# ANALYSIS OF IMPLEMENTING THE UKRAINIAN HEALTHCARE REFORM IN 2023

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**Abstract**: *The main research task is to study the issue of effectiveness of implementing the healthcare reform in Ukraine using the main levers of influence on the most significant items of expenditure in the medical industry itself. Also, we investigate the main items of income and expenses of medical service providers, their specific weight and management methods for more rational use.*

*It is worth noting that the positive dynamics in the direction of effectiveness of the healthcare industry is not only the main priority. It is also a direct tool that drives the general processes in the medical industry. Increasing the level of social protection is one of the primary goals of medicine and, as a result, improving the quality of state population life. In a chain reaction, this will lead to a reduction in costs for the healthcare industry due to faster recovery of patients and reduction of time spent in a state of temporary incapacity.*

*One of the key aspects of the medical reform efficiency remains the issue of remuneration of workers. Before carrying out reform measures, doctor salaries were officially at the minimum level. Therefore, the principle of treatment for the patient's money was widespread in the industry.*

*The main motivating element of the human capital efficiency is salary – reward for work results. So, if the salary directly depends on the target indicators that must be achieved in the production process, then the employee's motivation increases. Based on the fact that the main direction of funds expenditure at medical institutions is labour costs, the main efforts and attention should be paid in the organisational and administrative plan to work with the effective use of this item of expenses.*

*It is worth noting that the salary of any employee is the main measure of his work efficiency. It is a motivator to improve the quality and treatment efficiency. If the amount of reward depends on the employee's performance indicators, the system will have additional motivation not only in the quantitative characteristics of the work result, but also in the qualitative parameters.*

**Introduction**

Over the past 6 years, the Ukrainian healthcare system has received a powerful push for development. As an expected consequence, it increased in functioning efficiency. The initiator of this starting point was the Ukrainian Law on State Financial Guarantees of Healthcare for Population (Verkhovna Rada of Ukraine, 2023). The result of adopting and implementing this act was the creation of the main operators through which the reform and functioning of the entire healthcare system is carried out. They are the National Health Service of Ukraine (insures and manages funds), the Public Health Center of the Ukrainian Healthcare Ministry (controls and matches the healthcare market with quality standards of aid provision), and the state enterprise "Medical Procurement of Ukraine" (orders and controls the funds expenditure to provide the industry with means of production).

The main principle of the medical reform in Ukraine was payment not for the availability of the material base and personnel of the service provider, but for the fact of providing a medical service. The latter was called "money follows patients". Thus, the reform operator changed the basic motivation of the healthcare institution from the expansion of the "bed fund" and the extensive development of administrative duties according to the principle of bureaucratic opportunism. That was done to increase economic efficiency in the form of saving resources, valuing the quality of personnel and provided services. The right to choose a doctor and hospital is given exclusively to the patient. All patients, regardless of their location or residence, have equal rights to receive medical services in any relevant healthcare institution that cooperates with the national insurer – NHSU (the National Healthcare Service of Ukraine).

With regard to the field of public health, the main task in this direction is to switch to a more effective system of control and saving resources. The ways are increasing the effectiveness of surveillance and biosecurity functioning and preventing unnecessary expenses that could have been avoided with timely administrative regulation and control in public health.

However, it should be noted that the priority direction of reform introduction is to raise the efficiency of this industry functioning not only in administrative regulation and avoiding excessive state costs. That concerns first of all increase in population social security and life quality improvement. In turn, it will reduce costs for the treatment and rehabilitation of patients who have not timely consulted a doctor, have not been properly informed or have been treated ineffectively.

During 6 years of the healthcare reform implementation, significant changes have occurred in financing, administration, and basic principles of medical industry. It should be expected that such structural changes had an impact on the main economic indicators of the industry.

**Literature review**

In 2015, the United Nations approved the 2030 Sustainable Development Program. One of the main goals of this program is the priority of ensuring a healthy life and promoting well-being for all people of different age As for Ukraine's policy on this issue, it should also be directed at certain priorities (Manuilova et al.., 2023).

Researched sources that studied the process of implementing the healthcare reform in Ukraine found that the concept of the efficiency of the medical industry is not measured only by the category of economic indicators of the industry activity. It also includes more extended definitions. Accordingly, the indicators that characterize the activity in the field of medical institutions are one of the significant criteria in the assessment (Medianyk & Lypchanskyi, 2016).

Also, economic efficiency can be defined as direct and indirect indicators of the healthcare impact on the country's economy due to the improvement of population health indicators and implementation of preventive measures (Vudvud, 2022).

Foreign approaches to assessing the healthcare effectiveness are based on three levels: the general level (resource provision of the industry and the state of population health); the level of organisations providing medical care; the level of incidence rates (Alshrafi, 2016).

