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ELECTRONIC SYSTEM OF PERSONAL MEDICAL RECORDS

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Abstract:
Preparatory work was carried out in the article to introduce the automated system of personal medical records (hereinafter - ASPR or the system) at the institute clinic, which should be implemented on the basis of the existing local computer network at the institution. ASPR was considered as a complete software and hardware complex in the server and switching nodes, network equipment, medical personnel terminals, peripheral devices and specialized software components. Based on the study of Russian colleague experience, borrowed from open sources and the current regulatory framework, the authors formulated the technical requirements for this system.
Keywords: automated system, implementation, healthcare establishment, technical requirements, personal health.

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INTRODUCTION:

The goal of ASPR is to create a fully digital workplace for medical personnel, to ensure high quality patient care, to reduce the number of medical errors, to increase the efficiency and the productivity of a clinic, and to provide the medical staff with the necessary information to make the right decisions [6, p. 95].

METHODS

The tasks of ASPR implementation. In order to achieve the set goal in the implementation of ASPR, we planned to solve the following tasks:
- to improve the efficiency of the institute clinic management;
- to improve the quality and reduce the duration of patient care;
- to improve the efficiency of medical personnel work;
- to organize operative information interaction between doctors of various specialties;
- to improve the effectiveness of health care institution scientific activities;
- to optimize the use of available human and material resources;
- to promote the development of medical personnel skills;
- to ensure the preservation of personal information confidentiality about patients and its protection from unauthorized access;
- to reduce the time frame and simplify the procedures for the preparation of clinic reports.

RESULTS:

ASPR is the means of complex automation of diagnostic and scientific activities. In particular, we planned to introduce ASPR to automate the following business processes [1, p. 85]:
- the management of the organizational structure and personnel, which implies a set of administrative functions for the development of an organizational structure, staffing, the movement of employees, the scheduling of employees and the monitoring of its performance;
- the maintenance of a patient's electronic medical record (PEMR) includes an outpatient card of the patient and a medical chart of a patient with a view to quick access to records of doctors, results of instrumental and laboratory studies and appointment sheets;
- the organization of outpatient admission of patients, which includes the keeping of reception logs by medical consultants, the functions of the registry and the doctor workplaces of a consultative polyclinic;
- hospitalization, discharge and the movement of patients. Includes the functions of reception desk for

patient registration, the keeping of hospitalization logs, the operational accounting of department hospital beds, the management of the queue for the hospitalization of patients, the filling in of the medical records of an inpatient patient, the registration of movement between the departments and all types of patient discharge;
- the organization of diagnosis and the treatment of patients at a hospital. It provides the functions of records for consultations, laboratory and diagnostic studies, the development of a sheet of prescriptions and a temperature sheet, the notes on completed appointments, the keeping of operation logs, a schedule of operations, the records of preoperative, stage and discharge epicrisis and other documents that can be included in a medical chart of a stationary patient;
- the conduct of diagnostic studies. The drawing up of schedules for diagnostic equipment loading, the keeping of logs, the drawing up of conclusions, the connection of diagnostic equipment to the system of medical image archiving, the loading of work letters to diagnostic equipment.
- the conduct of laboratory research. The development of directions for laboratory research, the sampling and the registration of biomaterial, sample preparation, the determination of workplaces, the connection of single / bidirectional analyzers, the maintenance of biomaterial archive, quality control, the validation of research results;
- the accounting of medicines. The determination of storage facilities for medicines, the maintenance of medicinal product nomenclature, expendable and dressing materials, the control over their shelf life, the record of receipts, the transfers between warehouses and departments, writing-off, automatic record of expenditures, inventory check, the ordering of medicines and the export of data from other accounting systems;
- the development of accounting forms of statistical reports. The functions of statistical report development analysis on approved forms of the Ministry of Health, State Statistical Service and other reports for management, PCI;
- The maintenance of the regulatory knowledge base. The functions of template maintenance for medical records, treatment regimens, the standards for instrumental and laboratory studies, reference treatment protocols, reference books for medicines, and so on;
- information support of scientific activity. The functions of indicator input to carry out scientific researches. The functions of patient group selection for research. Data export from other primary data analysis systems;

- informational interaction in a long term with a nationwide electronic patient register created in accordance with the resolution of the Ministry of Health. The register, as is known, is the information resource of the Ministry of Health, which is conducted using information technologies, electronic document circulation and electronic digital signature, in which health facilities of all forms of property are obliged to record certain information about patients.

