

## INFLUENCE OF MODERN EDUCATIONAL ENVIRONMENT ON THE NEURO-MENTAL HEALTH OF SCHOOL-AGE CHILDREN

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The steadily growing prevalence of various psycho-social maladaptation forms among children and adolescents is reported all over the world. The today's tempo of life associated with active introduction and widespread use of information technology results in the dramatic increase in educational workload, thereby provoking a significant increase in the prevalence of borderline mental disorders, primarily neurotic disorders in schoolchildren. Investigation of various forms of neuro-mental health impairment and somatic disorders in school-age children is among research priorities in different countries. The paper provides systematized data of the studies focused on assessing neuro-mental disorders in schoolchildren.

**Keywords:** children's health, factors of school environment, school-related diseases, school educational environment, children's neuro-mental health

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## ВЛИЯНИЕ СОВРЕМЕННОЙ ОБРАЗОВАТЕЛЬНОЙ СРЕДЫ НА НЕРВНО-ПСИХИЧЕСКОЕ ЗДОРОВЬЕ ДЕТЕЙ ШКОЛЬНОГО ВОЗРАСТА

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Во всем мире отмечают неуклонный рост различных форм психосоциальной дезадаптации у лиц детского и подросткового возраста. Современный ритм жизни с активным внедрением и повсеместным использованием информационных технологий приводит к резкому увеличению нагрузки в сфере образования, что провоцирует значительный рост пограничной психической патологии, в первую очередь расстройств невротического характера у школьников. Изучение форм нарушения нервно-психического здоровья и соматических расстройств у детей школьного возраста является одним из приоритетных направлений исследований в разных странах. В статье приведены и систематизированы данные исследований, посвященных изучению нервно-психических расстройств у школьников.

**Ключевые слова:** здоровье детей, факторы внутришкольной среды, школьно-обусловленные болезни, школьная образовательная среда, нервно-психическое здоровье детей

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According to the state statistics and scientific research results, a negative trend in health indicators of children and adolescents is observed in Russia over almost three decades. Thus, according to the data available, physical education lessons at school are reported to be the main form of physical activity in primary school-age children. Furthermore, there is insufficient outdoor exercise, while high anxiety levels observed in primary school-age children are often associated with fears and worries directly related to school attendance [1–6]. Similar data are provided by researchers from different countries, which suggest steady deterioration of students' health; the growing prevalence of neurological and mental disorders, metabolic disorders (mostly obesity) is reported, along with high rate of childhood and adolescent suicide in a number of countries [7–13]. Since the individual's health formation depends on the combination of endogenous and exogenous factors he/she is exposed to, the currently ongoing research is focused on determining the causes of the neuro-mental and somatic health problems in school-age children. It is necessary to study the features of students' health formation at various stages of school ontogeny for further rational organization

of preventive and health improving measures in educational institutions. It has been confirmed that the today's educational process adversely affects students' health. Thus, about 50% of schoolchildren show difficulty and disorders of adaptation to the educational environment factors, which, in turn, often results in significantly increased prevalence of functional nervous system impairment among schoolchildren [1–13]. The prevalence of chronic disorders among school-age children has significantly increased over the past two decades. According to the data of various studies, the prevalence of chronic disorders in high income countries varies between 3.5–35% of children under the age of 17 years [11–13]. Children with various neuro-mental and chronic disorders are at higher risk of psycho-social difficulties and developmental disorders compared to healthy peers. Furthermore, it has been confirmed that students with chronic disorders have a higher rate of stress, difficulty understanding and mastering the curriculum, as well as lower attendance later in life compared to healthy students [11].

At the same time, the major forms and possible causes of the increase in the prevalence of neuro-mental and somatic disorders in school-age children are inadequately disclosed

in the available literature. The study was aimed to review the available data of the studies focused on the position of the disease class “Mental and behavioural disorders” in the structure of incidence in terms of child-care attendance and incidence among school-age children, prevalence, age-related features and structure of this disease class, as well as the impact of educational environment factors on the development of neuro-mental disorders in school-age children.

## Methods

A review of papers published in 2010–2022 in scientific and practical periodicals available from Russian and foreign databases (RSCI and PubMed, Cyberleninka) was performed.

