

Original article

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Management of medical care capacity and hospitalization process with the use of digital technology at a specialized federal center

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Abstract

Introduction Scheduling and distribution of medical care capacities approved by a healthcare organization, management of the key processes of patient selection and hospitalization with the use of digital technology are the most important organizational tools for successful implementation of state assignments. **Purpose** To develop an organizational model of medical care capacities, management of the processes of patient selection and hospitalization at a specialized federal center with the use of digital technology.

Materials and methods Analysis of the plans of rendering specialized medical care in 72,547 cases, including high-tech medical care, for 10-year period (years 2013-2022) in the fields of "traumatology and orthopedics" and "neurosurgery" by means of healthcare information system and digital patients' registries was conducted by the continuous method. **Results** Rates and types of patients' nonappearance for hospitalization were identified: the rate of informed nonappearance was 37.9 ± 0.4 (per 100 planned patients), the rate of uninformed nonappearance was 18.4 ± 0.4 (per 100 patients who referred to admission), the rate of repeated nonappearance was 1.6 ± 0.1 , and the rate of patients' unplanned referral (arrival) was 6.0 ± 0.1 . The rate of hospitalization rejection for a 10-year period (2013-2022) was 6.4 ± 0.1 (per 100 patients who sought medical care). For a 3-year period (2020-2022), the rate of non-confirmed surgical indications was 6.9 ± 0.1 (per 100 patients). Comparative analysis of 5-year periods (2013-2017 and 2018-2022) identified a 1.4-fold increase in an average 5-year rate of hospitalization refusal ($t = 13.6$, $P < 0.0001$). For a 5-year period (2018-2022), the rate of hospitalization of patients aged 75 and older was 5.3 ± 0.1 , of patients with co-morbidity (diabetes mellitus) 11.8 ± 0.2 per 100 treated patients. Multi-purpose calculation method for prediction of patients' hospitalization was offered.

Discussion Based on the specified rate of patients' nonappearance for hospitalization it would be advisable to provide a number of patients that would be over the plan in order to achieve necessary hospitalization numbers. An operating reserve in the digital patients' registry would solve an issue of hospitalization plan execution and to substitute the patients who were not able to appear.

Conclusion Our study has identified regularities of implementation of planned hospitalization of patients to traumatology/orthopedics and neurosurgery units in the conditions of a federal center.

Keywords: capacity of medical care, hospitalizing management, information technology

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INTRODUCTION

Planning and structural distribution to departments of patients for a specialized medical care, including a high-tech one, approved for a medical institution, management of key processes for selection and hospitalization of patients using digital technologies are the most important organizational tools for the successful implementation of the state task and modern functioning of any institution based on the principle of centering on the patient, improvement of availability and quality of medical care and patients' satisfaction [1-6].

The problem of non-appearance of patients for planned hospitalization or to outpatient appointments on a set date is considered by many authors as one of the main reasons for the difficulties in fulfilling state assignments by a medical institution, which is almost impossible to solve without the introduction of modern digital technologies [1, 4, 5, 7, 8].

An analysis of the data from the EMIAS information system in Moscow for 2019, carried out by the Research Institute for Health Organization and Medical Management of the Moscow City Health Department, showed that up to 19 % of registered patients did not attend outpatient appointments with clinic doctors¹. According to a number of authors, from 6.5 to 23 % of patients did not appear for hospitalization on the appointed date [1, 8-9]. Nonappearance of patients for appointments and hospitalization without timely informing the host medical facility reduces the possibility of rendering medical care to other citizens at an earlier date due to full appointment lists in the consultation clinic or a full admission plan for hospitalization in the hospital.

In 2020-2022, also resulting from the pandemic, the rates of nonappearance at outpatient appointments

¹ URL: <https://niioz.ru/news/otdel-metodologii-provedeniya-audita-effektivnostiproanaliziroval-situatsiyu-s-nesostoyavshimisya-v/>

and planned hospitalizations increased. A patient's failure to appear on the scheduled date and the subsequent provision of medical care to him in a delayed time frame may be a significant issue and may affect the outcome of treatment. Studies have shown that even the choice of the type of invitation (reminder) to the patient, which should be age-oriented, matters. For young and middle-aged patients, text messages are preferred, and for older patients, phone calls are more suitable. Reducing the proportion of missed appointments and hospitalizations will help increase the availability of medical care and, as a result, reduce the waiting time [9-10].

