Research Article

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Development of a Methodological Approach to Support and Analysis of the Execution of Standards for Diagnostic and Treatment Processes in a Multidisciplinary Hospital

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ABSTRACT

Standardization is one of the most important tools for ensuring the quality of medical care. The paper presents analysis results of a number of existing federal and regional standards that regulate the processes of providing medical care, which confirm the need and expediency of developing internal standards for diagnostic and treatment processes (DTP) in a medical institution. The authors also formulate requirements for their minimum content.

The importance of the effective implementation of the developed internal DTP standards necessitates the development of a methodological approach to standard execution support and analysis.

The approach presented in the article is methodically based on the use of modified operogrammes, which allow taking into account the DTP specifics and resource equipment of a particular medical institution.

The authors propose key areas for standard execution support and possible forms of implementation in information systems, as well as basic directions for standard execution analysis with integral indicators for assessment of those standards.

Approbation of the developed methodological approach was carried out on the example of the N.V. Sklifosovsky Research Institute for Emergency Medicine in terms of DTP standard execution support and analysis in relation to ordering laboratory, instrumental tests and consultations at various stages of the patient treatment process. The results of the approbation confirmed that the introduction of the methodological approach increases the effectiveness of the implementation of the developed DTP standards in the activities of a medical institution, and also ensures the achievement of a number of important systemic management effects.

Keywords: treatment and diagnostic process, modified operogramme, standard of diagnostic and treatment process, small group, checklist, standard execution support, standard execution analysis, automation

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IS - information systems
DTP - diagnostic and treatment processes
ICD - International Classification of Diseases
INN - international nonproprietary name
MES - medical and economic standards
ACVA - acute cerebrovascular accident
ICU - intensive care unit (s)

RELEVANCE

At the present stage of the Russian healthcare system development, special attention is paid to ensuring the quality of medical care, including by means of its standardization [1].

A review of the approaches and stages of standardization of medical care in Russia is presented in a number of works by domestic scientists and healthcare organizers [2–5], which indicate that the standardization system as the basis for managing the quality of medical care historically, starting from the middle of the 19th century, has undergone significant transformation.

The current system of standards governing the processes of providing medical care includes federal (regulations on the organization of the provision of medical care by types, conditions and forms; procedures for the provision of medical care; standards of medical care by types and diseases; clinical recommendations) and regional (practices, clinical recommendations and orders of the regional level) standards.

The system of documents related to both of the above groups sets an important general vector, structure and framework for the organization of medical care for various specialties and types of diseases. However, it seems appropriate to create internal standards for medical organizations that reflect a detailed description of the organization of diagnostic and treatment processes (DTP) and their provision with resources, as well as mechanisms, taking into account the characteristics and specifics of a particular medical institution.

At the same time, the most important stage in managing the quality of medical care at the level of a medical institution is not only the development of internal DTP standards, but also their effective execution, which makes it possible to reduce the degree of rejection within the medical community that most organizational changes face.

As part of the effective implementation of the developed DTP standards, one of the most urgent tasks is to create systems for standard execution support and analysis in a medical institution that would simplify the work of medical personnel when applying a standard, as well as facilitate receiving timely and high-quality feedback to adjust the current system of internal standards by managers at various levels.

The aim of the study: To develop an organizational and methodological approach to the DTP standard execution support and analysis in the context of the formation of an integrated quality management system in a medical institution.

Research objectives:

1. To conduct an analysis of the requirements for the content of the DTP standards of a multidisciplinary hospital in terms of quality management in health care.
2. To develop a methodological basis for the approach to DTP standard execution support for medical personnel.
3. To develop a methodological basis for DTP standard execution analysis in a multidisciplinary hospital at various levels of the institution management.
4. To test the methodological approach to standard execution support and analysis on the examples of the DTP of a multidisciplinary hospital.

This article presents the results of the authors' work on the development and testing of the methodological approach to DTP standard execution support and analysis on the basis of the N.V. Sklifosovsky Research Institute for Emergency Medicine.

MATERIAL AND METHODS

The study used methods of systems analysis and synthesis.

As a research material, the authors used the DTP models of the N.V. Sklifosovsky Research Institute for Emergency Medicine, which were developed on the basis of the organizational and methodological approach to the description and standardization of diagnostic and treatment processes [6].

RESEARCH RESULTS

The main stated goals of standardization in healthcare are to ensure the availability and quality of medical care [1].

From this point of view, the most important types of standards are those that regulate the processes of providing medical care by types and groups of diseases.

These include procedures for the provision of medical care, regulations on the organization of the provision of medical care, standards of medical care, clinical recommendations, etc.

Due to the fact that the above system of standards is developed and approved at the federal and / or regional level and should be universal for all medical institutions, it contains a rather limited list of averaged characteristics of diagnostic and treatment processes by types and groups of diseases.

