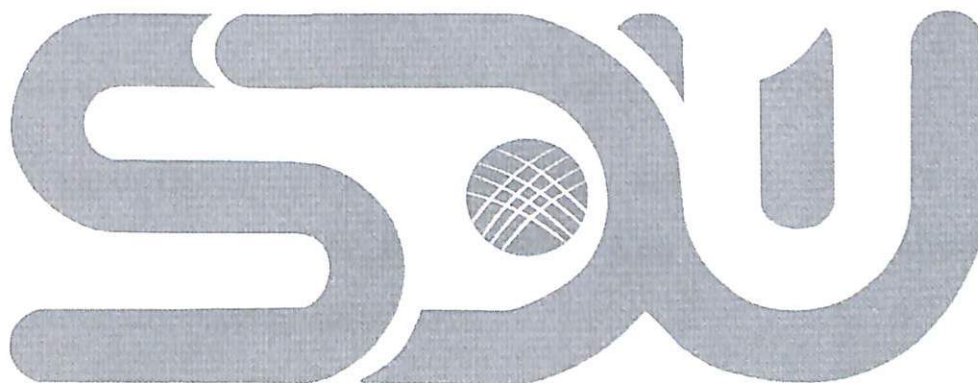


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ABSTRACT

The purpose of this study is optimization with the help of optimization algorithms and increasing the efficiency of therapeutic and diagnostic processes of the supposed optimal correlation between the results of these processes and the labor and material costs necessary for achieving it. Also, a review of medical information systems and the dynamics of their development.

The paper describes the main scientific and medical databases and how to access them, and considers bibliographic and full-text databases for users, researchers, doctors and general users.

The forecast of its development is given and the main trends that have been formed over the years of observation are noted. Scientific-based automated improvement of the organization and management of medical and diagnostic processes will allow to raise the solution of the main healthcare tasks to a qualitatively new level.

It is stated that the efficiency in many respects depends on the organization and management of medical-diagnostic processes. Also given are averaged data on the performed installations, the distribution of developments on technologies and database management systems, by types of treatment and prevention institutions and forms of ownership. The work also performed an overall assessment of the state of automation of the market of medical and preventive institutions and their shortcomings in organization and management lead to serious errors in the diagnosis and treatment of patients.

Key words: medical-diagnostic processes, automated management, management of medical-diagnostic processes, public health.

АНДАТПА

Бұл зерттеудің мақсаты оңтайландыру көмегімен алгоритмдер оңтайландыру және тиімділігін арттыру және емдеу-диагностикалық процестердің болжанатын оңтайлы арақатынасы нәтижелерін осы процестердің және қажетті қол жеткізу үшін еңбек және материалдық шығындар қарастыру болып табылады. Сонымен қатар, медициналық ақпараттық жүйелер, шолу және олардың даму динамикасын қарастыру.

Негізгі ғылыми-медициналық деректер базасын және тәсілдері, оларға қол жеткізу қарастырылып, библиографиялық және толық мәтінді деректер базасын пайдаланушыларға арналған, зерттеушілер, дәрігерлер мен жалпы пайдалану жұмысында сипатталады.

Болжам мен оның дамуы мен негізгі тенденциялары байқалады, қалыптасқан арналған байқау беріледі. Ғылыми-негізделген автоматтандырылған жетілдіріп, сапалы жаңа деңгейі негізінде міндеттерді шешу мен денсаулық сақтауды ұйымдастыру және басқару емдеу-диагностикалық үдерістерді көтеруге мүмкіндік береді.

Тиімділігі көбіне тәуелді ұйымдастыру және басқару емдеу-диагностикалық процесстерді басқару келтіріледі. Сондай-ақ, орташаланған туралы деректер орындалған инсталляция келтіріліп, бөлу әзірлемелер бойынша технологиялар мен жүйелер деректер базасын басқару жүйелері, түрлері бойынша емдеу-профилактикалық мекемелер мен меншік нысандары. Және де сондай-ақ, орындалған жалпы жай-күйін бағалау автоматтандыру нарығын емдеу-профилактикалық мекемелерінің жұмысы және олардың кемшіліктері, елеулі қателер мен емдеудегі пациенттерді басқару әкеледі

Кілт сөздер: емдік-диагностикалық процестерді, автоматтандырылған басқарма, емдеу-диагностикалық басқарманың үдерістері, денсаулық сақтау.

АННОТАЦИЯ

Целью исследования данной работы является оптимизация с помощью алгоритмов оптимизации и повышение эффективности лечебно-диагностических процессов предполагаемых оптимальное соотношение результатов этих процессов и необходимых для его достижения трудовых и материальных затрат. Так же, обзор медицинских информационных систем и динамики их развития.

В работе описываются основные научно-медицинские базы данных и способы доступа к ним, рассматриваются библиографические и полнотекстовые базы данных, предназначенные для пользователей, исследователей, врачей и общего пользования.

Дается прогноз его развития и отмечаются основные тенденции, сформировавшиеся загоды наблюдения. Научно-обоснованное автоматизационные совершенствование организации и управления лечебно-диагностическими процессами позволит поднять на качественно новый уровень решение основных задач здравоохранения.

Приводятся, что эффективность во многом зависит от организации и управления лечебно-диагностическими процессами. Также приводятся усредненные данные о выполненных инсталляциях, распределении разработок по технологиям и системам управления базами данных, по видам лечебно-профилактических учреждений и формам собственности. В работе также выполнена общая оценка состояния автоматизации рынка лечебно-профилактических учреждений и их недостатки в организации, управлении приводят к серьезным ошибкам в диагностике и лечении пациентов.

Ключевые слова: лечебно-диагностическими процессами, автоматизационные управление, управления лечебно-диагностическими процессами, здравоохранения.

CONTENTS

INTRODUCTION	8
1 CONCEPT OF AUTOMATION CONTROL MEDICAL- DIAGNOSTIC HEALTH PROCESSES	
1.1 Management of medical-diagnostic processes as an object of research.....	9
1.2 Analysis of health management technology.....	11
1.3 Information technology of the activities of the receptionist.....	14
2 INFORMATION TECHNOLOGY OF THE ACTIVITIES OF THE DOCTOR OF THE HOSPITAL DEPARTMENT.....	16
2.1 Information technology of the activities of a senior nurse.....	22
2.2 The use of information technology in the domestic health.....	22
2.3 Classification of medical computer systems used in medical institutions..	24
2.4 The current state of the use of information technology in health.....	27
2.4.1 Information technology activity of the dispatcher of research results.....	31
2.4.2 The architecture of a distributed automated health management system.....	34
3 THE METHOD OF DESIGNING AUTOMATED INFORMATION TECHNOLOGIES IN ORGANIZATIONAL MANAGEMENT.....	37
3.1 Statement of the problem of automation of management of diagnostic and treatment processes in public health bodies.....	38
3.1.1 Structure of the automated control system for medical diagnostic processes	39
3.1.2 Optimization of the patient examination route taking into account contraindication.....	40
3.1.3 Typical adaptive information technology of the organization of medical-diagnostic processes in medical institutions.....	41
3.2 Information technology of the activities of the discharge department employee.....	44
3.2.1 Information technology of the activities of the hospital administrator.....	50
3.2.2 Information technology of the activities of the database administrator.....	53
3.2.3 Information technology of the activity of the polyclinic registrar.....	56
3.3 Information technology of the activity of the doctor of the polyclinic...	60

3.3.1	The doctor can view outpatient cards in full, and in parts.....	64
3.3.2	Automation of control of the performing discipline.....	66
3.4	Typical adaptive information technology for control of the performance discipline	69
4	The problem of training users of information technology in the health system.....	77
4.1	Psychological aspects of teaching doctors information technologies.....	78
4.2	Classification of medical computer systems used in medical institutions...	80
4.3	Analysis and isolation of a complex of factors for increasing the effectiveness of therapeutic and diagnostic processes.....	82
	CONCLUSION.....	85
	REFERENCES.....	86

INTRODUCTION

In the introduction, the urgency of the problem is justified, the goal work, object and subject of research. Scientific The results brought to the defense are determined by their scientific novelty and practical importance, provides information on the use and implementation of results of work. In the first chapter, the problem of increasing the effectiveness therapeutic-diagnostic processes, the concept of an integrated automation of operative management of medical diagnostic processes based on modern information technology. An analysis of the existing health management system revealed following major shortcomings:

1. Significant temporary and financial costs for the collection, storage, processing and transfer of medical information in health authorities.
2. Lack of capacity to collect information in real-time mode with dynamic state change health of the population
3. Ineffective management solutions through the use of average statutory indicators.
4. Lack of accounting for the real costs of medical institutions examination, diagnosis and treatment of patients.

To overcome the above deficiencies, it is proposed introduce a system of collection and processing technological information of medical-diagnostic processes in the regime real time. The paper substantiates the necessity of using in such a system of modern information technology. System analysis of treatment-diagnostic processes allowed identify the composition of factors that affect their effectiveness. In medical such factors as: complexity of the disease, organization of treatment and diagnostic processes, professional level doctors, timeliness of prognosis and timeliness of prevention diseases of the population, performing medical discipline staff. In health authorities, the factors of increasing. The effectiveness of therapeutic and diagnostic processes include: provision of medical institutions with premises, equipment, specialists, medicines, timeliness of forecasting and timeliness of disease prevention, conformity real data to the norms of medical and diagnostic processes, executive discipline of health

officials. Based on the analysis of the above factors, the following directions of complex automation of management of medical-diagnostic processes:

- 1) the organization of medical-diagnostic processes in healthcare institutions
- 2) analysis of professional activities of specialists and making decisions on their adjustment activities and professional development
- 3) accounting, analysis and making decisions on the provision of medical facilities facilities, equipment, specialists, medicines
- 4) analysis, forecasting diseases of the population and decision-making on their prevention
- 5) analysis and making a decision on compliance with the standards of medical care real data
- 6) accounting, analysis of the performance discipline and acceptance decisions on its increase.

The proposed implementation of these formation of a database of medical diagnostic processes, which will allow for an objective analysis of information and use it for formation of various kinds of decisions.

1. CONCEPT OF AUTOMATION CONTROL MEDICAL-DIAGNOSTIC HEALTH PROCESSES

1.1. Management of medical-diagnostic processes as an object research

Based on the analysis of the existing management system in health care institutions and public health services, its main shortcomings are listed. In order to overcome the above-mentioned deficiencies, it is proposed to introduce in the practice of health care institutions a system for collecting and processing technological information of diagnostic and treatment processes in real time. The necessity of using modern information technologies in this system is justified.

The chapter analyzes the current state of the use of funds informatization in domestic and foreign public health. Based on the analysis of the health

management automation problem, a classification of existing medical automated information systems is proposed.

The composition of the factors determining the effectiveness of therapeutic and diagnostic processes in medical institutions and health authorities is determined. Based on the analysis of the above factors, directions for automating health management have been identified. In the basis of the implementation of the selected directions, it is proposed to create a database of medical diagnostic processes that will allow an objective analysis of information and use it in the formation of various kinds of solutions [1].

The hierarchical, territorially distributed nature of the ACS in the health of the region is substantiated, its architecture, principles of development and operation are defined. The composition of ACS subsystems by medical diagnostic processes in institutions and public health bodies is determined. Formulations of tasks of automation of management of medical-diagnostic processes in medical institutions and public health bodies are formulated.

An increase in the efficiency of medical diagnostic processes presupposes an optimal correlation between the results of these processes and the labor and material costs necessary to achieve it. Obviously, the efficiency in many respects depends on the organization and management of diagnostic and treatment processes. Disadvantages of organization and management lead to serious errors in the diagnosis and treatment of patients. All this has a significant impact on the results of the analysis, predicting the indicators of the health status of the population, the effectiveness of preventive measures and leads, from the point of view of the organization of health care, to unreasonable financial costs. Scientifically-based improvement of the organization and management of diagnostic and treatment processes will allow to raise to a qualitatively new level the solution of the basic tasks of public health.

Complexity, variety of therapeutic and diagnostic processes and forms of their implementation requires a comprehensive application of modern informatization tools at all levels of the healthcare organization.

The need to expand the tasks of informing health care is reflected in a significant number of decisions¹ adopted both at the federal level, both nationally and nationally.

The proposed method allows to optimally order the patient's assigned studies taking into account contraindications. In the event that the doctor himself assigns the order of some studies, then a conditional-optimal ordering function for the assigned studies is constructed. In this case, the time intervals that should take place between ordered studies are calculated. Immediately, the patient's schedule is compiled after analyzing the workload of the laboratories, the patient's own capabilities and taking into account the computed order of the studies assigned to him. In the event that as a result of carrying out a part of the research, the doctor needs to change the composition of the assigned studies, then the previous procedure is canceled and the task is solved anew for the new staff.

Typical adaptive information technology of the organization of medical-diagnostic processes in medical institutions. To create an automated subsystem for managing the organization of medical-diagnostic processes in a medical institution, it is necessary to design the appropriate information technology.

1.2 Analysis of health management technology

In general, for all medical institutions the generalized cycle of examination, diagnosis and treatment of patients is the same. However, in more detailed consideration, some stages of the generalized cycle for the polyclinic, specialized centers and hospital will differ. This is due primarily to the difference in the organizations of examination, diagnosis and treatment of patients in these institutions. Figure 1.1 presents a general schema for the organization of treatment and diagnostic processes in a polyclinic. The patient turns to registry, which sends him to a consultation with one or more specialists. The specialist, after examining the patient, appoints him additional consultations, studies in diagnostic departments or laboratories. All information on the results of studies and consultations is recorded in the corresponding outpatient card. Having received

the results of the full examination, the expert makes a conclusion, if necessary, prescribes treatment, generates an extract, which is recorded in the registry.[2]

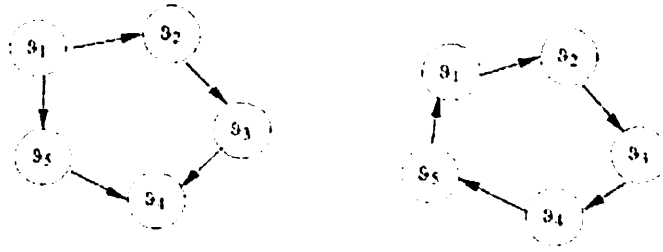


Figure 1.1 Scheme of technology for managing the activities of medical institutions by health authorities

A generalized scheme for the organization of treatment and diagnostic processes in a hospital is presented in. The patient enters the ward of the receiving dormitory, which sends him to one of the departments of the hospital. The attending physician can appoint consultations of specialists from other departments, research in laboratories, diagnostic departments, treatment. At the completion of the examination and treatment, the discharge department forms an extract from the medical history.

The modern health management system is built mainly on the analysis of statistical information on regulatory indicators of resource use, such as the number of visits, bed turnover, the number of studies conducted, the procedures performed, and so on. In Figure 1.1 the current scheme of technology for managing the activities of medical institutions by health authorities is presented.

Medical institutions transfer medical and statistical information to the health authorities, which is the basis for applying mathematical methods for assessing the effectiveness of their activities, predicting diseases, planning various types of support. In the case of sufficient information, decisions are made on the organization of treatment and diagnostic processes and appropriate control actions are developed in the form of allocation of finance, medicines, equipment, organization of new institutions and so on. If the analysis of the data showed the lack of completeness of information for making managerial decisions, then the amount and type of information to be collected is determined.

Using methods of linear programming, the problems of optimal accommodation of rural hospitals, pharmacies, sanatoriums, optimization of

structures of multi-profile hospitals are being solved. Methods of dynamic programming are used to construct an imitating dynamic model of the health care system and to solve problems of determining the volumes of preventive measures of certain diseases at a minimum cost for their treatment. In the planning of health care, traditional economic methods are used, such as analytical, comparative, balance, normative, method of network planning. At each stage, in real time, all information related to patients staying in a medical institution is documented. At the same time, at a certain step, if necessary, the control stage allows to pass certain stages of the cycle.

In Figure 1.2 shows the classification of existing medical computer systems used in hospitals.