The process of healthcare reform in Ukraine includes decentralization and autonomy of healthcare institutions. A similar topic was research in the works of Canadian scientists. Their analysis showed that the political process at the central level can affect the healthcare efficiency in the direction of its main task – focusing on people's health (Denis et al., 2023).

The issue of ensuring the level of medical care quality in industry can be defined as an urgent issue of stabilization and dynamics of developing the healthcare industry potential in Ukraine. This question refers to

the general aspects of increasing the professional activity management of the medical personnel at the national, regional and local levels (Chorna et al., 2019; World Health Statistics, 2017).

Currently, according to the conducted research, there is a problem with the NHSU tariffs that are underestimated. For example, today the treatment of a heart attack actually costs about 80,000 hryvnias. Simultaneously, only 16,000 hryvnias are allocated from the budget for this medical service. Therefore, there may be situations when the patient will be forced to either pay extra or not receive the necessary medical care (Vorovskyi et al., 2022).

Based on the sources analysis, we can conclude that the general indicator that evaluates the medical industry effectiveness at the national level and the level of strategic planning is the life expectancy indicator. The main economic indicators for evaluating the healthcare effectiveness are the healthcare costs share in the volume of the gross domestic product, the total number of medical personnel.

The main healthcare transformations are (Barzilovich, 2020):

– Implementation of the state guaranteed package of medical care;
– Development of a network of cardiac centers;
– Creation of the Unified National Purchaser of Medical Services;
– Introduction of the principle "money follows patients";
– Autonomy of medical care providers;
– Creation of a contractual model of healthcare financing;
– Introduction of the E-Health system;
– A transparent and efficient system of medicine procurement.

As for the client-orientation of medical institutions and medical workers themselves, the NHSU defines this as the main focus of its work. Implementation of such an important priority is achieved through the possibility of freely choosing a doctor and a healthcare facility. At the same time, it is worth noting that the patient has free access to both state medicine and private institutions (Terenda et al., 2021).

The World Health Organization identifies it is necessary to ensure protection of healthcare workers, so that they can keep working and rescuing lives. Thus, they provide everyone who needs with quality medical care (WHO, 2022).

One of the key healthcare reform tasks was also to bring the salaries of doctors and medical personnel to a transparent official scheme of payment and to move away from the so-called "pocket pay" for doctors. It is worth noting that the principle "money follows patients" was implemented through the economic incentive of the healthcare institution to become more service-oriented and patient-friendly. The more services the medical institution provides, the more income it receives from the National Health Service.

In the USA, influence of the Medicaid program expansion on medical liability was studied. And the conclusions were as follows: the program expansion increased the demand for medical services. At the same time, it was determined that there should be a direct dependence in increasing the medical responsibility of practicing doctors and hospitals in the field of office abuse. Thus, there should be a direct relationship between the medical employee's results and his personal bonus or liability (Luo et al., 2022).

The problem of medical workers' shortage, especially in rural areas due to the insufficiently effective personnel motivation policy, is very relevant today in healthcare. The shortage problem, especially in mental health (psychiatrists, neuropathologists, psychologists), is also present in other EU countries (Sun et al., 2020).

Investigating the concept of motivation, we noted a rather apt description given by Chorna et al. (2022). In particular, the concept of motivation is a reason that is the basis of the choice of actions and deeds. It is a set of internal and external conditions that cause both positive and negative attitude to work. They can be strong or weak, conscious and unconscious. It depends on many factors, especially in healthcare. A motivation is a "fundamental brick" in the motivational process.

The author also gives a classification of motivations (listed in Table 1).

| Internal | Positive | Individual | individual traits, character, habits, traditions, level of culture, personal characteristics; psychoemotional or biosocial factors. |
| | | Social | reward, salary, additional premium payments, social services (travel in public transport, payment for telephone and other communication services, healthcare, etc.), promotion on the career ladder and various incentives |

| External | Positive | material goods, career growth, etc. |
| | Negative | sanctions of a negative nature on workers by the institution's administration through punishments, fines, criticism, condemnation |

**Table 1. Types of motivations**

Source: Based on Chorna et al. (2022)

To define the term "motivation", the author proposes the following formulation: a set of reasons of a psychological nature that stimulates, supports, or reduces orientation, activity, and corrects human behaviour. (Chorna et al., 2022).

The main reasons for insufficient quality and demonstrated effectiveness of medical services are, among others, a low number of specialist in the medical field, a decreased fair level of wages and the lack of an effective motivation system (Shevchuk, 2023).

The main motivating element of the efficiency of human capital is salary – a reward for work results. The motivation question of medical workers, like employees of any enterprise, is always relevant. The most important in terms of the type and volume of funds spent is direct material motivation in the form of a reward for performed work. It is formed on the basis of the remuneration system, bonus policy, monetary incentives.

