

System resources of physical rehabilitation / physical therapy in musculoskeletal disorders

Andrii Hertsyk

Lviv State University of Physical Culture Street, Lviv, Ukraine

Purpose: to determine and analyze the system resources of the physical rehabilitation in the musculoskeletal disorders.

Material & Methods: the resources of subsystems "specialist of physical rehabilitation" and "patient" were analyzed. Literature analysis and system analysis were applied.

Results: the role of resources in the system functioning has been discovered. The distribution, types, contents and links of resources of the system of physical rehabilitation in musculoskeletal disorders have been analyzed. The role of the information resource in the rehabilitation process has been defined. The necessity of coordinating the activities of the attending physician and the specialist of physical rehabilitation in the allocation of resources has been justified. Criteria for evaluating the effectiveness of rehabilitation based on the expended resources have been proposed.

Conclusions: the purpose of physical rehabilitation is achieved by all kinds of resources of specialist of physical rehabilitation and patient. The resource of direct action is information, that specialist of physical rehabilitation receives from the attending physician and/or collects independently when examining the patient.

Keywords: physical rehabilitation, musculoskeletal disorders, system.

Introduction

The interaction of open social systems and, in particular, physical rehabilitation with the external environment consists in that the environment provides resources to the system, and receives from it functioning products. These are material, financial, energy, human, organizational, information resources, which as a result of functioning of the system, turn into the necessary, material, financial or information product for the environment. The system of physical rehabilitation is designed to satisfy requirement of health protection that acts as the environment, and, using its resources, to transfer a patient to condition which cannot be reached by other systems of the environment.

Physical rehabilitation at disorders of the musculoskeletal system works as the closed system only on short (rather general duration of rehabilitation process) interval of time that is without exchange of resources with the environment [1].

Resources are closely connected among themselves. At the same time, their influence on the system is miscellaneous and not always proportional to quantity. Resources can be divided on such that directly influence the system – direct action, and such which have no fast direct influence – mediated action. The assessment of influence of the noted factors significantly depends on the concrete system, the tasks of the research and the researcher's position. The problem is in that to analyze the most essential connections which choice is defined by specific conditions of management of this or that object, or process from the large number of interactions of the system with the external environment [2]. Concerning physical rehabilitation, it should be taken into account that influence of the system resources of the environment in connection with the interpretation of physical rehabilitation as the open social

system process which is the special sort interaction of a specialist in physical rehabilitation (physical rehabilitologist) and a patient.

Physical rehabilitation is the open difficult system as it consists of separate subsystems, such as the specialist in physical rehabilitation, the patient, the purpose of rehabilitation [1; 3].

The purpose of functioning of the system of physical rehabilitation is renewal of motive functions, activity and health of a patient [4]. The purpose is achieved by the realization of rehabilitation potential of the patient. It is the complex of biological and psychophysiological characteristics of individual and also social-surrounded factors which allow realizing in this or that degree its potential abilities [5].

Rehabilitation potential and its realization are connected with resources of which the system of physical rehabilitation disposes. As any other system, physical rehabilitation functions in the conditions of deficiency of resources therefore their effective use is condition of timely realization of rehabilitation potential and achievement of the purpose of rehabilitation.

Studying of resources of the system of physical rehabilitation at disorders of the musculoskeletal system should be considered the scientific problem which needs the decision within the system researches of the rehabilitation process for the purpose of its improvement. The solution of this question opens the way to the solution of other important practical problem – account, replenishment and effective use of resources of physical rehabilitation.

Communication of the research with scientific programs, plans, subjects

The work was performed within the Built plan of the research work in the sphere of physical culture and sport for 2011–2015 on the subject 4.2 “Physical rehabilitation of disabled people with disorders of musculoskeletal system” (the head of the project prof. Vovkanych A. S.) (number of the state registration is 0111U006471).

The purpose of the research:

to define and analyze resources of the system of physical rehabilitation.

Material and Methods of the research

Research methods: analysis of references, system analysis and synthesis.

Results of the research and their discussion

Resources of the system of physical rehabilitation belong to two subsystems – physical rehabilitologist and patient.

Physical rehabilitologist uses own resources and resources of which he disposes for the sake of renewal of motive functions and activity of the patient. All this types of resources, what characteristic of open social systems, except for financial.

The organizational resource is made by the organization of the rehabilitation process in medical-rehabilitation institution. These are features of providing rehabilitation services, their form, for example: individual, group, independent, under supervision. One of the perspective directions of strengthening of the organizational resource should consider the activity of physical rehabilitologist as the part of multidisciplinary crew [6].