The structure of a number of the designated documents is regulated at the legislative level. In particular, the Federal Law No. 323-FZ of 21 November, 2011 On Basics of Health Protection of the Citizens in the Russian Federation (as amended on May 26, 2021) [1] regulates the content of the procedures for the provision of medical care (Article 37, paragraph 3), which are developed according to its individual types, specialties, diseases or conditions (groups of diseases or conditions) and should include the stages of providing medical care; rules for organizing the activities of a medical organization (its structural unit, a doctor); equipment standard for a medical organization, its structural divisions; recommended staffing standards of a medical organization, its structural divisions; other provisions, based on the characteristics of medical care provision.

The same legal act [1] regulates the content of medical care standards which are developed in accordance with the nomenclature of medical services and include averaged target parameters for medical services' frequency of provision and multiplicity of application; medication (indicating average doses) registered in the Russian Federation; medical devices subject to implantation into the human body; blood components; types of therapeutic nutrition, including specialized therapeutic nutrition products; other items based on the characteristics of the disease (condition).

It is obvious that such regulation of diagnostic and treatment processes sets only framework requirements and cannot be fully applied in a particular medical institution without significant detail.

Here and below, DTP is understood as a set of actions for diagnosing and treating a patient from the moment of hospital admission until the moment of hospital discharge [7].

The authors' experience shows that the internal DTP standard for the purpose of its effective practical implementation in a medical institution should contain at least the following elements:

- DTP identification (codes of the International Classification of Diseases - ICD, codes of the medical and economic standards - MES, etc.);
- operations (actions) of the process, frequency (probability of execution) and multiplicity (number of repetitions) during the implementation of the process, codes of basic medical services;
- participants in the process and the logic of their interaction when performing actions of the process;
- labor costs of the participants in the process and the average labor costs per operation (action) for the entire process;
- the sign of the obligation to perform an operation (action) in this particular medical institution (laboratory and instrumental examinations, consultations, etc.);
- the name, quantity, frequency and multiplicity of application of each medicinal product used during the process;
- the name and quantity of consumables used in the process, the frequency of their application;
- the equipment used in the process, the time of its use;
- the facilities used in the process, the duration of using the facilities for an operation (action);

— external and internal documents regulating the course of the process (standards, procedures, clinical guidelines, standard operating procedures - SOPs, orders of the institution, etc.) and other key characteristics of the DTP.

All the quantitative characteristics indicated in the above list of mandatory elements of the standard are of an average nature for a particular medical institution, taking into account the peculiarities of its diagnostic and treatment processes and their material support.

An analysis of a number of existing standards approved at the federal/regional level for compliance with the most important of the above requirements is presented in Table 1.

Table 1

Analysis of a number of current federal and regional standards

IItems Nos.	Content elements of the standard	Examples of standards				
		Federal level			Regional level	
		Procedure for providing medical care to patients with cardiovascular diseases [8]	Standard of specialized medical care for peptic ulcer of the stomach and duodenum [9]	Clinical guidelines for the treatment for gallstones [10]	Order of the Moscow City Health Department On further improvement of the organization of medical care for patients with ACVA stroke…" [11]	Instruction for the diagnosis and treatment of acute surgical diseases of the abdominal organs [12]
1	ICD codes	–	+	+	+	+
2	MES codes	–	–	–	–	–
3	Participants in the process and the area of responsibility of each of them, the logic of interaction	Participants of the process are partially defined	–	–	Participants of the process are partially defined	–
4	Time taken to complete process steps	–	Average bed-day	–	Duration of significant stages	Duration of significant stages
5	Set of mandatory and optional services	–	Mandatory + optional	Mandatory + optional	Mandatory + optional are partially defined	Mandatory + optional
6	Mandatory/optional for performing in hospital	–	–	–	–	–
7	Codes of basic medical services included in the DTP	–	+	–	–	–
8	Frequency and multiplicity of performing basic medical services	–	Frequency + multiplicity	–	–	Multiplicity (optional)
9	Required medicines	–	Specific INN	Groups of drugs, selectively INN	Partially specific INN	Generalized drug groups
10	Required consumables	–	–	–	–	–
11	Required tools and equipment	+	–	–	–	–
12	Required facilities	+	–	–	Partially defined	–

Notes: DTP — diagnostic and treatment processes; ICD - International Classification of Diseases; INN - international nonproprietary name; MES - medical and economic standards; ACVA - acute cerebrovascular accident

It is obvious from the performed analysis that none of the presented documents contains the essential package of the most important DTP characteristics, which makes it necessary and expedient to create internal standards of a medical institution based on them, taking into account the specifics of its activities and resource equipment.

The authors developed and presented in relevant publications an approach [6, 13] to the description and standardization of the DTP of a multidisciplinary hospital, the methodological basis of which is a modified operogramme (Fig. 1). This approach makes it possible to form an internal DTP standard for a medical institution that meets the above requirements for its content.

The model of the DTP described in the format shown in Fig. 1 contains both the logic of interaction between the participants in the processes of diagnosing and treating a patient depicted graphically (the left part of the operogramme), and the quantitative characteristics of the resource support of the process by groups: labor costs of participants, medicines, consumables, equipment, facilities (right side of the operogramme).

A detailed step-by-step description of the DTP allows us to clearly assign responsibility for each action to the participants - representatives of various structural divisions of the medical institution (the admission department, therapeutic and intensive care departments, diagnostic services, etc.).

