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Medical experts aspects of the efficiency of measures for rehabilitation of disabled respiratory diseases

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In ratifying the 2011 Convention on the Rights of Disabled and the Optional Protocol (the Law of Ukraine dated 16 December 2009, Number 1767 – VI), Ukraine undertook the legal obligation to ensure its full implementation, display correctly the provisions of documents in national law, the social and economic development and the state budget, improve social protection of disabled persons aimed at building «equal opportunities» for disabled people in different spheres of life, including rehabilitation [1].

The issue of rehabilitation facilities and items closely associated with the concept of the nature of rehabilitation, which can be represented as a process of influence on the patient and as the system measures and a result [2].

The task for optimizing and establishing more effective individual elements of the system as a whole requires a comprehensive approach to the issues of rehabilitation.

The implementation of the social policy in the rehabilitation of disabled persons by the means of individual rehabilitation program (IRP), the main function of which is to provide the comprehensive rehabilitation process specific disabilities. When developing IRP the doctors and rehabilitators of the medical and social expert commission should focus on achieving a specific end result [3].

Our analysis of the effectiveness of medical and social rehabilitation of disabled persons with respiratory diseases showed that fully restored the livelihoods of disability groups to relieve 3,02 %, partly – 17.31 % held by rehabilitation measures have failed and disability remained at the previous 65.73 %, worse health and increased the degree of disability at 1.85 %, data is not presented in 12.09 % of cases. During 3 years of follow dropped 39.4 % rate of those completely restored livelihoods, 42.1 % increased rate of those partially restored livelihoods, decreased by 5.6 % inefficiency of the rehabilitation, 54.1 % higher ill health and the transition to a severe disability group [4]. So results of rehabilitation are not very optimistic, which contribute to the accumulation in the community of persons with special needs have led us to construct a mathematical model that would give the answer to the question which measures of the medical and social rehabilitation are most favorable to achieve the final result.

In literature there are many papers examining the role of rehabilitation programs to restore social capacity pulmonary patients and the disabled, but they mainly deal medical rehabilitation [5–7]. Our task was to assess the quality of comprehensive individual rehabilitation program pulmonary disabled account.

The aim of the study: To calculate prognostically meaningful measures of the medical and social rehabilitation of disabled persons with respiratory diseases that affect on the quality of rehabilitation.

Materials and methods

We analyzed 15,434 IRP disabled pathology of respiratory (code J 00–J 99) developed by the medical and social expert commission in 22 regions of Ukraine. The young persons include 35.40 %, average – 59.04 %, old – 5.56 %, the disabled group I – 1.31 %, the second – 19.58 %, third – 79.11 %.

The monitoring for 3 years (2012–2014). Based on these data the mathematical modeling was conducted to identify priority actions for medical and social rehabilitation,

which will enhance the effectiveness of rehabilitation of the disabled.

The mumeric variation material was subjected to statistical analysis using the software package Maple 15. In order to identify the priority indicators and create predictive models performed multivariate linear discriminant analysis of Fisher.

The summary model of the multifactor regression is as follows:

$У = a_0 + a_1x_1 + a_2\times2 + ... + a_{48}x_{48} + a_{49}x_{49.}$

where y – indicators of innovation (rehabilitation); x_1, x_2, x_3,..., x_{48}, x_{49} – factors affecting output indicators; a_0 – permanent indicator that is independent of the influence of factors; a_1, a_2, a_3,..., a_{48}, a_{49} – multifactor regression coefficients.

The study was conducted on 49 factors – species rehabilitation services, formulated in the form of a valid IRP.

The parameters were evaluated by calculating the values of Wilks' Lambda, analyzed the resulting system of equations qualifications and adequacy of the model. As the endpoint we used the indicator of «restoring life» disabled for the time period of 1 year from the time of IRP. Ranking score «renewal of life» consistent form IRP: «Disability fully restored», «Disability partially restored», «disability is not restored», «disability increased».

Methods: statistical, analytical, objective analysis of the present IRP, mathematical modeling using multivariate linear discriminant analysis Fisher [8].