The waiting time for a planned provision of medical care is one of the constituent aspects of the program of state guarantees and observance of the rights of citizens; organizational measures aimed at reducing long waiting lists are relevant. An increase in the waiting time for a planned medical assistance is associated with an imbalance between the need for medical services and their provision [10].

The waiting time for hospitalization is influenced, among other things, by the average duration of inpatient treatment. Improvement of organizational and intensification of treatment and diagnostic processes may assist to achieve the required clinical result without loss of quality and to discharge patients at an earlier date. Thus, the use of Fast-track technology for knee and hip arthroplasty has reduced the average duration of inpatient treatment from 14 to 4 days [11].

It is necessary to introduce a process approach in preparing patients for hospitalization in federal clinics. Insufficient interaction and continuity between referral organizations, outpatient clinics, hospitals, the lack of unified regulated algorithms for preparing patients for hospitalization, including for surgical treatment, also affect the waiting time for hospitalization. The solution should be the optimization of the process of pre-hospital preparation of patients, the development and mandatory application of uniform clinical recommendations for preparing patients for hospitalization (by profile), increasing the coordinating function and responsibility of the referring medical institution and the attending physician [10, 12].

It is almost impossible to solve many existing problems without the introduction of modern digital technologies.

Global trends in the digital transformation of the healthcare attribute electronic registries and analysis systems to the section of predictive analytics (Predictive Analytics) – the smart use of data, predictive modeling of future events, support and justification for making managerial decisions [13-14].

In Decree of the President of the Russian Federation No. 474 dated July 21, 2020 “On the National Development

Goals of the Russian Federation for the period up to 2030”, two of the five national development goals of the Russian Federation are devoted to preserving the health of the population and digital transformation. The introduction of the principles of client-centricity, digitalization – changing approaches to working with citizens to solve their life situations, including through the introduction of new digital solutions – is an absolute trend of the current stage of development in all branches of the Russian Federation [15-17].

Information systems are a management tool, and the quality of the process of their implementation is no less important success factor than the quality of the system itself whereas unprofessional implementation can discredit the idea of information technology as a whole. The introduction of digital systems is a real opportunity to optimally rebuild internal processes, increase work efficiency and bring the organization's activities to a new level [18]. The relevance of the issue of transition from individual IT systems to digital ecosystem solutions, where all participants in the process are users, seems logical in regard to modern trends in patient-centricity [19].

In order to implement the transition of the Russian Federation to a value-oriented model of healthcare, it is necessary to develop competition as a fundamental mechanism for improving the quality of services, to provide an integrated approach and to form an interdisciplinary team of specialists, which ensures the individual needs of the patient, and achieves a high level of “patient orientation”, informatization of the medical process, development and improvement of the quality control system of medical care (development of resulting criteria for the quality of medical care for all diseases), the introduction of ratings for medical organizations, departments, doctors [20-23].

Evaluation of the effectiveness of the use of hospital beds in medical facilities enables to rationally use internal resources in the provision of medical care and make analytically well-thought-out management decisions [23].

The main tasks of internal quality control and safety of medical activities are not only the prevention of violations in the provision of medical care [24], but also the adoption of managerial decisions to improve organizational approaches to the implementation of medical activities, which we propose in this paper.

Purpose: to present an organizational model for managing the capacity of medical care facility, selection and hospitalization processes in a specialized federal center using digital technologies

MATERIALS AND METHODS

A continuous method was used to analyze the execution of the planned 72,547 cases of specialized, including high-tech, medical care at the Federal Center for Traumatology, Orthopedics and Arthroplasty of the Ministry of Health of Russia (Barnaul, hereinafter referred to as the Center) over a 10-year period (2013-2022) in the medical specialties "traumatology and orthopedics" and "neurosurgery" with the help of the medical information system of the institution and the digital register of patients functioning at the Center [25]. The parameters of the plans and the actual results of patients' hospitalizations were analyzed.

Based on a continuous analysis of 24,998 packages of patients' documents submitted for consideration over 2 years (2021-2022), an indicator of the frequency of unconfirmed indications for surgery (per 100 patients) was established.

A continuous analysis of 39,799 cases of those who completed treatment over a 5-year period (2018-2022) was carried out; the incidence rates for the age category of patients "75 years and older" and patients with concomitant pathology "diabetes mellitus" (per 100 treated patients) were established.

