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НАУЧНЫЙ МЕДИЦИНСКИЙ ЖУРНАЛ ВОРОНЕЖСКОГО ГОСУДАРСТВЕННОГО  
МЕДИЦИНСКОГО УНИВЕРСИТЕТА ИМ. Н. Н. БУРДЕНКО  
И РОССИЙСКОГО НАЦИОНАЛЬНОГО ИССЛЕДОВАТЕЛЬСКОГО  
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## SELF-ASSESSMENT OF HEALTH AND LIFESTYLE AS A BASIS FOR UNDERSTANDING HEALTH PRESERVATION BY SCHOOLCHILDREN

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The article describes the possibility of using the data on the health status and lifestyle self-assessment obtained during the questionnaire survey of high school students in the teacher's preventive activities aimed at preserving and improving the schoolchildren's health. The main indicators that according to the respondents determine their quality of life have been revealed, and health status is ranked only third. It has been found that 40% of students consider their health to be "good", while 53% currently do not worry about their health at all. Certain characteristics of physical activity, nutrition, sleep schedule, prevalence of bad habits in students attending schools of various types are provided. Despite high subjective assessment of physical activity, only 8% of schoolchildren do morning exercises every day, most of students do not attend sports sections. More than 40% of students sleep less than seven hours, which has a negative effect on the adolescents' health. Evidence has been obtained that 19% of schoolchildren have tried vaping and 13% vape regularly, which is definitely worrisome.

**Keywords:** lifestyle, health, school, teacher, students, nutrition, physical activity, bad habits, electronic cigarette

**Author contribution:** Goncharova DG — literature review, statistical data processing, manuscript writing; Sokolova AI, Izotova LV — data acquisition, literature review, statistical data processing.

**Compliance with ethical standards:** the study complied with the requirements of biomedical ethics, did not endanger the participants and was conducted in accordance with the ethical principles stated in the Declaration of Helsinki and the European Community directives (8/609EC). The informed consent was submitted by all study participants.

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## САМООЦЕНКА СОСТОЯНИЯ ЗДОРОВЬЯ И ОБРАЗА ЖИЗНИ КАК ОСНОВА ФОРМИРОВАНИЯ ПРЕДСТАВЛЕНИЙ ШКОЛЬНИКОВ О ЗДОРОВЬЕСБЕРЕЖЕНИИ

Д. Г. Гончарова <sup>✉</sup>, А. И. Соколова, Л. В. Изотова

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В статье рассмотрена возможность использования данных, полученных в ходе анкетирования учащихся старших классов по вопросам самооценки состояния здоровья, образа жизни, в профилактической деятельности учителя, направленной на сохранение и укрепление здоровья школьников. Выявлены основные, по мнению респондентов, показатели, которые формируют качество их жизни, при этом состояние здоровья занимает лишь третье место. Установлено, что 40% учащихся оценивают свое состояние здоровья как «хорошее», а 53% в настоящее время вообще не беспокоятся о здоровье. Раскрыты отдельные характеристики двигательной активности, питания, режима сна и отдыха, распространения вредных привычек у учащихся школ разных типов. Несмотря на высокую субъективную оценку двигательной активности, лишь 8% школьников каждый день делают утреннюю гимнастику, значительная часть учащихся не занимается в спортивных секциях. Более 40% учащихся спят менее семи часов, что негативно сказывается на состоянии здоровья подростков. Получены данные о том, что 19% школьников пробовали курить электронные сигареты, а 13% делают это регулярно, что, несомненно, вызывает тревогу.

**Ключевые слова:** образ жизни, здоровье, школа, учитель, учащиеся, питание, двигательная активность, вредные привычки, электронная сигарета

**Вклад авторов:** Д. Г. Гончарова — анализ литературы, статистическая обработка данных, написание статьи; А. И. Соколова, Л. В. Изотова — сбор материала, анализ литературы, статистическая обработка данных.

**Соблюдение этических стандартов:** исследование соответствовало требованиям биомедицинской этики, не подвергало опасности участников и было проведено с соблюдением этических норм, изложенных в Хельсинкской декларации и директивах Европейского сообщества (8/609EC). Все респонденты подписали добровольное информированное согласие на участие в исследовании.

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The issues of health and lifestyle formation even occupied ancient philosophers. Reflections on the value of health for human being can be found in the writings of almost all philosophers. The issues of health formation were studied by Aristotle, Pythagoras, Socrates, Plato, etc. In their writings they analyzed the issues of the harmony of spirit and body in humans that to some extent provided the basis for healthy lifestyle formation. The knowledge gained through several centuries suggests that health has been of significant value for human life. It is obvious that people have been thinking about health and the factors that affect health formation since ancient times. The factors capable of affecting human health are diverse. These factors acting simultaneously have an impact on

the formation of personality, form the culture and the motivated health-preserving behavior [1, 2].

Child and adolescent welfare is one of the most important directions of the state policy in the Russian Federation. However, the impact of various environmental factors (ecological, biomedical, social, etc.) eventually increases morbidity in children of all age groups. That is why it is important to maintain and improve health since childhood: the educational institutions where children and adolescents spend most of their time come to the foreground here [3].

There are numerous studies of the features of the teaching process and nurture organization in modern school. Among other things these studies are focused on the issues of

whether the schedule of the classes is normal and scheduling is correct, as well as on the issues of the number of educational activity types per week or day, the use of health-preserving technologies, etc. The rapid development of technologies has led to the fact that active integration of the digital educational means, that have significantly changed the educational environment, into the teaching process has become a priority. That is why an urgent problem of ensuring hygienic life safety in children and adolescents in the context of using informational technologies has arisen [4, 5].

The study was aimed to discover the role of the health and lifestyle self-assessment in the development of understanding of health preservation in schoolchildren.

## METHODS

The study was performed in the urban district of Voronezh during the academic year 2021–2022. The subjects were children aged 14–17 attending schools of various types: comprehensive schools (including those implementing the programs of in-depth and profile study of certain subjects), gymnasiums, lyceums. A total of 10 educational institutions were selected for the study. Selection of schoolchildren in the schools of all types was performed by systemic sampling. The respondents were selected using the following inclusion criteria: 9–10 grade students (the average class size was 25 people); age at the time of the study 14–17 years; availability of the informed consent to study participation under condition of anonymity.

The total sample size was 700 people, who were students at 10 selected educational institutions. A total of 70 people from each selected educational institution were included in the experimental group.

The questionnaire method was used for subjective assessment of the students' health status and lifestyle. The survey was performed on a voluntary basis using the online service [6]. The framework of the 63-item questionnaire was represented by the questions most often used in similar questionnaires, such as Attitude to Health by R.A. Berezovskaya, Index of Attitude to Health by S. Derjabo and V. Yasvin, Harmony in the Schoolchildren's Lifestyle by N.S. Garkusha, Health Status Self-Assessment by V. P. Voitenko, etc [7, 8].

Statistical data processing was performed using the Statistica 13.0 software package (StatSoft; USA). The data obtained were previously tested for normality.

## RESULTS

Based on the data analysis it can be stated that more than a half of the respondents surveyed (64%) are quite happy with their lives. When comparing the answers given by students from educational institutions of different types, only slight differences between the answers can be seen. The majority of respondents quite happy with their quality of life attend gymnasia (68%) and lyceums (65%), while a slightly lower number attends a comprehensive secondary school (62%). The students who express a negative view of their quality of life have been also revealed, however, the share of such students is small.

To define the components of the quality of life that are most important for adolescents, we included the question "What do you think determines the quality of your life?" in the questionnaire for schoolchildren. When analyzing the data obtained, it can be noted that the majority of students (32%) believe that material living conditions determine their quality of life, family relationships are ranked second (23%), and health status occupies only the third place (21%). Different situation

regarding determination of essential factors contributing to the quality of life becomes evident when comparing educational institutions of various types. Comparison of the numbers of selected answers between students of educational institutions of various types, shows that the majority of students attending gymnasia (32%) and lyceums (42%) chose material living conditions as a factor determining their quality of life, while health status and family relationships were most often chosen by adolescents who attended comprehensive secondary schools.

Unfortunately, the surveyed adolescents do not consider their health status as the most important factor determining the quality of life: it is only ranked third. Furthermore, it should be noted that 40% of respondents consider their health to be "good", 30% think it is "satisfactory", 26% believe it is "excellent", while 4% and less than 1% think their health is "poor" and "extremely poor". Perhaps, the majority rank their health status only third due to the fact that more than a half of the respondents (53%) do not worry about their health, and their health has not changed significantly over the past year (59%).

Physical activity is one of the components of healthy lifestyle. Despite the fact that almost a half of the respondents (48%) consider sports and physical fitness as the factors that are crucial for health formation, only 8% of schoolchildren do their morning exercises every day and more than a half (56%) never do morning exercises. Training in sports sections is also of no interest: these are attended by only one third of the respondents.

Interestingly, too, that many schoolchildren consider their lifestyle as active (62%), however, a considerable proportion does not attend sports sections, does not do morning exercises every day, and generally believes that sports is just somewhat important for children of their age. Perhaps, the students put a dramatically different meaning in the concept of "active lifestyle" and believe that physical education lessons and walking outdoors are enough. Not only educational institutions, but also family motivate to do sports, since it is parents who lay the foundation for the need for motion in early childhood.

Physiologically wholesome sleep also plays a key role in maintaining health and forming healthy lifestyle. Sleep duration in school-aged children gradually changes, at the age of 15–17 it is about 9–8 h. After returning home from school only 20% of the respondents prefer active recreation (walking outdoors), 33% do their homework, which can take more than two hours (27% of the respondents), and 41% prefer sleeping to compensate the lack of sleep, which could cause shift to the later bedtime. Despite the fact that about a half of the respondents, specifically 52%, believe they have enough sleep, many of them reduce sleep duration without considering the consequences, i.e. the fact that this can affect their physical, emotional, and psychological well-being. Adolescents tend to stay far into the night with the books, smartphone or computer, thereby shifting their bedtime and going to bed after midnight (43%). According to the questionnaire survey, 41% of students sleep less than seven hours. Naturally, the lack of sleep is guaranteed in this situation, since the students have to get up early in the morning to go to school.

When performing a more thorough comparative analysis of the data acquired in different educational institutions, some features can be noted. A total of 56% of students attending comprehensive secondary schools believe they have enough sleep, while students attending gymnasia and lyceums believe the duration of their sleep is insufficient (54% and 54%, respectively). A total of 52% students attending lyceums go to bed after midnight, 50% and 53% of students attending comprehensive schools and gymnasia go to bed between

22:00 and 24:00, while 39% and 49%, respectively, sleep less than seven hours. In our opinion, one of the reasons could be the shifting schedule. It is also likely that the lack of sleep is caused by wrong bedtime planning.

One of the groups of the risk factors contributing to unhealthy lifestyle is represented by bad habits (smoking, alcohol abuse, drug abuse). Recently vaping becomes increasingly important. Most of the respondents (68%) responded negatively to the question "Do you vape?", 19% tried vaping, and 13% responded positively. As for frequency, the option "few times a day" was selected by 10%. However, despite all this, teachers, physicians, and the majority of parents are worried about the growing popularity of vaping among adolescents. One of the problems related to vaping is as follows: adolescents hear that vaping is less dangerous to health than tobacco smoking and think it is not harmful. Furthermore, there is little hazard information on the wrappings of vapes. Despite the fact that 66% of the respondents responded positively to the question "Do you think vaping is harmful?", 25% of children noted they "did not know". Preventive work in the form of discussions and activities is constantly carried out at school. However, it is equally important to talk about it at home, not flatly saying "It is harmful", but discussing the issue. This requires that parents are also aware of the subject matter.

