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To the question of decision making in physical rehabilitation

Abstract. ***Purpose****: searching for a solution of the problem of coordination in a complex hierarchical systems, and study of the mechanism of decision making in physical rehabilitation.* ***Material and Methods****: modern approaches to the management of complex hierarchical systems were reviewed; the job descriptions of a physician and instructor of physical therapy were analyzed.* ***Results****: centers and stages of decision making in physical rehabilitation were defined by decomposition method, ways to improve coordination in decision making were suggested.* ***Conclusions****: the mechanism of decision making in physical rehabilitation requires improvement.*

Keywords: *physical rehabilitation, remedial gymnastics, hierarchical system, decision-making, the postulate of compatibility.*

Introduction. Physical rehabilitation should be considered as a difficult hierarchical system which works in variable conditions. The definition and the studying of factors of the effective functioning of such systems remains an actual scientific problem which is solved mainly by representatives of physical and mathematical sciences [1–5]. One of the directions of the improvement of functioning of difficult hierarchical systems is the increase of efficiency and flexibility of the mechanism of coordination in an adoption of operational, tactical and strategic decisions [6].

Two manifestations of the complexity of a system are considered: the external and the internal complexities. The external complexity is defined by the complexity of relationship with the environment, the complexity of a control system that potentially estimates on a feedback of system and environment. The internal complexity is defined by the complexity of a set of internal states that potentially estimate on the complexity of management in the system. A subsystem of making a decision has to be always in difficult systems [7]. Its design significantly depends on a type of tasks for which it is developed, available data, information and knowledge, and also from users of a system.

Physical rehabilitation shows the internal and external complexity and therefore has to include a decision-making subsystem. The improvement of coordination of the activity of a doctor and a specialist in physical rehabilitation (an instructor of MPC) in the adoption of administrative decisions can improve the functioning of system of physical rehabilitation. In the research the main attention is paid to the external manifestation of the complexity of physical rehabilitation.

Communication of the research with scientific programs, plans, subjects. The work was performed within the Consolidating plan of the research work in the sphere of physical culture and sport for 2011-2015 on a subject 4.2 “Physical rehabilitation of disabled people with violations of activity of the musculoskeletal system”.

The objective of the research: to find the general solutions of a problem of coordination in difficult hierarchical systems, to describe the decision-making process in physical rehabilitation and to offer options of its improvement.

Material and methods of the research: analysis of references, system analysis, decomposition method.

Results of the research and their discussion. It was established by the method of the decomposition that physical rehabilitation is an open difficult hierarchical system as it consists of the separate interconnected subsystems. At the same time it can be considered as a subsystem in the health system and as an object of its management. Health protection in this case acts as a system of the highest level, or a metasystem. Its elements are a doctor, an instructor of MPC (a physical rehabilitator) and a patient.

Providing rehabilitation services in medical institutions is regulated by the order of Ministry of Health of Ukraine No. 176 of 29.03.2011. Such duties are assigned to a doctor on medical physical culture and a nurse (an instructor) on medical physical culture [8; 9].

Experts, who have a higher sports education, can be also appointed to a position of the instructor on medical physical culture. These experts are considered such who have special preparation on medical physical

culture [9]. Thus, specialists in physical rehabilitation can hold a position of an instructor on medical physical culture.

We analyzed duty regulations of a doctor and an instructor of MPC for the purpose of studying of their role in the rehabilitation process.

According to duty regulations, an instructor of MPC has the following tasks and duties which directly concern carrying out rehabilitation actions (on separate points of duty regulations):

4.1.1. He provides the primary prevention of diseases of a person by methods of fitness training, the correction of the mode of physical activity under the leadership of a doctor.

4.1.2. He competently gives individual and group classes in physiotherapy exercises.

4.1.3. He trains patients with various pathology in techniques of a prevention of diseases and their complications, carries out a selection of complexes of physical exercises for independent classes on physiotherapy and improving exercises, changes a technique of the performance of procedures and their dosage depending on features of a disease, extent of functional violations according to appointments of attending physicians.

4.1.4. He observes patients for the purpose of the studying of their state and the efficiency of classes depending on what changes or supplements a technique of classes, coordinates it with an attending physician.

4.1.6. He makes recommendations about improving systems and programs, about physiotherapy exercises, a motive mode and improving physical training in house conditions.

