

Possible approaches to evaluating the effectiveness of rehabilitation services

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Abstract

Purpose: the article scientifically substantiates models for assessing the effectiveness of rehabilitation services to ensure the quality of provision of rehabilitation assistance in the healthcare sector at the individual level, at the level of a rehabilitation center/department/institution, and the state level.

Material & Methods: an analysis of various approaches to assessing the effectiveness of rehabilitation services is presented, particularly in rehabilitation centers created, among other things, based on sanatorium-resort enterprises.

Results: the general principle of evaluating the effectiveness of individual rehabilitation of patients based on the International Classification of Functioning (ICF) is considered. Generally accepted scales are presented that can be used to determine the corresponding category of ICF domains on patients' health status for the purpose of rehabilitation. If generally accepted scales do not match the ICF domains, it is suggested that subscales be used and definitions of quantitative values be provided following the ICF recommendations. As for quantitative characteristics, mainly instrumental, functional, and laboratory, it is also advisable to reduce them to a five-level scale. Based on the expert method, rehabilitation efficiency indicators have been developed at different levels (individual, rehabilitation center/department/institution, or state), which can be applied in different rehabilitation periods. These indicators are presented in the form of "quality trees" ("efficiency trees").

Conclusions: to quantify the effectiveness of rehabilitation, it is proposed to use a qualimetric method, in which individual performance indicators are assessed using points, and the complex indicator is the arithmetic average. The combination of principles for evaluating the effectiveness of individual rehabilitation of patients based on the ICF and the qualimetric method allows us to objectively determine the patient's rehabilitation potential of, evaluate the effectiveness of rehabilitation measures at different levels and in different periods, and achieve short-term and long-term goals.

Key words: rehabilitation, effectiveness of rehabilitation, performance indicator.



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Можливі підходи до оцінки ефективності реабілітаційних послуг

Мета: науково обґрунтувати моделі оцінки ефективності реабілітаційних послуг на індивідуальному рівні, на рівні реабілітаційного центру/відділення/закладу або на рівні держави для забезпечення якості надання реабілітаційної допомоги у сфері охорони здоров'я.

Матеріал і методи: представлено аналіз різних підходів щодо оцінки ефективності реабілітаційних послуг, зокрема, в реабілітаційних центрах, створених, в тому числі, на базі санаторно-курорт-

них закладів.

Результати: розглянуто загальний принцип оцінки ефективності індивідуальної реабілітації хворих на засадах Міжнародної класифікації функціонування (МКФ). Наведено загальноприйняті шкали, які можливо застосовувати для визначника відповідної категорії доменів МКФ щодо стану здоров'я хворих з метою реабілітації. У разі, коли загальноприйняті шкали не збігаються з доменами МКФ, пропонується використовувати субшкали та приводити визначення кількісних значень відповідно до рекомендацій МКФ. Щодо кількісних характеристик, зокрема, інструментальних, функціональних та лабораторних, то їх також доцільно приводити до п'ятирівневої шкали. За допомогою експертного методу розроблено показники ефективності реабілітації на різних рівнях (індивідуальному, реабілітаційному центрі/відділенні/закладу або держави), що може бути застосовано у різні періоди реабілітації. Ці показники представлено у вигляді «дерева якості» («дерева ефективності»).

Висновки: для кількісної оцінки ефективності реабілітації пропонується застосовувати кваліметричний метод, у якому одиничні показники ефективності оцінюються за допомогою балів, а комплексний показник є середньоарифметичним одиничних показників. Поєднання принципів оцінки ефективності індивідуальної реабілітації хворих на засадах МКФ та кваліметричного методу, її кількісної оцінки, дозволяє об'єктивно визначити реабілітаційний потенціал хворого, оцінити ефективність реабілітаційних заходів на різних рівнях та у різні періоди, та досягти короткострокових і довгострокових цілей.

Ключові слова: реабілітація, ефективність реабілітації, показник ефективності.

Introduction

Rehabilitation is an integral part of universal health coverage. According to WHO, today, about 2.4 billion people worldwide suffer from diseases for which rehabilitation is indicated, and due to several factors, the need for rehabilitation around the world will increase (WHO, 2023). Emergencies, including armed conflicts, disasters, and disease outbreaks, increase rehabilitation needs. However, many people do not receive the necessary rehabilitation services due to low income.