Organization of health preservation activities in comprehensive schools is a complex goal-oriented process that includes a combination of interrelated methods, techniques, approaches, and activities, the key role in planning of which is played by the schoolchild involvement in the process. Selection of the instructional techniques for development of healthy lifestyle skills should leave adolescents some room for personal fulfillment. This can be easily implemented by using the results of the adolescents' health status and lifestyle self-assessment obtained during the questionnaire survey. The students can see both positives and negatives of this or another lifestyle through their own example and examples of their classmates. It is important that the teacher plays a role of assistant in obtaining knowledge, but not the role of a tough boss, when conducting preventive work related to the issues of healthy lifestyle. It is necessary to interest the students and affect their value-motivational sphere. This is the only way to obtain effective results.

## DISCUSSION

According to the currently accepted point of view, the children's health and health of the general population is affected by a wide variety of factors (internal and environmental factors), among which social (nutrition, housing conditions, lifestyle, psychological atmosphere, etc.), epidemiological, ecological factors, and factors of the teaching process are the priorities. Health status of children and adolescents is a major development indicator of the State. Subjective analysis of the students' life quality and living conditions has shown that it is material living conditions that determine the quality of life for the majority of schoolchildren, while health status is only ranked third. The focus on material things is also reflected in assessment of material living conditions and housing conditions.

It is well known that adolescence is a period when the child's body is through intense growth and development of all functional systems of the body. Maturation of biological processes and functions, as well as social and personality development of the child and shaping of his/her worldview occur during this period. Hormonal changes in the body that often shape the adolescent's behavior and attitude towards

processes and events happening all around are another feature of adolescence. Subjective assessment of their health status and lifestyle is one of the indicators allowing us to understand adolescents.

According to a number of researchers [9–11], the factor of intra-school environment predetermines 12% of morbidity in primary school students and 21% of morbidity by the end of school, i.e. its significance almost doubles. The socio-hygienic factor determines 27% of morbidity at school entry and 14% at the end of study, this was also somehow reflected in our study. Strengthening of the role of the so-called "school factor" is noted in children of school age. The impact of individual factors depends on the children's age. Such factors include malnutrition in children and adolescents, including school meals, intensification of educational process, teaching methods and technologies not matching the students' age-related features and functional abilities, the students' static posture and reduced motor activity, breaching the sanitary and hygienic rules by the educational institution, the lack of systematic work on formation of the value of health and healthy lifestyle [12–14]. This is confirmed by the results of our questionnaire survey of adolescents focused on studying the subjective assessment of health and lifestyle.

Studying the factors that are most important for assessment of health indicators has shown that lifestyle as a subjective factor of social development may be a leading factor that nowadays reflects health status. It accounts for 50–55% of all factors. Furthermore, it directly affects health, regardless of social and environmental conditions (the impact of social and environmental conditions and factors is mediated by lifestyle) [15, 16].

Shaping healthy lifestyle in children involves the use of a set of measures aimed at maintaining health, promoting healthy lifestyles, developing the desire to take responsibility for the health, implementing a personalized approach to healthy lifestyle formation in children, combating the risk factors of disorders, managing educational activities and raising awareness of the danger of smoking and alcohol abuse among children, preventing socially significant disorders in children. Political, medical, and educational components are important in terms of establishing the basis of healthy lifestyle. Scientific knowledge, rational daily routine and work-rest schedule, well-structured nutrition, preventive care, physical activity, no bad habits, etc. most often become the starting point for development of the desire for healthy lifestyle in schoolchildren [17–20].

The concept of "health preservation technologies" that has recently emerged is focused on consolidation of all intentions of the educational system aimed at maintaining, forming, and improving the students' well-being. Health preservation technologies address the issues of the students' health preservation and improvement.

## CONCLUSIONS

The relevance of forming the concepts of "health" and "healthy lifestyle" in children and adolescents is beyond doubt. The surveyed schoolchildren have a rather high level of knowledge about health preservation, but, unfortunately, theoretical knowledge is not always used in real life. That is why it is extremely important for the teacher to develop motivation to be healthy and take responsibility not only for their own health, but also the health of others, in children during the teaching process and nurture. The joint efforts of students, teachers, parents, and medical professionals focused on promoting the knowledge about healthy lifestyle through personal example, experiments, and practical use of knowledge, play a key role in this process.

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## HYGIENIC ASSESSMENT OF THE MEDICAL STUDENTS' MENTAL PERFORMANCE IN RELATION TO CLASS TIME AND DRINKING REGIME

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Today, the issue of preservation, maintenance and development of mental performance is of great importance due to social transformation and the school and higher education system upgrade. The growing body of information, continuous modernization of the training programmes, the use of various technical training aids that result in intensification of cognitive activity have a negative impact on the students' mental state. The study was aimed to assess the medical students' mental performance indicators in relation to the time of the day and the daily fluid intake. A total of 300 students were enrolled, who had both morning and afternoon (after lunch) classes. Mental performance of medical students was assessed using the Anfimov's table. It was found that the students' mental performance depended not only on the start time, but also on the water consumption regime. The main trends of water consumption in young adults were defined: moderate water consumption (1–2 L per day) prevailed, low water consumption (less than 1 L per day) was ranked second, and high water consumption (more than 2 L per day) was the rarest.

**Keywords:** mental performance, correction test, class time, youth, medical school, university medicine

**Author contribution:** Shultz KV, Potseluev NYu — data acquisition and processing; Nagornyak AS, Zhukova OV — data acquisition; Kazizaeva AS — manuscript writing.

**Compliance with ethical standards:** the study was approved by the Ethics Committee of the Altai State Medical University (protocol № 13 of 20 February 2022). All students submitted the informed consent to study participation.

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## ГИГИЕНИЧЕСКАЯ ОЦЕНКА УМСТВЕННОЙ РАБОТОСПОСОБНОСТИ СТУДЕНТОВ МЕДИЦИНСКОГО ВУЗА В ЗАВИСИМОСТИ ОТ ВРЕМЕНИ ЗАНЯТИЙ И ПИТЬЕВОГО РЕЖИМА

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Проблема сохранения, поддержания и развития умственной работоспособности в настоящее время приобретает большое значение в связи с социальными преобразованиями и обновлением системы школьного и высшего образования. Возрастающий объем информации, постоянная модернизация учебных программ, привлечение разнообразных технических средств обучения, влекущие интенсификацию умственной деятельности, — все это отрицательно влияет на нервно-психическое состояние учащихся. Целью настоящего исследования было оценить состояние показателей умственной работоспособности студентов медицинского вуза в зависимости от времени суток и среднесуточного количества потребляемой жидкости. В исследовании приняли участие 300 студентов, занятия у которых проходили как в первой, так и во второй половине дня (после обеда). Оценку умственной работоспособности студентов медицинского университета проводили с использованием таблицы Анфимова. Установлено, что показатели умственной работоспособности студентов зависят не только от времени проведения занятия, но и от режима водопотребления. Определены основные тенденции водопотребления среди молодежи: преобладает умеренное водопотребление (1–2 л в сутки), на втором месте пониженное водопотребление (менее 1 л в сутки), реже всего повышенное водопотребление (более 2 л в сутки).

**Ключевые слова:** умственная работоспособность, корректурная проба, время занятия, молодежь, медицинский вуз, университетская медицина

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Today, the issue of preservation, maintenance and development of mental performance is of great importance due to social transformation and the school and higher education system upgrade [1, 2, 4]. The growing body of information, continuous modernization of the training programmes, the use of various technical training aids that result in intensification of cognitive activity have a negative impact on the students' mental state [1–5].

Currently, high-level skills and abilities, psychoemotional criteria (perception, attention, etc.), and psychophysiological features form the basis of effective performance [6–9].

The papers [10–17] show that the calcium and magnesium deficiency and imbalance against the background of the increased concentrations of manganese, iron, and silicon

in drinking tap water are the risk factors of the mental performance decline in adolescents.

To maintain high performance, students should adhere to the work and rest regime, make breaks, do exercises [18, 19]. There are a lot of theories about what should be the load. However, it should be noted that the load should be calculated individually for each age group taking into account the students' abilities and the training course [20–23]. Medical education has a number of key features, that is why the guidelines for medical students should be different from that for students educated in other areas [24–26]. This is due to the fact that educational process in medical schools is different from that in other higher educational institutions: medical students have a higher level



of responsibility, deal with the larger amount of material to be learned, etc. All the above result in the need to study the medical students' performance.

The study was aimed to assess the medical students' mental performance indicators in relation to the time of the day and the daily fluid intake.

## METHODS

Mental performance of students of the medical university was assessed using the Anfimov's table. A total of 300 adult second-year students of the Institute of Clinical Medicine and the Institute of Public Health and Preventive Medicine, Altai State Medical University, were enrolled. Among them there were 247 females and 53 males aged 18–31. The study was performed in spring (March–April 2022). The students, who had morning and afternoon classes, were divided into three groups: group 1 — engaged from 08:00 ( $n = 143$ ), group 2 — engaged from 14:00 ( $n = 88$ ), group 3 — engaged from 16:20 ( $n = 69$ ) local time (UTC+7). The differences in the following indicators were assessed: the total number of symbols viewed, the total number of mistakes, the average speed of perception/processing of visual information (bit/s). Incomplete tables, the tables containing arithmetic errors or completed using the wrong method were excluded.

The students reported their gender, age, and average fluid intake before the correction test when filling in the questionnaire with the following response options: “less than 1 L per day”, “1–2 L per day”, “more than 2 L per day”.

Statistical data processing was performed using the SPSS STATISTICS 19 software package (IBM; USA). The distribution of variables was assessed using the Shapiro–Wilk test and the Kolmogorov–Smirnov test. The quantitative data were presented as median (Me) and the first and third quartiles [Q1; Q3], while the qualitative data were presented as the share and the 95% confidence interval calculated using the modified Wald method and compared using the Pearson's chi-squared test ( $\chi^2$ ). Multiple intergroup comparisons of the mental performance indicators were performed using the Kruskal–Wallis H test, and the differences between the median values of two groups were tested using the Mann–Whitney  $U$  test. The differences were considered significant at  $p = 0.017$ .

## RESULTS

In the first phase of the study we assessed the differences between the mental performance indicators in the studied groups in relation to the start times for the university. Preliminary assessment of the data distribution showed that the distribution of most variables was non-normal (Shapiro–Wilk test and Kolmogorov–Smirnov test,  $p < 0.05$ ) or the requirement of equal variances was not met when performing intergroup comparison, that is why nonparametric statistics was used.

In group 1, the total number of mistakes was 0–7 (Me = 3), furthermore, the results of 50% of subjects ranged between 2 and 5 mistakes. In group 2, the total number of mistakes varied between 0–6 (Me = 3) and the 25<sup>th</sup> and 75<sup>th</sup> percentiles corresponded to 2 and 5 mistakes. In group 3, the total number of mistakes was between 1–7 (Me = 4) and the 25<sup>th</sup> and 75<sup>th</sup> percentiles corresponded to 2 and 5 mistakes. Since  $H$  (Kruskal–Wallis test) appeared to be less than 0.001, thus confirming the differences in the total number of mistakes, the pairwise comparison was further performed using the Mann–Whitney  $U$  test and taking into account the new significance level ( $p = 0.017$ ).