The automation of above functions and tasks shall be carried out by the means of typical ASPR functionality [3, p. 71].

At the first stage of automation, we did not plan to automate certain business processes of a clinic, in particular, the accounting of working time for payroll, regulated accounting, procurement planning, the management of indirect costs, the calculation of planned and actual production costs, but they provided for the possibility of their implementation in future by system functionality expansion.

DISCUSSION:

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General requirements for the system.
1. The requirements for ASPR structure. ASPR should have a client-server architecture and be based on the following basic principles:
- openness - the system should use publicly available and specified solutions, protocols and interfaces, which should ensure the integration of created solutions, both with each other and with external information systems;
- modularity - the system should be built using a modular architecture, which implies the implementation of the basic functions as separate modules, which enable their independent modification. A failure in the operation of one of the modules should not lead to a complete cessation of the system functioning as a whole;
- scalability - the architecture of the system should allow to increase system performance, the volumes of stored and processed information without a long stoppage of work and a significant modification of the program code;
- manageability and configuration - the system must be managed at all levels of its architecture: at the infrastructure level, at the functional level, at the data representation level;
- systemic - all interconnected subsystems of a created system should use a unified methodology, and meet the unified principles of interaction, reliability and management;
- personalization - the provision of information to users should be carried out taking into account the personal settings of users;
- the unity of the graphical representation - general principles of graphical representation of information and the organization of user access to the system functionality and services should be used during the design and the development of user interfaces;
- the security of information - mechanisms and measures should be provided to ensure the protection of restricted access information.

Taking into account the tasks, we assumed the presence of the following main functional subsystems in ASPR program component [9, p. 279] (Table 1).
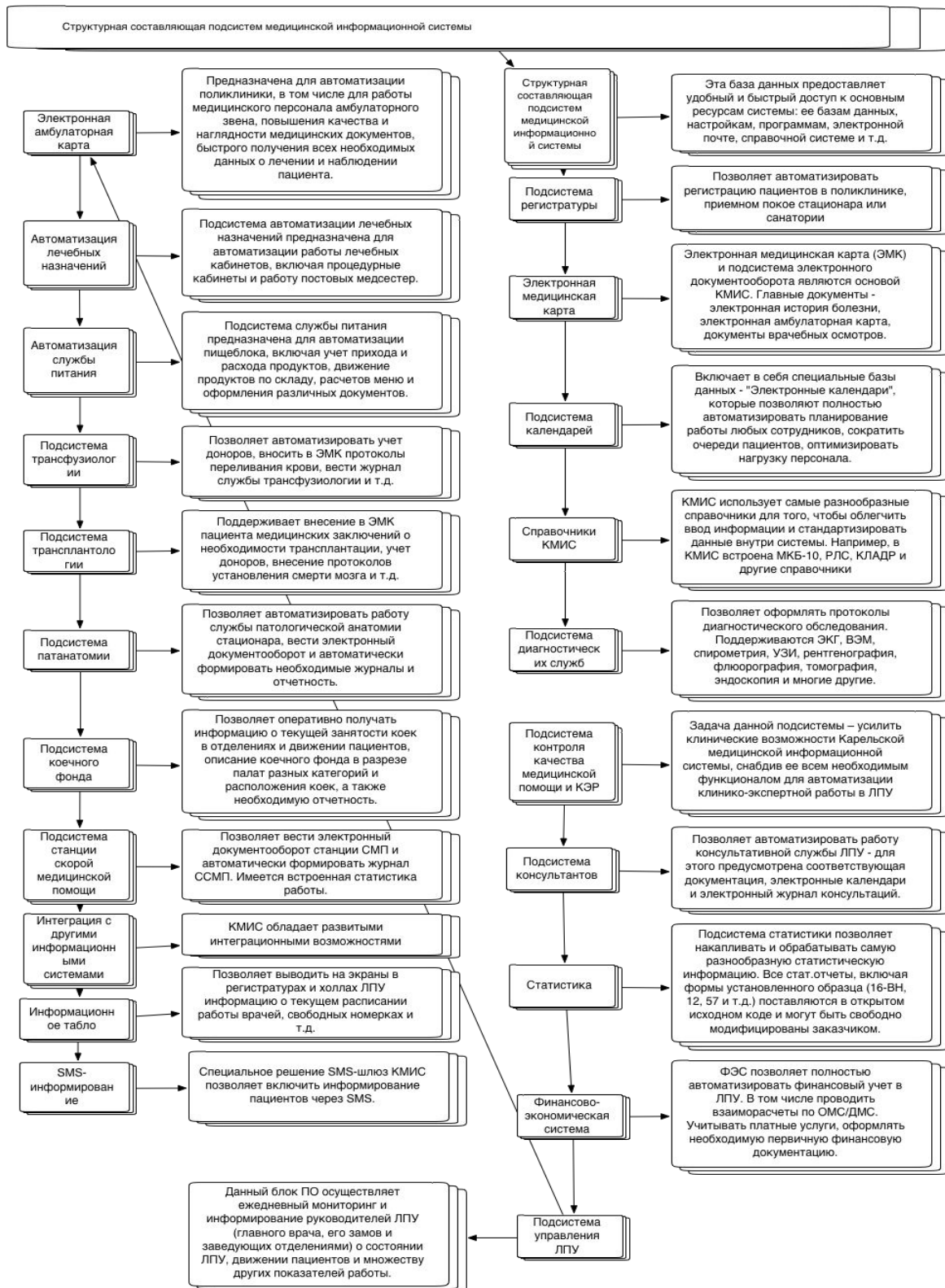
Figure 1 - The structural component of the subsystem of a medical information system