It should be noted that the development of such models is carried out by small groups created in specialized departments from the medical personnel directly involved in the described DTP. In this regard, during the work on the models, all participants, including invited specialists from related departments, have the opportunity to constructively discuss the processes and find common ground.

ДП. ...

№ п/п	Операция процесса	Участник 1	Участник 2	Участник 3	Трудозатраты, мин	Обязательный для выполнения в стационаре	Частота	Кратность	Среднее время за случай, мин	Медикаменты					Расходные материалы				Оборудование, используемое в процессе					Помещения, используемые в процессе			Управление
										Наименование	Ед.измерения	Количество (на манипуляцию)	Частота	Кратность	Наименование	Ед.измерения	Количество (на манипуляцию)	Частота	Наименование	Количество	Время использования (за манипуляцию), мин	Частота	Среднее время использования (за случай), мин	Наименование	Время использования (за манипуляцию), мин	Среднее время использования (за случай), мин	
		А	Б	В																							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28

Fig. 1. Format of the modified operogramme [6]

All the developed models undergo multi-level examination in the specialized department, diagnostic services, the chief physician service, etc. [6].

The final DTP models take into account not only the requirements of federal and regional standards, but also clinical practice and treatment methods used in a particular institution, in terms of equipment, technologies, competencies and resource equipment.

The models in the form of modified operogrammes are agreed internal standards for a medical institution, that is, a formalized (graphical and tabular) description of the DTP with all the necessary quantitative characteristics of these processes.

However, as the authors' experience shows, it is not enough to develop an internal standard for the DTP, it is necessary to organize its effective implementation in the daily activities of a medical institution.

Moreover, the most important elements of the effective implementation of the standard are to provide support for its correct execution at the stage of the DTP implementation for medical personnel and a system for standard execution analysis after the completion of the DTP.

This paper presents a methodological approach to DTP standard execution support and analysis in a multidisciplinary hospital.

Such a tool as a checklist is well-known in management practice. In a broad sense, a checklist is a monitoring and checkout list that captures the most important steps and critical points of a process, which may, among other things, contain instructions for their implementation. The use of checklists can significantly ease the burden on staff by reducing the decision-making time in a repetitive process, as well as increase the efficiency of achieving its result.

As we noted above, the most important groups of DTP characteristics are presented in a modified operogramme and include: process actions and logic (the structure of interaction between participants), labor costs for the implementation of a process, medicines, consumables, equipment and tools, as well as suitable facilities.

Obviously, in order to effectively implement the DTP, it is for these groups that support should be provided for the work of medical personnel during internal standard execution.

For this purpose, the widest range of opportunities for creating a system of DTP standard execution support is provided within the framework of automated information systems (IS).

Thus, for example, the most important actions within the framework of the DTP are the performance of necessary instrumental and laboratory examinations, as well as consultations of related specialists at various stages of the process: to establish a diagnosis, determine the tactics and type of treatment, the volume and methods of surgical interventions, the choice of drug therapy, and evaluation of its effectiveness, etc.

In this regard, it is advisable to create automated checklists that appear in the IS when a doctor selects a preliminary / clinical diagnosis with an ICD-10 code and represent a set of mandatory (frequency in the model is 1) examinations, consultations prescribed to a patient with this diagnosis in accordance with the approved internal DTP standard.

Also, the checklist should indicate the prescriptions that are mandatory for execution in the medical institution, regardless of the patient's recent examination/consultation results.

Beyond that, it is possible to add tests and consultations to the checklist, which are additionally prescribed to the patient if there are appropriate indications (the frequency in the model is less than 1).

Such checklists greatly simplify the daily work of a doctor when prescribing examinations / consultations for patients in accordance with the diagnosis.

All the information necessary to create such checklists is contained in the modified operogrammes which are the internal DTP standards of the medical institution.

In creating such checklists, the crucial role of representatives of medical personnel from the relevant small groups should be noted.

Table 2 shows the key (from the authors' point of view) directions for creating an automated system for supporting execution of the standards and possible forms of their implementation in IS.

An equally important element of the effective implementation of approved internal standards is the creation of a system for standard execution analysis, the purpose of which is to obtain timely information for making management decisions on the need to adjust the DTP or its standard.

In the logic of the presented methodological approach, the DTP standard execution analysis should also be carried out for each of the above groups of key DTP characteristics.

It should be noted that it is advisable to perform standard execution analysis for each group of key DTP characteristics from the standpoint of various participants in the process that make key decisions, as well as organize the DTP implementation.

For example, the main roles that analyze the compliance of the logic and actions within the DTP framework with the approved internal standard are the attending physician, the management of the specialized department, the Chief Physician Service and a small group.

The main subject of analysis for the attending physician is to verify that the diagnosis and treatment of a particular patient with a specific diagnosis is organized in accordance with the requirements of the internal standard for the actions taken (performing mandatory laboratory and instrumental examinations, consultations of related specialists, preoperative preparation, etc.).

The main subject of analysis for the head of the department responsible for the treatment of patients with a specific diagnosis is the assessment of the degree of compliance with the internal standard of all implemented DTP for all patients with the specific diagnosis during the period under review.