The results of intergroup comparison showed that there were differences in the total number of symbols viewed between groups 1 and 2 ( $U = 9012.5$ ,  $Z = -0.363$ ,  $p = 0.717$ ), however, the total number of mistakes in group 1 was significantly lower than that in group 3 ( $U = 3126$ ,  $Z = -3.912$ ,  $p < 0.001$ ). There were similar differences between groups 2 and 3 ( $U = 1654$ ,  $Z = -3.72$ ,  $p < 0.001$ ), in which students, who started studying at 16:20, made more mistakes than their colleagues, who started studying at 14:00.

The pairwise comparison using the Mann–Whitney  $U$  test taking into account the new significance level ( $p = 0.017$ ) showed that there were no differences in the average speed of perception/processing of visual information between groups 1 and 2 ( $U = 9206$ ,  $Z = -0.066$ ,  $p = 0.947$ ). However, there were significant differences between groups 1 and 3 ( $U = 56$ ,  $Z = -10.885$ ,  $p < 0.001$ ) and groups 2 and 3 ( $U = 35.5$ ,  $Z = -9.716$ ,  $p < 0.001$ ): students, who started studying at 16:20, showed lower average speed of perception/processing of visual information.

In the next phase, all the study participants were divided into groups based on both start times and water consumption (according to the questionnaire survey results).

In group 1, 30 individuals consumed less than 1 L per day (21%; 95% CI: 15.1–28.4), 97 individuals consumed 1–2 L per day (67.8%; 95% CI: 59.8–75.0), while the number of individuals consuming more than 2 L per day was 16 (11.2%; 95% CI: 6.9–17.5). In group 2, 16 individuals consumed less than 1 L per day (18.2%; 95% CI: 11.4–27.6), 97 individuals consumed 1–2 L per day (69.3%; 95% CI: 59.0–79.0), and the number of individuals consuming more than 2 L per day was 11 (12.5%; 95% CI: 7.0–21.2). In group 3, 14 individuals consumed less than 1 L per day (20.3%; 95% CI: 12.4–31.4), 47 individuals consumed 1–2 L per day (68.1%; 95% CI: 56.4–77.0), and the number of those consuming more than 2 L per day was 8 (11.6%; 95% CI: 5.7–21.5). The intergroup comparison of proportions using the Pearson's chi-squared test ( $\chi^2 = 0.316$ ;  $p = 0.989$ ) showed that there were no differences in water consumption, and moderate water consumption generally prevailed.

In the subsequent phase, the pairwise comparison of the mental performance and water consumption indicators in different groups was performed. We managed to reveal the following differences: the total number of symbols viewed was significantly higher in group 1 than in groups 2 and 3 among individuals, who consumed 1–2 L or more than 2 L per day. There were no differences between individuals, who consumed less than 1 L per day, which could be due to developing dehydration by lunch time and could require correction. Since there are no differences between groups 2 and 3, we can speak about the continuous trend towards dehydration by the evening time that remains almost unchanged even after the meal, which could be due to drinking sweet carbonated drinks, tea, and coffee that fail to fully compensate the body fluid loss. Perhaps, the relationships between other indicators are more complex and require building a larger sample taking into account individual characteristics of the body and the drinking water microelement composition.

## DISCUSSION

It should be noted that today assessment of the medical students' performance requires extra hygienic research, since the results provided show performance estimates for only a part of students. Further research focused on investigation and hygienic assessment of water consumption and performance of undergraduate/graduate students and students with

intermediary classes is required. The issue of the dynamic changes in mental performance of students in part-time and extramural courses seems to be poorly understood. According to the literature data, the performance estimate is an important indicator allowing one to assess the student's overall physical and psychoemotional well-being [7, 8].

Estimation of a set of indicators in the specialists of the highest qualification category, postgraduate and doctoral students, is also of certain interest. According to the official statistics, each year only about 10–12% of specialists complete their educational programmes with the candidate's or doctor's dissertation defense. This negatively affects the scientific efficiency of the provider institutions. It seems to be important to establish the patterns of changes in the indicators of both mental and physical performance in the specified groups, establish possible relationships between irrational time allocation in learning and mental fatigue. Preventive correction of mental fatigue will make it possible to improve the rate of dissertation defense and preserve high motivation for resuming the scientific and pedagogical activities in valuable professionals.

As for estimation of the relationships between the indicators of mental performance and water consumption based on the

data obtained and the literature data, it seems relevant to form, as far as possible, homogeneous samples to study imbalance of calcium and magnesium in drinking water, iodine and selenium deficiency, and adverse effects of contamination with heavy metals and organochlorine compounds.

## CONCLUSIONS

It has been found that the students' mental performance depends not only on the class time, but also on the water consumption regime. The main trends of water consumption observed in youth have been defined: moderate water consumption (1–2 L per day) prevail, low water consumption (less than 1 L per day) is ranked second, and high water consumption (more than 2 L per day) is the rarest. Evening classes in combination with dehydration contribute to the general decline in mental performance. Further studies of the dynamic changes in performance of young adults and the combined effects of such factors, as individual features of circadian rhythms, microelement imbalance or deficiency in the body, and psychoemotional background, seem to be promising.


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## HYGIENE AS A SCIENCE IN MODERN CLINICAL THERAPEUTIC PRACTICE: FROM OBSERVATION TO DIGITALIZATION (PART ONE)

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Building on the global medical historiography, this review attempts to demonstrate the continued interest and involvement of doctors in investigation of the influence of environmental factors, their epidemiological and pathological aspects, on life expectancy and health of human beings, as well as to cover the most significant domestically developed prevention measures applicable in everyday life, during epidemics and against occupational hazards. We have also attempted to outline the history of interinfluence of the two medical specializations, including the new round of their transformation as they merge into the digital reality of today. The review shows that when medicine, as science and trade, in Russia was going through its establishing phases in Russia, the prominent Russian experts underscored the need for integrated application of therapeutic and hygienic approaches, development of the most effective combination thereof with the aim of qualitative improvement of public health care. The article considers the historical prerequisites for development of the system of preventive and anti-epidemic measures, which are the key safeguards against diseases, and development of the hygiene, including occupational hygiene, from the moment of inception to the age of digital medicine we live in currently.

**Keywords:** hygiene, therapy, history of medicine, prevention, digitalization of hygiene


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## ГИГИЕНИЧЕСКАЯ НАУКА В СОВРЕМЕННОЙ КЛИНИЧЕСКОЙ ТЕРАПЕВТИЧЕСКОЙ ПРАКТИКЕ: ОТ НАБЛЮДЕНИЯ К ЦИФРОВИЗАЦИИ (ЧАСТЬ ПЕРВАЯ)

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В обзоре предпринята попытка продемонстрировать неизменный интерес и вовлеченность врачей в изучение влияния факторов внешней среды с позиций эпидемиологии и патологии на продолжительность жизни и здоровье людей на основе общемировой медицинской историографии, коснуться наиболее значимых отечественных разработок в области профилактических мероприятий для использования в повседневной жизни, медицине труда и в периоды эпидемий, а также попытаться наметить контуры истории взаимного влияния двух медицинских специализаций, в том числе нового витка их трансформации в процессе погружения в сегодняшнюю цифровую реальность. Показано, что в ходе становления медицины в России выдающиеся отечественные специалисты акцентировали внимание на комплексном использовании терапевтических и гигиенических подходов, формировании наиболее эффективного сочетания этих направлений, чтобы качественно улучшить охрану здоровья населения. В статье рассмотрены исторические предпосылки развития системы профилактических и противоэпидемических мероприятий, являющихся главными средствами предупреждения заболеваний, с развитием гигиены (в том числе гигиены труда) с момента зарождения и до настоящего времени — эпохи цифровой медицины.

**Ключевые слова:** гигиена, терапия, история медицины, профилактика, цифровизация гигиены

**Вклад авторов:** Н. И. Шеина, Н. А. Скоблина, Е. А. Дубровина — научное руководство, написание статьи; Д. Д. Каминер, Е. Ю. Санакоева, В. П. Ворона — сбор материала, анализ литературы.

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While being independent areas of medicine, hygiene and therapeutics have been closely intertwined throughout their histories and remain so in the modern age healthcare organization system. Continuing with the division of the history of hygiene into long periods, the "empirical and pragmatic stage of the history of hygiene and therapeutics" and the "stage of research and experimental hygiene", it was suggested to register the beginning of the third stage thereof, one that sees digital technologies enabling the two fields of medicine to jointly expand prevention and patient treatment capabilities in various life situations [1].

The new stage begins at the outset of the SARS-CoV-2 pandemic. The last three years will go down in the history of health prevention because of the coronavirus infection. This was the period when virtually every hygienist, epidemiologist and physician around the world underscored the need for

an overhaul of the approach to training and the very essence of practice of healthcare professionals involved in sanitary and medical prevention efforts.

The author outlines the digital experience of interaction between medical institutions, doctors and patients enabled by telemedical solutions, mobile applications, voice assistants, special remote diagnostics devices, internet of things and artificial intelligence [1].

### Methods

We reviewed 50 papers covering the history of development of the therapeutic and hygienic branches of medicine. For the purpose, we scanned the eLibrary, PubMed, Cyberleninka databases for sources in 2020–2023.

## Ideas about hygiene in the ancient times

The knowledge about hygiene based on practical experience and everyday observations started taking shape in ancient times. As long ago as in 2500s BC, there lived a Egyptian physician named Methm, who was responsible for health of the workers and slaves that were building the pyramids. The numerous surviving papyri dedicated to medicine show that ancient Egyptians attached great importance to hygiene and sanitation [2]. The Ebers Papyrus, written around 1500 BC and found by archaeologists in Thebes in 1874, contains over 900 recipes of medicines and recommendations for their use. In addition, the 108 sheets of this 20.5 meter long ancient monument set dietary rules and prescribe skin care routines for priests [3].

Hippocrates, the great ancient Greek physician (born about 460 BC), developed medicine and believed that there are natural causes behind symptoms of diseases. "On a healthy lifestyle", "On water, air and terrain", his discourses related to hygiene, survived to the present [4].

Galen (born c. 130), the ancient Roman physician, surgeon and philosopher unified all of Greek medicine and used it as the basis for his own doctrines and practices [5]. He wrote "Hygiene", which is better known as the "On Preservation of Health" discourse, during one of the most fruitful periods of his life (170–180). Galen also authored two treatises on the relationship between health and well-being. He investigated the theoretical matter of whether hygiene is part of medicine or gymnastics, and outlined the interrelated roles of physicians and physiotherapists [5]. A fundamental work by Vitruvius (80–70 BC), an ancient Roman architect and scientist/encyclopedist, tells that architects are obliged to factor in human physiology and hygiene rules when building cities and houses. This is a vivid example of an empirical approach to hygiene: relying on common sense, a scientist, a thinker and not a medical professional gives practical advice regarding everyday hygiene and health improvement for citizens of ancient Italian cities [6].

Speaking of Ancient Rome, it is only fair to mention Aulus Cornelius Celsus (about 25 – 50 BC), a scientist/encyclopedist who gave us interesting information about hygiene, diet, therapy, various pathologies, anatomy, surgery, pharmacology and more. The surviving fragment "On Medicine" (chapters 6–13) describes the most common ideas about hygiene and therapeutics adhered to by doctors of late antiquity [7].