A continuous analysis of the results of hospitalization of 8,907 patients (for 2022) was performed, systemic organizational problems were identified in the process of developing and implementing a hospitalization plan, indicators of the nonappearance of patients at the appointed date of hospitalization and their types were established.

RESULTS

The problem of nonappearance of patients for planned hospitalization on the set date is considered by us as one of the main reasons for the difficulties in fulfilling the state assignment and other approved medical care by a medical organization.

In 2022, we performed a complete analysis of the results of hospitalization of 8,907 patients. To study the problems, optimize the process of hospitalization of patients, a new computer program "Hospitalization Monitoring" has been created, passed the stage of approbation and is being prepared for state registration (functions online).

The types of patients' nonappearance have been established that hinder planning and subsequent organization of all processes at the institution as a whole.

Informed non-appearance Patients inform the receiving medical organization in advance about their impossible arrival on the appointed hospitalization date, or this information is revealed by the Center's employees during active telephone calls to patients 1.5 months before the date of hospitalization. The reasons why patients

The calculation and comparative analysis of the rates of refusals in hospitalization over a 10-year period (2013-2022) per 100 patients who applied to the admission department (77,536 individuals) were carried out, the average five-year indicators (2013-2017) and (2018-2022) were determined, the dynamics for the compared periods was established.

Statistical processing of the obtained data was performed using the SPSS Statistics 27 program. The compliance of the sample values with the normal distribution in MS Excel was confirmed by a graphical method, which made it possible to reflect the results in the form of a mean ($\bar{x}$) and standard error (m). Student's t-test was used to assess the statistical significance of differences in mean values in groups. For a 95 % confidence interval, the difference was considered significant at $p < 0.05$.

The Center is a federal medical organization that provides planned specialized, including high-tech, medical care in the field of "traumatology and orthopedics" and "neurosurgery", having the following structure: 150 beds for adults, 15 beds for children, 7 operating rooms, anesthesiology and resuscitation department of 12 beds, diagnostic departments, an early medical rehabilitation department and a consultative clinic. Over a 10-year period, residents of 58 constituent entities of the Russian Federation underwent treatment at the Center, the average annual medical care capacity included 8.6 thousand hospitalizations, 8.0 thousand high-tech surgeries on the joints of the extremities and the spine.

refuse from the hospitalization on the scheduled date are medical contraindications (health condition, results of tests and examinations), personal circumstances (inability to leave home on the appointed date due to personal, domestic, economic and other reasons). At the end of 2022, the rate of informed absence was 37.9 ± 0.4 (per 100 scheduled patients).

Uninformed non-appearance Patients do not inform the receiving medical organization in advance about inability to arrive on the appointed date of hospitalization, or confirm their arrival in an active telephone call by the Center's employees 1.5 months before the date of hospitalization but do not arrive on the appointed date. At the end of 2022, the rate of uninformed absence was 18.4 ± 0.4 (per 100 patients who applied to the admission department).

Repeated non-appearance after the first one, the patient is transferred by us to the "Operational Reserve" created by the Center's digital register, after which the patient is automatically assigned and informed of a second date of hospitalization (it is reported, among

other things, to the referring organization, the healthcare authorities of the constituent entity of the Russian Federation, hereinafter referred to as the OHI). Patients do not inform the receiving medical organization in advance about their inability to arrive on the rescheduled date of hospitalization, or confirm their arrival in an active telephone call by the Center's employees 1.5 months before the date of hospitalization but do not re-arrive on the appointed date. At the end of 2022, the rate of repeated non-appearance was 1.6 ± 0.1 (per 100 patients who applied to the admission department). All the facts of repeated non-appearance of patients are carried out through the consideration of the medical inspection board; we close the coupon and report the information and details of the protocol of the VC to the sending organization (OHI of the subject of the Russian Federation).

The list of problems considered also includes an unscheduled appearance (arrival) of patients; patients arrive at the receiving medical facility not on the appointed date of hospitalization, or are hospitalized after a consultative appointment at the Center's clinic or are transferred from other medical organizations (due to the presence of urgent indications). At the end of 2022, the rate of unscheduled attendance (arrival) of patients (per 100 patients who applied to the admission department) was 6.0 ± 0.1 .

Another aspect of the issue under consideration is refusals to be hospitalized in the admission department of the host medical organization due to the presence of medical contraindications for surgery (very high or critical risk of complications).