The Chief Physician Service conducts an analysis of compliance with the internal standards of the DTP logic for all departments.

The main task of the small group responsible for the development and updating of the internal standard is to analyze the typical and most frequent deviations in the prescription of mandatory diagnostic tests and consultations and decide on the advisability of making adjustments to the standard.

Table 2

Key directions of creating an automated system for standard execution support

The most important group of DTP characteristics	Key directions for creating a system of standard execution support	Possible form of implementation in IS	User group
Process actions, their participants, required sequence and duration	Support for prescriptions of mandatory instrumental and laboratory tests, consultations of specialists	Checklists	Attending physician
	Support for conducting the prescribed mandatory instrumental and laboratory tests, consultations of specialists	Reminder system	Attending physician; Specialist performing the prescription of the attending physician
	Support for sequencing the prescriptions (when important)	Reminder system	Attending physician
	Support for compliance with the required preparation of the patient for the prescribed instrumental and laboratory tests (when important)	Reminder system Help system	Attending physician; Nursing staff
	Support for ensuring the required duration of actions (in cases where the duration of actions' execution is important)	Reminder system	Attending physician; Specialist performing the prescription
	Support for ensuring requirements for examinations' technology	Help system	Specialist performing the prescription
	Support for ensuring compliance of the manipulations with current regulatory documents	Help system with the possibility to view the regulatory documents	Physicians; Nursing staff
	Support for the ability to fulfill the role of DTP participants (valid certificates and permissions)	Reminder system	Physicians; Nursing staff
Medications	Support for the selection of INNs from a group of drugs	Checklists with instructions	Attending physician
	Support for determining the amount of the drug, taking into account the dose and dosage	Help system; Online calculator	Attending physician
	Support for the prescribed drug therapy, taking into account the sequence	Reminder system	Attending physician; Nursing staff
	Support for ensuring the required amount of medicines with the current expiration date in the operational warehouse (department warehouse)	Reminder system	Head nurse of the department; Head of the department
Consumables	Support for the selection of key consumables for performing manipulations (medication prescriptions, surgical interventions, resuscitation, instrumental and laboratory tests, etc.)	Help system	Attending physician; Surgeon; Anesthetist; Resuscitator; Diagnostic physician; Nursing staff
	Support for ensuring the required amount of consumables with the current expiration date in the operational warehouse (warehouse of the department, operating unit, etc.)	Reminder system	Chief nurse of the operating unit; Head nurse of the department; Head of the department; Head of the operating unit
Workplace (equipment, tools, facilities)	Support for selecting the required set of tools by type of surgery prescribed	Help system	Surgeon; Nurse; operating unit
	Support for the provision of the necessary sets of instruments with the current sterilization period in the operational warehouse (the warehouse of the operating unit)	Reminder system	Chief nurse of the operating unit; Head of the operating unit
	Support for ensuring that the facility and workplace are in compliance with the standard	Reminder system with the possibility to view the workplace standard	Head of department

Notes: IS - information systems; DTP — diagnostic and treatment processes; INN - international nonproprietary name

Thus, it is obvious that for different roles in the course of the analysis, a different level of aggregation of actual data on DTP implementation (patient, group of patients, diagnosis, department, set of departments, etc.) is required.

Key areas of standard execution analysis for the most important groups of DTP characteristics, as well as integral indicators of the assessment are presented in Table 3.

Table 3

Key areas and integral indicators of standard execution analysis

The most important group of DTP characteristics	Key directions for standard execution analysis	Integral standard execution parameters
Process actions, their participants, required sequence and duration	Prescriptions of mandatory instrumental and laboratory tests, consultations of specialists	The proportion of prescribed mandatory instrumental and laboratory tests, consultations of specialists in accordance with the standard
	Conducting the prescribed mandatory instrumental and laboratory tests, consultations of specialists	The proportion of unexecuted tests, consultations from the prescribed ones
	Sequencing the prescriptions (when important)	The proportion of deviations from the standard in the sequence
	Preparation of the patient for the prescribed instrumental and laboratory tests (when important)	The proportion of deviations from the standard in preparation of patients
	Ensuring the required duration of actions (in cases where the duration of actions' execution is important)	The proportion of actions with critical timing deviations
	Ensuring requirements for examinations' technology	The proportion of examinations conducted with violation of technology
	Ensuring compliance of the manipulations with current regulatory documents	The proportion of manipulations carried out with deviations from regulatory documents
	Ability to fulfill the role of DTP participants (valid certificates and permissions)	The proportion of medical personnel of the department with invalid certificates, permissions, etc.
Medications	Selection of INN from a group of drugs in accordance with the standard	The proportion of prescribed drugs (INN) that do not meet the standard
	The amount of the drug, taking into account the dose and dosage	The proportion of medicines, the amount of which is prescribed with a deviation from the standard
	Execution of the prescribed drug therapy, taking into account the sequence	The proportion of completed prescriptions
	Ensuring the required amount of medicines with the current expiration date in the operational warehouse (department warehouse)	The proportion of DTPs that failed due to lack of medicines
Consumables	Selection of key consumables for performing manipulations (medication prescriptions, surgical interventions, resuscitation, instrumental and laboratory tests, etc.)	The proportion of manipulations (by groups) carried out using consumables with a deviation from the standard
	Ensuring the required amount of consumables with the current expiration date in the operational warehouse (warehouse of the department, operating unit, etc.)	The proportion of DTPs that failed due to lack of consumables
Workplace (equipment, tools, facilities)	Selecting the required set of tools by type of surgery prescribed	The proportion of erroneously selected instrument sets for surgeries
	Provision of the required sets of instruments with the current sterilization period in the operational warehouse (the warehouse of the operating unit)	The proportion of surgeries that failed due to lack of sets of instruments
	Ensuring that the workplace is in compliance with the standard	The proportion of DTPs that failed due to non-compliance of workplaces with the standard