## The establishment of hygiene in the Middle Ages

"The Canon of Medicine", a tractate written by Abu Ali ibn Sina (980–1037), a great scholar from Central Asia, describes important aspects of hygiene, ways and means of treatment and prevention of diseases caused by sleep disorders, nutrition, etc. [8].

There are some other historical documents on hygiene worth mentioning. In the 13<sup>th</sup> century, Arnaldus de Villanueva (1235–1311), a Spanish philosopher, medic and alchemist, published two works: "Occupational Hygiene" and "Occupational Diseases" [9]. As for therapeutics, he addressed this subject in the "Salerno Code of Health" [10].

## Development of hygiene as a science in the Modern Age

From the very outset, hygiene was closely interrelated not only with therapeutics but with the occupational health field, too. Paracelsus (1493–1541), a doctor that also investigated medicinal chemistry, was showing great interest in prevention of occupational diseases among miners [11].

In 1546, the treatise "On Infectious Diseases" attempted to summarize information about the patterns of spreading of infectious diseases. The author of this work, Girolamo Fracastoro (1478–1553) from Venice, was not only a physician but also a writer. It is him that single-handedly named the contagious disease "syphilis" [12].

In the 16<sup>th</sup> century, "De re metallica", a work by Georg Agricola (1494–1555), a German physician and father of mineralogy, was published posthumously; that book has many sheets dedicated to the issues of occupational health [13].

The "Diseases of Workers" by Bernardino Ramazzini (1633–1714) published in 1701 became the main reference book on hygiene and therapeutics for the next two centuries [14].

Another historical milestone is the "System of Complete Medical Police" study. This is a work comprised of six volumes; written by Peter Frank (1745–1821) and published in 1817, it touches upon the majority of issues of public sanitation. [15].

Eight years later, Christoph Wilhelm Hufeland (1762–1836), the physician-in-chief for the Prussian King Friedrich Wilhelm III, published "Macrobiotics", a book about personal hygiene. These works have, in a way, finalized the period of observational attitude to hygiene stemming from everyday experiences [16].

The researcher of the history of hygiene [1] proposes to divide the history of development of hygiene as a science into two periods: first period — from antiquity to the end of the 18<sup>th</sup> century when "empirical hygiene" was emerging, second period — age of "scientific and experimental hygiene", which began after the publication of works of Max Pettenkofer (1818–1901), a German physician and founder of the first school of hygienists, and the works of his students. In 1865, Max Pettenkofer established the first department of hygiene at the medical faculty of the University of Munich. The subjects studied there were factors of the environment (water, air, soil, food).

In the 1880s, Louis Pasteur (1822–1895), a French scholar, discovered a link between germs and transmission of diseases. His ideas had a profound impact on understanding and further thoughts about hygiene and therapeutics developed in the West [17].

During those years, hygienic science was increasingly evolving from purely empirical observations to being filled with new experimental data. A name to be remembered here is that of Michel Lévy (1809–1872), a French medical service general who authored hygienic recommendations set out in the "Treatise on Public and Private Hygiene" [18]. It is also important to mention Edmund Parkes (1819–1876) an English scientist, military physician, hygienist and author of the "Practical Guide to Hygiene" and a whole series of essays covering the battle against the cholera epidemic in London and Asia [19].

## The origin and development of hygiene as a science in Russia

Empirical knowledge about hygiene was formed as early as in the time of the Ancient Rus'. "Domostroy", the famous guide describing how a Russian family should live (a monument of Russian literature of the 16<sup>th</sup> century), gives the basics of proper food storage, cleanliness and tidiness.

In the 18<sup>th</sup> century, Peter the Great did a lot to protect the health of the public and prevent spread of the diseases when the epidemiological situation was difficult in Russia. In April 1699, he issued a decree "On the observation of cleanliness in Moscow and on the punishment for throwing rubbish and all kinds of litter into streets and alleys." There were created nurse jobs and sanitary bureaus opened; by the end of the 19<sup>th</sup> century, there were more than twenty of them. This is when

the sanitary culture in Russia has officially began to evolve [20]. In 1718, the health protection right was enshrined, rules ensuring proper sanitary and hygienic conditions for everyday life and trade introduced, sewers built and trashcans installed on the streets. The shaving decree has reduced the incidence of head lice in the population. Peter the Great made public baths as accessible as possible, limited the sale of alcohol, introduced many regulations pertaining to the protection of health and environment, established the record of incidence of various diseases, launched the health department for military personnel.

Subsequently, Catherine II continued to improve sanitary conditions: she forbade dumping of waste and sewage into the Moscow River and other rivers flowing through the city.

Many Russian doctors of the 18<sup>th</sup>–19<sup>th</sup> centuries underscored the special importance of measures aimed at prevention of high morbidity among the population. M.Ya. Mudrov (1776–1831), professor of pathology and therapeutics at the Moscow University, personifies a whole age of improvement of medical sciences and a combination of hygienic and therapeutic approaches in Russia. His students became a special generation of highly educated Russian doctors. M.Ya. Mudrov developed the patient survey and examination routines, introduced medical histories and student practice in the wards and also proposed methods for treating diseases with the help of the healing powers of nature. He was the first Russian doctor to start practicing percussion and auscultation; M.Ya. Mudrov described medical history and formulated the ethical principles of a doctor [21]. He always considered patients in close connection with the environment, the factors that are the sources and causes of diseases, and practiced individual approach to treatment. To reveal the roots of a pathology, M.Ya. Mudrov interviewed his patients carefully to find out all the details of their lives [22]. He introduced anamnesis into medical records and also developed the plan of its registration. Throughout his practice, M.Ya. Mudrov collected more than 20,000 patient histories, and his approach has been used and improved for 200 years [22]. He developed the preventive vector of medicine. The idea of disease prevention through reduction of the harmful effects of the environment was developed in works on military hygiene. His first work, "The Principles of Military Pathology in Relation to Gunshot Wounds and Amputations on the Battlefield, or the Consequences of Bedside Treatment", was about military medicine. M.Ya. Mudrov covered medical care in the army, hospital management, principles of evacuation of the wounded, the most common operations in wartime and common diseases, and also taught students how to apply bandages. "The Word on the Benefits and Problems of Military Hygiene" was reprinted three times; for a long time, this work was the guiding book for students and doctors.

Relying on the experience of prevention and treatment of cholera, which has grown into an epidemic in 1830–1831, M.Ya. Mudrov and I.E. Dyadkovsky wrote the "Treatise on Cholera, an Extremely Contagious Disease." The rules of prevention and control of epidemics given in that work were taught to hygienists in a separate training course at the Moscow University [23].

M.Ya. Mudrov is rightfully considered the founder of original Russian medicine, which was further developed in the works of such scientists as N.I. Pirogov, G.A. Zakharyin, S.P. Botkin, A.A. Ostroumov [24].

N.I. Pirogov (1810–1881), the outstanding surgeon of the Russian Empire, wrote: "I believe in hygiene. This is the true progress of our science. The future belongs to preventive medicine" [25–27].

Professor G.A. Zakharyin (1829–1898), another well-known Russian clinician and founder of the Moscow Therapeutic School and School Hygiene, noted in his 1873 speech: "The more mature a practicing doctor is, the better he understands the power of hygiene and the relative weakness of treatment and therapeutics... Only if the patient possesses certain medical skills can the therapy be most successful" [28]. G.A. Zakharyin introduced laboratory examination methods, compiled the pulmonary tuberculosis classification, described the liver cirrhosis treatment method, provided a scientific justification of bloodletting, developed the patient interview algorithm and basics of balneotherapy.

S.P. Botkin (1831–1889) was the founder of the St. Petersburg Therapeutic School. He considered the human body from the point of view of its external environment, attached great importance to the state of the nervous system during development of a disease, emphasized the importance of personalized approach to treatment, "in order to treat not the disease, but the patient." S.P. Botkin also founded field therapy and initiated admission of women to higher medical education curricula. In 1861, he opened the first free-of-charge outpatient clinic.

A.A. Ostroumov (1844–1908), an outstanding Russian therapist, believed that the nervous system plays the key part; he considered the body as a whole and stated that disorders of one organ affect the entire body and change functioning of other parts of the body.

It is important to mention other doctors that contributed tangibly to the development of hygiene.

#### **Development of hygiene curricula and establishment of hygienic school in Russia**

In Russia, hygiene as a forensic medicine was taught at the Medical Surgical Academy (St. Petersburg) from the very outset of its operation, that is, from 1798. At the beginning, it was called "Medical Police", and from 1835 — "Medical Police and Hygiene". The Russian Academy of Hygiene and the first independent department of hygiene were opened in 1871 under the guidance of A.P. Dobroslavin (1842–1889), a private professor [29]. He set up an experimental laboratory at the department, established the first school for hygienists in Russia, wrote the first Russian hygiene textbooks [30].

The wide spread of epidemic diseases aggravated the urgency of opening of departments of hygiene. In the second semester of the 1864–1865 academic year, the first ever regular course of hygiene as an independent discipline was launched at the medical faculty of the Imperial Kazan University.

A.I. Yakobiy (1827–1907) was the first teacher of hygiene in Russia. His contemporaries wrote in their memoirs about his public lecture "On happiness from the point of view of hygiene", which A.I. Yakobiy gave in the spring of 1869. What the listeners found interesting is the golden thread he run through the lecture: the idea that "it is only through hygiene that mankind can reach happiness" [31].

The first teacher of hygiene at the Imperial Medical Surgical Academy and the first head of the department of hygiene was I.M. Sorokin (1833–1917). His specialties were hygiene as it applies to toxicology and forensic medicine.

Prevention has been considered in designs of medical institutions also since ancient times, which disallows considering the history of rise of hygiene and its relationship with therapeutics without factoring in hygienic measures adopted by therapeutic establishments because they affect the results of treatment significantly.

## History of development of preventive approach in designs of medical institutions

The history of development of hospitals can be traced back to ancient times, when the first medical establishments were opened in the temples of Egypt and Ancient Greece. Later, guest houses were used for pilgrims and wanderers, and they also served as hospices for the crippled and the incurable. They were called "Houses of the Lord" in France, "Refuge of Saint Lazarus" in Italy. In Rus', hospitals were established at the Kiev Pechersk Lavra, the Trinity Lavra of St. Sergius etc. in the 11<sup>th</sup> century.

Western-style hospital buildings were built during the reign of Peter the Great in Moscow, St. Petersburg and other cities. The first hospitals had enfilade architecture with large rooms filled with 60–100 beds each. Back then, healthcare professionals did not yet realize the need to isolate patients, and the only inconvenience was the sewer running through corridors. Later, such buildings were replaced by more modern hospitals, the design of which reflected the desire to isolate certain categories of patients.

Hospitals that resembled pavilions were quite common back in the 19<sup>th</sup> century. This kind of design was a step forward in the prevention of nosocomial infections. Searching for a better hospital building project, in the middle of the 19<sup>th</sup> century doctors chose the most primitive design, that of barracks, which proved effective during the Crimean War in Russia and the American Civil War. They were single-storey wooden buildings without a ceiling. The roof had a monitor comprised of glass frames. The barracks were positioned at a certain distance from each other. Each had a large room/cell accommodating 20 to 40 people.

In the middle of the 19<sup>th</sup> century, hospital departments and hospitals themselves started to specialize by diseases and, in the first place, by age, and thus children's hospitals appeared.