The information resource of physical rehabilitologist is information which is transformed to the professional knowledge, which is necessary for effective and safe activity. In view of its importance, the resource needs more detailed consideration.

The term “information” means the message, data on some event, someone’s activity or development of some process which reduces the lack of information on these phenomena. The term connected with other important concepts of the same terminological row namely: “knowledge” and “data”. As a rule, they understand information, which is submitted in the certain forms, which are adequate to possible processes of its processing as data [7].

The information resource is the organized set of the documented information, statements, data and knowledge, which is intended for satisfaction of information needs of a consumer. Data are the basis of information that serves for representation, preservation and information processing. Oral messages, printing and electronic documents, other material data carriers [8] can be its sources. Information on the basis of which it is possible to reach certain conclusions, consider knowledge by means of logical opinions [7].

The proper and pertinent information is called relevant. If the information message is unnecessary the subject for decision-making, then it is information noise which can entail information overload [8].

Information is divided into constant, conditionally constant

and variable by the stability degree. Constant information does not change, conditionally constant remains invariable rather wide interval of time, and variable contains data which are constantly updated for rather short period of time [8].

The general knowledge of etiology, pathogenesis, clinical displays of diseases, are formed on the basis of constant information. Knowledge of techniques and technologies of physical rehabilitation are based on conditionally constant information which changes infrequently. The noted knowledge makes theoretical basis of professional preparedness of physical rehabilitologist and is formed at stages of pre-degree and post-degree preparation. The continuous study happens in the form of advanced training courses, seminars, training, exchange of experience, self-education.

Information on the specific patient, directed to rehabilitation, differs by the stability degree. Physical rehabilitologist receives it from the case history and from the attending physician.

It is necessary to write down such data from the case history:

- passport data;
- date of hospitalization;
- profession;
- main diagnosis (concerns musculoskeletal system), date of establishment, clinical picture (set of displays of disease), complication;
- associated diseases and their complications;
- information on the executed operative measures;
- information on results of the previous rehabilitation.

These data concern constant or conditionally constant information on the motive sphere of the patient, duration and the course of disease, the carried-out treatment and rehabilitation. They are input parameters with which study interaction of physical rehabilitologist and the patient begins.

The following information, necessary for functioning of the system of physical rehabilitation, is the variable character and arrives from the attending physician. Frequency of change depends on the course of disease and the stage medical-rehabilitation process. The variable component of information resource of physical rehabilitologist at disorders of the musculoskeletal system concerns individual restrictions, purposes and time.

Restriction concerning holding rehabilitation actions is imposed by the attending physician, having directed the patient on rehabilitation. He has to provide to rehabilitologist the information about individual contraindication and caution to performance of rehabilitation actions at disorders of the musculoskeletal system. Restrictions mainly concern the range of movements, postural poses, power and functional loadings. Change of the course of disease, clinical manifestations, treatment techniques will entail strengthening, ease, or cancellation of certain restrictions.

Information from the attending physician concerning the purposes of treatment will help physical rehabilitologist to establish the whole rehabilitations which would be coordinated with the treatment purposes, for example: reduction of hypostasis, reduction of pain, elimination of contracture, renewal of power qualities. Coordination of the purposes will promote synergy effect of cooperation of both experts and, as a result, fast re-

newal of health of the patient.

Information concerning time concerns duration of individual application of techniques of conservative treatment of the musculoskeletal system dates of the planned operative measures predicted by the doctor, individual terms of healing, the predicted terms of stay of the patient in medical institution. The noted information will make possible planning of rehabilitation actions and their synchronization with medical.

Physical rehabilitologist has to obtain the main part of information on functional condition of the musculoskeletal system independently, having executed rehabilitation inspection. Information can also arrive from other physical rehabilitologist who worked previously with the patient.

Material means of medical-rehabilitation institution form material resource of physical rehabilitologist. First of all, these are specially equipped rooms (halls, offices) and technical means for transportation of patients within institution (carts, tables, chairs, lifts, elevators). It is expedient to include the following to the list of the rehabilitation equipment for patients with disorders of the musculoskeletal system:

- dumbbells, encumbrance for extremities; expanders, plaits for training of power qualities;
- gym wall bars, sticks, balls of different sizes, for flexibility development;
- parallel bars of variable width and height for vertical adjustment and study of gait;
- traction and safety harnesses;
- mirrors for training of motive control;
- tables for performance of active and passive exercises;
- massage tables, rollers, pillows, supports;
- mats, rugs for exercises on floor;
- supportive applications for movement: carts, walkers, crutches, sticks;
- platforms for training of gait and balance;
- systems of suspended therapy;
- devices and trainers for improvement of mobility, development of force, power and general endurance, functional training.