The results

The first phase of the study defined the evaluation vector regression coefficients and linear regression model created on the recovery rate of disabled life with respiratory diseases. According to the method of least squares conducted vectors determining factors in the regression estimates:

$$Y(x)=\begin{pmatrix}\begin{bmatrix}0\\0.56\\0.27\\0.02\\0.38\\0.02\\0.02\\0.87\\0.21\\0.09\end{bmatrix} & \begin{bmatrix}0.06\\0\\-0.01\\0\\0.36\\0.04\\0.13\\0.25\\0.27\\0.15\end{bmatrix} & \begin{bmatrix}-0.01\\-0.01\\0.13\\-0.02\\0.31\\0.76\\0.51\\-0.05\\-0.01\\0.03\end{bmatrix} & \begin{bmatrix}0\\0\\0.01\\0.2\\0\\0.02\\0\\0.01\\0\\0\end{bmatrix} & \begin{bmatrix}0\\0\\0\\0\\0\\0\\0\\0\\0.01\\0\end{bmatrix}\end{pmatrix}$$

We should notice that the direction vector regression coefficients for most indicators was positive, that is among the 61 evaluated factors only 6 parameters predicted a negative impact on «the restoration of life» (Y (x)). Accordingly, the linear regression model for disability due to respiratory pathology had form:

$$\begin{aligned}Y(x) &= 0+0.56x_1+0.27x_2+0.02x_3+0.38x_4+0.02x_5+0.02x_6+0.87x_7+0.21x_8+0.09x_9+\\ &+0.06x_{10}+0x_{11}-0.01x_{12}+0x_{13}+0.36x_{14}+0.04x_{15}+0.13x_{16}+0.25x_{17}+0.27x_{18}+0.15x_{19}-\\ &-0.01x_{20}-0.01x_{21}+0.13x_{22}-0.02x_{23}+0.31x_{24}+0.76x_{25}+0.51x_{26}-0.05x_{27}-0.01x_{28}+0.03x_{29}+\\ &+0x_{30}+0x_{31}+0.01x_{32}+0.2x_{33}+0x_{34}+0.02x_{35}+0x_{36}+0.01x_{37}+0x_{38}+0x_{39}+\\ &+0x_{40}+0x_{41}+0x_{42}+0x_{43}+0x_{44}+0x_{45}+0x_{46}+0x_{47}+0.01x_{48}+0x_{49}\end{aligned}$$

• Medical rehabilitation: x_1 – replacement therapy, x_2 – preventive measures, x_3 – reconstructive surgery, x_4 – spa treatment x_5 – psychiatric help, x_6 – hearing aid, x_7 – medical observation.

• Psycho-pedagogical rehabilitation: x_8 – counseling, x_9 – psyhopedagogical diagnosis, x_{10} – psychological and pedagogical correction, x_{11} – educational services, x_{12} – collective form of training, including the integrated and inclusive education, x_{13} – individual form of training.

• Physical rehabilitation: x_{14} – counseling, x_{15} – ergotherapy, x_{16} – kinesotherapy, x_{17} – therapeutic massage, x_{18} – physiotherapy.

• Vocational rehabilitation: x_{19} – examination of potential professional abilities, x_{20} – professional orientation, x_{21} – professional selection, x_{22} – training, retraining and advanced training, x_{23} – vocational education.

• Labor rehabilitation: x_{24} – accessories and jobs on the basis of security and the special needs of disabled, x_{25} – rational employment (disabled renovation work for the same or a new profession), x_{26} – types of professions and specialties available for health.

• Athletic sports rehabilitation: x_{27} – skills training classes in physical education, x_{28} – recovery and rehabilitation camps of physical and sport rehabilitation of the disabled, x_{29} – studying and training classes in physical culture and sports, x_{30} – sports.

• Social rehabilitation and home: x_{31} – adaptation of furniture, installation of equipment to adapt premises, x_{32} – social nursing home, x_{33} – work therapy.

