



METHODOLOGY FOR THE STUDY AND ASSESSMENT OF POPULATION'S PHYSICAL DEVELOPMENT

*Guidelines to the practical lesson
for students in the specialties 222 "Medicine"
and 228 "Pediatrics" on the course "Social Medicine,
Public Health (Public Health)"*

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
Харківський національний медичний університет

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МЕТОДИКА ВИВЧЕННЯ ТА ОЦІНКА ФІЗИЧНОГО РОЗВИТКУ НАСЕЛЕННЯ

*Методичні вказівки
до практичного заняття студентів
спеціальностей 222 «Медицина» та 228 «Педіатрія»
з дисципліни «Соціальна медицина,
громадське здоров'я» (Громадське здоров'я)*

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Compilers V. A. Ohniev
 S. H. Usenko

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Упорядники В. А. Огнев
 С. Г. Усенко

GUIDELINES FOR TOPIC TRAINING

The aim of the class: to study the methodology of the assessment of population's physical development.

Students need to know:

➤ **Programme Issues:**

- definition of the concept of “physical development”, its genetic and social dependence;
- biological and morpho-functional development;
- methods of physical development evaluation;
- regional features and dynamics of physical development indications, acceleration.

The main international and national normative legal documents on the topic:

- Convention on the Rights of the Child, adopted by the United Nations in 1989;
- The United Nations Global Initiative “Education for All”, adopted in 2000;
- The national program “National plan of action for the UN Convention on the Rights of the Child implementation for the period until 2016”, approved by the Law of Ukraine on 5 March 2009 No. 1065-VI;
- The state standard of primary education, approved by the Resolution of the Cabinet of Ministers of Ukraine on 20 April 2011, No. 462.

Need to be able:

- To analyze and evaluate physical development of the population.

Recommended literature

Basic literature

1. Michael Horvat, Luke E. Kelly, Martin E. Block, Ron V. Croce Developmental and Adapted Physical Activity Assessment. 2nd edition URL: <https://www.amazon.com/Developmental-Physical-Activity-Assessment-Resource/dp/1492543802>
2. Physical development of the population, signs of study, assessment URL: en.medicine-guidebook.com
3. Organizational Training & Development Revision: 1/2013; 2/2015; 4/2016, 5/2018 Upstate Medical University. Introduction to Population Specific Considerations URL: https://www.upstate.edu/hr/document/pop_spec_clin_ss.pdf

Additional literature

1. Ajmol Ali, Deborah Pigou, Linda Clarke, Claire McLachlan Literature Review on Motor Skill and Physical Activity in Preschool Children in New Zealand / A.Ali et al. // Advances in Physical Education. – 2017. – № 7. – P. 10–26. URL : <http://www.scrip.org/journal/ape>
2. Bouchard C. Genomic predictors of trainability / C. Bouchard // Experimental Physiology. – 2012. – 97 (3). – P. 347–352. URL: <https://www.ncbi.nlm.nih.gov/books/NBK201497/>

3. Antonios D. Christodoulos, Helen T. Douda, Sawas P. Tokmakidis Cardiorespiratory Fitness, Metabolic Risk, and Inflammation in Children / A. D. Christodoulos et al. // International Journal of Pediatrics. – 2012. 2012: 270515 URL: doi: [10.1155/2012/270515](https://doi.org/10.1155/2012/270515)

Information Resources

1. <https://www.ncbi.nlm.nih.gov/books/NBK201497/>
2. CDC (Centers for disease and Prevention) <http://www.cdc.gov/obesity/index.html>.
3. https://www.upstate.edu/hr/document/pop_spec_clin_ss.pdf

THEORETICAL MATERIAL FOR CLASS TRAINING

1. Concept of “physical development”

Physical development is one of the most important features determining the population’s health level. However, the indicators of physical development are not obligatory for the official statistical analysis and they are not reflected in the reporting, which does not allow constant monitoring the level and dynamics of physical development of the population of the country.