The list should be added with the equipment and devices for application the pre-shaped physical factors (electric energy, heat, cold, water). They are used for reduction of pain and inflammation, renewal of mobility of tissues, supports of muscle work at violation of innervations at disorders of the musculoskeletal system.

The human resource is closely connected with the organization of rendering of services and stage of rehabilitation. The resource is formed by persons whom physical rehabilitologist involves in the rehabilitation process and to whom delegates part of the powers. Physical rehabilitologist can recruit informal assistants from among volunteers, relatives and the patient's relatives. The listed persons help to carry out the rehabilitation program, to move and insure the patient, to make observation, to control results after obligatory instructing. Duty of physical rehabilitologist is ensuring their effective and safe activity. There are positions of the technician of physical therapy, the assistant and the assistant to the physical therapist in economically developed countries. These persons have special training and according to the functions carry out separate rehabilitation actions [9].

The energy resource can be divided into two components. The first is thermal and electric energy which physical rehabilitologist uses therapeutic agents in quality. The second – muscular energy of the expert which is implemented through manual interaction with the patient, for example:

- inspection of the musculoskeletal system by means of palpation, manual muscular testing, tests, with isometric tension, testing by the passive movement, testing “the final feeling” [10];
- facilitation, inhibition, stimulation at performance by the patient of active exercises;
- passive exercises by means of rehabilitologist;
- massage, post-isometric relaxation;
- movement of the patient;
- insurance of the patient.

Thus, anthropometrical indicators, method of execution of manipulations, physical fitness (flexibility, power qualities, and endurance) are factors which define the energy potential of physical rehabilitologist.

The time resource is connected with rationing of operating time of physical rehabilitologist. This time, during which, the expert prepares for interaction with the patient or directly works with it.

Physical rehabilitologist always works in the conditions of the limited operating time. Planning duration of separate classes and the whole rehabilitation course, it is necessary to take into account the physiologic processes in the patient's organism connected with the disease course, healing, and functional renewal.

The need for the time resource grows at deficiency of all other resources. Increase in duration of rehabilitation can entail developing of secondary diseases and complications with irreversible changes in the musculoskeletal system, such as osteoarthritis, resistant discordant contractures, ankylosis. The risk of invalidization of the patient will grow.

The expert should pay special attention on information and power which are considerably formed by him for the optimum use of the time resource. Information can re-customize very quickly activity of physical rehabilitologist and has to be treated as the factor of the direct action on the system of physical rehabilitation.

The subsystem “patient” owns or disposes of all types of resources: organizational, information, material, financial, human, power, time.

It is possible to carry possibilities of the patient concerning the organization of independent rehabilitation classes to organizational resources. It is possible to carry out them at different stages of rehabilitation. The object depends on stage, for example: medical hospital, residence, rehabilitation and sports institutions, on open space. In all cases such form of rehabilitation in common with the expert of physical rehabilitation has to be planned and controlled. The large role will be played by the previous motive experience of the patient got during the previous rehabilitation and sports activities or physical culture.

Information resource is made by the relevant information, which is necessary for the patient for making decisions on the rehabilitation process. It has to arrive from the doctor and physical rehabilitologist. Information which the patient obtains from other sources, such as patients, popular literature on medical subject, the telecast, Internet often is irrelevant, has the nature of information noise and can negatively influence interaction of the patient and specialist in physical rehabilitation.

Material resources are material means and the equipment which the patient uses for independent classes. It is dumbbells, expanders and plait for training of power qualities, gymnastic sticks for the development of flexibility and elimination of contractures, supportive applications for movement, and platforms for training of gait and balance, house cardiovascular machine for endurance development at disorders of the musculoskeletal system.

Financial resources of the patient are formed of own preservations, financial aid, insurance payments. They can be directed to payment of paid rehabilitation services and acquisition of the equipment for independent classes.

Human resources are persons whom the patient involves in providing the rehabilitation help: assistants, volunteers, relatives and family members, trustees. Physical rehabilitologist can delegate part of competences from performance of the rehabilitation actions connected with renewal of the lost motive functions, movements, insurance, and control to the listed persons. The previous instructing and study of the involved persons for guaranteeing their effective and safe participation in the rehabilitation process has to be indispensable condition.

