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Abstract. *Today, the effectiveness of the implementation of information systems for var-ious purposes in medical institutions (MCI) is one of the most important issues. The classification of medical information systems (MIS) using modern communications and local information networks is considered: basic medical information systems, medical information systems at the medical level.*
The article analyzes and models factors that may influence the diagnosis. We also build mathematical models taking into account factors affecting system changes.

1. Introduction

Modern medical organizations produce and accumulate huge amounts of data. The quality of medical care, the general standard of living of the population, the level of development of the country as a whole and of each of its territorial entities in particular depends on how effectively this information is used by doctors, managers, and governing bodies. Therefore, the need to use large, and at the same time still constantly growing, amounts of information in solving diagnostic, therapeutic, statistical, managerial and other tasks, determines today the creation of information systems in medical institutions. Maps, bulletins, procedural reports, records of patients, drugs - all the workflow was done on paper. This affected the speed and, consequently, the quality of patient care, hampered the work of medical, medical personnel, which led to medical errors, a great investment of time to fill out cards, and to compile reports. This complicated the management of health facilities MCI (lack of control over the work of the units, lack of operational, analytical information) and the work of the controlling authorities. A feature of the MIS is the transition from local work with medical information to an integrated system, where all data passing through the institution is accessible from a single information environment. At the same time, the paperless technology is fully implemented, however, the possibility of obtaining a ”hard copy” of any document remains. The use of Modern medical organizations produce and accumulate huge amounts of data. The quality of medical care, the general standard of living of the population, the level of development of the country as a whole and of each of its territorial entities in particular depends on how effectively this information is used by doctors, managers, and governing bodies. Therefore, the need to use large, and at the same time still constantly growing, amounts of information in solving diagnostic, therapeutic, statistical, managerial and other tasks, determines today the creation of information systems in medical institutions. Maps, bulletins, procedural reports, records of patients, drugs – all the workflow was done on paper. This affected the speed and, consequently, the quality of patient care, hampered the work of medical, medical personnel, which led to medical errors, a great investment of time to fill out cards, and to compile reports. This complicated the management of health facilities

MCI (lack of control over the work of the units, lack of operational, analytical information) and the work of the controlling authorities. A feature of the MIS is the transition from local work with medical information to an integrated system, where all data passing through the institution is accessible from a single information environment. At the same time, the paperless technology is fully implemented, however, the possibility of obtaining a ”hard copy” of any document remains. The use of modern medical technologies allows to improve the quality of medical services, optimize the management of various structural medical units and create the basis for reaching the world level of medical services. Discusses the classification of medical information systems (MIS): medical information systems at the base level, medical information systems at the level of medical institutions, medical information systems at the territorial level and federal level.

2. Formulation of the problem

Modern medical organizations produce and accumulate huge amounts of data. The quality of medical care, the general standard of living of the population, the level of development of the country as a whole and of each of its territorial units in particular depends on how effectively this information is used by doctors, managers and government bodies. Therefore, the need to use large and at the same time constantly growing amounts of information to solve diagnostic, therapeutic, statistical, managerial and other tasks today defines the creation of information systems in medical institutions. Maps, bulletins, procedural reports, patient records, medications the entire workflow was done on paper. This affected the speed and, as a result, the quality of patient care, which hampered the work of medical personnel, which led to medical errors, a considerable amount of time to fill out cards and to compile reports. This complicated the management of medical institutions MCI (lack of control over the work of departments, lack of operational, analytical information) and the work of regulatory bodies. One of the main ways to solve a number of medical, social and economic problems is to inform health workers. These challenges include finding effective tools to improve the three most important attributes of care: service quality, patient safety, and cost-effectiveness. A key element of the information is the use of modern clinical information systems equipped with decision-making mechanisms in hospitals. However, these systems are not widely used, since scientific and methodological approaches to the development of clinical information systems have not yet been developed. Modern IT is widely used computers, computer networks and all kinds of software in the management process. The purpose of the introduction of information technology is the creation of information systems (IS) for the analysis and adoption of management decisions based on them. Information technology includes two factors: machine and human. A specific embodiment of information technology is mainly automated systems, and only in this case it is customary to talk about computer technology. For modern information technology, the following features are typical [1], [2]:

• eend-to-end information support at all stages of information transfer based on integrated databases, providing a unified form of data presentation, storage, search, display, recovery and protection;

• opportunities for collaboration based on networking technologies integrated through communication.

