






ISSN: 2617-6548

URL: www.ijirss.com



Innovative physical education and health model for students of special medical groups: Interdisciplinary experience

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Abstract

This article presents the Health REVIVE Model, an innovative physical education and health framework developed at Astana Medical University for students in special medical groups. The aim of the study is the development of an innovative physical education and health model of physical education classes for students with disabilities based on the interdisciplinary experience of Astana Medical University. The research methodology includes a comprehensive approach: data analysis and synthesis, comparative analysis, structural-functional modeling, and a cross-sectional design (sociological survey, retrospective analysis of medical records, and pedagogical experiment). Results. The model addresses systemic challenges in physical education and aims to boost motivation and improve the quality of life for students with health limitations. It integrates diagnostics, training, practical sessions, and evaluation to provide a flexible, interdisciplinary approach tailored to individual medical needs. Key advantages include interdepartmental collaboration, the synergy of professional competencies, and the creation of optimal conditions for students' physical development. The model emphasizes comprehensive support and individualized adaptation of physical activities to enhance physical fitness while accounting for students' health conditions. Conclusions. The observational study revealed the urgent need for such an interdisciplinary and adaptive approach. The Health REVIVE Model is structured around four components: diagnostic, target, process, and reflexive-evaluative. This structure ensures effective monitoring and modification of physical activity programs for students of special medical groups. The scientific novelty of the model lies in its focus on forming an individual's physical culture as an integrative quality, preparing graduates for health-preserving professional activities and active social participation.

Keywords: Innovations in physical education, Interdisciplinary experience, Physical education and health model, Special medical group, Teenagers.

DOI: 10.53894/ijirss.v8i6.10243

Funding: This research has been funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (Grant No. AP22685615) "Improvement of medical and organizational measures aimed at improving the quality of life of students assigned to special medical groups" (2024-2026).

History: Received: 30 July 2025 / Revised: 1 September 2025 / Accepted: 3 September 2025 / Published: 26 September 2025

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Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Institutional Review Board Statement: The Local Bioethics Committee of nJSC "Astana Medical University" granted approval for this study on November 7, 2023 (Protocol No. 15).

Publisher: Innovative Research Publishing

1. Introduction

Despite global recommendations, there has been a steady decline in physical activity among adolescents, with 81% of 11-17-year-olds not meeting the established standards [1]. In Kazakhstan, 67.6% of young people by the age of 15 do not achieve the recommended level of daily activity [2].

The organization of physical education is an important element of the education system, both at the international and national levels. A study by Cabanas and Sanchez in 2020 found that adolescents actively participating in physical activity programs exhibit higher levels of social behavior, while a sedentary lifestyle harms their ability to regulate emotions and work effectively in teams[3].

In turn, Chaput, et al. [4] examining 24-hour physical activity standards among Canadian youth, concluded that an integrated approach that includes physical activity, sedentary behavior control, and adequate sleep avoids the limitations associated with a focus solely on physical exercise. Such an integrated approach helps to form the foundations of the general well-being of adolescents and maintain their physical and mental health[4].

In a number of countries with developed healthcare and education systems, such as Germany [5], Norway [6], and Japan [7], physical education is considered an integral part of a comprehensive health promotion program. Foreign experience in organizing physical education for students with disabilities is characterized by a comprehensive approach, including the development of individual programs, interdisciplinary cooperation of specialists, and the active participation of parents.

The results of national studies show that the health of students begins to deteriorate at school and continues to deteriorate during their student years. According to the results of preventive medical examinations in the 2022-2023 academic year, among students in the age category of 15-19 years in the city of Astana, out of a total of 6,748 examined, 4,582 people (67.9%) have various health problems. Among the violations identified, 2,514 students (or about 55% of the total number with violations) suffer from myopia, 1,124 people (approximately 25%) have scoliosis, and 249 students (approximately 5%) have iron deficiency anemia.

Lack of physical activity, poor nutrition and others against the background of intense academic workload lead to an increase in diseases among young people and the risk of developing hypokinesia, especially for students classified by health status as special medical groups (SMG). SMG are individuals with deviations in health of a permanent or temporary (after injuries and illnesses) nature, requiring a limitation on the volume and intensity of physical activity, but admitted to the implementation of a specialized curriculum for physical education in educational institutions in a gentle mode.