### Major types and prevalence of neuro-mental and somatic disorders in school-age children

Currently, about 60% of children have certain chronic disorders. Moreover, no more than 13% of pre-school children and 1–2% of adolescents can be considered perfectly healthy. Longitudinal studies have shown that in general in the 1–9 grades there is a negative trend in the health status of schoolchildren, the prevalence of chronic diseases increases, the occupancy rate for health groups III–IV increases due to a decrease in the number of children assigned to health groups I and II (in 2005–2010 the population of healthy schoolchildren (health group I) reduced from 4.3 to 0% in primary school and from 2.5 to 0% in high school) [1–16, 18]. According to the available data, nervous system disorders are reported in 12% of surveyed schoolchildren, while mental disorders are reported in 6% of school students [4]. As for the central nervous system (CNS) disorders, students have neuroses with predominant severe astheno-neurotic syndromes, mononeuroses (tics, enuresis, sluttering), vegetovascular dysfunction, pathocharacterological and psychopathic personality development, borderline intellectual functioning, epilepsy syndromes, remission of endogenous disorders in a large number of cases.

Some authors believe that the schoolchildren's health status is an integral indicator reflecting the effects of environmental and in-school factors, educational activities on the students' bodies that is composed from the levels of physical and intellectual development at different ages. This also depends on the state of neuroendocrine processes, body's functional status, immune defense, and adaptive reactions [14–16]. The combined effects of the educational process adverse factors result in deterioration of adaptive capacity of the nervous, endocrine, immune and other systems of the growing body, as well as in functional disorders and their progression, development of chronic diseases [11, 17, 18]. In recent decades, a steadily growing rate of various forms of psycho-social maladaptation among children and adolescents is reported in Russia, which leads to severe socio-economical consequences. The increase in the number of cases of criminal, addictive and auto-aggressive forms of behavioral deviations, drug abuse and early alcohol abuse, various forms of deviant behavior in adolescent students, borderline mental disorders, primarily neurotic disorders, in schoolchildren, is observed in Russia [1–7]. This is partially due to revolutionary changes in the field of information technology and a dramatic increase in information load, as well as to other changes in educational sphere [10–12]. Thus, the study focused on assessing the students' school experience demonstrates three models of school experience: “negative on all items” (37%), “negative on all items, except school workload” (40%) and “generally positive” (23%) [11].

The overall prevalence of all mental disorders is 10.11%, including 11.48% among boys and 8.68% among girls [12]. The other study was focused on assessing the causes and development conditions of school maladjustment and borderline mental disorders in 155 children/adolescents (108 males, 47 females) treated in the psychiatric day hospital for children and adolescents [14]. In this study, family history of neuro-mental disorders was reported in 50% of patients regardless of their gender; residual organic manifestations were reported in 94.8% of surveyed individuals, 61.3% showed somatic asthenization [14].

According to the available data, about 18.3% of surveyed schoolchildren and adolescent students have some neurodevelopmental disorders [19]. The growing rate of somatic disorders capable of causing certain mental disorders, such as depression, is reported. Thus, for example, a number of foreign studies have revealed excess body weight in 19.7%, obesity in 16%, and the combination of excess body weight and obesity in 35.7%. In addition, the trend towards the increase in the prevalence of excess body weight with age is observed [20]. Summarizing the results of domestic studies, we can also note the increase of incidence in terms of child-care attendance to 1779.1‰ among children aged 0–14 years [21]. The worst dynamics of health status is observed in individuals in their late teens (15–17 years). About 50% of students have career restraints due to health problems, 50–70% have health barriers to military service, and every fifth individual has reproductive problems. The study of the children and adolescent health status has shown that there has been a trend towards an increase in the incidence in terms of child-care attendance by 2–4% per year and in the prevalence of chronic disorders in Russia over 20 years; reduction of the number of healthy children in all age and gender groups is observed. According to official statistics, the overall incidence among children aged 0–14 years, including incidence among individuals in their early teens (10–14 years), exceeds 2400‰, while the incidence among individuals in their late teens (15–17 years) is close to 2000‰ [22].