The rate of refusal in hospitalization over a 10-year period (2013-2022) (per 100 patients who applied to the admission department) was 6.4 ± 0.1 .

The average five-year rate of refusal in hospitalization for 2013-2017 (per 100 patients who applied to the admission department) is 5.4 ± 0.1 . Average 5-year hospitalization denial rate for 2018-2022 (per 100 patients who applied to the admission department) was 7.3 ± 0.1 . Comparative analysis found an increase in the average five-year rates of hospitalization refusals for the compared periods by 1.4 times ($t = 13.6$; $p < 0.0001$).

The established levels of indicators and problematic issues in the organization of planning and distribution of volumes of medical care, hospitalization determined the main directions for improving internal key processes, on which we focused our attention in the development and implementation of system solutions.

The Federal State Budgetary Institution FC for TOA of the Ministry of Health of Russia (Barnaul) has developed, implemented and operates

an organizational model for managing the volume of medical care, selection and hospitalization processes using digital technologies, structured in stages based on a process approach, hereinafter referred to as the model (Fig. 1).

Stage 1 – Planning medical care capacity and its structural distribution for a year based on an analysis of the main indicators of the departments (specialization profile of each department, staffing and bed capacity, average bed-day, tariffs, financial result, other circumstances); analysis of the results and identification of patterns, including sanitary-epidemiological, seasonal, other nature, for previous periods (optimally, for a 2-3-year period), automatic calculation of the required bed capacity for the accurate execution of the state task.

To optimize the planning stage, the Center created a commission for planning and distribution of medical care volumes, developed a planning and control procedure, a regulation on the commission, a unified form of the plan and distribution of medical care volumes, containing the following sections:

- nomenclature composition of structural units, types of medical care, groups, clinical and statistical groups (CSG), indicators of capacity for each month;
- the commission carries out a weekly monitoring of the results of the implementation of the plan, makes operational adjustments (if necessary), and makes other systemic decisions.

Stage 2 – organization of the patients selection to hospitalization

To optimize the stage of selecting patients for hospitalization, the complex expert processes in the FCTOE have been digitized, the work of the medical commission for selecting patients has been transferred into electronic format as much as possible (members of the commission, secretaries and consultants work through a personal account in the MIS, consideration of document packages, confirmation of indications or other decisions are carried out in a remote way, with automatic formation and numbering of commission protocols, signing with an electronic digital signature), the protocols are placed in the subsystems of the Uniform State Health Information System: "Monitoring system for the provision of high-tech medical care", "Monitoring system for the provision of specialized medical care". After passing through the medical commission, the entire array of information is automatically transferred to the created digital register of patients of the Center, where all information about patients is accumulated. Automatic notification of patients about the decision and the preliminary date of hospitalization is done on the day of the decision.