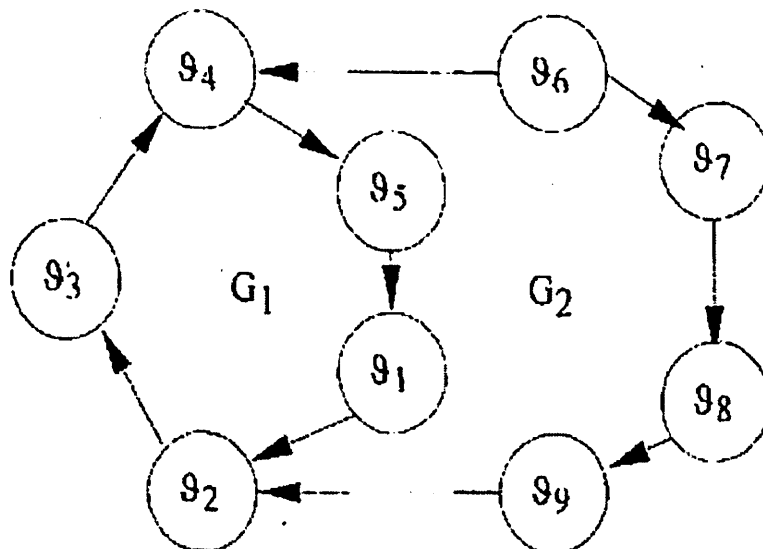


Figure 1.2 The structure of the distributed ACS by the treatment and diagnostic processes of the health of the region

Time, quality of the generalized cycle of examination, diagnosis and treatment of patients, the effectiveness of treatment and diagnostic processes depends on various factors. In order to distinguish these factors, it is necessary first of all to analyze the technologies for managing the diagnostic and treatment processes of departments, which are the main structural elements of medical institutions, from the systemic positions. [3]

The first level of the hierarchy of management is made by the heads of the medical institution: chief doctors and deputies. This level of managers carries out the planning, control and management of the provision of equipment, medicines, the burden of specialists and the department as a whole, and the schedule of the laboratories. One of the important tasks of managers at this level is the development of control actions based on expertise of professional activities of specialists.

The second level of the hierarchy of management is formed by the heads of the departments that manage the activities of doctors, controlling and correcting, if necessary, the diagnostic and treatment processes. In addition, in each department the head manages the activity of the senior nurse in terms of securing the separation of medicines.

The third level consists of doctors who directly manage medical diagnostic processes: prescribe studies and treatments, adjust them depending on the condition of patients. Doctors also manage the activities of nurses: control timeliness and correctness of the performance of medical appointments, make the necessary adjustments.

The fourth level of the hierarchy is made up of senior nurses who manage the organization of nurses' duty in the departments and performing medical appointments. Nurses are the executors of medical-diagnostic processes.

Thus, the doctors of medical institutions and, if necessary, the heads of the departments manage directly the medical and diagnostic processes. Heads of departments, heads of medical institutions, employees of health authorities manage the organization and provision of medical-diagnostic processes in medical institutions.

1.3 Information technology of the activities of the receptionist

After entering the system and entering your password, the employee can enter and view the relevant information about the patient, obtain statistics, and record the patient's transfers to other departments in the data bank of the treatment and diagnostic processes.

When registering the results of a pre-hospital examination of the patient, the employee indicates the date of the examination and records the result. If the analysis is complex and consists of several analyzes, the employee fills in the electronic form of a complex analysis.

For each patient, an employee can enter specific information: treatment regimen, transportability, a dietary table, preferential rights (disabled, veterans, etc.), social status, special marks. This information is then automatically inserted into the header of the patient's electronic medical history.

When the patient is hospitalized, the receptionist shall indicate the time and date of his admission to the medical institution, the name of the ward and the number of the ward. Chambers are selected from the number of available seats, corresponding to the sex of the hospitalized patient.

The receptionist can obtain statistical information about the receipts, extracts and transfers of patients for any day; the number of vacant seats in the ward chambers; number of occupied places with reception of list structure of patients. The receptionist can register the patient's transfer to the free rooms of other departments.

Health, as a branch of the national economy, is a complex, multidisciplinary system characterized by the diversity of its organization forms and the breadth of the range of its tasks. The main task of the management, which is facing the health care system, is to increase the efficiency of the treatment and diagnostic processes. The healthcare system of any region, in terms of treatment and diagnostic processes, has a hierarchical management structure, the elements of which are respectively: health ministries, city and district government bodies, and medical institutions.

The use of the average statistical indicators does not allow to draw a conclusion: is it better for patients as a result of certain measures (treatment, prevention, medical examination, hospitalization, etc.). This required the development of a system of indicators that allows for a qualitative assessment of medical services and makes it possible to assess the dynamics of changes in clinical conditions of patients to some extent. To obtain such characteristics as the

frequency of hospitalization, duration, duration of remission, intensity of disability, the patient registers, the so-called statistical coupons, were created and used. With their help, it is possible to obtain more complete data on the dynamics of the course of various diseases of patients and to evaluate the effectiveness of the doctor, department, institution, and services of the region. However, for the comprehensive analysis and management of the activities of medical personnel performing the examination, diagnosis and treatment of patients, it is necessary to create a formalized or electronic medical history. Formation of an electronic medical history will lead to the creation of a database of all those treated. Analysis of the data bank for a large number of case histories in any sections will allow managers to evaluate the effectiveness of medical diagnostic processes, and doctors formulate various types of medical recommendations on a more extensive and objective basis, compared with how it is done now on the basis of observations and comparison of a small sample of patients.

To create an effective management system for medical and diagnostic processes and reduce the cost of processing the increasing volumes of medical information, it is necessary to use modern means of informatization. Modern network equipment and software tools allow to develop a collection system and real-time processing of complete and adequate information reflecting the treatment and diagnostic processes.[4]

2. Information technology of the activities of the doctor of the hospital department.

After registering and entering the password, the doctor has the ability to enter and view information on the results of working with the patient, to obtain statistics, to enter and view information on the results of consultations of patients from other departments, and to analyze archival patient records. In addition, if the doctor is the head of the department, then he can monitor the work of specialists in this department of the hospital. To record information on the results of work with a patient in the database, you need to register. The patient's registration is carried

out by selecting from the list of patients directed to the receiving rest and undergoing treatment in this department. The list displays the number of the medical history and the presence in the medical history of the diary for the current day. After selecting a patient from the list, his passport information is displayed on the screen. If the patient's passport data has changed, the doctor can correct them.

At any stage of the patient's work, you can view all the information from his current and archival electronic case histories. Each change in the diagnostic and treatment process is reflected in the database only after confirmation by the electronic signature of the appropriate doctor. To create the results of the initial inspection or diary entries in the database, special directories are used. It is possible to copy the sections of the latest diary entries. The results of the survey are described as follows. In the left half of the screen there is a list of questions and possible answers. In the right half, the text that is generated as a result of the responses is displayed. This allows the doctor to check the correctness of the entered information, if necessary, return to a particular question and correct the answer. Questions are divided into three types according to the type of answer: YES, NO (presence or absence), numeric value is a refinement of 10 characters in length; enumerated answers.

Registration of the main and concomitant diagnoses is carried out using the ICD-10 reference books and clinical forms of diagnoses. In case the diagnoses were registered earlier, the specialist can form or adjust the schedules of prescriptions and treatment. Formation of the examination schedule assigned to the patient is made only after registration of the main or concomitant diagnosis. The scheme contains research in laboratories, diagnostic departments, as well as consultations of doctors from other departments.

In a number of medical institutions, in parallel with the statistics on the international classification, internal statistics are conducted in the context of the medical and economic standard (MEA). The correspondence between the ICD code and MES is established when working with diagnoses. A doctor can get a list of complex studies that are conducted in a hospital. Each line displays the name of

the analysis, the laboratory department, where the analysis and the required material for the study are carried out. The structure of such an analysis is presented in the form of a tree. The complex analysis can include both simple and complex analyzes.

The purpose of research and consultation can be done not only by choosing from the appropriate lists, but also using typical schemes for examining the current disease. Some studies and consultations during the treatment of a patient in a hospital should be carried out at least 2-3 times, and a re-examination should be scheduled after a certain time. For this, in the subsystem, it is possible to put a specific survey on the control. Then, after a specified time, a reminder will appear to a specialist on the computer screen about the need to reassign this patient. The subsystem optimizes the schedule of examinations of patients taking into account contra-indicated studies, workload of laboratories, specialists. The schedule received is presented to the doctor in as recommendations on the screen. If necessary, the doctor can correct it. [5]

Formation of treatment regimens for the patient is made only after registration of the underlying or concomitant diagnoses. The purpose of drug treatment is carried out in two stages: the formation of a list of drugs and planning treatment for each drug: single dose, amount, time of admission, start date, end of admission. Each line of the list displays the name of the drug, the dosage and the form of the drug. If at the end of the line there is a plus sign "+", it means that in the warehouse in the warehouse this preparation is available. On the screen, you can display the corresponding Latin names of the drugs. The medication guide is a hierarchical structure. Related drugs constitute a certain group, which, in turn, can be part of another group, a higher level. Thus, the user finds the drugs he needs, sequentially deepening into the appropriate groups. The purpose of treatment can be done using also the appointment of the patient typical treatment regimens for the current disease.

The appointment of operations is performed by a doctor only with surgical specialization. To make the department a surgical status, you must set this status for it in the "Database Administrator" subsystem. In this case, the subsystem will

have an additional opportunity to create and view the list of operations assigned to this department with the date and name of the operation, the name of the operating surgeon. To describe the operations in the subsystem, a special form is used, which is generated by the database administrator. In Figure 2.1 presents a classification of existing medical computer systems used in medical institutions. Systems in which decision rules are used relate to the class of expert systems.

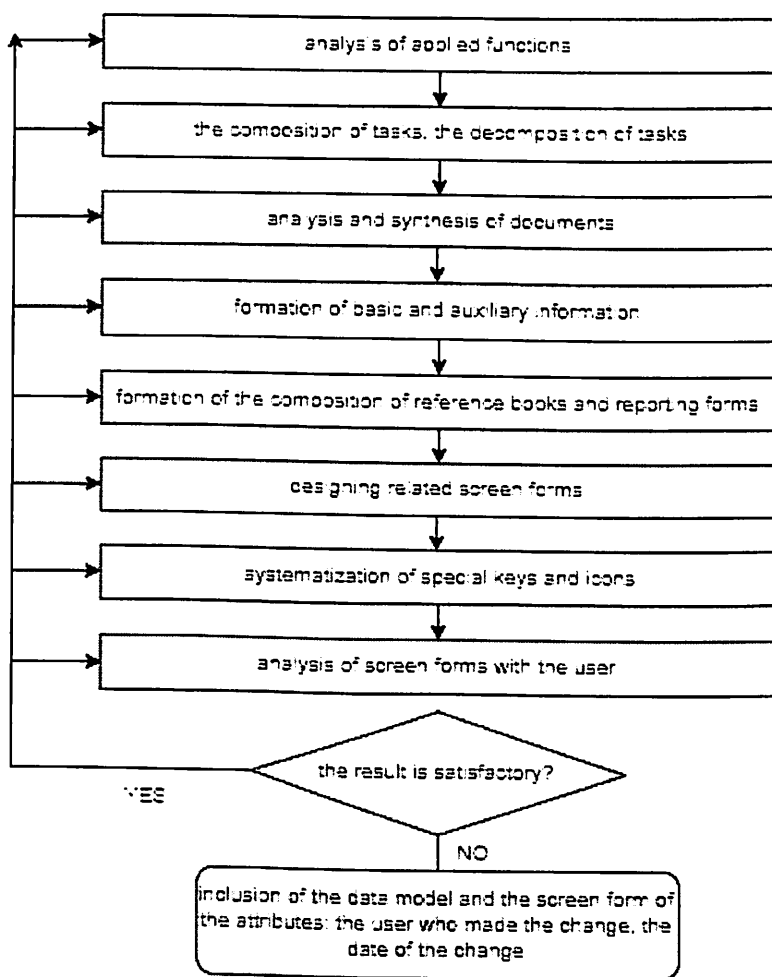


Figure 2.1 shows the classification of existing medical computer systems scheme used in hospitals

The doctor forms procedural marks for the nurse of the department, and can also adjust the features of the patient's observation and treatment regimens: transportability, a dietary table, preferential rights of the patient (invalid, participant of the Second World War, etc.), social status, treatment regimen of the patient, which is classified by special management, special notes. The physician must register in the database any movements of the patient inside the department and the hospital. The doctor has the opportunity to conduct consultations for

patients from other departments from his workplace. To this end, the physician must identify the patient from another ward by selecting him from the list of patients to whom his advice is assigned. Further work with the patient in the information plan is similar to working with the patient of this department, except for the possibility of recording the movement of the patient inside the hospital or separation, as well as changing the data of the passport department. Further, the database searches for information about patients. To search for patients, you can use the following criteria: surname, history number, room number, types of appointments. After receiving a list of patients who meet the search criteria, you can view or enter the necessary information. The number of patient status parameters can reach no more than 14. The composition of these parameters can be changed with the help of the "Database Administrator" subsystem. The date and time of the description of the status parameters is automatically fixed in the database. Those parameters that should be described by the nurse more than once a day are marked with a special color.

The choice of information on the treatment of patients can be carried out by its type: inside, intravenously, intramuscularly, subcutaneously, etc. For each patient, the name of the drug, the dose and indication for use are indicated. In case the doctor specified specific hours of taking the drug, then on the screen under the corresponding digits 0, 2, 4, 6, etc., there will be an asterisk symbol. The nurse should note the performed appointments. For each patient, the nurse can obtain a list of studies and consultations appointed by the doctor, indicating the laboratories where these studies are conducted, the dates and times of the studies. For convenience of work of the nurse in the subsystem the second possibility of entering information about the patient is realized. For each condition parameter, the prescribed drug, the study is determined by the corresponding group of patients. Each patient from the group corresponds to certain 'fields for entering and viewing information.

In the subsystem, you can receive the following output documents: recommendations for monitoring the parameters of the patients' condition, lists of medications for each patient, sheets prescribing drug treatment for all patients for

each type of appointment, a list of assigned studies for each patient; the composition of patients for each type of study, the composition of patients for each type of consultation, the composition of patients with a list of prescriptions for the biochemical laboratory, list of prescribed nutritional therapy, list of current department patients. A nurse can print out the appointment forms for consultation, research, for each patient. Having selected from the database the medicines prescribed to the patients of the department, the nurse can note the missing preparations, form and print the application to the senior nurse for their purchase.

2.1 Information technology of the activities of a senior nurse

With the help of a special mode of the subsystem, the senior nurse can view and print out on the printer a list of all prescription drugs: the name of the drug and the total daily dose for all patients to whom the drug was prescribed. For each drug, it is possible to view the list of patients who are assigned to this drug.

Analysis of the activities of senior nurses of various departments of the hospital allowed to design and implement the information technology presented in Table 2.1

Specifier	Parameters	Appointment
SELECT	List of samples (attributes that make up the scheme of the resulting relationship).	Determination of the parameters for realizing the relational projection operation.
FROM	List of tables used in the query.	Define the names of tables whose attribute values are applied to the relational operations described in the query.
WHERE	Logical conditions for data retrieval.	Determine the conditions for joining tables and retrieving table rows.

ORDER BY	List of attributes.	Change the order of the received data by sorting by the specified attributes.
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Table 2.1 some SELECT statement specifies and their purpose are given

After registering and entering the password, the senior nurse can review information on working with nurses applications for medicines, enter and view information on stocks of drugs in the warehouse, form and receive statistical output forms for the work of the department as a whole, including the time sheet.

In the majority of ALIS, the main areas of automation are patient flow management and data recording in the context of working with insurance companies, for example, MEDICO (Siemens), PMS (UK). Achievements in the field of creating new integrated circuits, computer networks and systems expand the capabilities of developers of the ALIS software used in medical institutions. Currently, there are medical workstations that allow you to receive on the computer screen a doctor at the same time an image, a patient's medical history and information from medical libraries. [6]

In a number of cases, attending physicians prescribe drugs that are absent in the ward. The senior nurse with the help of a subsystem can print out a list of absent drugs in the department and pass it on to the doctors with a view to changing the prescribing of these drugs to similar drugs. The subsystem implements the possibility of registering medicinal products in the warehouse of the department and forming requirements for medicines for the pharmacy. For each product, the following information is stored in the data bank: name, dosage, series, date of registration, shelf life, the price of the 1st unit, amount of product in stock, date of registration of the drug, a sign of the fund of the senior nurse (the information on such preparations will be accessible only to the senior nurse).

