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## Methodological and theoretical support of integrated computer information technology for monitoring and evaluation of the health status of children and adolescents involved in sports schools

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**Методолого-теоретичне забезпечення інтегрованої  
комп'ютерно-інформаційної технології моніторингу  
і оцінки стану здоров'я дітей і підлітків,  
що займаються в спортивних школах**

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**Методолого-теоретическое обеспечение  
интегрированной компьютерно-информационной  
технологии мониторинга и оценки состояния здоровья  
детей и подростков, занимающихся  
в спортивных школах**

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One of the priority directions of the state programs of the Republic of Uzbekistan is the development of mass sports and the involvement of all segments of the population in physical education with a view to promoting health and changing lifestyles. This is evidenced by the creation of a number of laws and regulations on the part of the Government and constantly updated policy documents [27,29].

Due to the special attention paid by the Government to the development of mass sports in country, as well as within the framework of government programs to provide the material and technical base of sports schools, the number of children and adolescents involved in sports and physical education has increased significantly in recent years. In connection with the increase in the number of children and adolescents involved in sports in country, the issues of professional sports selection, the state and prediction of the health of this contingent of people, the development of special preventive and rehabilitation measures to preserve the health of the future generation become especially relevant [28].

It is known that systematic sports training contributes the harmonious development of children, increases their mental performance, cellular and humoral immunity and other protective properties of the body, develops the functional economy of the somatic and autonomic nervous systems, and expands the range of functional capabilities. However, in the process of building a workout, it is necessary to build rational methods that take into account the age-related anatomical and physiological features of the child's body. Improving the effectiveness of operational control in the process of monitoring the health and functional state of the sportsmen's

body is associated with the development and introduction into the practice of medical control of simple and accessible methods of functional diagnostics based on modern technologies [1,2,21].

Specificity of muscular activity and orientation of training process determine patterns and peculiarities of diagnostics facilitating control of adaptation of systems and functions of organism leading in any sport or another [6,18,22,23].

Correctly selected and the most informative parameters reflecting functional capabilities of physiological systems ensuring performance of sportsmen taking into account the specifics of the sport and the stage of preparation, will allow to quickly assess the impact on health of training and competitive loads, determine dynamics of formation of functional capabilities, assess the level of training, timely and differentiated prevent the occurrence of nosological and nosological conditions and, ultimately, contribute to the increase of sports results [7,8,21,24].

Currently, research on youth sports in the system of training of sports reserves is being carried out [3,4,7,11,12, 14,15,18,19,25]. In particular, there is a search for rational planning of the load regime, effective methods of educational work with young sportsmen, model characteristics of the strongest sportsmen are being developed, the structure of training and competitive loads at various stages of long-term training, the system of integrated control in the management of training of young sportsmen is being improved, the system of selection and sports orientation is being improved [5,9,10,13,16,20].

In accordant with above mentioned, the development and use of integrated computer information technology for monitoring and assessing the health of children and adolescents engaged in sports schools is a challenge.

Discussing of the outlined problem, it seems that, first of all, we should determine the methodological and theoretical ideas of its implementation.

The integration of computer and information technology in the investigated problem is determined by the interconnected activities of the following subjects: children and adolescents, trainers, parents, doctors, the administration of a sports school, representatives of the public, etc.

In order to realize this problem, the following medical examinations [17] are carried out: assessment of indicators of physical development and level of sexual development (biological age); analysis of indicators: functional state of the cardiovascular system – pulse, blood pressure; responses to physical exertion; indicator of cognitive functions of the central nervous system – reaction rate; indicators of the autonomic nervous system; anthropometric indicators – body length, body weight, brush dynamometry, chest circumference at rest, inhalation and exhalation, caliperometry; medical and pedagogical observations in order to clarify the nature of the training process, the volume and intensity of the training load, its adequacy to the condition of those involved, as well as the detection and recording of deviations in the state of health.

Medical examination includes: collection of general and sports history, somatoscopic and anthropometric examination with determination of the degree of puberty by stages of secondary sexual signs.

The medical examination also includes an examination of specialists: a therapist, an orthopedist, an oculist, an otolaryngologist, a neuropathologist, who give a comprehensive assessment of the state of health.

Computer information technology for monitoring and assessing the health of children and adolescents engaged in sports schools includes:

1. Structural and functional diagram of integrated computer-information technology for monitoring and assessing the health of children and adolescents engaged in sports schools (see Scheme 1);

2. Main functions of the physician's WA (see Scheme 2);

3. Main functions of WA of trainer (see Scheme 3);

4. Structural and functional diagram of WA and integrated computer-information technology units for monitoring and assessing the health of children and adolescents engaged in sports schools (see Scheme 4).

