

ANALYSIS OF HEALTH DYNAMICS IN CHILDREN AND ADOLESCENTS BASED ON THE RESULTS OF REGULAR MEDICAL CHECK-UPS

Ganuzin VM¹ ✉, Maskova GS¹, Storozheva IV², Sukhova NS²

¹ Yaroslavl State Medical University, Yaroslavl, Russia

² Children's Polyclinic No. 3, Yaroslavl, Russia

The article deals with the issues of health in children and adolescents aged 7–17 years. The objective of this study is to analyze health experience in school-age children and adolescents based on regular medical check-up results. According to regular medical check-up results, 15,192 schoolchildren were examined in 2015, including 12,649 children aged 7–14 years and 2,543 children aged 15–17 years. In 2020, health of 18,708 schoolchildren was assessed, including 14,861 children aged 7 to 14 years and 3,847 children aged 15 to 17 years. The authors analyze dynamics of distribution of children into health groups, and age-related incidence of school-related diseases. In children and adolescents of different age, eye disorders occupy first place in the rank of prevalent school-related diseases; the events are followed by musculoskeletal diseases, nervous and GIT diseases, progressing with age, including scoliosis. Percentage of healthy children without the signs of a school-related abnormality at school is reducing. In the majority of cases, pathological abnormalities are found in 15–17-year-old adolescents.

Key words: health of children and adolescents, school-related diseases, age dynamics.

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✉ **Correspondence should be addressed:** Valery M. Ganuzin,
ul. Revolutsionnaya, 5, Yaroslavl, 150000, Russia; vganuzin@rambler.ru

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АНАЛИЗ ДИНАМИКИ СОСТОЯНИЯ ЗДОРОВЬЯ ДЕТЕЙ И ПОДРОСТКОВ ПО РЕЗУЛЬТАТАМ ДИСПАНСЕРНЫХ ОСМОТРОВ

В. М. Ганузин¹ ✉, Г. С. Маскова¹, И. В. Сторожева², Н. С. Сухова²

¹ Ярославский государственный медицинский университет, Ярославль, Россия

² Детская поликлиника № 3, Ярославль, Россия

В статье рассматриваются вопросы состояния здоровья детей и подростков 7–17 летнего возраста. Цель исследования это анализ состояния здоровья у детей и подростков школьного возраста по данным диспансерных осмотров. По данным диспансерных осмотров, в 2015 году было обследовано 15192 школьников, в том числе 12649 человек в возрасте от 7 до 14 лет и 2543 человек от 15 до 17 лет. В 2020 году проанализировано состояние здоровья 18708 школьников, в том числе 14861 человек с 7 до 14 и 3847 человек с 15 до 17 лет. Авторы анализируют динамику распределения детей на группы здоровья, возрастные особенности распространенности школьно-обусловленных заболеваний. У детей всех возрастных групп среди школьно-обусловленных заболеваний на первом месте по распространенности находятся болезни глаза и его придаточного аппарата, далее — болезни костно-мышечной системы, нервной системы и желудочно-кишечного тракта, которые с возрастом имеют тенденцию к увеличению, в том числе и сколиотические нарушения. Процент здоровых детей, не имеющих проявлений рассматриваемой школьно-обусловленной патологии в процессе обучения в школе сокращается. При этом в большей степени патологические отклонения выявляются у подростков 15–17-летнего возраста.

Ключевые слова: здоровье детей и подростков, школьно-обусловленные заболевания, возрастная динамика.

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✉ **Для корреспонденции:** Валерий Михайлович Ганузин,
ул. Революционная, 5, Ярославль, 150000, Россия; vganuzin@rambler.ru

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RELEVANCE

Monitoring of health in children and adolescents, prevention of chronic diseases and functional deviations at the stage of school education is a high-priority task faced by any country [1–3]. At present, various social-hygienic, psychological and technical environmental factors produce an unfavorable effect on many children and adolescents [4–7]. A number of children and adolescents with health deviations and need in rehabilitation is constantly increased due to the intensive education process [8–12].

Analysis of regular medical check-up results enables to reveal certain age groups of children and adolescents requiring

intensive prophylaxis and clinical care to prevent and decrease the risk of school-related diseases [13–15].