The search for information on drugs in the database is carried out according to the following parameters or their combinations: name (Russian or English), form of release, series, expiry date, date of issue, indication of belonging to the senior nurse fund. If necessary, you can get a printout of the list of selected drugs.

To enter the names of products in the database, Mashkovsky's electronic reference book is used.

To formulate and print requirements, you must select the type of drugs: conventional drugs, extemporal drugs, drugs. Then, create a list of necessary drugs with the required number of units, specify the requirement number, edit the received request form on the screen if necessary and print it on the printer. For each type of drug, the requirement will have its own form. The special consideration is the arrival and consumption of alcohol in the department. The senior nurse enters in the database information about the date and amount of arrival or consumption of alcohol.

Statistical processing of data for the senior nurse is carried out in the following sections: receipt, discharge, transfers for any calendar day; the number and composition of patients in the ward indicating the ward; availability of vacant seats in the wards. Data obtained as a result of statistical processing can be presented in the form of output documents.

For presentation to the financial institutions of the hospital information on the time worked by the employees of the department, the senior nurse with the help of the subsystem forms the time sheets for the main and on-duty personnel. To do this, a list of employees is created, which is indicated in the report card. For each employee, the data involved in calculating the salary are specified, namely: the type of payment (hourly, full rate, 1/2 rate, 1/4 rate, nurse's rate, day of the child), workload factors, etc. After entering all the information on the report card you can get a paper copy of the document.

2.2 The use of information technology in the domestic health

Institutions of domestic health care have recently been intensively equipped with computer equipment, diagnostic equipment, network information transmission facilities. In addition, the use of computers in health care is expanding. According to the head of the problem commission "Application of computers in health planning and management" of the Scientific Council on Social Hygiene and Health Organization under the Presidium of the Academy of

Medical Sciences of the USSR Kant VI, published in 1987, since 1981, work was carried out to create a single integrated industrial management system "Public Health". This system included a set of administrative, economic and mathematical methods, organizational measures, computer facilities and communications. The purpose of this system was to collect, process and provide health authorities with consolidated analytical information for optimal planning and use of labor, material and financial resources allocated to health care [7]. An analysis of many years of experience in the implementation of automation tools in the activities of institutions and services of the Ministry of Health of Kazakhstan shows that the development was aimed at automating the collection and processing of medical and statistical parameters and some managerial functions of health authorities. In view of the complexity and vastness of the problems to be solved, the OSAU "Healthcare" branch system was developed in stages with the implementation of individual subsystems that solve their specific tasks. The specialized information-computational "centers", "departments" of the automated control system were created, large-scale development of medical automated systems together with scientific and technical institutions of other ministries and departments.

The use of modern information technologies in various areas of human activity led to the expansion of the areas of automation in solving the tasks of managing the health care organization. Not only the activities of the Health Offices are being automated, but also the activities of medical institutions with the aim of creating more complete data banks than currently collected medical and statistical data. According to the conceptual bases published in 1996, it is noted that the main directions for the use of new information technologies within the framework of medical diagnostic processes should be:

- 1) the formation of automated information resources of the city healthcare in the form of databases
- 2) the creation of automated information systems (AIS) of multi-profile hospitals
- 3) creation of automated information systems of outpatient-policlinic institutions

4) automation of pharmacy activities by equipping the pharmaceutical services with information systems

5) the creation of the automated control system "NII", "HIGH SCHOOL" for solving the original tasks inherent in these medical institutions.

However, the automated systems that are to be established, which must function in medical institutions, by their nature should not simply be information systems. The systems to be created must be automated systems of organizational management (ACS), since the range of tasks they solve must be wide enough. The tasks of such systems should be not only the collection, storage, retrieval and issuance of information about the patient's condition, but also help the doctor in diagnosing, prescribing examinations, selecting treatment regimens; control of treatment; recommendations for changing its course in accordance with the patient's condition; management of patient flows; planning the use of the resources of the medical institution, collecting information for medical statistics and insurance companies; calculation of treatment costs, as well as other medical and administrative tasks.

2.3 Classification of medical computer systems used in medical institutions

The analysis of publications has made it possible to base the classification of medical computer systems currently used in medical institutions as follows:

- presence or absence of automated decision-making procedures
- appointment of medical computer systems
- use of network hardware and software
- degree of automation of management of medical-diagnostic processes.

Consultation and diagnostic systems are designed to assist doctors in diagnosing and prescribing treatment. For example, describes a computer-based expert system designed to assist physicians in diagnosing surgical diseases in the abdominal cavity. Among the consulting and diagnostic expert systems, systems are identified, the source of information for which is a person and sensors of diagnostic equipment. The paper is devoted to a review of the use of logical methods in medicine, based on models of representation of medical knowledge -

cause-effect, anatomical, heuristic, pathophysiological; as well as supporting decision-making for medical tasks using deduction and induction [8].

In Figure 2.2 presents a classification of existing medical computer systems used in medical institutions. Systems in which decision rules are used relate to the class of expert systems.

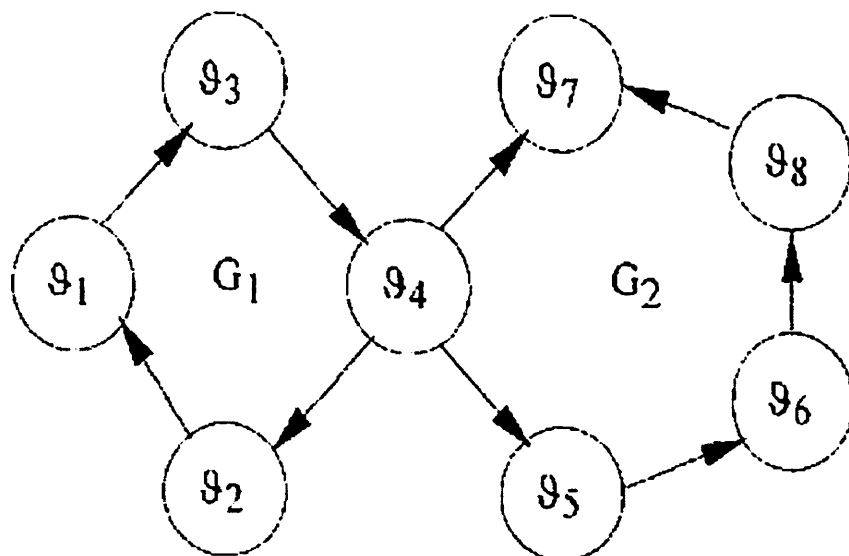


Figure 2.2 shows the classification of existing medical computer systems scheme used in hospitals

In a neural expert system and its application for medical diagnosis are described. The expert system presented in uses a model of clinical data for diagnosing the thyroid gland. In, a Guardian-type multimedia information system for computer support of home health care is described, which is used in two modes: the research mode for modeling various medical situations and the mode of searching for and transmitting the necessary medical information for operative interaction with hospital personnel.

There are systems that allow solving the problems of analysis and forecasting. In work, an expert system is proposed for assessing the professional level of a doctor. This system contains a package of 100 medical tasks that are offered to physicians for the solution. The answers of doctors are processed by a special algorithm. Additionally, patients are questioned and a comprehensive assessment of the physician's activity is generally made. The paper is devoted to a biomedical information system for estimating and predicting the dynamics of possible development of processes in the body. In addition, in the system of mass

donorological surveys of the population, there is an automated complex designed to predict diseases. A number of works are devoted to expert systems that are included in the surgical equipment or medical equipment intended for the administration of medicaments during anesthesia. At present, non-network expert systems are widely used. However, it can be assumed that the development of network hardware and software will allow to implement such systems in the network version if necessary. Medical computer systems of a medical institution that do not use decision rules belong to the class of non-expert systems. Depending on the purpose of these systems, these systems can be divided into reference and automated control systems for the organization of medical-diagnostic processes (ACS OLP).

In connection with the development of CD-ROMs and INTERNET networks, medical professionals have the ability to access, through reference computer systems, a wide range of data banks containing complete, well-structured and rapidly updated information on medicine. These data banks contain materials of journals, conference proceedings, monographs, information on medicines. The paper describes the main scientific and medical databases and methods of access to them, bibliographic and full-text databases for researchers, doctors and general use are considered. The database of publications on various medical fields MEDLINE, which is currently used in almost all large medical libraries, is very popular. Depending on the use of network hardware and software, it is possible to identify networked and non-networked automated control systems. At present, most of the works are devoted to non-networked automated control systems of the OLP related to automation of the activity of a certain specialist: the therapist, cardiologist, psychiatrist, surgeon and others.

The network ACS of the OLP consists of a set of similar or different types of automated workplaces of staff of medical institutions. In particular, the systems presented in consist of a set of similar automated workplaces for physicians. The paper describes a system in which the activities of registry staff, doctors and statistics are automated. Bulgarian specialists since 1986 have put into operation the "Polyclinic" system, consisting of the automated workplaces of four

departments: home care, dispensary observation, functional diagnostics, medical statistics. Automated information and medical diagnostic complex "Medisar" is used to form an electronic medical history only by the doctors of the departments of the hospital and polyclinic, for planning and recording their work.

As a result of the functioning of existing network and non-networked ACS MANAGEMENT SYSTEMS, data banks of records of patients are formed, reflecting, in varying degrees, medical records or outpatient maps of patients. In most foreign medical information systems, patient records entered into a computer, usually with the help of a scanner, are in the form of free text, which limits the use of this information in scientific research, assessing the quality of diagnosis, and treating patients. In the system described in, special electronic forms of patients appeals are filled. To collect and store a complete medical history in many domestic and foreign works there is a need for standardization and unification of the medical history, as well as some versions of electronic case histories. For example, in it is proposed to unify the descriptive part of the medical history with their subsequent storage in the computer's memory in the form of a logical tree. Describes one of the approaches to the formation of patient records using structured data, their properties and relationships.

Analysis of work on the use of medical computer systems in the activities of medical institutions shows that the main drawback of domestic automated control systems is the lack of integrated automation of management of medical diagnostic processes. In addition, in these systems, medical diagnostic processes are not considered as continuous technological processes. These shortcomings do not allow us to quickly control, manage the treatment and diagnostic processes based on the dynamics of the patients' state of change.

In systems that automate the activities of each participant in treatment and diagnostic processes, these shortcomings will be absent. Such systems will make it possible to create data banks not just electronic medical histories, but diagnostic and treatment processes . In addition, the systems will allow raising the performance discipline of medical personnel to a qualitatively new level. Qualitatively new level of doctors' work should be achieved due to the mandatory

input in the database of information on the planning of treatment of patients. Systemic display of this information for nurses will exclude the possibility of losing it or ignoring it. Obligatory introduction of information about the status of patients and the implementation of their treatment plan in the data bank of the nurses will allow doctors to promptly receive information from the data bank for the management of medical diagnostic processes.

2.4 The current state of the use of information technology in health

To increase the effectiveness of therapeutic and diagnostic processes, it is necessary to identify the set of factors influencing it and to automate the management of these factors on the basis of system analysis. One of such factors is the complexity of the disease. However, this factor does not objectively depend on therapeutic and diagnostic processes and is difficult to control. The time and quality of the treatment and diagnostic processes largely depends on their organization. Under the organization of the medical diagnostic process, we mean a set of measures that ensure the registration of a patient, planning the order and timing of research, counseling, and treatment.

To shorten the time of implementation and improve the quality of the diagnostic and treatment processes, their organization must satisfy the following basic requirements:

1) each participant in these processes should be relieved of the "manual" recording of information in the medical history or forms of referral, parsing other people's notes, "manual" reporting

2) physicians should have access to background information on standard research packages that provide a complete survey for the presumptive diagnoses

3) Patient examination routes should be planned optimally taking into account contraindications of diagnostic studies, workload of specialists, laboratories

4) doctors should be provided with the possibility of prompt access to current information about patients and archival data

5) cases of repeated surveys related to loss of information should be excluded

6) doctors should be informed promptly about the ongoing research in the medical institution, on the recruitment of available in the department medicines, immunity or allergic reactions of patients to medicinal products

7) medical-diagnostic processes should be supervised by managers on timeliness, diagnosis, on, timeliness of the assigned consultations, on the workload of specialists.

The quality of research and treatment of patients is directly affected by the professional level of nurses. This level is evaluated by doctors and is managed promptly during the execution of various procedures. The professional level of doctors influences the timeliness and correctness of diagnosis, the choice of the right directions of research, treatment. Since all stages of the cycle of examination and treatment of patients are documented, the professional level of physicians is reflected in the case histories. The analysis of patients' medical records allows for the expert assessment of the professional level of doctors and the development of management actions aimed at raising this level.

The availability and quality of research and treatment depends on the availability of the medical institution with the necessary specialists, equipment and medicines. The task of providing medical institutions with necessary specialists, equipment, and medicines is decided by the health authorities, based on financial possibilities. In the conditions of market relations, this task is partially solved by the medical institutions themselves.

Preventive measures are one of the directions of medical services for the population, allowing to identify various kinds of diseases, to timely organize diagnostics and treatment, to prevent complications. The factor of timely diagnosis and prevention of diseases largely depends on the choice of health authorities directions and the scope of preventive measures.

At present, there are standards of medical care in medical institutions: for each specialist at a polyclinic there is a standard time of admission of the patient, for the hospital - the patient's treatment standards in the hospital. However, the

human body has a complex structure, consisting of a set of interconnected subsystems, such as the nervous, respiratory, endocrine, lymphatic and other subsystems. Deviation from the normal functioning of one of the subsystems may entail the build-up, the functioning of both the other subsystems separately, and the whole organism as a whole. At the same time, diseases can have different degrees of complexity and manifest themselves in different ways at different times of the year. Therefore, it is obvious that for a specialist to make a decision, some cases of the disease require less time, others - greater. The discrepancy between the standards of medical and diagnostic processes for real data leads to a disruption in the workload of specialists in medical institutions and reduces the effectiveness of therapeutic and diagnostic processes.

Timely provision of medical personnel with information from the normative documents of higher organizations, high labor discipline in the performance of directives of managers is one of the tasks of management of any organization. Control over the implementation of directive orders of managers will allow them to make timely decisions on management, to raise the labor discipline of participants in medical diagnostic processes to a higher level.

Successful solution of the task of increasing the efficiency of diagnostic and treatment processes is possible only through the automation of the management of the entire complex of factors. The composition of the complex of factors is presented in below. In a medical institution, such factors include:

- organization of treatment and diagnostic processes
- professional level of medical personnel
- Timeliness of diagnostics and prophylaxis of diseases of patients of a medical institution
- executive discipline of medical personnel.

Factors for increasing the effectiveness of treatment and diagnostic processes in public health bodies include:

- provision of medical facilities with buildings, equipment, specialists, medicines, m.
- Timeliness of diagnosis and prevention of diseases of the population

- compliance of medical standards of medical-diagnostic processes with real data
- executive discipline of staff to implement the decisions of management and higher organizations.

Based on the analysis of the above factors, the following directions of integrated automation of management of diagnostic and treatment processes are proposed:

- 1) the organization of treatment and diagnostic processes in healthcare institutions
- 2) analysis of professional activities of specialists and making decisions on adjusting their activities and raising their professional level
- 3) accounting, analysis and decision-making on the provision of medical facilities with facilities, equipment, specialists, medicines
- 4) prediction of diseases of the population and decision-making on their diagnosis and prevention
- 5) decision-making on the compliance of standards of medical services with real data
- 6) accounting, analysis of the performance discipline and decision-making on its improvement.

