**Kharkov National Medical University**

**Department of Public Health and Healthcare Management**

**BIOSTATISTIC**

**Methodological guidelines for independent work for second (magistracy) degree higher education**

Educational qualification «Master of Medicine»

Professional qualification» «Physician»

Branch of knowledge 22 «Healthcare»

Speciality 222 «Medicine»

Student: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 Faculty:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Course: 3

Group: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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BIOSTATISTIC:Methodological guidelines for independent work for second (magistracy) degree higher education, educational qualification «Master of medicine», professional qualification «Physician», Branch of knowledge 22 «Healthcare», Specialty 222 «Medicine»:/ The drafters: Ohniev V.A.,Galicheva N.A, Chumak L.I. and others .- Kharkov. - KhNMU. - 2018. – 84p.

**The drafters:**

Ohniev V.A.,

Galicheva N.A,

Chumak L.I.

Chuchno I.A.

Zinchyk A.N.

Pomogaybo E.G.

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The Methodical guidelines are made to help students perform independent work on subject biostatistic. The Methodical guidelines are in accordance with the program of the education for student of medical faculty of the high educational institutions with III-IV level of accreditations. They comprise of all topics on discipline, which are used during practical lessons, with each of them having the following contents:

-the purpose of the lessons;

-a list required for assimilation of discipline of the knowledge’s and skills;

-a list of the recommended literature;

-individual tasks for independent work;

Performing independent work is an obligatory in this education program.

The Practical lessons are conducted according to timetable of the university. They begin with the name of current topic and checking of base level of knowledge of the students with test problems. Then, the teacher proceeds with analysis of the topic and test problems. Learning of the theme is aided by performing the individual independent work. At the end of the lesson teacher takes whole volume of work and signs it.

The Organization of the education process is realized for credit-module system in accordance with requirements in Bolon process.

Assimilation of the material in practical lesson (current control) is checked according to concrete purposes of the profound module. Total module control is realized on the last practical lesson with use the programmed methods of the education, situational tasks, questioning on standardized control questions.

The Types of the education work according to curriculum are: lectures, practical lessons, independent work of students, consultations.

The Study biostatistic is provided on 4th course, totalling 39 academic hours (1,5 credits), of them practical lessons - 15 hours, lectures - 4 hours, independent work of students - 20 hours.

Students disqualified to accreditation in this discipline are those with missed lectures, practical lessons and unsatisfactory marks.

**TOPIC PLAN OF PRACTICAL LESSONS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| №class. | №**topic** | **Contents** | **mark** | **page.** |
| **№ 1** | *Topic № 1* | Social Medicine and public health as a science.  |  | **7** |
| *Topic № 2*  | Medical statistic. the methodical bases to organizations of the statistical researches in system of the public health. |  | **8** |
| **№2** | *Topic № 3* | The organization and planning and its stages of the statistical researches in system of the public health. |  | **13** |
| **№ 3** | *Topic № 4* | The Relative values (the statistical coefficients), graphic methods of the analysis  |  | **19** |
| **№ 4** | *Topic № 5* | Variation rows, methods of their building. the mean value, methods of their calculation. |  | **27** |
| **№5** | *Topic № 6* | The characteristics of sign variety (mean standard deviation, coefficient of variation) |  | **30** |
| **№6** | *Topic № 7* | The parametric methods of the estimation and analysis of the statistical hypothesizes |  | **34** |
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| **№8** | *Topic № 9* | The Analysis intercommunication between investigation parameters of the statistical totalities (correlative - regressive analysis). |  | **44** |
| **№9** | *Topic № 10* | The Method to standardization. |  | **48** |
| **№10** | *Topic № 11* | The Dynamic rows and their analysis. |  | **51** |
| **№11** | *Topic № 12* | Design of epidemiological studies: case-control, cohort, randomized clinical researches. Gold standard. |  | **55** |
| **№12** | *Topic № 13* | Screening. Method of assessing the sensitivity and specificity of screening tests. |  | **58** |
| **№13** | *Topic № 14* | The risk factors, methods of the calculation and their estimation. |  | **60** |
| **№14** | *Topic № 15* | Basics of scientific publication preparation |  | **69** |
| **№15** | *Topic № 16* | Total control |  |  |
|  |  | **Mean mark** |  |  |
|  |  | Annexes |  | **70** |

The Results to progresses of the student:

|  |
| --- |
| **Student’s surname and name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-\_course\_\_\_\_\_\_group\_\_\_\_\_ faculty \_\_\_\_\_\_\_\_\_\_\_** |
|  | Quantity of marks | Signature of the teacher |
| Current control |  |  |
| Test control |  |  |
| Total module |  |  |
| Sum total marks |  |  |

**PURPOSE OF THE STUDY BIOSTATISTIC**

The Purpose of the study of biostatistic - long-run objectives - are fixed in accordance with educational – professional program of preparing the physician for basis of physician-preventive discipline which is a reason for development of the contents of discipline.

On the base of final integer of discipline and two profound modules are worded concrete purposes, which provide the achievement to long-run objective.

**THE LONG-RUN OBJECTIVE:**

-to possess theoretical base and modern principle to conclusive medicine;

-to possess theoretical base to biostatistics;

-to be able to know how to define and analyse the main biostatistics indices and criteria;

-to possess methodical and theoretical base of the shaping the statistical totalities for the further identical analyses;

-to be able to know the value of the results of the analysis for separate criteria and in inter-coupling with factors which they affect

**THE CONCRETE PURPOSE:**

-to know the determination of biostatistics as education discipline and its role in system of conclusive medicine;

-to possess theoretical and methodical base of biostatistics;

-to possess the main organizing element of the statistical research, its methodical and practical aspects;

-to possess the main approach and indexes for characteristic of the statistical totalities and estimations data in dynamic;

-to know how to evaluate and analyse the statistical indexes and parameters of the statistical totalities

**LIST OF PRACTICES AND SKILLS ON BIOSTATISTIC**

1. Composition of plan and program of the statistical research

2. Composition of model of the tables for development of statistical material and building of the graphic representation of statistical data

3. Calculation and estimation relative and mean arithmetical values for analysis of the state of health and activity of the medical institutions

4. Definition factors of the risk and estimation their influence upon health of the population.

5. Estimation validity of result of medico-biological and clinical research

6. Calculation and estimation of the standardized indexes (direct method to standardizations)

7. The Analysis inter-coupling between parameter under investigation of the statistical totalities.

**TOPIC № 1.**

**SOCIAL MEDICINE AND PUBLIC HEALTH AS A SCIENCE.**

**The Purpose of the lesson**. Get acquainted with contents of the notion Social medicine and public health.

As a result of studies of the subject student is obliged:

**Know:**

Social medicine and public health management as a science and as a subject, its importance for practical public health, the history of social medicine and public health management, stages of its development;

Development of social medicine, meaning works B.Ramatstsyny, Y.P. Frank, I.L Danylevskoho, S. Smith. Formation of social medicine as science, the role of A.Hrotyan, E. Resle, A. Fischer.

Development of social medicine in the works of Ukrainian scientists of the twentieth century: G. Korczak-Chepurkovskiy, Gurevich, Kagan, A.Tomilin, Merkov, L. Lekarev, K. Duplenko.

**Know how:**

Determining purpose and tasks of the Social medicine and public health.

**The Literature:**

1.Біостатистика / За загальної редакцією члена кореспондента АМН України, проф. В.Ф.Москаленка. − Книга плюс, 2009. − С.57-71.

2.Соціальна медицина та організація охорони здоров’я / Під загальною редакцією Ю.В. Вороненка, В.Ф. Москаленка. – Тернопіль: Укрмедкнига. 2000.

3.Тестові завдання з соціальної медицини, організації охорони здоров'я та біостатистики: Навч. посібник для студентів медич. ф-тів / За ред. В.А. Огнєва. − Харків: Майдан, 2005.

4.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

**For notes**

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**Date of the performing the work \_\_\_\_\_\_\_\_\_\_Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC № 2.**

 **MEDICAL STATISTICS. THE METHODICAL BASES TO ORGANIZATIONS OF THE STATISTICAL RESEARCHES IN SYSTEM OF THE PUBLIC HEALTH.**

**The Purpose of the lesson**. Get acquainted with contents of the notion "Biostatistic", statistical totalities, and to study the methods of the undertaking the statistical research, its stages.

As a result of studies of the subject student is obliged:

**Know:**

System analysis, statistical, demographic, historical, experimental, epidemiological, economic and sociological methods, methods of expert assessments, modeling, forecasting.

The importance of social medicine in health care.

Statistics and its role in medicine and in health care. Its subject and content. Statistical population. The importance of general and sampled populations in biomedical research. The concept of non-quantitative data and qualitative characteristics. Representativeness of sampled populations. Objects, observation units and features subject to registration. Sources of statistical information. Types of statistical data, statistical reporting, sample surveys. Marketing and sociological surveys, types of survey questions and survey arrangement in health care. The theory and the concept of statistical observation and stages of its implementation. Methodological bases, forms and methods of statistical monitoring and data collection. Reliability of observations. The use of different measurement scales: absolute, ordinal, interval, ratio.

Groups of statistical data, its methods and meaning. Group types, principles of statistical groups and classifications. Proportions of statistical groups. The concept of multi-dimensional classification. Types of sample surveys, the concept of randomization and stratification, clinical trials design.

Statistical tables, their characteristics, types and rules. Basic principles of reading and analyzing tables.

**Know how:**

The object of study, to build and characterize custom and general population. To formulate research purpose and tasks, to develop a plan and a program, to collect, develop, summarize and analyze the statistical material.

**The Literature:**

1.Біостатистика / За загальної редакцією члена кореспондента АМН України, проф. В.Ф.Москаленка. − Книга плюс, 2009. − С.57-71.

2.Соціальна медицина та організація охорони здоров’я / Під загальною редакцією Ю.В. Вороненка, В.Ф. Москаленка. – Тернопіль: Укрмедкнига. 2000.

3.Тестові завдання з соціальної медицини, організації охорони здоров'я та біостатистики: Навч. посібник для студентів медич. ф-тів / За ред. В.А. Огнєва. − Харків: Майдан, 2005.

4.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

***In help for preparing to practical occupation:***

***(fragment to lectures)***

The term "**statistics**" is derived from the Latin word "status", which means "certain situation" or "certain condition". Then the word "**stato**" (state) appeared, and those who possessed the knowledge of European states known as "**statista**", which meant "a statesman", "an expert on the state." In the XVII-XVIIІ centuries, the word "statista" formed the adjective "**statisticus**", which became the name of the new discipline known as "political science." This word was first applied in the lectures of **German Konring** (Germany). As a noun, this term was described in the "**Notatia politica vulgo statistica**" by **Gottfried Achenwall** (Germany) in 1743. Thus, the term "**statistics**" has appeared in German universities. In 1889, English scientist **Francis Galton** (1822-1911) suggested the term "**biometrics**" (from the Greek “bios” - life and “metron” - measure). This was the name of a new school of biology and anthropology associated with the use of mathematical methods in biological researches. In 1899, **G. Dunker** suggested another name - "**variation statistics**". (from the Latin. “variato”- change, oscillation and “status” – state, situation). The literature also mentions such term as "**biomathematics**" but, in the end, was named back to "**biological statistics**" and received international recognition. Thus, the transformation of the term "**biostatistics**" shows the historical evolution of this scientific concept formed on the basis of biometric science development and its practical application.

The history biometrics includes development 7 stages:

-Initial;

-Descriptive;

-Defining;

-Fundamental;

-Formalistic;

-Rationalistic;

-Classical.

The **initial period** is characterized by the first census of the population, its property and lands in ancient and medieval times. These studies were random and chaotic and had no scientific basis, but had a great practical value (military or tax).

The **defining (descriptive) period**. At this stage all events, phenomena, states in general, traditions and customs were described with the help of words. The descriptive school of statistics was represented by German scientists G. Kopring (1606-1681) and G.Achenwall (1719-1772). G. Achenwall introduced the term "Status", which means "certain situation or condition". It is obvious that this word is linked with the Italian word "stato" (state). In 1746 G.Achenwall began teaching a new discipline called "Political Science" in the Universities of Marburg and Gottingen.

The **defining period** (mathematical statistics or political arithmetic). The mathematical statistics reflected quantitative characteristics of social phenomena, their patterns and relationships. It appeared in England, and its most important representatives were John Graunt (1620-1674) and William Petty (1711-1785). W.Petty suggested the term "Statistics" from the Latin word - "Status". That is why W.Petty was called the inventor of statistics. Later this direction was developed in the works of F. Galton, K.Pierson, R.Fischer, and W.Gosset publishing his works under the pseudonym Student, and others.

The **fundamental period** began to develop in the mid-nineteenth century and was marked by the works of Belgian astronomer, mathematics, physics and statistics Lamber Adolphe Jacques Quetelet (22.02.1796-17.02.1874). He turned the statistics into a scientific discipline, and was the first to apply scientific methods of statistical data processing. The name of A.Quetelet is associated with the transition from collecting social statistics and quantitative data description to establishing correlations between the phenomena. This period has laid the scientific foundation of statistical research.

**Formalistic**, or the 5th stage of biostatistics, is characterized by emergence and development of the English biometrical school. The use of statistics in biology has developed significantly in the early nineteenth century. At this time scientists faced different theoretical and practical problems set by the theory of Charles Darwin. They needed an objective methodological tool, which were statistical methods that gave a good impulse to the development of biometrics. The leading role in this development was played by Francis Galton and Karl Pearson school of biologists. This school appeared under the influence of Charles Darwin’s brilliant work, and has made a revolution in biology.

**Rationalistic**, or the sixth stage of biological statistics, started with W.Johannsen’s (1857-1927) classical studies in 1902. W.Johannsen affirmed that special attention in biomedical research should be paid to biological experiment, not to mathematics. He believed that mathematical methods should be used as an auxiliary device in experimental data processing. He came to this conclusion making experiments with beans. He wrote that in the opposite case, the results can twist the real picture and lead to errors. Mathematics should provide targeted assistance rather than serve as a guiding idea.

**Classic**, or the seventh stage of biometrics development began with the works of W.Gosset and R.Fischer. They formulated modern approaches to arrangement and implementation of statistical research. One of the most important is the theory of small samples, which is why W.Gosset (Student) is considered a pioneer in this field. This period was marked with the creation of the basic theory of small samples and the theory of experiment planning, new terms and definitions of modern science.

In its modern sense, **Statistics is an independent social science that studies the quantitative aspect of mass, public events in close connection with their qualitative part under specific historical conditions.**

In the course of its development, general statistics influenced economic (industry, agriculture, construction, transport, communications, labor, etc.) and social statistics (politics, culture, medicine and health care, science, education, etc.).

Thus, each sector of the economy has its own statistics.

Medical statistics as an individual branch separated from the population statistics in 1865, when Fr. Oesterlen published the first guide on medical statistics in Germany.

**Medical statistics** is a part of general statistics which studies issues related to medicine, hygiene and health care.

*Theoretical bases of medical statistics include:*

- General dialectics;

- Economics;

- Medical sciences;

- General theory of statistics.

**Medical statistics consists of three main sections:**

1. **Public health statistics** studies the quantitative aspect of public health as a whole and its various groups (demographic indicators, morbidity, disability, physical development, prenosological state), dependence between public health, complex biological, medical and social factors and environmental factors.

2. **Health care system statistics** studies medical staff, health care facilities, assesses the activity of health authorities and institutions, as well as measures to protect public health.

3. **Statistics of socio-hygienic, clinical, experimental and other studies, assessment of the reliability of study results.**

**Main goals of medical statistics:**

1. To study public health status (demographic processes, morbidity, physical development, disability, etc.);

2. To determine the dependence between morbidity and mortality and different environmental factors.

3. To study medical staff and health care institutions in order to plan and determine the needs of the population in different types of medical care.

4. To assess the quality and efficiency of medical officers and health care institutions, as well as therapeutic measures to prevent morbidity and mortality;

5. To assess the reliability of statistical studies during socio-hygienic, clinical and experimental studies.

Center for Health Statistics of the Ministry of Health of Ukraine manages medical statistics within the country. Statistical service in regions, cities and districts is represented by information and analytical centers and departments of health care institutions.

**The objects of statistical science** include different statistical totality formed depending on the purpose of the study. These may be groups of people born in a certain year, sick, dead, etc.

**Statistical totality** is a large group consisting of a number of relatively homogeneous observation units and taken together within certain time and location.

**Statistical totality** consists of observation units (born, dead, ill, etc.).

Signs describing observation units or signs distinguishing observation units are called **statistical features** or accountable characteristics (gender, age, profession, etc.).

**Statistical features are divided into the following groups:**

1. attributive

2. quantitative

**By nature of variations:**

-alternativnye

-discrete (intermittent)

-continuous

**With respect to time:**

-instant

-interval

**According to measurement method:**

- primary, or recorded

-secondary, or calculated

**Attribute features** mean descriptive signs (sex, profession, treatment results, etc.)

**Quantitative features** are signs expressed by numbers (height, weight, age).

**Alternative features** are signs of two values (yes or no);

**Discrete features** refer to quantitative signs which can be represented only by certain values, without any intermediate values, and usually expressed with integers (number of floors - 1,2,3,4, etc; number of children in a family - 1,2,3,4, etc.).

Continious features mean quantitative signs which are continuously variable and can be represented by any value (child's height - may be 1m, 1m 15cm and so on). These values may be either integer or fractional.

**Instant features** characterize objects at a particular time (medical examination dated March 1, 2005.).

**Interval features** characterize objects within a certain period of time (month, year, etc.), for example, the number of people born or dead from January 1 to December 31).

Primary features characterize an observation unit in general, and can be both qualitative and quantitative. They are obtained directly from the observation unit (gender, height, weight, etc.)

**Secondary, or calculated features** are obtained by calculating the primary features, such as cost of medical services, profitability, morbidity and mortality rate per 1,000 population, and others.

In addition, recorded features are divided into factor features and resulting features.

**Factor** **features** refer to statistical signs which affect other resulting features.

Signs changed under the influence of factor features are called **resulting features**.

For example, the weight of a child increases with the age.

Therefore, age is a factor feature, while weight is a resulting feature.

**Statistical totality can be:**

1. General

2. Selective (sampled)

**General totality** *consists of all observation units that may be allocated to it in accordance with the intended purpose of the study.*

**Selective totality** *is a part of general totality selected by a special sampling method and intended to describe general totality.*

Methods of creating selective (sampled) populations include:

1. Random sampling;

2. Mechanical sampling;

3. Typological sampling;

4. Cluster sampling;

5. Directional sampling.

***-random sampling*** – draw, lottery, or random mechanical selection (sports lottery);

***-mechanical sampling*** - selection made by a certain principle (one in five, one in ten etc.);

-***typological sampling*** consists in dividing the total population into several similar groups and selecting observation units among them with the help of random mechanical or other method. For example, studying a disease, we can divide population into urban and rural, and then select observation units from each typological group. Observation units can be selected proportionately or disproportionately in accordance with the size of each group.