So, if the salary should have a direct dependence on the target indicators that should be achieved in the production process, then the employee's motivation increases. Based on the fact that the main direction of medical funds expenditure is labour costs, the main efforts and attention should be paid in the organisational and administrative plan to work with the effective use of this expenses item.

**Methodology and research methods**

To reach the goals of this study regarding the evaluation of the medical reform effectiveness for the analysed period at the macrolevel, we used the methods of analysis, generalisation, comparison, and synthesis.

During the information-analytical and directly empirical stages, we studied the possibilities of obtaining reliable and comparable information as for the income and expenses of healthcare institutions, quantitative indexes and indicators of the macrolevel industry staffing.

We used the method of theorising, describing and explaining facts, studying trends and regularities. Special attention was paid to the study of cause-and-effect relationships between indicators that affect the motivation of medical personnel (remuneration for rendered services, performed work). To study the fact and the degree of correlation between the above-mentioned indicators, formulas of economic indicators were used (Kupalova, 2008). They are explained below.

For the analysed correlation field, it can be assumed that the presence between all possible values values of **x** and **y** can be exponential.

The exponential regression equation:

$$y = a * ebx \tag{1}$$

The estimated regression equation:

$$y = a * ebx + \varepsilon \tag{2}$$

$e_i$ – the values observed for the errors $\varepsilon_i$, **a** and **b**, respectively, in the estimation of the parameters **a** and **b** of the regression model, which must be found. $\varepsilon$ is a random error, deviation.

Due to the fact that the deviations $\varepsilon_i$ for each particular observation **i** are random, and their values in the selected data field are uncertain, then:

1) Only estimates of parameters **a** and **b** can be saved from observations $x_i$ and $y_i$;

2) Estimates of the parameters **a** and **b** of the regression model are, respectively, the values of **a** and **b**, which are random in nature, due to the fact that they correspond to random sample data.

After linearisation, we get:

$$ln(y) = ln(a) + bx \tag{3}$$

To estimate parameters **a** and **b**, we will use the LSM technique (the method of least squares).

This method makes it possible to obtain the most accurate estimates of the regression equation parameters. But this is possible only if there are prerequisites for the random parameter **ε** and the independent variable **x**.

The LSM formula can be described as follows:

$$S = \sum (y_i - y_i^*)^2 \rightarrow \min \tag{4}$$

**S** – the sum of the least squares.

**System of ordinary equations:**

$$a*n + b\sum x = \sum y \tag{5}$$

**n** – the number of parameters

$$a*\sum x + b*\sum x^2 = \sum x*y \tag{6}$$

**Parameters of the regression equation**

**Simple average:**

$$\overline{x} = \frac{\sum x_i}{n} \tag{7}$$

It is the simple average of the **x** data field.

$$\overline{y} = \frac{\sum y_i}{n} \tag{8}$$

It is the simple average of the **y** data field.

$$\overline{xy} = \frac{\sum x_i y_i}{n} \tag{9}$$

It is the simple mean value of expressing the **x*y** data field.

**Calculation of deviations:**

$$S^2(x) = \frac{\sum x_i^2}{n} - \overline{x}^2 \tag{10}$$

$S^2(x)$ – the sampling variance for the **x** parameter.

$$S^2(y) = \frac{\sum y_i^2}{n} - \bar{y}^2 \qquad (11)$$

$S^2(y)$ – the sampling variance for the **y** parameter.

$$S(x) = \sqrt{S^2(x)} \qquad (12)$$

$S(x)$ –the standard deviation for the **x** parameter.

$$S(y) = \sqrt{S^2(y)} \qquad (13)$$

$S(y)$ – the standard deviation for the **y** parameter.

**The elasticity index**

The elasticity index is determined by the formula:

$$E = \frac{S(y)}{S(x)} \frac{x}{y} = \bar{x}\ln(b) \qquad (14)$$

**E** – the index of elasticity

**The correlation index**

The value of the correlation index **R** ranges from 0 to 1. The closer the correlation index is to unity, the closer the ratio is between the characteristics being analysed, the more reliable the regression equation is:

$$R = \sqrt{1 - \frac{\sum(y_i - y_x)^2}{\sum(y_i - \bar{y})^2}} \qquad (15)$$

**Results**

The initial stage of healthcare reforming was the introduction of transformations in the primary link – PMD. The medical system should be grounded on the system of determining the feasibility and necessary level of specialised and highly specialised medical care. Before the reform implementation, when the patient did not have a family doctor of his choice, specialised medical care, due to the lack of accessibility and overuse of such care, had an additional burden on the doctors of the specialised branch.

The only national insurance operator in the market of medical services was created in April 2018. It was the National Health Service of Ukraine (NHSU). The next stage of transformational processes was the stage of medical institution autonomy as aid providers. Consequently, healthcare institutions began to receive the main funding not directly from the budget, but through the National Health Service in accordance with the provided services and readiness to provide such services. In July 2018, the actual conclusion of PMD contracts began.