2.4.1 Information technology activity of the dispatcher of research results

The analysis of the activity of the dispatchers of studies in the laboratories and diagnostic departments of the hospital made it possible to design and implement the information technology. The subsystem can be parameterized for use in the appropriate diagnostic department, laboratory or department medical institution. After registering and entering a password, a specialist can view information about patients' assigned studies and, if necessary, enter research results [9].

Based on the system analysis of treatment and diagnostic processes, theoretical bases, methods and algorithms for solving the problem of optimization

of routes for examining patients, taking into account contraindications, are formulated, the basic requirements for standard types of provision of this subsystem are formulated, developed a typical adaptive information technology for performing diagnostic and diagnostic processes.

One of the tasks of organization of treatment and diagnostic processes in the institution is the task of optimal management of patients 'flows, depending on the research, consultations, workload of the laboratories, specialists and patients' capacities assigned to them. The task of managing the flow of patients is considered as the task of drawing up an optimal schedule of consultations, research procedures for each patient.

The formulation of the first stage problem belongs to the class of ordering problems in scheduling theory. The task has a specificity that does not allow us to apply the traditional methods of scheduling theory. To solve it, we introduce the notion of composition of the ordering functional of vertices of Hamiltonian cycles of contour type and semi continuity. In this chapter, we propose a method for solving this problem and proving the statements that justify the proposed method.

In connection with the fact that the information bank of the data of medical diagnostic processes is formed by each participant in real time, the complex of technical means is a local computer network based on personal computers and terminals located in the workplace of medical personnel. The mathematical support includes mathematical methods and algorithms for optimizing the routes of examination and treatment of patients, as well as algorithms for processing information of medical diagnostic processes. Information support of the subsystem is a data bank formed by the third-generation database management system (DBMS) type Informix. To prevent unauthorized entry and viewing of information in the subsystem, data protection is provided.

The structure of special software subsystem is an interconnected set of programs that automate the operation of typical participants in the treatment and diagnostic process. The system is operated on the basis of a typical adaptive information technology, developed as a result of the analysis of medical activities of employees of a medical institution. The methodical support of automated

control systems introduced in institutions is compiled taking into account the psychological characteristics of users - medical workers. It is proposed to use the developed system in automated information technologies for teaching clinical disciplines of students of medical universities and cadets of academies.

To select patients, you can use search parameters such as last name, medical history, department name, room number, name of the study. Having received a list of patients who meet the conditions of the search, the study manager can choose a specific patient.

The results of the study are introduced as follows. Screenmonitor is divided into two parts. In one of them a list of patients is presented, in the other - a list of studies for the selected patient. For each patient, the date of the study designated doctor. To record research results, a corresponding form with fields for input is displayed on the monitor screen. In the absence of a blank, the information is entered in free text. The dispatcher can view the results of studies conducted earlier for any period of time, and print these results.

Analysis of the need for expert evaluation of the professional activities of doctors, due to various forms, the complexity of manifestations of patients diseases and the lack of appropriate unambiguous methods for their examination and treatment. Expert evaluation allows a special commission to identify in a timely manner mistakes made by a doctor and to develop appropriate control actions on its activities. The absence of automated assessment methods leads to a high level of subjectivity of decisions taken by the expert commission. The use of modern informatization tools makes it possible to increase the effectiveness of expert evaluation.

The information of the diagnostic and treatment processes stored in the data bank of the ACS in a structured form allows to set and solve the task of an operative complex analysis of the professional activity of the doctor. Application of mathematical methods in automated processing expert assessments makes it possible to reduce the level of subjectivity of the decisions made by systematizing the results of evaluating the activities of the doctor and streamlining the process of their discussion.

Assessment of the consistency of experts' opinions on the types of errors allowed by the doctor is proposed to be carried out using numerical estimates and the method of rank correlations. To analyze the consistency of expert opinions, a human-machine procedure is proposed that uses the theory of statistical solutions. Based on the results of the expert opinion, the management of the medical institution makes a decision about the control actions applied to the physician: correction of the medical-diagnostic activity of the doctor, referral to refresher courses, reduction of the category, transfer to another job.

The department dispatcher can receive output documents reflecting the statistical characteristics of the work of this department and the list of patients who have been studied.

Based on the proposed procedure, a standard information technology for expert evaluation of the doctor's activity was developed. This approach can be used for expert evaluation of any professional activity, which is documented quite fully.

One of the important conditions for effective management of the institution's activities is the organization of timely implementation of decisions taken, the basis of which is document circulation and control of the performance discipline. Analysis of existing developments has shown the lack of a standard information technology control and management of the discipline. This drawback leads to the need for developers of systems of such labor-intensive work as refinement the basic version of a particular system in accordance with the technology of control of the performing discipline, in each new organization where its implementation is carried out [10].

For the control and management of the performing discipline, a typical adaptive information technology has been developed. This technology is used as a basis for a typical automated information system for monitoring and managing an executive discipline that has the ability to customize the organizational structure, the profile of the institution's activities, and the technology of working with the particular performer's system.

The paper suggests one of the approaches to the development of a management decision related to the allocation of a financial fund to encourage the staff of the institution among performers based on the results of control of the performance discipline. To substantiate the proposed method for solving the problem, statements are formulated and proved in the paper.

2.4.2 The architecture of a distributed automated health management system

To create more advanced control systems for diagnostic and diagnostic processes, it is necessary to use modern information technologies that allow creating distributed control systems. In most cases, when examining and treating a doctor, the entire history of the patient's illness is needed. It is obvious that at any time the doctor should be able to receive at his choice of an extract or a complete history of the disease from all the hospitals in the region where the patient has ever consulted. In order to realize this possibility, it is necessary to use an automated management system in each medical institution, one of the functions of which is the formation of a database of medical diagnostic processes. , In this case, all ACS of medical institutions should be integrated into a single network.

The health authorities collect certain information from all the medical institutions subordinate to it to solve their problems. Therefore, integrated databanks (IDBs) should be quickly created in the bodies, containing information on diagnostic and treatment processes necessary for these bodies. First of all, the integrated bank must contain the following mandatory information: surnames, names, patronymics of patients, the dates of appeals and names of medical institutions where this patient was examined and treated, surname, name, patronymic of the specialist; basic and concomitant diagnoses, delivered to the patient during the examination and treatment. For the prompt collection of information, health authorities should be included in a network that allows for the exchange of information between medical institutions.

The structure of the functions of the ACS of health authorities should include: the formation of IDB, the management tasks (analysis, disease

forecasting, planning of preventive measures and budget, insurance medicine, control of execution of decisions, etc.), transfer of information to the upper level, dispatching user requests. The structure of the functions of the AMS of medical institutions should include: the formation of a database of medical diagnostic processes, the management tasks (monitoring and adjustment of medical diagnostic procedures, professional control, etc.), information collection for insurance medicine, data transfer to the upper level.

The information of integrated banks will allow dispatching requests of doctors about the patient. It is advisable to unite the integrated data banks of city health authorities into an integrated bank of the Regional Authority. If, when a specialist requests, information about the patient is not found in the relevant integrated data bank of the city health authority, the regional integrated bank is contacted to determine whether there is information about the patient in the data banks of other cities in the region. If such information is available, then the names of the cities and hospitals where the patient was treated are determined. Requests are forwarded to the data banks of the relevant medical institutions, and the results of the requests are forwarded to the doctor who carried out the request. For the organization of data exchange between the AMS of medical institutions and the ACS of health authorities, the following should be determined:

- the structure of information transmitted to the integrated data bank;
- the structure of the information of the medical history transferred between the AMS of the medical institutions.

At the moment, various automated systems have been introduced in the medical institutions separately or in a complex. Complication of modern medicine led to the need for integration of these systems. Evolution and integration of automated systems in medicine, as well as the exchange of data between them, gave rise to a process of standardization, which has now acquired an international character and serves as one of the engines for the further progress of medical informatics.

3. THE METHOD OF DESIGNING AUTOMATED INFORMATION TECHNOLOGIES IN ORGANIZATIONAL MANAGEMENT

At the moment, we can distinguish three basic levels of standardization of foreign medical automated systems:

- Standardization of the contents of databases of automated systems and knowledge bases of medical systems for ensuring the adoption of medical decisions (terminology and information coding systems)
- standardization of interfaces (formats and protocols for electronic exchange of medical data at the level of systems and their components)
- standardization of hardware for collecting medical information (outputs of medical devices).

System analysis of the health authorities and medical institutions allowed to formulate technical requirements that must be the basis for the development of automated distribution of health management system, consisting of a set of interrelated automated control of these institutions:

- 1) modular organization of the system
- 2) the possibility of connecting additional automated workplaces of specialists
- 3) parametric adjustability of the automated control system for the structure, staffing; for a medical institution - additionally to a specific medical institution, its medical profile
- 4) the conformity of hardware and system software to a certain standard
- 5) ensuring the confidentiality of information, protection from distortion, loss, unauthorized access.

When developing an automated control system, it is advisable to use software tools that meet the standards of the Open Systems. Standards Open systems allow you to integrate hardware and software from different manufacturers among themselves. Therefore, the relevant application systems can run on different hardware and system platforms. In order to create ACS of health authorities, it is necessary:

1) based on a system analysis problems solved by the health authorities to develop an integrated structure of data banks corresponding city or regional level control

2) to formulate and solve the task of automating the management of the activities of medical institutions

3) to formulate technical requirements for the means of developing and implementing an automated control system

4) develop technical, mathematical, software, linguistic, information, organizational and methodological support automated control system. To create ACS of medical institutions it is necessary:

1) carry out a system analysis of existing medical technologies medical institutions

2) develop a standard information technology for the organization of treatment and diagnostic processes, which has the ability to adapt to the conditions of a particular medical institution

3) to formulate and solve the problem of automation of management of medical-diagnostic processes in medical institutions

4) formulate the technical requirements for the means for developing and implementing an automated control system

5) to develop the technical, mathematical, software, linguistic, informational, organizational and methodological support of the automated control systems.

The effectiveness of therapeutic and diagnostic processes depends on a number of factors that need to be managed in a medical institution. Therefore, the task of automating the management of medical-diagnostic processes in medical institutions can be considered as a complex of automation control tasks by each of the following factors: the organization of medical-diagnostic processes, professional level of doctors, timely diagnosis and prevention of diseases, the executive discipline of staff on the implementation of decisions of management and higher organizations. [11]

The electronic patient history records, which are presented in the database in a structured form, as a result of the automation of medical diagnostic processes, allow to automate medical scientific research, more deeply and comprehensively carry out statistical analysis, to recognize the factors of morbidity, and to conduct an expert evaluation of the professional activity of specialists.

The task of automating the management of the professional level of physicians is to develop mathematical methods and software and hardware that enable:

1) carry out an expert analysis of the case histories and evaluate the activities of doctors

2) determine the causes of professional errors: lack of completeness of the survey, lack of knowledge, negligent attitude towards work

3) decide on the management impact: differentiation of labor remuneration, referral for advanced training, etc.

The task of automating the management of the executive discipline of medical personnel is to develop software and hardware for general electronic document management (orders, orders and instructions) that allows information of regulatory documents coming from higher organizations to be reported to each physician and also to monitor the implementation of executive directives of managers.

3.1. Statement of the problem of automation of management of diagnostic and treatment processes in public health bodies

The basis for solving the problems of providing medical facilities with equipment, specialists, medicines is a data bank formed as a result of automation of management of medical and diagnostic processes in medical institutions. In addition, the data bank will allow the health authorities to perform a statistical analysis of the incidence of patients, the time spent servicing patients in hospitals and to develop more informed recommendations on the standards of medical care depending on the diseases and seasons. The use of mathematical methods will at the same time raise the forecasting, analysis, planning, provide a full overview of

the health status of the population, carry out operative control over observance of standards and standards of treatment, move from budgetary financing to modern methods of economic management of public health services.

The task of automating the management of medical and diagnostic processes in the healthcare system is to develop software and hardware that allow the database of medical diagnostic processes, mathematical models and methods to solve problems: analysis, forecasting, planning of the provision of medical facilities with "buildings," equipment, "by specialists, by medicines, ensuring compliance of standards of medical services with real processes, planning of the health budget. Main direction of automation since 1981, according to the draft OASU "Health", was management activities of health authorities, it has now developed a variety of application methods for solving relevant problems.

3.1.1 Structure of the automated control system for medical diagnostic processes

According to the statement of the problem of automation of management, the structure of the automated control system of medical diagnostic processes in a medical institution should, first of all, include the following automated control subsystems:

- 1) the organization of medical-diagnostic processes
- 2) the professional level of doctors
- 3) timely diagnosis and prevention of diseases
- 4) executive discipline of employees.

However, this structure can be extended for the following reasons. When creating a database of medical diagnostic processes, information from diagnostic computer systems can be used. In addition, the doctor can use a variety of consulting and diagnostic systems to get help when making a diagnosis or choosing the tactics of treatment. The information can directly enter the data bank from the diagnostic equipment or from the consulting and diagnostic system with the appropriate interface. If there is no interface, then information is entered by a doctor or nurse on the basis of paper documents - research results or consultations.

Currently, there are many different consulting and diagnostic systems that contain years of accumulated medical information and diagnostic algorithms. However, diagnostic systems can not be effective without the sound analytical thinking of a qualified medical professional. In addition, many of the consulting and diagnostic systems are far from perfect.

The development of scientific and technological progress leads to the development of new diagnostic equipment and the replacement of old ones used in medical institutions. Obviously, the new equipment will provide new knowledge that can be used in consulting and diagnostic systems or even replace some of them.

Therefore, before deciding on the advisability of using any consulting and diagnostic system, it is necessary to assess the degree of its successful application. One of the evaluation methods is given in.

Telemedicine, information and reference systems are promising means of health care. The use of the information system of a referential nature in the ACS of a rather well developed information system at the present time will allow organizing self-education of a doctor in the workplace and receiving information about the achievements of medical science, new diagnostic methods, medicines, the features of their use, and the recommended volumes of treatment. The further development of computer equipment and network equipment will allow doctors to connect to the INTERNET international network, to be aware of the latest achievements in medicine, to receive consultations of leading specialists. Thus, the introduction of modern information technologies is an important factor in increasing the level of organization and quality of medical diagnostic processes and leads to the fact that the role of a single individual in the treatment-diagnostic process decreases, and the role of the team increases. Therefore, the structure of the ASU of the medical institution should be expanded and the automated systems listed above should be included in its composition. [12]

Management of timely diagnosis and prevention of the disease is carried out on the basis of processing personalized information about the diseases of the population. When solving the control problem, mathematical models of the

connection of factors and signs of diseases can be used, as well as mathematical methods of recognition. In medical institutions, personalized information about patient diseases can be obtained as a result of automation of the management of the organization of medical and diagnostic processes. The health authorities must receive this information from the medical institutions subordinate to it. To organize an operative exchange of information, all medical institutions and management bodies should be linked by an information network. Therefore, the structure of ACS structures should include means of data transfer to one level of management above. Since in some cases doctors' requests should be forwarded to the data banks of medical institutions in other cities, healthcare data banks can be used to manage data flows between medical institutions. For the organization of dispatching and transmission of information, the corresponding software and hardware must be developed. Represents the structure of an automated control system for the treatment and diagnostic processes of a medical institution, which includes:

- consulting and diagnostic systems, diagnostic complexes with automated processing of data, means of telemedicine, information and reference systems
- an automated subsystem for managing the organization of treatment and diagnostic processes
- an automated subsystem for managing the professional level of doctors
- automated subsystem management of timely diagnosis and prevention of disease
- automated subsystem for management of employees performance discipline
- means for automatically generating and transmitting personalized information to the upper level of management.

To organize the exchange of data, automated management systems in the health care bodies should contain an integrated personalized information of all the medical institutions subordinate to it. This, will allow dispatching requests and responses of medical institutions. If, the organ. health care is subordinate to a higher level health authority, then the corresponding ACS should include means

for automatically transferring personalized information to the upper level of management. The solution of the problem of increasing the efficiency of medical diagnostic processes in the health care bodies determines the structure of the corresponding automated control system, which contains in below:

- an automated subsystem for managing the provision of medical and diagnostic processes with buildings, equipment, specialists, medicines, compliance with the norms of medical diagnostic processes to real processes on the basis of processing personalized information and planning future healthcare development

- an automated subsystem for managing the organization of preventive measures

- automated subsystem for management of employees' performance discipline

- means for automatic dispatch of user requests

- means for automatically generating and transmitting personalized information to the upper level of management.