Several blocks have been designed for the functioning of this subsystem. These blocks allow to control this system in specific actions (Table 1).

Table 1 - Specific actions for the subsystems of automated information medical systems

Subsystem	Component
Hospital process management	- registration of hospitalization - registration of refusals from hospitalization (taking into account the nuances) - registration of the magazine of hospitalized patients - registration of hospitalization refusal logs - the conduct of planned hospitalization queues - the conduct of planned hospitalization queues
The work of the hospital inpatient department	- initialization of the local medical history - registration of diagnoses - registration of examinations conducted at a reception department - registration of services carried out at a reception department (including manipulations, analyzes, etc.) - registration of appointments in an admission department - registration of patients' consent to medical intervention - registration of the patients' consent to the processing of personal data - keeping of personal value records, accepted things and the values, the drawing up of receipts - the ability to view patient data on a regional (federal) level - the correction of patient data
Patient flow management at hospital	- registration of all appointments in all departments of a hospital and the control of prescriptions - registration of research data - registration of epicrisis - registration of interaction stages with the Bureau of Medical and Social Expertise and its results - the formation and printing of temporary disability sheets - taking account the forms of temporary disability sheets, including the account of medical and social expertise results
Patient hospitalization	- registration of the direction and the fact of a patient transfer to each department of a hospital, including resuscitative one (except for the visits to the diagnostic ones) - the registration of patient' statement and the closing of local medical history - seal of death certificates
Nurse functions	Registration of the procedures prescribed by a doctor Registration of clinical trial samples
Senior Nurse (hospital)	Consideration of patient movement in a ward. Management of hospital bed use The drawing up of an application from a department to a warehouse, the return of medicines to a warehouse. The approval of medicine taking to a post, cabinets The consideration of medicine use at a department, the development of requirements for a warehouse, forecasting, medicine stock management at a warehouse. Write-off of medicines from a warehouse
Resuscitation (functions and tasks of resuscitative therapy)	- the input of indicators, an expert evaluation by scales - the input of anesthesia provision data - the input of data on anesthesia course (complications) - the input of data on anesthesia complications (an intensive care)
Hospital fund management, including private security management (underwear and so on)	- the accounting of the hospital bed fund in buildings, - departments - floors - categories of rooms - the profile of room (ward beds), - the location of beds in a ward, - the addition of beds to a ward in excess of the estimated number (bunk beds).
The planning of a hospital bed employment, including:	- a bed booking (for a planned hospitalization and other purposes) - the withdrawal of a bed from use due to repair - the planning of a bed release due to a scheduled discharge - the obtaining of information on the employment of the hospital bed fund and a prompt movement of patients. - taking into account the occupation of beds for food unit operation planning