Specialised medical care started the countdown of its transformation from 1 April 2020. Thus, the gross part of state healthcare expenditures was focused on the medical guarantee program (PMD). That was directed to the purchase of medical services for the population through the National Health Service.

Today, the reform implementation results are already obvious in the form of increasing the availability of medicines and types of diagnostics that are sufficiently valuable for patients.

One of the key aspects of the reform economic efficiency remains the issue of remuneration of medical workers. Before the reform implementation, the level of salaries of doctors was officially at the minimum level. Therefore, the treatment principle for the patient's money was widespread in the industry. It is worth

noting that the salary of any employee is the main measure of his work efficiency. It is a motivator to improve the quality of results. If the reward amount depends on the employee's performance indicators, the system will have additional motivation not only in the quantitative characteristics of the work result, but also in the qualitative parameters.

In Table 2, we have listed the main items of operating costs of a healthcare facility as a percentage of the total value of all listed items for the time period from 2020 till the first half of 2023.

| № | Indicator | 2020 year | 2021 year | 2022 year | 1-2 quarter 2023 year |
|---|---|---|---|---|---|
| 1 | Material costs | 15.99% | 24.94% | 22.68% | 25.05% |
| 2 | Salary expenses | 60.41% | 52.68% | 55.58% | 50.60% |
| 3 | Deductions for social events | 12.99% | 11.38% | 11.90% | 10.69% |
| 4 | Social costs | 0.26% | 0.34% | 0.29% | 0.28% |
| 5 | Amortisation | 5.02% | 6.18% | 6.16% | 9.94% |
| 6 | Other operating expenses | 5.33% | 4.48% | 3.38% | 3.44% |

**Table 2. The structure of the main selected operating costs of medical service providers (separate indicators), %**

Source: Compiled by the author based on the National Health Service of Ukraine (2023)

Also, the above data are shown for better visualisation in Diagram 3.
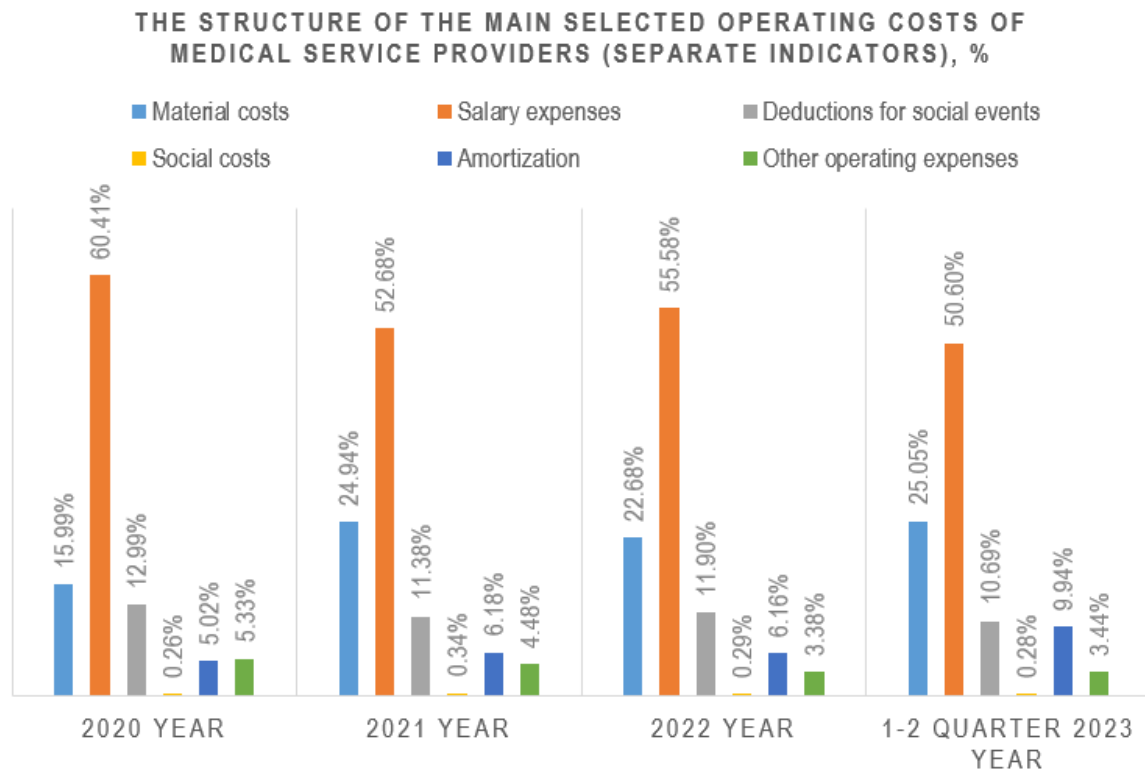


**Diagram 3. The visual structure of the main selected operating costs of medical service providers (separate indicators), %**

Source: Compiled by the author based on Table 2

It can be noted that the main item of operating expenses is labour costs. During the entire analysed period they make up more than 50% of the total volume of main operating expenses. Therefore, the effectiveness of using this type of expenses in healthcare institutions and in the medical field as a whole will be able to increase the effectiveness of the entire medical reform much more than expenses with a lower specific weight from the total volume of expenses.