In case of children, isolation of the patients by their diseases proved to be ineffective, which necessitated development of individual isolating boxes. The first designs of such boxes were developed in France, but the first real boxes were made in Russia (Melzer system boxes). Strict isolation of each infected patient allowed concentrating patients with various infections in one hospital, provided the sanitary and hygienic rules are observed.

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## CONTRIBUTIONS OF CERTAIN LIFESTYLE FACTORS TO HEALTH STATUS OF CONTEMPORARY SCHOOLCHILDREN

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Healthy lifestyle is one of the factors determining the human health status. The study was aimed to estimate the contributions of certain lifestyle factors to the health status of the ninth-grade students attending school in Voronezh. During the study special attention was paid to the key role of school and family in shaping the school student's strive for healthy lifestyle. The questionnaire survey carried out under conditions that precluded discussion without time limit was used as the main method. Nutrition, motor activity, personal hygiene, daily routine, and harmful habits are highlighted among the studied lifestyle components. The crucial role of such lifestyle factors, as nutrition and motor activity has been proven. The lifestyle differences between girls and boys have been revealed. Analysis of the data obtained has made it possible to find out that the main risk factors in the group of school students with the almost healthy lifestyle are malnutrition in boys and reduced motor activity in girls. Furthermore, in school students, whose lifestyle is associated with health risks, all the lifestyle components can be considered as risk factors, regardless of the child's gender.

**Keywords:** lifestyle, health, school, students, nutrition, motor activity

**Author contribution:** Medvedeva NYu — literature review, statistical data processing; Gunina SV, Urtenova AYu — data acquisition, literature review, statistical data processing.

**Compliance with ethical standards:** the study that was conducted in accordance with the ethical principles stated in the Declaration of Helsinki and the European Community directives (8/609EC), it did not violate human rights of endanger the respondents and complied with the requirements of biomedical ethics.

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## ВКЛАД ОТДЕЛЬНЫХ ФАКТОРОВ ОБРАЗА ЖИЗНИ В ФОРМИРОВАНИЕ СОСТОЯНИЯ ЗДОРОВЬЯ СОВРЕМЕННЫХ ШКОЛЬНИКОВ

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Здоровый образ жизни является одним из факторов, определяющих формирование состояния здоровья человека. Целью настоящего исследования было оценить вклад отдельных факторов образа жизни в формирование состояния здоровья учащихся девятых классов одной из школ г. Воронежа. В ходе исследования особое внимание было уделено ведущей роли школы и семьи при формировании стремления школьника к здоровому образу жизни. В качестве основного метода использовали анкетирование, которое проводили в исключаяющих возможность обсуждения условиях без ограничения во времени. Среди изученных компонентов образа жизни выделены питание, двигательная активность, личная гигиена, режим дня и вредные привычки. Доказана ведущая роль таких факторов образа жизни, как питание и двигательная активность. Выявлены различия в образе жизни девочек и мальчиков. Анализ полученных данных позволил установить, что в группе школьников, ведущих приближенный к здоровому образ жизни, основными факторами риска были нарушения питания у мальчиков и снижение двигательной активности у девочек. При этом у тех школьников, чей образ жизни был связан с риском для здоровья, к факторам риска можно было отнести практически все компоненты образа жизни, независимо от пола ребенка.

**Ключевые слова:** образ жизни, здоровье, школа, обучающиеся, питание, двигательная активность

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Preserving and maintaining health of the younger generation is an urgent challenge faced by our society. Under conditions of modern educational system, school students are significantly affected by the informational and emotional stress, which adversely affects their health when combined with physical inactivity and malnutrition. Stress, harmful habits, physical inactivity, malnutrition, poor personal hygiene result in impaired function of certain systems, thus affecting the school student's body functional state and adversely affecting the state of all systems and organs [1–5].

It is obvious that school contributes very much to the student's health. Since the students spend quite a lot of time

in educational institutions, it is alterations in their activity that may ensure positive effects on the health of children and adolescents and correction of the extra-school negative factors. It is believed that the contribution of the school risk factors to the health of children and adolescents is 20–40% [6]. This has been confirmed by various studies, however, educational background, the child's attitude towards school, and his/her life priorities contribute significantly to the extent, to which the school student's health is affected by the educational institution.

The study was aimed to estimate the contributions of certain lifestyle factors to the health status of the ninth-grade students attending school in Voronezh.

**Table 1.** Lifestyle classification for school-age children

| Lifestyle classification               | Assessment of vital functions  | Total score |
|--|--|-------------|
| Healthy lifestyle                      | Full compliance with healthy lifestyle   | 30–34       |
| Almost healthy lifestyle               | Almost healthy lifestyle, no harmful habits  | 35–44       |
| Lifestyle associated with health risks | Non-compliance with healthy lifestyle based on one or two components, no harmful habits  | 45–59       |
| Alarming lifestyle                     | Non-compliance with healthy lifestyle based on three or four components, first experience with tobacco smoking and alcohol consumption | 60–74       |
| Extremely alarming lifestyle           | Non-compliance with healthy lifestyle based on one or more components, risk of developing harmful habits                               | 75–84       |
| Dangerous to health lifestyle          | Non-compliance with healthy lifestyle based on one or more components, well-formed harmful habit                                       | 85–89       |

## METHODS

Scientific research involved assessment of the data of the online questionnaire survey of the nine-grade students attending the Comprehensive Secondary School № 102 in Voronezh. The survey covered the issues allowing one to reveal the main risk factors capable of affecting the health of children and adolescents.

The study aimed to reveal the risk factors and assess the school students' lifestyle involved 62 nine-grade students, among them 29 boys and 33 girls. The study was carried out February to April 2022. This period was selected for the study due to the fact that it is the period when school students spend much more time in educational institutions.

The questionnaire consisted of 30 questions divided into five items, six questions per item. The method to assess the lifestyle of the school-age children reported in the manual [7] was used in the study. The responses to each question were assessed using the 3-point scale: score 1 showed that the factor posed minor health risk, while score 3 corresponded to high risk. The respondent could score 30–90. The lifestyle option that corresponded to classification provided in Table 1 was defined based on the total score. To obtain representative responses, the questionnaire survey was carried out under conditions that precluded discussion without time limit.

Statistical data processing was performed by standard methods using the Statistica 13.0 software package (StatSoft; USA). The data obtained were previously tested for normality.

## RESULTS

Statistical processing of the data obtained by conducting the questionnaire survey has made it possible to compile the Lifestyle Profile of the Nine-Grade Students Attending the Comprehensive Secondary School № 102 provided in Table 2.

When analyzing the data obtained, it should first be noted that none of the respondents was assigned to the fifth or sixth category of the lifestyle classification. About 10% of school students can say that their lifestyle is healthy, almost a half

of students follow healthy or almost healthy lifestyle. The alarming lifestyle has been reported in 4.8% of the respondents.

Comparison of lifestyles in boys and girls shows clearly that girls predominate among students, who follow healthy or almost healthy lifestyle, while alarming lifestyle and lifestyle associated with health risks are more common in boys. Analysis of the findings shows that the share of girls with healthy or almost healthy lifestyle is 66.6%, while the share of boys following similar lifestyles is less than a half (44.8%).

Assessment of the lifestyle components aimed at identifying the risk factors that adversely affect the schoolchildren's health based on the previously obtained data is relevant for school students with the almost healthy lifestyle or lifestyle associated with health risks. Comparative analysis of the abundance of risk factors among boys and girls is provided in Fig. 1, 2.

According to the data provided in Fig. 1, the lifestyle downgrading observed in this category of school students is due to malnutrition and reduced motor activity. Thus, it is these lifestyle components that represent risk factors for these school students, since the average score for the total population of schoolchildren exceeds eight points. According to the lifestyle component assessment, scores 6–7 correspond to minor risk, scores 8–11 correspond to low risk, while scores  $\geq 12$  correspond to high risk.

It should be also noted that malnutrition is the main risk factor for boys in this group, while reduced motor activity is more common among girls. Furthermore, boys are more likely to disturb their daily routine and susceptible to developing harmful habits than girls.

The results of the questionnaire survey of the group of nine-grade students, whose lifestyle is associated with health risks, that are provided in Fig. 2 suggest that all lifestyle components, except personal hygiene, are almost at the same level and these components adversely affect the children's health. Thus, the lifestyle downgrading is due to additional impact of such factors, as daily routine disruption and developing harmful habits. The gender-related differences in the effects of various components are less obvious in school students with the lifestyle associated with health risks. It should be noted that harmful habits are more common in boys.

**Table 2.** Lifestyle profile of the nine-grade students attending the Comprehensive Secondary School № 102 (% of positive answers, n = 62)

| Lifestyle classification               | Boys | Girls | Total |
|--|------|-------|-------|
| Healthy lifestyle                      | 6.9  | 12.1  | 9.7   |
| Almost healthy lifestyle               | 37.9 | 54.5  | 46.8  |
| Lifestyle associated with health risks | 48.3 | 30.3  | 38.7  |
| Alarming lifestyle                     | 6.9  | 3.0   | 4.8   |
| Extremely alarming lifestyle           | 0.0  | 0.0   | 0.0   |
| Dangerous to health lifestyle          | 0.0  | 0.0   | 0.0   |

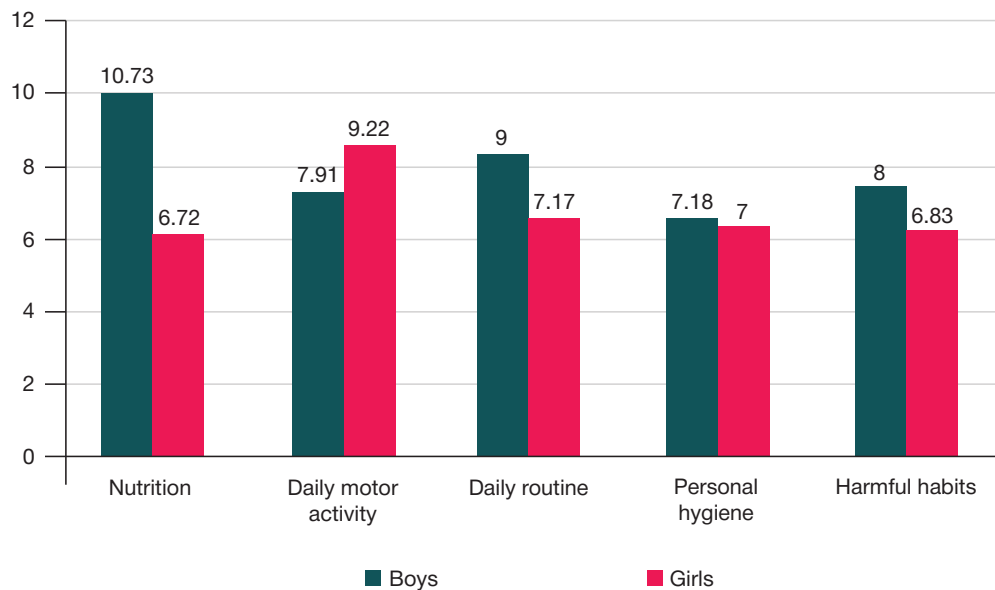


Fig. 1. Assessment of lifestyle components in the nine-grade students with the almost healthy lifestyle (scores)

## DISCUSSION

Contemporary authors consider lifestyle as a system of the most typical characteristics of the mode of activity and the attitude towards oneself, people around and society that is formed through this activity [8–12].

By definition, healthy lifestyle is a system of conscious activity and motivated behavior that meets biological and social needs of the growing organism and corresponds to physical, mental, and social well-being, i.e. optimal health status.

