



## THE COST-UTILITY ECONOMIC ANALYSIS OF THE EFFICIENCY OF MEDICAL REHABILITATION IN LOCOMOTOR DISEASES

### Anișoara CIMIL

Chair of Social Medicine and Health Management "Nicolae Testemitanu", State University of Medicine and Pharmacy "Nicolae Testemitanu", Chisinau, Republic of Moldova.

#### Abstract

The circumstances of the disability ascendancy related to the locomotor nosologists, currently ranked on the eighth place in the world, imply the performance of the management strategies of rehabilitation assistance, in order to diminish their impact on society. In the observational, retrospectral study, we aimed to estimate the determinant factors of the efficiency of rehabilitation assistance by estimating the dynamics of the locomotor functional parameters, performed for the beneficiaries of the treatment diagnosed with dangling and post-traumatic affections of the large joints; further, the dynamics of the functional parameters were statistically quantified through the prism of the "quality of life" index, through the following methods: calculus of the t-Student intensive indicator, standard error calculus, determination of the statistic conclusion (processed through variables, correlation, description and discrimination analysis) offering predictive results in view of the effectiveness of medical rehabilitation assistance. From the inability to evaluate in monetary terms the value of human life and the effectiveness of the carried out treatment, the cost-utility analysis (through QALY-quality adjusted life year, of international relevance) was approached by comparing the values of two utilities, prioritizing the more advantageous curative act from the medical-social point of view. The cost-utility economic analysis applied in the context of the estimated treatment, suggests on the priority of the treatment, which corresponds to the maximum value of the QALY scale, quantified with the utility 1.0 (according to the principle of continuity of treatment carried out at the stationary and outpatient stages).

#### Key words:

economic analysis, cost-utility, management, rehabilitation assistance, quality of life index (QOL), quality adjusted life year (QALY), degenerative affections, large joints

#### JEL Codes:

A19  
I31  
I39  
M19

### 1. INTRODUCTION

The sanitary management aims to optimize the value of investment in healthcare through making more performant the services, rationalizing them according to the resulting efficiency, defining the quality of the medical rehabilitation assistance, while imposing the safety of the cure and the efficacy of the curative act. Financial incapacity to ensure a fair service in relation to population demand, as well as the perpetuation of the various innovative curative ways, justify the application of

the economic analysis, which would reflect the consequences capitalized through monetary or non-monetary units. The lack of the notional prototype, which would define the effectiveness of treatment and the evasive application of economic analysis in the health field at the national level, reduces the potential for decaying of these data, including in the field of rehabilitation assistance applied in the area of orthopedics; the use of an unique support to quantify them would facilitate the comparison of different data that aim at monitoring the

performances of the functionality of the treatment beneficiaries, taking into account the fundamental criterion on interpretation of the results of the treatment by the scholars in the field – appreciation of the quality of life. Estimation of the quality of life (QOL) parameters in this study assumes a more advanced susceptibility in relation to the most developed clinical tools of evaluation of the treatment results, offering the possibility to rationalize and recover according to individual particularities of the disease [2].

## **2. DEGREE OF SCIENTIFIC APPROACH TO THE TOPIC AND ITS PRESENTATION IN THE SCIENTIFIC LITERATURE**

Various scientific studies present the importance of the QOL parameters in order to assess the effectiveness of the treatment, focusing on social independence and health condition, but the global QOL index assessment is not sufficiently eloquent in the absence of the study of certain nosology diagnosed in certain patients [1]. Various studies present eligible data with a statistical significance in favour of QOL improvement, in the context of locomotor diseases related to treatment, results which did not have a statistical correlation with the dynamics of the operating parameters [4].