OBJECTIVE OF THE STUDY

To examine the health of children and adolescents of school age based on the regular medical check-up results.

PATIENTS AND METHODS

We compared distribution of children and adolescents into health groups and incidence of school-related diseases among them in 2015 and 2020. Distribution of schoolchildren aged

7–14 years and 15–17 years into groups is associated with the requirement of the regional healthcare department to regular medical check-ups of schoolchildren.

According to regular medical check-up results, 15,192 schoolchildren were examined in 2015, including 12,649 children aged 7–14 years and 2,543 children aged 15–17 years. In 2020, health of 18,708 schoolchildren was assessed, including 14,861 children aged 7 to 14 years and 3,847 children aged 15 to 17 years.

The obtained data were subjected to statistical analysis using StatSoft Statistica 7.0. The groups were compared using Fisher's test, with statistical significance p value of 0.05 or less.

RESULTS

Distribution of schoolchildren into health groups depending on their age and the year of observation is presented in table 1.

Table 1 shows that specific gravity of children with health groups 1 and 2 is decreased with age, whereas a number of schoolchildren with health groups 3 and 4 is increased.

In 2020, a number of schoolchildren with health group 1 aged 7 to 14 years increased, and a number of children and adolescents with health group 3 decreased by a percentage as compared with 2015. Moreover, 2020 is a year of children and adolescents with health group 5.

Incidence of school-related diseases is presented in table 2.

School-related diseases are health problems in children aged 7 to 17 years resulting from academic overload, learning process and diet violation, and stress.

Table 2 shows that eye disorders occupy first place in the rank of prevalent school-related diseases in children and adolescents of the analyzed age groups both in 2015, and in 2020; the events are followed by musculoskeletal diseases, nervous and GIT diseases, progressing with age, including scoliosis. Trials of other authors confirm the data [6,14]. In

schoolchildren aged 15 to 17 years, speech abnormalities were reduced as compared with 7- to 14-year-olds.

According to the results of regular medical check-ups held in 2020, 3,847 adolescents aged 15 to 17 years underwent medical and preventive care. The care-related data are presented in table 3.

Table 3 shows that based on the results of regular medical check-ups held in 2020, among 3,847 15–17-year-old adolescents with visual organ pathology, 28.13% needed to wear corrective glasses (including 17.03% of young women and 11.1% of young men). Some of the adolescents were hospitalized to achieve the objectives of an examination, therapeutic and surgical treatment, whereas 4.26% of them were referred for health resort treatment.

According to the results of a regular medical check-up, all schoolchildren with other health abnormalities were under a regular medical check-up and sent for rehabilitation to specialized doctors.

DISCUSSION OF RESULTS

According to the research, children and adolescents with health group 2 prevail among other schoolchildren of different age both in 2015, and 2020. Schoolchildren with chronic diseases in the compensatory stage (health group 3) are ranked second and constitute 20 to 30% of all those examined, irrespective of age. The value of absolutely healthy children and adolescents (health group 1) remains low. Some authors state that the dynamics is associated with increased neuropsychic load, hypodynamia, disrupted daily routine and nutrition, and long-term use of gadgets both in learning, and for playing various computer games [8,13].

Our researches have shown that eye disorders, musculoskeletal diseases, nervous and GIT diseases, including scoliosis, progressing with age, are the most frequently found

Table 1. Distribution of children and adolescents aged 7–17 years into health groups (2015 and 2020)

Health group	2015		2020	
	7–14	15–17	7–14	15–17
	%	%	%	%
I	3.9*, **	3.0*, **	7.1*, **	2.7*, **
II	64.6	63.8	70.2	65.3
III	30.8	32.4	21.6	30.7
IV	0.7	0.8	0.2	0.4
V	0	0	0.9	0.9

Note. Significant differences at $p < 0,05$, * - significant differences in the registration frequency of children belonging to health groups 1 and 2 within one observation period, ** — significant differences in the registration frequency of children belonging to health groups 1 and 3 within one observation period.