For students with various pathologies, there is a need for special medical groups, where it is necessary to apply methods of medical prevention and treatment in order to restore their health and performance. However, in practice, such medical groups are absent, and adolescents included in these groups are often left without the necessary medical attention, which prevents their recovery and maintenance of working capacity.

The practice of physical education in Kazakhstan reveals a formal approach to organizing classes among adolescents classified as SMG with various diseases. This is manifested in insufficient interdepartmental coordination and limited content of the regulatory and methodological framework.

Since physical activity serves as an important tool for sustainable development at all levels, there is an urgent need to improve physical education systems. The low efficiency of traditional approaches in modern realities requires the development and implementation of innovative physical education and health models.

The aim of the study is the development of an innovative physical education and health model of physical education classes for students with disabilities based on the interdisciplinary experience of Astana Medical University.

Research objectives:

1. To study the current state of the organization of physical education classes for students with disabilities and their needs.
2. To study the structure of morbidity, which is the reason for classifying students as SMG.

3. Systematization of the obtained data and development of an innovative physical education and health model to improve the effectiveness of physical training of students with disabilities.

2. Materials and Methods

The study was approved by the Ethics Committee of nJSC Astana Medical University, Scientific Research Institute of Preventive Medicine named after Academician E.D. Dalenov (Protocol No.15, approval date: 07/11/2023). The study is being carried out as part of a project to improve medical and organizational measures for students of special medical groups. This research is funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (Grant No. AP 22685615). All procedures involving human participants were conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments. Informed consent was obtained from all participants and their legal guardians. The study is being carried out as part of a project to improve medical and organizational activities for SMG. The study was conducted at the student clinic (city clinic No. 3) and the Research Institute of Preventive Medicine named after Academician E. Dalenov at Astana Medical University.

The study was conducted in 3 stages:

1) Social research, a survey of teachers (n = 40) with at least 3 years of experience and students classified as SMG due to their health status (n = 286) aged 15-19 years, to assess the needs and barriers to the effective organization of physical education classes for SMG. 2) Retrospective study, analysis of medical documentation of form 026/u on exemption from physical education following order No. RK HM-175/2020 dated October 30, 2020.

3) Pedagogical experiment on the development of an innovative physical education and health model at the Astana Medical University for SMG students.

When designing an innovative physical education and health model, with an emphasis on the effective organization of physical education classes for SMG, a set of scientific research methods was used. It included a comprehensive analysis and synthesis of observational studies, a comparative analysis of domestic and foreign experience, as well as systematization of theoretical approaches, which made it possible to comprehensively assess the needs and existing barriers. In particular, a detailed analysis of medical documentation of form 026/u was carried out, concerning exemption from physical education and morbidity of SMG students. Based on the obtained data, structural and functional modeling was carried out with subsequent ascent from the abstract to the concrete, which ensured a comprehensive approach to the development of the model and its detailed elaboration.

3. Results

The current state of organization of physical education classes for students classified as SMG was studied. When asked about the state of sports equipment in the educational institution, 10% of respondents rated it as excellent, 40% as good, 35% as satisfactory, and 15% as unsatisfactory. The following answers were received to the question "What support measures for SMG students exist in your educational institution?" (Figure 1): the majority of teachers (40%) indicated that their educational institution does not have any support measures for SMG students. 15% of respondents noted that competition results are taken into account when assessing the achievements of SMG students. 10% of teachers found it difficult to answer this question, which may indicate the absence of clearly organized support measures for this category of students.

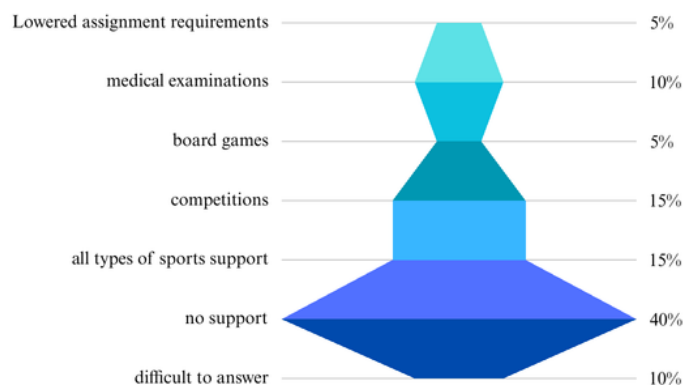


Figure 1.
Support measures for SMG students.