• Technical and other means of rehabilitation – 1. vehicles: x_{34} – wheel chair (stroller) different types, x_{35} – brooms, x_{36} – crutches, x_{37} – aids for walking.

• Special conditions for orientation, communication and information exchange: x_{38} – mobile phones for written communication, faxes and other means.

• Special conditions for self-service: x_{39} – additional household devices.

• Special care: x_{40} – toilet aids, x_{41} – aids for lifting, x_{42} – upholstered chairs with sanitary equipment.

• Special classes for education and employment: x_{43} – furniture special purpose.

• Prosthetic products: x_{44} – orthopedic products, x_{45} – orthopedic shoes, x_{46} – special clothing.

• Medical products: x_{47} – implants and other products in accordance with medical standards of health, x_{48} – hearing aids, x_{49} – prosthetic teeth, jaws.

According to the data, all methods of the rehabilitation of patients with disorders of the respiratory were such that they kept a positive effect on the final outcome of rehabilitation. However, it should be noted that the priority position to increase its «effectiveness» had «medical observation», «replacement therapy» and «spa treatment». In our view, these types of rehabilitation process for patients with diseases of the broncho-pulmonary systems can achieve control of the disease, both in terms of preventing recurrence of exacerbations and maintaining a respect komplaynsu basic treatment and maintenance of proper motivation lifestyle.

Similar, although less statistically significant, the data we obtained in terms of «physical rehabilitation». Thus, «physical rehabilitation counseling», «kinetic therapy», «ergotherapy», «medical massage» and «physiotherapy» – identified as prognostic factors «increase/restore Disability» in the disabled with respiratory disorders.

Among the measures «vocational rehabilitation» methods to «positive» influence attributed two of the five «assessment of potential professional abilities» and «training, retraining and advanced training». Conversely, the implementation of all phases of «vocational rehabilitation» predicts significantly improve or restore Disability disabled due to diseases of bronchopulmonary system.

The remaining factors were evaluated we had significant, although the model of these methods of rehabilitation were identified as prognostic tips. These include: Most measures «psychological and educational rehabilitation», «educational and training sessions with sports and sports rehabilitation», «social and nursing home» software «sticks» and «aids for walking».

Thus, our study allowed to identify the main prognostic significant characteristics of the «effectiveness» of rehabilitation, and yet reveal their features disabled in the pathology of the respiratory system. In particular, given the positive direction vector regression coefficients for the most indicators (90.2 %), and taking into account the relatively low value of most ratios (less than 1.0), and their differences are minimal, we can conclude that the impact of different types of rehabilitation the process of recovery or improvement of life in disabled people with disorders of the respiratory system is complex, multifactorial and relatively equivalent.

In the next stage of our research we conduct the determine the probable prognosis rehabilitation effectiveness of recommended measures in the regions (Table 1; Figure).

The interpretation of the data was performed by the statistical significance of a / v (x) where:

a) 7,000–10,000 chance of full recovery of life 62 %, 38 % partial;

b) 4000–7000 the probability of recovery of life 57 %, not 43 % recovery;

c) 0 –4,000 chance of not restoring Disability 52 % and 48 % deterioration.

According to the table 1 is now available on the structure of medical and social rehabilitation of disabled persons only 52 % of disabled predicts the likely «no recovery» and 48 % – an increase of Disability. These data predict or stability, or increase the severity of disability, which underlines the urgency of improving the existing system of rehabilitation of the disabled as a result of respiratory diseases.

In order to test the significance of the equation and its factors, the study of absolute and relative error of approximation – conducted a statistical analysis of the obtained regression (Table 2). For variance unbiased estimate, the following calculation:

Unbiased mistake E = U - U (x) = a - s * S

The average error of approximation:

$$A = \frac{\sum \left| \frac{\varepsilon}{Y} \right|}{n} 100\% = \frac{0,4072}{5} 100\% = 8,14\%$$

Evaluation of dispersion:

$$s_e^2 = \left(Y - X \cdot Y(x)\right)^T \cdot \left(Y - X \cdot Y(x)\right) = 73578,82.$$

Unbiased estimate of variance:

$$s^2 = \left| \frac{s_e^2}{n - m - 1} \right| = 1548,86$$

Evaluation standard deviation (standard error for the estimation Y):

$$S = \sqrt{s^2} = 39,36$$

The degree of common factors influence the outcome assessed by multiple correlation index between 0 and 1.