The table below shows the calculation of the of labour costs share in the total amount of PMD revenues.

| № | Indicator | 2020 year | 2021 year | 2022 year | 2023 year* |
|---|-----------|-----------|-----------|-----------|------------|
| 1 | Income under the medical guarantee program, thousand UAH | 16,122,102.40 | 91,771,562.10 | 103,573,679.10 | 117,610,754.20 |
| 2 | Labour costs, thousand UAH | 12,204,321.80 | 65,000,117.80 | 71,051,538.80 | 86,410,988.60 |
| 3 | The labour costs share in the total amount of income for PMG, % | 75.70% | 70.83% | 68.60% | 73.47% |
| | *based on planned calculations* | | | | |

**Table 4. Dynamics of absolute values of PMD receipts and labour costs of medical service providers for 2020-2022 and 2023***
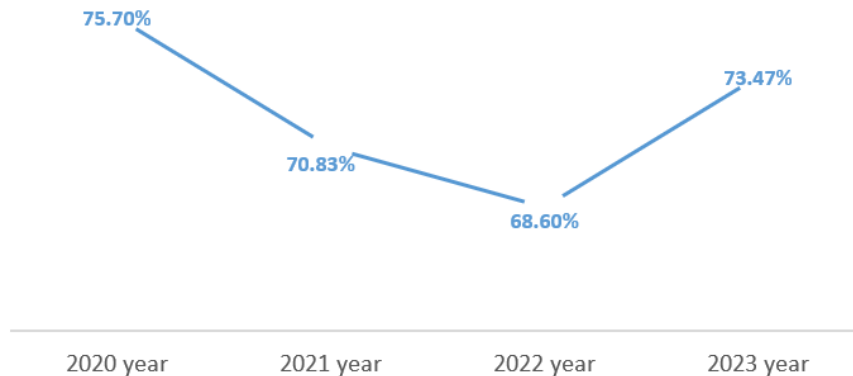
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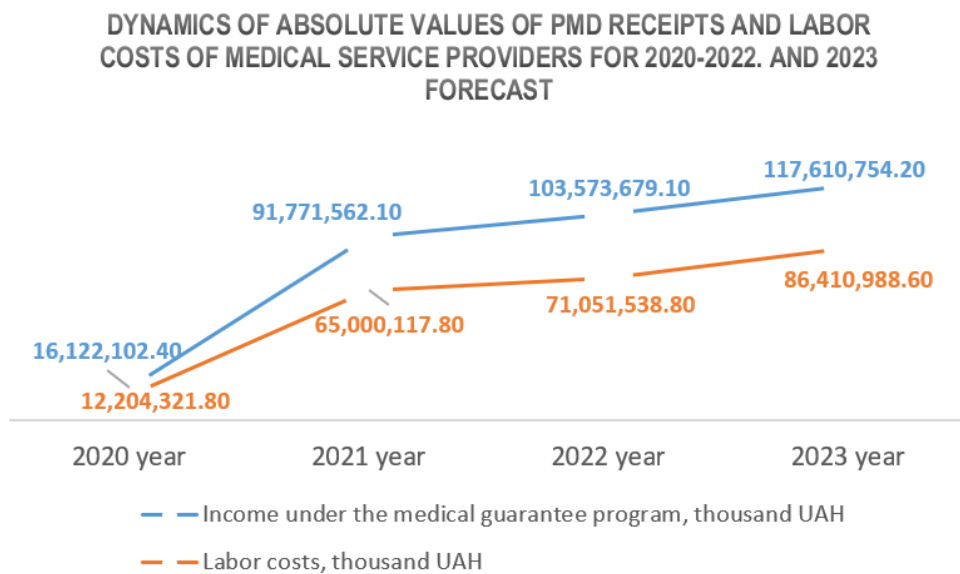


**Diagram 5. Dynamics of absolute values of PMD receipts and labour costs of medical service providers for 2020-2022. and 2023 forecast**