The results of the survey of teachers also showed that almost half of the respondents (45%) noted the lack of physical education teachers, coaches and other specialists in the field of sports in general. At the same time, 30% found it difficult to answer. Also, 60% of respondents confirmed the lack of specialists to work with SMG students, 10% found it difficult to answer.

Among the main difficulties in organizing and conducting physical education classes for SMG students, teachers identified the following problems in order of their importance:

- 1) Lack of sports equipment and equipment (70%);
- 2) Lack of motivation on the part of SMG students (45%);
- 3) Lack of adapted curricula for various diseases and functional limitations (35%);
- 4) Division into SMG groups is not provided (35%);
- 5) Lack of a clear system of interaction with primary health care to obtain recommendations on physical activity for each student (15%);
- 6) The need to improve the qualifications of teachers (15%).

The results of the survey among students showed that the majority of SMG students (40.2%) expressed dissatisfaction with the variety of physical exercises, especially noting the lack of exercises to develop coordination and flexibility. In the surveyed educational institutions, the physical training of SMG students includes the following areas: theoretical work (preparation and defense of abstracts) and practical classes mainly in basketball, volleyball, table tennis, chess and togyzkumalak. Structuring the responses of SMG students regarding their needs for sports equipment for physical education classes revealed the following trends: the majority of respondents (48%) noted the need to expand the range of cardiovascular equipment, such as treadmills, elliptical trainers and exercise bikes. In addition, a significant portion of respondents (28.8%) expressed a need for equipment for sports games, including balls, rackets and nets. Also, 23.2% of students indicated the importance of having gymnastic equipment such as mats, benches, goats, beams, rings and parallel bars (Figure 2).

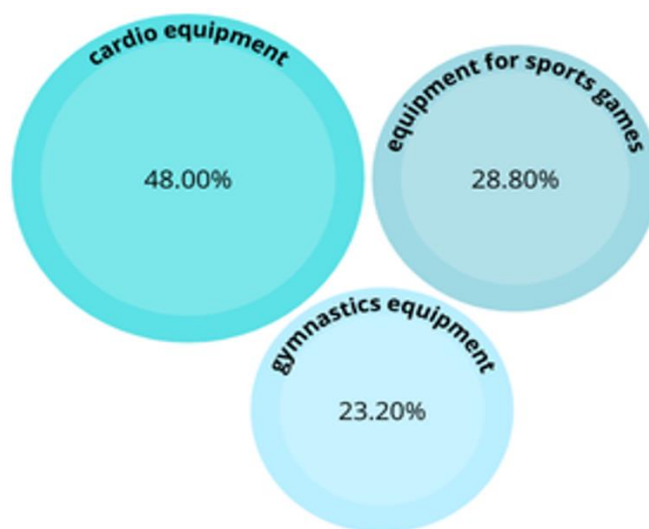


Figure 2.
Needs of SMG students by types of sports equipment.

Among the respondents, 44.8% rated their physical fitness as satisfactory, 26.1% as poor, 18.1% as very poor, and 11% rated it as good.

Thus, the current state of organization of physical education classes for SMG students remains unsatisfactory, despite some positive practices. The analysis revealed that classes are often formal in nature and are limited to writing essays or passive pastime, which does not meet the goals of physical education.

The key problems identified during the study include, but are not limited to: a shortage of qualified personnel (55.6% of respondents note a shortage of teachers trained to work with SMG); insufficient provision of sports equipment (only 11.1% of respondents rate its condition as excellent, while 48% of students indicate the need for cardiovascular equipment); low variability of programs, which is confirmed by the dissatisfaction of 68.9% of students with the limited set of exercises, especially for the development of coordination and flexibility; poor interaction with medical institutions, which reduces the effectiveness of load adaptation. Based on the analysis of 486 certificates of form 026/u, it was found that chronic diseases and functional disorders of various body systems are the main reasons for classifying students as SMG or exemption from physical education classes. Of the total, 302 certificates contained recommendations for classes in SMG, and 184 contained - exemption from physical education. The main reasons were classified following the International Classification of Diseases (Figures 3, 4).