4.1.9. He does an analysis of a work.

4.1.10. He studies and introduces a positive experience [9].

According to duty regulations, a doctor of MPC has the following tasks and duties which directly concern carrying out rehabilitation actions (on separate points of duty regulations):

6.1. Conducts special examinations of patients which are appointed the physiotherapy exercises by physicians, for the purpose of the definition of a complex of physiotherapy exercises, techniques of procedures and their dosage depending on features of a disease, extent of functional violations.

6.2. He observes patients for the purpose of the studying of their state and the efficiency of classes depending on what changes or supplements a technique of classes, coordinates it with the attending physician.

6.3. He directs and controls a work of nurses (instructors) on physiotherapy exercises (including making up complexes of physical exercises by them for remedial gymnastics and independent classes of patients) and nurses who carry out procedures of remedial and morning hygienic gymnastics.

6.5. He introduces new effective techniques of physiotherapy exercises, defines rational combinations of a course and separate procedures of physiotherapy exercises to other remedies and medical rehabilitation (compatibility, sequence, time intervals).

6.6. He carries out procedures of remedial gymnastics and other forms of physiotherapy exercises with certain patients or groups.

6.7. He makes recommendations about improving systems and programs in physiotherapy exercises, the motive modes and improving physical training in house conditions.

6.8. He does the analysis of a work, studies and introduces a positive experience [8].

On the basis of the stated it is possible to draw a conclusion that tasks and duties of an instructor and a doctor of MPC which directly concern carrying out rehabilitation actions, substantially coincide. An exception is a control function of a doctor MPC and his task is to introduce new effective techniques of MPC.

The analysis of duty regulations showed that there are at least three centers of making decisions in physical rehabilitation: an attending physician, a doctor of MPC and a physical rehabilitator (an instructor of MPC). It is necessary to consider the existence also of the fourth center –patient as its activity directly influences the rehabilitation process.

The existence of several centers of making decisions actualizes a problem of the effective coordination of their activity for the purpose of decision-making of different level for the achievement of the global purpose of functioning of the system.

There are various approaches to a statement and a solution of a problem of coordination in the difficult hierarchically ordered systems. Two approaches which are the basis for models, methods and algorithms of the coordination mechanism are basic. The coordination mechanism which is focused on a task, builds hierarchical model of a control system according to an optimizing task. At the use of the coordination mechanism focused on a control system, the model of a process is considered or in a generalized view, or take into account only

separate parameters of the process [6].

The task of coordination can be solved through the modification of the structure of a control system, i.e. a choice of the optimum scheme of interrelation between centers of making decisions. Another way is a choice of an optimum coordination signal which allows direct and synchronize the activity of the centers of making decisions for the achievement of the global purpose of functioning of the system at the distribution on the established hierarchical structure [6].

We will define the above-mentioned system concepts of physical rehabilitation.

The purpose of functioning of the system of rehabilitation should be considered the restoration of functionality of a patient. Communications which belong to carrying out rehabilitation actions extend from an attending physician to a patient through a doctor of MPC and a physical rehabilitator. Professional information acts as a coordination signal (which can be transformed when passing through the intermediate centers of making decisions).

The coordination mechanism focused on a task leans on methods of the interdisciplinary design optimization. It provides the decomposition of a big task on some simpler and the development of algorithm of their joint decision for the achievement of the optimum decision [10]. In rehabilitation the problem of big dimension is a long-term goal which needs to be divided into a row of short-term, demanding less than time for the achievement.

The decomposition of the global purpose which is recovery of health and functionality, on smaller can happen in two directions.

One way is an interdisciplinary optimization. We understand it as coordination or submission to rehabilitation of the treatment purposes. In such coordination an attending physician has to play a key role. Tasks of a physical rehabilitator – is to decompose the rehabilitation purposes on the basis of the strategy of treatment chosen by a doctor and obligatory to coordinate them with a patient.

Another way is a statement and coordination among themselves of smaller, short-term objectives which can be reached at the same time or consistently in interests of the solution of the big purposes that in turn conducts to the solution of the global purpose –recovery of health and functionality. The coordination has to take place at the level a rehabilitator –patient with possible involvement of a doctor of MPC.

The coordination mechanism focused on the control system is effective at the application in difficult systems with the rather constant hierarchically ordered structure. Its task is the definition of the optimum coordinating signal that allows direct activity of the centers of making decisions of various levels on the achievement of the global purpose of functioning of the system [1-3]. It is necessary to consider an attending physician in the hierarchical system of rehabilitation of the highest level by the center. A doctor of MPC, a rehabilitator and a patient act as the lowest levels.