## **3. DATA SOURCES AND METHODS USED**

The efficacy of medical rehabilitation of curative modalities by applying the economic analysis was estimated in the descriptive retrospective observational study, carried out by the

Functional Rehabilitation in Traumatology and Orthopedics Section of the MSPI CHTO during the period 2012-2016. Taking into account the objectives of the study, and in order to carry out the methodology of research, the following stages have been identified: calculus and random selection of the sample, extrapolation of the clinical and paraclinical data from the medical data sheet and the modeling of the diversified study surveys according to the topographic nosology and the change in the patient's quality of life in relation to the treatment.. The statistical process of the clinical-paraclinical data extracted from 373 medical records of the treatment recipients with the maximum nosologic incidence recorded in the section: spondilodiscarthrosis – 112 (30.0%), gonarthrosis – 108 (29.0%), coxarthrosis – 75 (20, 1%) and omarthrosis – 78 (20.9%).

The clinical and paraclinical material extracted retrospectively from reports and medical records was suggestive in determining the value of the physical-kinetic treatment efficacy, evaluating the following parameters: intensity and duration of pain, estimation of the articulated balance appreciated as goniometric (hip, knee, shoulder, vertebral column); muscle balance, strength / resistance and degree of hypotrophy of the periarticular muscles; the degree of shortening of the members and the deviation of their axes; walking characteristics and modalities of support, as well as the intension of claudication, etc. The dynamics of clinical-paraclinical results, expressed by functional parameters in relation to the treatment, were quantified in terms of the quality of the

patients' life, applying the QOL scale of international standard, promoted in the recovery, physical medicine and balneology and physiokinetotherapy clinics from Romania (the Romanian language version was validated by the studies of Prof. Mihaescu Anca-Sanda) [7]. The variables used to characterize the quality of life were the following: self-care, acceptance of social status, physical and mental health, life safety, hopes for the future, leisure activities, participation in public activities, access to education summed up to a common score of 40 points, each variable being assigned a score on a range of 1 to 5 points (hierarchically, in favourable ascendance). The effectiveness of rehabilitation assistance was assessed qualitatively and quantitatively by analyzing the dynamics of the functional parameters at the stage of initiation and completion of the treatment by the method of statistical evaluation of the results: calculus of the t-Student intensive indicator, standard error calculus, determination of the statistic conclusion, these data being processed through variables, correlation, description and discrimination analysis; the statistical dependence among qualitative parameters has been presented through contingency tables, by using the "X<sup>2</sup>" Criterion to verify the independence hypothesis of lines and columns. Testing the dynamics of the parameters from the group has been made through T-criterion test of coherent selections. Testing the equality of three and more environments has been made through dispensational analysis (the ANOVA procedure).

Further, we proposed to analyze to what extent the quality of life of the beneficiaries of the treatment has changed, by analyzing the variables that characterize the quality of life at the stage when the rehabilitation assistance is completed; in this respect, we used the comparison of the quality of life variables at the initiation and completion stages of the treatment process, using the dependence of the variables of the sample from the two questionnaire moments, by means of the correlation indicators and the statistical T-test Student test used for the verification the difference between environments that come from dependent samples (exploring the data of all patients, differentiated by groups according to topographic nosology).