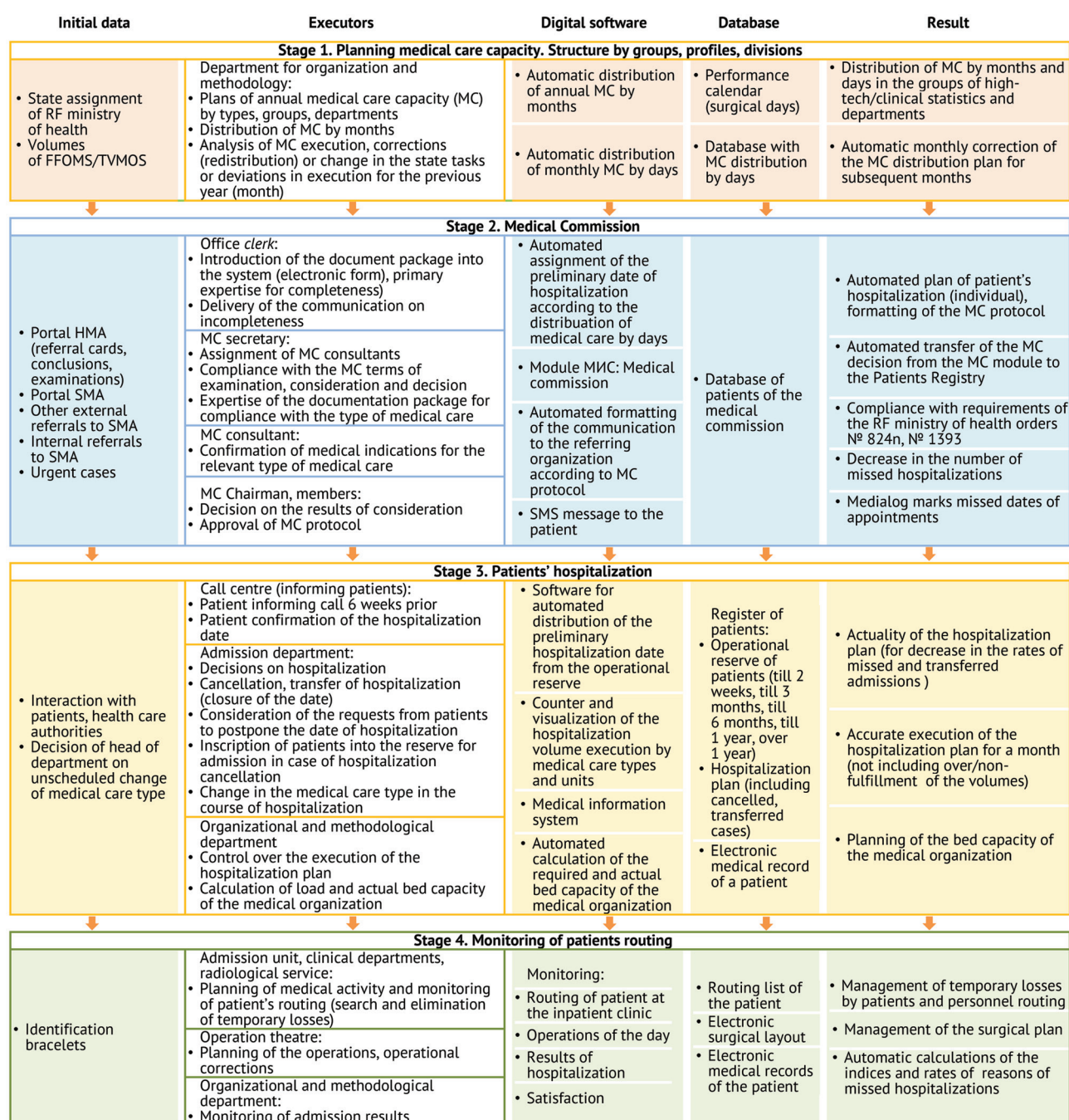


Fig. 1 Organizational model for managing the medical care capacity, selection and hospitalization processes using digital technologies at the Federal State Budgetary Institution FC for TOA of the Ministry of Health of Russia (Barnaul). Abbreviations: HMC, high-tech medical care; SMC – specialized medical care; CSG – clinical and statistical group; MIS – medical information system

Stage 3 – organization of hospitalization

Hospitalization planning occurs immediately after confirmation of the indications, a preliminary date of hospitalization is automatically assigned (auto-arrangement based on the parameters of MC volumes), the patient is notified (with SMS) of the preliminary date of hospitalization on the same day, an invitation to hospitalization with the necessary information on preparation for the operation is additionally sent by mail. A telephone call is made to patients 1.5 months before the scheduled date of hospitalization to confirm their

appearance on the set day. Results are automatically monitored on a daily basis, and in case of failed hospitalizations, new patients are automatically assigned to unoccupied places from the operational reserve of the register (examined patients who are able to quickly arrive at hospitalization).

Stage 4 – monitoring of outcomes, substantiation, development and implementation of new organizational and digital tools, focus on patient's needs, assessment of patient satisfaction. To change the identified problematic processes, we scientifically substantiated,

developed and implemented the computer program "Management of the volume of medical care and the number of beds in an organization providing specialized, including high-tech, medical care", which is an integral part of the organizational model for managing the volume of medical care, selection processes and hospitalization, bed-stock.

Organizational and digital solutions are proposed that systematize and simplify the fulfillment of obligations by the medical organization under the state task, other approved volumes of medical care.

The program is a modern tool for managing the activities of a medical organization and is designed for operational monitoring and control of the movement of approved annual volumes of medical care in real time (for specialized, including high-tech, medical care). It is based on indicators of the annual volumes of medical care approved as a state assignment of a medical organization, the volumes of mandatory medical insurance, the digital register of patients of the Federal State Budgetary Institution FC for TOA of the Ministry of Health of Russia (Barnaul) of the traumatological, orthopedic and neurosurgical profile [25], integrated with internal medical information system (MIS), electronic medical record (EMC) for automatic (without the participation of employees) register and updating of the necessary information, electronic referrals for hospitalization.

