

## RISK ASSESSMENT PRACTICE IN HYGIENIC AND EPIDEMIOLOGICAL STUDIES

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### EFFECT OF THE EDUCATIONAL ENVIRONMENT ON CHILDREN'S HEALTH AT PRESCHOOL AND SCHOOL AGE IN THE ARKHANGELSK REGION

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*The descriptive epidemiological study on the prevalence of "school" pathology in the child population and the influence of the conditions of educational environment in kindergartens and schools in the Arkhangelsk Region was performed. It was found that the main health problems detected during preventive medical examinations of the children and adolescents of school age are the violation of posture, scoliosis and impaired visual acuity. The highest frequency of posture disorders found in children in the transition to subject teaching, the intensity of scoliosis and impaired visual acuity are the most pronounced in the age group of 15 years. The association between measuring light levels, not meeting hygienic standards and the frequency of scoliosis in children before entering school is revealed ( $r_s=0,472$ ;  $p=0,048$ ); between measurements of furniture, not meeting sanitary requirements in school computer classes and the violation of visual acuity in children of 10–11 years ( $r_s=0,529$ ;  $p=0,024$ ); and between measurements of furniture, not meeting sanitary requirements in kindergartens and the violation of posture in children one year before admission and just before entering school ( $r_s=0,601$ ;  $p=0,008$  and  $r_s=0,90$ ;  $p=0,037$ , respectively).*

**Key words:** children of preschool and school age, medical examinations, incorrect posture, disturbance of visual acuity, educational environment, lighting, school furniture.

The health of children, their growth and development, and socio-psychological adjustment are to a large extent determined by the environment [3]. Such terms as "lifestyle disease", "school stress", and "school pathology" are widely used today [2, 11]. The intensity of growth and development that determine the essence of a child's body at the same time make it very vulnerable to negative impacts [6]. A child attends kindergarten and secondary school at the time of intensive development when the body is most sensitive to the impact of hazardous environmental factors. The school environment in which children spend more than 70% of their time contains health risk factors which impede the performance of the mechanisms of self-regulation of physiological functions and foster the development of diseases.

Throughout the entire time at school, modernization of the educational system has a negative

effect on the health of students [16]. Intensification of the learning process has exacerbated the issue of student health. Recent studies have shown that the main negative factors affecting student health are lack of physical activity, excessive study load, malnutrition, unsuitable furniture, insufficient lighting, lack of knowledge about a healthy lifestyle, failure to promote a healthy lifestyle.

Some researchers note that the number of children with signs of "school" pathology is growing [12, 8, 13, 14, 18]. Many medico-hygienic and psychophysiological studies, the results of the medical examinations across the country, the reports by draft committees show that the state of health of the younger generation is unsatisfactory [1, 4, 5, 7, 9, 10, 12].

In literature, one can come across such terms as "school myopia", "school scoliosis", and even "epidemics" of the school forms of pathology

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[15, 17]. At the same time, there is not enough information about detectability of the biggest “school” pathology at different stages of education.

The purpose of our research is to study the prevalence of postural disorders and disorder of visual acuity among kindergarteners and school-aged children in Arkhangelsk region, and assess the impact of the learning environment on the development of those pathologies.

We conducted a descriptive epidemiological study on the prevalence of “school” pathologies in the child population and the learning conditions in pre-schools and schools in the cities and districts of Arkhangelsk region. The health of children and teenagers was evaluated using the federal statistical observation form №31 “Information about the medical services provided to children and teenage students” for 2008-2013 in the following age groups: up to 14; before kindergarten; one year prior to secondary school; before entering a secondary school; at the end of the 1<sup>st</sup> schoolyear; before middle school (4<sup>th</sup>-5<sup>th</sup> grades), at the age of 15, and before graduation (16-17 years old).

The measurements of furniture and the light levels in the secondary schools and kindergartens of towns and districts of Arkhangelsk region were taken and analyzed using the federal statistical observation form “Information about the sanitary-hygienic situation in the public institutions serving children and teenagers” for 2008-2013.

To describe the health indicators, we used the level of pathological prevalence (per 1000 children in a respective age group) and the structure of pathological prevalence; the hygienic conditions of the educational environment were assessed using the relative weight of the measurements which did not meet the hygienic standards.

The qualitative indicators were compared using the chi-square method ( $\chi^2$ ). To prove the impact of the learning environment on the health of students, we used Spearman's rank correlation coefficient ( $r_s$ ). The critical value of the level of significance used during the testing of the null hypotheses equaled 0.05. The statistical analysis of the data was conducted using Stata 12.0 and Epi Info 3.4.1 statistical software.