Source: Based on Table 4

THE SHARE OF LABOR COSTS IN THE TOTAL AMOUNT OF INCOME
FOR PMG, %



**Diagram 6. The share of labour costs in the total amount of income for PMG, %**

Source: Based on Table 4

Based on the above, it can be stated that about 75% of the income from PMG goes to finance the item of expenses for the wages of employees of medical service providers. Thus, to analyse the effectiveness of using the largest amount of the expenses item, it is worth determining whether the medical staff remuneration system performs one of the main functions – motivation. For this, we made a sample from the data of the National Health Service (2022 and 2023) regarding the amount of the average salary of doctors and medical managers as well as the amount of income from PMD for the relevant period. The data are shown in Table 7.

| For a period, a month | Average salary of doctors, UAH per month | Average salary of managers of healthcare institutions, UAH per month | Income from PMD per month, thousand UAH |
|---|---|---|---|
| 01.2022 | 19,329.28 | 32,742.29 | 11,634,812.932 |
| 04.2022 | 19,296.14 | 35,507.04 | 12,312,132.791 |
| 07.2022 | 20,400.57 | 38,669.95 | 11,627,045.002 |
| 10.2022 | 20,229.17 | 38,313.81 | 11,512,916.128 |
| 01.2023 | 19,196.44 | 37,197.89 | 10,413,303.123 |
| 04.2023 | 20,554.28 | 39,101.42 | 11,268,471.773 |
| 07.2023 | 22,942.00 | 44,742.59 | 11,389,698.230 |

**Table 7. Dynamics of absolute values of PMD receipts and labour costs of medical service providers within 2020-2023**

Source: Based on the National Health Service of Ukraine (2023)

To determine the existence of relationships between the healthcare institution results, which are expressed in the amount of funds received from PMC and the remuneration of key participants (heads of healthcare institutions and doctors), we conducted a correlation analysis of indicators.

1. Correlation analysis of the relationship between indicators of the average salary of healthcare institution managers and income from PMC

We used the correlation analysis method to visually demonstrate the form of the relationship between the indicators we studied.
To calculate the regression parameters, we will build a calculation table:

| x | ln(y) | $x^2$ | $ln(y)^2$ | x*ln(y) |
|---|---|---|---|---|
| 32,742 | 16.2695 | 1,072,038,564 | 264.697 | 532,696.3683 |
| 35,507 | 16.3261 | 1,260,747,049 | 266.5414 | 579,690.6792 |
| 38,669 | 16.2688 | 1,495,291,561 | 264.6753 | 629,099.9444 |
| 38,313 | 16.259 | 1,467,885,969 | 264.3544 | 622,930.3043 |
| 37,197 | 16.1586 | 1,383,616,809 | 261.1002 | 601,051.2464 |
| 39,101 | 16.2375 | 1,528,888,201 | 263.657 | 634,903.2385 |
| 44,742 | 16.2482 | 2,001,846,564 | 264.0046 | 726,977.8512 |
| 266,271 | 113.7678 | 10,210,314,717 | 1849.03 | 4,327,349.6323 |

**Table 8. Calculation table for regression parameters**

Source: Generated by the author

For the above data, the system of equations has the following form:

$$7a + 266271 \cdot b = 113.768$$
$$266271 \cdot a + 10210314717 \cdot b = 4327349.632 \qquad (16)$$

If we multiply equation (16) of the system by -38038.714, we get a system that can be solved by the method of algebraic addition.

$$-266271a - 10128606415.494\,b = -4327579.516$$
$$266271*a + 10210314717*b = 4327349.632$$

The result is:
$$81708301.506*b = -229.884$$
$$b = -2.8138736599803E\text{-}6$$

To find the index **a** from equation (16), we will do the following operations:

$$7a + 266271*b = 113.768$$
$$7a + 266271*(-2.8138736599803E\text{-}6) = 113.768$$
$$7a = 114.517$$
$$a = 16.3596$$

We obtain the empirical regression indexs: b = -2.8138736599803E-6, a = 16.3596.

The regression equation (empirical regression equation):

$$y = e^{16.359574147962}e^{-2.8138736599803E\text{-}6x} = 12731300.78512e^{-2.8138736599803E\text{-}6x}$$

The empirical regression indexs **a** and **b** are only estimates of theoretical indexs **βi**. The equation itself reflects only the general trend in the behaviour of the analysed variables.