Ukrainian law (The Law Of Ukraine, 2020) defines rehabilitation as "a set of measures needed by a person experiencing or may experience a limitation in daily functioning due to a health condition or aging in interaction with his environment." Rehabilitation aims to help people be as autonomous as possible in their daily lives and enable them to study, work, engage in leisure activities, and perform critical social functions.

Investments in rehabilitation services produce

returns both at the individual and societal level (WHO, 2023), which is why, in most countries, ensuring the quality of care is the basis of national health policy. As for rehabilitation in the healthcare sector, many countries have adopted and operated programs to ensure the quality of medical care, particularly in Ukraine (Resolution of the CMU, 2021).

Following the Guidelines (WHO, 2019), the quality of rehabilitation must be ensured:

- effectiveness of rehabilitation;
- timely provision of rehabilitation services within the continuum of medical care;
- person-centered rehabilitation services that involve the direct participation of service consumers, family members, and caregivers;
- the safety of rehabilitation.

Assessing rehabilitation outcomes has become fundamental to the practice of evidence-based medicine.

Assessment is an integral part of treatment and rehabilitation planning.

The effectiveness of a rehabilitation service is measured by the degree to which the therapeutic effect is achieved. Regarding a specific patient – improving health status and restoring lost functions. At the healthcare and industry level, the effectiveness of rehabilitation is measured by several indicators.

The effectiveness of a rehabilitation service reflects the degree to which target indicators are achieved. It is ensured by compliance with established industry standards based on evidence-based medicine, which establish appropriate indicators/quality criteria by which the quality of rehabilitation care provided over a certain period can be assessed (Babov et al., 2021).

To date, there are no unified approaches to assessing the effectiveness of rehabilitation services. Treatment and rehabilitation were measured by progress towards goals. We do not have a standardized methodology to evaluate the effectiveness of rehabilitation or a reporting form.

However, a need has arisen for methods for quantitative and qualitative assessment of the effectiveness of rehabilitation services in sanatorium and resort conditions. It is essential for specialists in the sanatorium and resort industry to determine criteria for assessing the level of health and functional state of rehabilitators.

Considering the specificity and complexity of the object of assessment and the need to assess the quality of rehabilitation services quantitatively, the qualimetric method should be applied as a mathematical tool for evaluating quality and effectiveness. The subject of qualimetry is the quantitative assessment of quality.

The goal is to scientifically substantiate a model

for assessing the effectiveness of rehabilitation services in different periods of rehabilitation at the individual level, at the level of a rehabilitation center/department/institution, and at the state level to ensure the quality of provision of rehabilitation care in the healthcare sector.

Material and methods of research

During the research process, materials were used that characterize the assessment of the effectiveness of rehabilitation services in a rehabilitation department/institution, including those created based on a sanatorium-resort institution, namely the current regulatory and legal documentation relating to the organization of a rehabilitation system in the field of health care in Ukraine was analyzed, regulatory and methodological materials from the official website of the State Expert Center of the Ministry of Health of Ukraine. The methodological basis of the work is a systematic approach to the study of the object. To solve the scientific problem, the fundamental provisions of qualimetry and system analysis methods were used.

Results and Discussion

An effective rehabilitation system, like the healthcare system, is based on three main components: structure, process, and effectiveness (Bezverhnyuk & Babova, 2022). The same provisions are enshrined in the order (Order of the MHU, 2012).

To implement rehabilitation measures at all stages, the interdisciplinary rehabilitation team carries out:

- assessment of the patient's rehabilitation status and its dynamics;
- establishing a rehabilitation diagnosis, including a description of the state of functioning and disability and its changes in the process of rehabilitation measures;
- assessment of rehabilitation potential, which determines the level of maximum possible recovery of the patient within a certain period;

- determination of specific rehabilitation goals;
- development of an individual rehabilitation plan;
- assessment of the effectiveness of rehabilitation measures over time and formulation of the patient's rehabilitation prognosis (Cantista et al, 2018).

It is necessary to distinguish between assessment of the effectiveness of rehabilitation at different the system levels (Fig. 1).