	- accounting for linen and other bed fund
Operating nurse functions	- an operation course record
	- the consumption of medicines and supplies, their accounting in the system
Management of patient flows at polyclinic	- registration of an appeal
	- record of visits
	- input of appointments
	- input of diagnoses (including ICD10), anamnesis, status
	- introduction of treatment recommendations
	- input of directions
	- input of test results
	- registration of diagnostic data
	- the development of disability sheet
	- socially significant disease register keeping
	A doctor's diary view (a reception plan for a day).
	- personalized accounting of medical services
	- patient data correction
	- the record of home visits
	- the possibility to send for research and additional consultations of other specialists
	- the possibility to make a record for a repeated visit, the research and advice of other experts, directly on the schedule of a doctor or an office, without the need to return a patient to a registry.
	- the possibility to make an extract from a medical card
	- a referral to hospitalization
	- the development of directions for analyzes when you are taken to hospitalization
	- the development of notification and the protocol of neglect.
	- performance control
	- prescription of recipes
	- control of the right to prescribe preferential recipes
	- control of the right to preferential recipes
	- control of rates and amounts for preferential recipes
	- accounting for data concerning provided preferential recipes
	- accounting of necessary benefit types
	the prescription of preferential medicines in accordance with the requirements of the order of the Ministry of Health and Social Development of Russian Federation № 110 "On the order of medicines, medical products and specialized products of therapeutic nutrition prescription" issued on 12.02.2007
	- preliminary inspection (if any)
Registration (the keeping of doctor schedule, the record for a reception, updating, institutions, the search of sheets)	- the development of time slots with time quotas
	- the reservation of time slots for repeated receptions and the receptions of certain groups of persons
	- the work with an attached population (a specificity is necessary)
	- the search or the drawing up of cards (in the amount prescribed by legislation)
	- stamp printing
	- the view the reception schedule
	- the record taking into account the replacement of employees
	- occupation of treatment rooms, taking into account the appointment of doctors
Ambulance	- the interaction with municipal ambulance services - the provision of information
	- the interaction with municipal ambulance services - the getting of information
Vaccine prophylaxis	- vaccination sheet keeping
Possibility of expert sheet conduct	MES control
	Clinical and expert activity / The technological structure of medical services

Here, the need to develop the application of a neural network appears. The joint work of medical expert and programmer team provides a lot of training examples, consisting of many pairs of vectors. Now the task is to design a perceptron and to transfer the knowledge and experience to it contained in a variety of teaching examples. As the method of a perceptron preparation, you can use, for example, an algorithm for feedforward. Thus, the perceptron must learn to picture any vector of a learning set to the vector that coincides (or almost coincides) with the vector. Besides, with the appearance of a new patient

characterized by a new input vector, the perceptron must calculate a new vector for it containing the correct diagnosis delivered by the perceptron already without the help of an expert physician. In other words, the perceptron should be able to generalize the experience transferred to it to new, previously unrevealed examples of a subject area - to distribute the load to a medical institution.

An electronic medical history should have:
- the completeness of data - ideally it should be the only source of information about a patient's health;
- accessibility of medical institutions for patients and medical staff;
- unchangeability of records (protection from falsification);
- the logging of access to records (even for reading);
- remote access possibility;
- the provision of data for reports;
- accessibility for examination.

The main problems limiting the conduct of history in an electronic form, is the difficulty of access distinguishing, ensuring the unchangeability of records post factum, the legitimacy of records (it is always necessary to know who, what and when recorded) and protection from leaks. All information about health, including the copies of documents and accompanying images, is stored in one place - on a mobile device or in a computer. That is, information belongs only to a man.

SUMMARY:

The purpose of the medical card is to provide a repository of a user's personal medical information (a cardholder), as well as the access to this information for medical professionals - in strict accordance with an owner's permission. The personal medical data of a user is protected reliably from an unauthorized access by persons outside the circle of those to whom a user has granted the permission to his card access.

Personal electronic medical record:
- it eliminates the need to accumulate a huge archive of bulk papers, pictures, cardiograms, analyzes, etc. with a limited shelf life and the property is easy lost;
- it provides the possibility of all your medical data compact storage (experienced and chronic diseases, medications taken, allergic reactions, results of tests, ultrasound, ECG, X-ray, MRI and other examinations, visits to a doctor, etc.) in one place;
- it provides the access to medical records at any time from any place of the world;
- it allows to give access to medical records to any doctors; a minimal example - for acquaintance with the results of an analysis before an examination, for advice, etc.;

- it allows a cardholder to determine the visibility of his data external world independently. An owner assigns one of the three access classes for any record:
- a personal record (not available to anyone except for an owner);
- a standard entry (an access corresponds to the permissions set by an owner);
- an emergency record (available to any doctor, as they contain vital information about allergies, contraindications, chronic diseases);
- it supports an automatic placement in the record of survey results from medical organizations - the service participants (the import of medical records);
- it guarantees the confidentiality of information posted by users or sent for consultation.

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