There are some various approaches to the definition of the concept “physical development” in the literature:

- Physical development is a complex of functional and morphological properties of organism, which determines in sum the stock of its vital forces (I. S. Sluchanko);

- Physical development is a set of morphological and functional features characterizing organism’s development and formation in process of its growth (V. V. Yefremov and co-authors);

- but the most recognized and complete one is the definition of professor E. Ya. Beletskaya: “Physical development is a set of features characterizing the level and dynamic changes of the number of morphological and functional properties of certain individual and group of people expressed in the form of general and group standards of physical development. The states of physical development should be considered as the result of interaction of internal (endogenous) and external (exogenous) factors.

The endogenous factors are the following:

- heredity, mother’s health;
- physical condition of parents;
- peculiarities of intrauterine development.

The exogenous factors are the following:

- natural and climatic ones;
- socio-economic (economic development of society, working and living conditions, character of profession, etc.).

Individual’s physical development assessment is realized by comparison of his/her anthropometric indices (height, weight, chest circumference, etc.), as well as other developmental indicators (sexual maturation, dental formula, etc.) with average data for the corresponding gender and age. For receiving the

average indicators of human physical development the examination of the big groups of practically healthy people is realized. The measurement result data are processed by the method of biological statistics. The received average indicators **are the standards of physical development** of the relevant population groups. The difference of living conditions in different climatic zones, in cities and in rural areas, ethnographic differences cause the various levels of population's physical development, and therefore determine the local (regional) standards of physical development. Standards of physical development are specified approximately every 5 years.

Information about physical development is used by doctors of different specialties, primarily by pediatricians and specialists in the field of children and adolescents' hygiene.

Examination of physical development begins with the birth of a child. Later, it is carried out in children's clinics, in preschools establishments and in schools, in secondary and higher educational institutions, during conscription, special and periodic medical examinations, as well as the selective studies of health status of different groups of population.

Indicators of physical development, especially the combination of birth rate, mortality, morbidity, are not only the health criteria, but also the ones that reflect medical and recreational activities effectiveness.

These materials make possible observation of age development trends of children and adolescents.

2. Biological and morpho-functional development of a child

In physical development assessment the biological and morpho-functional child's development are distinguished. **Biological development is assessed by the following criteria:**

- height (standing height);
- dynamics of body mass during the year;
- age of milk teeth change to the permanent ones;
- bones ossification according to the X-ray examination;
- development the degree of secondary sexual characteristics;
- age of the first girls' menstruation.

According to these criteria the **biological development standards** for each age are developed and the actual data of a particular child are compared to them. After that, the biological development assessment in comparison with data on a three-point scale is performed by pointing: **is retarded in the development, corresponds to the development, or outstrips development.**

For assessment of **morpho-functional development** of a child such criteria are used:

- height of body in vertical measurement;
- body mass;
- chest size;
- and correspondence of the above mentioned characteristics to each other.

State and regional gender-age standards on the basis of these specified parameters are also developed. The received data are compared to them and the morpho-functional development assessment on a three-point scale is performed: *harmonious, disharmonious and sharply disharmonious development*.

3. The role of mass medical examinations for the physical development assessment of children

Physical development study of children and adolescents is particularly important, because it is an indicator of growth and organism formation. Physical development study of children and adolescents is realized simultaneously with the examination of health state during the physical examinations and dispensary surveillance, performed in children's clinics, teenage medical offices, medical and sport dispensaries and in other establishments of public health. Systematic surveillance of the physical development of children allows doctors to detect the early signs of its violation. The main evidences of wrong development are: the delay in growth and lack of weight. The frequency of children's examination depends on their age: early age children should be examined more often. Physical development largely depends on social living conditions, physical work, physical education and sports.

A complex of features during the mass medical examinations is used for the physical development assessment and among them we have to mention such ones:

- *anthropometric* ones (standing height, weight, chest size, and for the profound studies – additionally the height in sitting position, head size, shoulder length, size of forearm, tibia, and thigh);
- *functional, physiometric* ones – vital capacity of lungs (spirometry), muscle strength of the wrist (dynamometry);
- *and somatoscopic ones* – structure of body, development of muscles, shape of chest, legs, evidence of secondary sexual characteristics, pulse, blood pressure, etc.

Statistical processing of the obtained materials is realized by the statistical methods (the variational rows construction), regression level, and etc.

The analysis of the obtained data is carried out with the help of following factors:

- sigma estimates;
- and individual assessment on the regression scale.