In 2008-2013, approximately 75.6 thousand measurements of the light level were made in kindergartens and secondary schools of the towns and districts of Arkhangelsk region. Most of the measurements (67%) were made in the towns of Arkhangelsk region. The relative share of non-standard measurements of the light levels in kindergartens of the towns and districts of Arkhan-

gelsk region was the same and totaled 13.6% and 14.0% respectively ( $p=0,474$ ) (Table 1). The highest relative share of the measurements that did not meet the sanitary requirements was registered in Konosha (32%), Kholmogorsk (40%) and Leshukonskoye (54%) districts. Among all the towns of Arkhangelsk region, the biggest non-conformance of the light levels with the hygienic requirements was registered in the kindergartens of Severodvinsk (20%) and Koryazhma (13.8%) where every sixth measurement did not meet the sanitary standards.

In Arkhangelsk region, the relative weight of measurements of the light level in educational institutions which did not meet the hygienic standards (16.6%) was statistically significantly higher ( $p<0,001$ ) as compared to the towns (12.9%) by 3.7%. The relative weight of the measurements of the light level was the highest in Krasnoborskoye (17.4%), Velsk (18.2%), Vinogradovskiy (20.8%), Verkhnetoyemskiy (28.3%), and Mezenskiy (31.2%). In Konosha (50.1%) and Kholmogorsk (62.3%) districts, every second measurement of the light level does not conform to the sanitary standards. Among the towns of Arkhangelsk region, the biggest non-conformity of the light level with the hygienic standards is registered in Novodvinsk (22%) where every fifth study in the educational institution does not meet the hygienic standards.

During the period under review, 10.5 thousand measurements of furniture were taken in kindergartens. Most of the measurements (64.4%) were made in the towns of Arkhangelsk region. In secondary schools, about 4.5 thousand measurements of furniture were made. The relative weight of the measurements of furniture that do not meet the sanitary requirements in the secondary schools of the districts is twice as high as in the towns of Arkhangelsk region totaling 16.5% in secondary schools and 8.2% of measurements in kindergartens ( $p<0,001$ ) (Table 1).

Among the districts of Arkhangelsk region, the highest relative weight of the kindergarten furniture measurements which do not meet the hygienic requirements is registered in Konosha (20.3%), Onezhsky (20.8%), Ustiyani (21%) and Shenkursk (25.7%) districts where every fifth measurement does not meet the sanitary requirements. Among the districts of Arkhangelsk region, the highest relative weight of the secondary school furniture measurements is registered in Konosha (21%), Vinogradovskiy (18,9%), Lensky (30,3%), Vilegodsky (30,6%), Kholmogorsk (57,8%), Velsk

(64%), Verkhnyaya Toima (68%), Onezhsky (76,9%) and Shenkursk (80%) districts.

Table 1

Main hygienic parameters of educational institutions in the towns and districts of Arkhangelsk region in 2008-2013

Indicators	Towns			Districts			All areas			c <sup>2</sup>	p
	Total measurements, absolute number	Of them the number of measurements that do not meet the hygienic requirements		Total measurements, absolute number	Of them the number of measurements that do not meet the hygienic requirements		Total measurements, absolute number	Of them the number of measurements that do not meet the hygienic requirements			
		Absolute number	Relative weight, %		Absolute number	Relative weight, %		Absolute number	Relative weight, %		
<i>Kindergartens</i>											
Measurements of furniture	6757	316	4,6	3742	307	8,2	10499	623	5,9	53,6	<0,001
Light level	12268	1666	13,6	6303	880	14,0	18571	2546	13,7	0,51	0,474
<i>Secondary schools</i>											
Measurements of furniture	4454	442	9,9	4562	753	16,5	9016	1195	13,3	84,9	<0,001
Measurements of furniture in a computer class	128	24	18,8	213	48	22,5	341	72	21,1	0,69	0,406
Light level	38354	4944	12,9	18665	3095	16,6	57019	8039	14,1	141,2	<0,001

We took 341 measurements of the parameters of a computer user workplace in the secondary schools of Arkhangelsk region in the period under review. Sixty-three percent of the measurements were taken in the districts of Arkhangelsk region. The relative weight of the measurements which do not conform to the sanitary requirements totals 22.5% in the districts and 18.8% in the towns ( $p=0,406$ ). The relative weight of nonconforming measurements is higher Verkhnyaya Toima (26.7%), Velsk (45.8%), Primorsky (71.4%), and Konosha (86.7%) districts. Among the towns of Arkhangelsk region, the highest number of nonconforming measurements of computer user workplaces in computer classes is registered in Arkhangelsk (26%) and Novodvinsk (33.3%); here every third tested parameter of a student computer workplace in secondary schools does not meet the sanitary standards.

According to regular medical examinations, postural disorder and disorder of visual acuity are the leading pathologies in kindergarteners and school-aged children. Among the prevailing "school" pathologies, the relative weight of postural disorders and disorders of visual acuity total 39% and 35% respectively. The average annual incidence of postural disorders, disorders of visual acuity, and scoliosis in children under 17 in Arkhangelsk region overall over the 6-year period under review totals 138.3 ‰, 123 ‰ and 27.5 ‰ respectively.