<u>Parameters of the regression equation</u>

Selective averages:

$$\overline{x} = \frac{\sum x_i}{n} = \frac{266271}{7} = 38038.714 \qquad (17)$$

$$\overline{y} = \frac{\sum y_i}{n} = \frac{113.768}{7} = 16.253 \qquad (18)$$

$$\overline{xy} = \frac{\sum x_i y_i}{n} = \frac{4327349.63}{7} = 618192.805 \tag{19}$$

Sample variances:

$$S^2(x) = \frac{\sum x_i^2}{n} - \overline{x}^2 = \frac{10210314717}{7} - 38038.714^2 = 11672603.63 \tag{20}$$

$$S^2(y) = \frac{\sum y_i^2}{n} - \overline{y}^2 = \frac{1849.03}{7} - 16.253^2 = 0.00215 \tag{21}$$

Root mean square deviation:

$$S(x) = \sqrt{S^2(x)} = \sqrt{11672603.63} = 3416.519 \tag{22}$$

$$S(y) = \sqrt{S^2(y)} = \sqrt{0.00215} = 0.0464 \tag{23}$$

The elasticity index

The elasticity index is found by the formula:

$$E = \frac{S(y)}{S(x)} \frac{x}{y} = \overline{x} \ln(b)$$

E = 38038.714(-2.8138736599803E-6) = -0.107 (24)

In this case, the elasticity index is less than 1. Accordingly, when **x** changes by 1%, **y** will change less.

The correlation index

The value of the correlation index **R** ranges from 0 to 1. The closer the correlation index is to one, the closer the relationship is between the characteristics being analysed, the more reliable the regression equation is:

$$R = \sqrt{1 - \frac{\sum (y_i - y_x)^2}{\sum (y_i - \overline{y})^2}}$$

$$R = \sqrt{1 - \frac{1831133537681.8}{1924050169827.4}} = 0.22 \tag{25}$$

Obtained from calculation for the parameters analysed by us, the value of the correlation index indicates that the factor **x** has an insignificant effect on **y**.

Conclusions:
Thus, summarising the above calculations, we can state that we have studied the dependence of **y** on **x**. At the specification stage, a paired exponential regression was chosen. It was also established that the parameters of the model are statistically insignificant.
Its significance is not confirmed, i.e. there is no connection between **y** and **x**. The analysis of the elasticity index shows the insignificant influence of **x** on **y**.

2. Correlational analysis of the relationship between indicators of the average salary of doctors in healthcare institutions and income from PMC

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We used the method of correlation analysis to visually demonstrate the form of the relationship between the indicators we studied.

To calculate the regression parameters, we will build a calculation table:

| X | ln(y) | $x^2$ | $ln(y)^2$ | x*ln(y) |
|---|---|---|---|---|
| 19,329 | 16.2695 | 373,610,241 | 264.697 | 314,473.4012 |
| 19,296 | 16.3261 | 372,335,616 | 266.5414 | 315,028.3422 |
| 20,400 | 16.2688 | 416,160,000 | 264.6753 | 331,884.4259 |
| 20,229 | 16.259 | 409,212,441 | 264.3544 | 328,902.9083 |
| 19,196 | 16.1586 | 368,486,416 | 261.1002 | 310,180.3835 |
| 20,554 | 16.2375 | 422,466,916 | 263.657 | 333,745.9698 |
| 22,942 | 16.2482 | 526,335,364 | 264.0046 | 372,766.6591 |
| 141,946 | 113.7678 | 2,888,606,994 | 1849.03 | 2,306,982.09 |

**Table 9. Calculation table for regression parameters**

Source: Generated by the author

For the above data, the system of equations has the following form:

7a + 141946·b = 113.768
141946·a + 2888606994·b = 2306982.09                                              (26)

If we multiply equation (26) of the system by -20278, we get a system that can be solved by the method of algebraic addition.

-141946a -2878380988 b = -2306982.761
141946*a + 2888606994*b = 2306982.09

Then:

10226006*b = -0.671
b = -6.5575633993299E-8

We find the index **a** from equation (26):

7a + 141946*b = 113.768
7a + 141946*(-6.5575633993299E-8) = 113.768
7a = 113.777
a = 16.2539

Empirical regression indexes: b = -6.5575633993299E-8, a = 16.2539

Regression equation (empirical regression equation):

$y = e^{16.25386775448}e^{-6.5575633993299E-8x} = 11454208.26475e^{-6.5575633993299E-8x}$

Parameters of the regression equation

Selective averages:

$\bar{x} = \frac{\sum x_i}{n} = \frac{141946}{7} = 20278$                                              (27)

$$\overline{y} = \frac{\sum y_i}{n} = \frac{113.768}{7} = 16.253 \tag{28}$$

$$\overline{xy} = \frac{\sum x_i y_i}{n} = \frac{2306982.09}{7} = 329568.87 \tag{29}$$

Sample variances:

$$S^2(x) = \frac{\sum x_i^2}{n} - \overline{x}^2 = \frac{2888606994}{7} - 20278^2 = 1460858 \tag{30}$$

$$S^2(y) = \frac{\sum y_i^2}{n} - \overline{y}^2 = \frac{1849.03}{7} - 16.253^2 = 0.00215 \tag{31}$$

Root mean square deviation:

$$S(x) = \sqrt{S^2(x)} = \sqrt{1460858} = 1208.66 \tag{32}$$

$$S(y) = \sqrt{S^2(y)} = \sqrt{0.00215} = 0.0464 \tag{33}$$

The elasticity index

The elasticity index is found by the formula:

$$E = \frac{S(y)}{S(x)} \frac{x}{y} = \overline{x} \ln(b)$$

E = 20278(-6.5575633993299E-8) = -0.00133 (34)

In this case, the elasticity index is less than 1. Accordingly, when **x** changes by 1%, **y** changes by less than 1%. It can be concluded that the influence of **x** on **y** is insignificant.