Our findings show that the major causes of diseases in children and adolescents are associated with the effects of various negative factors, among which special niche is occupied by intra-school factors and lifestyle factors. Family, school, and society contribute significantly to shaping the school student's lifestyle. It is the features of lifestyle shaped under the influence of educational institution, society, and parental supervision that directly affect the child's health.

Nutrition, motor activity, personal hygiene, daily routine, and harmful habits are highlighted among the lifestyle components. The effects of various factors on these lifestyle components

define their type: negative or positive. The sources of negative factors may vary. Thus, malnutrition may be associated with insufficient family income, social and family risk factors, and high workload and the school student's engagement in the educational institution. Various risk factors often work in a complex adversely affecting the child's lifestyle, which, in turn, adversely affects his/her health.

The long-term research pursued by the Research Institute of Hygiene and Health of Children and Adolescents of RAMS and Sysin Research Institute of Human Ecology and Environmental Health has shown that the contribution of intra-school factors affecting the students' health is 21–27%, and students spend most of the day (about 70% of daytime) at school. As for their sanitary and epidemiological well-being, only 19% of institutions can be considered as prosperous, 55% — as conditionally prosperous, 25% — as vulnerable [13]. The researchers [14] note that it is necessary to take into account the age-related features and the fact that the child is through various stages of growth when assessing the school student's health.

Today, a lot of research is being done in this field. Each study is essential for both assessment of the efficacy of the currently

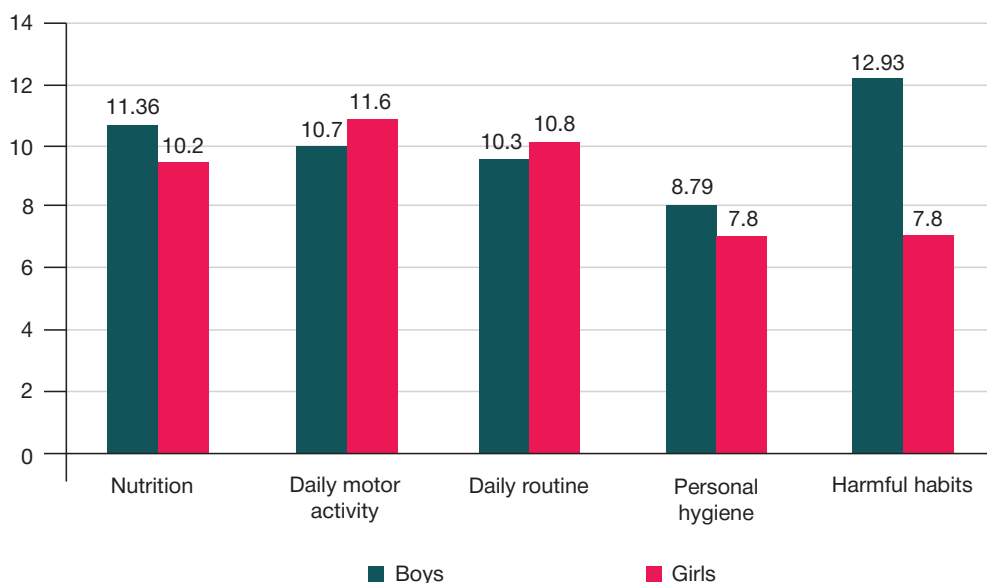


Fig. 2. Assessment of lifestyle components in the nine-grade students, whose lifestyle is associated with health risks (scores)

applied health preservation measures and identification of the major risk factors. Most data confirm the problems that have been already revealed in other regions. Some studies have revealed some features of health in children of certain age or children living in certain area together with some features of morbidity and physical growth associated with lifestyle and child's daily life [15].

The regions of our country are different, that is why different results can be obtained in these regions. The results would define the list of measures aimed at improving the school students' health. Every study, even the smallest one, is important, both for children it is focused on and for assessment of the overall picture, since despite the unique nature of each and every child, some common patterns, to varying extent typical for different regions or age groups of students, can be revealed.

On the one hand, unlike most recommendations, the totally personal approach to lifestyle adjustment in educational institutions is impossible, since the efforts cannot be focused directly on every single student. On the other hand, in today's conditions only personal approach to combating the risk factors appears to be effective enough, that is why it is necessary to consider the benefits of both approaches when developing the complex of measures aimed at preventive maintenance of a healthy lifestyle and shaping of the health preserving space in the educational institution. This would make it possible to effectively promote healthy lifestyles and prevent pathological conditions in schoolchildren in the context of efforts and resources available to the educational institution. The measures aimed at preventive maintenance of a healthy lifestyle and shaping of the health preserving space in the educational institution should include several phases, some of which may be represented by public events. When planning

and developing the events and various kinds of activities aimed at shaping a healthy lifestyle and health preservation, it must be remembered that hygienic education focused on prevention of harmful habits should be built not on a principle of prohibition and intimidation, but on a principle of explanation and adequate substitute [16–18]. Identification of children at risk, whose lifestyle is associated with health risks, would make it possible to focus the personalized efforts on them. Addressing the problems of these children in accordance on each and every lifestyle component based on the data obtained by monitoring would make working with the children even more effective.

## CONCLUSIONS

The findings indicate that more than a half of the nine-grade students attending the Comprehensive Secondary School № 102 follow healthy or almost healthy lifestyle, among them girls prevail. The fact that there are no children who follow alarming or dangerous to health lifestyle among the surveyed school students can be considered a positive result. It has been found out that the main risk factors in the group of school students with the almost healthy lifestyle are malnutrition in boys and reduced motor activity in girls. It has been proven that in the group of school students, whose lifestyle is associated with health risks, all the lifestyle components, except personal hygiene, can be considered as risk factors. The data obtained by performing the questionnaire survey and processing the results can be used for both personalized lifestyle assessment and developing the profile of the class or certain group of schoolchildren. It is recommended to reveal the gender-related differences by dividing the samples into boys and girls when performing further research.

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## MEDICAL AND SOCIAL REPRODUCTIVE HEALTH ISSUES FACED BY TODAY'S SCHOOLGIRLS

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Protection of the schoolgirls' reproductive health that often depends on many factors, one way or another associated with low awareness of the issue, is a global priority in modern society. The study was aimed to assess the factors that affect reproductive health of the school-age girls. An online questionnaire survey of 100 girls aged 15–18 aimed at detecting reproductive health problems was carried out in Moscow. The average age of menarche was  $12.3 \pm 1.2$  years, however, there were girls, who had menarche at the age of 10 years (10%), and those, who had menarche after the age of 14 (7%), among schoolgirls. Blood spotting between periods was observed in 21% and pelvic pain in 44% of schoolgirls; 81% had severe pain. Irritability, aggression, easy crying, rapid fatigue, and faintness before and during the periods were reported by 98%; swelling, weight gain, abdominal distension, constipation, diarrhea, breast engorgement and soreness were reported by 73%; headache, vertigo, nausea, vomiting, insomnia, increased sensitivity to smell and sound were noted by 50%; high blood pressure, heart-related pain, increased heart rate, panic attacks were reported by 21%; menstrual disorders were observed in 16% of school-age girls. The study showed that 60% of schoolgirls demonstrated medium awareness, 28% showed high awareness, and 12% had insufficient knowledge about reproductive health. The schoolgirls' insufficient awareness of the reproductive health-related issues is a major medical and social challenge that can negatively affect the schoolgirls' reproductive health and cause not only various reproductive system disorders, but also reproductive losses and even infertility later in life.

**Keywords:** reproductive health, preventive care, schoolgirls, awareness, menstrual disorder

**Author contribution:** Solovyova YuV — literature review, manuscript writing.

**Compliance with ethical standards:** all schoolgirls submitted the informed consent to study participation.

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## МЕДИКО-СОЦИАЛЬНЫЕ ПРОБЛЕМЫ РЕПРОДУКТИВНОГО ЗДОРОВЬЯ СОВРЕМЕННЫХ ШКОЛЬНИЦ

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Одной из основных глобальных задач современного общества является охрана репродуктивного здоровья школьниц, которое часто зависит от многих факторов, так или иначе связанных с низким уровнем информированности в этой сфере. Целью исследования было оценить факторы, влияющие на репродуктивное здоровье девочек школьного возраста. В г. Москве было проведено онлайн-анкетирование 100 девочек 15–18 лет, направленное на выявление проблем с репродуктивным здоровьем. Средний возраст начала менструации составил  $12,3 \pm 1,2$  лет, однако среди школьниц были девочки, у которых первая менструация наступила в 10 лет (10%), а также девочки, у которых она наступила после 14 лет (7%). Появление кровянистых выделений в период между менструациями наблюдалось у 21%, боли внизу живота — у 44% школьниц, при этом у 81% были выраженные боли. Раздражительность, агрессивность, плаксивость, быстрая утомляемость, слабость перед началом и во время менструации наблюдались у 98%, отеки, увеличение массы тела, вздутие живота, запоры, поносы, нагрубание и болезненность молочных желез — у 73%, головные боли, головокружение, тошнота, рвота, бессонница, повышенная чувствительность к запахам и звукам — у 50%, повышение артериального давления, боли в сердце, учащение сердцебиения, наличие панических атак — у 21%, а проблемы с менструальным циклом — у 16% девочек школьного возраста. Исследование показало, что среди школьниц 60% имеют средний уровень осведомленности, 28% — высокий уровень осведомленности, а 12% — недостаточные знания в области репродуктивного здоровья. Недостаточная осведомленность девочек-школьниц по вопросам репродуктивного здоровья представляет собой одну из основных медико-социальных проблем, которая может отрицательно сказаться на репродуктивном здоровье школьниц и в дальнейшем стать причиной не только различных заболеваний репродуктивной системы, но также репродуктивных потерь и даже бесплодия.

**Ключевые слова:** репродуктивное здоровье, профилактика, школьницы, осведомленность, нарушения менструального цикла

**Вклад авторов:** Ю. В. Соловьева — анализ литературных данных, написание статьи.

**Соблюдение этических стандартов:** все школьницы подписали добровольное информированное согласие на участие в исследовании.

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Currently, the schoolgirls' reproductive health protection is a global priority. Since the birth rate is low, the first and foremost task now is to minimize reproductive losses, both fetal and maternal, that is why it is necessary to develop and improve the measures aimed at preventing reproductive system disorders in girls as early as school age, before the onset of menarche [1–9].

The measures to preserve the schoolgirls' reproductive health should include primary and secondary prevention, including prevention of cancer. Among these are vaccination of girls and women of childbearing age against human papillomavirus within the established time frame, and hygienic

measures focused on reproductive health preservation, such as lack of hypothermia, stress elimination, timely and seasonal prevention and treatment of respiratory and urinary tract disorders, omitting piercing and tattoos in this part of the body, omitting the same-sex sexual contacts, frequently changing partners or having multiple sexual partners, frequent change of underwear and bed linen, preference for cotton underwear, careful choice of contraceptive method for girls. It is important to adhere to the correct diet, since gut microbiota alterations usually result in alterations of urogenital microbiota as well. Thus, for example, the study involving women with nonspecific vulvovaginitis revealed the increased abundance

of gut microbiota (*Escherichia coli*, *Klebsiella spp.*, *Enterobacter spp.*, *Proteus mirabilis*, *Morganella morganii*), which could be due to inflammatory disease of the gastrointestinal tract, individual structural features or poor personal hygiene [10, 11]. The other researchers proved that the increased abundance of staphylococci and streptococci in the urogenital tract could cause endometriosis, urogenital tract infection and spontaneous abortion later in life [11, 12].