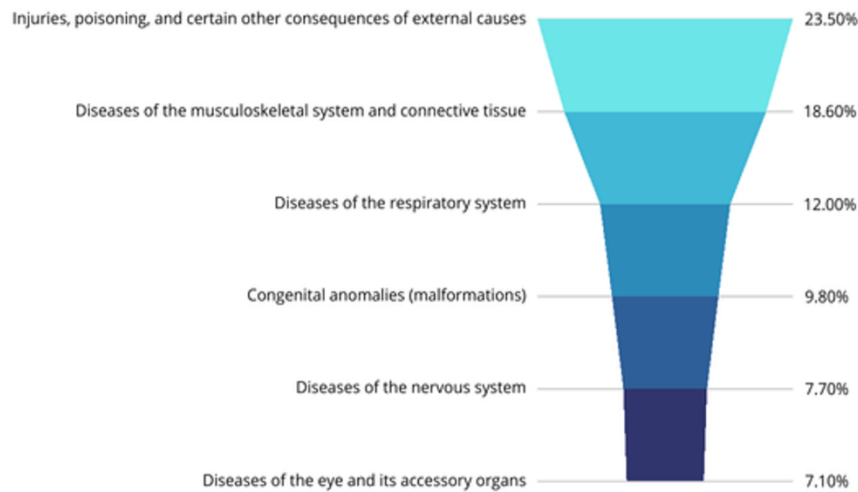


Figure 3.
Groups of adolescent diseases that are the reasons for exemption from physical education.

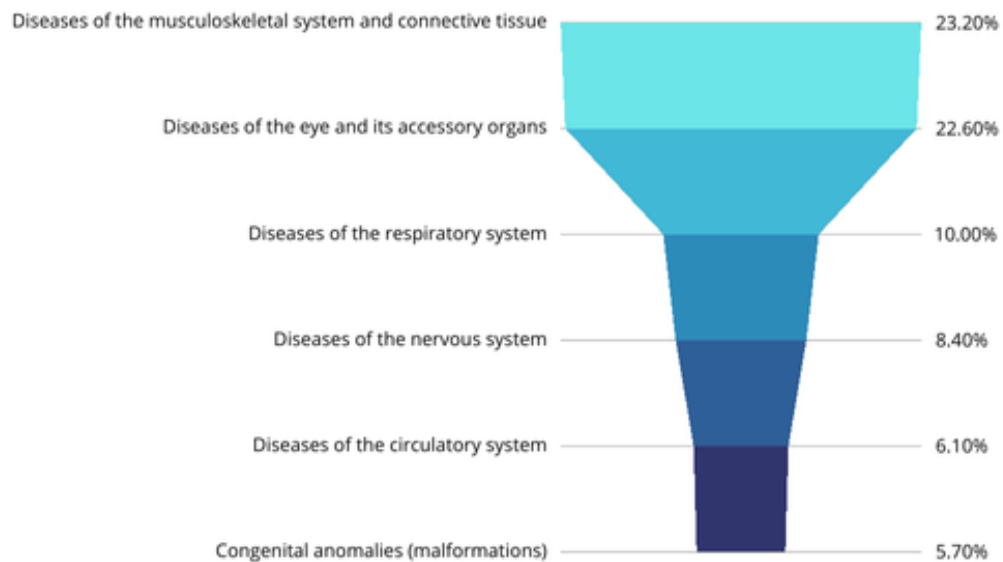


Figure 4.
Groups of adolescent diseases that are the reasons for inclusion in the SMG students during physical education classes.

According to the obtained analysis of issued certificates 026/u, it is possible to track the 5 most frequent reasons for exemption from physical education classes. As can be seen in Figure 3, injuries are in first place, diseases of the musculoskeletal system are in second place, diseases of the respiratory system are in third place, and then congenital anomalies and diseases of the nervous system.

Figure 4 shows groups of diseases that are the reasons for classifying students as SMG. Here, a similar structure of diseases is observed, but new categories are added, such as eye diseases (mainly myopia) and diseases of the circulatory system. This may be because these diseases do not always require complete exemption from physical activity, but imply restrictions and a special approach to classes.