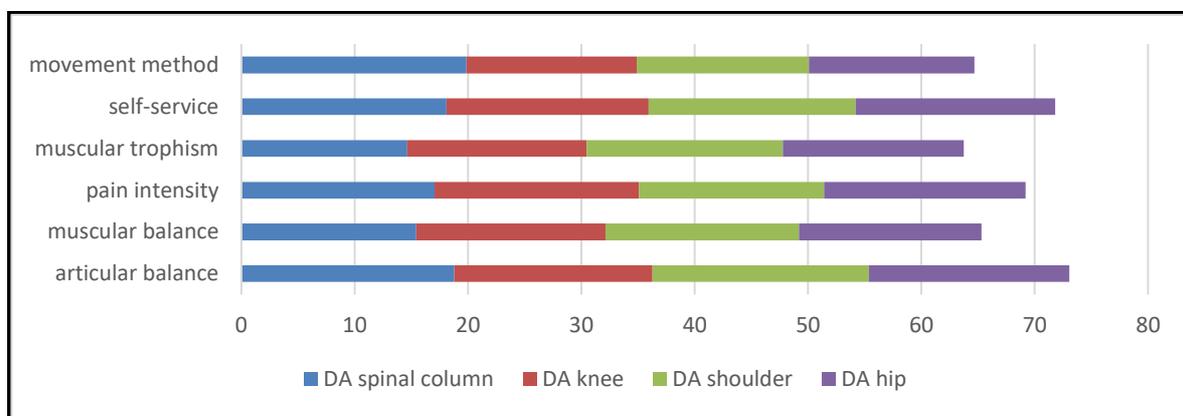
For the achievement of the proposed objectives, certain categories of statistical indicators were considered, taking into account the quality of their estimators (they come from a selection collectivity), and the activities for checking the significance of the determined estimators have been associated. Among the indicators involved in the analyzes were the following: the simple correlation coefficient between variables (Pearson), quantifying the intensity of the linear linkage between two variables; in our case the correlated variables were represented by the average score accumulated by the variables representing the quality of life at the two moments of the investigation (at initiation and completion of the act of treatment). Effectiveness of the recovery was relevant by estimating the dynamics of the functional parameters analyzed through the quantification of the quality of life indices assessed at the start and

completion stages of the treatment, while the level of efficiency of the medical rehabilitation assistance was equivalent with the degree of reestablishment of the rehabilitation potential.

#### 4. RESULTS OF OWN RESEARCH AND DISCUSSIONS

The comparison of variables that highlight the degree of change in the quality of life, recorded for

the beneficiaries of the treatment included in the study at the two questionnaire moments (at the initiation and finalization of the treatment), reports the difference of the results in terms of the quality of life dynamics exhibited by the most representative functional parameters on a wide range, reported to topographic nosology.



Functional parameters	DA spinal column	DA knee	DA shoulder	DA hip
articular balance	18,78	17,51	19,08	17,68
muscular balance	15,42	16,72	17,07	16,11
pain intensity	17,06	18,03	16,32	17,79
muscular trophism	14,64	15,84	17,29	15,98
self-service	18,09	17,86	18,24	17,61
movement method	19,87	15,02	15,2	14,6

Figure 1. Dynamics of the functional parameters quantified through the quality of life dynamics

Source: made by the author.

In Figure 1, the results of the variables dynamics (functional parameters) that characterize the quality of life of patients grouped in the four samples are deciphered, depending on the topographic nosology in the two questionnaire

moments. The sum value of the QOL index is differentiated according to topographic nosologies, being estimated with maximum efficiency in the context of shoulder degeneration treatment, having the QOL index  $\leq 34$  points and improvement in

decayed dynamics by  $15 \leq$  points; the sum value of the QOL index in the context of the knee joint degeneration treatment corresponds to  $32 \leq$  points, with the QOL dynamic  $9 \leq$  points; the sum of the QOL index in the context of the hip joint degeneration treatment corresponds to  $30 \leq$ , having a QOL dynamic of  $7 \leq$  points; the sum of the QOL index in the context of vertebral degeneration treatment is  $25 \leq$  points, with a QOL dynamic of  $10 \leq$  points.

The degree of ascent with the maximum statistical difference of QOL indices was estimated for the treatment beneficiaries who continued the recovery from the stationary stage at the outpatient stage, respecting the principle of continuity and staging of the treatment (the continuous rehabilitation was performed from the stationary stage to the outpatient one). The validation of the effectiveness of the recovery act differs according to the topographic nosology, while the highest efficacy outcome being explained by causative factors of major importance: the continuity of the act of recovery from the stationary stage to the outpatient stage. Thus, the dynamic quantification of functional parameters through the change of the QOL index, changes the statistical results distributed in two selections: maximum and average treatment efficacy. The economic analysis in the field of medicine is related to the lack of accuracy of the economic assessments in the form of monetary estimation. The sustainability of the benchmarking criteria applied in the sanitary services depends on the scrupulous analysis of financial resources, focusing on costs and consistency, which derive