The last method is the most comprehensive; because it gives a chance to take into account different features and their interrelation, as well as to distinguish the individuals with harmonious or disharmonious development.

Indicators of physical development in modern conditions are not an integral part of functional statistical reporting, which does not allow to evaluate constantly its condition of the whole country population. It can be realized on the basis of special sample studies, conducted in the following directions:

- dynamic surveillance of the physical development of the same contingents;
- determination of physical development patterns in different gender-age groups of population in dynamics in a certain period of time;

- development of regional sexual and age standards with the purpose of individual and group assessment of the physical development of children;
- and evaluation of the effectiveness of health measures.

4. Evaluation of physical development of modern growing generation

During the assessment of physical development of the growing population of Ukraine, it is necessary to distinguish the following patterns:

1) nowadays one can observe more rapid *acceleration* of physical development rates of young generation. It is characterized by changes of the initial level of physical development at birth, and acceleration of the development rates in all age groups and more comprehensive development of children and adolescents;

2) increasing of *disharmonic physical development*, and disharmony of mental and physical development rates especially;

3) growing number of persons with *excess body weight*, due to the life mode changes, nutrition habits, hypodynamia, etc.

Physical development is socially conditioned. It is considered that the level of social prosperity affects indicators of population's physical development, primarily children.

Recently indicators of children's physical development have significantly declined. In the period between 1999 and 2005, according to scientific data in Ukraine, the number of children and adults with the deficit or excess body mass has been increased. These deviations are largely connected with the dietary changes in recent years – the overconsumption of carbohydrates (bakery products, potatoes, etc.), that are cheaper than protein food products, as well as saturated fatty acids and high-calorie refined products. Generally, there is an imbalance in nutrition, diet violation, decrease in motor activity, as well as the frequent stresses, depressions, which provoke the development of obesity. Probably, the lack of protein in children's diet has led to the body weight decrease in most modern children (compared to 1970s–1980s). Pediatricians note that all children with the body weight deficiency as well as in children with the excess body mass, the incidence rate is much higher.

There can be the only way of solution of current situation: organization of rational nutrition and optimization of physical education, regeneration of physical culture and sport prestige among all social classes, and first of all among children, adolescents and youth.

In 20th century the acceleration process (from Latin “*acceleratio*” acceleration) was mostly inherent to the majority of economically developed countries. Acceleration meant more rapid growth and development of children and adolescents compared to previous generations. This concept was introduced in 1935 by German scientist E. Koch.

Acceleration clearly manifested in the second half of the 20th century. So, if in 1940–1941 years the body weight of children doubled in 5–6 months, then in 1965–1973 it began to double at the age of 4–6 months. If the change of milk teeth to the permanent teeth began in 1953 from the age of 6–7, then in 1984 it began to occur from the age of 5–6 years.

The terms of puberty has significantly changed (they were accelerated). There was an acceleration of secondary sexual characteristics development. In addition, children and adolescents had the earlier morphological stabilization. In 1980s the ossification process ended in boys 2 and in girls 3 years earlier than in the 1930s. The final growth terminated in a shorter period of time – in girls at the age of 16–17 years and in young men at the age of 18–19 years, ossification of long tubular bones was completed and ceased the growth in length. For 80 years (from 1890 up to 1970) 13 year-old boys became 16 cm taller, and girls – 14.8 cm. The consequence of the accelerated development of children and adolescents is the achievement of higher final body sizes in adults, prolongation of fertile period, as well as life duration in general.

The acceleration reasons are not entirely clear. There are the various hypotheses of *accelerated shifts reasons*. There are some causes of acceleration:

- improvement of children’s nutrition (the increased consumption of animal proteins and fats, vitamins, concentrates for infant feeding);
- more intensive insolation;
- urbanization (acceleration of urban life rate excites central nervous system (CNS) and activates its functions);
- genetic effect (constant population mixture, heterologous marriages and acceleration of the offspring development in connection with heterosis, i.e., with the property of hybrids of the first generation to exceed the best feature of one parent’s forms in the first generation).

However, there is no any doubt that the mixture of biological and social factors caused acceleration.

