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The Role of Mathematical Statistical Methods in Medicine and Biology

Tokhirova Farida Olimjonovna
Assistant Samarkand State Medical University

Shavkatova Shirin Furqatovna
Student of Samarkand State Medical University

Djurakulova Zuxra Ravshanovna
Student of Samarkand State Medical University

Djurakulova Fotima Ravshanovna
Student of Samarkand State Medical University

Abstract: Mathematical statistics is the basis for the application of quantitative analysis methods in various fields of human activity. Depending on the object of research, there are different directions of application of mathematical statistical methods. Much attention is paid to the use of statistical methods for processing medical and biological data. Mathematical statistics used for the correct collection and processing of statistical data. This article discusses the role of mathematical statistical methods in medicine and biology.

Keywords: Medicine, biology, mathematical statistics, medical statistics, methodology, data, biological process.

Introduction: Mathematical statistics is the basis for the application of quantitative analysis methods in various areas of human activity. Depending on the object of research, there are different directions for the application of mathematical statistical methods. Much attention is paid to the use of statistical methods for processing medical and biological data. In this regard, the question arises: "Why is statistics important in biology and medicine?". Because it is used to test various hypotheses and interpret experimental results. Statistics can provide important information about various biological processes, factors associated with them, morbidity, birth and death rates, the spread and recovery rate of infection, the population at a given time, etc. Medical statistics deals with these issues. **Medical statistics** is a branch of social statistics that studies the quantitative characteristics of population health, the development of the healthcare system, determines the degree of intensity of the influence of socio-economic factors on them, and also uses statistical methods to process and analyze the results of clinical and laboratory studies.

This definition is taken from the statistical dictionary, which also defines the tasks of medical statistics: That is, the timely receipt and development of information on diseases, deaths, disabilities, physical development of the general population and its individual groups, the location, condition, equipment of health institutions, medical personnel, clinical and laboratory studies. Thus, medical statistics assess the state of health of the population, public health, the environment in order to determine its safety and impact on human health.

The following sections are distinguished in medical statistics:

➢ sanitary and demographic processes,

➢ morbidity dynamics,

➢ population health statistics that study physical development

➢ health statistics, which study the activities of health institutions and medical workers.

Sources of information that allow for the assessment of key indicators : primary medical documents maintained in healthcare facilities on a daily basis;

statistical report;

Review. Statistical departments within medical organizations are engaged in the collection, processing and storage of data. Medical statistics uses mathematical statistical methods associated with the processing of sample data. The collection of medical and biological data is based on the law of large numbers, which allows mass surveys to determine the presence of objective patterns underlying epidemiological, social, and medical processes. Medical statistics allow researchers to study and understand important medical issues. It helps to identify cause-and-effect relationships, identify risk factors, assess the effectiveness of treatment, and predict the outcome of diseases.

Health statistics It is used to understand risk factors for communities, track health events such as diseases, study the impact of policy changes, and assess the quality and safety of healthcare.

Statistics is important for many institutions and even every individual. Here is what you need to understand first. Science helps to collect and organize data, is responsible for its correct processing, measures and analyzes data. Statistics allows you to see certain mass phenomena in numerical form. Mathematical statistics is used to correctly collect and process statistical data. It is used to describe large data sets representing any phenomenon, from the results of a physical experiment to a social survey or data on site visits.

To describe why statistical methods are used, statistical methods allow us to analyze data sets and find patterns in them, test hypotheses, and make predictions. Statistics helps us in the following ways: to assess the activity of a drug and determine its dose-response relationship, that is, to determine the effect of a drug and distinguish it from other dependent variables, to compare the effects of two or more drugs, and to determine the best method of treatment.

Statistics is also important in nursing because it helps nurses read, understand, and interpret literature and research findings and apply evidence-based methods to patient care, which helps improve treatment outcomes. The connection between statistics and biology is that within biology there is a field called biostatistics. Biostatistics is a field of study in which researchers apply statistical analysis to biological subjects. For example, we might design biological experiments to obtain and analyze data, and finally interpret the results to draw conclusions.

The following methods of mathematical statistics exist:

Along with the development and refinement of general concepts of mathematical statistics, it has its own separate sections:

➢ analysis of variance,

➢ correlation analysis,

➢ multivariate statistical analysis,

➢ statistical analysis of random processes,

➢ regression analysis,

➢ factor analysis.

When we talk about statistical methods in biology, biological statistics or biometrics is a field of scientific knowledge that involves the classification, systematization, and processing of experimental data in biology, medicine, and agriculture using mathematical statistical methods.

Statistical methodology is a source of tools for solving five main problems:

1. Design and conduct research, specifying research questions for the target population;

2. to build and document valid and reliable databases with minimal cost, effort, and delay;

3. manage the database and convert it into a user-friendly format;

4. analyze the data so that the conclusions are consistent with interpretations that help make sound decisions, and assess the uncertainty and risks that arise from sample variation;

5. communicate the results verbally or in a written document, or a combination of both.

Conclusion: A statistical criterion is a random variable and is subject to certain laws of distribution. When conducting statistical research, Statistica, MS Excel, as well as the widespread Mathcad mathematical package can be used as universal software products. At the same time, special attention should be paid to the stage of analysis of the results obtained, to the correct interpretation of the data obtained as a result of the program.

Practical tasks in medicine and biology often have a probability statement. All processes in living organisms, when studying them, are now almost mathematically modeled. In fact, in medical practice, mathematical models are used for computer analysis of cardiograms and the detection of heart diseases. The rapid introduction of modern information technologies into healthcare has made it possible to automate the maximum number of routine operations during statistical research. Currently, the introduction of mathematical statistical methods into biological sciences, in particular medicine, is an urgent issue. In modern healthcare, statistical methods are used at all levels: from the district doctor, to the registry office of the polyclinic and the ministry, up to scientific institutions. In contrast to practical healthcare, various statistical methods are used in scientific work in the fields of physiology, psychophysiology, clinical sciences. In scientific research, there is a problem of comparative assessment and verification of various processes: the effectiveness of treatment, the duration of the disease and the recovery period, the severity of the disease; comparison of methods, processes, properties of drugs and medical equipment, efficiency, preventive measures.

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