Table 2. Incidence of school-related diseases in children and adolescents based on regular medical check-up results (per 1,000 of those examined)

Disease	2015		2020	
	7–14 years	15–17 years	7–14 years	15–17 years
	‰	‰	‰	‰
Locomotor system pathology, incl. scoliosis	226.0 21.0	261.0 38.0	172.0 15.0*	242.0 46.6
Visual organ pathology	231.0	307.0	251.0	317.0
Gastrointestinal pathology	43.0*	81.0	29.0*	72.0
Speech defects	34.0*	2.0	27.0*	5.0
Nervous disorders	86.0	78.0	65.0	82.0

Note*. The differences between the groups of children and adolescents aged 7 to 14 years and 15 to 17 years within one period of observation are statistically significant ($p < 0.05$).

Table 3. A number of adolescents aged 15 to 17 years who underwent medical and preventive care (based on the results of regular medical check-ups held in 2020)

Item No.	Parameters	Number of patients	
		(abs.)	%
1	Hospitalized children:	27	0.70
	young men	14	0.36
	young women	13	0.34
2	Children obtaining health resort treatment:	164	4.26
	young men	71	1.85
	young women	93	2.41
3	Those who required surgery:	12	0.31
	young men	12	0.31
	young women	0	0
4	Those who underwent surgery:	10	0.26
	young men	10	0.26
	young women	0	0
5	Those who required vision correction:	343	28.13
	young men	135	11.10
	young women	208	17.03
6	Those who wear corrective glasses:	343	28.13
	young men	135	11.10
	young women	208	17.03

events in children and adolescents at school. This was confirmed by other authors [3,6,14]. Concern on schoolchildren's health and emerging trends in their health impairment with age was brought up in a number of reports during the VII Congress of School and University Medicine held on October 21–22, 2021.

The trial results confirm the previous data about high incidence of school-related diseases among children and adolescents, emergence of children with health groups 3 to 5, and their insufficient preventive mitigation. In our opinion, outpatient pediatricians need a closer cooperation with the Center of Children's Health to render medical and preventive aid to schoolchildren. Apart from finding diseases and analyzing the structure at different age, the Center employees carry out considerable preventive work associated with implementation of healthy lifestyles in a family and prevention of school-related disorders among schoolchildren, their parents and teachers.

We believe that administration of schools, education and healthcare departments need to adopt a strategy aimed at the implementation of 'Health Saving Educational and Health-Improving Technologies in Educational Establishments' taking

into account suggestions of the leading domestic hygienists [15,16]. School health workers need to regularly speak at teacher-parent meetings devoted to sensible nutrition, physical education and methods of prevention of school-related diseases cooperating with doctors from children's outpatient clinics.

CONCLUSION

Percentage of healthy children with no signs of the examined school-related abnormality at school is reduced. Pathological abnormalities are mainly found in 15–17-year-old adolescents. The obtained results show that children and adolescents must obtain intensive preventive and therapeutic aid as soon as they go to school, and not during the teen years only.

Doctors and teachers at schools need to cooperate and implement health-saving educational and health-improving technologies at schools and actively participate in joint parental involvement medical and pedagogical programs aimed at prevention of school-related diseases.