Acceleration can’t be considered as a definite positive or negative process. It sets many problems to modern physicians, namely:

- Earlier biological maturation, which occurs before the social maturity and civic empowerment (earlier start of sexual activity, increasing the number of “young” mothers, number of abortions in juveniles, etc.);
- the need to establish the new norms of labour, physical activity, nutrition, standards for children’s clothing, footwear, furniture and household items;
- increasing variability of all signs of age development and maturation, differentiation norm and pathology;
- and dissociation between limited growth of body’s diameter creates a tendency to the body’s gracilization and the growth of complications during the delivery process.

There are data about the fact that the acceleration shifts have the periodic character and there are short-term stabilization periods. However, it is difficult to trace the acceleration process in the historical aspect, as there is no reliable data about physical development indicators of generations’ living in the past centuries, and it is possible to make the conclusion only on the basis of the indirect data. In 1980s the reports of the acceleration process stabilization began to appear. Initially, this tendency was noted by scientists from Norway, Germany, Czechoslovakia, Italy Japan, and then the other economically developed

countries, by the end of the 20th century there was a marked deceleration (it has been appeared the term “deserration” – opposite to acceleration phenomenon).

Slowdown and suspension of acceleration process has been observed since 1993 (according to the data of L.V. Herman, in St. Petersburg). However, in the developing countries it is expected the significant acceleration of the individual development of children.

TEST TASKS

1. Physical development is an important indicator of population’s health. Which of the following features are used for the assessment of the morpho-functional development of a child?

- A. *Height (vertical body length), body mass dynamics, hand bones ossification according to X-ray data, degree of sex development, first menstruation duration in girls.*
- B. *Height (vertical body length), weight and body mass dynamics.*
- C. *Height (vertical body length), body weight, the term of replacement milk teeth to the constant ones.*
- D. *Height (vertical body length), body mass dynamics, chest size.*
- E. *Height (vertical body length), body weight, chest size, muscle strength of hand, lungs capacity and other.**

2. Concept of “physical development” of children and adolescents includes characteristics of their biological and morpho-functional development. Indicate which of the following characteristic signs of biological development of a child.

- A. *Annual height of body length, period of milk teeth change, hand bones ossification according to the radiographic data, secondary sex signs development, etc.**
- B. *Growth, mass and body mass dynamics.*
- C. *Height, body weight, the term of milk teeth replacement to the constant ones.*
- D. *Height (vertical body length), body mass dynamics, chest size.*
- E. *Height (vertical body length), body mass dynamics, hand bones ossification according to X-ray data, development degree of sex, first menstruation duration in girls.*

3. Physical development of children and adolescents is evaluated according to the following groups of signs: anthropometric, physiometric, and somatoscopic. Determine which of the following factors from above mentioned ones belong to physiometric features?

- A. *Manifestation of secondary sexual characteristics.*
- B. *Vital capacity of lungs, muscle strength of hand.**
- C. *Body weight, chest shape.*
- D. *Height and body weight.*
- E. *Size and form of chest.*

4. Determine which kind of physical development is characterized by the following features: height, body mass dynamics, age, change of milk teeth to the constant ones, ossification of hand according to the X-ray, etc.?

- A. Anthropometric.* *C. Morpho-functional.* *E. Physiometric.*
*B. Biological.** *D. Somatoscopic.*

5. Determine which of the following kind of physical development is characterized by such features: height, body weight, chest size, muscle strength of hand, vital capacity, etc.?

- A. Anthropometric.* *C. Morpho-functional.** *E. Physiometric.*
B. Biological. *D. Somatoscopic.*

6. Physical development of children and adolescents is evaluated taking into account such data: anthropometric, physiometric, and somatoscopic ones. Indicate which of the following features belong to the group of anthropometric ones:

- A. Manifestation of secondary sexual characteristics.*
B. Lungs capacity.
C. Muscular strength of hand.
*D. Vertical height, body weight, chest size.**
E. Chest form.

7. Some indicators characterized somatoscopic physical development. Determine which of the following ones exactly:

- A. Body structure, chest form, arterial pressure, pulse, etc.**
B. Lungs capacity.
C. Muscular strength of hand.
D. Vertical height, body weight.
E. Chest form.

8. In mass medical examinations performance, it is used a set of features for the physical development assessment. Determine which of the following methods are used to analyze the received data.