Multidimensional analysis methods will be used to analyze the generated databases, intermediate and final results. Taking into account the above-mentioned main functions of WA doctors and WA trainers, the development of appropriate knowledge bases and their formalization will be required.

Our proposed approach to the implementation of integrated computer-information technology for monitoring and assessing the health of children and adolescents engaged in sports schools will form the basis for effective implementation:

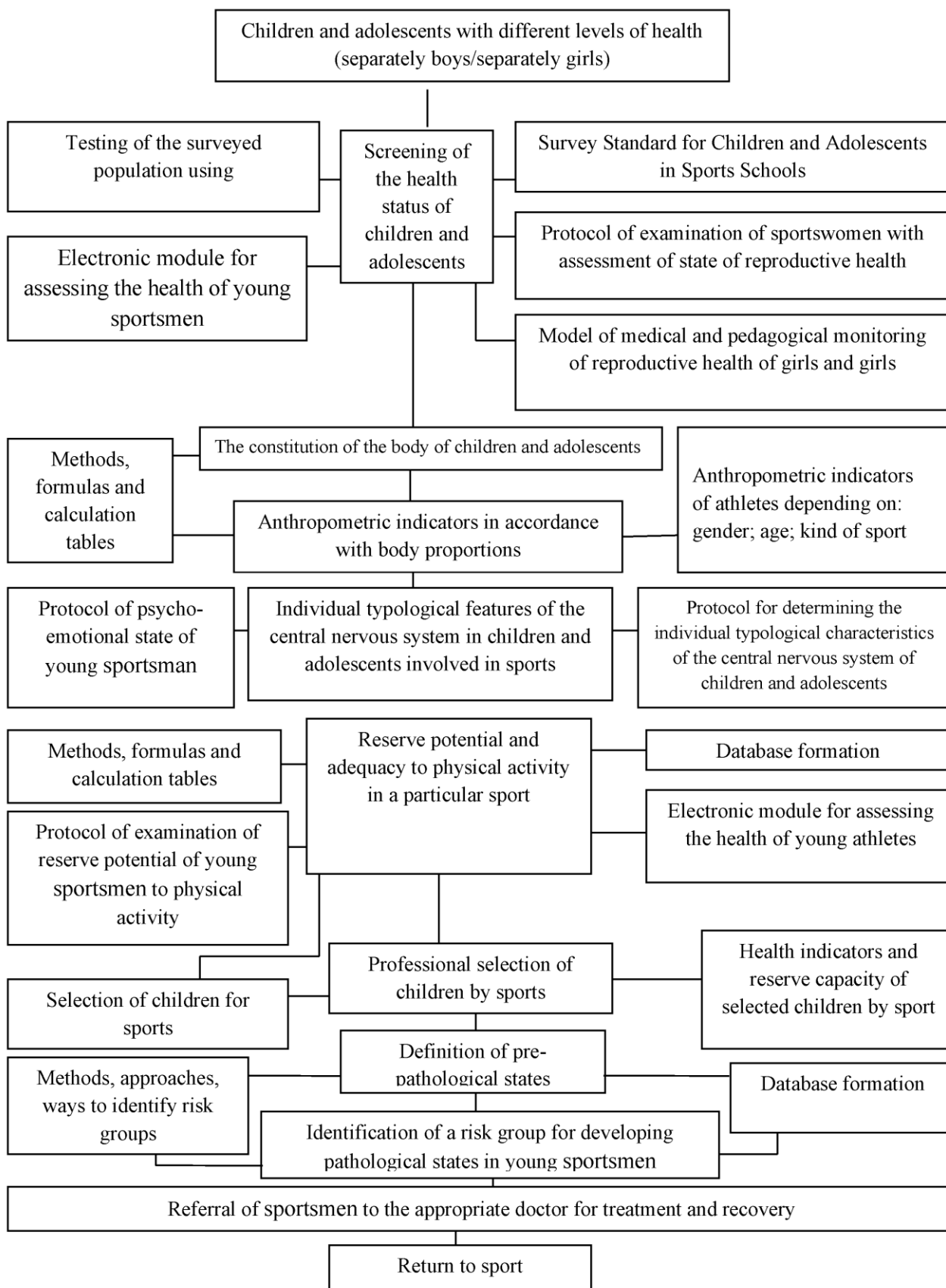
- organization of training process based on results of assessment of physical capabilities (physical performance, psychoemotional status and level of physical development according to indicators of body mass index, force and life indices) of young sportsman;