The study of prevalence of postural disorders by the periods of pre-school and secondary school

showed consistent increase in the incidence of this pathology in the groups of children from the point when they enter a kindergarten to middle school (4<sup>th</sup>-5<sup>th</sup> grades) – at this stage, the pathology reaches its maximum (274,6‰). Approximately 15% of the children already have postural disorders before starting secondary school. At the age of 15 and before graduating from secondary school, the level of postural disorders totals 240,8‰ and 159,5‰ respectively which indicates decreased incidence of this pathology in these age groups. In districts, the average annual incidence of detection of postural disorders in children is by 2 or more times higher as compared to towns starting from the period of a year prior to starting secondary school and before graduation (that is from 6 to 17 years old) (Table 2).

The "risk group" consists of teenagers aged 15-17; among the examined teenagers of that age, 9.6% had scoliosis which is by 9 times higher as compared to the group before starting secondary school. A high rate of growth of the cases of postural disorders (by 10.4 times) and scoliosis (by 8.6 times) over the 6-year period was determined among the children one year prior to starting secondary school (6 years old). The incidence of scoliosis is growing on average by 1.8 times in the first year of study at school and by 8.8 times – by the end of the learning period. In the districts, the average annual incidence of postural disorders in the children is 1.4-2 times higher as compared to the towns starting from the period of education in the 4<sup>th</sup>-

5<sup>th</sup> grades (when starting subject learning) and until graduation.

Table 2

Average annual incidence of postural disorders, disorders of visual acuity, and scoliosis in various age groups of children in the towns and districts of Arkhangelsk region in 2008-2013

Group	Postural disorders, ‰		Scoliosis, ‰		Disorder of visual acuity, ‰	
	Towns	Districts	Towns	Districts	Towns	Districts
Before starting kindergarten	8,2	9,9	0,7	0,2	16,4	41,3
One year prior to secondary school	5,6	134,5	3,9	3,2	43,1	76,6
Before starting secondary school	87,6	203,9	11,7	10,2	82,4	82,9
At the end of the first school year	136,8	292,5	19,4	19,9	121,3	148,6
Before subject-specific learning	166,0	367,4	33,1	47,0	165,7	277,0
At the age of 15	149,3	301,8	73,0	107,8	230,0	337,3
Before graduation	106,7	215,7	64,2	129,8	188,7	348,5

The maximum levels of prevalence of postural disorders in children across the board in Arkhangelsk region (294,4‰) are observed before graduation (10<sup>th</sup>-11<sup>th</sup> grades). In the group of children from starting kindergarten to starting the 10<sup>th</sup> grade at the age of 15, the cases of disorder of visual acuity are growing with each school year, which is followed by an insignificant decrease at the age of 16-17. In the districts of Arkhangelsk region, the incidence of disorders of visual acuity in all the age groups is higher as compared to the similar indicators in children living in towns (Table 2).

With the help of correlation analysis conducted in the districts of Arkhangelsk region, we established statistically significant relationships between the measurements of the light levels that do not meet the hygienic standards in kindergartens, and scoliosis in children before starting school ( $r_s=0,472$ ;  $p=0,048$ ), as well as between the furniture measurements that do not meet the sanitary standards in computer classes and cases of disorder of visual acuity in children aged 10-11 ( $r_s=0,529$ ;  $p=0,024$ ). In the towns of Arkhangelsk region, we detected a statistically significant relationship between the relative weight of furniture

measurements that do not meet the sanitary standards in kindergarten and postural disorders in children one year and immediately before secondary school ( $r_s=0,601$ ;  $p=0,008$ , and  $r_s=0,90$ ;  $p=0,037$  respectively).

Consequently, based on the results of medical examinations of children and teenage students in Arkhangelsk region, the main pathologies are postural disorders, scoliosis and disorders of visual acuity. The highest incidence of postural disorders is registered in children at the point of moving towards subject-specific learning; the intensity of scoliosis and disorders of visual acuity reaches its peak in the group of students aged 15. We established statistically significant associations between the relative weight of the light level measurements that do not meet the hygienic standards and the incidence of scoliosis in children before starting secondary school; furniture measurements that do not meet the sanitary requirements in computer classes and the incidence of disorders of visual acuity in children aged 10-11; and between the relative weight of the furniture measurements that do not meet the sanitary requirements in kindergartens and postural disorders in children one year and immediately before starting secondary school.