R is used to interpret the direction of communication. The denser the actual values yi located relative to the

Table 1

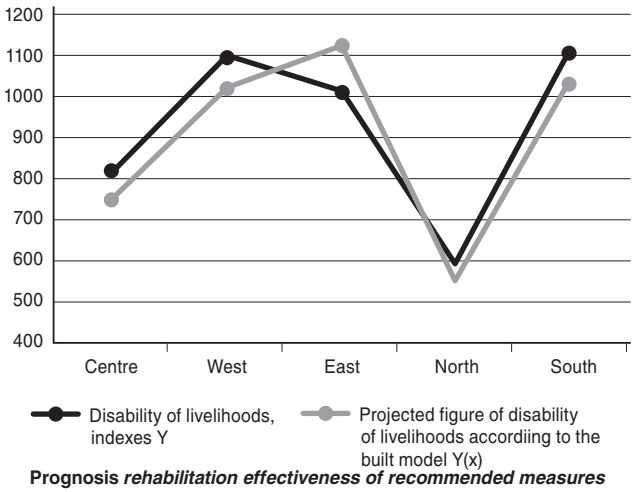
The prognosis of the restrictions of livelihoods

	Disability of livelihoods, indexes	Projected figure of disability of livelihoods according to the built model
	Y	Y(x)
Centre	751,95	826,32
West	1016,67	1093,19
East	564,50	600,54
North	1115,50	1014,09
South	1026,85	1107,18

Table 2

The calculation results are intermediate options to test F-Fisher criterion

Y	Y(x)	ε = Y – Y(x)	ε²	$(Y(x)-Y_{cp})^2$	
751,95	826,32	-74,37	5530,90	31086,63	0,0989
1016,67	1093,19	-76,52	5855,31	7815,62	0,0753
564,5	600,54	-36,04	1298,88	132324,25	0,0638
1115,5	1014,09	101,41	10283,99	35057,32	0,0909
1026,85	1107,18	-80,33	6452,91	9719,20	0,0782
			29421,99	216003,01	0,4072



Prognosis *rehabilitation effectiveness of recommended measures in the regions*

regression line, the less is the residual variance and therefore more value Ry (x_1,..., xm).

Thus, the R value close to 1, the better the regression equation to describe the evidence and factors strongly influence the outcome. With the value of R close to 0 regression wrong to describe the evidence and factors do little impact on the result.

$$R = \sqrt{1 - \frac{s_e^2}{\sum \left(y - y_{cp}\right)^2}} = \sqrt{1 - \frac{73578,82}{216003,01}} = 0,81201$$

According to data obtained relationship between Y and factor X – «strong».

The assessment of the significance of the equation multiple regression was performed by testing the hypothesis of the vanishing of the coefficient of determination calculated according to the population. To check the use of F-Fisher criterion.

$$R^2 = 0,65936$$

$$F = \frac{R^2}{1 - R^2} \frac{n - m - 1}{m} = \frac{0,65936}{1 - 0,65936} \frac{49 - 5 - 1}{5} = 16.6466$$

$$F_{кр} = 2,4$$

Since the actual value of $F > F_{kp}$, the coefficient of determination statistically significant, and thus the resulting regression equation is statistically reliable. This means that the model can be used for forecasting and further analysis.