The early research results demonstrate that anxiety (43%), oppositional behavior (30%), antisocial personality disorders (10%), alcohol (27%) and drug (18%) abuse in adolescents can sometimes be associated with persistent attention deficit hyperactivity disorder (ADHD) (in 50–80% of cases) [23]. According to a number of studies, such neuropsychiatric disorders, as anxiety and fear related disorders ( $30.7 \pm 1.6\%$ ), somatoform ( $60.8 \pm 2.8\%$ ) and hyperkinetic ( $61.4 \pm 1.7\%$ ) disorders, are most typical for students attending gymnasiums and innovative schools. Behavioral disorders ( $53.2 \pm 2.9\%$ ) are more typical for students attending comprehensive schools [24]. The prevalence rate of different borderline mental disorders of varying severity reaches 55%, where 80% is the share of preclinical forms, which usually remain undetected during the routine check-ups. Severe clinical symptoms of borderline neuro-mental disorders have been reported in  $97.5 \pm 0.5\%$  of students attending innovative schools and  $92.7 \pm 1.5\%$  of students attending comprehensive schools in various training periods. Insufficient provision of the educational environment psychological safety results in the emergence of a number of factors adversely affecting the students' mental and physical health and contributing to the educational process disruption [19, 24, 25].

Analysis of the prevalence of severe clinical depression, dysthymia and bipolar disorder among children and adolescents aged 6–16 years has shown that 2.004% of surveyed individuals have severe depression, 0.352% have dysthymia, and 0.856%

have bipolar disorder. The overall prevalence of severe mood disorders is 3.212% [26]. In addition, some authors note the impact of the high rate of psychosomatic complaints and behavioral deviations in adolescents, especially boys [27]. This is confirmed by domestic studies. Thus, it has been noted that the majority of students with mental retardation feel negative when trying to understand the terms related to school attendance: a negative attitude towards school attendance is reported in 57% of students [28]. Today, there are many studies focused on assessing cognitive features and adaptation of children and adolescents at school. However, neuro-mental disorders, social skills, communication, education/professional life and comprehensive studies are less thoroughly discussed [29].

Behavioral disorders associated with the disorders of intellectual development often become the causes of impaired social and psychological adaptation of students of this category later in life. According to the research data, neurosis and neurosis-like conditions prevail among pre-nosological forms of neuro-mental disorders in primary school students, while pathocharacterological reactions prevail in the middle and high school students [14, 24]. According to the research, about 40% of schoolchildren suffer from psychosomatic disorders; somatoform and psychosomatic disorders, long-term response to stress are observed in 77.3% of children having family problems; 22–23% show persistent behavioral deviations with pathocharacterological reactions. The analysis of the assessment results of 155 children and adolescents aged 10–15 revealed residual organic manifestations contributing to the development and decompensation of the disease manifestations in 147 patients (94.8%). Somatic weakness was reported in the majority of children (61.3%). The analysis of the subjects' family background showed that 74 children (47.4%) were brought up in intact families, and supportive parenting was reported in 43.2% of such families; as for single-parent families, the families with altered structure, supportive parenting was reported in 25.9% of cases. Hyperprotection and hypoprotection prevailed in cases of unharmonious parenting [14].

About 46% of schoolchildren have various astheno-neurotic disorders, increased irritability, irrational mood swings, concentration problems. Psychasthenic disorders in the form of various phobias (fear of the dark, being alone, school, bad marks) are also typical for students, some children suffer from repetitive movements (tics) [1–16, 24].

Assessment of academic success has shown that the majority of cases of persistent school failure result from various kinds of intellectual disability, such as mental retardation. Furthermore, certain cognitive disorders of mild severity, associated primarily with attention deficit and difficulty concentrating, are reported in every tenth school-age child [7, 11, 25]. The combination of adverse genetic, perinatal factors, primary residual damage to the brain structures changing their function results in the overall susceptibility to the disorders that can be induced by a wide variety of triggering external factors [23]. Today, the leading place in the structure of functional impairments and chronic disorders is occupied by mental and behavioral disorders [11, 14, 24, 26]. Furthermore, 39.4% of disorders are represented by neurological deficits, 17.4% are represented by residual organic CNS damage, 17.4% are represented by the diagnosed ADHD; specific disorders of the development of school skills are reported in 14.0% of cases [4]. Assessment of neurological disorders showed that complaints of neurological phenomena (sleep disorders, asthenic syndrome and mood swings, headache) prevailed among school students.