- A. With the help of variation coefficient.*
B. With the help of correlation coefficient.
C. With the help of arithmetic mean.
*D. With the help of sigma assessment.**
E. With the help of the extensiveness indicator.

9. A set of features for the physical development assessment is used during mass medical examinations checkups. Determine which of the following methods are used to analyze received data:

- A. With the help of individual assessments on the regression scale.**
B. With the help of variation coefficient.
C. With the help of correlation coefficient.
D. With the help of the extensiveness indicator.
E. With the help of ratio indicator.

10. Determine which of the following patterns can be distinguished, assessing the growing population development of Ukraine?

- A. Decrease the number of cases of disharmonious physical development as well as excess body weight.*
B. Decrease of physical development rates of young generation and increasing of persons with the excess body mass.

- C. *Decreasing the number of disharmonious physical development events and accelerating of physical development rate of young generation.*
- D. *Increasing the number of disharmonious physical development cases and increasing of persons with the excess body mass.**
- E. *Increasing of number of the disharmonious physical development events and decreasing of persons with the excess body mass*

11. Which of the following are the regularities for assessment of physical development of growing generation of Ukraine?

- A. *Decrease the number of cases of disharmonious physical development as well as excess body weight.*
- B. *Decrease of physical development rates of young generation and increasing of persons with the excess body mass.*
- C. *Decreasing the number of disharmonious physical development events and growth of number of individuals with excess body weight.*
- D. *Acceleration of the pace of physical development of young generation and an increase the number of cases of disharmonious physical development.**
- E. *Acceleration of the pace of physical development of young generation and decrease the number of individuals with excess body weight.*

12. Which of the following regularities can you define for assessment of physical development of Ukrainian young generation?

- A. *Increasing of number of the disharmonious physical development cases and decreasing the pace of physical development.*
- B. *Increasing of number of the disharmonious physical development cases and decrease the number of individuals with excess body weight.*
- C. *Decrease of physical development rates of young generation and decrease of number of persons with the excess body mass.*
- D. *Decreasing the number of disharmonious physical development cases and acceleration of the pace of physical development of young generation.*
- E. *Acceleration of the pace of physical development of young generation and an increase the number of individuals with excess body weight.**

13. Recently, indicators of physical development of children have significantly deteriorated. The number of children and adults with deficit or excess body weight has increased. Determine which of the following are the causes of these excess body mass deviations?

- | | |
|-------------------------------------|---------------------------------|
| A. <i>Change of food habits.*</i> | D. <i>Dietary disorder.</i> |
| B. <i>Hypodynamia.</i> | E. <i>Constant depressions.</i> |
| C. <i>Violation of diet regime.</i> | |

14. In recent years, indicators of physical development of children have significantly deteriorated. The number of children and adults with the deficit or excess body weight has been increased. Determine which of the following are reasons of these deviations of body mass deficiency?

- | | |
|-------------------------------------|--|
| A. <i>Motor activity reduction.</i> | D. <i>Imbalance in nutrition.</i> |
| B. <i>Dietary disorder.</i> | E. <i>Lack of protein in nutrition.*</i> |
| C. <i>Violence of day regime.</i> | |

15. Recently, indicators of physical development of children have significantly deteriorated. The number of children and adults with deficit or excess body weight has been increased. Determine, which of the following measures can change this situation?

- A. Restoration of the physical culture and sports prestige among all social classes.
- B. Day regime optimization and the sufficient content of protein in nutrition.
- C. Rational nutrition organization and physical culture optimization.*
- D. Physical culture organization and day regime optimization.
- E. Balanced nutrition and day regime optimization.

CONTROL QUESTIONS

1. Give the definition of “Physical development”, please?
2. Which criteria belong to the biological development?
3. What are the standards of biological development?
4. What criteria relate to morpho-functional development?
5. What are the standards of morpho-functional development?
6. Which methods are used for analysis of received data?
7. What are regularities of physical development of the children’s population of Ukraine?
8. What is the cause of deterioration of physical development indicators?
9. How these indicators can be improved?
10. How did the acceleration process manifest in the second half of 20th c.?
11. How the terms of puberty have changed?
12. How the ossification processes have changed?
13. What acceleration processes are debated?
14. What are the problems posed by the acceleration process for the modern medical workers?

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Навчальне видання

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