## References

1. Aizman R.I. Monitoring zdoroviya uchashchikhsya, studentov b prepodavatelei: teoreticheskie i prikladnye aspekti // Health screening of school-aged children, college students and teachers: theory and practice // Health screening school children, college students, and teachers // Zdoroviesberegauscheye obrazovanie. – 2009. – № 2. – p. 14–19.
2. Bazarny V.F. Shkolniy stress i demograficheskaya katastrofa Rossii // School stress and the demographic catastrophe in Russia. – M., 2004.
3. Baranov A.A., Kuchma R.V., Sukhareva L.M. Zdorovie, obuchenie i vispitanie detei: istroiya I sovremenost // Health, education and upbringing of children: present and past. - M., 2006.
4. Bezrukh M.M. Zdoroviesberegayuschaya shkola // Energy-saving practices at school. M.: MPSI, 2004. – 240 p.

5. Gurov V.A. Vliyanie tekhnologicheskogo komponenta obrazovatelnoi sredi na psikhofiziologicheskoye razvitiye mladshikh shkolnikov // The impact of school technology on the psychophysiological development of elementary students // Krasnoyarsk: Polikom, 2008. – 258 p.
6. Gurov B.A. Metodologicheskiye osnovi monitoringa zdoroviesbergayushei deyatel'nosti v shkole // A methodological component of health promotion at school // Nauchno-pedagogicheskoye obozrenie. – 2014. - № 1 (3). – p. 76.
7. Gurov B.A. Trevozhnost' i zdorovie mladshikh shkolnikov // Anxiety and health of elementary students // Vsetnik Tomsk. Gos-ped.un-ta. – 2009. – Issue 4 (82). – p. 56–60.
8. Zhukova E.A., Tsirkin V.I. Dve tendentsii v vozrastnoi dinamike ostroti zreniya malchikov i devochek na protyazhenii obucheniya v srednei shkole // Two trends in the age-related dynamics of visual acuity in boys and girls throughout secondary school // Sensorniye sistemi. – 2008. – V.22. – № 3. – P. 241–247.
9. Zdorovie detei v obrazovatel'nykh uchrezhdeniyakh. Organizatsiya i kontrol' // Child health at school. Organization and screening // Edited by M.F. Rzyankina, V.G. Molochny. – N.Novgorod: Feniks, 2005. – 376 p.
10. Kazin E.M., Aidarkin E.K., Fyodorov A.I., Kasatkina N.E., Sviridova I.A. Teoretiko-prikladnye aspekty zdoroviya kak bazovoi adaptivnoi, lichnostnoi i sotsialnoi tsennosti. Soobschenie 1. Sotsialno-biologicheskaya osnova zdoroviya i adaptivnykh vozmozhnostei individa // Theory and practice behind health as a basic adjustable, personal and social value. Message 1. Socio-biological foundation of health and adaptive abilities of an individual // Valeologiya. – № 2. – 2012. – P. 7–13.
11. Kuchma V.R., Stepanova M.I. Stress u shkolnikov: prichiny, posledstviya, profilaktika // Stress in school children: causes, consequences, prevention // Meditsina truda i promyshlennaya ekologiya. – 2001. – 8. - P. 32–37.
12. Kuchma V.R., Sukhareva L.M. Prioritetniye kriterii otsenki sostoyaniya zdorovia i profilaktiki zabolevaniy detei i podrostkov // Main criteria for health assessment and disease prevention in children and teenagers // Gigiena i sanitariya. – 2005. – № 6. – P. 42–45.
13. Miklyaeva A.V., Rumyantseva P.B.=V. Shkol'naya trevozhnost': diagnostika, korektsiya, razvitiye // School anxiety: diagnostics, correction, development. SPb: Rech, 2004. – 248 p.
14. Nefedovskaya L.V. Miopiya u detei kak mediko-sotsial'naya problema // Myopia in children as a medico-social issue // Ros. pediatr. zhurn. – 2008. – № 2. – p. 50–53.
15. Sidorenko E.I. Problemy i perspektivy detskoi oftalmologii: doklad po okhrane zreniya detei. Issues and future of child ophthalmology: report on the protection of child vision // Vestnik oftalmologii. – 2006. – № 1. – p. 41–42.
16. Surayeva L.M. Proyektirovaniye i realizatsiya sistemi ozdorovitel'nykh tekhnologiy v doprofessional'nom obrazovanii uchashchikhsya: dis.kand.nauk. Designing and implementing the system of health technology in pre-professional education: thesis of a candidate of sciences. Toliyatti, 2002. – 225 p.
17. Tepper E.A., Taranushenko T.E., Grishkevich N.Yu. Osobennosti formirovaniya "shkolnoi" patologii v ten let // Development of a "school" pathology throughout the ten years of learning. Saransk scientific medical journal. - 2013. - V. 9. - № 1. - p. 101–106.
18. Chechel'nitskaya S.M. Narusheniya osanki u detei // Postural disorders in children. Rostov-na-Donu: Fenix, 2009. – 286 p.