This coordination mechanism is based on a postulate of the compatibility [5]. According to it, the activity of the center of making decisions (e.g., a rehabilitator) can answer the global purpose if the activity is coordinated according to a problem which is solved at the level of the direct management of this control center. For a rehabilitator such highest center most often is an attending physician, is more rare – a doctor of MPC, for a doctor of MPC – an attending physician, for a patient – a rehabilitator.

Other provision of a postulate of the compatibility concerns the operating center. The achievement of the global purpose will become possible when an operating center (an attending physician) coordinates the elements which are directly subordinated to it (a doctor of MPC or a rehabilitator) according to own purposes and if thus problems of the hierarchical system are compatible.

Thus, the direct management of rehabilitation actions or their carrying out by an attending physician contradicts modern mechanisms of coordination in the decision-making process in the difficult hierarchically ordered systems. Our experience testifies that such practice is unfortunately widespread in medical institutions. Rehabilitators often expect from an attending physician of detailed instructions concerning carrying out rehabilitation actions, and it doesn't belong to his duties and competence.

Being guided by a postulate of the compatibility and the coordination mechanism focused on a control system, it is possible to allocate the following stages of the coordination of the centers of making decisions in physical rehabilitation:

1. An attending physician, acting as a center of making decisions of the highest level, plans the treatment strategy where physical rehabilitation is a component.

2. An attending physician submits information to the lowest centers: to a doctor of MPC or directly a physical rehabilitator. This information has to carry out the function of a coordination signal for the combination of problems of the activity of a rehabilitator with a treatment strategy.

3. A physical rehabilitator, in turn, directs own coordination signal to a patient which combines and coordinates the activity with problems of the activity of a rehabilitator.

4. Coordination signals promote the solution of local tasks at each level according to duty regulations. Information on results of the activity of a patient arrives to a rehabilitator and about the activity of a rehabilitator – to an attending physician (or to a doctor of MPC as to an intermediate center).

5. On the basis of feedback signals, received from the lowest center of making decisions – a rehabilitator (or a doctor of MPC as an intermediate center), an attending physician can change the treatment strategy, define a new coordination signal and send it to a rehabilitator.

However such system of coordination from five stages can't be considered as a universal for the solution of problems of rehabilitation.

The first three stages should be executed for a start of the rehabilitation process, and the following – for its carrying out. It is necessary to carry out the fifth stage only for a full repeated control of a control system according to conditions of the compatibility postulate. The basis is a change of strategy of the treatment which is carried out by an attending physician without or taking into account results of rehabilitation. Such "restarting" can't often happen for the objective reasons.

The coordination purpose in the system of rehabilitation and the metasystem of health protection – are the expeditious adoption of the optimum decision concerning the rehabilitation process and its components by the exchange of information between centers of managements of various levels: an attending physician, a doctor of MPC, a rehabilitator and a patient. Such approach is applied in all difficult hierarchical systems which function in the multitask mode in dynamic conditions [6].

The effective coordinated activity reduces the need for frequent coordination signals of the highest level at each level. The task of each center –is a support of the processes corresponding to the level and stated in duty regulations after all criterion of the efficiency of structures of the management of difficult systems is ability to provide an optimum performance of key processes [6]. Each process has to have the center of making decisions and be provided with the optimum coordination signals of the highest level.

Conclusions. The coordination problem can be solved in two ways at making decisions in the hierarchically ordered systems. The first – is through the modification of the structure of a control system, i.e. a choice of the optimum scheme of interrelation between centers of making decisions. Other way is a choice of an optimum coordination signal which allows direct and synchronize the activity of the centers of decision-making for the achievement of the global purpose of functioning of the system at the distribution on the established hierarchical structure.

Physical rehabilitation can be considered as a hierarchical system in the metasystem of health protection as an object of its management. As the centers of decision-making an attending physician (the highest level), a doctor of MPC, a physical rehabilitator (an instructor of MPC) and a patient which are elements of the system of health protection. Their activity has to be based on a postulate of the compatibility and be coordinated in some stages. The taken in practice a direct charge of rehabilitation actions, or their carrying out by an attending physician, contradict the modern mechanisms of coordination in the decision-making process in the difficult hierarchically ordered systems.

The increase of the efficiency of making decisions in physical rehabilitation can go way of the improvement of activity of all centers of making decisions, the optimization of coordination signals and feedbacks.

Prospects of further researches consist in studying of the maintenance of coordination signals and feedbacks.

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