- ***cluster sampling*** - general population is divided into clusters (groups), which may consist of families. These families will form the sampled statistical population;

-***directional sampling*** concicts in selecting people according to certain criteria (people of the same experience, age, education, etc.).

The main feature of sampled population consists in its **representativeness**, ie the ability to display the properties of the whole general population.

**In this regard, sampled statistical totality must comply with the following requirements:**

1. It shall include the main characteristics of general statistical totality.

2. Its size shall be sufficient to reflect the general statistical totality.

**Statistical totality has the following properties:**

1. Distribution of a certain feature (frequency, proportion -%, ‰, etc.) is expressed by relative values.

2. Medium feature level (Mode – Mo, Median - Me, arithmetic mean – X)

3. Variety of features (Lim-limit, Am - amplitude, δ-sigma - standard deviation).

4. Feature representativeness (mx-average error of the arithmetic mean, mp- average error of the relative value, etc).

5. Relation between features (rxy - correlation rate, Rxy - regression rate, and so on.)

**For notes**

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**Date of the performing the work \_\_\_\_\_\_\_\_\_\_Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC № 3.**

**THE ORGANIZATION AND PLANNING AND ITS STAGES OF THE STATISTICAL RESEARCHES IN SYSTEM OF THE PUBLIC HEALTH.**

**The Purpose of the lesson**. to study the methods of the undertaking the statistical research, its stages.

As a result of studies of the subject student is obliged:

**Know:**

System analysis, statistical, demographic, historical, experimental, epidemiological, economic and sociological methods, methods of expert assessments, modeling, forecasting.

The importance of social medicine in health care.

Statistics and its role in medicine and in health care. Its subject and content. Statistical population. The importance of general and sampled populations in biomedical research. The concept of non-quantitative data and qualitative characteristics. Representativeness of sampled populations. Objects, observation units and features subject to registration. Sources of statistical information. Types of statistical data, statistical reporting, sample surveys. Marketing and sociological surveys, types of survey questions and survey arrangement in health care. The theory and the concept of statistical observation and stages of its implementation. Methodological bases, forms and methods of statistical monitoring and data collection. Reliability of observations. The use of different measurement scales: absolute, ordinal, interval, ratio.

Groups of statistical data, its methods and meaning. Group types, principles of statistical groups and classifications. Proportions of statistical groups. The concept of multi-dimensional classification. Types of sample surveys, the concept of randomization and stratification, clinical trials design.

Statistical tables, their characteristics, types and rules. Basic principles of reading and analyzing tables.

**Know how:**

The object of study, to build and characterize custom and general population. To formulate research purpose and tasks, to develop a plan and a program, to collect, develop, summarize and analyze the statistical material.

**The Literature:**

1.Біостатистика / За загальної редакцією члена кореспондента АМН України, проф. В.Ф.Москаленка. − Книга плюс, 2009. − С.57-71.

2.Соціальна медицина та організація охорони здоров’я / Під загальною редакцією Ю.В. Вороненка, В.Ф. Москаленка. – Тернопіль: Укрмедкнига. 2000.

3.Тестові завдання з соціальної медицини, організації охорони здоров'я та біостатистики: Навч. посібник для студентів медич. ф-тів / За ред. В.А. Огнєва. − Харків: Майдан, 2005.

4.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

***In help for preparing to practical occupation:***

***(fragment to lectures)***

**Statistical study** **means investigation of a social phenomena on the basis of statistical data.**

When arranging and conducting a statistical study, it is necessary to consider its form, mode and type.

**1. There are two forms of statistical study:**

- Reporting;

- Special statistical observation.

**Reporting** as a form of statistical observation is characterized by the fact that statistical study uses official reporting documents.

If the study goes beyond the information obtained from official reports, it is called **special statistical observation.**

**Methods to obtain statistical information:**

1. Documentary (data copying).

2. Surveys, or anamnestic method:

- Questionnaires;

- Mail questionnaire;

- Self-registration;

- Field interview.

3. Direct observation

The **documentary method** is sourced by different documents (medical history, outpatient slips, observation checklists, etc.). This method is called the method of data copying.

In **survey method** all the information is obtained from responses of interviewed people. Survey can be arranged in a different way: questionnaires, mail questionnaires, self-registration and field interview.

Questionnaires method is based on voluntary filling of application forms.

In case of **mail questionnaire** method, researchers send polling cards with relevant instructions. When polling cards are filled, respondents sent them back by mail or by other means.

In case of **self-registration** method, all respondents are provided with application forms and explained how to fill them. These forms are returned in any way convenient for respondents.

The **field interview** method (the most reliable method) researchers interview respondents (observation units), and their answers are recorded in the form of a questionnaire.

In case of **direct observation method** all statistical data is obtained by personal inspection, measurement, weighing, etc. (pulse, blood pressure, dynamometry etc).

Types of statistical study are divided according to the scope and time spent.

Depending on the scope:

1. continuous

2. non-continuous.

**Continuous observation** provides for registration of all observation units included into statistical population.

In case of **non-continuous observation,** only a part of observation units is recorded.

Non-continuous observation is divided into:

- Examination of the main scope;

- Sample survey;

- monographic description.

Examination of the **main scope** provides registration of the majority of cases (50%) constituting a general statistical population.

**Sample surveys**, as opposed to the main scope examination, provides for the registration of fewer cases (less than 50%) constituting statistical population and is selected according to specific methods.

Monographic description provides detailed examination of individual units or small groups of statistical population (description of individual typical families for the entire population).

According to the time spent, all statistical studies are divided into:

1. Current studies.

2. Intermittent:

- one-time;

- periodic.

**Current observation** is carried out continuously and starts as soon as a studied fact appears.

**One-time observation** takes place when observation units are registered immediately.

If one-time observations are repeated at certain time intervals, they are called **periodic** (census, medical examinations, etc.).

Any statistical study should begin with a clear arrangement and planning, therefore, any statistical study is divided into time-related steps.

**1. Determine study purpose and objectives, to draw up a study plan and a research program.**

**2. Collect necessary materials.**

**3. Process and summarize the materials.**

**4. Provide analysis, literary design, conclusions and practical suggestions.**

**Step 1: Determine study purpose and objectives, to draw up a study plan and a research program.**

**Study purpose** is a statement of theoretical positions and practical needs which leaded to the study and limit its scope and content.

For example:

*Study purpose*: To substantiate and to develop a system for prevention of chronic non-specific lung diseases.

*Objectives*:

1. To study the age-sex composition of patients with chronic non-specific lung diseases.

2. To study risk factors for these diseases.

3. To develop a set of preventive measures on order to reduce the rate of chronic non-specific lung diseases among the population.

***Study plan*** determines all organizational issues of the study.

When drawing up a study plan, it is necessary to consider the following:

1. To define a study object and study location.

2. To determine the timing of all study stages.

3. To determine the type of statistical study.

4. To appoint study managers and supervisors.

5. To determine who will fund the study.

and other organizational issues.

***Study program*** is a list of explicit questions that need to be answered on the basis of different types of work.

Study program consists of three parts:

1. Material collection program.

2. Development program.

3. Analysis program.

Each part of the program is provided to perform a specific task. Thus, *material collection program* includes:

1. Determination of observation unit.

2. Determination of all accounted features.

3. Drawing up of record cards (profiles, information collection cards, registration forms, etc.).

*Development program:*

1. Distribution of accounted features into groups.

2. Preparation of tables.

*Analysis program:*

1. Determination of the required indicators to describe the phenomenon under study.

2. Application of computer technologies in the study.

3. Determination of criteria to ensure the reliability of statistical study.

Thus, the first stage of statistical study prepare the basis for its implementation in subsequent steps.

**Step 2: Collect necessary materials**

During the second step we collect statistical materials depending on the form and method of information gathering. It may be based on official statistical accounting documents, cards, etc..

**Step 3: Process and summarize the materials.**

After collecting, we proceed to material processing and summary. At the same time, we perform the following steps:

1. Control over the collected material, in order to exclude spoiled or blank cards.

2. Material encryption, which shall be paid special attention when materials are processed with the help of computer.

3. In case of manual processing, we distribute and calculate the statistical materials according to specific features. This process is automatic if we use computers.

4. We summarize the statistical data - fill in the tables prepared during the first step.

5. Calculate statistical indicators.

6. Reflect the obtained results in the form of graphics.

**Step 4: Provide analysis, literary design, conclusions and practical suggestions.**

This is the final stage. Based on the analysis of the data we draw conclusions necessary for the implementation of various practical activities.

The fourth step is implemented in the following sequence:

1. The results obtained are compared with the norms, standards, other studies, etc.

2. We draw up conclusions.

3. Create a literary design of the work performed.

4. Develop practical suggestions.

During the development program (1 step of statistical analysis) it is necessary to develop tables.

***Statistical table*** is a form of systematic, rational and visual presentation of digital material characterizing a phenomena or a processes.

**Tables can be**

1. Simple;

2. Grouped;

3. Combined (complex)

Every statistical table shall include the subject and the predicate.

**Statistical subject** is the main feature of a phenomena under study (eg – diagnosis).

**Statistical predicate** means all the signs describing the subject (sex, age, treated case, etc).

**Simple table** gives a summary of the material with only one feature taken into account, such as gender or age.

**Grouped table** allows you to make a summary of the material by two or more features that are not connected with each other.

**Combined table** allows making a summary by two or more interconnected features.

**All tables shall be created as follows:**

1. Each table must have a name;

2. Each table must be assigned with a serial number;

3. Each feature taken into account must be named as well;

4. It is necessary to sum up the table both vertically and horizontally;

5. All the boxes must be completed.

**Independent work:**

Task 1

Each student receives a set of filled medical records - 25 documents (slips, statistical coupons for refined diagnoses, statistical cards of discharged patients, etc.).

On the basis of these documents we can:

1. Formulate the purpose and objectives of the study.

2. Develop a plan and a research program.

3. Create models of statistical tables.

4. Fulfill the third step of statistical study:

- Control over the collected material in order to exclude spoiled or blank cards.

- Encrypt all accounted features (gender, age, nosological form, treatment cases).

- Distribution and calculation of statistical material according to specific features.

- Summarize the material in a table (fill in both grouped and combined tables).

**The Decision:**

*The Purpose of the research:*

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*The Problem of the research:*

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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*The Plan of the research:*

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*The Program of the research:*

*1-st part – program of the collection:*

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2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*2-nd part – program of the development:*

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2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3.

*3-rd part – program of the analysis:*

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2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**The Models of the tables (to finish formation):**

*The simple table (for one indication)*

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*Group table:*

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| Diagnosis |  | Total |
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*Combined table:*

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**For notes**

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**Date of the performing the work \_\_\_\_\_\_\_\_\_\_Signature of the teacher** \_\_\_\_\_\_\_\_\_

**TOPIC 4.**

**RELATIVE VALUE (STATISTICAL COEFICIENTS), GRAPHIC METHODS OF THE ANALYSIS**

**The Purpose of the lesson**. Adopt the determination all type relative value and rules of the building of the graphics.

As a result of studies of the subject student is obliged:

**Know:**

The Notion about statistical indexes, their type, form of the presentation.

The Absolute data, relative values, their practical importance.

The Types of the relative values, methods of their calculation and methodical bases to use for analysis data.

The Notion and types of the structure medico-biological data, structured change, particularities of their analysis.

The Graphic methods of the analysis data. The Types graph, rules of their building.

**Know how:**

Calculate intensive, extensive indexes, indexes of the correlation and visual indexes and use them in practical activity.

**The Literature:**

1. Біостатистика / За загальної редакцією члена кореспондента АМН України, проф. В.Ф.Москаленка. − Книга плюс, 2009. − С.72-85.

2. Соціальна медицина та організація охорони здоров’я / Під загальною редакцією Ю.В. Вороненка, В.Ф. Москаленка. – Тернопіль: Укрмедкнига. 2000.

3.Тестові завдання з соціальної медицини, організації охорони здоров'я та біостатистики: Навч. посібник для студентів медич. ф-тів / За ред. В.А. Огнєва. − Харків: Майдан, 2005.

4.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

***In help for preparing to practical occupation:***

*(fragment of lectures)*

**The first property** characterizes distribution (frequency, proportion) of an accounted feature within the statistical totality (gender, age, performance, etc.).

**There are several types of features distribution within the statistical totality:**

1.Alternative;

2.Normal, or symmetrical;

3.Asymmetrical (right, left, double-humped or bimodal).

From a quantitative point of view, feature distribution is characterized by relative values, since in most cases absolute values are not suitable for comparative analysis of the phenomenon under study.

In statistics, absolute value mean a number of units and their total amount in a statistical totality received through the calculation of observation units. We can also say that absolute numbers are number names. Each of them has its own measurement unit: tons, meters, hryvnias, etc.

Absolute values express the total size of a population or its parts, but absolute numbers do not allow us to compare phenomenas. For example, 250 people die annually in the city of Belgorod, while 1600 die in Kharkiv. Can we conclude that the death rate in Kharkiv is higher than in Belgorod? Of course not, due to a different number of population in these cities. We will be able to compare only if we calculate how many people die in each city per 1000 habitants.

**Therefore, in order to describe the distribution of statistical features within a population, we must convert absolute numbers into relative numbers, which include:**

1. Intensive indices

2. Extensive indices

3. Proportions (correlation)

4. Visibility indices

**Intensive index** is an indicator of incidence or frequency. He points to the frequency of a phenomenon under study within its environment (fertility, mortality, perinatal mortality, etc.).

Intensity indices can be:

***general*** - overall mortality, fertility, morbidity, disability, etc .;

***specific*** – according to individual groups (age, gender, reason, experience, etc.).

**Intensive index** is the ratio of a studied phenomenon to statistical (medium) population multiplied by the base number. The base number may be equal to 01, 10, 100, 1000, etc.

In order to calculate the intensive index, we should consider only those environments where such phenomenon occurs.

The base is usually chosen depending on the relation between the phenomenon and the environment. You must strive to ensure that the resulting intensity ratio is convenient for use and is equal to an integer.

For example, 200 people out of 1 million are diagnosed with diphtheria. If the base number is 10, the intensive index is equal to 0.002, and if the base number is 10,000, we receive 2. However, there are certain exceptions when intensive indices are calculated only on a specific basis:

1. All demographic indices are calculated only per 1000 people (birth rate, death rate, infant mortality, etc.).

2. Mortality rate is calculated per 100 people only.

3. Temporary disability rate is calculated per 100 people only.

Intensive indices **are used**:

1. To determine the rate of phenomena studied in a statistical population;

2. To compare the phenomena in two or more statistical populations;

3. To determine any changes in the frequency of phenomena within a statistical population.

**Extensive index** is an indicator of proportion, structure or distribution. It shows the distribution of the whole statistical population into component parts, that is, it shows the proportion of individual phenomena parts (WBC differential).

The extensive index is the ratio of a phenomenon under study to the whole phenomenon multiplied by the base number. The base number of extensive index in most cases is equal to 100.

**Proportion** (correlation) index describes the relation between several dissimilar values (patient capacity, food, doctors, capacity of preparatory and school facilities, etc.)

Proportion is the ratio of dissimilar values multiplied by the base number.

The base number may be 1, 10, 100, 1000, etc.

This ratio is similar to intensity index; however, they differ as follows.

In case of **intensive index**, the phenomenon is considered within certain environment (if it's population of a city – we calculate how many people there were dead, born, injured, etc.), while in case of **proportion** we have two separate populations to show how they are related with each other.

**Differences between intensive factor and extensive**

|  |  |
| --- | --- |
| **intensive** | **extensive** |
| Characterises frequency of the phenomena | Characterises part of phenomena |
| Compare possible in any event. | Compare possible only inwardly one totality |
| For calculation it is necessary to know the ambience and its phenomena’s. | For calculation it is necessary to know the integer of a phenomena and its component parts. |
| Base can be any (1,10,100,1000 etc) | Most often base 100. |

**Visibility index** shows an increase or decrease of compared values for certain periods of time with respect to one of them.

Visibility index is used to characterize dynamic processes.

Visibility index is calculated as follows: we take one of the comparable values as 100%, and calculate other values with respect to it.

**Visibility index can be represented by:**

1. Absolute values

2. Intensive indices

3. Proportions

4. Mean values

Statistical data summarized in a table often requires visual images in the form of graphics. Unlike tables, graphics shows a more precise overall distribution picture and phenomenon trends.

Graphics are used to facilitate material understanding, to perform its statistical analysis and to compare the data obtained. They help to understand multiple correlations of features, patterns and relationships of individual phenomena, and to draw illustrative conclusions. Graphics also contribute to the promotion and distribution of statistical data.

Only a properly built graphic can illustrate the detected pattern or trend.

**Graphic** is a visual representation of statistical values with the help of geometric lines and figures (diagrams) or geographic map charts (index maps).

In order to comply with the basic terms of use, each graphic should include the following elements:

-graphic image,

-field,

-spatial and dimensional references,

-scale lines,

-explication.

**Graphic image** means geometric signs, lines and figures illustrating the statistical data. It must comply with the set objectives and be more precise.

**Graphic field** is the location of graphic images.

**Spatial references** is a system of coordinate networks. We often use a system of rectangular coordinates or curved scales. They are suitable for pie diagrams.

**Dimensional references** are determined by a system of dimensional scales, which can be uniform and non-uniform. In case of uniform scales, intervals are proportional to the numbers. For example, if the number is doubled, then the interval between the numbers should also be two times greater.

**Graphic scale** is a measure to transfer a quantitative value into a graphic value.

Explication is a short statement of the content, time and location data. Diagrams should also contain marks along the scale line, and explanations to specific graphic elements.

**The statistics distinguish these types of graphic images:**

1. Diagrams

a) linear (plain coordinates and spherical coordinates);

b) spatial (pie charts, intra-bar and bar charts);

c) 3-D (cube, pyramid) charts

d) figured (bed, man, wood, etc.)

2. Index maps.

3. Diagrammatic charts.

**Linear diagrams: rules of construction and use.**

***Linear diagrams*** are used to visualize the development of a phenomenon over time and its dynamics. They are presented in the form of a continuous line for the continuity of the process. A phenomenon on such diagram is depicted as a straight, broken or curve line (temperature sheet, the monthly child's weight, incidence depending on age and others).