Obviously, for each of the presented in Table 3 integral indicators of standard execution, it is necessary to develop a calculation methodology taking into account the DTP characteristics of a particular medical institution.

The analysis carried out in this way provides feedback for making decisions on DTP improving or making adjustments to approved internal standards.

An enlarged diagram of the methodological approach to DTP standard execution support and analysis is shown in Fig. 2.

The methodological approach presented in this paper was partially tested by the authors on the basis of the DTP of the N.V. Sklifosovsky Research Institute for Emergency Medicine (hereinafter - the Institute).

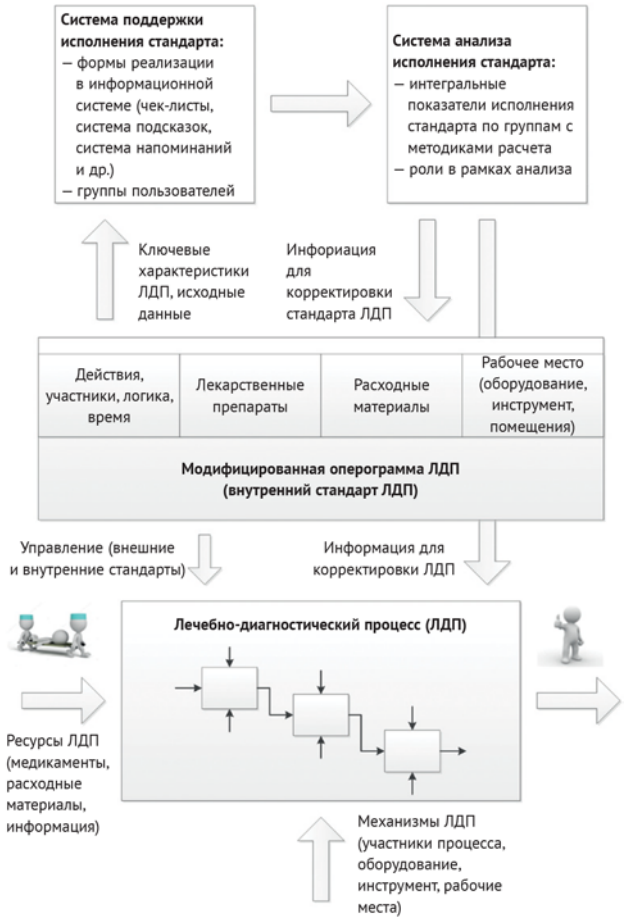

Fig. 2. Scheme of a methodological approach to DTP (diagnostic and treatment processes) standard execution support and analysis

At the moment, the methodological approach has been tested on one of the most important groups of DTP characteristics - the prescription and performance of instrumental and laboratory examinations, consultations of specialists during the diagnosis and treatment of patients in accordance with the standard.

Currently, the Institute has 13 small groups working on a permanent basis in the areas of therapeutic and surgical specialties. The experience of developing modified operogrammes and DTP internal standards by small groups is presented by the authors in detail in relevant publications [6, 13].

After the development of modified operogrammes for each of the DTP and their multi-level examination, the participants of the small group work on checklists which are a list of mandatory (frequency in the model is 1) and often prescribed according to indications additional (frequency in the model is less than 1) tests and consultations.

First of all, the above system of checklists was developed and implemented for the processes of examining patients in the admission department of the Institute for 30 nosologies in traumatology, abdominal and thoracic surgery, vascular surgery, neurosurgery, neurology and gynecology.

At the first stage, a printed format of checklists was developed, which were filled out by doctors on duty in the relevant specialty as they prescribed examinations and consultations, and these checklists were attached to outpatient cards and patient histories.

Fig. 3. An example of the printed checklist for the process of admitting a patient with suspected gastrointestinal bleeding

However, there were exceptions. Thus, when a patient was admitted with suspected acute cerebrovascular accident, due to the strict time frame for diagnosis in the admissions department (60 minutes) and the particular importance of well-coordinated work of the entire team of specialists, a small neurology group decided that each of the participants (a neurologist on duty, a nurse in the treatment room, a CT technician, etc.) should make marks in the checklist.