3.1.2 Optimization of the patient examination route taking into account contraindications

One of the tasks of organization of medical-diagnostic processes in the medical institution is the task of managing patient flows. This task at the moment, depending on the type of treatment institution, is decided, respectively, with the help of the registry in polyclinic or dispatchers of laboratories and diagnostic departments and hospital. Since there is no complete and objective information about the workload and capabilities of laboratories, diagnostic departments, specialists, then such an organization imposes certain difficulties in management and generates queues. In addition, the shortcoming of the existing dispatch is the absence of accounting for the time of contraindications between the appointed patients research. Automate the formation of a survey schedule patient will allow to quickly manage the flow of patients medical institution. When examining a patient in a medical institution, he, as a rule, appoint specialist advice and a

specific set of research. Among the prescribed studies may be studies that are contraindicated for each other for a number of days. We will assume that study B is contraindicated to study A for conducting for some number of days P, if study B can not be carried out for medical reasons earlier than O days after the study A.

The task of scheduling a patient survey should be automated, taking into account the wishes and capabilities of the patient. To solve this problem, it is first of all necessary to solve the problem of optimal ordering of the studies assigned to the patient, taking into account the time of contraindications between them. The date of each of the assigned studies is determined based on the received ordered sequence, the workload of the laboratories and the patient's capabilities. Dates of consultations of specialists are also determined based on the workload of specialists and the capabilities of patients.

This task is particularly relevant in the case of mass preventive examinations in outpatient-type outpatient facilities, as well as in the teaching of medical university students to algorithms for diagnosing various diseases.

3.1.3 Typical adaptive information technology of the organization of medical-diagnostic processes in medical institutions

An analysis of the activities of the pharmacy staff providing drugs to the department of the hospital made it possible to design and implement the information technology. After registering and entering a password, a pharmacy employee can register and view incoming and outgoing documents, check the stock of medicines for availability and expiry date, get background information and work reports. A pharmacy employee can view in the database the requirements coming from senior nurses of departments for medicines, which indicate the name and amount of the drug. In the case of an extemporal drug, additionally the name and dose of the component parts are indicated. When medicines are delivered to a medical institution, a pharmacy employee enters the information of commodity-transport waybills into the database. All 1 documents can be printed. A pharmacy employee can monitor the pharmacy stores, as well as

control the shelf life of drugs, by choosing the database information using the search conditions that they have created.

A pharmacy employee must accompany a database of medications, introducing and correcting information on names, membership of a particular group of medicines, norms of use, availability in a medical institution. If it is necessary to write-off for any reason a medical product, the pharmacy employee forms an act of write-off that contains the relevant information stored in the database. In addition, a pharmacy employee can obtain the necessary output forms for the registration of medicines in the pharmacy and in the departments of the medical institution. To create an automated subsystem for managing the organization of medical-diagnostic processes in a medical institution, it is necessary to design the appropriate information technology.

In general, for all medical institutions the generalized cycle of examination, diagnosis and treatment of patients is the same. However, in more detailed consideration, some stages of the generalized cycle for the polyclinic, specialized centers and hospital will differ. This is due primarily to the difference in the organizations of examination, diagnosis and treatment of patients in these institutions. In belowpresents a general schema for the organization of treatment and diagnostic processes in a polyclinic. [13]

The patient applies to the registry, which sends him to a consultation with one or more specialists. The specialist, after examining the patient, appoints him additional consultations, studies in diagnostic departments or laboratories. All information on the results of studies and consultations is recorded in the corresponding outpatient card. Having received the results of the full examination, the expert makes a conclusion, if necessary, prescribes treatment, generates an extract, which is recorded in the registry. A generalized scheme for the organization of treatment and diagnostic processes in a hospital is presented in below. The patient enters the ward of the receiving dormitory, which sends him to one of the departments of the hospital. The attending physician can appoint consultations of specialists from other departments, research in laboratories,

diagnostic departments, treatment. At the completion of the examination and treatment, the discharge department forms an extract from the medical history.

The analysis of the schemes of the organization showed that the part common to the polyclinic and the hospital is related to the work of laboratories and diagnostic departments. General for medical institutions is also the collection of medical information, such as complaints, anamnesis, the results of an objective examination; diagnosis, appointment of examination and so on. The difference between the organizations of treatment and diagnostic processes in the types of treatment institutions considered are the processes of patient registration in a medical institution and treatment. Specific implementations of each of the standard organizations are distinguished by the profile of examination and treatment of patients. For example, there are hematological, tuberculosis, oncological centers, etc. In addition, nowadays there are medical institutions, where two types of organization of medical and diagnostic processes are combined. For example, in the health care system there are polyclinics in which there is a day hospital. Therefore, it is necessary to develop a standard information technology for the organization of medical-diagnostic processes in a medical institution that can be adapted to a specific medical institution. It is obvious that a typical technology should consist of information technologies of each participant of medical diagnostic processes. The analysis of the activity of the reception staff allowed to design and implement the information technology presented in below. After entering the system and entering your password, the employee can enter and view the relevant information about the patient, obtain statistics, and record the patients transfers to other departments in the data bank of the treatment and diagnostic processes.

The patient is registered according to the following procedure. If the patient was not previously registered, then his passport data are entered. The uniqueness of the patients passport data is determined in accordance with the key fields that are mandatory for filling: the series and number of the insurance policy, Full Name, Date of Birth, floor, district of residence. When you first enter information about the patient in the subsystem, his personal number is automatically

generated. In case the patient was previously treated in this hospital and an electronic medical history was established, it is possible to select the relevant information from the electronic archive and, if necessary, change the passport data.

When registering a primary diagnosis and a diagnosis of admission, the ICD-1X disease reference books and nosologies (clinical forms of diseases) are used. Directory of diseases is a hierarchical model, which includes classes, groups, diagnoses, and their refinement. The full name of the diagnosis consists of a diagnosis and its specification. When registering the results of a pre-hospital examination of the patient, the employee indicates the date of the examination and records the result. If the analysis is complex and consists of several analyzes, the employee fills in the electronic form of a complex analysis. For each patient, an employee can enter specific information: treatment regimen, transportability, a dietary table, preferential rights (disabled, veterans, etc.), social status, special marks. This information is then automatically inserted into the header of the patient's electronic medical history. When the patient is hospitalized, the receptionist shall indicate the time and date of his admission to the medical institution, the name of the ward and the number of the ward. Chambers are selected from the number of available seats, corresponding to the sex of the hospitalized patient. The receptionist can obtain statistical information about the receipts, extracts and transfers of patients for any day, the number of vacant seats in the ward chambers, number of occupied places with reception of list structure of patients. The receptionist can register the patient's transfer to the free rooms of other departments.

3.2 Information technology of the activities of the discharge department employee

After successful registration and entering the password, the representative of the discharge department selects from the data bank a list of patients who were discharged from the previous day. If you need to select patients discharged earlier, it is necessary to call a calendar and indicate the day of interest to the employee.

The list of patients issued on the selected day will appear on the screen. The employee has the opportunity to view the patients medical history.

The information of the medical history is not subject to correction. The diary entries contain information that was entered by specialists as a result of a primary and daily inspection, as well as the results of consultations and protocols of the operations performed. The results of the studies are recorded in the data bank directly in the laboratories in accordance with the designations. The treatment performed reflects the result of the nurses' performance of the doctor's appointments department. The temperature sheet is filled in on duty nurse. After viewing the electronic medical history, the user can get a discharge epicrisis, a statistical record, the act on the patient's medical condition for the military registration and enlistment office, according to the established form.

The analysis of the activity of doctors from different departments of the hospital allowed to design and implement the information technology presented in below. After registering and entering the password, the doctor has the ability to enter and view information on the results of working with the patient, to obtain statistics, to enter and view information on the results of consultations of patients from other departments, and to analyze archival patient records. In addition, if the doctor is the head of the department, then he can monitor the work of specialists in this department of the hospital. To record information on the results of work with a patient in the database, it is necessary to register it. The patient's registration is carried out by selecting from the list of patients directed to the receiving rest and undergoing treatment in this department. The list displays the number of the medical history and the presence in the medical history of the diary for the current day. After selecting a patient from the list, his passport information is displayed on the screen. If the patients passport data has changed, the doctor can correct them.

At any stage of the patients work, you can view all the information from his current and archival electronic case histories. Each change in the diagnostic and treatment process is reflected in the database only after confirmation by the electronic signature of the appropriate doctor. To create the results of the initial

inspection or diary entries in the database, special directories are used. It is possible to copy the sections of the latest diary entries. The results of the survey are described as follows. In the left half of the screen there is a list of questions and possible answers. In the right half, the text that is generated as a result of the responses is displayed. This allows the doctor to check the correctness of the entered information, if necessary, return to a particular question and correct the answer. Questions are divided into three types according to the type of answer: YES, NO (presence or absence), numeric value is a refinement of 10 characters in length; enumerated answers.

Registration of the main and concomitant diagnoses is carried out using the ICD-10 reference books and clinical forms of diagnoses. In case the diagnoses were registered earlier, the specialist can form or adjust the schedules of prescriptions and treatment. Formation of the examination schedule assigned to the patient is made only after registration of the main or concomitant diagnosis. The scheme contains research in laboratories, diagnostic departments, as well as consultations of doctors from other departments.

In a number of medical institutions, in parallel with the statistics on the international classification, internal statistics are conducted in the context of the medical and economic standard (MEA). The correspondence between the ICD code and MES is established when working with diagnoses.

A doctor can get a list of complex studies that are conducted in a hospital. Each line displays the name of the analysis, the laboratory (department), where the analysis and the required material for the study are carried out. The structure of such an analysis is presented in the form of a tree. The complex analysis can include both simple and complex analyzes.

For each simple analysis, in turn, you can view information about the method of the study, the length of the fence, the timing of the outcome, recommendations and norms. In some cases, there is no need to conduct the entire spectrum of complex research. Therefore, the system has the opportunity to reject the scheme from unnecessary research.

The purpose of research and consultation can be done not only by choosing from the appropriate lists, but also using typical schemes for examining the current disease. Some studies and consultations during the treatment of a patient in a hospital should be carried out at least 2-3 times, and a re-examination should be scheduled after a certain time. For this, in the subsystem, it is possible to put a specific survey on the control. Then, after a specified time, a reminder will appear to a specialist on the computer screen about the need to reassign this patient.

The subsystem optimizes the schedule of examinations of patients taking into account contra-indicated studies, workload of laboratories, specialists. The schedule received is presented to the doctor in as recommendations on the screen. If necessary, the doctor can correct it.

3.2.1 Information technology of the activities of the hospital administrator

The analysis of the activities of hospital administrators allowed to design and implement the information technology. After registering and entering the password, the hospital administrator can conduct an operational analysis of the activities of subordinate specialists and departments on the basis of statistical information, and form a schedule for on-duty duty on the hospital.

To analyze the activities of specialists, the hospital administrator sets the time period and the conditions for finding the necessary information. The subsystem processes information from the data bank of diagnostic and diagnostic processes and displays statistical results in the form of output forms on the monitor screen, which can be subsequently printed. The hospital administrator can obtain the following statistical information for the departments and the hospital as a whole for any period of time: the burden of the disease units, list of vacant posts, patient flows through hospitalization, outcomes of the disease, list of patients who do not have working diagnoses or the number of bed-days exceeds the norm. In this case, the administrator can select from the database the current and archival medical records of any patient.

One of the tasks of a hospital administrator is the examination of the professional activity of doctors based on a database of treatment and diagnostic processes. The theory and, the information technology formed on its basis, are described in Chapter 3. Formation of treatment regimens for the patient is made only after registration of the underlying or concomitant diagnoses. The purpose of drug treatment is carried out in two stages: the formation of a list of drugs and planning treatment for each drug: single dose, amount, time of admission, start date, end of admission. Each line of the list displays the name of the drug, the dosage and the form of the drug. If at the end of the line there is a plus sign "+", it means that in the warehouse in the warehouse this preparation is available. On the screen, you can display the corresponding Latin names of the drugs. The medication guide is a hierarchical structure. Related drugs constitute a certain group, which, in turn, can be part of another group, a higher level. Thus, the user finds the drugs he needs, sequentially deepening into the appropriate groups. The purpose of treatment can be done using also the appointment of the patient typical treatment regimens for the current disease.

The appointment of operations is performed by a doctor only with surgical specialization. To make the department a surgical status, you must set this status for it in the "Database Administrator" subsystem. In this case, the subsystem will have an additional opportunity to create and view the list of operations assigned to this department with the date and name of the operation, the name of the operating surgeon. To describe the operations in the subsystem, a special form is used, which is generated by the database administrator.

After a complete review of all the information entered by the doctor must confirm it with his electronic signature. If something suits the doctor, he can return to the appropriate section, correct the data and go back to the electronic signature mode. After the successful confirmation by electronic signature, information is recorded in the patient's medical history and is not available for subsequent correction. Electronically signed diagnoses will not be subject to deletion and correction. Analyzes and consultations on the destination sheet of the examinations and medications on the destination sheet of treatment will also not

be subject to removal, except for cases of cancellation with an indication of the cause. The dates of electronically signed analyzes and consultations can be changed in the list of examinations. The doctor can form a discharge epicrisis, an act on the patient's health status for the military commissariat, a coupon of statistical records.

The doctor forms procedural marks for the nurse of the department, and can also adjust the features of the patient's observation and treatment regimens: transportability, a dietary table, preferential rights of the patient (invalid, participant of the Second World War, etc.), social status, treatment regimen of the patient, which is classified by special management, special notes. The physician must register in the database any movements of the patient inside the department and the hospital. The doctor has the opportunity to conduct consultations for patients from other departments from his workplace. To this end, the physician must identify the patient from another ward by selecting him from the list of patients to whom his advice is assigned. Further work with the patient in the information plan is similar to working with the patient of this department, except for the possibility of recording the movement of the patient inside the hospital or separation, as well as changing the data of the passport department. The subsystem provides two types of statistics for the department: operational statistics and reporting. Operative statistics reflect the work of the department on a specific day: the number of receipts, extracts, transfers of patients to other departments; the composition of patients in ward wards; List of offices with indication of vacant seats in the chambers. Reporting statistics are carried out in the following sections: the number and composition of patients who entered the reporting period from various hospitalization channels, for each basic diagnosis, the information on the average and total bed-day in the department for the reporting period, quantitative characteristics for each outcome of the disease.

Head of the department is available to monitor the work of doctors of the department. Control is performed according to the following criteria: the absence of records of a primary examination in the medical history, absence of diary entries in the medical history, absence of basic diagnoses in patients who have lain

in the department for more than three days, the presence of special markers in the patient's medical history, exceeding the period of treatment established by the main diagnosis. For each of the criteria, appropriate lists of patients and attending physicians are formed.

3.2.2 Information technology of the activities of the database administrator

The main task of the database administrator is to maintain directories and parametrical configuration of the automated management subsystem of the organization of medical-diagnostic processes of the medical institution. After registering and entering the password, the database administrator selects the names of the directories that need to be created or adjusted. The system uses general purpose directories and medical reference books.

To describe the treatment and diagnostic processes in the system, the following medical reference books are used: questions and answers for describing the history of the disease and the results of an objective examination, International Disease Codifier ICD-10, standard nosologies, medical and economic standard, standard schemes of examination and treatment, medicinal preparations, standard recommendations for discharge or transfer, types and protocols of operations, type and composition of the temperature sheet, simple and complex laboratory tests, research materials, methods of research. To implement the parametrically adjustable system for the structure and composition of the medical institution, as well as the convenience of users of the subsystem, the database administrator generates general purpose directories: the names of laboratories and departments, the composition and characteristics of the employees of the medical institution, composition and characteristics of ward chambers, names of cities and districts where patients live, kinds and forms of release of medical products, blood groups, outcomes of the disease, hospitalization channels, categories of preferential services, patient treatment regimens, etc. If, for some reason, the subsystem user needs to change the password, the database administrator deletes the old user password and allows him to set a new one.