With the help of the developed digital tool, a set of tasks for planning the activities of the institution was solved:

- ✓ planning and formation of an application for annual medical care volume for a medical organization, based on the bed capacity and key performance indicators at previous periods of work;

- ✓ automatic structural distribution of MC volumes to specialized departments for each month of the year, week, working days according to the specified parameters: types, profiles, medical care groups, CSG, according to the nomenclature lists approved by the State Guarantees Program;

- ✓ automatic assignment of preliminary dates of patient's hospitalization (formation of a hospitalization plan), routing according to the departments planned for hospitalization (based on the profile and bed capacity of the department), types and groups of medical care, regions of residence, other registered features;

- ✓ compliance with the mandatory efficiency criterion for federal medical organizations (according to the order of the Ministry of Health of the Russian Federation dated April 29, 2020 No. 387n) which is 40 % of treated patients from other regions of the Russian Federation (automatic formation of a hospitalization plan);

- ✓ operational adjustment (automatic update) of the hospitalization plan on a daily basis in connection with the daily information about non-appearance of patients;

- ✓ in case of failed hospitalization (medical contraindications established in the admission department or uninformed non-appearance of the patient), automatic replacement of patients according to the vacant places from the operational reserve of the register in compliance with the nomenclature identity of the unit (hospitalization within the next 1-2 weeks);

- ✓ there is a reserve for the volume of medical care for a number of groups in cases of emergency hospitalization of patients based on the current average annual indicators of unscheduled appearance of patients (closed for automatic placement);

- ✓ automatic control over the execution of planned volumes of medical care for completed cases of treatment for the required monitoring period (day, week, month, quarter, other period);

- ✓ counter of the remaining volumes of medical care available for hospitalization for the current year and month (other required period), for each department;

- ✓ visualization of volume balances available for hospitalization by types and groups, overfulfillment and underfulfillment of target indicators with color marking of critical minimum volume balances or their excesses;

- ✓ automatic calculation of the required hospital bed capacity in a given time period, based on the actual load parameters (volumes of medical care, average length of a bed-day, other criteria);

- ✓ statistical accounting, analysis, reporting, registers for payment, etc.

The program helps to predict and identify potential organizational risks (nonappearance, seasonal dependence, epidemic periods – to ensure uniform sampling of annual volumes and the purchase of materials and implants, etc.).

The main users of the program are the structural subdivisions of the Center involved in planning, distributing and monitoring the execution of the volume of medical care (organizational and methodological department, hospitalization department, admissions department, planning and economic department, information technology department).

On 26 September 2022, we successfully completed the procedure for state registration of the computer program "Management of the volume of medical care and the number of beds in an organization providing specialized, including high-tech, medical care" which meets the requirements of the legislation on information security and personal data protection in the Federal Service on Intellectual Property (Rospatent) [26].

In connection with the established indicators of nonappearance of patients for hospitalization, refusals in hospitalization, unscheduled appearance (arrivals) of patients while forming a preliminary hospitalization plan for the target period (month, quarter, year), it is necessary to provide for an additional number

of patients in excess of the plan to achieve the necessary final indicators for completed hospitalizations .

We have developed a methodology for planning, calculating and achieving the final (required) number of hospitalized (for the required period):

$$Pi = Po - Ni - Nn - Op + V - Ov - Pp - Pn,$$

where **Pi** (abs.) is the predicted total of hospitalized patients, **Po** is the number of scheduled patients (projective calling plan), **Ni** is the number of informed nonappearance of patients, **Nn** is the number of uninformed non-appearance of patients, **Op** is the number of refusals at the admission department for planned patients (medical contraindications), **V** is number of unscheduled arrivals (appearance of patients on an unspecified date, emergency hospitalizations), **Ov** is number of refusals in the admission department for unscheduled patients (no indications for hospitalization, medical contraindications), **Pp** is number of patients in the transitional group (already hospitalized, but not yet included in the list of completed cases, because they continue treatment, not discharged; hospitalized in the same month, but will be discharged next month), **Pn** is number of patients with several cases (volumes).