Assessment of the effectiveness of rehabilitation, both at the individual level and at the level of an organization or territorial entity, is formed, taking into account the target indicators of rehabilitation services. This assessment is based on analysing changes in the dysfunctions, structures, limitations of activities, and participation of individuals in society and their integration into the environment.

Assessing the effectiveness of rehabilitation services at the individual level makes it possible to adjust a person's individual rehabilitation program following his capabilities. It is needed both during and after completion of a certain rehabilitation cycle.

At the organizational level, assessing the effectiveness of rehabilitation services makes it possible to adjust the rehabilitation process and carry out personnel and system changes in the organization.

At the state level, assessing the results of rehabilitation services makes it possible to compare the effectiveness of organizing the rehabilitation process in different regions of the country.

Assessing the effectiveness of rehabilitation services at the individual level. To assess the effectiveness of the diagnostic and treatment process stages, the structure, process, and result of medical care in a particular case, the indicators of the quality of medical care/rehabilitation care specified in the protocol are used. Clinical indicators are developed according to the methodology approved by the order (Order of the MHU, 2012).

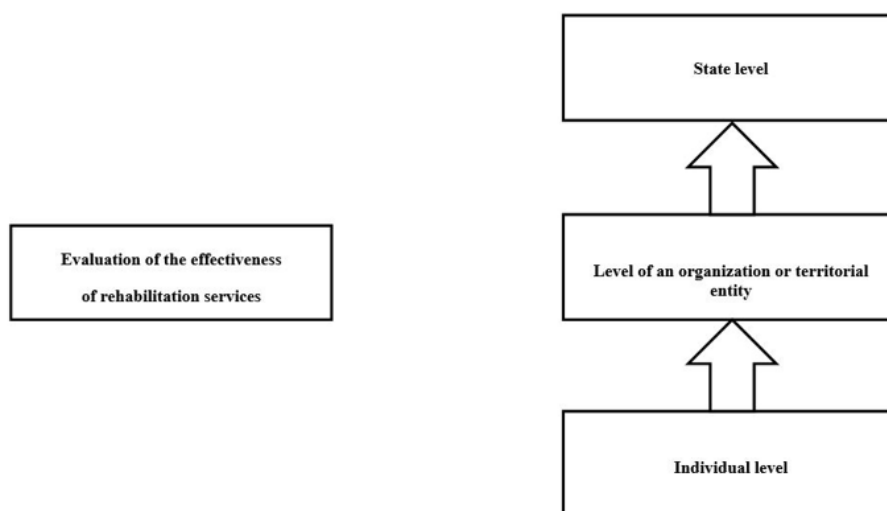


Figure 1. Levels of standardization of evaluation of rehabilitation effectiveness.

The content of the indicators corresponds to the adapted clinical setting and standard of care.

Evaluation of the effectiveness of rehabilitation services in a rehabilitation department/center (including those created based on a sanatorium-resort institution) is carried out by a doctor of physical and rehabilitation medicine (PRM) based on subjective and objective assessments of improving the functional state of body systems, reducing complaints, according to clinical and instrumental indicators.

Data analysis showed that there are no uniform approaches to assessing the effectiveness of rehabilitation services today. Various experts in this field suggest taking into account the type of course of the disease, the number of exacerbations before and after rehabilitation, the dynamics of visits to primary care, cases of inpatient treatment, and temporary disability (Shepel & Levkov, 2022). For persons with disabilities, it is proposed to use methods for assessing the dynamics of the functional class of the main disorder, everyday capabilities, and ability to work, assessing the dynamics of the frequency of exacerbations and attacks, and assessing patients' subjective satisfaction (Ipatov, 2021).

In any case, the methodology for assessing the effectiveness of rehabilitation services should contain the following main aspects: physical health, mental health, level of independence in daily life activities, social health, and economic security. If the first three aspects can be assessed reliably, social health is assessed subjectively, and economic security depends on many factors (Dragomyretska, 2006).

In practice, these aspects are assessed as "health-related quality of life," making it possible to evaluate the adequacy of therapeutic and preventive measures and the duration of remission in each patient. Often, to assess the effectiveness of rehabilitation, the quality of life criterion is used, which is assessed using questionnaires, particularly SF-36, SF-12, and others.