***Radial diagram*** **is a separate type of linear diagram.** It is built in the polar coordinate system and is used to image cyclic dynamic data. It can be, for example, the frequency of emergency calls for children with pneumonia grouped by months.

**Intra-bar charts, bar charts and pie charts** are the most common spatial diagrams.

***Bar chart (column)*** reflect absolute numbers, intensive indices (morbidity, mortality) ratios for one or more periods, territories of certain population groups.

Constructing a bar chart, it is necessary to draw a system of plain coordinates to determine the size of each column and intervals between them. Bar basis should be of the same size and placed on the abscissa, while the upper part should change depending on the index value, which is drawn in an appropriate scale with respect to the vertical axis. Each individual bar corresponds to a particular event or a phenomenon within different periods of time. The distance between the bar should be equal, though sometimes they can be located next to each other.

Bar charts are used not only to compare the phenomenon dynamics, but to demonstrate the composition of certain phenomena (intra-bar charts).

***Intra-bar charts*** ***(intracolumn)*** are used to characterize the structure of a certain phenomenon (mortality, morbidity, etc.) or its parts.

Phenomenon parts are represented as a percentage of the total number. The height of the column is taken as 100% and divided in proportion to the rate of individual parts in percent. They are arranged in descending (increasing) sequence.

The structure of investigated phenomenon (morbidity, mortality, etc) can be submitted in the form of a **pie chart**.

In order to construct a pie chart of a random radius, it is necessary to draw a circle. This circle is divided into segments proportional to the percentage distribution of the image data, which is determined by the formula:

X = 360 °: 100 = 3,6 °, where:

X means angle. Circle segments are connected to the center by lines and create sectors which demonstrate the structure of the studied phenomena.

**3-D charts:**

3D charts are used to achieve better visual representation. They present data in the form of geometric images, pictures or symbols.

For example, these may be images of people or beds to represent patients and hospital beds, and many others.

***Index maps and diagrammatic charts*** describe territorial distribution in absolute or relative terms located on maps. Index maps give a visualization of practical indicators that characterize individual geographical units (districts, regions, states) according to particular criterion.

In order to do this, we apply hatching or different color shades corresponding to phenomenon intensity on the map. If we take a certain hatch for each group of areas, will be able to see the prevalence of diseases or other phenomena by different territories.

The main disadvantage of index maps is that they only give a general idea of statistical rates in different areas, but do not reflect their absolute values.

In case of ***diagrammatic charts,*** we draw small linear bars displaying absolute or relative numbers on a corresponding map area. This allows you to determine the fluctuations in different regions. At the same time, we can highlight different areas with background colors to represent other indicators.

**Therefore, each graphic should meet the following requirements:**

1. have a title reflecting the data presented

2. have the right graphic type

3. have the right scale

4. include a legend

**Independent work:**

**Task 1**

As of, provided in Annex 1 in this working book (the data to put into table 4.1), calculate and graphically represent corresponding to relative indexes (intensive, extensive, proportions (correlation) and visibility) on one of proposed areas. The obtained results analyse them and draw a conclusion.

**Variant** ( Region**) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Table 4.1**.

Factors of the picture of health and provision medical aid of the population \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ region in 2017.

(given conditional)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Region | Totalnumberofpopulation | Was bornchildrenforyear | Totalnumberof doctors | Totalnumberof beds | Totalnumberof deathpersons | Of them on reason of the deaths |
| Cardio-vascular diseases | OncologicalD diseases | Traumas,accidentsand poisoning | Others |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* |
|  |  |  |  |  |  |  |  |  |  |

***The Intensive index:***

 *× base (100,1000 )*

Under study phenomena can be: patients, deceased, new-borns, hospitalised, and applied to polyclinic and others.

 Ambience - an amount of the population, working and others

The Calculation of index

*1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*3.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*4\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*5\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

***2.* Graphic scene to death-rate on area**

For this from Annex 2 carry in table 4.2. corresponding to data, for 2017 - enter accounting. Represent graphic data, definable type and name graphics.

Table 4.2

***Dynamic of population’s*** ***death-rate***

***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ regions for row of the years***

|  |  |
| --- | --- |
| Year | Index of death-rate per 1000 of population |
| 2013 |  |
| 2014 |  |
| 2015 |  |
| 2016 |  |
| 2017 |  |

|  |
| --- |
| *‰**year* |

*Pic.1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

***Conclusion****:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

***Extensive index:***

 х base (100)

A Part of under study phenomena: distribution patients, deceased, hospitalised and others on taken into account sign (the sex, age, period to hospitalisations and etc.

The Phenomena as a whole: the total number of patients deceased and etc.

**The Calculation of the factors:**

*1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*3.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*4.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

***2.*** The Graphic scene got data.

Represent graphically the obtained data, definable type and name graphics.

|  |
| --- |
|  |

*Pic.2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

***Conclusion****:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**The proportions index *(correlation):***

 *х base (1,10,100,1000)*

Correlation between phenomena’s, not bound between themselves (amount hospital beds, doctors and etc on amount of the population)

**The Calculation of the factors:**

*1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

 ***2 .***The Graphic scene to provision of the population by physician for row of the years.

Given presented in Annex 3 carry in table 4.3, for 2017 - enter accounting. Represent graphic got data, definable type and name graphics.

Table 4.3

Dynamic to provision of the population of the region \_\_\_\_\_\_\_\_\_\_ physician

|  |  |
| --- | --- |
| Year | Provision of the doctors per 10000 population |
| 2013 |  |
| 2014 |  |
| 2015 |  |
| 2016 |  |
| 2017 |  |

|  |
| --- |
| *‰* *years* |

*Pic.3.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

***Conclusion****:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

***Visibility index***

* (100)*

Present in visual indexes the level to death-rate in the region of \_\_\_\_ for row of the years (see Annex 2.). Data to bring in table 4.4

Table 4.4

*Dynamics of population’s death-rate in region \_\_ per some years*

|  |  |  |
| --- | --- | --- |
| years | Level of death-rate | Visual index  |
| 2013 |  |  |
| 2014 |  |  |
| 2015 |  |  |
| 2016 |  |  |
| 2017 |  |  |

The Calculation of the factors:

*1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*3.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*4\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*5\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**2. The Graphic scene got data.**

Represent graphic obtained data, definable type and name graphics.

|  |
| --- |
| *‰**year* |

*Pic.4.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

***Conclusion****:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**For notes**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Date of the performing the work \_\_\_\_\_\_\_\_\_\_Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC 5**.

**VARIATIONAL ROWS, METHODS OF THEIR BUILDING. THE MEAN VALUE, METHODS OF THEIR** **CALCULATION.**

**The Purpose of the lesson.** Adopt the determination and rules of the building of the variational row, of the mean values.

As a result of studies that student is obliged:

**Know:**

The Determination of the variational row and methods of its building. The Types of the variational rows. The mean values in clinical and epidemiological researches, their types, practical meaning, methods of the calculation.

**Know how:**

Form the variational row. Calculate the mean arithmetical values

**The Literature:**

1.Біостатистика / За загальної редакцією члена кореспондента АМН України, проф. В.Ф.Москаленка. − Книга плюс, 2009. − С.99-110.

2.Соціальна медицина та організація охорони здоров’я / Під загальною редакцією Ю.В. Вороненка, В.Ф. Москаленка. – Тернопіль: Укрмедкнига. 2000. − С.52-62.

3.Посібник із соціальної медицини та організації охорони здоров’я / Під редакцією Ю.В. Вороненка. – Київ: Здоров’я. 2002. с.23 – 32.

4.Збірник тестових завдань до державного випробувань з гігієни, соціальної медицини, організації та економіки охорони здоров’я / В.Ф.Москаленко та ін. за ред.: В.Ф.Москаленка, В.Г.Бардова, О.П.Яворовського. – Вінниця: Нова Книга, 2012. –200с.

5.Тестові завдання з соціальної медицини, організації охорони здоров'я та біостатистики: Навч. посібник для студентів медич. ф-тів / За ред. В.А. Огнєва. − Харків: Майдан, 2005. − С.44 – 46.

6.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

**In help for preparing to practical occupation:**

(fragment to lectures)

Variation series in statistics are needed to describe quantitative features of a statistical population (mean vlaues, feature heterogeneity, etc.).

Variation series are divided into ranked and unranked.

**Ranked variational series** means a series of numerical measurements of a specific feature different in value and arranged in a specific sequence.

**Unranked variational series** means a series of randomly-located variants.

Variational series consists of a variant (x), frequency (f) and number of observations (n).

Variant is a numerical value of each feature under study.

Frequency is an absolute number of individual variants in a statistical population which indicates how many times this variant appeared in variational series.

Variational series can be:

1. Simple

2. Grouped (weighted or non-interval)

3. Interval

**Simple** variational series is a set of numerical measurements where each variant is found once.

**Grouped (weighted) variational series** is a set of numerical measurements where each variant appears two or more times.

**Interval variational series** represents variantsin the form of groups.

Intervals in variational series are divided into **closed** if each of them has the upper and the lower limit, and **open** if none of the limits is specified. (Age 60 and older, height below 120 cm, etc.).

In addition, variational series are divided into ***discrete*** (**discontinuous**), where variants may only be represented by integers or obtained by calculations (distribution by heart rate, number of bed-days, attendance) and ***increte* (continuous)**, where variants are represented as integer and fractional numbers or as the result of measurements.

**Ranked variational series shall comply with the following requirements:**

1. All series must be continuous.

2. Groups must have equal intervals.

3. Variants must be placed in a certain order (ascending or descending)

4. Open groups are undesirable.

5. Each variational series should have a name.

Average feature level provides a general characteristic of quantitative features.

**Average value** is a derivative value of statistical aggregate which characterizes the overall number of observations with one number, and serves as a general characteristic of the summary statistics according to particular quantitative feature.

Average values should be determined on the basis of mass summary of facts and should apply only to *qualitatively homogenous totality* – this is the main condition of their practical and scientific use. It is not possible to determine average values if the sum of the studied features, processes or phenomena are composed of heterogeneous elements.

*Sufficient number of observations* is also an essential condition to calculate average values.

Types of average values

1. Mode (Mo).

2. Median (Me).

3. Arithmetic average (X).

4. Geometric average

5. Quadratic average, etc.

**Mode (Mo)** corresponds to features which are most frequent in the given variational series or statistical aggregate.

**Median (Me)** corresponds to features which occupy a medium position in variational series.

**Arithmetic average** is more precise in comparison with mode and median, as it is based on all the observations performed and is calculated in several ways, depending on the number of variants and availability of computers.

**Methods of calculating arithmetic average**

1. Arithmetic mean

2. Method of moments

***Arithmetic mean*** is the most common form of averages. It can be **simple** or **balanced**. For simple variational series a variant is repeated only once and is defined by **simple arithmetic mean**, which is calculated as the ratio between the variant sum and the total number of observations.

Weighted arithmetic mean is determined for grouped variations.

**Arithmetic mean has the following properties:**

1. Arithmetic mean in a symmetric row always occupies a medium position (X = Mo = Me).

2. Arithmetic mean is a generalizing, i.e. abstract value.

3. Deviation from the mean variant is always equal to zero ((Σd-X) = 0

**Average mean is widely used in practical health care:**

1. To analyze the activity of public health authorities and institutions (average bed occupancy, length of hospital stay, number of visits per capita, etc.);

2. In physical development assessment (height, weight, chest circumference, etc.);

3. To determine medical and physiological characteristics (heart rate, breathing, blood pressure, etc.);

4. To assess the data of medico-social and sanitary studies (average number of laboratory tests, average diet rates, level of radioactive contamination, etc.).

**Independent work:**

**Task 1**

On the grounds of provided in Annex 4 situational tasks to form the grouped variational row. In accordance with task necessary to define the name of the variational row.

**Grouped variational row**

Variant \_\_\_\_\_\_\_\_, taken into account by indication\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| **х** | **f** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
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|  |  |

##### Conclusion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**For notes**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Date of the performing the work \_\_\_\_\_\_\_\_\_\_Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC 6.**

**THE CHARACTERISTICS OF SIGN VARIETY (MEAN STANDARD DEVIATION, COEFFICIENT OF VARIATION)**

**The Purpose of the lesson:** To adopt the determination variety of the sign and methods of their calculation.

As a result of studies that student is obliged to:

**Know:**

The Notion of variation, its meaning. Variability parameter to totality, methods of the estimation. The Absolute indexes of variation mean standard deviation, their estimation. The Relative indexes of variation: coefficient of variation and determination. The Measures of variation, notion about law of the distribution, their types, features.

**Know how:**

Calculate indexes of the variety sign and use in practice of the physician.

**The Literature:**

1.Біостатистика / За загальної редакцією члена кореспондента АМН України, проф. В.Ф.Москаленка. − Книга плюс, 2009. − С.99-110.

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3.Посібник із соціальної медицини та організації охорони здоров’я / Під редакцією Ю.В. Вороненка. – Київ: Здоров’я. 2002. с.23 – 32.

4.Збірник тестових завдань до державного випробувань з гігієни, соціальної медицини, організації та економіки охорони здоров’я / В.Ф.Москаленко та ін. за ред.: В.Ф.Москаленка, В.Г.Бардова, О.П.Яворовського. – Вінниця: Нова Книга, 2012. –200с.

5.Тестові завдання з соціальної медицини, організації охорони здоров'я та біостатистики: Навч. посібник для студентів медич. ф-тів / За ред. В.А. Огнєва. − Харків: Майдан, 2005. − С.44 – 46.

6.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

**In help for preparing to practical occupation:**

(fragment to lectures)

Arithmetic mean has a limited significance when considered independently, as it does not reflect the fluctuations of quantitative variants in a statistical population (variational series). Therefore, it is important to take into account **the diversity (variety, variability) of the studied feature**.

 **Feature diversity (third property)** means the degree of feature heterogeneity within the statistical population.

**For example:** we have 2 statistical populations of 8 observation units. The average height of these observation units is 167 cm. However, the height of all units in group 1 is 167cm, while in group 2 it is distributed from 161 to 180 cm. It turns out that the average value does not characterize the studied quantitative feature (height) in full. Particularly, we do not know if the statistical population is homogeneous or heterogeneous according to this feature. That is why we use such term as feature diversity.

Criteria for evaluating the heterogeneity degree include: Lim – limit, Am-amplitude, -sigma – mean square deviation and coefficient of variation.

**Limit** is defined by extreme variant values in varational series

Lim Vmax ÷ Vmin

**Amplitude** is the difference between extreme variants

Am = Vmax – Vmin

**Mean square deviation** provides the most complete description of feature diversity in a statistical population, since it reflects not only extreme values of the statistical aggregate, but its internal structure.

Mean square deviation is denoted by the Greek letter δ.

Basing on the diversity of studied feature in a statistical population, we can formulate the **3 sigma rule**, which must be treated as follows.

According to the theory of mathematical statistics proven in a large number of observations, within the boundaries of **(X ± 1δ)** there will be not less than **68.3%** of total population variants. Outside of this range there can be up to 31.7% of all observations.

Within the boundaries of **(X ± 2δ**) there will be **95.5%** of all variants.

Almost the entire variational series - **99.7%** will be in the range of (**X ± 3δ**). Individual variants (up to 0.3% of the population) may not meet the general distribution principle and be excluded due to its low or high level ("skipped" variants).

**Examples of the 3 sigma rule application**

**Task 1**

1. To determine the extreme values of the given variants, provided that the average systolic blood pressure among women of 40-48 years is 120 mmhg and σ = ± 5mmhg.

**Solution**: In accordance with the 3 sigma rule, the extreme values in the variational series will be equal to 3 sigmas, which is 99.7% of the cases.

We determine the 3 sigma = ± 15mmhg (5 x 3 + 15).

Therefore, the lower limit of variational series is 105, and the upper limit is 135.

**Conclusion**: The minimum and the maximum limit of the variational series range from 105 to 135, and 99.7% of all variants will fall within these limits.

**Task 2**

The mean growth of 150 schoolgirls at age 12 years forms 137 cm and σ=2,0. What amount of the schoolgirls can have a growth within from 133cm till 141cm.

**Solving:** According to rule of 3- sigma, in limits of 1σ - 68,3% of schoolgirls; in limits of 2σ - 95,5% schoolgirls; in limits of 3σ - 99,7% schoolgirls.

Beside us limit 133 - 141 comprises of itself 2 sigma, meaning 95,5% schoolgirls.

We find 95,5% schoolgirls from 150.

100% - 150 schoolgirls.

95.5% - X

X=(150 × 95.5)/100 = 143 schoolgirls

**The coefficient of variation** is a relative measure of the variety of the sign, which is expressed in abstract, rather than referred to as number and is defined on formula:

Coefficient of variation necessary to calculate in that event if necessary to compare between itself degree of the spottiness, since in many events for this

it is impossible use mean standard deviation.

The approximate criterions of the estimation of variability on its factor are possible to consider:

 -a low level - before 10 %;

 -an mean level - 10-20 %,

 -a high level – higher than 20 %.

The high level of the coefficient is indicative of low accuracy generalizing features of the mean value, which one of the ways of increasing is an increase the number of the observations.

**Task 3**

Average duration of the treatment of patients in surgical department is 8,5 days, σ =0,5 days, in therapeutic department - 25,6 days, σ =1,2 days.

What mean is most typical?

**The Decision:** we calculate the coefficient of variation for every department.

For surgical department (0,5/8,5)\*100 = 5,8%

For therapeutic department (1,2/25,6)\*100 = 4,6%.

**The Conclusion:** the most typical mean arithmetical in therapeutic department.

The formulas of the calculation of the mean values and criterion of the variety sign are presented in section "Independent work".

**Independent work:**

Task 1

For performing the independent work it is necessary to make variational row (annex 4) carried in table 6.1. On the grounds of data this row to calculate on mean arithmetical way and value the parameters, characterizing variational row (the methods of the calculation to present in the manner of tables):

 - an Arithmetic average (X);

 - an Mean square deviation (σ);

 - a coefficient of variation.

Draw a conclusion.

**Table 6.1**

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| --- | --- | --- | --- | --- | --- |
| **Х** | **f** | **хf** | **d** | **d2** | **fd2** |
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|  |  |  |  |  |  |
|  | n | ∑ |  |  | ∑ |

The Calculation of the Arithmetic average:



X - Arithmetic average; ∑ - a sign of the summation; x – mean of variant; f - (the frequency) number repetitions each variants; n - a total number of the observations.

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The Calculation Mean square deviation (σ):



σ – the Mean square deviation (sigma); d - a deviation each variants from mean arithmetical value (h1 - X, h2 - X and etc); f - a frequencies; n - a total number of the observations.

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The Calculation of the coefficient of variation:



Сυ – coefficient of variation;

*σ* – mean standard deviation;

Х – mean arithmetical value.