References

- Kuchma VR. Nauchny'e osnovy` razrabotki i vnedreniya sovremenny'x modelej oxrany` zdorov'ya obuchayushhixsya v obrazovatel'ny'x organizatsiyax. *Voprosy` shkol'noj i universitetskoj mediciny` i zdorov'ya*. 2017; 3: 19–29. Russian.
- Kuchma VR. Mediko-profilakticheskie osnovy` dostizheniya ozhidaemy'x rezul'tatov meropriyatij desyatiletija detstva na period do 2027 goda. *Voprosy` shkol'noj i universitetskoj mediciny` i zdorov'ya*. 2021; 1: 11–23. Russian.
- Rapoport IK. Sostoyanie zdorov'ya moskovskix shkol'nikov v dinamike obucheniya s pervogo po odinnadczatyj klass. *Bezopasnaya obrazovatel'naya sreda v sovremennoj shkole: Materialy` nauchno-prakticheskoy konferencii*, Moskva. 2016; 45–51s. Russian.
- Miller DP and Chang J. Parental Work Schedules and Child Overweight or Obesity: Does Family Structure Matter? *Journal of Marriage and Family*. 2015;77 (5): 1266–1281. <https://doi.org/10.1111/jomf.12215>
- Álvarez-García D, Núñez Pérez JC, Dobarro González A, Pérez CR. Risk factors associated with cybervictimization in adolescence. *International Journal of Clinical and Health Psychology*. 2015;15(3):226–235. <https://doi.org/10.1016/j.ijchp.2015.03.002>
- Xmel'niczkaya EA, Kiku PF, Sabirova KM, Kabieva AA. Kompleksnaya ocenka sostoyaniya zdorov'ya i rasprostranennosti faktorov riska xronicheskix neinfekcionny'x zabozevanij sredi shkol'nikov Primorskogo kraja. *Ekologiya cheloveka*. 2021; 8: 21–27. <https://doi.org/10.33396/1728-0869-2021-8-12-27>. Russian.
- Mirskaya NB. Faktory` riska, negativno vliyayushhie na formirovanie kostno-my'shechnoj sistemy` detej i podrostkov v sovremenny'x usloviyax. *Gigiena i sanitariya*. 2013; 1: 65–71. Russian.
- Kuchma VR, Sedova AS, Stepanova MI, Rapoport IK, Polenova MA, Sokolova SB, Aleksandrova IE, Chubarovskij VV. Osobennosti zhiznedeyatel'nosti i samochuvstviya detej i podrostkov, distancionno obuchayushhixsya vo vremya e'pidemii novoj koronavirusnoj infekcii (COVID-19). *Voprosy` shkol'noj i universitetskoj mediciny` i zdorov'ya*. 2020; 2: 4–23. Russian.
- Hooff Graafland JH. New technologies and 21st century children: Recent trends and outcomes. *OECD Education Working Papers*, 179. Paris: OECD Publishing. 2018. <https://doi.org/10.1787/19939019>
- Lu W. Adolescent Depression: National Trends, Risk Factors, and Healthcare Disparities. *American journal of health behavior*. 2019; 43: 181–194. DOI: 10.5993 / AJHB.43.1.15

11. Growing up in a digital world: benefits and risks (2018). *The Lancet Child & Adolescent Health*. 2018; 2 (2.): 79. DOI: 10.1016 / S2352-4642 (18) 30002-6
12. Ganuzin VM, Romanycheva EN, Kurchina EG. Deyatel'nost' otdeleniya mediko-social'noj pomoshhi polikliniki v profilaktike i reabilitacii detej i podrostkov iz semej, naxodyashhixsya v trudnoj zhiznennoj situacii. *Voprosy' shkol'noj i universitetskoj mediciny' i zdorov'ya*. 2016; 2: 36-38. Russian.
13. Tabachkova AS. Rasprostranennost' zabolevanij zheludochno-kishechnogo trakta sredi shkol'nikov. *Sociosfera*. 2021; 2: 98-102. Russian.
14. Ganuzin VM, Golubyatnikova EV. Detskaya invalidnost', profilaktika, reabilitaciya i abilitaciya detej s ogranichenny'mi vozmozhnostyami. *Voprosy' psicheskogo zdorov'ya detej i podrostkov*. 2017; 17(2): 55-56 (prilozhenie). Russian.
15. Rapoport IK, Aleksandrova IE, Xramczov PI, Gorelova ZhYu, Kuchma VR, Stepanova MI i dr. Baza danny'x «Informacionnaya baza danny'x dlya realizacii raboty' po ohrane zdorov'ya obuchayushhixsya v obrazovatel'ny'x organizaciyax. (Zdorov'esberegayushhie obrazovatel'ny'e i ozdorovitel'ny'e tehnologii v obrazovatel'ny'x organizaciyax)». *Federal'naya sluzhba po intellektual'noj sobstvennosti. Gosudarstvennaya registraciya bazy' danny'x, ohranyaemoj avtorskimi pravami. Nomer registracii (svidetel'stvo) 2020622805, data registracii 24.12.2020*. Russian
16. Xramczov PI. Fiziologo-gigienicheskie predposylki povysheniya zdorov'eformiruyushhej e'ffektivnosti fizicheskogo vospitaniya detej v obrazovatel'ny'x organizaciyax. *Voprosy' shkol'noj i universitetskoj mediciny' i zdorov'ya*. 2017; 4: 15-20. Russian.