After testing the printed form of checklists in the admission department and confirming their convenience and expediency for use by doctors within the DTP framework, a decision was made on the need to automate checklists in the current medical information system UMIAS (Unified Medical Information and Analytical System).

The Institute prepared technical requirements for UMIAS developers to expand the functionality of the system in order to ensure the possibility of using the developed standards and checklists within this system.

As a result, the functionality of the system (constructor) was created, which allows any hospital in the city of Moscow to independently create the necessary checklists in UMIAS for various stages of diagnosis and treatment (admission department, therapeutic department) of a patient with a specific diagnosis. When forming an automated checklist in the system, it was possible to specify such important characteristics of the patient model as age category, gender, standard treatment period, type of payment, referral channel and conditions for providing medical care. In addition, the most important fields to fill in are “Department” and “Diagnoses according to ICD-10”, since it is to these fields that the checklist is linked in the system (Fig. 4).

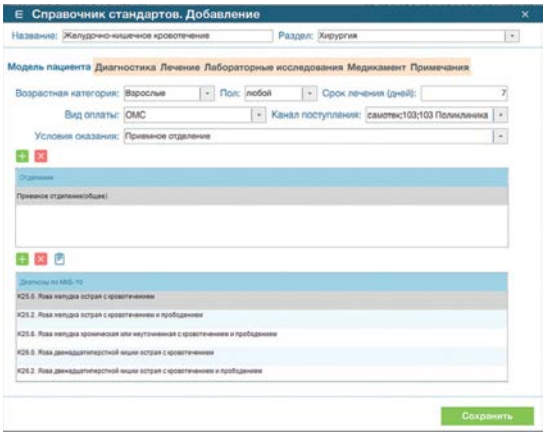

Fig. 4. The entry of patient model characteristics during the formation of an automated checklist in UMIAS

The checklist itself is formed in the sections of "Diagnostics" (instrumental diagnostics, consultations), "Treatment" (therapeutic manipulations, vaccination, etc.) and "Laboratory examinations" with current codes in accordance with the Order No. 804n dated 13.10 .2017 of the Ministry of Health of the Russian Federation On approval of the nomenclature of medical services [14], as well as an indication of the frequency and multiplicity for each service (Fig. 5).

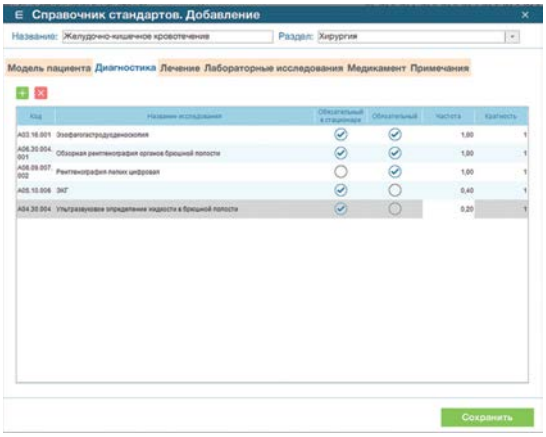

Fig. 5. The entry of instrumental examinations during the formation of an automated checklist in UMIAS

The system provides the possibility to indicate the obligation to perform a particular test in a hospital, regardless of whether the patient has recent results.

As a result, when filling in the "Main Diagnosis" field in UMIAS (selecting the ICD-10 code) and confirming it during initial examination by the doctor of the admission department or by the attending physician of a therapeutic department, a window appears in the system with a set of prescriptions in accordance with the standard (Fig. 6).

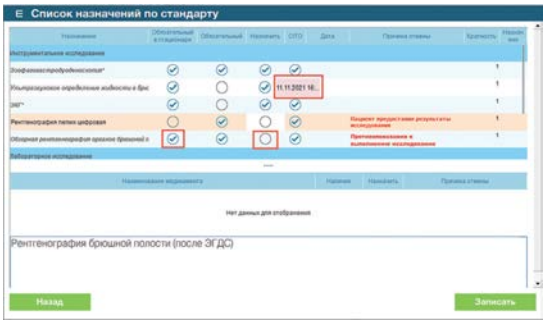

Fig. 6. An automated checklist

Services marked as mandatory during adding the checklist to the system (frequency - 1) are automatically displayed as prescribed ones. The doctor can, if necessary, choose the date of a service, as well as add or cancel some of the prescriptions. When canceling a prescription for a mandatory service, the doctor must indicate the reason for the cancellation in the appropriate field (for example, the patient provided the results of the examination).

If the doctor cancels a prescription marked as obligatory to be performed in the hospital, the "Reason for cancellation" field must also be filled in (for example, the patient has contraindications for the test). If the doctor tries to save prescriptions without filling in this field, a pop-up window appears with the text: "You must fill in the 'Reason for Cancellation' field".

After the doctor completes work with the list of prescriptions, they are automatically sent to the relevant diagnostic/ therapeutic departments of the Institute for execution.

Currently, the Institute has developed and automated 62 checklists for 8 profiles of medical activity. At the same time, only two departments are fully equipped with automated checklists - the admission department and the Department for Mental Patients with Acute Poisoning. The rest of the departments are equipped with checklists only partially to the extent that the development of DTP standards that are in their area of responsibility is underway.