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**The Scale of the estimation of the coefficient of variation:**

If the Сυ < 10% – the weak variety of the sign;

If the Сυ – 10 – 20% – mean variety;

If the Сυ > 20% – big variety

##### Conclusion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Task 2**

According number of variant (Annex 5), execute the independent work.

**Variant \_\_\_\_\_**

The Situational task to copy from Annex:

##### \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

##### The Decision:

##### \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

##### Conclusion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Date of the performing the work \_\_\_\_\_\_\_\_\_\_Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC 7.**

**THE PARAMETRIC METHODS OF THE ESTIMATION AND ANALYSIS OF THE STATISTICAL HYPOTHESISES.**

**The Purpose of the lesson.** Adopt need of the undertaking the estimation to validity result statistical research and study the methods of the estimation to validity got result and their differences.

As a result of studies of the subject student is obliged:

**Know:**

The Methods of the estimation to validity medico-biological researches (parametric and nonparametric). The Selective observation as the source to statistical information. Zero and alternative hypothesis. Inaccuracy of first and second sort. The Level to value of the statistical criterion. Mean inaccuracy of mean and relative value, confidential interval. The Estimation to validity to differences: criterion of Student, methods of the calculation, its estimation, typical mistakes of the use.

**Know how:**

Calculate the error of representativity (the mean error), confidential borders and define validity to differences got result for mean and relative values.

**The Literature:**

1. Соціальна медицина та організація охорони здоров’я / Під загальною редакцією Ю.В. Вороненка, В.Ф. Москаленка. – Тернопіль: Укрмедкнига. 2000.

2.Тестові завдання з соціальної медицини, організації охорони здоров'я та біостатистики: Навч. посібник для студентів медич. ф-тів / За ред. В.А. Огнєва. − Харків: Майдан, 2005.

3.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

**In help for preparing to practical occupation:**

(fragment to lectures)

**Representativity** (validity) - an ability of selective statistical totality greatly and realistically to characterize the general statistical totality. This indication characterize selective statistical totality only.

**Representativity** shows the extent how data obtained under selective research, differ from result, which could be received under general statistical research.

Representativity is a component element of the estimation of validity of obtained result, but estimation of validity of obtained result provides:

1. **definition of representativity** (the mean error of the mean arithmetical value, mean error of the relative value etc.)

2. **definition of confidential borders** of the indexes obtained under selective research in general statistical totality.

3. **definition of validity to differences** obtained result on criterion t, X2 etc.

The error of representativity appears in that event, when necessary on a part to characterize phenomena as a whole, on selective statistical totality - a general statistical totality. These mistakes are inevitable.

If the data, obtained under selective research (mean arithmetical, relative value, coefficient of correlation and others) carrying on general totality,it is necessary to calculate the corresponding mean errors. The Formulas of their calculation are presented in section "Independent work".

**INDEPENDENT WORK:**

**Task 1**

To estimate validity of a result of statistical researches, using the data of individual tasks on topic №5-6 "Relative values (the statistical coefficients), graphic methods of the analysis" and №8 "characteristic and analysis of statistical data, mean values and coefficient of variation ".

**For this calculate:**

 - a error of representativity: mean error of the mean arithmetical value, mean error of the relative value;

 - a confidential borders mean and relative value, obtained under selective reseach in general statistical totality, with validity of the faultless forecast not less 95%;

 - draw a conclusion.

**The data:**

*for mean values:*

|  |  |  |  |
| --- | --- | --- | --- |
| № of variant | Mean value(Х) | Mean standard deviation(σ) | Fill after calculation: |
| Mean error of mean arithmetic value (mх) | confidential bordersМ*ген* |
|  |  |  |  |  |

for relative values (birth rate or death-rate):

|  |  |  |
| --- | --- | --- |
| № of variant | Relative value (Р) | Fill after calculation: |
| Mean error of relative value (mр) | confidential borders(Р*ген*) |
|  |  |  |  |

**1. Calculate mean error of result selective research (the error of representativity):**

**a) mean error of mean arithmetical:**

, if n > 30

, if n < 30

mх – mean error mean arithmetic value;

σ – mean standard deviation (sigma);

n – a total number of the observations.

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**b) Mean error of relative value:**

, if n>30

****, if n<30

mр – mean error of relative value;

P – relative value;

q – difference between base and relative value (100% – Р)

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**2. Define the confidential borders:**

a) for mean value, obtained under selective research in general statistical totality, with validity of the faultless forecast not less 95 %;



Хgen – mean arithmetic value in general totality;

Хselec – mean value, got under selective research;

t – confidential criterion (criterion to validity of Student), its is installed researcher itself, considering amount of the observations (n) and degree of the faultless forecast – Р (Table’s meaning);

mх – mean error of mean arithmetic value.

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**а) for relative value, obtained under selective research in general statistical totality, with validity of the faultless forecast not less 95 %;**



Рgen – relative value in general totality;

Рselec – relative value in selective totality;

t – the confidential criterion (the criterion to validity of Student), which installs researcher itself, considering amount of the observations (n) and degree of the faultless forecast - P;

mр – mean error of relative value.

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##### Conclusion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Task 2**

According number of variant (Annex 6), execute the independent work.

**Variant \_\_\_\_\_**

The Situational task to copy from Annex:

##### \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |
| --- | --- | --- | --- |
| № of selective totality | Mean or relative value of statistic totality(Х or Р) | Mean error of mean arithmetic or relative value(mx or р) | Criterion to validity to differences of the statistical values(t) |
| 1. |  |  |  |
| 2. |  |  |

**а) for mean value**



Х1 &Х2 Mean arithmetic, got in two selective totalities;

m1 m2 – Mean errors of these values

t – Coefficient of validity t (Student’s criterion ).

**б) for relative values :**



Р1 & Р2 – relative values, got in two selective totalities;

m1, m2 – mean errors of these values

t – Coefficient of validity - t (Student’s criterion).

##### The Decision:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

##### Conclusion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Task 3**

According number of variant (Annex 7), do the independent work.

**Variant \_\_\_\_\_**

The Situational task to copy from Annex:

To estimate the validity of the difference in 2-h small totalities, using table of meaning of Student criterion (t).

Name of table: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |
| --- | --- | --- | --- |
| **Region** | Amount of the observations in group | Value **t** criterion | Result of the estimation |
| **1** | **2** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

##### Conclusion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**For notes**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Date of the performing the work \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signature of the teacher**\_\_\_\_\_\_\_\_\_**TOPIC 8.**

**NONPARAMETRIC METHODS OF THE ESTIMATION AND ANALYSIS OF THE STATISTICAL HYPOTHESIZES.**

**The Purpose of the lesson**: Adopt need and possibility of the undertaking the estimation to validity to differences result statistical research by nonparametric methods.

As a result of studies of the subject student is obliged to:

**Know:**

The Motivation of the events of the use nonparametric methods of the estimation, their meaning.

The Types of the compared totalities, their feature.

The Analysis and estimation result in bound totalities, criterion of signs, Wilcoxon criterion.

Checking the statistical hypothesis for independent totalities, Kolmogorov-Smirnov criterion, White criterion and serial criterion.

The Criterion χ2-square, its estimation and practical application.

**Know how:**

Choose corresponding of nonparametric criterion for estimation of validity to differences result statistical research. Calculate and value on criterions: signs, Wilcoxon, Kolmogorov-Smirnov, criterion of correspondences (*χ2*).

**The Literature:**

1.Соціальна медицина та організація охорони здоров’я / Під загальною редакцією Ю.В. Вороненка, В.Ф. Москаленка. – Тернопіль: Укрмедкнига. 2000.

2.Тестові завдання з соціальної медицини, організації охорони здоров'я та біостатистики: Навч. посібник для студентів медич. ф-тів / За ред. В.А. Огнєва. − Харків: Майдан, 2005.

3.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

**In help for preparing to practical occupation:**

(fragment to lectures)

In statistics using the parametric criterion is founded on suggestion about that that quantitative signs in statistical totality have normal (symmetrical) distribution. However this does not always exist, since many signs can have abnormal (nonsymmetrical) distribution. Often it happens to have the work with quantitative not only, but also qualitative taken into account sign, which are sometimes expressed by serial numbers, index and other sign. In such events necessary to use the nonparametric criterion. The Calculation nonparametric criterion does not require the calculation a parameter variational row. The Statistical estimation of the observations by means of nonparametric of the criterion, as a rule, more simply, than estimation by parametric methods and does not require the bulky calculation. In too time not review on simplicity calculation their reliability enough temple. Nonparametric method of the analysis is possible to use and in respect of normal distribution, but it is necessary to remember that they possess the smaller power in contrast with parametric methods. However this defect possible to compensate increase an amount observations.

The estimation to validity to differences of the under study phenomena is one of the most important sections of the using nonparametric methods. Herewith used methods nonparametric criterion possible to split into 2 groups:

-an nonparametric criterions of estimations to validity of the difference in two **interconnected** statistical totalities;

-an nonparametric criteria estimations to validity of the difference in two **independent** statistical totalities.

**The First group present:**

- Criterion of signs (Z);

-Т- criterion Wilcoxon.

**The Second group:**

-a serial criterion;

-a White’s criterion;

-Х- the criterion of Van der Varden;

- Kolmogorov-Smirnov’s criterion

**Nonparametric criteria of the estimation to validity of the difference in two interconnected statistical totalities;**

**Criterion of signs (Z)**

The Criterion of signs is used in that event, when compared results are presented in the manner of sign but if taken into account signs of the studied phenomena are presented in other form their necessary to translate in sign expressions. The Methods this criterion is based on simple conclusion: if two by two compared meaning two hung samples greatly do not differ the each other, that number positive and negative differences will turn out to be absolutely alike. But if greatly dominate the pluses or minuses, this will point to positive or negative action of the under study factor on effective sign. Herewith zero differences neither positive, nor negative result, are marked by numeral "0" and in calculation do not take.

**Т- Criterion of Wilcoxon:**

In that event, when compared samples are bound two by two some general condition and there are ambiguous quantitative change the under investigation phenomena (the reduction and increasing), that reasonable, for determination of validity difference between pair, use Т-Criterion of Wilcoxon. This criterion more powerful, than criterion of signs, it pertains to rank criterions. This method takes into account not only directivity of the difference, but also its value. By means of T- Criterion of Wilcoxon possible to compare from 6 to 25 pairs of the observations. For big amount pair critical Т- Criterion of Wilcoxon define on special formula.

**Nonparametric criteria of the estimation to validity of the difference in two independent statistical totalities.**

**Х- criterion of Van der Varden;**

This nonparametric criterion pertains to group of the rank criterion, its use by comparing with each other independent totalities, except this it allows to compare the groups with unequal amount of the observations.

**Kolmogorov-Smirnov’s criterion**

From nonparametric methods of the estimation to validity of the difference in two independent statistical totalities criterion of Kolmogorov-Smirnov the most powerful.

**INDEPENDENT WORK:**

THE TASKS:

On the grounds of provided in allowance\* the situational problems to conduct the nonparametric methods, estimation to validity to differences result statistical research:

-Criterion of signs(Z) - Annex 8;

- Т- Criterion of Wilcoxon - Annex 9;

- Kolmogorov-Smirnov’s criterion - Annex 10;

- criterion of correspondences (χ2).- Annex 11.

1. **Estimation to validity difference by means of criterion of signs *(Z),*** (Annex 8)

*Variant\_\_\_\_\_\_\_\_\_*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| Children | Directivity of the changes |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |

Amount of the observations with positive result \_\_\_\_\_\_\_

Amount of the observations with negative result \_\_\_\_\_\_\_

Number - Z \_\_\_\_\_\_\_

Critical meaning of "Z" (Urbax coefficient according table)\_\_\_\_\_\_\_\_\_

**Conclusion** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

##### 2. Estimation to validity difference by means of

##### Т- Criterion of Wilcoxon (Annex 9)

*Variant* \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Patients** |  | **Difference** | **Rank of the difference** | **Meaning of rank with sign (-)** | **Meaning of rank with sign (+)** |
|  |  |
| **1** | 2 | 3 | 4 | 5 | 6 | 7 |
| **1** |  |  |  |  |  |  |
| **2** |  |  |  |  |  |  |
| **3** |  |  |  |  |  |  |
| **4** |  |  |  |  |  |  |
| **5** |  |  |  |  |  |  |
| **6** |  |  |  |  |  |  |
| **7** |  |  |  |  |  |  |
| **8** |  |  |  |  |  |  |

**The Calculation:**

Sum total rank with sign (+) Т =\_\_\_\_\_\_\_

Sum total rank with sign (-) - Т=\_\_\_\_\_\_\_

Used "T" for conclusion \_\_\_\_\_\_\_

Border meaning of Т-Criterion of Wilcoxonfor interconnected totalities (Urbax coefficient according table)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Conclusion** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***3.* Estimation to validity difference by means of Kolmogorov-Smirnov’s criterion**

##### (Annex 10):

***Variant*** \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variants*x* and *y*in source order | Frequency variant on group | Accumulative frequency on group | Accumulative share | Difference |
| Рх | Ру | Sх | Sу |  |  | - |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
|   |  |  |  |  |  |  |  |
|   |  |  |  |  |  |  |  |
|   |  |  |  |  |  |  |  |
|   |  |  |  |  |  |  |  |
|   |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
|   |  |  |  |  |  |  |  |
|   |  |  |  |  |  |  |  |
|   |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

The Calculation

nx\_\_\_\_\_\_\_\_\_\_\_\_

ny\_\_\_\_\_\_\_\_\_\_\_\_

Most difference accumulative frequencies (D), column 8\_\_\_\_\_\_\_\_\_\_

Table meaning λ2 0,05 \_\_\_\_\_\_\_\_\_\_\_\_\_\_

To Define criterion λ2  on formula:

 =*--------------------------------------------------* = \_\_\_

D - most difference of accumulative frequencies;

**Conclusion** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***4.* Estimation to validity difference by means of criterion of the correspondence to - *( χ2)***

##### (Annex 11)

*Variant* \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Amount of examined | Of them | Expected amount | Р-Р΄ |  |  |
|  |  |  |  |  |  |  |  |
| (Р) | (Р΄) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Total | Abs. |  |  |  |  |  |  |  |  |  |
| % |  |  |  |  |  |  |  |  |  |

**The Calculation**

Amount "degrees of the liberty" define on formula:

n ́=(S-1)\*(r-1),

S - amount gradation (column 3 and 4)\_\_\_\_\_\_\_\_\_\_\_

r - amount of the compared groups \_\_\_\_\_\_\_\_\_\_\_\_

Table meaning of criterion correspondences to if n ́= \_\_\_\_,

 χ2 0,05=\_\_\_\_\_\_\_\_\_\_

 Calculation criterion correspondences (χ2) on formula:

 χ2 =  = ------------------------- = \_\_\_\_\_\_\_\_\_\_.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Conclusion** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Date of the performing the work \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC 9.**

**ANALYSIS INTERCOMMUNICATION BETWEEN INVESTIGATION PARAMETERS OF THE STATISTICAL TOTALITY (CORRELATIVE-REGRESSIVE ANALYSIS)**

**The Purpose of the lesson**: Adopt essence a relationship between phenomena’s or sign and methods of its determination.

As a result of studies of the subject student is obliged:

**Know:**

The Study relationship between quantitative variable. The Notion about functional and correlative relationship. The Correlation, types factor to correlations. The coefficient to linear correlation, its estimation, feature.

Nonparametric methods of the estimation relationship - a rank coefficient to correlations. Regressive analysis, coefficient to regressions, equation to regressions. Use the regressive analysis for practical activity.

**Know how:**

Calculate the coefficient to correlations on method square and rank, value the nature, power relationship, its validity; use the coefficient to correlations in practical activity.

**The Literature:**

1. Біостатистика / За загальної редакцією члена кореспондента АМН України, проф.В.Ф.Москаленка. − Книга плюс, 2009. − С.124-134.

2.Соціальна медицина та організація охорони здоров’я / Під загальною редакцією Ю.В. Вороненка, В.Ф. Москаленка. – Тернопіль: Укрмедкнига. 2000.

3.Тестові завдання з соціальної медицини, організації охорони здоров'я та біостатистики: Навч. посібник для студентів медич. ф-тів / За ред. В.А. Огнєва. − Харків: Майдан, 2005.

4.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

**In help for preparing to practical occupation:**

(fragment to lectures)

**The fifth property of statistical population characterizes the relationship between features.**

There are two forms of quantitative relationships between phenomena and processes:

-functional;

 -correlation.

**Functional relationship** is a relationship in which the value of one feature strictly corresponds to the value of other interrelated feature. (Radius of a circle corresponds to specific circle area).

**Correlation relationship** means a relationship in which the average value of one feature corresponds to several values of other interrelated feature.

Correlation is shown only within a statistical population. Using the correlation method, it is important to remember that the relationship between different features can be measured only in a qualitatively uniform statistical population.

**The correlation relationship can be expressed in the form of:**

- Tables;

- Graphics;

- Correlation rate.

The lack of tables and graphs is that they reflect the relationship and its directions, but do not describe the extent of correlation dependency.

**Correlation rate** (Rxy) measures relationship strength and directions with only one figure.

**Correlation strength** is the degree of conjugation between different features, or degree of dependence of one feature from another.

Correlation strength is measured within 0 and ± 1, wherein:

0 to ± 0,29 means weak dependence.

0.3 to ± 0,69 means average dependence.

0.7 to ± 1 means strong dependence

Correlation directions can be divided into:

- Direct;

- Reverse.

In case of **direct correlation** changing average value of a feature results in changing average value of other interrelated feature (For example: increase in temperature results in pulse rate increase). Direct correlation is marked with (+) sign.

In case of **reverse correlation** changed the average value of one feature results in opposite change of the average value of other interrelated feature. (Eg: in the autumn, lower temperatures result in higher incidence among children). Reverse correlation is marke dwith (-).

**In addition, correlation can be:**

- Straight

- Curved

Straight correlation is characterized by a relative uniform change in the average values of one feature with equal changes of another feature (for example, correspondence between the highest and lowest levels of blood pressure).

In case of curved correlation, a uniform change in the value of one feature can result in increasing or decreasing value of another feature.

The relationship between different features is measured with correlation coefficient in case of straight correlation, and with correlation rate in case of curved correlations.

**The most common calculation methods are:**

- Square method (Pearson's method)

- Spearman's rank correlation method

**Independent work:**

Task 1

##### On the grounds of provided the situational tasks (Annex 12) to define and estimate the coefficient to rank correlation. Draw a conclusion. The Results to present in the tables.