Early sexual initiation, unintended pregnancy, and, consequently, abortions in girls can promote the development of cervical diseases, such as cervical ectopion, and even cause neoplasms later in life [11, 12].

The schoolgirls' psychological health and a favorable psychological climate both at school and in the family (timely referral to a psychologist, adherence to sleep and rest regime aimed at eliminating psychoemotional load) are important [11, 12].

Physical development is a major criterion of health. Today's schoolchildren more and more often show advance in the rate of growth and sexual maturation compared to schoolchildren, who lived in early 20<sup>th</sup> century [13–15]. The earlier maturation of organs and systems, including the reproductive system, contributes to earlier sexual initiation in schoolgirls, earlier sexual contacts, earlier pregnancy and delivery, and earlier development of various reproductive system disorders.

The reproductive system disorders observed in girls include dysmenorrhea (menstrual disorder), disorders of sex development, delayed puberty, various abnormalities of the vagina and uterus, inflammatory diseases of the pelvic organs, ovarian tumors and cysts. The untimely detected reproductive system disorders may seriously affect the girls' physical, psychological and even mental health [16].

It must be remembered that in adolescence the amounts of gonadotropic hormones, especially the luteinizing hormone, increase progressively over a year, which results in the gradually increasing production of sex hormones at the onset of puberty. The growth rate increases to reach its maximum 2–3 years after the start of puberty. Girls usually mature almost two years faster than boys. Today's girls enter puberty at the age of 9–10 years. During this period the body is affected by estrogens actively produced by the ovary: pubic hair and breasts grow, the body shape changes (hips become wider), the amount of subcutaneous fat increases, and the fat is distributed in a certain way. The schoolchildren's growth rate reaches its maximum by the age of 12. The normal menarche age in girls is 11–13 years. Later the growth rate gradually slows down [17]. The closure of growth zones in girls is accompanied by cessation of growth by the age of 18 [3].

Pubertal development results in the maximum increase in the size of the ovary, labia minora, and the uterus, and contributes to the increase in the vaginal wall thickness [18]. It should be noted that the maximum growth of internal reproductive organs is observed at the age of 10–14 years. Girls have their first ovulatory cycles 10–12 months after menarche. The rate of ovulatory cycles reaches 80% within about 1.5–2 years, however, in 25% of girls the cycles can still be anovulatory or show the corpus luteum insufficiency during the first 3–5 years. Puberty normally ends at the age of 14–17 years. It is interesting to note that the gap between the onset of puberty and sexual maturity is approximately 6–7 years [3, 4, 19].

The reproductive system disorders that require immediate response from the specialists and are dangerous for reproductive health are the diminished functional activity of the gonads (female hypogonadism), delayed puberty, menstrual disorder, precocious puberty, virilism, urinary tract infections, urination disorder [6, 20].

The study was aimed to assess factors that affect the schoolgirls' reproductive health.

## METHODS

A total of 100 schoolgirls aged 15–18 were enrolled in the study performed in an online questionnaire format in the Comprehensive Secondary School № 2065 (Moscow) contracted to implement the scientific and methodical cooperation. The inclusion criteria were as follows: availability of the correctly filled questionnaire, availability of the informed consent, belonging to appropriate age and gender group. The questionnaire survey was performed from 2021 to 2022.

The questionnaire consisted of several items that included questions about the respondent's age and age of menarche, questions related to various menstrual disorders (increased or reduced duration of menstrual cycle, late periods, blood spotting between periods, pelvic pain between periods, type of pelvic pain). Furthermore, the symptoms of vegetative dystonia were assessed before and during the periods.

The schoolgirls' awareness of the reproductive health issues was assessed using the 0–3 rating scale, where score 0 corresponded to lack of awareness and score 3 corresponded to good knowledge about reproductive health.

A 10-point rating scale was used to assess the period pain: score 0 corresponded to no pain, score 1–3 to mild pain, score 4–6 to moderate pain, score 7–9 to severe pain, and score 10 to extremely severe pain.

Statistical data processing was performed using Excel 2016 (Microsoft; USA) and the Statistica 10 software package (Statsoft; USA). When performing data processing, the results obtained were previously tested for normality. Descriptive statistics, i.e. the mean (M) and standard deviation (σ), were used.

## RESULTS

The average age of menarche was  $12.3 \pm 1.2$  years, however, there were girls, who got their first period at the age of 10 years (10%), and those, who got their first period after 14 years (7%), among schoolgirls. Menstrual disorders included the increase in the duration of the menstrual cycle up to 35 days or more in 6%, and the decrease in the cycle length to less than 21 days in 3% of the respondents. The more than nine days late periods were observed in 25%, and the less than nine days late periods in 48% of schoolgirls. In 21% of cases, the girls noted blood spotting between periods. Pelvic pain between periods was noted by 44% of schoolgirls, while severe pelvic pain during the periods were reported by 81% of girls. According to the pain assessment, 25% of respondents had severe pain, 16% had moderate pain, while 4% had extremely severe pain.

Irritability, aggression, easy crying, rapid fatigue, and faintness before and during the periods were reported by 98% of respondents. Swelling, weight gain, abdominal distension, constipation, diarrhea, breast engorgement and soreness before and during the periods were reported by 73% of schoolgirls. Headache, vertigo, nausea, vomiting, insomnia, increased sensitivity to smell and sound before and during their periods were noted by 50% of school-age girls. High blood pressure, heart-related pain, increased heart rate, panic attacks before and during the periods were reported by 21% of respondents. Menstrual disorders were reported in 16% of cases.

Assessment of the schoolgirls' awareness of reproductive health issues has shown that 60% of today's school-age girls demonstrate moderate awareness, while 28% demonstrate

high awareness. However, 12% of girls have insufficient reproductive health-related knowledge and skills. Girls often do not notice the first symptoms of disorders due to lack of awareness.

## DISCUSSION

The study has made it possible to reveal various reproductive health problems in schoolgirls and assess the girls' awareness of reproductive health issues. According to the results, today's schoolgirls generally demonstrate medium knowledge, however, 12% of them have insufficient knowledge, which represents not only medical, but also social challenge related to the schoolgirls' reproductive health.

Today's schoolgirls who show insufficient awareness of their reproductive health may fill the knowledge gaps with the help of teachers, parents, and medical professionals both at school and through extracurricular activities and open lessons involving experts in this area (pediatricians, pediatric gynecologists, family and school physicians). Schoolchildren should be provided up-to-date information about their reproductive health that should be discussed in biology and physical education classes, as well as during extracurricular activities. Today, decreasing the incidence of reproductive system disorders among girls is a priority in reproductive health protection.

Considering the fact that medical and social aspects of the girls' reproductive health constitute one of the urgent issues of reproductive health protection, and joint efforts of the system of medical institutions and teachers are the main method of the reproductive system disorder prevention, only cooperation would help to solve the medical and social

problems of the today's schoolgirls' reproductive health in terms of early detection, treatment, and preventive measures aimed at shaping healthy lifestyle and habits related to reproductive health. There is evidence in the literature about effective implementation of various preventive measures related to reproductive health protection in school-age girls [20].

## CONCLUSIONS

Assessment of factors affecting reproductive health of today's schoolgirls has shown that insufficient awareness of the reproductive health-related issues in the 15–18-years-old girls is a major factor. Thus, it was estimated that only 28% of girls showed high awareness of reproductive health issues, 12% showed lack of knowledge, while the bulk of the study participants (60%) showed medium awareness. Furthermore, in 10% of cases the early onset of menarche was reported, while 7% of girls had late menarche; menstrual disorders represented by the increased or decreased menstrual cycle length, pelvic pain between the periods, as well as the symptoms of vegetative dystonia were also noted. Insufficient knowledge about reproductive health negatively affects not only the schoolgirls' health, but also overall health in both 15–18-years-old girls and future generations. Schoolgirls should be provided up-to-date information about reproductive health that should be made a part of educational process at school. Furthermore, school-age girls need up-to-date information from contemporary sources (mass media, internet, etc.) provided by the leading experts in prevention of reproductive system disorders: pediatricians, family physicians, gynecologists, urologists, fertility specialists, endocrinologists, neurologists, cardiologists.

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## POPULATION AGING AND ITS DEMOGRAPHIC EFFECTS

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Aging is a destructive physiological process that increases with age and results in the decrease in the body's adaptive capacity. Aging is irreversible, however, it can be prolonged for many decades though maintaining active longevity. The study was aimed to assess ageing in terms of demography and analyze demographic policy in the Voronezh region. The study involved assessment of the major demographic parameters of the population, such as mortality, birth rate, population, and life expectancy. The data were provided by the territorial agency of the Federal State Statistics Service in the Voronezh region (Voronezhstat). It has been found that in recent years (2015–2021) birth rate has decreased by 1.4 times, life expectancy has decreased by 4.1 years, and mortality has increased by 1.5 times (2019–2021). Today, the population of elderly people is growing. This results in the situation when mortality exceeds birth rate. Population aging observed in the Voronezh region is rapid. To improve the major parameters, the demographic policy outlined in the document "On Approval of the Concept of Demographic Policy in the Voronezh Region for the Period up to 2025" has been implemented that is focused on improving both birth rate and the quality of life of the population. The project has not yet brought any desirable result, however, activities in this field contribute to improvement of major demographic indicators.

**Keywords:** aging, demographic policy, mortality, fertility, population, life expectancy

**Author contribution:** Ionova AS — data acquisition and analysis; Skrebneva AV, Melikhova EP — study planning, literature review, data interpretation.

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## СТАРЕНИЕ НАСЕЛЕНИЯ И ЕГО ДЕМОГРАФИЧЕСКИЕ ПОСЛЕДСТВИЯ

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Старение — это нарастающий с возрастом разрушительный физиологический процесс, который приводит к снижению адаптационных способностей организма. Старение — процесс необратимый, однако он может быть пролонгирован (удлинен) на многие десятилетия за счет поддержания активного долголетия. Целью исследования было оценить процесс старения применительно к демографии и проанализировать демографическую политику Воронежской области. В ходе исследования изучены основные демографические показатели населения, такие как смертность, рождаемость, численность населения и ожидаемая продолжительность жизни. Данные подготовлены территориальным органом Федеральной службы государственной статистики по Воронежской области (Воронежстат). Установлено, что за последние годы (2015–2021) рождаемость снизилась в 1,4 раза, ожидаемая продолжительность жизни уменьшилась на 4,1 года, а смертность увеличилась в 1,5 раза (2019–2021). В настоящее время имеет место увеличение численности пожилых людей, которое приводит к превышению смертности над рождаемостью. Процесс старения населения Воронежской области протекает интенсивно. Для улучшения основных показателей реализована демографическая политика, изложенная в документе «Об утверждении концепции демографической политики Воронежской области на период до 2025 года», которая направлена не только на повышение рождаемости, но и на улучшение качества жизни населения. Пока проект не принес желаемых результатов, однако работы, которые ведутся в этом направлении, вносят свой вклад в улучшение основных демографических показателей.

**Ключевые слова:** старение, демографическая политика, смертность, рождаемость, численность населения, ожидаемая продолжительность жизни

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Aging is an extensive process that has already embraced almost all spheres of government. The data provided by the UN show that the global population of elderly people in 2000 was 600 million people, while in 2021 it exceeded 761 million people. It is predicted that the population of elderly people may reach 1603 million people in 2050. According to various scientific sources, in 2050 there will be more elderly people than children in the world [1].

