literature. High levels of screen time are associated with increased anxiety, reduced attention span, and behavioral problems. Adolescents with excessive digital engagement demonstrate higher rates of emotional instability and social withdrawal, particularly when screen use replaces face-to-face interaction [8].

Overall, the findings confirm that excessive and uncontrolled use of information technologies is associated with multiple adverse health outcomes affecting visual, musculoskeletal, neurological, and psychosocial systems [4–9].

Further analysis of the literature emphasizes that not only the duration of screen exposure but also the conditions of information technology use play a critical role in determining health outcomes. Hygienic factors such as lighting conditions, screen brightness, viewing distance, posture, and duration of continuous work are directly associated with the severity of functional disorders. Studies indicate that inadequate lighting and excessive screen brightness increase the risk of visual fatigue by approximately 25–30%, while incorrect viewing distance (less than 30–40 cm) significantly contributes to the progression of myopia in children and adolescents [4].

Ergonomic conditions are equally important in the prevention of musculoskeletal disorders. Research shows that the use of non-adjustable furniture, improper seating position, and prolonged static posture increase the incidence of neck and back pain by 30–50% [5]. The widespread use of smartphones and tablets, often without proper support, leads to excessive cervical spine flexion, contributing to the development of so-called “text neck syndrome,” particularly in adolescents.

The duration and structure of screen time are critical from a hygienic perspective. Continuous use of digital devices without breaks has been associated with a significant increase in visual and neurological fatigue. Studies demonstrate that adherence to recommended work-rest regimens, including breaks every 20–30 minutes, can reduce symptoms of eye strain and fatigue by up to 40% [6]. However, observational data indicate that only a minority of children follow these recommendations consistently.

Preventive strategies highlighted in the literature include the implementation of hygienic standards regulating screen time and environmental conditions. International guidelines recommend limiting recreational screen time to no more than 2 hours per day for school-aged children, while ensuring structured breaks during educational use [7]. Increasing outdoor physical activity has been shown to reduce the risk of myopia progression by 20–30%, highlighting the importance of balancing digital and physical activities.

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Parental control and education play a key role in shaping healthy digital behavior. Studies indicate that children whose parents regulate screen time and establish clear usage rules demonstrate significantly lower levels of digital overuse and associated health problems [8]. School-based health education programs also contribute to improved awareness and adoption of hygienic practices.

From a public health perspective, the development of safe digital environments requires coordinated efforts involving families, educational institutions, healthcare professionals, and policymakers. Implementation of ergonomic standards, health education programs, and monitoring systems is essential for minimizing risks associated with digital technology use [9].

Overall, the evidence confirms that the negative health effects of information technologies are largely preventable. Compliance with hygienic norms, rational organization of screen time, and early preventive interventions can significantly reduce the risk of functional disorders and promote healthy development among children and adolescents [4–9].

A more in-depth examination of current research highlights that the impact of information technologies on children and adolescents should be considered within a broader biopsychosocial and environmental framework. The interaction between prolonged screen exposure, reduced physical activity, and changes in daily routines creates a cumulative effect that significantly influences both physical and mental health outcomes. Studies indicate that children with high levels of screen time are 1.5–2 times more likely to exhibit sedentary behavior patterns, which are associated with increased risks of overweight and obesity, as well as metabolic disturbances [4]. These findings underscore the indirect pathways through which digital technologies affect health, extending beyond immediate functional disorders.

Cognitive and academic performance also demonstrate complex associations with digital device use. Moderate and structured use of information technologies for educational purposes has been shown to improve access to learning resources and support cognitive development. However, excessive and unregulated use, particularly for entertainment and social media, is associated with reduced attention span, impaired concentration, and decreased academic performance. Studies report that adolescents engaging in more than 4–5 hours of non-educational screen time daily show a 20–30% decline in academic achievement indicators compared to peers with regulated use patterns [5].