Other rehabilitation impact indices (RIIs) are also used, which consist of scores on these instruments and include functional status before and after rehabilitation. One of the most well-known RIIs is "absolute functional gain" (AFG), which assesses the difference between functional scores at a patient's admission to rehabilitation and discharge. Other authors use "relative functional gain" (RFG), also called the Heinemann Index or Montebello Rehabilitation Factor Score (MRFS), which indicates functional recovery as a percentage of maximum potential improvement (Koh et al., 2013). The Rehabilitation Effectiveness Index (REI) is also used, expressing the average increase per day in functional assessment points. It takes into account the recovery rate (Sánchez-Rodríguez et al., 2015).

To develop a rehabilitation program and evaluate the effectiveness of rehabilitation services, the current International Classification of Function-

ing, Disability and Health (ICF), developed based on the International Classification of Impairments, Disability and Disability (ICD), should be used. In 2001, it was decided to change the conceptual position - to move from the classification of "health consequences" to the classification of "health components" (WHO, 2001). A rehabilitation diagnosis is a list of the patient's problems that determine the patient's functioning (significant problems).

In Ukraine, based on the ICF, the national classifier NK 030:2022 "Classifier of functioning, disability and health" has been approved (Order of the Ministry of Economy, 2022).

In clinical settings, the ICF is used to assess the body's functional state, to set goals, plan and monitor treatment, and to measure treatment results. The ICF uses domains - a set of interrelated physiological functions, anatomical structures, actions, tasks, and areas of life. The ICF includes several scales: body functions and structures (B - Body functions, S - Body structures), activity (A - Activity) and participation (P - Participation). Body functions are encoded by one qualifier, reflecting the degree or magnitude of excitation. The presence of a violation is assessed using a single (negative) scale: 0 - no problems (0-4%); 1 - mild problems (5-24%); 2 - moderate problems (25-49%); 3 - severe problems (50-95%); 4 - absolute problems (96-100%).

Environmental factors can also be classified as barriers or predisposing factors.

The ICF has created validated ICF Core Sets (CS) that are used to clearly describe the patient's functioning status. On the website "ICF Based Documentation Form" (ICF, 2016), you can create an ICF CS questionnaire for selected nosological forms. Also, this site has a guide to using the ICF BN, particularly to generating electronic ICF Based Documentation Form (Bickenbach, 2012). In concomitant diseases, the ICF CS for the underlying disease can be supplemented with categories from other ICF CS.

The ICF rehabilitation set contains 30 domains (Table 1).

The quantitative value of the determinant of the corresponding category of ICF domains is essential. Several generally accepted scales are used to assess the patient's health status for rehabilitation: modified Rankin scale, Ashworth scale, Rivermead mobility index, Barthel index, US National Institutes of Health stroke severity scale, Glasgow coma scale, Berg balance scale, House index, visual analog pain scale, and others. The advantage of most of these questionnaires and rankings is that they are validated; that is, metric characteristics are assessed. RAS analysis is often used for this purpose, which determines the test technology based on calculating the significance of the problem of approving the methodology and the level of expression of the measured value. This statistical method ensures the transformation of the results

Table 1. Domains of the ICF rehabilitation set

1	b130	Energy and drive functions
2	b134	Sleep functions
3	b152	Emotional functions
4	b280	Sensation of pain
5	b455	Exercise tolerance functions
6	b620	Urination functions
7	b640	Sexual functions
8	b710	Mobility of joint functions
9	b730	Muscle power functions
10	d230	Carrying out daily routine
11	d240	Handling stress and other psychological demands
12	d410	Changing a body position
13	d415	Maintaining a body position
14	d420	Transferring oneself
15	d450	Walking
16	d455	Moving around
17	d465	Moving around using equipment
18	d470	Using transportation
19	d510	Washing oneself
20	d520	Caring for body parts
21	d530	Toileting
22	d540	Dressing
23	d550	Eating
24	d570	Looking after one`s health
25	d640	Doing housework
26	d660	Assisting others
27	d710	Basic interpersonal interactions
28	d770	Intimate relationships
29	d850	Remunerative employment
30	d920	Recreation and leisure

Table 2. GAS scale

Level	Description of the scale for achieving goals
- 2	Initial preprocessing (initial level)
- 1	Progress towards the goal without achieving the goal
0	Expected level after treatment
+ 1	Better result than expected
+ 2	A much better result than expected

obtained during the testing process into an interval scale – the logit scale (Boone et al., 2014).