The effectiveness of management depends not only on the available resources, but also on a clearly formulated realistic achievable goal, the results of which are evaluated according to relevant indicators. Without this, the control system is not effective. The main goal of these processes is to create a single information space for all stakeholders (potential information users): various health structures and services, management and control bodies, manufacturers of medical equipment and medicines, research organizations and consumers of medical goods and services. This will greatly enhance the exchange of information and accelerate the introduction of the latest achievements of science and practice into everyday practice that meet the goals of improving and developing health care [1].

3. Formulation of the problem

With the help of the model, they solve the main tasks of the research, including studying the nature of the indicator change when the factors affecting the system change; determination of optimal levels of

factors to obtain the required or desired values of indicators of the system state. The construction of such models is carried out on the basis of sampling observation, the results of which form the initial database (training information), which is a matrix of observations with the number of rows equal to the number of objects observed and the number of columns equal to the number of controlled factors and simulated. The analysis of this information is based on the modeling process, taking into account the main drawbacks of the creation of the following:

1. In some cases, information is insufficient (opinion-based information about patients and opinions about the treatment of doctors).
2. There is not enough evidence of a disease, and because of the various causes of these symptoms is not enough.
3. Adaptive restructuring of the forms and methods of information delivery in the process of solving problems.
4. Paperless document processing.

The first thing that is mentioned from above is the problem of poor quality modeling. Here are some ways to solve this problem. We can try to complement the MISing mathematical methods with linearization and extrapolation. However, we have no such possibility, because data loss is very important. The second way for a certain group of diagnoses will be to obtain optimal models by creating a single model based on its symptoms. As the number of observations increases, models will be developed. The model has no demand for individual models.

Linear regression analysis was selected to determine the effectiveness of treatment and the effect of symptoms on the diagnosis. Given the poor quality of the original data, we can use non-linear methods. Analysis shows that linear regression analysis shows its effectiveness in many areas.

$$y = a_0 + a_1 x_1 + a_2 x_2 + ... + a_n x_n . \quad (1)$$

In this formula, *y* is diagnostic (dependent variables); $x_1, x_2, ..., x_n$ symptoms (independent variables). Where a_i - odd numbers in the form of a triangle [4]:

$$\mu_A(a_i) = \begin{cases} \dfrac{x - \beta_i}{c_i} & x > \beta_i, \\ \dfrac{\beta_i - x}{c_i} & x \le \beta_i. \end{cases}$$

an fuzzy number a_i in the form of a parameter can be written as follows:

$$a_i = (\beta_i, c_i)$$

Whereβ_i - is the center of the interval,c_i- is the width of the interval $c_i \ge 0$.

Then *y*-parameters of fuzzy numbers are defined as follows:
center of the interval:

$$a_y = \sum_j \beta_j x_{ij} = \beta^T x$$

width of the interval:

$$c_y = \sum_j c_j \left| x_{ij} \right| = c^T |x|$$

For an fuzzy logical model to be correct, the actual y value of an fuzzy number is as follows, the intervals given to the constraints must be associated with uncertainty:

$$\begin{cases} \beta^T x - c^T |x| \le y, \\ \beta^T x + c^T |x| \ge y. \end{cases} \quad (2)$$

(1) The solution of the problem can be summarized as follows:
It is necessary to find the parameters of fuzzy coefficients:
a) The tested values of yk correspond to the evaluation interval.
b) Minimum "sum of width" for the evaluation interval.
These requirements can be solved using the following linear programming problem [10]:

$$\begin{cases} \sum_k \sum_j c_j |x_{kj}| \to \min, \\ \sum_i \beta_i x_{ki} - \sum_i c_i |x_{ki}| \le y_k, \\ \sum_i \beta_i x_{ki} + \sum_i c_i |x_{ki}| \ge y_k. \end{cases}$$

The decision making process often has to deal with tasks that are often multidimensional in nature. In this case, the set of criteria is usually non-equalizing. Assessment models are used to measure a single measure of the performance (overall goal) of a set of performance indicators (specific goals). In other words, assessment models are a mechanism for reducing special-purpose functions to a generalized objective function. Building models of indicators of the state of multidimensional medical systems depending on the factors influencing them is an important task of statistical analysis performed by researchers using modern information technologies [2], [4], [6], [7].
As in any IS, they include the collection of information, which is preceded by obtaining primary patient data as a result of his examination or automatic use of special equipment for recording the patients condition (basically such information can be considered technological), and, finally, from other specialized MIS (for example, pharmacopoeia, anesthesiology or from medical libraries). Of course, in such a system it is necessary to structure and store information, as well as search tools, not only in the database, but also in various storages, in particular, roentgenograms or cardiograms. The large amount of computation associated with quantifying information in the system requires the inclusion of various applications in the MIS. Modern MIS work online, so when they work, users can have access to distributed databases or other diverse information resources, including those located on the Internet. A significant expansion of the range of equipment used in health care, and improving the quality of medical care lead to the inclusion of additional information in the MIS resource.