According to the available data, mental retardation is a large group of disorders characterized by intellectual and mental disability, generally due to developmental disorder; early developmental disorders of the CNS can be provoked by biological (genetic and intrauterine factors, perinatal disorders, chronic disorders and other conditions) and socio-psychological (emotional and social deprivation, stressful situations, educational neglect) factors [4]. Mental retardation represents a significant brain development slowdown most often detected when the child enters school that manifests itself as the lack of overall knowledge, narrow-mindedness, intellectual immaturity, poor intellectual orientation, predominance of gaming interests, emotional immaturity. Many children with mental retardation show signs of cerebathenia and hyperdynamic syndrome. When assessing such children, speech and language delay, decreased mental performance due to deficiency and exhaustion of attention and memory are reported [4, 28, 29]. The study of psychosocial maladaptation in children and adolescents of grades 5–9 showed that the students having a negative experience of school attendance (many years of demonstrating a negative attitude to underachieving students and those unable to strictly observe classroom discipline of teachers and classmates) show low or even negative sociometric status index, more severe symptoms of the learning process inadequacy and decreased academic performance, higher severity of personality disorders, low self-esteem, increased motivation to avoid failure [30]. It was also shown that in classes with advanced study of certain disciplines training intensification during classes exceeded optimal (60–80%) and constituted 85–90%, while in the control group it did not exceed 80% [31].

Today, attention deficit hyperactivity disorder (ADHD) is among the most common nosological forms of neuro-mental disorders and represents the most common cause of behavioral disorders and learning difficulties in pre-school and primary school age children. According to the data of foreign and domestic epidemiological studies, the prevalence of ADHD among children of these age groups reaches 4.0–9.5%. Moreover, according to various authors, it varies between 12 and 29% of pediatric population. Physiological status of the child with ADHD is characterized by changes in the cerebral cortex regulatory influences on the subcortical structures, which is reflected in the brain energy state alterations [28]. This is associated with the increased tone of the autonomic nervous system sympathetic and parasympathetic divisions and impaired coordination ability. The major ADHD manifestations include disorders of attention (attention deficit), signs of impulsivity and hyperactivity. The decrease in the hyperactivity symptom severity with age is reported, however, attention problems, distractibility, and impulsivity can persist for a long time, constituting a factor of neurosis, social maladaptation [23, 26–32].

The analysis of data on the prevalence of functional nervous system disorders and chronic neuro-mental disorders in schoolchildren has shown that their rates in intensive schools are three times higher than in conventional schools [33].

At the same time, 40–50% of generally healthy students have some symptoms of functional nervous system disorders [4, 34]. Preclinical forms of functional nervous system disorders found in students include disseminated microsymptoms of organic lesion, dyslalia (cluttering), labyrinthopathy, mental retardation [4]. Psychological trauma finds a fertile soil in students with premorbid background and biological insufficiency (weak type of higher nervous activity, residual microsymptoms of organic lesion), which, in turn, result

in monosymptomatic neuroses (enuresis, sluttering, hyperkinetic and neurotic disorders) [17–34]. Some researchers believe that the nervous system asthenization results from excess load on the CNS followed by impaired cortical neurodynamics, resulting in the fact that negative emotions, feelings of danger, distress, uncertainty, ambiguity predominate in schoolchildren, while the screening tests show predominance of neurological complaints (sleep disorders, tearfulness, headache) [4, 8–34]. Functional nervous system disorders in the form of vascular dysfunction are reported in 19.3% of schoolchildren, asthenic syndrome in 8.3%, closed head injury sequelae in 4.9%, and minimal brain dysfunction in 2.8% of students [4, 34]. It is assumed that the emergence and development of a number of functional disorders and chronic diseases are largely associated with the increased psychoemotional load and the students' low physical activity [11, 34]. Furthermore, some authors assume that delayed formation of connectivity between the leading brain structures underlies many borderline mental disorders in children at early stages [23]. According to the assessment results of 70 primary school-age children, in 50 cases (71.4%) personal characteristics were revealed that made it possible to distinguish five variants of behavior. Predominant types were as follows: irritability (44.5%), adjustment disorders (42.8%), and increased irritability (20.4%) [35].

Thus, of neuro-mental disorders, functional disorders of the CNS, neuroses and astheno-neurotic manifestations, ADHD predominate in school-age children, while pathocharacterological reactions are more typical for older students.