Our research allowed to identify factors (measures) rehabilitation, which is a priority, it aims to stimulate a positive impact on the end result: the restoration or improvement of life disabled. In particular, the implementation of comprehensive follow-up disabled is not difficult groups (disabled III group) in one year predicts «complete restoration of life», «replacement therapy», «reconstructive surgery», «spa treatment», «medical supervision» «therapeutic massage», «physiotherapy», «psycho-pedagogical diagnostics», «collective form of training», «expert potential of professional skills», «professional focus», «professional selection», «training», «adaptation and creation job security and taking into account the special needs of the disabled», «sustainable employment», «adequate professions and specialties, recommended to medical ans social expert commission», «social and nursing home» software «sticks».

In the disabled with severe Disabled (disabled groups II and I) use the above recommended action would lead to «partial restoration of life».

Conclusions

According to the data, the existing provision of medical and social rehabilitation of the disabled as a result of the pathology of the respiratory notprovides recovery «disability» in disabled due to respiratory diseases, or «growth of disability», which requires the reorganization of medical and social rehabilitation of pulmonary patients.

To predict the end point «restore life» disabled due to pathology of the brochi-pulmonary system in the preparation of IRP should be used multifactor statistical model taking into account the 49 key factors. The impact of different types of rehabilitation process of recovery or improvement of life in disabled people with disorders of the respiratory system is complex, multifactorial and relatively equivalent.

The improving the rehabilitation of disabled pulmonary profile will help restore their livelihoods and reintegration into society.

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МЕДИКО-ЕКСПЕРТНІ АСПЕКТИ ЕФЕКТИВНОСТІ ЗАХОДІВ РЕАБІЛІТАЦІЇ ІНВАЛІДІВ З ХВОРОБАМИ ОРГАНІВ ДИХАННЯ

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Резюме

Реалізація соціальної політики у сфері реабілітації інвалідів здійснюється за допомогою індивідуальної програми реабілітації, основною функцією якої є забезпечення процесу комплексної реабілітації конкретного інваліда. При розробці індивідуальної програми реабілітації лікарі МСЕК повинні орієнтуватись на досягнення конкретного кінцевого результату.

З метою оцінки ефективності реабілітаційних заходів у інвалідів з хворобами органів дихання нами проаналізовано 15434 індивідуальних програм реабілітації, які розроблені МСЕК 22 областей України. Як показали результати дослідження, існуюча якість медико-соціальної реабілітації інвалідів з патологією органів дихання диктує необхідність реорганізації системи.

Висновки. *На підставі математичного моделювання було визначено 49 основних чинників, які позитивно прогностично можуть впливати на кінцевий результат реабілітації, на процес відновлення або підвищення рівня життєдіяльності у інвалідів з патологією органів дихання.*

Ключові слова: *медико-соціальна реабілітація інвалідів, ефективність, хвороби органів дихання, індивідуальна програма реабілітації.*

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МЕДИКО-ЭКСПЕРТНЫЕ АСПЕКТЫ ЭФФЕКТИВНОСТИ МЕРОПРИЯТИЙ РЕАБИЛИТАЦИИ ИНВАЛИДОВ С БОЛЕЗНЯМИ ОРГАНОВ ДЫХАНИЯ

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Резюме

Реализация социальной политики в сфере реабилитации инвалидов осуществляется с помощью индивидуальной программы реабилитации, основной функцией которой является обеспечение процесса комплексной реабилитации конкретного инвалида. При разработке индивидуальной программы реабилитации врачи МСЭК должны ориентироваться на достижение конкретного конечного результата.

С целью оценки эффективности реабилитационных мероприятий у инвалидов с болезнями органов дыхания нами проанализированы 15434 индивидуальных программы реабилитации, разработанные МСЭК 22 областей Украины. Как показали результаты исследования, существующее качество медико-социальной реабилитации инвалидов с патологией органов дыхания диктует необходимость реорганизации системы.

Выводы. *На основании математического моделирования были определены 49 основных факторов, которые позитивно прогностически могут влиять на конечный результат реабилитации, на процесс восстановления или повышения уровня жизнедеятельности у инвалидов с патологией органов дыхания.*

Ключевые слова: *медико-социальная реабилитация инвалидов, эффективность, болезни органов дыхания, индивидуальная программа реабилитации.*

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