Among the main groups of diseases that are the reasons for classifying students as SMG, the following can be distinguished: myopia, scoliosis, osteochondrosis, asthma, congenital pathologies, etc. These diseases require an individual approach to physical activity, but do not exclude it completely. Nosologies that lead to complete exemption from physical education classes, such as diseases like asthma and myopia, but the main focus is on more severe conditions, such as fractures, congenital pathologies, and injuries that make it impossible to perform standard physical activities.

In both cases, diseases such as asthma and myopia are present, which indicates their prevalence among adolescents and their impact on physical activity.

Thus, in the case of assignment to SMG, the emphasis is on diseases that require adaptation of physical activity (for example, scoliosis, osteochondrosis). Exemption from classes is more often associated with acute conditions (fractures, injuries) or severe congenital pathologies that make it impossible to perform even minimal physical activity.

Having studied the opinions of teachers, students, and analyzed the main reasons for classifying students as SMG, we propose an innovative physical education and health model of physical education for students with health problems, aimed

at optimizing the physical fitness of SMG students. The model is based on the principles of adequate physical activity of adolescents, corresponding to the state of health, characteristics of the disease, and interests of the students of the SMG (Figure 5).

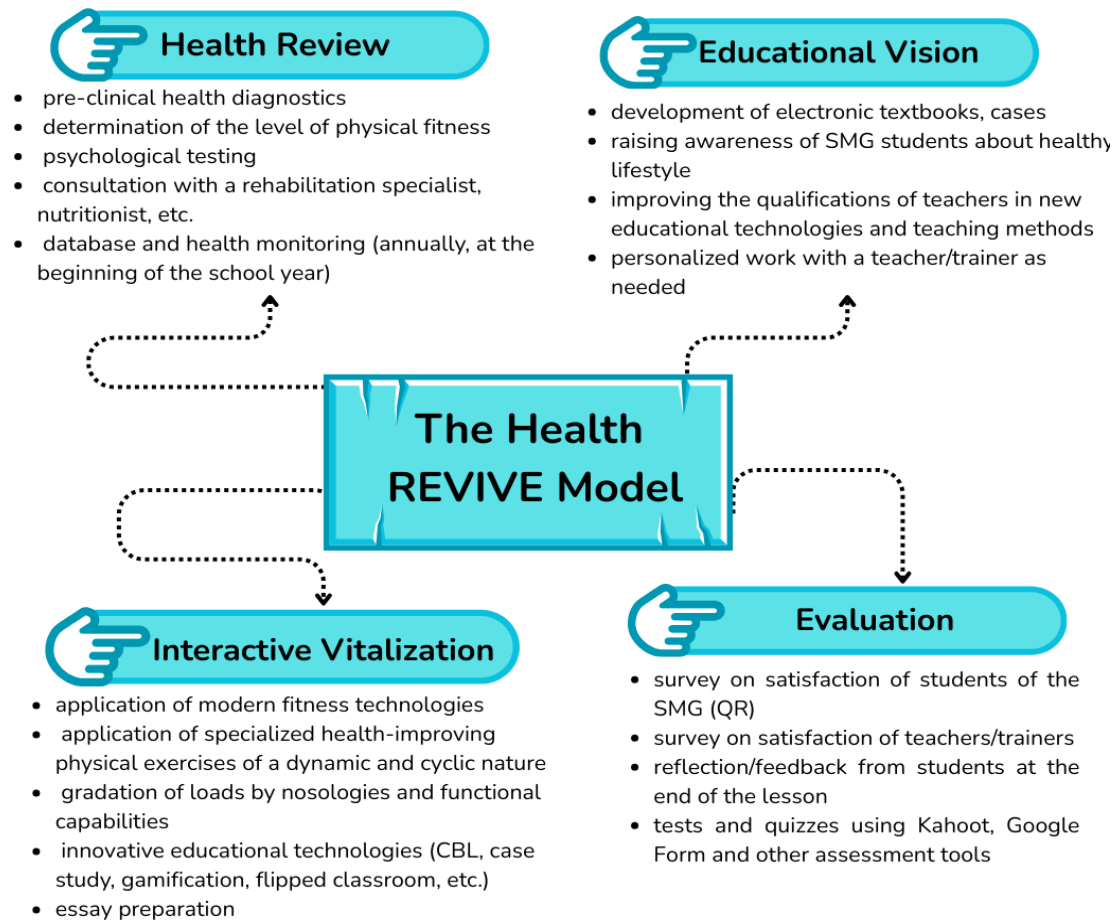


Figure 5.