According to domestic studies, a negative dynamics of the incidence of mental disorders in children and adolescents is observed since 2007. In the Russian Federation, the number of reported cases of mental disorders was 703,200 in children aged 0–14 years and 273,500 in adolescents aged 15–17 years, which constituted 16.5 and 6.5% of the total number of patients, respectively [36]. The share of mental disorders in the overall incidence structure is small (about 3%): these rank 10<sup>th</sup> in children and 11<sup>th</sup> in adolescents [37]. In 2015, it was found that at least 11–16% of children and adolescents had at least one mental disorder. Furthermore, according to various research data, the global prevalence of mental disorders among children and adolescents is 3.5–38.3% [37].

It is necessary to note the relationship between somatic disorders/impairments and secondary mental disorders in adolescents. The analysis of somatic disorders in school-age children has shown that diseases of the respiratory system occupy the leading place in the structure of incidence in terms of child-care attendance (58.49 and 58.41%), diseases of the digestive system occupy the second place (5.84 and 5.30%), and the third place is occupied by diseases of the eye and adnexa (5.20 and 5.33%). Furthermore, the most prevalent diseases include infectious and parasitic diseases, diseases of the skin, nervous and musculoskeletal systems [38, 39]. The growing rate of injuries (by 10.40%) and diseases of the digestive system (by 2.53%) is reported in children of this age group, which can be indicative of the problem related to shaping good nutritional habits and health preserving behavior [11, 15]. According to some authors, the combined share of the listed above disease classes is 86.2% [21]. The more detailed analysis of the structure of the leading disease classes has shown that diseases of the respiratory system predominate mostly due to seasonal ARI and ARVI (94.4%), influenza, acute sinusitis, acute nasopharyngitis, acute bronchitis. Abnormalities associated with various visual acuity disorders predominate among eye disorders (52.4%): myopia, hyperopia, astigmatism, strabismus, accommodative dysfunction; acute inflammatory disorders of the eye account

for 9.7% [38]. The majority of authors note a significant role in pediatric and adolescent morbidity played by school related illnesses [6]. Constant eye strain contributes to progression of vision problems, physical inactivity plays a negative role, since it disturbs normal development of the musculoskeletal system, circulatory and respiratory system organs, which results in disorders of these systems later in life [11]. In the class of disorders of the musculoskeletal system, the first places are occupied by flat feet, spinal instability, scoliosis (98.3%). These disorders are determined and to the great extent dependent on the school environment factors [21]. The share of children with normal body weight has decreased by 16.9% in boys and by 13.9% in girls. Underweight individuals predominate among children with abnormal body weight (80%). The growing share of runt children is reported (1.3%) [22]. The prevalence of various health problems among first-grade students is 1635%, while the rate of functional impairment is 1100% and the rate of chronic disorders is 535%. Various physical development disorders are found in 19.0% of primary-school students, among them there are many children with physical developmental delays. In early 2000s, functional disorders of the musculoskeletal system, neuro-mental disorders, functional disorders of the digestive and cardiovascular system moved to the leading places in first-grade students, while in individuals in their late teens these places were occupied by neuro-mental disorders, functional disorders of the cardiovascular and musculoskeletal systems, visual problems. The growing share of functional disorders of the circulatory system in the structure of morbidity of schoolchildren of all age groups should be noted. Among functional disorders found in schoolchildren attending institutions of new type, disorders of the endocrine, cardiovascular, musculoskeletal, and nervous systems are the most prevalent [11, 15–18, 22, 33]. It has been confirmed that the growing rate of somatic disorders in children and adolescents often results in the development of secondary mental disorders (anxiety, depression, body dysmorphic disorder, etc.), while the combination of somatic and mental disorders significantly impairs the quality of life and adaptation [40].

Thus, high prevalence of various neuro-mental disorders among children and adolescents should be noted, along with their association with a number of out-of-school and education-related factors. The extraordinary diversity of the disease entities in mental disorders of children and adolescents requires a more thorough investigation of the risk factors of this group of disorders. Some authors note the role played by educational workload and educational process intensification, high psychoemotional stress associated with learning in the development of a wide variety of adolescent mental disorders. Furthermore, excess educational workload can result in somatic disorders being a major risk factor of severe mental illness and formation of the “vicious circle”, thereby significantly deteriorating correction of condition in such patients later in life. The complex interplay between biological, socio-economic, environmental, psychological and educational factors, living conditions, lifestyle, quality of medical care is poorly understood. It is reasonable to study the major aspects of the impact of educational process and related school risk factors of neuro-mental disorders in children and adolescents.