In the different countries of the world, relevant projects are being developed or already under implementation to automate the management of the health care organization. All projects have a global goal to improve the management of the healthcare organization as a whole. Common to these projects is the use of network information services. However, each of these projects, according to information from publications, has its own peculiarities. In some projects, the main task is the organization of electronic data interchange only in the organizational processes of medical activity, in others - in all its types: the transfer of statistical data, telemedicine, the transfer of medical information to insurance companies, etc. [14]

The notion of "information management in the field of medicine and public health" in the US implies the use of computing, communication technology and includes a wide range of information activities - from the narrow specific task of ensuring the use of a doctor remote reference database to the organization of complex systems that meet the information needs of large institutions and health authorities. A meeting was held at the National Medical Library in the United States in April 1995, attended by representatives of the Centers for Disease Control and Prevention, the Health Policy Agency and other organizations. The meeting addressed the problems of detection and suppression of potential sources of diseases. To solve these problems, it is planned to widely use the national information infrastructure. In the western part of New York, a medical telecommunications superhighway is organized, the use of which will allow doctors to use full information about patient diagnoses, treatment methods and research materials. The network will allow to receive the newest medical technologies and consultations of experts large clinics. One of the hospitals in North Carolina (USA) carries out an active program to improve the quality of medical care for patients in geographically remote areas. The work of this hospital uses a database of medical information records on the status of patients, which is formed by speed scanning of paper documents. The THINK adolescent health information network covers public libraries, various local agencies in one district

of Illinois (USA). It is designed to collect, process and use information related to the physical and mental health of adolescents.

Since the information of the data bank of medical diagnostic processes should be formed in real time by each participant, the subsystem should be a local computer network on the basis of personal computers and terminals located at workplaces of medical personnel. In each doctor's office, laboratory, polyclinic registry, reception room, department, discharge department of the hospital, the pharmacy, terminals or personal computers must be located through which the information on the survey results is transferred to the appropriate data bank stored on the server. The mathematics of the subsystem is a collection mathematical methods and algorithms underlying the logical and computing processes of the subsystem. The structure of mathematical support includes methods and algorithms for solving the problem of optimizing the route of examining patients in a medical institution, as well as algorithms for processing information that ensure the functioning of the subsystem and that satisfy the requirements of accuracy and speed. At present, Open Systems technologies are widely used in system software. An open system is a system developed in accordance with standards agreed upon at the international level and covering all aspects of system interaction and information exchange. The subsystem should be based on the information technologies of the Open Systems. The use of Open Systems technologies will provide the developed subsystem:

- ease of integration with third-party systems, provided that they fully comply with the standards of the Open Systems
- it is sufficient to harmonize the data structures to integrate the software components of such systems, for the integration of systems that do not meet the standards, it is necessary, in addition to agreeing data structures, to develop and interface
- compatibility with different versions of operating systems and hardware families.

The use of Open Systems in medical systems will allow to unite already existing computer systems into a single integrated information environment. To

ensure the effective functioning of the subsystem as a system software, it is necessary to use a multi-mode, multi-user operating system of UNIX type, as well as software for creating and supporting local and global computer networks, respectively, of the ETHERNET and X.25 type

The use of Open Systems technologies will create a global Healthcare network by linking local networks of medical institutions with each other. The special software of the subsystem should be an interconnected package of application programs that automate the work of the employees of the relevant units of the medical institution. Therefore, the structure of special software for the management subsystem of the organization of medical and diagnostic processes in medical institutions should consist of the following packages of applied programs - subsystems: Specialist of the reception dormitory, hospital department doctor, nurse, senior nurse, the results manager of the research, employee of a pharmacy, employee of the discharge department, hospital administrator, database administrator, the registrar of a polyclinic, doctor of polyclinic, administrator of the polyclinic. The peculiarity of these software packages should be their adaptation to the profile of the medical institution. Depending on the type of organization of treatment and diagnostic processes, special software will be formed from the number of subsystems listed above and parametrically adjusted to the profile of the medical institution.

3.2.3 Information technology of the activity of the polyclinic registrar

The analysis of the activity of the clinic registrars made it possible to design and implement the information technology. Main functions of the registry are: patient registration, referral to various specialists in the polyclinic, issuing forms with the results of the research, organizing the call of dispensary patients.

In the case of a patient's request to the clinic for medical assistance, the registrar enters the patient's passport data. In this case, if the patient does not first contact the clinic, information about him is already available in the database. This information is displayed on the registrar terminal and can be adjusted. In the dialogue with the system, the recorder chooses specialist, to which he sends the

patient for examination. In some cases, in order to accelerate the survey, certain research before visiting specialists. Therefore, the system forms the patient's route in such a way that the patient comes to the specialist's office with the results of the research. The registrar prints a form in which the number of the office is determined, the time of visiting the specialists or the laboratory.

When applying to the registry, the patient can receive various reference information stored in the data bank: the schedule of admission of specialists, the schedule of admission of laboratories, the addresses of other medical institutions. After completion of the examination in the clinic, the patient turns to the registry after discharge. The registrar searches the database for information about the patient, prints the result of the survey and the extract. The patient is given an extract on his hands, and the result of the examination in the form of an outpatient card remains in the registry. If the patient is referred for consultation to other medical institutions, the registrar will print out a special form of referral.

To arrange a visit to the polyclinic by dispensary patients, the registrar, on the basis of the data bank, creates appropriate patient lists with information on the visit dates and specialists, prints letterheads that are sent to patients by mail. The dates of the patient's regular visits to the polyclinic are appointed by the appropriate specialists during the last examination and treatment of these patients.

The data bank should contain information of two types: information of medical diagnostic processes and various types of background information. Information on treatment and diagnostic processes should include: patient registration data (passport data, patient's blood group, allergic reactions, contraindications to medicines, etc.), outpatient cards and / or medical records, Patient examination and treatment routes; data of dispensary observation: terms of appearance, peculiarities during the course of the disease and the treatment process, etc., operative information about the presence of drugs in the departments and pharmacies. Background information should include: information on studies conducted in a medical institution, information about employees, information about medicinal preparations, auxiliary directories for the formation of an

anamnesis, objective data, diagnoses, schemes of optimal examinations, monitoring schemes for patients on dispensary records, etc.

To prevent unauthorized viewing and entering information, a password protection must be provided in the subsystem. Three degrees of protection are offered. The first degree of protection is associated with the entrance to the operating environment. To do this, enter the user name and password. After the information is correctly entered, the subsystem must be automatically loaded to exclude the access of unqualified specialists to the operating environment. The second degree of protection is connected with access to the information of the bank of data of medical-diagnostic processes. For admission to work with the subsystem, medical personnel must register by specifying several key parameters that uniquely determine their identity, for example: the personal code of the specialist in the subsystem, Full Name, specialization, position. After the identification the expert should enter the password. The password is formed by traditional procedures adopted in software systems. In case the password is correct and corresponds to the entered specialist code, the subsystem allows further work. To save changes in the data bank, the subsystem requests the password of a working specialist. In the event that this password does not match the password specified at the login to the subsystem, the information in the data bank is not stored. Requirements for linguistic support linguistic support is an integral set of formal languages describing information and algorithms for its processing in the process of examination and treatment. Linguistic support can be divided into basic and control. The basic software includes programming languages:

- 1) the programming language of a database management system such as Informix.
- 2) for the solution of specific auxiliary problems - a widely used programming language for C.

The manager linguistic support includes the language of user interaction with the system. The simplest from the point of view of exploitation is the query-response language, and the dialogue should be organized at the level of medical concepts. The volume and semantics of the information entered into the database

must meet the needs of specialists, and the time for entering information should be kept to a minimum. Therefore, the following options for entering information must be implemented in the subsystem:

- input of information from the keyboard
- selection from directories.

For example, patient passport data must be entered directly from the keyboard. However, at the same time there should be an opportunity to view the list of patients who have ever applied to this medical institution. If the required patient is present in this list, then when you select it, the passport data should be automatically displayed on the screen. In the subsystem of the organization of medical diagnostic processes, it should be possible to use the briefly coded names of areas, sex and other information, which, if desired, should be deciphered. The use of coded information reduces the amount of information input by personnel.

To create information about the patient's condition and at the same time reduce the time for entering information into the database, it is necessary to use medical directories that describe complaints, anamnesis, results of objective examination, etc. Directories should be formed and tuned to the profile of a particular health care facility using a special software tool, "Database Administrator." In the absence of the required information in the directory, it should be possible to enter it from the keyboard. The use of directories not only shortens the time of entering information, but also minimizes the number of errors, and the input of information.

The information stored in the first reference books of complaints, anamnesis, examination is not classical and axiomatic, it will change during the operation of the subsystem. Therefore, directories should be replenished and corrected. Specialists using electronic directories in their work should not have access to their change. This should be done centrally by the database administrator who accompanies the system on the basis of the document on the revision of the directories agreed upon and approved by management. In the subsystem of the organization of medical-diagnostic processes, the codifiers used in medicine should be used. In particular, the ICD-10 diagnosis coding system, nosology

reference book, medical and economic standards for examination and treatment approved by the Ministry of Health, and the directory of medicinal herbs should be used.

The use of directories will make it possible to store information about patients in a database in coded form. This will allow to automate the statistical processing of information in the research work of medical workers: to facilitate and accelerate the systematic and statistical analysis of bank information. In particular, the analysis of the data bank will make it possible to establish the most characteristic complaints, anamnesis, the results of an objective examination, and research on a particular disease. This information will help doctors in determining or clarifying the most characteristic signs of the manifestation of a disease. The composition of organizational and methodological support includes a set of documents that determine the organization and methodology automated management of the organization of medical-diagnostic processes.

The methodological support should contain a specification, a general description of the subsystem, operating instructions for the automation system complex, a description of the interaction language, and the form of the output documents. Specification of methodical support should contain a complete list of existing documents that are part of the methodological support. A general description of the subsystem should serve to familiarize users with the structure and composition of its functions. The descriptions of the subsystem determine its functional components, composition, 1/1, the characteristics of the automation tools used. Instructions for the use of automation tools contains rules for their use in practical work. This manual provides recommendations for preparing the tools for operation and operation, describes the operating modes, user selection rules for the required automation tools, the composition and procedure for performing specific procedures. Description of the language contains all the information necessary for the user to organize its interaction with the subsystem: general information and guidance on the use of the language, applications. Forms of output documents contain their names, type of storage media: paper, magnetic media, the name of the modes that allow receiving these documents.

3.3 Information technology of the activity of the doctor of the polyclinic

An analysis of the activities of the doctors at the polyclinic made it possible to design and implement the information technology presented in below:

$$t_1(\varphi) = \max\{c(\mathcal{G}_{\varphi^{-1}(1)}, \mathcal{G}_{\varphi^{-1}(2)})\} = 0;$$

$$t_2(\varphi) = \max\{c(\mathcal{G}_{\varphi^{-1}(2)}, \mathcal{G}_{\varphi^{-1}(3)}), \max(c(\mathcal{G}_{\varphi^{-1}(1)}, \mathcal{G}_{\varphi^{-1}(3)}) - c(\mathcal{G}_{\varphi^{-1}(1)}, \mathcal{G}_{\varphi^{-1}(2)})\} =$$

.....

$$t_{p-1}(\varphi) = \max\{c(\mathcal{G}_{\varphi^{-1}(p-1)}, \mathcal{G}_{\varphi^{-1}(p)}), \max_{k=1, p-2} (c(\mathcal{G}_{\varphi^{-1}(k)}, \mathcal{G}_{\varphi^{-1}(p)}) -$$

$$- \sum_{m=k}^{p-2} c(\mathcal{G}_{\varphi^{-1}(m)}, \mathcal{G}_{\varphi^{-1}(m+1)})\} =$$

$$= \max\{0, \max_{k=1, p-2} (0 - \sum_{m=k}^{p-2} c(\mathcal{G}_{\varphi^{-1}(m)}, \mathcal{G}_{\varphi^{-1}(m+1)})\} = 0.$$

After registering and entering the password, the doctor can receive lists of patients sent to him for examination from the registry, enter, view, correct information on the results of work with patients, including those on dispensary records, to analyze archival patient records, to review the schedule of admission of patients by specialists, the work of laboratories, reference information about the addresses of medical institutions. To record information on the results of work with a patient in the database, it is necessary to register it. The patient is registered by choosing from the list of patients sent by the registry to the doctor. After selecting a patient from the list, his passport data is displayed on the screen. If the patient's passport data has changed, the specialist can correct them.

At any stage of the patient's work, the doctor can view all the information from his current and archival outpatient cards. Each change in the treatment-diagnostic process is reflected in the data bank only after confirmation by the electronic signature of the corresponding doctor. The organizational support includes normative materials that determine the place of the subsystem within the organizational structure of the medical institution. These materials contain orders, job descriptions of personnel, programs of training courses and advanced training of users. Analysis of the activities of specialists from medical institutions made it possible to distinguish two main aspects of management:

- 1) professional activity that reflects the level of their knowledge, skills
- 2) an executive discipline that reflects the ability of a specialist to correctly and timely fulfill the tasks of the leader and higher organizations.

State institutions have their own specific information flows of documents and tasks. However, the rules of labor discipline are common to all state organizations, and each head seeks to ensure that all of its tasks are carried out on time. It is possible to monitor the fulfillment of the growing volumes of tasks only through the development and implementation of automated information technology for monitoring and managing the executive discipline of employees. If the process of professional activity of specialists is reflected in paper or electronic documents, the analysis of these documents will make a decision on the level of their professionalism. In the future, we will use the concept of "examination card, and patient treatment", which will indicate, respectively, the patient's medical history for the hospital and an outpatient card for the clinic. The professional activity of the doctor is reflected in the examination cards and the treatment of his patients. The analysis of the information of these cards will allow to identify in a timely manner mistakes made by a specialist, to correct his professional activity, to assess the level of knowledge, to plan advanced training courses, to carry out a differentiated payment for his activities. Use in the work of the medical institution of an automated system of organization of treatment and diagnostic processes allows the creation of a data bank that stores the information of the examination and treatment cards of patients in a certain structured form. The structure of the information provides an opportunity for rapid and systematic analysis of examination and treatment cards for patients. The use of modern informatization tools will increase the effectiveness of expert evaluation.

Currently, there are different approaches to assessing the professional activity of doctors. One approach is described in which is based on the idea of applying a special card of patients' reviews about the "deontological" appearance of the attending physician with subsequent processing on a computer. The patient expresses his / her opinion about the work of a particular doctor by selecting the appropriate characterization of the relationship between the physician and the

patient in the feedback card. Evaluations from map reviews are integrated with the available information about this specialist, which is obtained as a result of computer certification. Computer certification is conducted through a dialogue between the doctor and the computer. The doctor is offered a package of 100 tasks, depending on the category, specialty and position of the doctor. The disadvantage of this approach is the need to constantly update the tasks to exclude repeat polls of doctors and the limited possibilities for analyzing the activities of a doctor.

The complexity of the manifestation of diseases, the lack of formalization of medical knowledge necessitate expert evaluation of the professional activity of doctors, which is based on an assessment of the quality of treatment and diagnostic processes. Currently, the evaluation the quality of medical diagnostic processes and the management of medical records is carried out by the method of examining the examination and treatment cards for patients, which is carried out by the clinical and expert commission of the medical institution. The members of the commission, analyzing each diagnostic and treatment process, answer the questions of a specially developed expert evaluation card. Results are submitted to the chairman for consideration.

This approach has now been implemented in the Moscow State inpatient treatment and prophylactic institutions, as well as in the Republican Clinical Hospital of the Republic of Kazakhstan. There are the following disadvantages of expert evaluation:

- 1) analysis of the specialists handwriting increases the length of time for analyzing the volume of maps necessary for making a decision
- 2) restriction of the experts memory makes it difficult to systematically review the evaluated cards and, as a consequence, a comprehensive analysis of the doctor's activities
- 3) checking the consistency of experts' opinions is carried out on a qualitative level in the form of discussions without preliminary quantitative analysis, which makes it difficult to systematize mistakes made by a doctor and leads to a slowing down of the decision-making process.