- selection of children in specialized sections of sports single combats at the age of 6–7 years where the main attention at the first stage (1–2 years) will be devoted to general physical fitness. This will facilitate faster and more optimal adaptation of the child to physical activity;

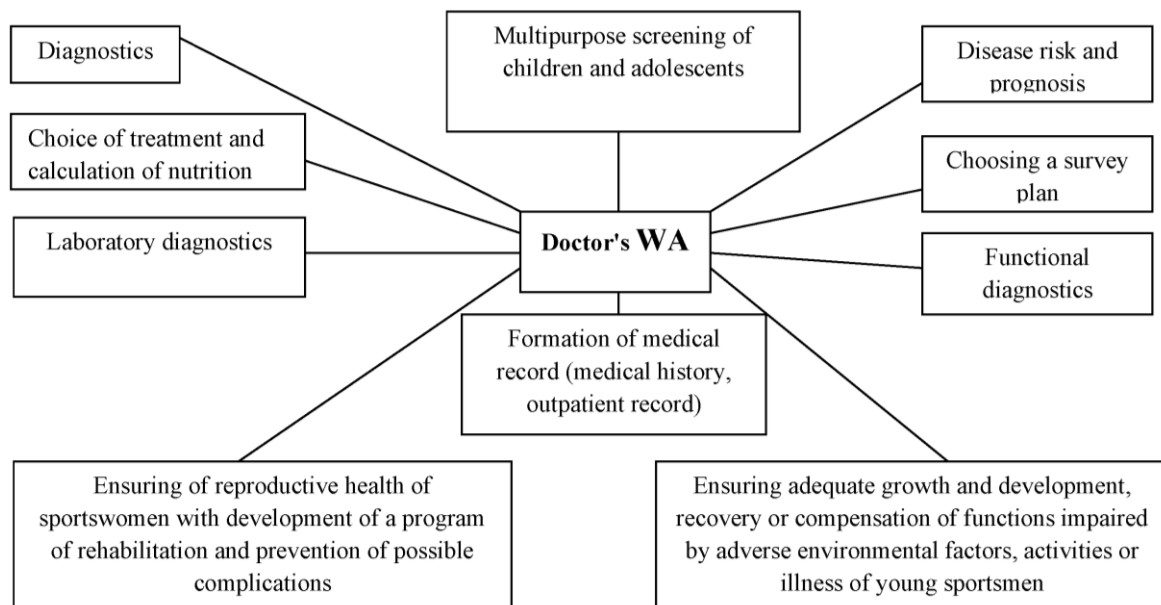
- In order to detect pre-pathological conditions in the reproductive health of young sportswomen, it is mandatory to consult a gynecologist and ultrasound examination of pelvic organs in girls and girls engaged in sports during an in-depth medical examination;

- during examination and selection of young sportsmen, analysis of cardiac rhythm variability, which is an objective, reliable and non-invasive method of assessing the state of vegetative regulation. Evaluation of heart rate variability indices allows predicting and carrying out operational control of functional state of young athletes' organism;