#### **Impact of modern educational environment factors on the schoolchildren's neuro-mental health**

The data of many studies demonstrate unfavorable changes in the major pediatric health indicators at school, which is largely due to the fact that advanced educational technologies

do not undergo sanitary and hygienic testing aimed at assessing safety for schoolchildren's health. Under exposure to increasing educational workload, training intensification and informatization, mastering the curriculum is achieved through significant strain on the students' body functional capabilities. According to the results of some domestic studies, the most significant determinants of students' health status include the increased intensity and monotony of school work, intellectual workload, reduced duration of breaks and rehabilitation deficit index. Some authors believe that organization of educational process and school meals is a leading risk-inducing factor of neuro-mental and somatic disorders in schoolchildren, regardless of the educational institution type and grade [36]. Today, the issue of the relationship between the microsocial environmental, constitutional biological, exogenous organic and somatogenic factors contributing to the development of borderline mental disorders in children and adolescents showing school maladjustment remains urgent [14]. Some studies show the association of school maladjustment and borderline mental disorders with the family history of neuro-mental disorders [13]. According to the research conducted by pediatricians, current situation is characterized by the presence and growing rate of unfavorable in- and out-of-school factors affecting the students' health. It is also characterized by growing rate of disorders, regardless of the form of training [30]. The most significant psychotrauma-inducing stimuli include excess educational workload and disruption of the educational process (especially in schools of new type). A number of authors believe that it is these factors that cause neurotic disorders with further somatization of neurosis, predominance of visceral symptoms and impaired function of organs and systems, as well as reduced overall resistance of the growing body [33–34, 41].

About 50% of schoolchildren have problems related to adaptation to the educational environment factors due to adverse effects of modern educational environment factors. A significant increase in the prevalence of the nervous system functional disorders among schoolchildren has been reported [4–6]. It has been found that high educational workload, including that experienced when taking extra classes, long time spent on the computer, impaired daily routine, insufficient sleep, conflicts at school and in the family, psychosomatic disorders in teachers and other factors play an important role in the development of neurotic mental disorders (asthenic and neurotic reactions, neuroses) [18, 23, 30, 31].

The growing rate of neuro-mental disorders is largely related to extensive use of digital technology in the educational process [42]. The emergence and development of new digital informational and educational environment has some positive aspects, but is also characterized by a number of additional factors capable of adversely affecting the students' health status. In the modern educational process, the students are exposed to the combined effects of electromagnetic emission and acoustic impact, extra static and psychoemotional stress, educational process intensification and increased visual load associated with introduction of digital tutorials with various font design since the very beginning of training. Today, the impact and possible adverse effects of exposure to these school risk factors on the students' health, child's body functional state and development of education-related disorders are poorly understood [8, 11]. It has been confirmed that the use of advanced information technology and Wi-Fi systems in the educational process results in transformation of training condition, increased effects of electromagnetic waves of various ranges, increased noise levels [43]. Noise exposure degrades the quality of training and sometimes provokes

pediatric asthenic and neurological disorders (fatigue, overall exhaustion, headache and vertigo). In addition, the use of gadgets significantly increases visual load and requires specific operating conditions (for example, certain illumination levels in classroom), which, in turn, can further worsen the described symptoms [44]. According to the sanitary and hygienic testing results, about 17% of institutions have increased indoor noise levels [45]. The growing body of research demonstrates adverse effects of digital tutorials on the health status of schoolchildren, which is due to the use of different font designs creating excess visual load and provoking fatigue, its cumulation and exhaustion in children. In this regard, the hygienic control of electromagnetic emission, noise levels, and standardization of the processes of using electronic educational resources becomes relevant.