These shortcomings lead to a rather high level of subjectivism of the final decisions taken by the expert commission. An expert's skipping of any errors in the activity of a specialist can lead to a significant decrease in the level of the diagnostic and treatment process. The application of mathematical methods for the processing of expert assessments, modern means of informatization will allow to systematize the results of expert evaluation of the doctor's activity and streamline their discussion, thereby reducing the level of subjectivity of the decisions made. However, subjectivism will not be completely eliminated, since medicine is a difficult formalized area, and existing diagnostic and treatment algorithms occupy a small part of it. Doctors of even one specialization have different levels of medical knowledge, experience, intuition, used in the examination and treatment of patients. Therefore, the lack of a level of formalization of medical knowledge leads to the possibility of ambiguity in the opinion of experts on the composition and sequence of examination and treatment. To conduct expert assessment it is necessary, first of all, to determine the composition of the expert commission. The first step in selecting experts is to determine the quantitative composition of the commission. The number of experts should be large enough so that they can collectively take into account the essential properties of the problem and that the solution found with their help be accurate enough. However, with a large number of experts, difficulties arise in organizing the examination. In the event that the size of the expert group is determined, go directly to the selection of experts. The composition of the medical expert commission should include highly qualified doctors-experts of the relevant specialization. For example, experts should evaluate the activity of cardiologists - highly qualified cardiologists. In this case, experts will have the greatest competence in analyzing the activities of a doctor. According to the theory of expert evaluation, to create an expert commission, first of all, a list of physicians with such qualities as competence, creativity, heuristics, intuition, independence, and comprehensiveness is formed.

3.3.1 The doctor can view outpatient cards in full, and in parts.

Automation of expert evaluation will raise expert appraisal to a qualitatively new level. At the same time, an automated system of expert evaluation of the activities of specialists should provide:

1) the ability to view survey cards and treat patients in full, by sections and their combination

2) the possibility of viewing reference information of medical and economic standards for the implementation of a comparative analysis of necessary and conducted research

3) input, storage, viewing, correction of types and directly errors

4) checking the consistency of experts' opinions on the types of mistakes made by the doctor in the analyzed examination and treatment cards of patients

5) the formation of the recommended procedure for discussing the types of errors in accordance with the procedure discussed above

6) printing of lists of errors admitted by the doctor, indicating the numbers of the examination cards and the treatment of patients

7) control over the organization and discipline of performance of expert evaluation by the chairman of the expert commission

The following information technology is based on the work of the automated system of expert evaluation of specialists' activity. The activity of a certain doctor is considered. The chairman of the expert commission forms its composition, as well as a set of analyzed cards for the examination and treatment of patients of this doctor for a certain period of time. The resulting set of electronic cards is submitted for analysis to each expert. The expert analyzes the content of each card from the selected set regardless of the results of the analysis of another expert. If an error is detected, the expert fixes its type, description, or notes that the survey map does not contain errors. In this case, all experts work with the same set of types of errors, which will further systematize the results of the examination. The error description is entered into the database in plain text.

In the case that a lot of maps are analyzed by all experts, in accordance with algorithms of the procedure for processing and analyzing the results of expert evaluation, the system calculates the resulting estimates, verifies the hypotheses

about the adequacy of the initial data to the results of ranking and consensus of expert opinions. Further, in accordance with this procedure, the expert commission analyzes and discusses the results of mathematical processing. If the experts decide on the need to adjust their estimates, then return to the stage of selecting estimates, where necessary adjustments are made. If necessary, the composition of the expert commission may be changed or a lot of analyzed cards may be changed. Based on the results of the expert conclusion, a decision is made about the professional level of the doctor.

At any time, the chairman of the commission can monitor the implementation of expert evaluation. The Chairperson can get current statistics on the number of examinations and patient treatment cards analyzed by experts, the types and number of errors identified by the expert. For each type of error, the chairman can get a list of their specifics and view the patient's maps where they are identified. If necessary, the chairman of the expert commission develops a controlling influence on the expert in the form of reminders, recommendations, reprimands and other measures.

One of the important conditions for the effective management of the activities of any institution is the organization of timely implementation of decisions taken, the basis of which is document circulation and control of the performance discipline. The task of control of the performing discipline was solved mainly on the most part of enterprises and institutions as a sorting problem of accounting and control type. The active introduction of modern PCs, network hardware required the development of more sophisticated automated document management systems and control of the performance discipline, taking into account the achievements of modern applied informatics. The state management system contains a set of requirements for the documentation of management activities and organization of work with documents in government, institutions, public organizations and enterprises. There are instructions on the management of departments and enterprises, in which these requirements are specified. In accordance with regulatory requirements, the organization's workflow covers the movement of documents from the moment they are received or created to the

completion of execution, transfer to storage. The main stages of processing documents in the organization are registration, consideration, transfer to the executor, storage, control of execution, formation of cases, transfer of the case to the archive. The technology of document management involves the maintenance of registration and control forms in the form of magazines and files.

3.3.2 Automation of control of the performing discipline

Effective document management in any institution is associated with the storage and processing of large amounts of documents. The main problem of traditional document management technology is the practical impossibility of centrally monitoring the movement of organization documents in real time. In modern institutions and enterprises, the main technological tools for working with documents are computers installed in the workplace of performers and connected to the network. In such institutions, it becomes possible to use the network to move documents among performers and to centrally track the progress of the workflow up to the work of the final performers.

The task of automation of document circulation and control of the performance discipline is to develop an automated system for collecting, storing and processing information that allows increasing the efficiency of the structural units of institutions or enterprises by:

Currently, there are many software products designed for office automation. Foreign software packages such as Lotus Notes, Staffware, Linkworks etc. can be used for workflow of any enterprises and institutions. Most of these systems have tools that let you create software systems control performing discipline in accordance with the regulations and instructions of a particular company or organization.

However, the main drawback of the existing developments is the lack of a system approach in the development of technology for monitoring the implementation of solutions in individual workplaces. This drawback makes it necessary to perform system designers a time-consuming work as revision basic version of a system in accordance with the control technology of executive

discipline in each of the new organization, which carried out its implementation. Even the use of such modern software development tools as CASE - technologies, requires for a full cycle of creating a system from 3 to 6 months.

To create a unified approach to expert appraisal, it is necessary first of all to identify typical sections of the examination and treatment map that describe the patient's treatment and diagnostic process. Selected typical sections are given in

Table3.1.

№	Purpose of the sample partition
1	Description of the patient's condition (on admission, primary inspection, diary entries by numbers)
2	Results of studies performed at the place of residence
3	Diagnoses (at admission, workers, final)
4	Assigned consultations
5	Assigned research
6	Assigned operations
7	Prescribed medication
8	Cancellation of prescribed medications
9	Information of consultations
10	Information of the conducted researches
11	Description of the performed operations
12	Information of medical treatment
13	Temperature sheet

To create effective automated control systems for performing discipline, it is necessary to solve the following main tasks:

Successful solution of these tasks will allow the developers to reduce the time and financial costs for the implementation and maintenance of information systems in a particular institution or enterprise of the organization due to the lack

of the need to refine the basic software. The following basic principles should be based on the development of a standard automated information system for the control of the performance discipline:

1. Mobility in the class of the most common computer and network hardware platforms.

2. Adaptability of the system to the organizational structure of the institution or enterprise.

3. Protection against unauthorized access to the system data bank.

4. Unification of the user interface of the system.

Any state system is characterized by a large number of elements - institutions, information links and interaction between them. Each institution in turn has a hierarchical structure of subordination of performers. The structures of specific institutions differ from each other in the number of hierarchy levels and the number of employees at each level. Direct communication from the control element to the managed element is carried out in the form of documents and tasks associated with a particular solution. At each subordinate level, directives are executed or passed on to perform further in the hierarchy. Feedback from the managed element to the manager provides for the presentation of various types of reports on the performance of tasks associated with different documents.

All documents of a state institution or enterprises related to the management of their activities can be divided into two types: external; internal documents. External documents include documents and letters addressed to the head of the institution or to the institution from higher management bodies, various organizations and citizens. To this type of documents are: decisions, orders of higher authorities, laws, presidential decrees, letters of higher management bodies, ministries, departments, enterprises, organizations, citizens and the media. Internal documents are documents prepared in the institution itself. Such documents may be outgoing documents or documents for internal use: decisions and orders of the head and his deputies, reporting documents sent to higher authorities, letters to various organizations, citizens.

3.4 Typical adaptive information technology for control of the performance discipline

System analysis of the abovementioned documents of state institutions and enterprises allowed to develop a unified electronic card of the document containing the following information: the outgoing date and number, document type, the subject matter of the document, abstract to the document (a summary of the document), author of the document, type (law, deputy's request, personal order, etc.) and type (complaint, application, request) of the document; category of the author, address of the author of the document, number of pages of the document, sheets of the application, the file number in which the paper copy of the document is stored, type of the result of the examination of the document keywords, document movement (name, date of transfer, period of return, assignment of transfer, result - return for revision, lack of revision), the curator of the document and his position, note for each movement of the document, a list of all incoming and outgoing documents associated with this document (numbers, dates, types), The name of the file in which the electronic copy of the document is stored. To transfer the document for execution and putting into control, a unified task control card was developed that contains the following information: the manager who issued the assignment; task executors and their positions, responsible executors; initial and current deadline for the assignment; the fact of execution of the task by each performer and the whole task as a whole, number and date of creation of the card, type of card creation (control, registration), the date the job was last modified, the significance of the task, the type of the result of the task, the attributes of the document-basis (number, date, type) and the associated ground reference (number, date, author), the content of the assignment; the person to whom control over the execution of the task is assigned, history of the task, observation, conclusion.

The effectiveness of organizational management processes largely depends on the level of development and the degree of automation of the information technologies used. In this chapter, the analysis of the development processes of existing automated systems of organizational management, which revealed the

shortcomings of the design phase of the functions of the system and related information technologies. The main disadvantage is the intuitive nature of the implementation of this stage, which depends on the qualifications, experience of the developer and the degree of ownership of the methods of system analysis. In addition, at the present time, the actual task of modern computer science is the development of a methodology for the design of automated information systems (AIS), based on the active use of methodological, technological, algorithmic and software repositories from previous projects.

In accordance with the classification, a typical software structure of the organizational management sub-systems is presented. The requirements formulated by generators of arbitrary requests, reporting forms, directories, as well as modules for input, processing and display information. In order to use generators in various applied fields, it is noted that the uniformity and the assertiveness of the corresponding information technologies are necessary for the data model of a particular AIS. The paper proposes a generalized methodology, the design of information technologies related to the implementation of the functions of input, processing and display of information of a particular subject area. The proposed methodology is the development of a structural method for designing automated information systems. Formation of the results of the examination, registration of the main and accompanying diagnoses, the appointment of studies and consultations, treatment schemes is carried out in a similar way to the information technologies of the subsystem "branch doctor".

To analyze the activities of doctors, the administrator of the clinic sets the time period and the conditions for finding the necessary information. The subsystem processes the information of the data bank of diagnostic and diagnostic processes and displays statistical results in the report view on the monitor screen.

At the request of the administrator, the subsystem displays information about the addresses of medical institutions, the schedule of admission of patients by specialists and laboratories of this clinic. In case the administrator conducts the patients' reception, he can quickly receive and enter all the information about the patient in the same way as the information technology of the subsystem "specialist

of the polyclinic". One of the tasks of the polyclinic administrator is the examination of the professional activity of specialists based on the database of medical diagnostic processes. Automation of control of the performing discipline allows to create a tree of execution of a decision in the database and to analyze the progress of execution of any decision with accuracy to the performers, terms and content of tasks.

To implement the control of execution of any solution, a typical adaptive information technology is proposed. The beginning of the control process is to obtain information on the implementation of the decision. The analysis of the reliability of information allows either to return the relevant document for revision, or to record information about the documents describing the solution in the form of electronic cards in the database. The registration cards of documents and the tasks issued on the basis of these documents are sent to the respective executors. As executors, according to the hierarchy of the organization, there may be, respectively, leaders, deputy heads, department heads, and ordinary employees. If the performers, in turn, form new tasks by their subordinates, then these executors create new task control cards using an automated system. The new control cards specify the corresponding subordinates as executors. Thus, as the tasks are detailed and their executors are instructed, a hierarchy of associated electronic job cards is created in the form of the execution tree for each solution.

When creating the task, an electronic job card is entered into the database of the system for each performer. If necessary, the controller can create paper copies of control cards, which together with a paper document can be transferred to the performers. After the task is completed, each performer submits a paper or oral report on the task to the appropriate monitoring authority. As a result of the analysis of the results of the assignment, the supervisory authority decides whether to complete its execution or whether it is necessary to adjust the deadlines for execution, and possibly the composition of the performers. Corresponding information is reflected in electronic cards of tasks and documents. If the task is completed, the supervising authority places in the task card the deadline for actual execution, and thus this task is automatically removed from control. When the

task is removed from the control, the cards of all performers of the lower hierarchy level associated with this task are automatically removed.

When transferring a hard copy of the document for approval and signature to the manager in the electronic registration card of the document, the date of the transfer of the document is marked, which is automatically reflected in the corresponding associated electronic cards of the tasks of subordinate executors. At the end of each working day, the employee of the registration unit makes a printout of documents and tasks registered for the day, which is filed in a special magazine. Quantitative and qualitative analysis of the information of electronic cards of tasks allows the decision-maker to assess the degree of the employee's performance discipline for any given decisions for any period and to develop appropriate control actions for their activities. The unified information technology of control of the performing discipline has the ability to parametrically adjust the form of work of managers and the convenience of working with the system to a particular performer. For the convenience of the artist's work with the system, the following parametric settings are provided: the list of copied fields when creating a new job and document, setting the values of certain default fields, the list of executors, printer type, printer connection port, and others.

The forms of work of heads of institutions, organizations and enterprises are quite diverse. Some of the tasks the manager can immediately transfer to the executor for execution, others - are prepared by the assistant, passed on for approval to the head, and then only sent to the performer. Therefore, control cards, depending on the form of work of managers, can be automatically or automatically sent to performers. This property of the system is determined by means of a special setting. The automated information system developed on the basis of this technology makes it possible to implement the following functions at each workplace:

1. Registration of any documents, tasks and sending them over the network to the performer.
2. Automatic transfer of the terms for renewal or completion of tasks at each level of the decision tree to related tasks of a lower level.

3. Prohibition of access to electronic cards, in which the user is not the author of the assignment or its executor.

4. Prohibition of updating information, electronic cards, in which the user is not the author of the assignment.

5. Free choice and printing of cards of documents and tasks available to the user.

6. Analysis at each level of the execution tree to solve related tasks of a lower level.

7. Registration in the database in chronological order of all actions associated with the task, as well as reasons for non-fulfillment, cancellation of the assignment, return for revision, etc.

8. Generation of arbitrary reporting forms without changing the software of the information system.

9. Adoption of managerial decisions on the basis of an operational quantitative and qualitative analysis of the employee's performance discipline.

Information technologies are a means of management in many areas of economic and scientific activity. From the level of development and automation of information technologies, the effectiveness of management processes largely depends. The design and development of information system (IS) software is a complex multi-stage process, as the developers of information systems must take into account the many requirements for database organization (DB) and application functioning.

One of the most effective ways to reduce the cost of developing and improving the quality of programs is the active use of methodological, technological, algorithmic and software from previous projects. Over the past decade, a new direction in programming technology - CASE-technology - has been formed, which is a tool for system analysts, developers and programmers and allows to automate the process of software design and development. In most modern CASE-technologies, structural analysis and design methodologies are used, based on visual diagrammatic techniques. In this case, graphs, diagrams, tables and are used to describe the model of the system being designed. Such

methodologies provide a rigorous and intuitive description of the projected system, which begins with its general review and is then detailed, acquiring a hierarchical structure with an increasing number of levels [15]. The advantage of CASE technologies is the following:

- 1) the process of design and development is accelerated
- 2) the quality of the created software is improved due to the means of automatic control of the project
- 3) the developers are freed from routine work
- 4) development and maintenance of development is supported
- 5) technologies for reusing the development component are supported.