The energy resource is formed of physical capacities of the patient and is the big and important part of rehabilitation potential at disorders of the musculoskeletal system. It is connected with the work of systems of power supply and endurance. Physical endurance is characterized by times during which the patient can be engaged in physical functioning which level ensures realization of necessary rehabilitation interventions in rehabilitation [5]. Information on the previous motive status can serve as reference point for rough estimate of the energy resource. Speed and volume of reconstruction of energy resource depends on basic disease and its complications, general condition of health and age.

The time resource consists in the choice by the patient of duration of separate classes (under supervision and independent) and the whole rehabilitation course. Time should be treated as the major resource which loss cannot be offset completely. Even the temporary refusal of the patient of rehabilitation classes increases the time of renewal and can entail transition of functional violations of the musculoskeletal system to irreversible structural. As a result, the need for other resources and for the second grows in the first case – purposes and objects of physical rehabilitation will not be achieved.

The patient at the same time is object/subject of medical and rehabilitation processes which can conditionally be divided on the basis of the system analysis. In the first case the direct operating influence is carried out by the attending physician (the operating health protection subsystem), and in the second – physical rehabilitologist (the operating subsystem of physical

rehabilitation).

Mutual influence of subsystems in the course of their functioning happens in the presence of the general restrictions which can be the general resources. Strengthening of activity of one subsystem will entail reduction of the part of resources another and vice versa. Resources can be distributed under the influence of random factors, or for subsystems the compromise solution will be made. In that case, the governing body of the highest level has to make decisions for the benefit of the whole system [2]. Such body acts the attending physician in the medical rehabilitation process who acts in the meta-system of health protection.

Cooperation and interaction of the doctor and physical rehabilitologist consists in the general effective use of system resources, especially the patient's resources. The general resources, which predetermine mutual influence of the meta-system and the studied system, are time and energy in medical and rehabilitation processes.

The resource of energy concerns reserve opportunities of organism of the patient and is shown by the individual reaction to conservative, or expeditious treatment and therapeutic exercise stresses. It is connected with the work of immune system, functional potential of life support systems, adaptation reserve and compensatory opportunities of cardiovascular and respiratory systems. The resource of energy enters the rehabilitation potential of the patient.

The resource of time is closely connected with energy resource. First, it limits the simultaneous or parallel solution of the different purposes of treatment and rehabilitation, forces to define priorities and to plan activity taking into account speed of recovery processes in each case. Secondly, big expenses of physical energy by the patient provide longer periods of renewal and vice versa [1].

Resources are closely connected with the concept "technology". By one of definitions, "technology is means of transformation of resources (materials, raw materials, people, information) in products or services which are previously planned in product or choice" [11]. Therefore, the purpose of physical rehabilitation is achieved by resources by means of rehabilitation technologies, and rehabilitation technologies are means of transformation of resources into the purpose.

Leaning on the role of resources in functioning of systems, it is possible to open the concept "efficiency" in relation to the rehabilitation process at disorders of the musculoskeletal system. It is necessary to consider such physical rehabilitation as effective at which renewal of motive functions, activity and health of the patient, is reached by smaller expenses of resources, first of all, of time. Intermediate criterion of efficiency can be the achievement planned, or the highest level of motive functions and activity at the separate stage of rehabilitation by previously defined resources.

Conclusions

Physical rehabilitation as the open social system uses all types of resources for the achievement of the purpose: organizational, information, financial, material, human, power, time. The system resources belong to physical rehabilitologist and the patient, or are at their order.

Physical rehabilitolog has the greatest influence on the formation of power and information resources. Information which arrives from the attending physician and the patient can re-customize very quickly activity of physical rehabilitolog and has to be treated as the factor of the direct action on the system of physical rehabilitation.

Resources of the patient make the basis of rehabilitation potential.

Energy and time resources of the patient share the attending physician and physical rehabilitolog. It imposes certain restrictions for holding rehabilitation actions and demands accurate cross-disciplinary coordination in which the doctor plays the leading role.

The achievement of the intermediate purposes and the object of physical rehabilitation with smaller expenses of resources, especially time, testify to the efficiency of activity of physical rehabilitolog. The over-expenditure of the time resource increases the need for all others and can entail transition of functional violations of the musculoskeletal system to irreversible structural.

The resources turn into the purpose by means of technologies of physical rehabilitation.

The prospect of the subsequent researches consists in studying of internal communications of the system of physical rehabilitation at disorders of the musculoskeletal system.

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Andrii Hertsyk: *PhD (Physical Education and Sport); Lviv State University of Physical Culture Street. Kosciuszko, 11, Lviv, 79000, Ukraine.*

ORCID.ORG/0000-0003-1764-5625

E-mail: ahertsyk@gmail.com