The today's educational process requires high concentration of attention, ability to constantly promptly switch between the educational tasks. This, in turn, contributes to the cognitive function intensification and neuro-mental overload, often resulting in deterioration of adaptation and children's learning activity [11, 43]. Modern educational system has evolved towards the increasing amount and complexity of academic information, rapid intellectual activity intensification, introduction of new academic disciplines and programs. The educational process organization is among major factors affecting the students' health. It should be noted that educational institutions not always comply with the sanitary legislation requirements for educational process organization [31, 33]. The today's educational system is primarily focused on the training intensification, and, despite wide variety of training programs, the majority of such programs are not focused on preservation and improvement of students' health [31, 43]. It has been found that the majority of reforms introduced into the educational system in combination with the existing extracurricular workload adversely affect the children's somatic and neuro-mental health. The steady increase in the academic workload results in compensation for large amounts of time spent on learning by reducing sleep and physical activity. According to the available data, 75% of schoolchildren are physically inactive, 40–55% of surveyed individuals demonstrate severe fatigue in the end of the school day or week. Furthermore, elevated blood pressure is reported in 60%, and neurosis-like reactions are found in 80% of children. The listed above responses contribute to the disorders of cardiovascular and musculoskeletal systems, autonomic dysfunction and neuro-mental disorders later in life [11]. The studies have shown that when conventional forms of training are used, 50% of schoolchildren are at the average level of neuro-mental development, 35% are at the level below average, 15% show underdevelopment. In the group of students with intense forms of training, 55% of students are at the average level of neuro-mental development, 25% are at the level above average, 20% are at the level below average. When performing psychological testing of students using the Kettle test, the researchers have found that 30% of surveyed individuals in conventional classes are at risk of borderline mental disorders: they demonstrate high levels of anxiety, irritability, low activity and intelligence, high sensitivity [8]. Among adolescents enrolled in intensive training programs, the majority of students demonstrate high neuroticism: their share is 66.6% vs. 21.4% in comprehensive classes. In students of the lyceum classes with normal neuroticism levels, the average score of neuroticism severity is higher than that of schoolchildren attending comprehensive classes (40.8% vs. 36.2%), which indicates approaching the upper limit of normal for this neuroticism level [5].

Thus, a number of medical experts believe that high educational workload currently represents the most negative factor of school environment [1–8, 25, 46].

It should be noted that even compliance of educational institutions with the hygienic requirements does not ensure no of out-of-school risk to the health of schoolchildren, since the risk is most often associated with domestic surroundings, family members' habits and knowledge about healthy lifestyle (rational nutrition, adherence to sleep and wakefulness, work and rest regimes) [4, 8, 9, 11, 47]. Currently, the issue of childhood and adolescent psycho-traumatic factors as the basis for the broad spectrum of psychosomatic and neurotic disorders, high risk of severe depression and suicide remains relevant. Psycho-traumatic factors are a multidisciplinary problem that requires coordination of the in-school and out-of-school activities, since these factors are often associated with not only poor relationships in the class and school community, but also with parents, their communication with the child and with each other [1–16]. It has been proven that poor psychological safety of the educational environment, inadequate school climate, pedagogical violence, didactogeny, bullying and victimization contribute to shaping mental and physical health of individuals involved in educational process [48]. In addition, the emergence and development of mental disorders are influenced by emotional instability, high levels of anxiety, psychovegetative lability, as well as by mistreating victim by the family and teachers, which contributes to prolonged stress followed by the development of neuro-mental disorders resulting in difficulties with social functioning restoration later in life [48]. Psychosomatic and neurotic

disorders in schoolchildren are often associated not only with poor relationships between the student and the teacher and peers with each other, but also with the parents' personalities playing an important role in the child's development, his/her response to bullying and pedagogical violence, as well as in the development of didactogeny, post-traumatic and post-didactic stress disorders [48].

## CONCLUSION

Thus, when considering modern educational environment factors adversely affecting the students' health, we should distinguish increased educational workload, unregulated use of digital technology in educational process, as well as significant effects of a number of psychosocial traumatic factors (bullying, conflicts at school, pedagogical violence, family problems). The increasing share of school-related health problems in the structure of functional disorders and chronic diseases of schoolchildren dictates the need for optimization of learning conditions, which is an urgent task. Neuro-mental disorders that are most common in students include borderline mental disorders, anxiety disorder, behavioral disorders. Borderline mental disorders in children/adolescents showing school maladjustment are based on complex pathogenetic mechanisms, biological (organic) and psychogenic (neurotic), which determine the choice of treatment/rehabilitation and preventive programs. Such disorders can be prevented only via identification of individual features of schoolchildren's mental development. Such measures should supplement systemic organization of activities aimed at students' health improvement.

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