In the Department for Mental Patients with Acute Poisoning, due to a rather narrow specialization, 4 DTP standards were identified and developed:

- treatment for poisoning using drugs, medicines and biological substances, the toxic effects of substances, mainly for non-medical purposes (with the exception of the toxic effects of corrosive agents), cases of mild and moderate severity;
- treatment for poisoning using drugs, medicines and biological substances, toxic effects of substances, mainly for non-medical purposes (with the exception of toxic effects of corrosive agents), severe cases (patients after treatment in the intensive care unit (ICU) for emergency detoxification);
- treatment for the toxic effects of corrosive agents, cases of mild and moderate severity;
- treatment for the toxic effects of corrosive agents, severe cases (patients after treatment in the ICU for emergency detoxification).

Initially, it was in accordance with these standards that a small group decided to develop 4 checklists. However, during the discussion, the expediency of dividing the checklist according to one of the above standards into 6 more checklists depending on the nature of the poisonous substance was revealed, since this factor significantly affects the required set of primary laboratory diagnostic services.

Thus, the work on the formation of checklists is quite flexible and should take into account the specifics of examinations performed for various patient models.

After the development and automation of checklists for DTP, all doctors of the Department for Mental Patients with Acute Poisoning were trained to work with them in the system. After a month of working with the checklists, the small group collected feedback and made the necessary adjustments both to the checklists and to the internal DTP standards.

The next stage of approbation of the presented methodological approach at the Institute was the development and automation of a system for standard execution analysis in terms of performed prescriptions and consultations.

The basis for the creation of this system was the data accumulated by the system on the use of the checklists, including aggregated data on the actual frequency of prescribing certain diagnostic tests and consultations specified in the DTP standard.

In order to analyze the standard execution in this aspect, the authors developed a methodology for calculating the standard execution coefficient in various sections (patient, nosology, department, etc.), projects of system interfaces and prepared technical requirements for automating the system in UMIAS for 4 key roles: Doctor, Head, Chief Physician Service ("Top") and Small Group.

Thus, the attending physician has access to the analysis of the standard execution coefficient for a selected period for the patients assigned to him, as well as the opportunity to analyze which examinations were not prescribed in accordance with the standard and additionally prescribe them if necessary, in case the patient has not yet been discharged (Fig. 7).

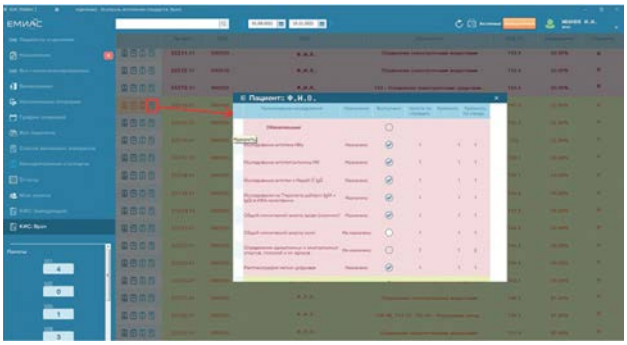

Fig. 7. Interface of the system for standard execution analysis (the role of “Doctor”)

The head of the department has the opportunity to analyze the standard execution coefficient for a selected period for the department as a whole, for all patients with a specific nosology, for all patients of a particular doctor, and for each patient individually (Fig. 8).

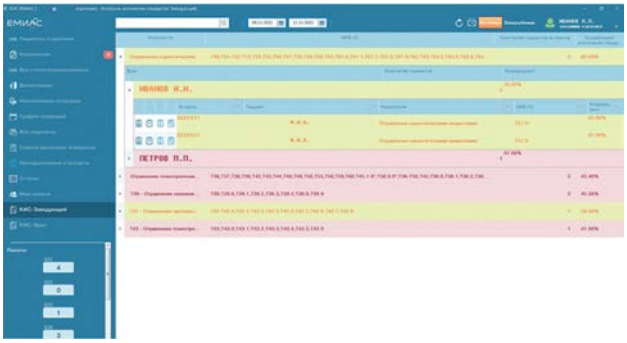

Fig. 8. Interface of the system for standard execution analysis (the role of “Head”): analysis of standard execution by the Doctor

The chief physician service (the role of "Top") has the opportunity to conduct a comparative analysis of the standard execution coefficient for the departments for a selected period, as well as receive detailed information on nosologies, doctors, patients, along with the Head (Fig. 9). In addition, the "Top" interface provides information about doctors with the maximum and minimum standard execution coefficient for each department.

Fig. 9. Interface of the system for standard execution analysis (the role of “Top”)

Members of small groups by specialties have the opportunity to analyze the execution coefficient of the standards they created for selected periods (Fig. 10), as well as the most frequently indicated reasons for canceling mandatory prescriptions by doctors and selected additional examinations. Such an analysis enables the small groups’ leaders to decide on the advisability of adjusting the internal DTP standards and initiate this work.

The presented system for standard execution analysis was piloted in the Department for Mental Patients with Acute Poisoning of the Institute.