Nevertheless, CASE-technologies can not be considered independent methodologies, they only develop structural methodologies and make their application more efficient by automation. Ultimately, the success of developing a system using CASE-technologies is largely determined by a detailed study of the stages of analyzing the requirements for the system and its functional design. The main research tool of these stages is structural system analysis.

The conceptual model corresponds to the logical level of the data model and includes a description of the attributes, their formats, tables and table relationships among themselves. The questions of designing conceptual data models are classical, in the literature these questions are given great attention. For each subject area, a logical functional specification of the automated system is formed. Moreover, the methods for the formation of these specifications are intuitive and largely depend on the qualification, experience of the developer and the degree of ownership of the method of structural system analysis. At present, automated information systems (AIS) are widely used in various fields, which, according to their purpose, occupy a certain place among various kinds of automated systems. Therefore, an urgent issue is the development of a universal methodology for the formation of the logical functional specification of the AIS. In the logical functional specification of any automated information system of organizational management, the following generalized subsets of functions can be distinguished:

1. Generate arbitrary queries on the set of model data.

2. Generation of arbitrary reporting forms.
3. Administration of reference books.
4. Input, processing, display of information, according to the requirements of the application area.

When creating the AIS, developers, together with users, form a description of the set of possible requests for information, based on the needs of the relevant organization where the AIS should function. However, the experience of introducing AIS shows that during the operation there is a need to obtain information, requests for which were not provided for in the design. One of the criteria for assessing the quality of the developed AIS is its ability to handle arbitrary requests that are not planned during design. The tools of relational databases allow you to make an arbitrary request for data, but to use them you need not only a complete knowledge of the structure of the database, its conceptual model, but also the knowledge of the structured query language. The user should have knowledge of the formation of EOB queries that implement relational algebra and manipulate data, manage DBMS administration tools, and interact with the operating system.

The peculiarity of AIS is that they must provide the user's work only at the application level. Therefore, to perform arbitrary user requests, it is necessary to develop a system for automated query generation (SAG), which allows implementing the following technology for generating and processing queries. The user generates a description of the query, applied names of objects and attributes; defines the sampling constraints for some application attributes. The system allows you to save the generated query description as a template that can be accessed by other users of the IC. Based on the user's applied query description, the system builds a corresponding SQL query and passes it to the database management system (DBMS). The DBMS processes the request and sends the resulting sample to the system, which is displayed on the screen and can be printed on the printer. The information system for implementing queries and obtaining answers uses the conceptual model of the database. The system of automated generation of arbitrary queries should not depend on the concrete

implementation of the conceptual model of the database, but should be configured parametrically to work with it. In addition, the system must have a problem-oriented interface that helps the user describe the request. An obligatory requirement for the operation of any information system is the availability of a specialist who administers the system and has knowledge of the conceptual model. All other users may not have this knowledge, but should be able to use query templates that are created by the administrator.

4. The problem of training users of information technology in the health system

Studying of the newest computer technologies forms at the doctor the special outlook which allows it to carry out the practical and research work at the highest level. Therefore, the goals, tasks and content of the organization of training in medical informatics are given great attention both abroad and in our country.

Information technologies serve both for solving administrative, management tasks, and in the interests of practicing doctors. The head of the medical institution should be able to systematically obtain the information necessary to organize the work of his subordinates and assess it in the context of the activities of his institution. This requires skills in working with computer technology, as well as skills in the use of information technology. Therefore, the National Health Service provides information training for employees in the following five areas: information collection, adoption of operational decisions; management, planning and strategy, Information Systems, informatics.

Within the framework of the fifth working conference of the International Medical Informations Association (IMIA), a discussion was held in which specialists in medical informatics from the Netherlands, Germany, Canada, USA participated. The necessity of teaching medical informatics in higher educational institutions as a separate course was discussed. The term "medical informatics" was adopted in 1975 and is being further clarified. Usually this means analyzing medical information and its use in the diagnosis, treatment and prevention of

diseases. A number of researchers understand this term more broadly, including all aspects of the use of information in health care. The opinion is expressed that the objects of research and the field of application of medical informatics cover virtually everything, medicine. Medical informatics together with mathematical statistics and epidemiology form the methodological basis for solving problems in medicine and public health. Medical Informatics allows: to analyze information flows on the basis of software tools for ensuring decision-making; create "medical, databases and knowledge, to plan, carry out statistical processing of information and evaluate clinical processes, epidemiological studies, to form medical documents. Since medical informatics is focused primarily on solving medical problems, it should be considered as a medical discipline, and not as part of the actual informatics. telecommunications, collection, storage and retrieval of information, processing and application of data in biomedical research, technology development. The medical informatics course at the Stanford University School of Medicine includes clinical informatics, bioinformatics, computer science, decision theory, the fundamentals of biomedicine, the health economics, social and ethical disciplines. The Faculty of Medical Informatics at the University of Lincoping (Sweden) also conducts training in both technical topics and medicine. Technical education is conducted for 4-5 annual programs, including electrical engineering, applied physics, computers, engineering, industry and biology. Medical education includes medicine, nursing, laboratory technology, rehabilitation and guardianship. Much attention is paid to information technology in the training and use of medical knowledge, its social and economic impact on society.

4.1 Psychological aspects of teaching doctors information technologies

One of the stages of implementing any information technology is user training. In the process of learning, the trainee must study the information technology of his activity and gain skills in working with the computer system. Automated control systems of medical-diagnostic processes realize the medical technology of examination and treatment of patients. However, unlike the expert

systems used by specialists of a certain level of intelligence and education, a fairly wide range of users should work with an automated management system, the circle of which is quite wide: doctors and nurses of various ages, intellect and thinking style. Therefore, the problem arises of training a diverse and heterogeneous group of medical workers. According to the didactic theory, the generalized model of the learning process can be represented in the form of six basic stages of acquiring knowledge, skills, skills of creative activity: motivation, organization, understanding, control and evaluation, repetition and generalization. The model of the learning process assumes that the progress achieved during the training is provided by passing through all the stages that have a temporary and functional framework. It is essential that in learning all stages are realized in a certain sequence, and this process can be cyclic.

It is impossible to provide all kinds of reports, (therefore it is necessary to present to the system administrator the opportunity to create custom reports templates, to embed them in AIS for use by other users. To solve the task, it is necessary to develop:

- 1) the template language for the report template and the language creation editor
- 2) an editor that allows you to describe a report template in the description language
- 3) the translator of the description language of the report templates in the terms of the DBMS programming language.

To facilitate the user's work on creating reports, it is necessary to develop a language for describing report templates in terms of the application domain. The report template description editor allows you to generate a report description in the language L . The vocabulary of the V language has the following composition: I - identifiers (list of attributes of the data model described in terms of the application domain), S - service words for the description language of report templates, K - constants (places of connection of formed templates).

The translation of the template description from L to the programming language of the DBMS should consist of the following steps: a) lexical and

syntactic analysis of the template description. b) compilation of the template description into the structure of the DBMS programming language, compiling the template from the programming language into the boot file.

When developing the report templates editor, you must adhere to modern standards. Most modern text editors of programs are built into the "programming system and directly from them you can run the programs for compilation and execution. Examples are the editors built in the programming system Turbo C, Turbo Pascal, etc. These same principles should be used when creating the description editor. In this way, the report template description editor should allow you to create and edit the description of the template, translate it into the language of the AIS creation, carry out to check the compliance of the task.

Traditionally, information system directories have a hierarchical structure. Moreover, most directories have a linear structure, which can be considered as a single-level hierarchical structure. Therefore, the task of administering directories for any AIS can be considered as a task of creating and supporting hierarchical structures.

Generators of reporting forms and arbitrary queries are customizable to the structure of the AIS data model and interact with this structure to form SQL requests. The results of interaction are made out in the form of templates, which are stored in the corresponding data bank.

Using generators of directories, queries and reporting forms, observance of formulated requirements and implementation of the above actions when designing a specific information system will significantly shorten the development time of the system software. Verification of the compliance of the functioning of the developed system with the requirements of the initial task is carried out at the stage of qualification testing. By results of testing, if necessary, adjustments are made to the design of the information system. In this case, the use of CASE - programming technology will allow to correct the software of the system in a short time.

4.2 Classification of medical computer systems used in medical institutions

Consultation and diagnostic systems are designed to assist doctors in diagnosing and prescribing treatment. For example, the paper describes a computer expert system designed to assist doctors in diagnosing surgical diseases in the abdominal cavity. Among the consulting and diagnostic expert systems are systems, the source of information for which is a person and sensors of diagnostic equipment.

The results of estimating the entire set of Q maps in according to the relations: to m w

$$a, j = 2, b^j, i = 1, n, j = 1, ra, a^{\wedge} = 2: a_{ij} / i: a_j, i = 1, n$$

$$C\{Z^{\wedge}\{ii-C2'L^{\wedge}i^{\wedge}i^{\wedge}\}. (Cia_j - Crb; jZ_j^{\wedge} O, Vi = l,r,$$

$$(C,ai -C^{\wedge}b^{\wedge}Zi s(C,ai, -C^{\wedge}b^{\wedge}r, \dots Vi=u^{\wedge}, C, SO, Cj SO.$$

The work is devoted to the review of the use of logical methods in medicine, based on models of representation of medical knowledge - cause-effect, anatomical, heuristic, pathophysiological, as well as supporting decision-making for medical tasks using deduction and induction. The paper describes a neural expert system and its application for setting a medical diagnosis. The expert system presented in the work uses a model of clinical data for diagnosing the thyroid gland. The paper describes the Guardian-type multimedia information system for computer support of home health care, which is used in two modes: the research mode for modeling various medical situations and the mode of searching for and transferring the necessary medical information for operational interaction with hospital personnel.

There are systems that allow solving the problems of analysis and forecasting. In work the expert system for an estimation of a professional level of the doctor is offered. This system contains a package of 100 medical tasks that are offered to physicians for the solution. The answers of doctors are processed by a special algorithm. A number of works are devoted to expert systems, which are included in the surgical equipment or medical equipment intended for the

administration of medicaments during anesthesia. Additionally, patients are questioned and a comprehensive assessment of the physician's activity is generally made. The work is devoted to biomedical information system for estimation and forecasting of dynamics of possible development of processes in the body. In addition, in the system of mass donor-zoological surveys of the population there is an automated complex designed to predict diseases. Deviation from the normal functioning of one of the subsystems may entail the build-up, the functioning of both the other subsystems separately, and the whole organism as a whole. At the same time, diseases can have different degrees of complexity and manifest themselves in different ways at different times of the year.

In Table 4.1 shows the classification of existing medical computer systems used in hospitals.

Actions	The formalized condition for vertex isolation	Justification
1. Selection of the first vertex.	Ife V such, then $c(\&_{k}, \&_{T})^0$ it is fulfilled: $(c(\>, \wedge) < c(D_k, D_t))$, $TO u/(1) = 1.$	
The construction of a set of vertex numbers I. In the first step $I = \{1\}$.	If e U is such that $(y (0 e I) \& (\text{---} .3 \setminus / (k))$ and the conditions $TO \setminus I (k) = I + 1$ and $(1c) e I.$	The assertion 2.6 and the corollary 2.6.1.
End	Result: $TM^0, \cdot \setminus \wedge$)	

Table 4.1 Classification of medical computer systems used in medical institutions

4.3 Analysis and isolation of a complex of factors for increasing the effectiveness of therapeutic and diagnostic processes

To increase the effectiveness of therapeutic and diagnostic processes, it is necessary to identify the set of factors influencing it and to automate the management of these factors on the basis of system analysis. One of such factors is the complexity of the disease. However, this factor does not objectively depend on therapeutic and diagnostic processes and is difficult to control. The time and quality of the treatment and diagnostic processes largely depends on their organization. Under the organization of the medical diagnostic process, we mean a set of measures that ensure the registration of a patient, planning the procedure and time for conducting studies, consultations, and treatment.

The quality of research and treatment of patients is directly affected by the professional level of nurses. This level is evaluated by doctors and is managed promptly during the execution of various procedures. The professional level of doctors influences the timeliness and correctness of diagnosis, the choice of the right directions of research, treatment. Since all stages of the cycle of examination and treatment of patients are documented, the professional level of physicians is reflected in the case histories.

The analysis of patients' medical records allows for the expert assessment of the professional level of doctors and the development of management actions aimed at raising this level. The availability and quality of research and treatment depends on the availability of the medical institution with the necessary specialists, equipment and medicines. The task of providing medical institutions with necessary specialists, equipment, and medicines is decided by the health authorities, based on financial possibilities. In the conditions of market relations, this task is partially solved by the medical institutions themselves. Preventive measures are one of the directions of medical services for the population, allowing to identify various kinds of diseases, to timely organize diagnostics and treatment, to prevent complications. The factor of timely diagnosis and prevention of diseases largely depends on the choice of health authorities directions and the scope of preventive measures. Currently, there are standards of care in hospitals:

for each specialist clinics there standard time patient admission to hospital standards of patient treatment in a hospital. However, the human body has a complex structure, consisting of a set of interconnected subsystems, such as the nervous, respiratory, endocrine, lymphatic and other subsystems.

Assessment of the consistency of expert opinions on types errors suggested by the doctor are suggested to be carried out using and the method of rank correlations. We denote by $Q = \{q_j^s = 1, k\}$ - the number of examination cards and patient treatment, $A = \{b_{1j}, b_{2j}, \dots, b_{mj}\}$ - possible estimation of error types for the $Q_j \in Q$; $A = \{(a_{ij}, a_{2j}, \dots, a_{mj})\}$ - a set of estimates of error types for the set Q , where $U = \{0,1\}$ is a criterion the difference of the i -th type error, determined by the j^{th} expert for the map $q_j \in Q$, a_{ij} - the number of errors of the i^{th} type, determined by the j -M expert on the set $Q = 1, n, j = 1, m$.

Therefore, it is obvious that for a specialist to make a decision, some cases of the disease require less time, others - greater. The discrepancy between the standards of therapeutic and diagnostic processes for real data leads to a disruption in the workload of specialists in medical institutions and reduces the effectiveness of therapeutic and diagnostic processes. Timely provision of medical personnel with information from the regulations of the higher organizations, high labor discipline in carrying out the directives of the leaders of one of any organization management tasks. Control over the implementation of directive orders of managers will allow them to make timely decisions on management, to raise the labor discipline of participants in medical diagnostic processes to a higher level.

Statement of the task of automation of management of medical-diagnostic processes in medical institutions

The effectiveness of therapeutic and diagnostic processes depends on a number of factors that need to be managed in a medical institution. Therefore, the task of automating the management of medical-diagnostic processes in medical institutions can be considered as a complex of automation control tasks by each of the following factors: timely diagnosis and prevention of diseases, the executive discipline of staff on the implementation of decisions of management and higher organizations.

CONCLUSION

System analysis of the problem of increasing the efficiency of medical-diagnostic processes was carried out, shortcomings of the existing health management system were noted. The directions of complex automation of operative management of medical-diagnostic processes are determined. The classification of computer systems used in the organization of medical diagnostic processes is given. The concept of complex automation of operational management of medical diagnostic processes based on the use of modern information technologies was developed. The structure of the hierarchically geographically distributed automated management system is proposed, which includes: a set of automated control systems of institutions and public health bodies united by automatic means of information transfer.

Adaptive information technology of the organization of medical-diagnostic processes in public health institutions is developed, which is the basis for the work of the corresponding automated system. The system has the possibility of parametric adjustment on the profile and structure of the medical institution.

The problem of optimization of a route of examination of patients taking into account contra-indications between appointments on time is formulated. The set of statements for solving the problem is proved. A method and an algorithm for its solution are developed. Use of the developed method in the automated system will allow to carry out effective management of patient flows depending on the prescribed consultations and studies taking into account contraindications, workload of laboratories and specialists.

A human-machine procedure for arranging expert appraisal of the professional activity of specialists is proposed, which makes it possible to reduce the subjectivity of the expert opinion.

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