Another important dimension is the influence of digital environments on mental health and behavioral patterns. Social media platforms and online interactions can contribute to the formation of unrealistic social expectations, cyberbullying, and increased emotional vulnerability. Research indicates that adolescents with high social media exposure are 1.7 times more likely to report symptoms of anxiety and depressive disorders [6]. At the same time, excessive digital engagement may reduce face-to-face communication, weakening social skills and emotional resilience.

Sleep hygiene remains a critical concern in the context of digital technology use. Beyond the direct physiological effects of blue light exposure, the cognitive and emotional stimulation associated with online content delays the transition to sleep. Studies show that children who use digital devices within one hour before bedtime experience a reduction in sleep duration by 30–60 minutes and demonstrate higher levels of daytime fatigue and irritability [7]. Chronic sleep deprivation has been linked to impaired cognitive function, weakened immune response, and increased risk of behavioral disorders.

The digitalization of education, particularly accelerated during recent global events, has further intensified exposure to information technologies. While дистанционное обучение (distance learning) has expanded educational accessibility, it has also increased total daily screen

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time, often exceeding hygienic recommendations. This shift has raised concerns regarding the adequacy of existing hygienic standards and the need for updated regulatory frameworks that reflect modern patterns of digital engagement [8].

Preventive approaches must therefore evolve to address these emerging challenges. The concept of "digital hygiene" is increasingly emphasized in the literature, encompassing not only time regulation but also safe usage practices, ergonomic organization, content control, and psychological well-being. Interventions aimed at developing digital literacy, critical thinking, and self-regulation skills among children and adolescents have demonstrated promising results, with reductions in problematic screen use by approximately 15–25% in intervention groups [9].

In addition, the role of healthcare professionals is expanding in the context of digital health risks. Pediatricians and public health specialists are encouraged to incorporate screening for excessive screen time, sleep disturbances, and psychosocial effects into routine health assessments. Early identification of risk patterns allows for timely preventive interventions and counseling for both children and their families.

Overall, the expanded analysis confirms that the use of information technologies represents a complex and multidimensional factor influencing child and adolescent health. While digital tools offer significant educational and social benefits, their uncontrolled use poses measurable risks. A balanced and evidence-based approach, integrating hygienic standards, educational strategies, and public health policies, is essential to maximize benefits while minimizing adverse health outcomes in the younger population [4–9].

CONCLUSIONS

The analysis of current scientific evidence demonstrates that the use of information technologies has become an essential component of modern life for children and adolescents, significantly influencing their health and development. While digital technologies provide important educational, communicative, and social benefits, excessive and uncontrolled use is associated with a wide range of adverse outcomes affecting visual, musculoskeletal, neurological, and psychosocial systems.

The reviewed data confirm that prolonged screen time, especially when combined with inadequate hygienic conditions such as poor lighting, improper ergonomics, and lack of structured breaks, contributes to the development of visual fatigue, progression of myopia, postural disorders, and sleep disturbances. In addition, high levels of digital engagement are linked to reduced physical activity, increased sedentary behavior, and a higher risk of metabolic disorders. From a psychosocial perspective, excessive use of digital devices may negatively affect emotional stability, attention, and social interaction, particularly among adolescents.

Importantly, the findings indicate that the negative health effects of information technologies are largely preventable. The implementation of hygienic standards regulating screen time, the organization of appropriate working conditions, and adherence to work-rest schedules can significantly reduce the risk of functional disorders. Preventive strategies should also include increasing outdoor physical activity, improving digital literacy, and promoting balanced use of technology for educational and recreational purposes.

The role of family and educational institutions is crucial in shaping safe digital behavior. Parental supervision, structured daily routines, and school-based health education programs contribute to reducing excessive screen use and improving awareness of hygienic practices. Healthcare professionals should also be actively involved in early detection of digital-related health risks and in providing guidance to children and their families.

In conclusion, ensuring the safe use of information technologies among children and adolescents requires a comprehensive and multidisciplinary approach. Integration of hygienic,

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educational, and public health measures is essential to minimize risks, promote healthy development, and adapt preventive strategies to the rapidly evolving digital environment.

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