Situational task \_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Order number of indication | Difference of ranks | Square of rank’s difference |
| х | y | x | y | (x- y) |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  | ∑d2 |

The Calculation of the coefficient to rank correlation (Spirmen method):

,

X & Y – phenomena’s, between which is defined relationship;

ρ – coefficient to rank correlation;

d2 – difference rank in square;

n – amount under investigation pairs

##### \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**To estimate the validity of the coefficient to rank correlation (CRC):**

a) To define mean error CRC:

, if n<30

, if n>30,

mρ – mean error of the coefficient of rank correlation;

ρ – coefficient of rank correlation in square;

n – amount under investigation pairs

##### \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

б) To define criterion to validity (Student’s criterion – t):

,

t – criterion to validity (Student’s criterion);

ρ – coefficient of rank correlation;

mρ – error of the coefficient of rank correlation.

##### \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) To estimate the criterion to validity on table of meaning of Student’s criterion: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

For calculations of the coefficient to linear correlation (Pirson) use the formula:



х & у – phenomena’s, between which is defined relationship;

dx dy deflections of each meaning x and y from corresponding means arithmetical (Xх & Xу).

to define the error of the coefficient to linear correlation:

, if n<30

, if n>30

mr – mean error coefficient to linear correlation;

r2 – coefficient to linear correlation in square;

n – amount under investigation pairs

to define criterion of validity (Student’s criterion – t):

,

t – criterion to validity (Student’s criterion);

r – coefficient to linear correlation;

mr – mean error coefficient to linear correlation.

**Regression rate** shows average changes in the second feature when the first feature is changed by a specific unit. It is associated with a correlation coefficient and is calculated using the following formula:

,

Rx/y - coefficient to regressions of the sign *х* for y;

 rx/y - coefficient of correlation;

 σ х – mean square deviation of sign *х*;

σ y – mean square deviation of sign y.

**For notes**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Date of the performing the work \_\_\_\_\_\_\_\_\_\_Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC 10.**

**THE METHOD OF STANDARDIZATION.**

**The Purpose of the lesson**: Get acquainted with possibility of the use standardisation indexes in practical person of the public health and study the methods of their calculation.

As a result of studies of the subject student is obliged:

**Know:**

Problems of statistics rate comparison. Types of standardization, their characteristics and evaluation. The essence, meaning and application of standards to determine the effect of different factors on public health and the activities of health care institutions. Calculation of standard rates by direct method and their analysis.

**Know how:**

Calculate the standardizations indexes, do the conclusions, use in practical activity.

**The Literature:**

1. Біостатистика / За загальної редакцією члена кореспондента АМН України, проф.В.Ф.Москаленка. − Книга плюс, 2009. − С.86-90.

2.Соціальна медицина та організація охорони здоров’я / Під загальною редакцією Ю.В. Вороненка, В.Ф. Москаленка. – Тернопіль: Укрмедкнига. 2000.

3.Тестові завдання з соціальної медицини, організації охорони здоров'я та біостатистики: Навч. посібник для студентів медич. ф-тів / За ред. В.А. Огнєва. − Харків: Майдан, 2005.

4.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

**In help for preparing to practical occupation:**

(fragment to lectures)

Comparing the general intensive indicators, is necessary to comply with the most important condition - the homogeneity of compared populations, especially in features which can affect the overall rates. Thus, mortality rate in a hospital depends on several factors (severity of illness, age, quality of treatment, care, delivery of patients requiring emergency surgery, etc.).

In these cases, differences in the overall rates may be caused by heterogeneity of compared groups. The impact of these adverse factors should be excluded, otherwise the comparison of the phenomena studied in these cases is meaningless. To eliminate the influence of adverse factors on the frequency of the phenomena studied in heterogeneous populations, we can use standardization method.

**Standardization method** is the method of calculating conditional (standard) rates which replace intensive rates in cases where the latter comparison is difficult due to lack of comparability among groups.

**Standard rates** show what general indices in comparable populations could have been if they were homogeneous. The ability to use this method during data analysis has a significant practical value, and therefore, is extremely important.

**Practical importance of standardization method:**

-It allows to compare the frequency of similar phenomena in heterogeneous groups;

-It allows to evaluate the influence of studied factors (heterogeneity) on the the phenomenon under study.

**There are three methods for determining standard rates:**

-direct;

-reverse;

-indirect

Methods are selected according to the form of primary material.

**Direct standardization method** is used if we have enough data on the composition of the population and the composition of the phenomenon under investigation (age, sex, profession, etc.).

**Indirect method** is used if there is no distribution of specific features, or if we have small number of groups, which reduces results reliability.

**Reverse method** is used when there is no data on the structure of the population in compared groups.

**Direct standardization method** is most widely used in biomedical research.

**Direct method includes 5 basic steps:**

Step 1 - Calculation of intra-group and general intensive indicators;

Step 2 - Selection and calculation of a standard;

Step 3 - Calculation of expected values based on the standard;

Step 4- Calculation of standard rates;

Step 5 - Comparison of intensive and standard rates. Conclusions.

**Independent work:**

Task 1

According the situational tasks (Annex 13), calculate the standardizations indexes by direct method and draw a conclusion. The Results to present in the manner of tables.

Table\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Region \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name of table \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **1-stage** calculation of intra-group and general intensive indexes |  |  |  |  |  |  |  |  |  |  |
| **2- stage**Selection and calculation of a standard |  |  |  |  |  |  |  |  |  |  |
| **3- stage** calculation of the expected values based on the standard |  |  |  |  |  |  |  |  |  |  |
| **4- stage** Calculation of standard rates |  |  |

**The Calculation of standardizations indexes:**

**1 - stage** - *Calculation of intra-group and general intensive indicators:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**2 - stage** - *Selection and calculation of a standard (for standard is recommended to take the amount of the compared phenomena’s):*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**3 - stage** - *Calculation of expected values based on the standard:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**4 - stage** - *Calculation of standard rates:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

 **5 - stage** - *a comparison intensive and* *standardizations rates:*

|  |  |  |  |
| --- | --- | --- | --- |
| Indexes |  |  | Results of the comparison |
| intensive indexes |  |  |  |
| Standardized factor |  |  |  |

**Conclusion**

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

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**For notes**

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**Date of the performing the work \_\_\_\_\_\_\_\_\_\_Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC 11.**

**THE DYNAMIC ROWS AND THEIR ANALYSIS.**

**The Purpose of the lesson:** to get acquainted with possibility, condition and methods of the analysis of the dynamic rows.

As a result of studies of the subject student is obliged to:

**Know:**

The Types of the rows of dynamic, the Main rules of the building and analysis of the dynamic rows at study dynamic medical-biological phenomena, the main indexes of the analysis of the dynamic rows, the Main receiving the processing the dynamic row for the reason determinations trend, the Study and measurement of the seasonal fluctuations in rows of dynamic, the Correlation of the dynamic rows, the Interpolation and extrapolation in rows of dynamic, the Forecasting on base of the extrapolations of the rows of dynamic.

**Know how:**

To calculate and value the indexes of the dynamic row, conduct the transformation and levelling the dynamic row by different methods.

**The Literature:**

1. Біостатистика / За загальної редакцією члена кореспондента АМН України, проф.В.Ф.Москаленка. − Книга плюс, 2009. − С.91-98.

2.Соціальна медицина та організація охорони здоров’я / Під загальною редакцією Ю.В. Вороненка, В.Ф. Москаленка. – Тернопіль: Укрмедкнига. 2000.

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4.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

**In help for preparing to practical lesson:**

(fragment to lectures)

In order to identify patterns in health status and medical care level, corresponding figures are analyzed in dynamics (medical service rate, bed population ratio, average annual number of visits per 1 inhabitant; birth rate, mortality, morbidity).

However, the dynamics is sometimes presented with not gradual, but with directional changes, in the form of fluctuations to one direction or another. This may depend on the general trend of changes and the influence of random factors.

To eliminate possible impacts and to identify random changes, you need to convert or align time series using appropriate methods depending on the nature and purpose of the studied phenomena.

The phenomenon may vary at different rates, so the analysis of its dynamics should include special time series indicators. It is very important when we conduct a comparative analysis of multiple time series (indicators change in different areas or in different groups). Therefore, all doctors should be aware of the time series method.

**Dynamic rows** means a series of statistical values that show changes in the phenomenon over time and is arranged in chronological order at specific intervals.

Dynamics and indicators of time (years, quarters, months, etc.) are the main elements of Dynamic rows.

**The Level of the row** is a magnitude constituting time series - the extent of a phenomenon over a certain period or within a specified period of time.

Depending on the levels which indicate phenomena state, Dynamic rows can be divided into:

1. ***Instant (Moment)*** - characterize a phenomenon at a particular time (staff, beds by the end of the calendar year, patients identified during medical examinations).

2. ***Interval*** – series levels are for a certain period of time (admission to hospitals, annual death rate, number of emergency calls during the day).

Different interval and instant series are defined with different features. Since the levels of interval series are equal to the total phenomenon size over time, they depend on the duration of a certain period of time and can be represented as a final outcome. Instant series contain elements of review calculation (for example, population of Ukraine according to the census), so it is impossible to summarize the results.

**Values studied in dynamics (*The Level of the row*) may be represented as:**

-Absolute numbers

-Relative numbers (intensive indicators, ratios)

-Mean values.

According to given criteria time series can be divided into absolute, relative and mean.

It is not always possible to use absolute values when studying the dynamics, since they are often associated with changes in the population or the number of bases.

For example, reduced number of admission to hospitals can be associated with a reduction of hospital beds over a period of time rather than with actual health outcomes. Examination of extensive indicators (structure) in dynamics is in most cases inappropriate, and can be performed only in special cases, provided a clear interpretation and reflected changes in the structure of the entire to totality.

**Depending on the intervals between levels** time series can be divided into equidistant (uniform intervals between the dates) and non-equidistant (irregular time intervals or time periods).

**According to the nature of processes presented**, Dynamic rows can be divided into ***stationary*** and ***nonstationary***.

If mathematically expected (forecasted) characteristic values and parameters of stability (standard deviation, coefficient of variation) are constant, independent of time, the process is called **stationary**. Such series shall be also called stationary.

**Medical and social processes** over time, as a rule, are not fixed, because each of them has a certain tendency of development. Such time series are called **nonstationary**.

An important condition for the proper construction of Dynamic rows and its further characterization is to compare its individual levels. Comparing the data over time, you must always keep in mind the territorial and qualitative comparison of the results.

**The main reasons that make it difficult or impossible to compare levels of Dynamic rows** **are as follows:**

- Changed measurement or accounting units (estimation of economic efficiency of medical institutions in different cash equivalents over given periods - rubles, coupons, hryvnias, US dollars);

- Irregular periodization (quantitative – by year, qualitative - by social and economic period, change in priority of different types of institutions, in the structure of therapeutic and preventive care);

- Changes in the list of analysis objects (transfer of medical institutions from one submission to another);

- Changes in territorial boundaries of regions, districts, etc. ..

If you have the above conditions, the problem is usually solved by recalculation.

Methods of medical statistics allow to assess changes occurred over a period of time, and quantify their development. For this purpose, we use the following indicators: **absolute growth, growth rate, increment rate**.

Time series are not always composed of sequentially reducing or increasing levels. Dynamic rows levels often fluctuate, making it complicated to identify the pattern of a phenomenon. In these case, we need to align time series in order to determine the dynamic tendencies.

**There are several ways to solve this problem:**

-to strengthen Dynamic rows intervals;

-to align Dynamic rows with the help of group average;

-to align Dynamic rows with the help of moving average;

**Intervals can be enlarged** by summing the data of a number of adjacent levels.

**Aligning Dynamic rows** **with the help of group average.**

Dynamic rows can be aligned with the help of group average by summing adjacent levels of adjacent periods, and then dividing the resulting sum by the number of terms.

**Aligning Dynamic rows** **with the help of moving average;**

Moving average allows each to replace each level by the average value of level data and two levels adjacent to it.

**For the analysis of Dynamic rows** **we use a number of indicators that characterize phenomenon changes over certain periods of time. These include:**

-absolute increment (or decrease);

-increment rate (or decrease rate);

-growth rate;

-absolute value of 1% of increment.

**Absolute increment** is the difference between a certain level of time series and the previous level. It shows how the level changed over a certain period in comparison to the previous one.

**Increment rate** is the ratio of the number of levels to the level which is accepted as a basis, expressed as a percentage. It shows the percentage increase or decrease in specific level over a certain period.

**Growth rate** is the ratio of absolute increment over the period to the absolute increment of the previous period, expressed as a percentage.

**Absolute value** is the ratio of absolute increment to the increment rate.

**Independent work:**

**Task**

On the grounds of provided the situational tasks (Annex 14):

 - calculate the indexes of the dynamic row;

 - estimate the got indexes and prepare a conclusion.

The Results to present in the tables.

**Table**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **Region** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name of table \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| --- | --- | --- | --- | --- | --- |
| **Years** |  | Absolute increment | Increment rate **%** | Growth rate **%** | Absolute value of 1% of increment |
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**The Decision:**

*The Absolute* increment *(the decrease) - a difference between the following and previous level.*

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*The Increment rate* *or rate to decreases - a percent attitude following level to previous.*

##### \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*The Growth rate**- a percent attitude of the absolute increase (the decreases) to previous level.*

##### \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

##### Absolute value of 1% of increment - an attitude of the absolute increase to growth rate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

##### Conclusion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**For notes**

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**Date of the performing the work \_\_\_\_\_\_\_\_\_\_Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC 12.**

**Design of epidemiological STUDIES:**

**Case-control, COHORT, randomized clinical STUDIES.**

**GOLD STANDARD.**

**The purpose of the lesson:** to get acquainted with basics of the design of epidemiological studies (case-control, cohort, randomized clinical studies), with the concept of "Gold Standard".

As a result of studies of the subject student is obliged to:

**Know:**

The concept of modern epidemiology. Classification of epidemiological studies. Comparative characteristics of different types of studies, assessment of the evidence and results. Empirical and experimental studies. Retrospective and prospective studies. Empirical studies (descriptive and analytical). Descriptive epidemiology: a description of the individual case and case series. Analytical epidemiological studies. Cohort studies and case-control studies.

Design of epidemiological studies: a case-control, cohort, randomized clinical studies. Gold standard. Design of epidemiological and clinical studies. Research ethics. Types of design. Types of control. "Blindness" studies. The required sample size. Selecting an object and research units. The criteria for inclusion and deactivation. The concept of randomization and stratification.

**Know how:**

Identify methods of epidemiological studies and to form its design.

**The Literature:**

1.Епідеміологічні методи вивчання неінфекційних захворювань: навчальний посібник / В. М. Лехан, Ю. В. Вороненко, О. М. Максименко та інш. – К.: Сфера, 2005.–204с.

2.Общая эпидемиология с основами доказательной медицины: руководство к практическим занятиям: учебное пособие / под редакцией В.И.Покровского, Н.И.Брико. – 2-е изд., испр. и доп. – М.: ГЭОТАР-Медиа, 2012. – 496 с.: ил.

3.Біостатистика / за заг. ред. чл.-кор. АМН України, проф. В.Ф. Москаленка. – К. : Книга плюс, 2009. − С. 57-135.

4. Огнев В.А. Эпидемиология астмы и аллергии у детей: монография.– Харків.– «Щедра садиба плюс», 2015. –336с.

5.Социальная медицина, общественное здоровье (биостатистика): методические разработки для студентов к проведению практического занятия по теме ***«***Дизайн эпидемиологических исследований: случай-контроль, когортные, рандомизированные клинические исследования. Золотой стандарт***»*** для подготовки студентов по специальности 7.12010001 «Лечебное дело», 7.12010002, «Педиатрия», 7.12010003 «Медико-профилактическое дело», 7.12010005 «Стоматология» / сост. В.А. Огнев, И.А. Чухно, А.В. и др. – Харьков :ХНМУ, 2018. – 32с.

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**Independent work:**

**Situational task**

In the regional settlement, the N. region, it is necessary to organize and conduct a multi-purpose selective epidemiological study to identify the incidence among the population and establish their causal relationship with the goal of developing a regional program for the preservation and promotion of public health. The estimated prevalence of diseases among the population and number of population are known. The settlement is located in close proximity to a large industrial enterprise. Source data of the situational problem must be transferred from Annex 15 of this notebook.

**The task:**

-establish the degree of reliability of the planned study,

-determine the necessary number of people for inclusion in the sample statistical aggregate;

-determine the best methods of epidemiological study to achieve this goal, depending on the task (the tasks are presented in Table \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

-Draw conclusions

During independent work of students, the teacher answers the questions that arise and monitors the correctness of the assignment. After finishing the independent work, the teacher checks the task.

**Decision** **of the task:**

1. **Source data and establishing the degree of reliability of the planned study:**

**N –** number ofpopulation - \_\_\_\_\_\_\_\_\_ persons.

**I** - estimated prevalence of diseases \_\_\_\_\_\_\_ ‰.

t - the reliability criterion is taken equal to 1.96 ≈ 2.

**Δ -** The maximum allowable error shouldn’t be more than 25% of the value of the index (**I**). Consequently, **Δ** will be 25% of the \_\_\_\_\_ i.e.:

 **Δ**= (25×\_\_\_\_\_\_\_) / 100 = \_\_\_\_\_ ‰, **Δ2**= \_\_\_\_\_ ‰

**2. Determination of the number of people to be included in the selective statistical population for the study of disease;**

In the case of a known population size, the sample size is determined by the formula:



Where:

**n**- required sample size;

**N**- number of population;

t- reliability criterion (equal to 1.96 ≈ 2)

**I**- the estimated frequency diseases

**q = (R- I)** where, R is used dimensionality of index I

**Δ -** selected maximum permissible error of the indicator. It’s 25% of the indicator (**I**).**Δ** *= \_\_\_\_\_\_\_ ‰*

n = (\_\_\_\_\_×(1000 -\_\_\_\_\_) × 22 × \_\_\_\_\_\_) /

 (\_\_\_\_\_ × \_\_\_\_\_) + (\_\_\_\_×(1000 -\_\_\_\_\_)×22) = \_\_\_\_\_\_ people**.**

**3.** **To determine the optimal methods of epidemiological study to achieve this goal, depending on the task**

Optimal research methods

in relation to various issues of medicine and health

|  |  |
| --- | --- |
| **Task (to study):** | **Optimal method** |
| Prevalence |  |
| The frequency of occurrence of new cases (diseases, their consequences) |  |
| The risk of occurrence |  |
| Prediction of morbidity |  |
| Diagnosis of diseases |  |
| Treatment of diseases |  |
| Disease prevention |  |
| Cause |  |

**Conclusion: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**For notes**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date of the performing the work \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC 13.**

**SCREENING. ASSESSMENT METHODOLOGY THE SENSITIVITY AND SPECIFICITY OF SCREENING TESTS.**

**The purpose of the lesson:** To study the screening method for obtaining statistical information.

As a result of studies of the subject student is obliged to:

**Know:**

Skrinng. Evaluation of the screening results. Requirements to screening tests. Sensitivity and specificity of the screening test, the methodology of calculation and assessment. Relationship between sensitivity and specificity. The concept of the ROC-analysis. Prognostic factors and risk factors, their significance and possibility of using.