Innovative model for organizing physical education classes for students of the Health REVIVE Model using the example of nJSC AMU.

An innovative model for organizing physical education classes for students of the Medical Group has been successfully implemented in the practice of physical education of medical students of the Astana Medical University since the beginning of 2025. The Health REVIVE Model is a comprehensive, structured and innovative model aimed at restoring, strengthening and improving the health and well-being of students of the Medical Group through a systematic examination (diagnostics) process, targeted educational content and vision, interactive physical exercises and continuous assessment. The implementation of the model is ensured by an interdisciplinary team including specialists in the field of physical education and sports, psychology, dietetics, public health, as well as doctors (pediatricians, general practitioners, rehabilitation specialists, endocrinologists), traditional medicine specialists and researchers. In accordance with the examination schedule, laboratory assistants from the Research Institute of Preventive Medicine named after Academician E. Dalenov are involved in pre-clinical health diagnostics. The model is a holistic system aimed at optimizing the physical education process for students with disabilities. It consists of four interconnected components:

- 1) Health Review (diagnostic): involves a comprehensive assessment of the health, physical development and functional capabilities of the student with the involvement of an interdisciplinary team of specialists.
- 2) Educational Vision (target): defines individual goals and objectives based on the diagnostic results and taking into account the opinions of students.
- 3) Interactive Vitalization (process): includes the development and implementation of adapted training programs, the use of modern fitness technologies and innovative educational methods (CBL, Case Study).
- 4) Evaluation (reflexive and evaluative): involves systematic monitoring of the effectiveness of classes and collecting feedback from students using QR codes and online tools (Kahoot, Google Forms).

4. Discussion

The results of the surveys conducted among teachers and students of the SMG, as well as the analysis of medical documentation, convincingly demonstrate the continuing unsatisfactory situation in the organization of physical education for this category of students. The identified problems (staff shortage, low motivation, lack of equipment) are consistent with the data of Mustafa Haider and the findings of the 2010 studies, which emphasizes their universality and sustainability [8, 9]. Traditional approaches to physical education often do not take into account the nuances and diversity of students'

academic, physical and psychological needs, and traditional assessment models are static and inadequate for personalized learning [10, 11]. The Health REVIVE Model is a response to these problems. It combines psychological, medical, physiological and pedagogical aspects, which corresponds to modern innovative approaches [12]. The involvement of an interdisciplinary team, including doctors, physical education teachers, psychologists and other specialists, ensures the synergy of professional competencies and allows for the implementation of the principle of individualization of training, taking into account the unique needs of each student, their level of physical fitness, personal preferences and health status [13]. The Health REVIVE Model is focused on the development and strengthening of students' own health resources, which corresponds to the salutogenic perspective aimed at developing students' conscious attitude to their health and promoting a broad understanding of the concept of health [14]. The implementation of the model is focused on the needs of students, their physical and psychological development, including the analysis of motivation, self-efficacy and emotional intelligence [15]. Methods such as the use of gamification (Kahoot quizzes) and innovative technologies (Case-Based Learning, Case Study, flipped classrooms) can improve motivation and academic performance, which is consistent with the findings of other studies [16]. The practical significance of the model lies in its adaptive potential, especially for implementation in medical universities, where there are unique opportunities for the formation of interdisciplinary teams. Thus, the model provides not only a differentiated approach to the organization of classes and a holistic approach to assessment, but also contributes to the formation of a sustainable, conscious attitude to their health in students.