Литература

1. Кучма В. Р. Научные основы разработки и внедрения современных моделей охраны здоровья обучающихся в образовательных организациях. *Вопросы школьной и университетской медицины и здоровья*. 2017; 3: 19-29.
2. Кучма В. Р. Медико-профилактические основы достижения ожидаемых результатов мероприятий десятилетия детства на период до 2027 года. *Вопросы школьной и университетской медицины и здоровья*. 2021; 1: 11-23.
3. Рапопорт И. К. Состояние здоровья московских школьников в динамике обучения с первого по одиннадцатый класс. *Безопасная образовательная среда в современной школе: Материалы научно-практической конференции*, Москва. 2016; 45-51с.
4. Miller DP and Chang J. Parental Work Schedules and Child Overweight or Obesity: Does Family Structure Matter? *Journal of Marriage and Family*. 2015;77 (5): 1266-1281. <https://doi.org/10.1111/jomf.12215>
5. Álvarez-García D, Núñez Pérez JC, Dobarro González A, Pérez CR. Risk factors associated with cybervictimization in adolescence. *International Journal of Clinical and Health Psychology*. 2015;15(3):226-235. <https://doi.org/10.1016/j.ijchp.2015.03.002>.
6. Хмельницкая Е.А., Кику П. Ф., Сабирова К.М., Кабиева А. А. Комплексная оценка состояния здоровья и распространенности факторов риска хронических неинфекционных заболеваний среди школьников Приморского края. *Экология человека*. 2021;8:21-27 <https://doi.org/10.33396/1728-0869-2021-8-12-27>
7. Мирская Н. Б. Факторы риска, негативно влияющие на формирование костно-мышечной системы детей и подростков в современных условиях. *Гигиена и санитария*. 2013; 1: 65-71.
8. Кучма В. Р., Седова А. С., Степанова М. И., Рапопорт И. К., Поленова М. А., Соколова С. Б., Александрова И. Э., Чубаровский В. В. Особенности жизнедеятельности и самочувствия детей и подростков, дистанционно обучающихся во время эпидемии новой коронавирусной инфекции (COVID-19). *Вопросы школьной и университетской медицины и здоровья*. 2020; 2: 4-23.
9. Hoof Graafland JH. New technologies and 21st century children: Recent trends and outcomes. *OECD Education Working Papers*, 179. Paris: OECD Publishing, 2018. <https://doi.org/10.1787/19939019>
10. Lu W. Adolescent Depression: National Trends, Risk Factors, and Healthcare Disparities. *American journal of health behavior*. 2019;43:181-194. DOI: 10.5993 / AJHB.43.1.15
11. Growing up in a digital world: benefits and risks (2018). *The Lancet Child & Adolescent Health*. 2018; 2 (2.): 79. DOI: 10.1016 / S2352-4642 (18) 30002-6
12. Ганузин В.М., Романьчева Е. Н., Курчина Е. Г. Деятельность отделения медико-социальной помощи поликлиники в профилактике и реабилитации детей и подростков из семей, находящихся в трудной жизненной ситуации. *Вопросы школьной и университетской медицины и здоровья*. 2016; 2: 36-38.
13. Табачкова А. С. Распространенность заболеваний желудочно-кишечного тракта среди школьников. *Социосфера*. 2021;2: 98-102.
14. Ганузин В.М., Голубятникова Е. В. Детская инвалидность, профилактика, реабилитация и абилитация детей с ограниченными возможностями. *Вопросы психического здоровья детей и подростков*. 2017; 17(2): 55-56 (приложение).
15. Рапопорт И.К., Александрова И. Э., Храмцов П. И., Горелова Ж. Ю., Кучма В. Р., Степанова М. И. и др. База данных «Информационная база данных для реализации работы по охране здоровья обучающихся в образовательных организациях. (Здоровьесберегающие образовательные и оздоровительные технологии в образовательных организациях)». *Федеральная служба по интеллектуальной собственности. Государственная регистрация базы данных, охраняемой авторскими правами. Номер регистрации (свидетельство) 2020622805, дата регистрации 24.12.2020*.
16. Храмцов П. И. Физиолого-гигиенические предпосылки повышения здоровьесформирующей эффективности физического воспитания детей в образовательных организациях. *Вопросы школьной и университетской медицины и здоровья*. 2017; 4: 15-20.