**Know how:**

Apply the screening method in the practical activity of the doctor, to master the methodology of calculating risk indicators and their evaluation.

**The Literature:**

1.Епідеміологічні методи вивчання неінфекційних захворювань: навчальний посібник / В. М. Лехан, Ю. В. Вороненко, О. М. Максименко та інш. – К.: Сфера, 2005.–204с.

2.Общая эпидемиология с основами доказательной медицины: руководство к практическим занятиям: учебное пособие / под редакцией В.И.Покровского, Н.И.Брико. – 2-е изд., испр. и доп. – М.: ГЭОТАР-Медиа, 2012. – 496 с.: ил.

3. Біостатистика / за заг. ред. чл.-кор. АМН України, проф. В.Ф. Москаленка. – К. : Книга плюс, 2009. − С. 31-51.

4. Огнев В.А. Эпидемиология астмы и аллергии у детей: монография.– Харків.– «Щедра садиба плюс», 2015. –336с.

5.Социальная медицина, общественное здоровье (биостатистика): методические разработки для преподавателей к проведению практического занятия по теме « Скрининг. Методики оценки эффективности скрининговых тестов» для подготовки студентов по специальности 7.12010001 «Лечебное дело», 7.12010002, «Педиатрия», 7.12010003 «Медико-профилактическое дело», 7.12010005 «Стоматология» / сост. В.А. Огнев, И.А.Чухно, и др. – Харьков :ХНМУ, 2018. – 28с.

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**Independent work:**

**task №1**

In the medical institution of the locality, located in close proximity to a large industrial complex, a selective screening test was conducted among the population to identify the incidence. The corresponding results were obtained for the screening test. Source data of the situational problem must be transferred from Annex 16 of this notebook to Table. 13.1.

**The task:**

It is necessary according to the results of the screening test:

-To calculate the accuracy indicators (sensitivity, specificity, prognostic value of positive and negative result) and reproducibility (indicator of compliance and reproducibility);

-To conduct ROC-analysis (to assess the quality of the screening test);-Draw conclusions.

During independent work of students, the teacher answers the questions that arise and monitors the correctness of the assignment. After finishing the independent work, the teacher checks the task.

Table 13.1

|  |  |  |
| --- | --- | --- |
| Screening-test | Medical examination | Total |
| Present | Absent |
| Positive | \_\_\_\_\_ (a) | \_\_\_\_\_ (b) | \_\_\_\_\_\_ |
| Negative | **\_\_\_\_\_**(C) | \_\_\_\_\_ (d) | \_\_\_\_\_\_ |
| Total | \_\_\_\_\_ (a + c) | \_\_\_\_\_ (b + d) | \_\_\_\_\_ (a + b + c + d) |

**Sensitivity indicator:**

$$\frac{a}{a+c}\*100= \frac{}{} \*100=\\_\\_\\_\\_\\_\%$$

**Specificity indicator:**

$$\frac{d}{b+d}\*100= \frac{}{} \*100=\\_\\_\\_\\_\\_\\_\%$$

**The positive predictive value (PPV):**

$$\frac{a}{a+b}\*100= \frac{}{} \*100=\\_\\_\\_\\_\\_\\_\\_\%$$

**The negative predictive value (NPV):**

$$\frac{d}{c+d}\*100=\frac{}{} \*100 =\\_\\_\\_\\_\\_\\_\\_\% $$

**Compliance indicator:**

$$\frac{a+d}{a+b+c+d}\*100= \frac{}{} \*100=\\_\\_\\_\\_\\_\\_\\_\\_\%$$

**Reproducibility indicator:**

$$\frac{a}{a+b+c}\*100= \frac{}{} \*100=\\_\\_\\_\\_\\_\\_\\_\\_\%$$

**2. ROC -** analysis of the screening test

|  |
| --- |
| *Sensitivity* |

 *1-specificity*

**Conclusion:**

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**Date of the performing the work \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC 14**.

**THE RISK FACTORS, METHODS OF CALCULATION AND THER ESTIMATION.**

**The Purpose of the lesson:** to know the notion "Factors of risk" and to study the main methods of their quantitative estimation.

As a result of studying the topic, student is obliged to:

**Know:**

The Notion of factor of risk. The Factors of risk, methods of their calculation and analysis. Absolute, additional risk. The Relative risk, additional population risk. The Attitude of chances. Practical use the methods of the estimation risk.

**Know how:**

Estimate value of risk factors and define their role in arising of diseases or its upshot in populations.

**The Literature:**

1.Соціальна медицина та організація охорони здоров’я / Під загальною редакцією Ю.В. Вороненка, В.Ф. Москаленка. – Тернопіль: Укрмедкнига. 2000.

2.Тестові завдання з соціальної медицини, організації охорони здоров'я та біостатистики: Навч. посібник для студентів медич. ф-тів / За ред. В.А. Огнєва. − Харків: Майдан, 2005.

3.Lectures for Biostatistic. Department of public health and healthcare management, KNMU

***Help for preparing for practical occupation:***

*(fragment to lectures)*

**The Factors of risk (risk factor**) - a factor, which itself is not the reason of the disease or deaths of the person, but it creates the condition of the deterioration of the condition of its health to developing of the diseases up to the deaths.

Risk factors often are not the direct cause of the diseases. Interest to this phenomenon grew invariably high recently due to the following reasons:

-a direct reason for many chronic diseases are found (For example, malignant neoplasm’s, coronary heart disease, endocrine diseases and others);

-many diseases are polyetiological and it is difficult to select the possible direct reason;

-the possibility of the use the knowledge’s about factor of the risk in practice (for prognosis of the arising the diseases, in diagnostic process, in purpose of the preventive maintenance).

Necessary to remember that under simultaneous influence of several risk factors, the resulting risk can be more or less, than it is expected under simple summation of the influence of separate factors or reasons. If the general result is more than the amount of the influences of the separate reasons, this phenomenon is identified Synergism and if less - Antagonism.

**The Factors of risk** of the disease or death can be of endogenous or exogenous origins. Amongst them there are controlled (unhealthy lifestyle, contamination of surrounding, arterial hypertension and other) and uncontrolled (the age, sex, heredity, climate, natural conditions and others) factors. These factors are numerous.

**It is necessary to know that the notion “Risk factor” is conserved for the risk factor that has not yet caused the disease or death; hereon it’s more correct to adopt the notion, “the reason” of the disease or deaths of the person.**

A strong proof about the notion, factor is the causative reason or is the factor of the risk, is defined by the type of study. The Best way to realise, the maximal potential factors for probability of the development of the disease, was through experiment. However studying of the influence of a majority of factors of risk on person by means of experimental studies is impossible. So we usually use the more sparing methods of the study – the empirical method(descriptive and analytical).

In the course of these investigations, spreading of factor of risk, time of appearance and frequency of the diseases or their upshot beside participant of the study are included, but then causal relationship are fixed by means of the mathematical statistical methods. Hypothesis is formulated on result of the descriptive studies about reason of the diseases, which is subsequently checked in analytical and, as much as possible, in experimental studies.

In epidemiological investigations information about risk factor is collected by means of questioning, with provision for data monitoring (ecological, social-hygienic) and etc.

One of the most complete models which help to track the relations between reason and disease, is founded on polyfactorial nature of the reasons of the many diseases. In accordance with this model all factors of risk (the reasons of the diseases) are possibly divide into:

-sufficient,

 -additional

 -and necessary.

**The Sufficient risk factors** are such factors, which inevitably bring about determined consequences. The Single risk factor of the diseases as a rule is not sufficient. For example, using the fat food will bring about the development atherosclerosis, since this factor affect many factors of endogenous and exogenous nature.

**The risk factors** not being sufficient by themselves will be **additional**. For example, hyperlipidemiya, arterial hypertension, smoking are considered factors, which influence the heart attack of the myocardium.

**The Necessary factor** of risk is that factor when present bring about the disease without fall. For example, contamination mycobacterium tuberculosis - a necessity, but insufficient condition for development of the tuberculosis since not everyone infected develops the disease.

In epidemiological investigations for feature of health to populations and determinations of the influence of risk factors on disease and death-rate we use the quantitative approaches. Different indexes are used for different types of the epidemiological studies. Depending on problems of the epidemiological studies most often use are two factors of frequency:

 **- spreading (the general sick-rate);**

 **- and frequency of the new events** (the sick-rate, own sick-rate), contents and methods of the calculation which greatly differ from similar factors in traditional medical statistics.

**Spreading** **(Prevalence rate - PR)** gives the belief about counting and calculating of the list of all events of the revealed diseases (the upshot - invalidity, death-rate) in determined length of time (for instance, for year) or about counting and calculating list of persons or sufferings determined by disease at the time of examinations (in spite of the fact that examination can last several weeks or months).

Most often information on spreading of diseases amongst populations are obtained when undertaking single-moment and transverse epidemiological study.

**Example of the calculation of the coefficient of spreading:**

When undertaking the medical examination of 2000 women at age 70-74 years, 80 of them is diagnosed arthritis rheumatics. Factor of spreading is calculated as the attitude of the number of persons, which exists under the study condition, to all examined for determined period of time

 ****

The Conclusion: arthritis rheumatic women of age 70-74 years meet with frequency of 40 events on 1000 women.

The Frequency of the new events of disease in populations is identified as the **incidence rate**. The incidence rate characterizes the rate, velocity of the appearance of the new events of the diseases determined most often in one year. The appearance is met under new events or finding of sick persons, who did not suffer before. In this connection to population, the subject of risk, does not include the persons, already sufferings from considered diseases, since new events need to be revealed. The Population, subject of risk, form all people, who can develop the given disease. The level of diseases characterizes the probability of the risk of the arising the disease in populations. If one population has a higher index of incidence rate, than the other, then it is possible to say that this population has higher risk of developing the diseases.

**The indexes of incidence rate** can be of two types and obtain when undertaking cohort studies:

a).**cumulative (accumulated) coefficient of sick-rate** (cumulative incidence rate, CI );

b).**coefficient sick-rate** (incidence rate, incidence density - IR).

**The Cumulative** **coefficient of sick-rate** – a portion of the healthy persons, who fall ill during determined period of the study

 The Value of cumulative sick-rate is directly connected with the duration of the period of observation: when longer, that above factor is cumulative sick-rate.

Example of the calculation of the coefficient to sick-rate:

For studying the sick-rate, scientists have selected the cohort, excluded from it are persons, in whom his diagnosis was already made, in single-moment study. The Cohort from 2000 persons existed on length of 15 years. Through each 2,5 participants were examined. At the end of observation period 90 persons were diagnosed.

Cumulative coefficient to sick-rate

 ****

The Conclusion: cumulative coefficient of dimension during 15 years has formed under investigation of cohort - 45 events per 1000 persons.

Coming from that, the time of the development of the disease for participant cohort studies will be different (beside each its period of the development of the disease), is incorporated in the notion “**Value to duration of the risk”**, which is measured in person-year and presents itself with the amount of time of the observation for each patient before arising of event (the upshot).

For example, duration of the risk for person, which develop the disease in 7 years after beginning of observations, forms 7 years; for person, in which disease appeared in a year, - risk 1. The Adding number of the persons with miscellaneous duration of the risk, we get total duration of the risk.

The index of sick-rate characterizing the occurrence of new diseases, received in such study, is identified the coefficient of sick-rate (incidence rate, incidence density - IR).

**The Example of the calculation of the coefficient to sick-rate:**

In cohort of 3000 men at age 40-44 years, on duration 10 years are noted 29 events of the heart attack of the myocardium.

Time of the arising the events of the heart attack of the myocardium and duration risk are presented in table.

|  |  |  |
| --- | --- | --- |
| Time from the beginning of observations before moment of the appearance of the heart attack of the myocardium (years) | Quantity of infarction cases | Duration of the risk of the person - years |
| 2 | 3 | 6 |
| 4 | 5 | 20 |
| 6 | 9 | 54 |
| 8 | 12 | 96 |
| 10 | No | 0 |
| TOTAL | 29 | 176 |

Index of sick-rate:

 per year or  case per year per 1000

 for men at age 40-44 years

Broad using in analytical epidemiological study have got the **indexes of the risk** due to its visibility. Probability of some disadvantageous event or upshot can usually be understood under risk. In epidemiological study risk is defined as probability of the appearance of the individual of the disease or its upshot during given period of time. Though risk is defined as "individual" index, but it cannot be measured directly on separate persons, but is revealed on base of the observation for population, subject to negative influence of internal and external factors (exhibited group).

**Quantitative effect of the influence is possible to express through:**

1).**The indexes of the individual risk:** absolute risk (additional, attributive - attributable, risk difference) and relative risk (relative risk, risk ratio);

2). **The indexes of the population risk**.

**The Absolute risk (the additional risk)** - a difference of the indexes of sick-rate or upshot beside persons, subjected to and not subjected to influence of the factor under study. Absolute, additional risk points to additional number of the cases of the diseases or their upshot, conditioned influence factor risk and confirms that there are actual chances of the origin of some event during given period of time (probability disease, deaths).

The Absolute risk enables to reveal, to what absolute increasing to diseases (death-rate, invalidity) will bring the influence of the factor that emphasizes importance of the problem with standpoint of public health.

**The Relative risk** (relative risk, risk ratio) - a ratio of the index of sick-rate (or upshot) of persons, subjected to influence of the under study factor, to value of the index of sick-rate (or upshot) of the persons, not subjected to such influence.

The Relative risk is sufficiently demonstrative and most idle time index, which characterizes the degree of the risk of the arising the disease.

The Relative risk characterizes power of the relationship between influence and upshot that is to say biological aspect. The big value of the relative risk points to how important the role given influences the aetiology under study pathology.

The Value of the relative risk allows to answer the question: "In how many times above disease amongst persons, being subjected to influence of the factor of the risk, than amongst persons, not being subjected to this influence?" The ratio of the risk, equal to 1,0, witnesses: risk of the disease same in group as exhibited, so and unexposed (arising the disease is not connected with data by factor). The ratio of the risk more 1,0 affords ground speak of raised risk of the arising the disease in exhibited to given influence to group. The ratio of the risk less than 1,0 is indicative of smaller risk in exhibited group (possible expect that in this group acts some defensive factor). One of the essential defect of the index of the relative risk is that its meaning is changed depending on period of time, to which he is referred. When increase the period of the observation risk for any disease it approaches to unit.

**The Notions relative and additional (absolute) risk differs on clinical sense.** Since additional risk reflects additional probability of the disease, its using as individual index of the risk in majority of situation is more informative in comparison with relative risk. On the other hand, relative risk better demonstrates power of causal relationship. The Relative risk does not carry information on value of the absolute risk to diseases or upshot. Even under high results of the relative risk, absolute risk can be quite small if disease is quite rare.

**Example of the calculation absolute and relative risk**

The result of medico-social research is recorded that sick-rate by peptic ulcer disease of smoking men is 25,44, and nonsmoking men - 10,07.

Absolute (additional) risk of sick-rate by peptic ulcer disease of smoking men is

25,44 - 10,07 = 15,37 on 1000 smoking.

**The Conclusion:** absolute risk of the origin to peptic ulcer disease of smoking men forms 15,37 on 1000.

Relative risk of sick-rate by peptic ulcer disease of smoking men is

25,44:10,07=2,5.

**The Conclusion:** Relative risk of the origin of peptic ulcer disease of smoking men is 2,5 times higher than non-smokers.

For full estimation of the dangerous influence factor risk on public health, it is necessary to take into consideration also the spreading of risk factor in populations. Since more dangerous factor of the risk (with low relative risk), but with high spreading in given populations can provoke the more significant sick-rate, than dangerous but seldom meeting factor of the risk. In such event appears the question: "Is contribution of the factor of the risk in the general sick-rate of the group of the people, rather then separate individual?" Such sort of information helps to define, how factors of the risk is really essential, but how important for health of the population given territory that allows the leader of the system of the public health on scientific base to take rational and efficient management decisions.

**Such factors of the risk calculate for this reasonable as:**

 **- additional population risk;**

 **- an additional part of population risk;**

 **- a ratio of the chances.**

**Additional population risk** **(ARp)** calculates as product of absolute (additional) risk on spreading factor of the risk in populations. This index gives the belief about additional sick-rate in populations, connected with factor of the risk.

Besides, it is possible to define the share to sick-rate in populations, conditioned by factor of the risk that is to say **additional part of population risk**. It is calculated by fissions of the factor of additional population risk on value of the total sick-rate or death-rate in populations.

**For example of the calculation of the index of the risk, in cohort researches**

**Example 1.**

 ***Determination of the additional risk of deaths from lung cancer beside smoking in populations***

***The Simple risks:***

death-rate from lung cancer amongst smoking - 0,96 on 1000 populations per year

death-rate from lung cancer amongst nonsmoking - 0,07 on 1000 populations per year

spreading of smoking - 77%

general death-rate from lung cancer - 0,56 on 1000 populations per year

***Comparative risks:***

absolute risk = 0,96 - 0,07 = 0,89 on 1000 populations per year relative risk - 0,96 : 0,07 = 13,7 times

additional population risk = 0,89 \* 0,46 = 0,41 cases on 1000 populations per year

additional part of population risk = 0,41 : 0,56 = 0,74 = 74%

**For example 2.**

**The Determination of the risk of the Brest cancer and quantity of labours.**

***The Simple risks:***

sick-rate of the Breast canceramong women, having in anamnesis 1-2 labours - 1,07 per 1000 women

sick-rate of the Breast canceramong women, having in anamnesis > 2 labours - 0,11 per 1000 women

part of women, having in anamnesis 1-2 labours - 50%

general sick-rate of the Breast cancer- 0,59 on 1000 women

***The Comparative risks:***

additional risk =1,07 - 0,11 =0,96 per 1000 women

relative risk = 1,07 : 0,11 = 9,73 times

additional population risk = 0,96 \* 0,50 = 0,58 per 1000 women additional part of population risk = 0,58 : 0,59 = 0,33 =33%.