Continuous implementation of the components of the physical education and health model for organizing physical education classes for students of the SMG allows achieving the following results:

1. The diagnostic component (Health Review) is aimed at assessing the health and physical fitness of students, includes an interdisciplinary approach with the involvement of a full-time psychologist, full-time rehabilitation specialists, ophthalmologists, traumatologists and other specialists. Pre-clinical health diagnostics is carried out at the laboratory of health diagnostics of the Research Institute of Preventive Medicine named after Academician E.D. Dalenov and includes:

- measurement of physical indicators: height, weight, body mass index, blood pressure, heart rate, arm muscle strength, vital capacity of the lungs, saturation level. The level of visceral fat, the level of total fat, daily metabolism, and the level of muscle mass are determined by the method of bioelectrical resistance on a professional body composition analyzer Tanita BC-545N and Omron BF 506.
- express analysis of the level of glucose, cholesterol, hemoglobin in the blood.
- determination of the nutritional status and quality of life of SMG students.
- determination of psychological well-being using the Beck scale to measure the severity of depressive and anxiety symptoms in SMG students.
- ultrasound examinations if necessary (in particular, thyroid ultrasound). - determination of physical fitness (endurance coefficient, assessment of flexibility, strength, bending and coordination abilities).
- determination of the functional state of the body systems (adaptation potential according to the method of R.M. Baevsky, physical condition index according to the method of E.A. Pirogova, Stange test, Martine-Kushelevsky test, Romberg test).
- determination of the health group according to the method of G.L. Apanasenko and distribution into SMG groups.

Based on the obtained results of pre-clinical health diagnostics, a database of examined individuals is formed, which serves as the basis for further monitoring of the health status of SMG students.

2. The target component (Educational Vision) defines the main objectives and areas of work with SMG students. It includes methodological support of the educational process, which involves the development of specialized teaching aids for SMG, as well as the creation of an electronic textbook for students with posture disorders, the development of adapted programs for physical education classes and educational cases for conducting classes using Case-Based Learning (CBL) and Case Study technologies. To date, Astana Medical University has developed educational electronic textbooks on a set of corrective exercises for scoliosis and the correct technique of volleyball elements. Author's programs have been developed for therapeutic and health-improving physical education, volleyball, basketball, football, table tennis techniques and a methodological manual on the specifics of physical education classes for SMG students. Cases from clinical practice have been prepared for conducting classes using innovative CBL and Case Study technologies for a detailed analysis of clinical cases related to common diseases of SMG students and physical activity.

An important aspect is conducting sociological surveys to study the opinion of SMG students on preferred types of physical activity, which allows taking into account their interests and needs when planning classes.

The Healthy Lifestyle Center of the Dalenov Research Institute of Preventive Medicine organizes educational events such as training, lectures, marathons, and sports events aimed at promoting a healthy lifestyle and integrating SMG students into health-preserving processes. More than 37 events have been held aimed at developing students' sustainable motivation for regular physical activity and a conscious attitude to health. Among them, a special place is occupied by annual mass events such as the MUA RUN marathon and Rector's Cup tournaments in various sports. To increase the involvement and motivation of participants, famous personalities from the fields of sports and healthcare take part in the events, which helps to popularize physical education among students. A comparative analysis of the current situation with the 2023-2024 academic year revealed a significant increase in interest in participating in the university's health-saving events. There was a 41% increase in the number of students, including students of special medical groups, actively involved in such initiatives. This approach demonstrates its effectiveness in creating conditions for the formation of a valuable attitude towards a healthy lifestyle.

Physical education teachers of the Astana Medical University are actively improving their professional competence, including mastering new educational technologies. Particular attention is paid to the introduction of gamification elements into the educational process, which makes classes more exciting and effective for SMG students.

3. The procedural component (Interactive Vitalization) includes organizing and conducting classes with SMG students at the fitness center of the Astana Medical University according to an adapted program, which consists of specialized health-improving physical exercises of a dynamic and cyclic nature. The program is developed taking into account the health status of students, which ensures the safety and effectiveness of training. SMG students have the opportunity to combine different types of training that are suitable for all levels of training, but vary in duration and intensity for SMG students. The main types of training include:

- Cardio-aerobic training: treadmill training (walking, light jogging), training on exercise bikes, using elliptical trainers (orbitreks) for low-impact loads.
- Strength training (with moderate load): exercises on rowing machines to strengthen the muscles of the back, chest, and legs, work with an adjustable load on exercise machines to develop strength without the risk of overload.
- Functional training: exercises with a fitball to improve balance and coordination, training with dumbbells to strengthen the muscles of the core and limbs. In addition to physical activity, the procedural component includes educational elements, such as preparing essays, projects, and defending independent work, using innovative learning technologies, CBL, Case study, and a flipped classroom. This contributes to the development of critical thinking, deepening knowledge about a healthy lifestyle, and forming a conscious attitude towards one's health.