It should be noted that specific difficulties may arise when choosing a tool for assessing the severity of violations. Most internationally generally accepted methods correlated with the ICF are listed in the database of rehabilitation measures (Rehabilitation Measures Database, 2023).

The CS and scoring of each ICF domain category form the basis for creating a definite ICF profile. The rehabilitation potential dynamics are assessed based on the next stage of rehabilitation measures.

Rehabilitation goals are established, coordinating the actions of multidisciplinary team members to guide rehabilitation interventions towards a specif-

ic outcome. Goals can also be used to evaluate the success of rehabilitation interventions (Bakaliuk et al., 2021).

The general method of goal setting comes from SMART goals. It is generally accepted that the abbreviation means S – specific; M – measurable; A – achievable; R – realistic; T – timed. There is also the Turner-Stokes Goal Attainment Scaling (GAS), a system based on rehabilitation research (Turner-Stokes, 2009). GAS is a “mathematical method for quantifying goal achievement.” The GAS describes the process of goal setting and uses a five-point scale to measure whether a goal has been achieved (Table 2). GAS goals can be selected from all of the ICF domains (activity, participation, quality of life, and environmental factors).

It should be noted that both clinical and instrumental assessment methods (including complex and special ones) can be used to determine the health status of patients with particular disorders. In all cases, the obtained patient examination data are converted into scores according to the given scale. The form for assessing the condition of rehabilitators (ICF CHECKLIST Version 2.1a, Clinician Form) is presented on the WHO website (WHO, 2003).

Most commonly accepted scales do not overlap with ICF domains due to differences in health subject matter and dimensionality. In this case, subscales can be used. If the questionnaires are not divided into 5 ranges, but are quantified in points, quantitative values can be determined by the ICF recommendations – from 0 to 4.

Savchenko V.M. and co-authors (Savchenko et al, 2021) proposed a system for assessing the third-level domains of the rehabilitation set, which includes:

- name of the assessment tool (research method, scales, tests);
- name of the parameter (indicator, characteristic) used for this;
- qualitative description or quantitative characteristics of each gradation of a five-level scale of parameter changes.

The system is presented in the form of a table, which contains codes of the 2nd and 3rd levels of domains, a description of the subject characteristics of the domain, the name of the assessment

tool, the name of the parameter indicating the unit of measurement, the value or description of the scale gradations according to the determinant from 0 to 4.

As for quantitative characteristics, in particular, instrumental, functional and laboratory, they can be reduced to a five-level scale. Two examples of the use of gradation (scale) of ICF domain determinants regarding quantitative characteristics are given in Table. 3.

Regarding the quantitative assessment of the effectiveness (results) of rehabilitation (ER), you can use the indicator calculated by formula (1). In this case, clinical data are used – $K(1+2+...n)$, laboratory data – $L(1+2+...n)$ and functional data – $F(1+2+...n)$. These data can be assessed using scores from 0 to 4 (formalization of scores is similar to the ICF domain qualifiers). Then, the quantitative assessment of the results of rehabilitation is the sum of points divided by the number of characteristics taken into account n:

$$ER = \frac{K+L+F}{n} \quad (1)$$

Another way of expressing the effectiveness of rehabilitation (ER) reflects the change in the rehabilitation status of the rehabilitator during the course of rehabilitation, calculated using the formula:

$$ER = (RP2 - RP1 / MRP \cdot 100) (\%), \quad (2)$$

Where:

RP1 – sum of points before rehabilitation;

Table 3. Examples of the use of gradation (scale) of ICF domain determinants regarding quantitative characteristics