4. Medical information systems and their classification

The classification of medical information systems is based on a hierarchical principle and corresponds to the multi-level structure of health care.
There are:
Basic medical information systems, the main purpose of which is computer support for the work of doctors of various specialties; they make it possible to improve the quality of preventive and laboratory diagnostic work, especially in conditions of mass service with a shortage of time for qualified specialists.
According to the tasks to be solved:
The main medical information systems, their main task is computer support for doctors in various fields; they can improve the quality of preventive and laboratory diagnostics, especially for low-quality public service providers. In accordance with the selected functions:
a) assisting the doctor according to the diagnosis of the patient;
b) consultative and diagnostic systems (for the diagnosis of pathological conditions, including the prognosis and development of recommendations on methods of treatment, for diseases of various types);

c) instrument-computer systems (for informational support and / or automation of the diagnostic and therapeutic process carried out in direct contact with the patient's body);
d) automated workplaces of specialists (for automating the entire technological process of a doctor of a relevant specialty and providing information support in making diagnostic and tactical medical decisions).
Thus, a medical information system (MIS) is a combination of software and hardware, databases, and knowledge designed to automate various processes occurring in hospitals and the health care system (MCI). The objectives of the creation of MIS [2], [5]:
1. Creating a single information space;
2. Monitoring and quality management of medical care;
3. Increasing the transparency of the work of medical institutions and the effectiveness of management decisions;
4. Reducing the time of examination and treatment of patients;
5. Fast detection and decision making.
At the same time, the existing and projected MIS mainly perform separate information system functions from a number of workstations to help organize information services for the health information system's accounting system or basic health-related processes (for example, information support for postoperative patients or maintaining medical statistics) [7], [10].
The specificity of medical information systems is as follows:
1. Patient Orientation: The core of MIS is the history of the disease.
2. Increased developer responsibility.
3. Integration of administrative, medical and financial information.
4. Integration with specific types of equipment.
Medical information systems have a number of functional capabilities:
• Collection, registration, structuring and creation of the information space;
• Ensuring information sharing;
• storage and retrieval of information;
• statistical data analysis;
• monitoring the effectiveness and quality of medical care;
• Support in making decisions;
• Analysis and control of resource management institutions;
• Support for the economic component of the treatment process.
• Creating a model that will help the doctor determine the disease on the basis of signs.

Conclusion

This system of equations is solved by the method of a system of linear equations, and unknown phenomena are detected. The decision-making process often has to deal with problems that are often multidimensional in nature. In this case, the set of criteria is usually unmatched. Assessment models are used to measure a single measure of the performance (overall goal) of a set of performance indicators (specific goals). In other words, assessment models are the mechanism for reducing special-purpose functions to a general objective function [1], [2].
As a result, one can observe variables in different spheres of space. Existing information on existing experimental data will increase the adequacy of the non-public expert system. We summarize the priorities of fuzzy expert systems that manifest themselves in solving complex algorithmic diagnostic tasks. Regression analysis allows you to simulate a case for diagnostic solutions. Information technologies can be successfully applied in various fields of modern medicine. For example, in the field of patient safety, modern automated systems can enhance the quality and safety control of medicines and medical services, reduce the likelihood of medical errors, provide ambulance with the means of rapid communication and access to vital patient information. Modern technological solutions are able to provide free

access to health services regardless of the place of residence of the patient, significantly increase the availability of high-tech medical services, medical expertise.
Thus, we can safely say that medical information systems, consisting of many specialized modules, help in the simultaneous solution of diagnostic, therapeutic, managerial, financial, statistical and other tasks. In turn, all this, ultimately, contributes to the achievement of the final goal of any health care facility (MCI) - the provision of quality medical services. The selection of these factors is modeled on the basis of expert knowledge. This model can be widely used in decision making.

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