To expand their physical development and rehabilitation opportunities, SMG students:

- Attend additional swimming classes, which help strengthen muscles and reduce the load on joints.
- Can sign up for therapeutic physical training at local clinics for individual work on restoring health.
- Participate in table tennis, chess, togyzkumalak, volleyball and other activity sections at Astana Medical University, which develop not only physical but also cognitive abilities.

Such an integrated approach allows SMG students not only to improve their physical condition, but also to develop teamwork skills, strategic thinking and discipline, which contributes to their successful social adaptation and integration into society.

1. The reflexive-evaluation component (Evaluation) is aimed at analyzing the results of the educational process and collecting feedback from SMG students. To ensure an objective and systematic assessment of SMG students' satisfaction with the quality of educational services, QR codes are placed near each classroom. Scanning a QR code allows students to quickly and anonymously evaluate various aspects of the lesson, such as: teaching methods; organization of the lesson; interaction with the teacher; and overall satisfaction. Analysis of attendance indicators and feedback from students of the SMG revealed an increase in motivation for physical education classes by 40% and an increase in the level of satisfaction by 25.9% compared to the baseline data.

The data obtained using QR codes is analyzed by the Quality Audit Group of the Educational Process of nJSC "Astana Medical University" to identify trends, problem areas, and develop measures to improve the quality of education. In addition, the teacher carries out regular oral reflection with students after each lesson, which allows for promptly adjusting the teaching methods following their needs and feedback. Theoretical knowledge is assessed using modern educational technologies, such as online tests and quizzes on the Kahoot and Google Forms platforms.

4.1. Limitations

The innovative physical education and health model developed by the authors, although demonstrating significant potential, is more applicable in the context of medical higher education institutions, where resources are available to form an interdisciplinary team.

Advantages:

Overall, the Health REVIVE Model developed by the authors represents a scientifically based solution to the current problems of physical education of SMG students, demonstrating the potential for improving the quality and accessibility of physical education and health activities in higher education.

5. Conclusion

The conducted study revealed systemic problems in the organization of physical education for students of SMG, confirming the formal nature of classes and their insufficient effectiveness. The key problems identified include a shortage of qualified personnel, unsatisfactory material and technical equipment, limited variability of programs and weak interaction with medical institutions. The analysis of medical documentation also confirmed the need for a differentiated approach to physical education, given the prevalence of chronic diseases and injuries among this category of students.

The developed innovative physical education and health model, The Health REVIVE Model, based on an interdisciplinary approach, demonstrated significant potential for solving the identified problems. Its advantages include interdepartmental interaction, synergy of professional competencies, and the creation of optimal conditions for physical development, taking into account individual needs and medical indications. Preliminary results of the model implementation show an increase in the motivation and satisfaction of SMG students with physical education classes. The Health REVIVE Model is a comprehensive and flexible system that integrates diagnostic, target, procedural, and reflexive-evaluative components, which ensures a comprehensive approach to physical education and health work with SMG students. Its implementation opens up new prospects for improving the physical education system in educational

institutions, providing a qualitatively new level of support for students, taking into account individual medical indications. To improve the quality and effectiveness of physical education and health activities of SMG students, it is necessary to modernize the physical education system through the introduction of an integrated and interconnected approach to organizing classes, including 1) studying the interests, motives, attitudes of SMG students to physical education classes and physical education and health activities; 2) determining the desire of SMG students and teachers to overcome health deficiencies and barriers to the effective organization of physical education classes for SMG; 3) identifying the individual characteristics of SMG students, their level of knowledge about the causes of diseases and the principles of prevention; 4) justification of the means, forms, methods and principles of physical self-improvement; 5) ensuring the maximum level of material and technical support for educational and physical education and health activities for SMG students on issues of diseases and deviations in health.

In the future, it is planned to conduct longitudinal studies for a comprehensive assessment of the long-term commitment of SMG students to physical education and health activities and the sustainability of the influence of the developed model on their health.

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