Example	Section ICF	Domain (second level)	Domain (fourth level)	Indicator	Value parameter	Value of the domain Identifier parameter, points
1	b4 functions of the blood system and the immune system	b430 functions of the blood system	b4301 oxygen transport functions of blood	hemoglobin content (g/l)	120-140	0
					119-91	1
					81-90	2
					71-80	3
					< 70	4
2	b5 functions of digestive, endocrine systems and metabolism	b530 body weight maintenance functions	–	body mass index (BMI) (kg/cm ²)	normal body weight 18.99<BMI<24.99	0
					excess body weight 24.99<BMI<30.00	1
					first degree obesity 26.99<BMI<35.00 or a small mass deficit 16.99<BMI<19.00	2
					obesity II degree 34.99<BMI<40.00 or moderate weight loss 14.99<BMI<17.00	3
					III degree obesity BMI>40.00 or cachexia BMI<15.00	4

RP2 – sum of points after rehabilitation;
MRP – maximum rehabilitation potential.

As noted above, assessment of the effectiveness of rehabilitation should be carried out at different levels of the health care system.

At the same time, at the individual level, an assessment of the effectiveness of rehabilitation can also be carried out from the patient's point of view as a consumer of rehabilitation services. The qualimetry method and a set of multivariate linear regression equations are better suited for this.

To comprehensively characterize quality in qualimetry, a multi-level structure of indicators is used, for example, the "quality tree" or the "Ishikawa diagram". Indicators can be developed using the expert method. In this case, the qualitative and quantitative composition of the expert group should be taken into account; in particular, the work experience of experts in the field of rehabilitation, level of education, etc., should be taken into account.

When experts establish weight coefficients for specific indicators, it is necessary to decide on the concordance coefficient to determine the degree of consistency of expert assessments (Shkonda, Kalyanov, 2010). If all the indicators are significant, as in our case, that is, the ranking method is not suitable, then the formula for the complex indicator should take the form of a weighted arithmetic average.

Figure 2 shows the efficiency "tree" we developed (presented in the form of a "quality tree") of rehabilitation from the point of view of the rehabilitator (consumer of rehabilitation services). As shown in Fig. 2, at the first level, there are two indicators: the quality of rehabilitation services and satisfaction with the rehabilitation results. At the second

level, there are ten characteristics of rehabilitation effectiveness.

For qualimetric assessment, single indicator (E1-E10) must have a quantitative value. For this purpose, we used a qualimetric rating scale from 0 to 3 points, where 0 is inconsistency/non-compliance, 1 – is minimal compliance / partial compliance, 2 – is partial compliance, and 3 – is complete execution.

For clarity of presentation of the complex indicator, this indicator was normalized as a percentage of the sample, which has a property value of 100%. For this purpose, a dimension recalculation factor of 100/3 was used. Then, the formula for a comprehensive assessment of the effectiveness of sanatorium-resort rehabilitation from the patient's point of view is as follows:

$$Erp = (\sum E_i) \cdot 100/3, [\%], \quad (3)$$

where Erp is a comprehensive indicator of the effectiveness of rehabilitation from the patient's point of view; E_i – i – single efficiency indicator.

A scale should be used to formalize a comprehensive indicator of the effectiveness of sanatorium-resort rehabilitation. Harrington's psychophysical desirability scale and its numerical intervals are best suited for this case (Trautmann, Weihs, 2006); therefore, for making decisions on assessing the efficacy of sanatorium-resort rehabilitation from the patient's point of view, the following criteria are proposed: <20% – inferior effectiveness; (20 – <37)% – moderate; (37 – <63)% – good; (63 – <80)% – very good; (80 – 100)% – excellent.

As for assessing the effectiveness of rehabilitation measures from the point of view of the management of the institution providing rehabilitation ser-