from the comparison of their potentials. Decisional unpredictability due to the results that are difficult to be assessed in monetary terms, can be presented by the cost-utility analysis (QALY, which expresses the lifetime adjusted to the quality of life) which is a tool for carrying out financial analysis through which there can be compared the consequences of applying different treatment programs, thus identifying the intervention areas that have priority for the quality of the patient's life. If the comparative estimation of different treatment programs is restricted by the difficult methodology to assign a monetary value in the medical field, being applied the utility approach, by attributing some numerated values to the obtained results that reflect the patient's perception in terms of the CV, then selection of the optimum strategy in order to reach maximum utility is determined by the results that reflect the perfecting of the quality of life, and the maximization of the cost of the curative interventions is imperative from the ethical point of view, having in view the valorisation of the CV index [3, 5]. Thus, the application of the cost-utility economic analysis is ethically justified in recommending to implement the optimal variant of the investment options, able to provide maximum utility for the improvement of the health condition.

In the present study, the application of cost-utility analysis is more preferable than of other methods, due to the compatibility of numerated representativeness of the patient's subjective perception expressed by the dimension of the quality of life, being realized by summing up the product of the functional parameters obtained on

the scale of the results interpretation on a range of values between 0 and 1 (the modified perception of the patients related to the treatment function, by assigning numerated values to the results according to QALY (Quality Adjusted Life Years) index): the usefulness assigned with 1 point corresponds to the results of perfect quality of life, and the usefulness assigned with 0 points – describes the efficiency results with the most insignificant values of the quality of life). Although the utility has been estimated as an exact numeric parameter, in medical practice it is defined taking into account the subjective perceptions of the patient, reported to the quantifiable value of the QOL index.

In the carried out study, statistical data related to the dynamics of the functional parameters have been estimated through the QOL scale, thus the efficiency of the recovery treatment has been interpreted through the quality of life depending on the individual perception of individual patients, quantified and summarized in a total score of 40 points, that imply the perfect quality of life. In terms of carrying out the cost-utility analysis we proposed to analyze the degree of ascension of the perception on the quality of life of patients from the two groups, differentiated according to the way of treatment: in stationary conditions with / without continuity at the outpatient stage.

Taking into account the different value of the treatment results determined by the recovery method, we applied a comparison tool between the curative options used in the economic analysis process to identify and assess the most cost-effective results. The results decanted in the study

and conformed to the requirements of achieving this goal, allow adjusting the mathematical model exhibited underlying by the formula (1):

$$\text{cost-utility analysis} = \frac{\text{Cost A} - \text{Cost B}}{\text{QALY A} - \text{QALY B}}$$

where, Cost – summing up of costs; QALY A, B – utility of medical interventions A and B.

The modalities of curative intervention and the QOL indicative value were estimated in two dimensions: in the form of monetary value and the subjective perception numeration of QOL, values that present the impact of the quality of life index in relation to the modality of the treatment and its cost. According to Torrance's author calculus [1], the value of the QOL index quantifies the medical-social effect through the utility coefficient represented below by formula (2):

$$U = 1642 \times (mP \times mR \times mS \times mH) - 0,42,$$

where U represents utility (utility index results from summing up the multifactorial factors of the utility), while mP, mR, mS, mH – multiplicative factors of utility (MFU) reported to the characteristics of functionality: P - physical, R - self-service, S - social, H – global health condition.

(P) – mobility and physical independence (P), measured on a range of 0.52 to 1, express the ability to move around in different environments with / or lack of physical limitations: in lifting, walking, running, flexing;

(R) – the helpless self-service ability, quantified on a range of 0.50 to 1, expresses the absence / presence of limitations in the context of socialization;

(S) – the socio-cognitive function: social and emotional, quantified on a range of 0.77 to 1,

expresses the degree of aggression / relaxation and the level of connection with persons from the entourage;

(H) – the health condition expressed by the absence / presence of deficiencies / physical defects, measured on a range of 0.74 to 1.