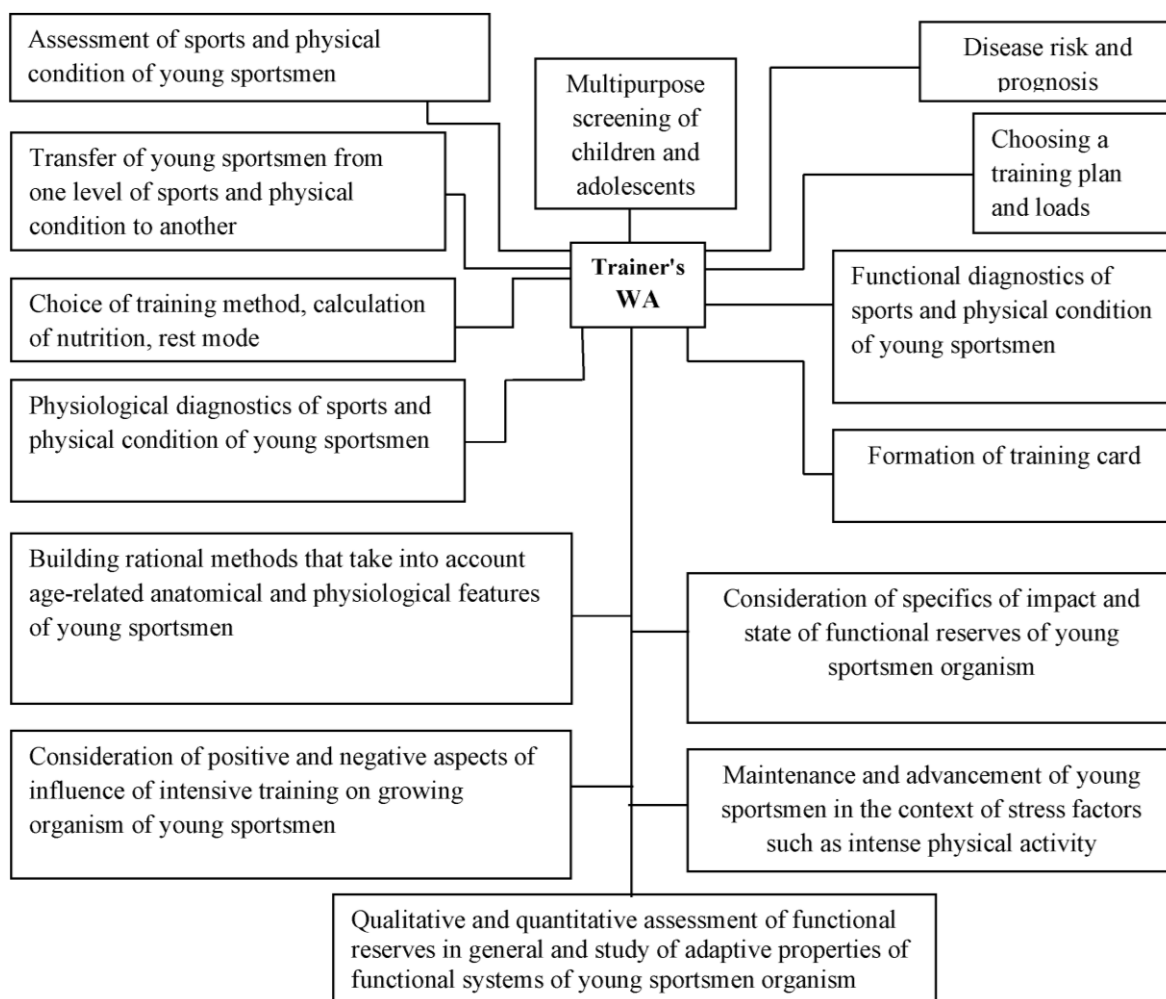
- at least 2–3 times a year to carry out a comprehensive assessment of physical development, functional state and psychoemotional status of young sportsmen engaged in single combats.



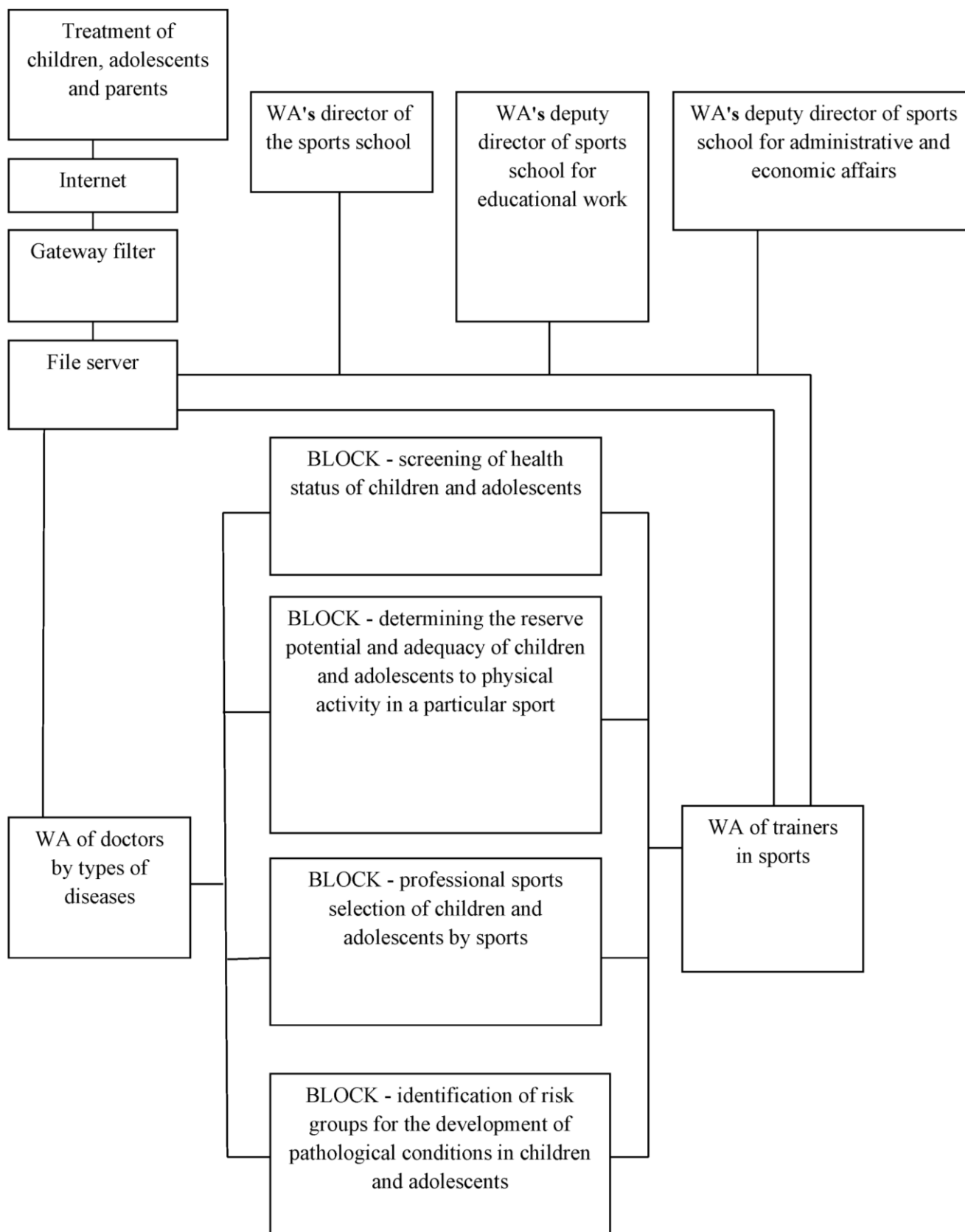
**Scheme 1.** Structural and functional diagram of integrated computer-information technology for monitoring and assessing the health of children and adolescents engaged in sports schools