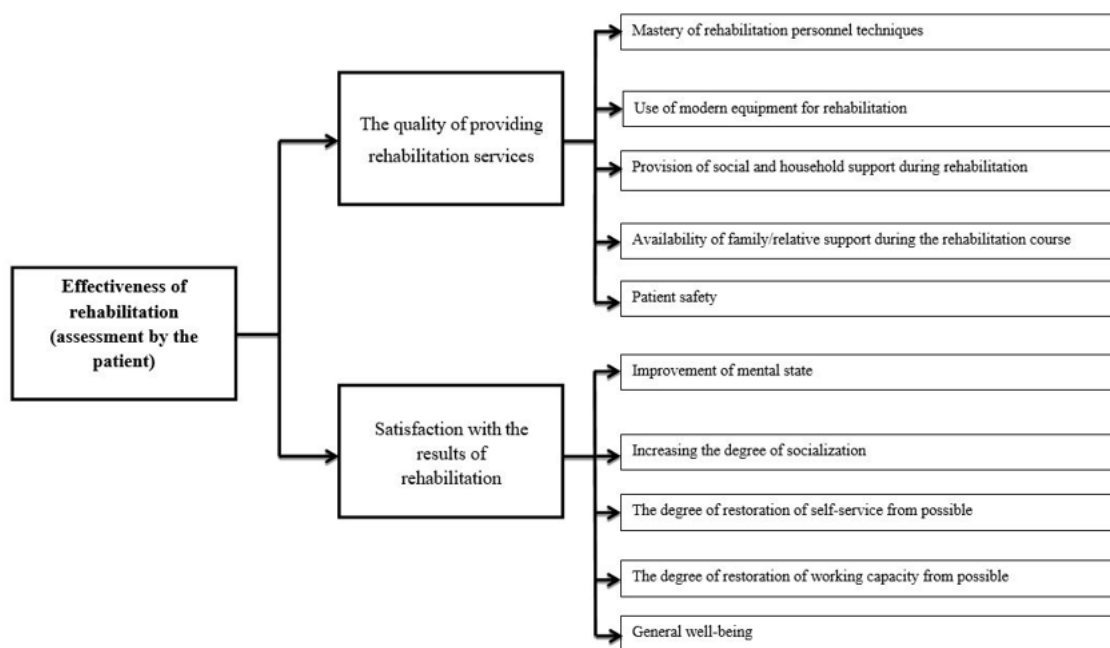


Figure 2. "Tree" of rehabilitation efficiency from the patient's point of view.

vices, the "tree" of rehabilitation effectiveness may look like this (Fig. 3).

As seen in Fig. 3, in this case there is one level of indicators (there are also ten of them). These performance indicators can be used as quality indicators when assessing an establishment's performance on the performance of its quality management systems.

According to our experts, the "tree" of rehabilitation effectiveness at the level or state should look like this (Fig. 4).

Conclusions

Today, in the problem of providing medical and rehabilitation services, in particular in rehabilitation centers/departments/institutions, including those created based on a sanatorium-resort institution, the factor of economic profitability comes first. It cannot be achieved without the introduction of new, highly effective technologies, and without monitoring the therapeutic and preventive value of these technologies. The high cost of equipment, differences in the material and technical base, as well as the need to individualize programs dictate the