Fig. 10. Interface of the system for standard execution analysis (the role of “Small group”)

First of all, the capabilities of the system were presented to the head of the Department. In the course of this discussion and analysis of the system's operation in the Department for Mental Patients with Acute Poisoning, a number of inaccuracies were identified in the distribution of patients according to the standards in connection with the intersecting ICD-10 codes, as a result, a request was formulated and sent to the developers of UMIAS to improve the functionality.

In addition, cases of systematic refusal of a number of doctors of the Department to use checklists and their prescription of tests not included in the DTP standard, as well as services with incorrectly selected codes. During the discussion of the reasons for the refusal by the head of the Department and the small group with these employees, it was revealed that they were quite simple and explained by their use of UMIAS protocols (Examination of the doctor on duty / attending physician) different from those that trigger the checklist (Primary examination).

The doctors of the Department were retrained to work with the system of checklists and the system for standard execution analysis in UMIAS. In addition, based on the standard execution analysis by the small group, a revision of the DTP standards was initiated in terms of adjusting the composition, frequency and multiplicity of actions.

DISCUSSION

As already noted, the methodological basis for the approach to DTP standard execution support and analysis is a modified operogramme developed and presented by the authors earlier as part of the organizational and methodological approach to describing and standardizing the DTP of a multidisciplinary hospital [6, 13].

Approbation of the methodological approach to DTP standard execution support and analysis was carried out on the basis of the N.V. Sklifosovsky Research Institute for Emergency Medicine regarding the prescription and performance of instrumental and laboratory examinations, consultations of specialists in accordance with the approved standards.

The testing results allow us to single out the following as key effects from the implementation of the systems of standard execution support and analysis:

1. In terms of improving the quality of medical care:

- reducing the number of errors during prescribing examinations, consultations of specialists;
- increasing the degree of internal DTP standard execution in terms of mandatory prescriptions.

Thus, in the Central Admission Department of the Institute, the support system (checklists) covers 95% of the developed DTP standards.

In the therapeutic departments, checklists for 32 approved DTP standards have been developed and automated. And in the Department for Mental Patients with Acute Poisoning, the support system covers 100% of the developed and implemented DTP standards.

2. In terms of increasing the profitability of a medical institution:

- reducing the number of over-prescribed tests and consultations;
- reducing the number of erroneously selected codes for basic medical services, which leads to a decreased number of reprimands when working with insurance companies.

In particular, for mandatory prescriptions, when applying the developed DTP standards, there was a 100% reduction in the number of errors during the selection of codes for basic medical services.

3. In terms of improving the manageability of the DTP:

— a significant simplification and increase in the efficiency of the daily prescribing by doctors instrumental and laboratory tests and consultations of specialists due to the appearance in the system of a designated set of services for patients with a specific diagnosis;

- providing timely information about deviations from the DTP standards at various management levels, which allows optimizing the work of medical personnel in the implementation of the DTP;

— the possibility of timely adjustment of DTP standards based on analytical and actual data.

Thus, according to the results of the implementation of the standard execution support system, the time for making mandatory prescriptions was reduced by more than 3 times. At the same time, the management of the departments has the opportunity to monitor the DTP standard execution by medical personnel in real time, and the small groups have a monthly opportunity to analyze the relevance of the standards and adjust them if necessary.

Therefore, the presented methodological approach, together with the organizational and methodological approach for describing and normalizing processes [6, 13], form a sufficient methodological basis for managing the quality of the DTP of a medical institution: DTP standard development - DTP standard execution support - DTP standard execution analysis - DTP / DTP standard adjustment.

At present, the authors are carrying out further work on the methodological development and testing of the system of DTP standard execution support and analysis in terms of prescribing and dispensing medicines and consumables on the basis of the N.V. Sklifosovsky Research Institute for Emergency Medicine.

CONCLUSIONS

1. An analysis of a number of standards governing the processes of providing medical care at the federal and regional levels was carried out, and a minimum list of elements was formulated that should contain an internal standard for diagnostic and treatment processes, taking into account the characteristics of the processes of a medical institution and their resource equipment in terms of quality management in healthcare.

2. The authors developed and presented a methodological approach to standard execution support and analysis of diagnostic and treatment processes in a medical institution, containing key areas for creating a system of DTP standard execution support and forms for their implementation in the information system, key areas for DTP standard execution analysis and integrated indicators for assessing the standard execution degree, as well as an enlarged scheme of the methodological approach.

3. In the course of approbation of the methodological approach on the example of diagnostic and treatment processes of the N.V. Sklifosovsky Research Institute for Emergency Medicine, a methodical study of the system of DTP standard execution support and analysis was carried out in terms of the prescription and performance of instrumental and laboratory examinations, consultations of specialists, technical requirements and interfaces were developed, on the basis of which the necessary refinement of the UMIAS functionality was carried out by the system developers. Pilot implementation of automated checklists and a system for standard execution analysis in a number of departments of the Institute showed that the application of the presented methodological approach makes it possible to significantly increase the efficiency of introducing the developed standards of diagnostic and treatment processes into the daily activities of a medical institution, as well as achieve a number of important systemic management effects.

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