The issue of population aging in Russia is urgent, and addressing the issue is one of the priorities in the state policy. This is confirmed by the document developed, the "Demographic Policy of the Russian Federation for the Period up to 2025" (of 9 October 2007) [2]. The document is focused on ensuring growth of the population and birth rate, reducing mortality, and increasing life expectancy through preserving and improving health and improving the quality of life. The concept described provided the basis for development of the program "Concept

of Demographic Policy in the Voronezh Region for the Period up to 2025" in the Voronezh region. The program is aimed at maintaining the population of 2.11 million people, increasing life expectancy up to 75.1 years and birth rate by 15.1%. Migration gain should be 7.51 thousand people.

Government of the Voronezh region plans to achieve such results through developing perinatal technologies and improving the quality of conditions that promote the increase in birth rate.

The study was aimed to assess ageing in terms of demography and analyze the demographic policy in the Voronezh region.

## METHODS

The study involved systematizing and reporting statistical data (data reduction, pooling, and reporting). The official statistical data taken from the accounting documents of the territorial

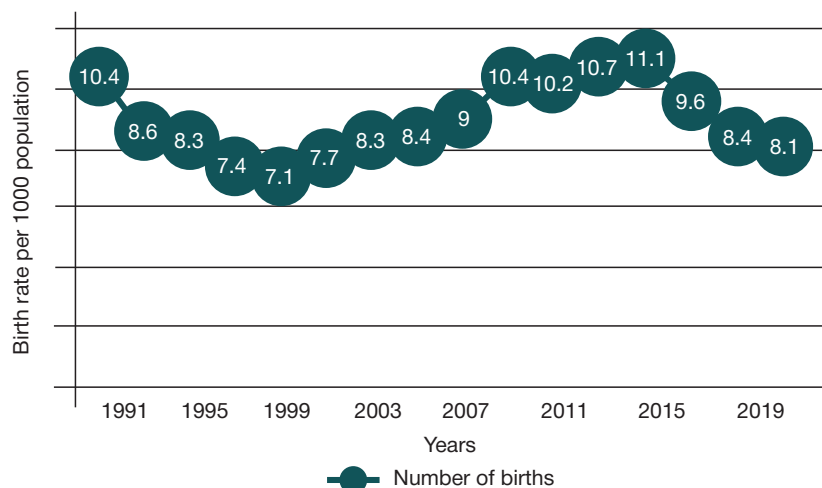


Fig. 1. Trends in birth rate observed in 1991–2021

agency of the Federal State Statistics Service in the Voronezh region (Voronezhstat) were used for analysis [3]. The interval between 1991 and 2021 was selected for the study.

Assessment of the population of the Voronezh region, birth rate, mortality, and life expectancy was performed by analyzing both trends in these indicators over time and the structure of the body of knowledge. Statistical data processing was performed using the Excel 2013 spreadsheet (Microsoft; USA).

## RESULTS

In the Voronezh region, population aging is the most rapid, and the demographic indicators show negative trends.

The increase in the share of elderly people along with the decrease in the number of children are referred to as demographic aging. Both processes result from the decrease in birth rate and mortality (see Fig. 1, 2) [4].

The graph shows that the highest birth rate was observed in early 1990s and between 2009 and 2015 (Fig.1). The number of births has been decreasing over the last 5 years.

Analysis of the data on mortality of the population in 1991–2021 showed that mortality increased in the 1990s and 2021 during the pandemic of coronavirus infection (Fig. 2).

Analysis of the population in the Voronezh region showed that it decreased by more than 163,000 people between 1991 and 2021 (Fig. 3).

Life expectancy in the Voronezh region appears to be unstable. In early 1990s life expectancy was 70.4 years, while in 2000

it was 66.54. This parameter increased by 4.3 years between 2000 and 2019. Life expectancy dropped to 69.5 years by 2021 (Fig. 4).

## DISCUSSION

The data provided by Voronezhstat show that birth rate has been decreasing since late 1980s. The lowest birth rate was reported in 1999.

The increase in birth rate has been reported since 2007. Thus, this parameter increased from 20,670 births to 25,290 births by 2014. Birth rate decreased in 2021: a total of 18,593 children were born.

Perhaps, such values result from the amendments to the legislation regarding the increase in birth rate together with motherhood and childhood protection in both Russia as a whole and the Voronezh region (since early 2007). Slowdown of the increase in birth rate by 2021 may be due to the effects of the COVID-19 pandemic and global instability [5].

The negative birth rate trend in the region results from the small number of children per family (1–2 children), the increase in the number of primiparous women of advanced maternal age, and the increase in extramarital births [6]. The listed above factors are obstacles to the solution of the problems stipulated in the program “Concept of Demographic Policy in the Voronezh Region for the Period up to 2025”.

The analysis of mortality over the studied period showed that this parameter increased in the 1990s and in 2021, which could be the result of the COVID-19 pandemic.

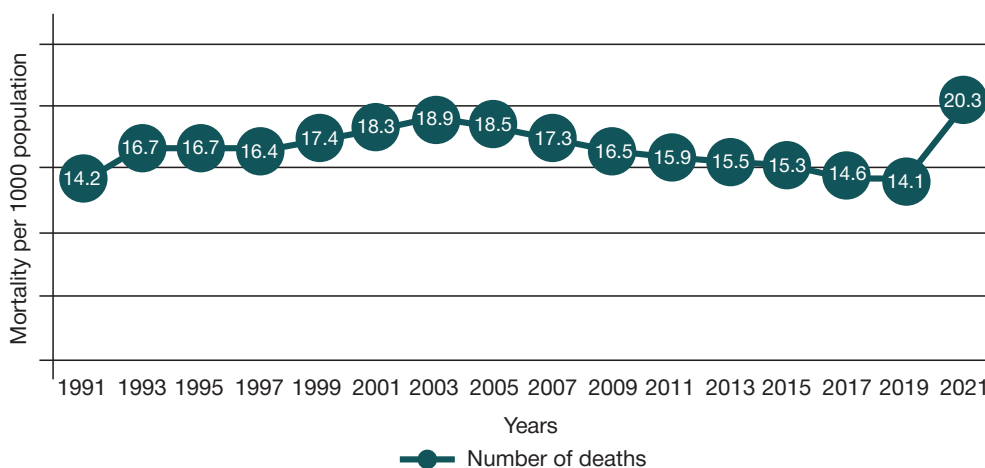


Fig. 2. Trends in mortality observed in 1991–2021

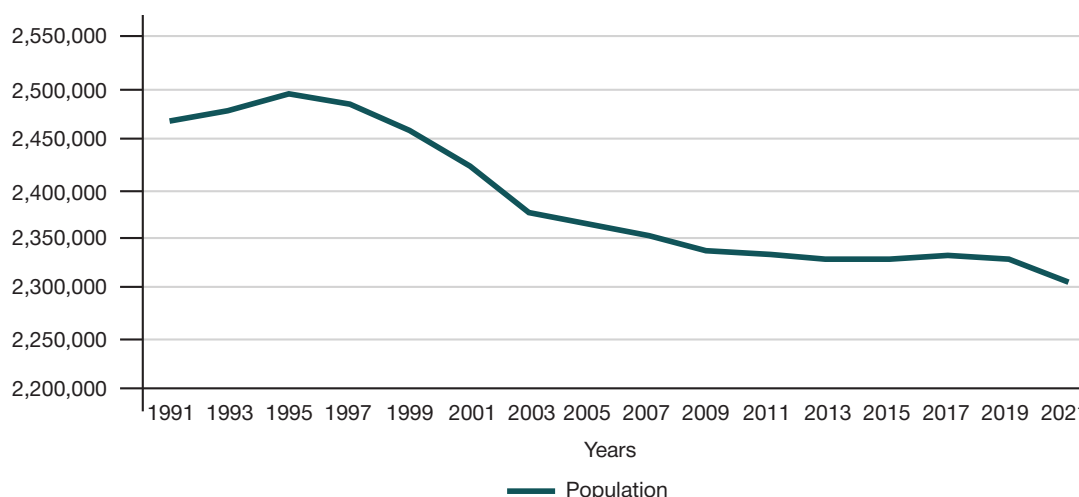


Fig. 3. Population in 1991–2021

Analysis of the population in the Voronezh region showed that in 1990s the values were higher than during the period between 2003 and 2021, despite the negative trends in birth rate and mortality observed in the 1990s. This can be explained by the increase in other parameters: migration rate and life expectancy [6].

Life expectancy in the Voronezh region undulates: it was 70.4 years in 1990s, 66.5 years in 2000, 70.8 years in 2019, and 69.5 years in 2021. Furthermore, one of the stated goals of the demographic policy in the Voronezh region is to increase life expectancy to 75 years. According to the research, life expectancy is directly related to the level of development of medicine [7].

## CONCLUSIONS

Analysis of demographic indicators in the Voronezh region shows that the program “Concept of Demographic Policy in the Voronezh Region for the Period up to 2025” demonstrates

no positive trends: birth rate has decreased, mortality has increased, and life expectancy has decreased by 4.1 years compared to the year 2019. Comparison with the 1990s and 2000s shows that the values of the main demographic parameters are negative. This could be due to the COVID-19 pandemic. Aging is an irresistible but inhibited process. This very fact is taken into account when developing state programs on demography. The risk factors of aging are as follows: healthcare development level, external and internal environment, standard of living. There are two interrelated processes: the increase in the number of elderly people, that results in slower growth of the population, involves increasing mortality and decreasing birth rate, and vice versa, the decrease in birth rate and the increase in mortality and life expectancy result in the larger share of people of retirement age. These facts confirm the correlation between aging process and the demographic effects. The fact that aging is irreversible has to be taken into account when developing state programs on demography.

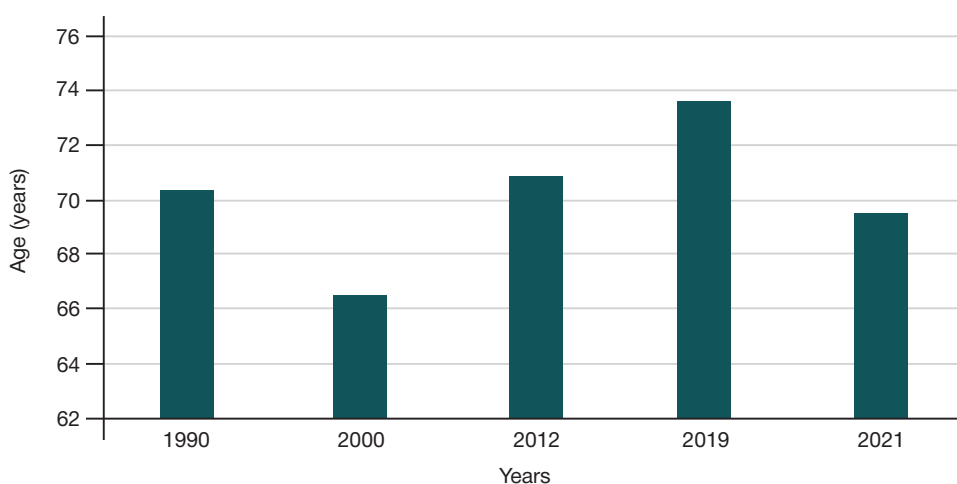


Fig. 4. Live expectancy over the years

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