In the event that the predicted total of hospitalized (calculated) does not correspond to the target plan for the completed hospitalizations for the period (month) (does not reach or exceed), it is necessary to adjust (increase or decrease) the number of planned patients (calculated plan of calls) according to the established indicators for institution (by months + it is advisable to take into account the revealed seasonality of maximum nonappearance).

We have established the period of maximum nonappearance of patients for hospitalization and failed hospitalizations (September), the recurrence trend of which is almost identical over a 10-year period (for the conditions of the Altai Territory: an agrarian region with a low population density of 12.8 people/km², and 42 % of the rural population)². At the end

² Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/chisl_RF_01-01-2022_VPN-2020.xls

of 2022, in September, hospitalization did not take place in 58.3 % of cases of initially planned patients, and in previous years it was up to 45.0 %.

In addition to changes in organizational approaches, the system helped us identify other existing problems and optimize a number of clinical processes.

A continuous analysis of 39,799 cases of completed treatment of patients over a 5-year period (2018-2022) allowed us to establish hospitalization rates for patients in the age category "75 years and older" – 5.3 ± 0.1 , patients with concomitant pathology "diabetes" – 11.8 ± 0.1 (per 100 treated patients), patients with periprosthetic infection in 2022 (only cases of multi-resistant flora) – 0.28 ± 0.06 (per 100 treated patients). These categories of patients require specialized support and increased financial costs of the medical organization.

One of the main principles of patient-centricity is to provide an integrated approach in the treatment of patients (ensuring the ability of multidisciplinary teams to work). We have justified the introduction of a geriatrician, an endocrinologist, a neurologist in the pediatric department of traumatology and orthopedics (botulinum toxin therapy in a hospital) into the staff list of the Center; licensing of the necessary works (services) was performed.

Organizational technologies enabled to receive additional funds in the amount of 10.5 million rubles for 2022. For creating and submitting invoice registers for payment, we used new patient treatment complexity factors, provided for in clause 6 of Appendix No. 3 of the State Guarantees Program, methodological recommendations of the Ministry of Health of Russia and FFOMS on methods of payment for medical care at the expense of compulsory medical insurance, CSG (botulinum therapy) was changed to a more expensive one, savings, including by reducing the rate of bed-days, an additional CSG for antimicrobial therapy was introduced.

DISCUSSION

The issue of studying the seasonality of this phenomenon requires further systematic study. In 2020-2021, the indicators were influenced by the long period of the pandemic, and the indicators of the maximum nonappearance of patients coincided with the dates of peak morbidity values in the Russian Federation and regions.

Obviously, for different regions of the Russian Federation, these indicators will differ from those established by us due to the regional issues; however, the proposed method for calculating the predicted total of hospitalized patients is universal and will be useful for planning and implementing the volume of medical care, optimizing internal organizational processes.

Thus, the problem of non-appearance of patients for planned hospitalization on the appointed date results in significant disorganization and requires huge additional efforts on the part of the host medical organization to urgently adjust their hospitalization plans in order to prevent disruptions in the execution of the state task.

Based on the established significant rates of nonappearance of patients, we have created an Operational Reserve in the digital register of patients in order to quickly resolve the issue of fulfilling the planned indicators for complete hospitalization which allows us to replace the absent individuals with other patients of an identical nomenclature group as soon as possible

(automatically with the auto-placer function in our software) and communicate hospitalization dates to new patients. The Operational Reserve is formed automatically. These are patients who reported their inability of arriving on a previously appointed date, patients with previously identified medical contraindications from the group of their short-term elimination, other cases.

The balance counter of medical care volumes for all groups helps to fulfill the exact planned indicators, without exceeding or decreasing the set target values.

Over a 3-year period (2020-2022), based on a continuous analysis of 30,102 packages of documents of patients submitted for consideration to the Center, we established an indicator of the rate of unconfirmed indications for surgery, which was 6.9 ± 0.1 (per 100 patients).

The level of the indicator allows us to conclude that the definition of medical indications is sufficiently high-quality and the selection of patients by referral organizations and OHIs of the constituent entities of the Russian Federation for the provision of specialized, including high-tech, medical care in a specialized federal medical organization.