For estimation of the relative risk in research "case - control", special index, which is identified the **attitude of the chances (odds ratio),** is used. This is because methods to organizations and undertaking the retrospective epidemiological research of the type "case - control" differs from methods of the organizations and undertaking of cohort research. The Groups of the observation (main - a sick concrete disease and control - a person without under study pathology) are formed not natural image, but researcher. Calculate the indexes of the frequency of the disease, but on their base - indexes of the risk as in cohort study impossible. However in research of the type "case - control" known frequencies of the influence factor risk in the main and control group. The Comparison of these frequencies gives the index of the risk, which and in itself, and mathematically equivalent relative risk and is defined as attitude of the chances of the event in one group to chance of the event in the other group.

**The Chance** - an attitude to probability of event occurring or not. The Chances and probability contains same information, but expressed differently. If probability that that event will occur, marked *p,* then chances of this event occurring will are *p/(1-p)*. For example if probability of recovery forms 0,3 that the chances to recover are 0,3/(1-0,3) = 0,43. The Attitude of the chances makes it possible to reckon for base table of attended.

**Table of attended**

|  |  |  |
| --- | --- | --- |
|  | Disease | Total |
| Main group | Control group |
| There was influence | a | b | a+b |
| There was not influence | c | d | c+d |
| Total | a+c | b+d | a+c+ b+d |

*Attitude of the chances (AC) =*

Meaning of AC from 0 to 1 corresponds to the reduction of the risk. The Attitude of the chances, equal to 1, is indicative of absence of the effect. If frequency of the influence in the main group above, that AC will be more than 1 points to increased risk. The reverse is also true.

**Example of the calculation of the relative risk (attitude of the chances)**

The Purpose of the epidemiological study of the type "case - control" was to study the influence of the particularities of the food ration on arising the cancer of the pancreas. The information is provided in table.

Use sick and patient of the control group of roasted meat more than 1 time a week

|  |  |  |
| --- | --- | --- |
| Group | Exhibited (consume roasted meat more than 1 time at week) | Total |
| Yes | No |
| Sick persons with cancer of pancreas | 53 | 43 | 96 |
| Control group | 53 | 85 | 138 |
| Total | 106 | 128 | 234 |

The Relative risk (the attitude of the chances) for this type of the study is calculated with the formula:

RR (AC) = 

Meaning of the relative risk 1,98 is indicative of presence expressed dependencies between consumption of roasted meat more than 1 time a week and arising of the cancer of the pancreas

**Independent work:**

Task

Use data in Annex 17 and calculate the indexes of the risk on one of regions. Analyse the results and prepare the conclusion.

 **- Spreading diseases (the general sick-rate):**

|  |  |  |  |
| --- | --- | --- | --- |
|  of all registered diseases at current year of the \_\_\_\_ | х 1000 | = | \_\_\_\_\_ ‰ |
| Average number of the population \_\_\_\_ |

**Conclusion\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**- Cumulative sick-rate**

|  |  |  |  |
| --- | --- | --- | --- |
| all diseases revealed for the first time for 10 years \_\_\_\_ | х 1000 | = | \_\_\_\_\_ ‰ |
| Duration of the risk (person-years) for 10 years \_\_\_ |

**Conclusion** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Sick-rate (primary):**

|  |  |  |  |
| --- | --- | --- | --- |
| # of all diseases revealed for the first time per 10 years | х 1000 | = | \_\_\_\_\_ ‰ |
| Average number of the population \_\_\_\_ |

Time of the arising the events of the diseases and duration risk

(from exhibit 4)

|  |  |  |
| --- | --- | --- |
| Time begins at the moment of observations to moment of the appearance \_\_\_\_\_\_\_\_\_\_\_\_, year | Quantityof cases | Duration person- years |
| 2 |  |  |
| 4 |  |  |
| 6 |  |  |
| 8 |  |  |
| 10 |  |  |
| Total |  |  |

**Conclusion** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Absolute (the additional risk):**

Coefficient of sick-rare persons, being subjected to influence of the factor of the risk \_\_\_\_\_\_\_ - a Coefficient of persons, not being subjected to influence a factor of the risk

 \_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_‰

**Conclusion** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Relative risk*:***

|  |  |  |
| --- | --- | --- |
| Coefficient of diseases of persons, being subjected to influence of a factor of the risk \_\_\_\_\_\_\_ | = | \_\_\_\_\_times |
| Coefficient of diseases of persons, not being subjected to influence a factor of the risk |

**Conclusion** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Additional population risk:

Absolute (additional) risk \_\_\_\_\_\_\_\_ ×

spreading of risk factor in population\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_

**Conclusion** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Additional part of population risk**

|  |  |  |
| --- | --- | --- |
| Additional population risk \_\_\_\_\_\_\_ | = | \_\_\_\_\_% |
| Coefficient of spreading of diseases \_\_\_\_\_\_\_\_\_\_ |

**Conclusion** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**The Attitude of the chances:**

Sharing the factor of the risk in main and checking groups

|  |  |  |
| --- | --- | --- |
| Group | Presence of the factor of the risk | Total |
| Yes | No |
| Main group(sick, deceased and etc.) |  |  |  |
| Control group(healthy persons) |  |  |  |
| Total |  |  |  |

**AC = **

***Conclusion***

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***For notes***

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**Date of the performing the work \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signature of the teacher \_\_\_\_\_\_\_\_\_**

**TOPIC 15.**

**BASIS OF PREPARATION OF SCIENTIFIC PUBLICATIONS.**

**The purpose of the lesson:** to get acquainted with the basics of preparing a scientific publication.

As a result of studies of the subject student is obliged to:

**Know:**

The structure of scientific work (purpose, amount and methods of our own research, conclusions). Design features of scientific papers (presentation of data in tables, graphics representations). Design rules of links to sources of information, list of the literature.

**Know how:**

Make a scientific publication to print.

**The Literature:**

**1.**Методология научных исследовании / Пещеров Г.И., Слоботчиков О.Р. учебное пособие – М. Институт мировых цивилизаций. – 2017. – 312с.

**2.** Порядок оформления учебных и научно-исследовательских документов / В.Н. Павленко, А.С. Набатов , И.М. Тараненко. – Учеб. пособие. – Харьков: Нац. аэрокосм. ун-т «Харьк. авиац. ин-т», 2007. – 65 с.

**3.**Как написать научную статью: методические рекомендации по обобщению педагогического опыта и представлению результатов научных исследований / Стрельцова, М.В., Поцелуева О.Н. — п. Рассвет: Изд-во АДЕККК, 2015. — 31 с.

**4.**Lectures for Biostatistic. Department of Social medicine and OPH, KNMU

**For notes**

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**Date of the performing the work \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signature of the teacher \_\_\_\_\_\_\_\_\_**

**ANNEXES**

Annex 1

**THE INDIVIDUAL TASKS OF TOPIC 4**

**«Relative value (statistical coeficients), graphic methods of the analysis»**

Some factors of the population’s health and provision by medical aid of the population in 2017.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Region** | **Quantity of population** | **Quantity of newborns during the year** | **Quantity of doctors** | **Quantity of beds** | **Quantity of of death persons** | **Reasons of death** |
| **Cardio-vascular diseases** | **Oncological****diseases** | **Traumas, accidents and poisoning** | **Others** |
| **1** | 1803455 | 14067 | 6763 | 15925 | 27593 | 16694 | 3725 | 2677 | 4498 |
| **2** | 1055912 | 8658 | 4044 | 9450 | 16895 | 10052 | 2112 | 1554 | 3176 |
| **3** | 3701150 | 27018 | 14879 | 32348 | 62920 | 38129 | 7425 | 6166 | 11200 |
| **4** | 493201 | 4340 | 1943 | 4256 | 7645 | 4617 | 1063 | 680 | 1284 |
| **5** | 1424899 | 10259 | 6099 | 12553 | 21943 | 13210 | 2809 | 1865 | 4060 |
| **6** | 1824858 | 12409 | 7573 | 15840 | 29015 | 17206 | 3511 | 2756 | 5542 |
| **7** | 1696349 | 13401 | 7277 | 14504 | 25615 | 14498 | 3432 | 2331 | 5354 |
| **8** | 1673319 | 13554 | 6827 | 14206 | 27442 | 16301 | 3760 | 2580 | 4802 |
| **9** | 1332499 | 10260 | 5503 | 11659 | 21586 | 12693 | 2785 | 1900 | 4209 |
| **10** | 2949599 | 21532 | 12359 | 25721 | 46899 | 28514 | 6378 | 4643 | 7363 |

**Annex 2**

**THE INDIVIDUAL TASKS OF TOPIC 4**

**«Relative value (statistical coeficients), graphic methods of the analysis»**

Level to death-rate in area for last 5 years on 1000 populations

 (given conditional)

|  |  |
| --- | --- |
| **Region** | **Coefficients of death-rate :** |
| 2013 | 2014 | 2015 | 2016 | 2017 |
| **1** | 14.2 | 14.3 | 14.9 | 15.2 |  |
| **2** | 14.8 | 15.1 | 15.6 | 15.9 |  |
| **3** | 15.1 | 15.5 | 16.6 | 16.7 |  |
| **4** | 13.9 | 14.2 | 14.4 | 14.6 |  |
| **5** | 14.9 | 15.2 | 15.1 | 15.3 |  |
| **6** | 14.0 | 14.5 | 14.7 | 14.8 |  |
| **7** | 13.9 | 14.2 | 14.4 | 14.6 |  |
| **8** | 15.3 | 15.9 | 16.0 | 16.2 |  |
| **9** | 14.9 | 15.1 | 15.5 | 15.9 |  |
| **10** | 14.9 | 15.1 | 15.4 | 15.6 |  |

Annex 3

**THE INDIVIDUAL TASKS OF TOPIC 4**

**«Relative value (statistical coeficients), graphic methods of the analysis»**

Provision of the populations by doctors in regions of Ukraine

for last 5 years on 10000 populations (given conditional)

|  |  |
| --- | --- |
| Region | provision by doctors per 10.000 population |
| 2013 | 2014 | 2015 | 2016 | 2017 |
| 1 | 40.2 | 44.3 | 46.4 | 45.2 |  |
| 2 | 40.8 | 42.1 | 43.6 | 46.9 |  |
| 3 | 42.1 | 43.5 | 44.6 | 45.0 |  |
| 4 | 41.9 | 43.2 | 43.0 | 44.3 |  |
| 5 | 42.9 | 43.5 | 44.1 | 44.6 |  |
| 6 | 41.0 | 42.5 | 43.0 | 43.2 |  |
| 7 | 41.9 | 42.2 | 43.4 | 44.6 |  |
| 8 | 42.3 | 44.3 | 45.0 | 46.2 |  |
| 9 | 42.9 | 43.1 | 44.5 | 45.9 |  |
| 10 | 41.9 | 43.1 | 44.4 | 45.6 |  |

**Annex 4**

**THE INDIVIDUAL TASKS OF TOPIC 5**

**«Variational rows, methods of their building»**

|  |  |
| --- | --- |
|  | Sings, which we study |
| Unit of observation | Height (cm) | Body’s mass (kg) | Frequency of pulse | Lung vital capacity (cm) | Diastolic pressure | Systolic pressure | Height in sitting (cm) | Volume of thorax (cm) | Strong of hand’s muscles (kg) | Frequency of breathing  |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| 1 | 164 | 84 | 63 | 3000 | 65 | 110 | 130 | 91 | 23 | 14 |
| 2 | 167 | 83 | 69 | 3600 | 80 | 120 | 136 | 97 | 45 | 18 |
| 3 | 168 | 83 | 68 | 3500 | 80 | 120 | 135 | 96 | 40 | 17 |
| 4 | 170 | 82 | 64 | 3100 | 70 | 110 | 131 | 92 | 25 | 14 |
| 5 | 168 | 81 | 67 | 3400 | 80 | 120 | 134 | 95 | 35 | 17 |
| 6 | 169 | 79 | 68 | 3500 | 80 | 120 | 135 | 96 | 40 | 19 |
| 7 | 172 | 79 | 70 | 3700 | 83 | 125 | 137 | 98 | 40 | 18 |
| 8 | 171 | 80 | 68 | 3500 | 80 | 120 | 135 | 96 | 50 | 20 |
| 9 | 170 | 80 | 69 | 3600 | 80 | 130 | 136 | 97 | 40 | 21 |
| 10 | 169 | 81 | 72 | 3900 | 85 | 120 | 136 | 100 | 45 | 17 |
| 11 | 168 | 80 | 71 | 3800 | 85 | 120 | 137 | 97 | 53 | 17 |
| 12 | 168 | 81 | 70 | 3700 | 83 | 125 | 136 | 99 | 52 | 16 |
| 13 | 165 | 81 | 69 | 3600 | 80 | 125 | 135 | 98 | 50 | 18 |
| 14 | 165 | 83 | 68 | 3500 | 80 | 120 | 135 | 96 | 45 | 17 |
| 15 | 165 | 85 | 68 | 3200 | 80 | 120 | 135 | 96 | 40 | 18 |
| 16 | 166 | 83 | 65 | 3200 | 75 | 120 | 135 | 93 | 40 | 14 |
| 17 | 166 | 84 | 70 | 3200 | 75 | 120 | 132 | 93 | 28 | 14 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| 18 | 166 | 81 | 65 | 3300 | 75 | 110 | 132 | 94 | 28 | 14 |
| 19 | 166 | 81 | 66 | 3300 | 77 | 115 | 132 | 94 | 28 | 16 |
| 20 | 167 | 82 | 66 | 3300 | 77 | 115 | 132 | 94 | 30 | 16 |
| 21 | 167 | 83 | 66 | 3400 | 77 | 115 | 133 | 95 | 30 | 18 |
| 22 | 166 | 83 | 66 | 3400 | 77 | 115 | 133 | 99 | 30 | 20 |
| 23 | 171 | 85 | 67 | 3800 | 77 | 120 | 134 | 97 | 30 | 21 |
| 24 | 169 | 85 | 67 | 3600 | 80 | 125 | 134 | 95 | 35 | 18 |
| 25 | 170 | 86 | 71 | 3700 | 80 | 120 | 133 | 98 | 35 | 18 |
| 26 | 167 | 83 | 69 | 3400 | 85 | 120 | 134 | 100 | 52 | 20 |
| 27 | 167 | 84 | 70 | 3400 | 80 | 120 | 138 | 105 | 45 | 21 |
| 28 | 168 | 81 | 67 | 3500 | 85 | 120 | 137 | 97 | 35 | 17 |
| 29 | 167 | 81 | 67 | 3600 | 83 | 125 | 133 | 98 | 35 | 16 |
| 30 | 169 | 82 | 68 | 3600 | 80 | 125 | 136 | 99 | 40 | 22 |
| 31 | 169 | 83 | 69 | 3700 | 80 | 120 | 135 | 95 | 50 | 21 |
| 32 | 169 | 83 | 69 | 3800 | 80 | 120 | 136 | 95 | 50 | 17 |
| 33 | 172 | 85 | 70 | 3900 | 80 | 130 | 139 | 94 | 45 | 16 |
| 34 | 171 | 85 | 71 | 4000 | 80 | 130 | 142 | 94 | 28 | 14 |
| 35 | 172 | 86 | 69 | 3800 | 90 | 120 | 138 | 93 | 54 | 14 |
| 36 | 173 | 81 | 69 | 3600 | 83 | 125 | 136 | 100 | 40 | 15 |

**Annex 5**

**THE INDIVIDUAL TASKS OF TOPIC 4**

**«The characteristics of sign variety (mean standard deviation, coefficient of variation)»**

**1.** Meanterm of patient’s presents in hospital A is 10 days, σ=±0,5days, in hospital B – 10,2 days, σ=±1,2days. What mean is most typical?

**2.** Mean height of children 140,0sm, σ=±3,0. How many children in percents have the height between 134,0 and 146,0?

**3.** Mean height of men 176,5sm, σ=±4,2. How many men in percents have the height between 172,3 and 180,7?

**4.** Mean body’s mass of newborn boys 3450g, σ=±350g, mean body’s mass of newborn girls – 3250g, σ=±300g. What mean is most variety?

**5.** Mean body’s mass of newborn 3400g, σ=±350g, mean height – 52,0sm, σ=±2,0sm. What mean is most variety?

**6.** Mean body’s mass of schoolboys 62,6kg, σ=±4,5kg, mean height – 165,0sm, σ=±5,0sm. What mean is most variety?

**7.** Mean body’s mass of schoolboys 62,6kg, σ=±4,5kg. How many schoolboys in percents have the body’s mass between 53,6 and 71,6?

**8.** Mean height of 13 years old boys are 165,0sm, σ=±5,0sm. How many boys in percents have the height between 150,0sm and 180,0sm?

**9.** Mean quantity of leukocytes 6000, σ=±650. What level of variety this sing has?

**10.** Mean level of haemoglobin is 130, σ=±4,0. What level of variety this sing has?

**11.** Mean pulse of adult healthy persons 70 per min, σ=±4. What level of variety this sing has?

**12.** Mean pulse of adult healthy persons 70 per min, σ=±4, mean pulse of adult persons with cardio-vascular diseases - 85 per min, σ=±10. What mean is most variety?

**Annex 6**

**THE INDIVIDUAL TASKS OF TOPIC 7**

**«The parametric and nonparametric methods of the estimation and analysis of the statistical hypothesizes»** Task 2.

1. Mean body’s mass of newborn after 1st pregnancy - 3410±60g, mean body’s mass of newborn after 2nd pregnancy – 3460±40g. To define reliability todifferences according t criterion.

2. Level of birth-rate in 1990 was 15,1 ±1,2‰, in 2000 – 7,6±1,3‰. To define reliability todifferences according t criterion.

3. Level of death-rate in 1980 was 12,1 ±1,2‰, in 1999 – 14,8±1,1‰. To define reliability todifferences according t criterion.

4. In 1980 mean height of 14 years girls was 158,5±2,5sm, in 2000 – 163,0±3,2sm. To define reliability todifferences according t criterion.

5. Percent of children with oftalmological problems in school №1 was 34,2±0,2%, in school №2 – 37,2±0,4%. To define reliability todifferences according t criterion.

6. Percent of children with scoliosis in school №1 was 38,2±0,3%, in school №2 – 40,2±0,8%. To define reliability todifferences according t criterion.

7. Level of lethality in therapeutic department is 1,1±0,04%, in surgical – 2,0±0,2%. To define reliability todifferences according t criterion.

8. Frequency of pulse before exam is 84±4, after exam - 70±3 per min. To define reliability todifferences according t criterion.

9. Level of death-rate during the rural population in 1990 was 13,5±0,8‰, in 1999 – 12,5±1,1‰. To define reliability todifferences according t criterion.

10. Level of sick-rate in Ukraine in 1990 was 1104±0,7‰, in 1999 - 1411±0,8‰. To define reliability todifferences according t criterion.