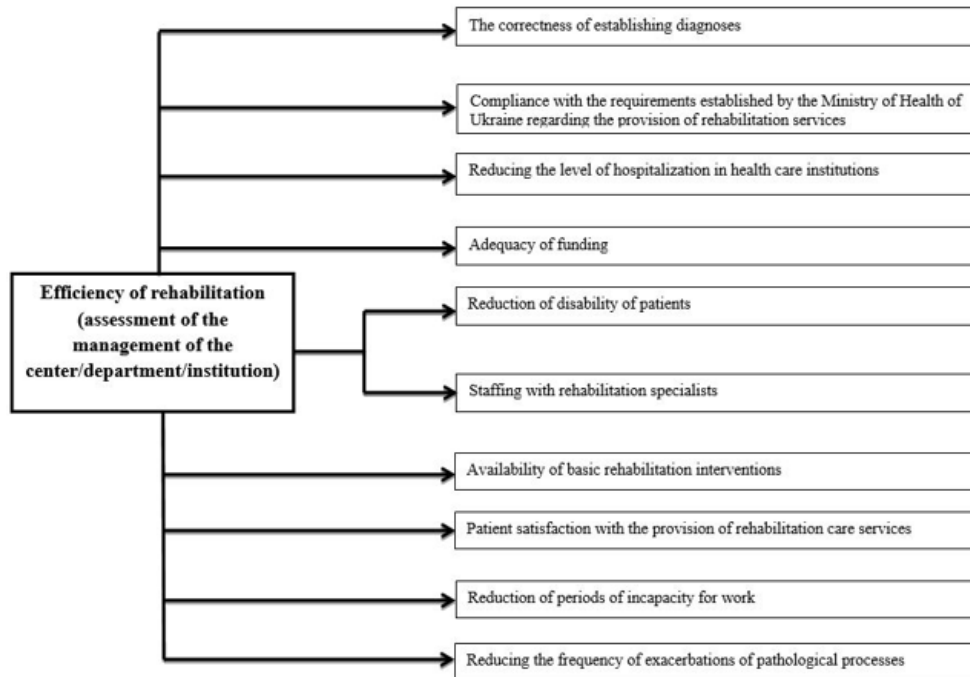


Figure 3. "Tree" of rehabilitation effectiveness from the point of view of the management of the institution providing rehabilitation services.

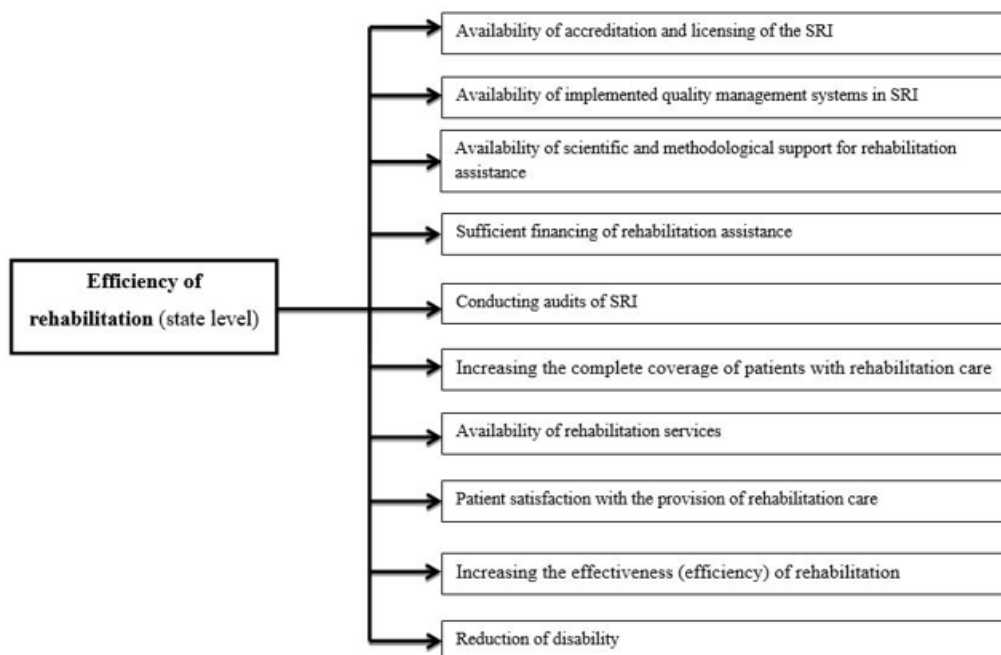


Figure 4. "Tree" of rehabilitation efficiency (state level).

need to create and implement accessible and informative means of monitoring their effectiveness. Data on the effectiveness of rehabilitation have not only medical but also socio-economic significance. To date, there are no unified approaches to assessing the effectiveness of rehabilitation services.

We propose using the expert method, indicators of the effectiveness of rehabilitation at different levels (individual, rehabilitation center/department/institution or state). These indicators are presented in the form of a "quality tree". To quantitatively assess the effectiveness of rehabilitation, it is proposed to use a qualimetric method, in which individual performance indicators are assessed using points, and the complex indicator is the arithmetic average of indicators.

The combination of principles for assessing the effectiveness of individual rehabilitation of patients

based on the ICF and the qualimetric method of its quantitative assessment allows us to evaluate the effectiveness of the rehabilitation program, determine the rehabilitation potential, the prognosis for the restoration of impaired functions and achieve short-term and long-term goals.

Author's contribution

Conceptualization, KB; methodology, TB; investigation, AK; writing - review and editing, RI; visualization, RI; supervision, KB and TB; project administration, KB. All authors have read and agreed with the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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