At the same time, the current orders of the Ministry of Health of the Russian Federation No. 824n of October 2, 2019 and No. 1363n of December 23, 2020 established complex multi-stage procedures for selecting patients, including by a medical commission at the stage of the host medical organization, which, in our opinion, can be simplified without significant losses in the quality of patient selection. Extremely short deadlines established for reviewing documents, organization of internal examination of packages of documents, confirmation of indications by members of the medical inspection board, drawing up a protocol of the decision of the medical board, posting these protocols in various resources - it is an incomplete list of the work of the federal medical organization. Eight employees of the Center are daily engaged in this laborious selection process, almost all employees of specialized departments are internal consultants (in rotation mode).

We believe that at the stage of the host medical organization, it is advisable to save the need to confirm medical indications for surgery by a expert medical commission only for complex expert cases. With an average annual number of 12,500 packages of

documents submitted for consideration to the Center, no more than 900 (7.2 %) packages of documents require an expert commission decision, the remaining 11,600 (92.8 %) packages do not require commission consideration and execution of MC protocols, it will be sufficient the decision of a traumatologist-orthopedist or a neurosurgeon of the host medical organization. Amendments to the orders of the Ministry of Health of the Russian Federation on optimizing the selection of patients for specialized, including high-tech, medical care at the stage of a federal medical organization will significantly simplify unnecessary requirements without losing the quality of confirming indications for surgery, freeing specialized specialists from additional workload and document flow.

Our comparative analysis of the 5-year periods, 2013-2017 and 2018-2022, established an increase in the average five-year rates of refusals to hospitalize (due to medical contraindications) by 1.4 times ($t = 13.6$; $p < 0.0001$). We consider it expedient to introduce a process approach in the Russian Federation in preparing patients for hospitalization at federal clinics, to optimize the process of pre-hospital preparation of patients, to develop, approve and to use obligatory uniform clinical recommendations for preparing for hospitalization (for specific profiles), to increase the coordinating function and responsibility of the referring medical organization and the attending physician. An additional stage of assessment (verification) of the patient's medical status is required before his trip to a federal medical organization (1.5-2 months before the trip, the main medical parameters should be checked it is a necessary measure), timely identification of medical contraindications and stabilization of concomitant somatic pathology. Insufficient interaction and continuity between the referral organizations, the outpatient link, the host clinics, as well as the lack of unified regulated algorithms for preparing patients for hospitalization affect the waiting time for hospitalization.

The annual change in the group numbers in the Program of State Guarantees for the Provision of Medical Care to Citizens represents an additional difficulty in adapting all internal systems, the register, and analyzing indicators in connection with the different nomenclature of groups, without obvious and clear benefit to everyone.

CONCLUSIONS

An organizational model for managing medical care capacity, selection and hospitalization processes in a specialized federal center using digital technologies has been proposed.

To achieve this goal, a set of tasks has been solved:

1. Organizational problems were identified in the provision of planned medical care in the relevant federal center.

2. Indicators of failed planned hospitalizations, their types and structure, seasonal patterns were established.

3. The structure of the predictive indicator of the number of hospitalized patients has been established.

4. A methodology has been developed for planning, calculating and achieving the final (required) number of hospitalized patients (for a specific period).

5. Organizational and digital solutions were proposed that systematize and simplify the fulfillment of obligations by the medical organization under the state assignment, other approved volumes of medical care.

6. A computer software has been developed for planning and distributing volumes of specialized, including high-tech, medical care in a medical organization.

7. The processes of selection and hospitalization of patients with the use of digital technologies have been systematized and improved.

8. Justified managerial decisions to improve internal organizational processes.

The study established the regularities of the implementation of planned hospitalization of patients of traumatology/orthopedic and neurosurgical profile in the conditions of a specialized federal center. For annual hospitalization plans, it is necessary to carry out structural calculations and consider the actual results and patterns, including sanitary-epidemiological and seasonal

ones, for previous periods (optimally for 3 years) for accurate planning and execution of the state task. The developed computer program for managing the volumes of medical care and hospitalization, timely notification of patients, the presence of an electronic counter of the remaining volumes in real time, the creation of an operational reserve of patients in the internal digital register to quickly replace failed hospitalizations, allows systematization of the process, manage the volumes of medical care and the hospitalization process.

The proposed method for calculating the predicted total of hospitalized patients is universal and will be useful for planning and implementing the volume of medical care, optimizing internal organizational processes for medical organizations.

Organizational and digital solutions have been proposed that systematize and simplify the fulfillment of obligations by the medical organization under the state task, other approved volumes of medical care.

Substantiated proposals for making changes to the current legislation have been formulated.

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