During the study, two different strategies were applied for the costs and the way of the treatment: A – performing the treatment at the stationary stage with the continuation of the outpatient stage, the monetary cost summarizing 8500 lei, the utility resulting in:

$$U(P1,R1,S1,H1)=1,42 \times (1,00 \times 1,00 \times 1,00 \times 1,00) -0,42=1,00$$

Where, B – carrying out treatment only in stationary conditions, monetary summary – 6500 lei, utility:

$$U(P4,R3,S4,H1) =1,42 \times (0,80 \times 0,77 \times 0,77 \times 1,00) =0,67$$

Upon completion of the treatment, there was a clinical discrepancy in view of these curative modalities, demonstrating significant efficacy in the field of quality of life in favour of more expensive curative ways. In this case, the value of QALY utility is higher at a cost insignificantly high for this intervention strategy, being preferable, however, for ethical considerations. Considering the advantage of QALY dynamics quantified by 1.0 points expressed by the intact health condition estimated in monetary values with a value higher with only 2000 lei, continuing the treatment at the ambulatory stage after the completion of the cure at the stationary stage. Comparing the numerical values of two utilities allows the prediction in the conclusion

of the more favourable curative solution, justifying the quantification of the quality of live indicators in order to estimate the modalities of the recovery. The cost of reaching 1.0 QALY, which corresponds to the intact health condition in the diagnosis of large joints degeneration, corresponds to 8500 lei.

## 5. CONCLUSIONS

The cost-utility approach in the health domain is enhanced by the ability to analyze the results expressed in terms of effectiveness by using quantitative and qualitative major information in the absence of the ability to assess the value of human life in monetary terms, thus favouring its efficiency on various levels: medical, social, economic.

This type of analysis represent a useful tool for substantiating decisions and management of limited resources in the health system by the economists specialized in the field of public health, justifying the quantification of the quality of life indicators for the purpose of estimating the way of recovery.

## 6. BIBLIOGRAPHY:

1. BURCKHARD, Carol S., ANDERSON, Kathryn L. The Quality of Life Scale (QOLS): Reliability, Validity and Utilization. In: Health Qual Life Outcomes. 2003. [Accesat 13.11.2018]. Disponibil: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC269997/>
2. DAN, M., BOCA, I., COJOCARU, E. Beneficiile programului complex de reabilitare funcțională asupra calității vieții persoanelor cu artroză. In:

- Revista română de kinetoterapie. 2014, vol. 20, Issue 34, pp. 102-109. ISSN 1224-6220.
3. FORTIN, M., HUDON, C. et al. Comparative assessment of three different indices of multimorbidity for studies on health-related quality of life. In: Health Qual Life Outcomes, 2005, november. [Accesat 09.11.2018]. Disponibil: <https://www.ncbi.nlm.nih.gov/pubmed/16305743>
  4. KOBELT, G., EBERHARDH, K. et al. Economic consequences of the progression of rheumatoid arthritis in Sweden. In: Arthritis and Rheumatism. 1999, vol. 42 (2), pp. 347-356. ISSN 2326-5191.
  5. PRITCHARD, Clive, SCULPHER, Mark. Productivity Costs: Principles and Practice in Economic Evaluation. London: Office of Health Economics, 2000. 105 p. ISBN 1 899040 765.
  6. TORRANCE, G.W. Utility measurement in healthcare: the things I never got to. In: Pharmacoeconomics. 2006, vol. 24 (11), pp. 1069-1078. [Accesat 13.11.2018]. Disponibil: <https://www.ncbi.nlm.nih.gov/pubmed/17067192>
  7. ONOSE, Gelu. Recuperare, Medicină Fizică și Balneoclimatologie. Vol. I. București: Ed. Academiei Române, 2008. 428 p. ISBN 9789733906353.