**Scheme 2.** Scheme Main functions of the doctor's WA



**Scheme 3.** Main functions of the trainer's WA



**Scheme 4.** Structural and functional diagram of WA and blocks of integrated computer and information technology for monitoring and assessing the health status of children and adolescents involved in sports schools

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In this work, an approach is proposed to implement the screening of the health status of children and adolescents. Through the approach can be determined the reserve potential and adequacy of children and adolescents to exercise in a particular sport type. Selection of children and adolescents in professional sports would identify risk groups for the development of pathological conditions in children and adolescents. On the basis of computer-information, technology for monitoring and assessing the health status of children and adolescents involved in sports schools is the main idea of the proposed approach. Particularly, based on integrated implementation workplace automation (WA) of doctors of different profiles and workplace automations of trainers in various sports are going to be realized as the result of this work.

**Key words:** screening, health status of children and adolescents, sport, exercise, reserve potential, sports selection, risk groups, development of pathological conditions, computer-information technology, monitoring, evaluation, physician's WA, WA trainer.

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Пропонується підхід до реалізації скринінгу стану здоров'я дітей і підлітків, визначення резервного потенціалу та адекватності дітей і підлітків до фізичного навантаження з того чи іншого виду спорту, професійного спортивного відбору дітей і підлітків за видами спорту, виявлення груп ризику на розвиток патологічних станів у дітей та підлітків, на базі комп'ютерно-інформаційної технології моніторингу і оцінки стану здоров'я дітей і підлітків, що займаються в спортивних школах, заснованої на інтегрованої реалізації АРМ (автоматизоване робоче місце) спортивних лікарів і АРМів тренерів з різних видів спорту.

**Ключові слова:** скринінг, стан здоров'я дітей і підлітків, вид спорту, фізичне навантаження, резервний потенціал, спортивний відбір, комп'ютерно-інформаційна технологія, моніторинг, оцінка, АРМ лікаря, АРМ тренера.

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Предлагается подход к реализации скрининга состояния здоровья детей и подростков, определения резервного потенциала и адекватности детей и подростков к физической нагрузке по тому или иному виду спорта, профессионального спортивного отбора детей и подростков по видам спорта, выявления групп риска на развитие патологических состояний у детей и подростков, на базе компьютерно-информационной технологии мониторинга и оценки состояния здоровья детей и подростков, занимающихся в спортивных школах, основанной на интегрированной реализации АРМ (автоматизированное рабочее место) спортивных врачей и АРМов тренеров по различным видам спорта.

**Ключевые слова:** скрининг, состояние здоровья детей и подростков, вид спорта, физическая нагрузка, резервный потенциал, спортивный отбор, компьютерно-информационная технология, мониторинг, оценка, АРМ врача, АРМ тренера.

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