11. Level of primary sick-rate in Ukraine in 1990 was 620±0,5‰, in 1999 - 661±0,8‰. To define reliability todifferences according t criterion.

12. Level of invalidity in Ukraine in 1992 was 49,3±0,7‰, in 1998 – 47,7±0,5‰. To define reliability todifferences according t criterion.

Annex 7

###### **THE INDIVIDUAL TASKS OF TOPIC 7**

**«The parametric and nonparametric methods of the estimation and analysis of the statistical hypothesizes»** Task 3

Results of difference of children’s body’s mass in two groups

|  |  |  |
| --- | --- | --- |
| **Region** | **Quantity of observations in groups** | **t criterion** |
| **1** | **2** |
| **1** | 10 | 7 | 2,2 |
| **2** | 12 | 7 | 2,0 |
| **3** | 9 | 9 | 1,96 |
| **4** | 10 | 6 | 2,2 |
| **5** | 10 | 9 | 2,0 |
| **6** | 8 | 9 | 2,2 |
| **7** | 9 | 7 | 2.18 |
| **8** | 9 | 5 | 2,02 |
| **9** | 6 | 9 | 2,1 |
| **10** | 8 | 12 | 2,2 |
| **11** | 9 | 7 | 2,0 |
| **12** | 12 | 9 | 1,95 |

Annex 8

###### **THE INDIVIDUAL TASKS OF TOPIC 8**

**«Nonparametric methods of the estimation and analysis of the statistical hypothesizes»** Task 1

Changes of quantity of leukocytes in compare of norm after treatment of new drugs.

|  |  |
| --- | --- |
| **Hospital** | **child** |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| **1** | = | –  | –  | –  | + | –  | –  | –  | –  | –  | –  |
| **2** | –  | –  | –  | –  | –  | + | –  | –  | –  | –  | = |
| **3** | + | –  | –  | –  | = | –  | –  | –  | + | –  | –  |
| **4** | –  | –  | + | –  | –  | = | –  | –  | –  | –  | –  |
| **5** | = | –  | –  | –  | + | –  | –  | –  | –  | + | –  |
| **6** | –  | –  | = | –  | –  | + | –  | –  | –  | –  | –  |
| **7** | + | –  | –  | –  | –  | –  | –  | –  | –  | –  | = |
| **8** | = | –  | –  | = | –  | –  | + | –  | –  | –  | –  |
| **9** | –  | + | –  | –  | = | –  | –  | –  | + | –  | –  |
| **10** | –  | –  | –  | –  | –  | + | + | –  | –  | –  | –  |

**Annex 9**

###### **THE INDIVIDUAL TASKS OF TOPIC 8**

**«Nonparametric methods of the estimation and analysis of the statistical hypothesizes»** Task 2

Changing of patient’s diastolic arterial pressure after treatment of new drug.

|  |  |  |
| --- | --- | --- |
| **Hospital** | **Period** | **Diastolic arterial pressure** |
| **A** | **before treatment** | 90 | 100 | 105 | 85 | 105 | 95 | 110 | 100 |
|  | **after treatment** | 85 | 80 | 90 | 90 | 115 | 85 | 85 | 75 |
| **B** | **before treatment** | 85 | 105 | 110 | 95 | 90 | 90 | 85 | 95 |
|  | **after treatment** | 80 | 110 | 100 | 100 | 80 | 85 | 80 | 80 |
| **C** | **before treatment** | 110 | 100 | 95 | 105 | 100 | 85 | 90 | 95 |
|  | **after treatment** | 105 | 110 | 80 | 100 | 90 | 90 | 80 | 80 |
| **F** | **before treatment** | 110 | 90 | 105 | 90 | 85 | 80 | 100 | 95 |
|  | **after treatment** | 100 | 85 | 110 | 80 | 80 | 100 | 75 | 90 |
| **K** | **before treatment** | 100 | 115 | 85 | 80 | 90 | 75 | 90 | 90 |
|  | **after treatment** | 90 | 100 | 90 | 75 | 80 | 80 | 80 | 80 |
| **M** | **before treatment** | 120 | 115 | 100 | 100 | 90 | 90 | 115 | 90 |
|  | **after treatment** | 110 | 110 | 100 | 110 | 80 | 80 | 90 | 85 |

**Annex 10**

###### **THE INDIVIDUAL TASKS OF TOPIC 8**

**«Nonparametric methods of the estimation and analysis of the statistical hypothesizes»** Task 3

**Level of leukocytes in blood of patients with ulcer diseases, which had complications**

**(group X) and without complications (group Z)**

|  |  |  |
| --- | --- | --- |
| **Hospital** | **Group** | **Level of leukocytes** |
| **A** | **X** | 12 | 15 | 14 | 14 | 22 | 20 | 20 | 24 |
|  | **Z** | 20 | 25 | 25 | 23 | 29 | 28 | 30 | 27 |
| **B** | **X** | 14 | 18 | 15 | 15 | 19 | 20 | 21 | 21 |
|  | **Z** | 19 | 24 | 24 | 23 | 27 | 24 | 28 | 28 |
| **C** | **X** | 17 | 16 | 14 | 14 | 18 | 21 | 23 | 20 |
|  | **Z** | 24 | 18 | 26 | 26 | 23 | 26 | 29 | 29 |
| **F** | **X** | 18 | 17 | 15 | 14 | 19 | 21 | 24 | 21 |
|  | **Z** | 24 | 19 | 25 | 24 | 23 | 25 | 29 | 26 |
| **K** | **X** | 16 | 15 | 15 | 15 | 15 | 21 | 24 | 15 |
|  | **Z** | 23 | 19 | 22 | 23 | 24 | 24 | 28 | 19 |
| **M** | **X** | 17 | 16 | 17 | 19 | 16 | 19 | 19 | 24 |
|  | **Z** | 24 | 19 | 24 | 25 | 23 | 25 | 24 | 30 |

**Annex 11**

###### **THE INDIVIDUAL TASKS OF TOPIC 8**

**«Nonparametric methods of the estimation and analysis of the statistical hypothesizes».**

Task 4

**Distribution of children, which were sick depending place of living**

|  |  |  |
| --- | --- | --- |
| **Region** | **Quantity of new-borns** | **Were born as sick** |
| A. Relative clean | 600 | 120 |
| B. Polluted | 785 | 355 |
| C. Relative clean | 700 | 130 |
| D. Polluted | 800 | 360 |
| F. Relative clean | 650 | 120 |
| K. Polluted | 780 | 350 |
| L. Relative clean | 700 | 130 |
| M. Polluted | 750 | 360 |
| N. Relative clean | 750 | 110 |
| O. Polluted | 800 | 320 |
| P. Relative clean | 600 | 100 |
| S. Polluted | 850 | 340 |

 **Annex 12**

## **THE INDIVIDUAL TASKS OF TOPIC 9**

**«Analysis intercommunication between investigation parameters of the statistical totality (correlative-regressive analysis)»**

Task 1

Level of smoking during the persons of different age (per 100 persons).

|  |  |
| --- | --- |
| **Level of smoking****(regions)** | **Age groups** |
| **till 24** | **25-29** | **30-34** | **35-39** | **40-44** | **45-49** |
| **A** | 52,5 | 53,8 | 51,6 | 45,4 | 40,2 | 38,4 |
| **B** | 36,3 | 36,8 | 35,4 | 33,5 | 28,5 | 22,0 |
| **C** | 45,7 | 46,8 | 44,6 | 41,9 | 38,9 | 30,6 |
| **D** | 36,9 | 37,9 | 35,7 | 32,8 | 28,4 | 24,6 |
| **F** | 48,9 | 49,9 | 36,8 | 32,0 | 28,7 | 24,1 |
| **K** | 45,7 | 45,9 | 43,7 | 39,8 | 35,5 | 29,8 |
| **L** | 35,8 | 36,9 | 35,9 | 32,5 | 26,8 | 24,9 |
| **M** | 39,8 | 41,5 | 38,9 | 35,5 | 32,5 | 29,5 |

 Annex 13

**THE INDIVIDUAL TASKS OF TOPIC 10**

**«The nethod of standartization»**

|  |  |  |  |
| --- | --- | --- | --- |
| **Region** | **District** | **Average number of population** | **Average number of death persons** |
| **Total** | **age, years** | **Total** | **age, years** |
| **0-14** | **15-59** | **60-and elder** | **0-14** | **15-59** | **60-and elder** |
| **1** | **A** | 30200 | 7600 | 16500 | 6100 | 425 | 16 | 225 | 184 |
| **1** | **B** | 56000 | 11200 | 38000 | 6800 | 616 | 34 | 412 | 170 |
| **2** | **C** | 68500 | 14400 | 44500 | 9600 | 710 | 30 | 500 | 180 |
| **2** | **D** | 38000 | 9200 | 22000 | 6800 | 440 | 19 | 220 | 210 |
| **3** | **K** | 78000 | 17200 | 50700 | 10100 | 860 | 35 | 535 | 290 |
| **3** | **L** | 43500 | 10000 | 24800 | 8700 | 625 | 20 | 355 | 250 |
| **4** | **N** | 30300 | 7650 | 16550 | 6100 | 430 | 15 | 231 | 184 |
| **4** | **P** | 53000 | 11000 | 37000 | 6000 | 620 | 32 | 414 | 170 |
| **5** | **M** | 68000 | 14300 | 44200 | 9500 | 730 | 30 | 520 | 180 |
| **5** | **F** | 38500 | 9300 | 22300 | 6900 | 430 | 15 | 214 | 210 |
| **6** | **S** | 78600 | 17300 | 50900 | 10400 | 850 | 30 | 530 | 290 |
| **6** | **Z** | 43800 | 10100 | 24900 | 8800 | 635 | 20 | 355 | 260 |

**Annex 14**

**THE INDIVIDUAL TASKS OF TOPIC 11**

**«The dynamic rows and their analysis»**

**Sick-rate of cardio-vascular diseases during of the population of regions**

**(per 1000 of population)**

|  |  |
| --- | --- |
| **Region** | **Year** |
| **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **Reporting year** |
| **1** | 209,0 | 235,0 | 245,0 | 230,0 | 270,0 | 266,3 | 300,0 |
| **2** | 220,0 | 215,0 | 258,5 | 243,0 | 287,0 | 295,4 | 310,0 |
| **3** | 225,0 | 218,6 | 246,0 | 250,0 | 248,0 | 276,0 | 296,3 |
| **4** | 256,0 | 232,0 | 265,0 | 278,0 | 250,0 | 280,0 | 300,3 |

**Level of domestic traumatism during of the population of regions**

**(per 10000 of population)**

|  |  |
| --- | --- |
| Region | **Year** |
| **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **Reporting year** |
| **5** | 20,2 | 23,3 | 22,4 | 23,9 | 23,6 | 26,6 | 26,1 |
| **6** | 22,3 | 21,4 | 25,8 | 24,3 | 24,6 | 25,2 | 25,8 |
| **7** | 22,5 | 21,7 | 24,6 | 25,5 | 24,8 | 27,4 | 26,8 |
| **8** | 25,4 | 23,2 | 26,5 | 24,5 | 25,0 | 25,2 | 25,1 |

**Level of hospitalization during of the population of regions**

**(per 10000 of population)**

|  |  |
| --- | --- |
| **Region** | **Year** |
| **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **Reporting year** |
| **9** | 19,0 | 18,5 | 20,8 | 20,3 | 21,2 | 25,8 | 23,6 |
| **10** | 17,3 | 17,0 | 18,0 | 17,6 | 20,0 | 21,3 | 19,0 |
| **11** | 2,6 | 2,5 | 2,7 | 2,6 | 2,8 | 3,1 | 2,9 |
| **12** | 2,2 | 2,3 | 2,1 | 2,4 | 2,6 | 2,5 | 2,7 |

**Annex 15**

## **THE INDIVIDUAL TASKS OF TOPIC № 12**

**«Design of epidemiological studies: case-control, cohort, randomized clinical studies. Gold standard»**

|  |  |  |
| --- | --- | --- |
| **Region** | **Population** | **Morbidity в ‰** |
|
| **1** | 10500 | 35 |
| **2** | 11200 | 40 |
| **3** | 12700 | 45 |
| **4** | 13200 | 55 |
| **5** | 14650 | 60 |
| **6** | 15100 | 65 |
| **7** | 16340 | 70 |
| **8** | 16900 | 75 |
| **9** | 17200 | 80 |
| **10** | 17580 | 85 |

**Annex 16**

## **INDIVIDUAL TASKS OF TOPIC № 13**

**«Screening. Assessment methodology the sensitivity and specificity of screening tests»**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variant** | **True positive****(a)** | **False positive****(b)** | **False negative****(c)** | **True negative****(d)** |
|
| **1** | 17 | 8 | 7 | 21 |
| **2** | 25 | 5 | 7 | 18 |
| **3** | 45 | 9 | 11 | 21 |
| **4** | 54 | 6 | 13 | 19 |
| **5** | 33 | 4 | 9 | 17 |
| **6** | 28 | 9 | 5 | 25 |
| **7** | 21 | 11 | 4 | 34 |
| **8** | 35 | 10 | 5 | 33 |
| **9** | 38 | 24 | 3 | 45 |
| **10** | 29 | 11 | 8 | 42 |

 **Annex 17**

**THE INDIVIDUAL TASKS OF TOPIC 14**

**«The risk factors, methods of the calculation and their estimation»**

Some data of population’s health of the separate regions of Ukraine

(given conditional)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Region | Group | Quantity of population | Have the risk factor | Have not the risk factor | Quantity of of death persons  | Registered all deseases | Revile new diseases during 10 years |
| On 2nd year | On 4th year | On 6th year | On 8th year | On 10th year | Total |
| А | О | 20 000 | 17000 | 3 000 | 334 | 31 000 | 87 | 87 | 89 | 90 | 0 | 353 |
|  | К | 18 000 | 9000 | 9 000 | 167 | 23 500 | 34 | 38 | 43 | 46 | 0 | 161 |
| Б | О | 21 000 | 17002 | 3 998 | 334 | 31 000 | 87 | 87 | 89 | 90 | 0 | 353 |
|  | К | 17 000 | 8000 | 9 000 | 132 | 14 564 | 34 | 38 | 43 | 46 | 0 | 161 |
| В | О | 22 000 | 17004 | 4 996 | 334 | 31 000 | 87 | 87 | 89 | 90 | 0 | 353 |
|  | К | 16 000 | 8700 | 7 300 | 123 | 13 345 | 25 | 28 | 33 | 35 | 0 | 121 |
| Г | О | 20 000 | 17006 | 2 994 | 334 | 31 000 | 87 | 87 | 89 | 90 | 0 | 353 |
|  | К | 19 000 | 4568 | 14 432 | 167 | 19 453 | 34 | 38 | 43 | 46 | 0 | 161 |
| Д | О | 12 000 | 9879 | 2 121 | 169 | 21 000 | 87 | 87 | 89 | 90 | 0 | 353 |
|  | К | 10 000 | 4389 | 5 611 | 76 | 9 329 | 34 | 38 | 43 | 46 | 0 | 161 |
| Е | О | 11 000 | 9876 | 1 124 | 176 | 14 563 | 24 | 27 | 29 | 33 | 0 | 113 |
|  | К | 9 000 | 3452 | 5 548 | 56 | 7 865 | 11 | 12 | 13 | 15 | 0 | 51 |
| Ж | О | 23 000 | 17012 | 5 988 | 386 | 31 000 | 24 | 27 | 29 | 33 | 0 | 113 |
|  | К | 19 000 | 6457 | 12 543 | 199 | 14 358 | 8 | 9 | 9 | 11 | 0 | 37 |
| З | О | 16 000 | 14657 | 1 343 | 334 | 31 000 | 24 | 27 | 29 | 33 | 0 | 113 |
|  | К | 14 000 | 6578 | 7 422 | 199 | 14 569 | 9 | 8 | 10 | 16 | 0 | 43 |
| И | О | 15 000 | 13458 | 1 542 | 276 | 23 458 | 24 | 27 | 29 | 33 | 0 | 113 |
|  | К | 12 000 | 4356 | 7 644 | 133 | 12 348 | 13 | 12 | 15 | 14 | 0 | 54 |

####  О – main group

 К – control group

##### Reductions

|  |  |  |
| --- | --- | --- |
|  II | - | Intensive index |
| EI | - | Extensive index |
| IC | - | Index of correlation (Proportion rate) |
| VI | - | Visibility index  |
| Х | - | Arithmetic average |
| Σ | - | Sum symbol |
| х | - | Variant |
| f  | - | (Frequency) number of each variants |
| n | - | Total number of observations |
|  σ  | - | Mean square deviation (sigma) |
| d  | - | Deviation of each variant from arithmetic average |
| Сυ | - | Coefficient of variation  |
| mх | - | Average error of mean arithmetical value |
| mр | - | Average error of relative value;  |
| P | - | Relative value;  |
| q | - | Difference between the base number and the rate (100% - Р) |
| Хgen  | - | Arithmetic average in general totality; |
| Хselec | - | Arithmetic average of selective totality  |
| t  | - | Reliability test (Student's validity test) |
| Рgen  | - | Relative value in general totality; |
| Рselec  | - | Relative value of selective totality |
|  χ2  | - | Non-parametric correspondence test |
| Z  | - | Nonparametric sign test |
| Т  | - | Nonparametric Wilcoxon test |
| S  | - | Number of gradations |
| r |  | Number of compared groups |
| λ2  |  | The Kolmogorov-Smirnov criterion |
| ρ  |  | Rank correlation coefficient |
| d2 |  | Squared rank difference |
| mρ |  | Rank correlation error |
| mr  |  | Linear correlation error |
| r |  | Linear correlation rate |

**Educational edition**

**BIOSTATISTIC.**

**Methodological guidelines**

BIOSTATISTIC:Methodological guidelines for independent work for second (magistracy) degree higher education, educational qualification «Master of medicine», professional qualification «Physician», Branch of knowledge 22 «Healthcare», Specialty 222 «Medicine»:/ The drafters: Ohniev V.A.,Galicheva N.A, Chumak L.I. and others .- Kharkov. - KhNMU. - 2018. – 84p.

The drafters: Ohniev Viktor Andreevich, doctor of medicine, professor

 Galicheva Nina Aleksandrovna, doctor of medicine, professor

 Chumak Lyubov Igorevna, PhD, associate professor

 Chuchno Inna Anatolievna, PhD, associate professor

 Zinchuk Andriy Nikolaevich, PhD, associate professor

 Pomogaybo Ekaterina Georgievna, assistant

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 *Monday - Friday - from 15.00 to 17.00 hours*

 *Saturday - from 9.00 to 13.00 hours.*