The correlation index

The value of the correlation index **R** ranges from 0 to 1. The closer the correlation index is to one, the closer the relationship is between the characteristics being analysed, the more reliable the regression equation is:

$$R = \sqrt{1 - \frac{\sum (y_i - y_x)^2}{\sum (y_i - \overline{y})^2}}$$

$$R = \sqrt{1 - \frac{0.0151}{0.0151}} = 0.00171 \tag{35}$$

The obtained value indicates that **x** has an insignificant effect on **y**.

The dependence **y** on **x** was studied. At the specification stage, a paired exponential regression was chosen. Its parameters were estimated. It was also established that the model parameters are statistically insignificant. But significance was not confirmed, that is, there is no connection between **y** and **x**. The elasticity index analysis indicates an insignificant influence of **x** on **y**.

Thus, based on the above, it can be stated that the salary of key employees (direct providers of medical services and management staff) does not depend on work results. That is, the main role of wages has been lost: dependence on work results and motivation to achieve results in a more efficient way.

Currently, it can be argued that the main criterion for the healthcare effectiveness (the quality of medical services) is not controlled. The lack of a system for monitoring the quality of services and the results of treatment creates prerequisites for the reproduction of process for the sake of action, and not for the sake of

results. Moreover, from the strategic goal perspective, improving the level of social protection and well-being of the population, the system is not focused on benchmarks and target levels.

**Conclusions**

In the course of this study, the question of the effectiveness of medical reform implementation in Ukraine was studied as for the main levers of influence on the most significant items of expenditure in the medical industry. An analysis of the main items of income and expenses of medical service providers, their specific weight and management methods for more rational use was also carried out.

It was determined that the priority direction of reform introduction is to increase the functioning efficiency of this industry not only in administrative regulation and avoiding excessive state costs. That also concerns increase in social security and life quality improvement. In turn, it will reduce the costs of treatment and recovery of patients who did not seek medical attention in time, were not properly informed, or were treated ineffectively.

It can be noted that the main item of operating expenses is labour costs. During the entire analysed period they make up more than 50% of the total volume of main operating expenses. Therefore, the effectiveness of using this type of expenses in healthcare institutions and in the medical field as a whole will be able to increase the effectiveness of the entire medical reform much more than expenses with a lower specific weight from the total volume of expenses.

Thus, one of the key aspects of the economic efficiency of the medical reform remains the issue of remuneration of medical workers.

According to research carried out by the National Health Service of Ukraine, about 75% of the income from PMD goes to finance the cost of wages for employees of medical service providers. Thus, to analyse the efficiency of using the largest amount of the cost item, it is worth determining whether the medical personnel remuneration system performs one of the main functions – motivation. The main motivating element of the efficiency of human capital is a salary – a reward for work results. So, if the salary directly depends on the target indicators that must be achieved in the production process, then the employee's motivation increases. Based on the fact that the main direction of medical funds expenditure is labour costs, the main efforts and attention should be paid in the organisational and administrative plan to work with the effective use of this item of expenses. If the amount of the reward depends on the employee's performance indicators, the system will have additional motivation not only in the quantitative characteristics of the work result, but also in the qualitative parameters.

To determine the presence of relationships between the results of the healthcare institution, which are expressed in the amount of funds received from PMD and the remuneration of key participants (heads of healthcare institutions and doctors), we conducted a correlation analysis of indicators on connections of each indicator with income, as a result of work in a monetary form.

The calculations resulted in the statement that the salary of key employees (direct providers of medical services and management staff) does not depend on work results. That is, the main role of wages has been lost: dependence on work results and motivation to achieve results in a more efficient way.

Currently, it can be argued that the main criterion for the effectiveness of the healthcare system (the quality of medical services) is not controlled. The lack of a system for monitoring the quality of services and the results of treatment creates prerequisites for the reproduction of the process for the sake of action, and not for the sake of the result. Moreover, from the strategic goal perspective (improving the level of social protection and well-being of population), the system is not focused on benchmarks and target levels.

Thus, we consider the following areas to be the main task of the further stage of reforming the medical field:

– Maximum efforts to bring the revenue part of healthcare institutions into line with rational needs, taking into account the principle of autonomy and self-sufficiency;

– Maximum effort directed at the further implementation of medical reforms, through more administration and control over the remuneration systems of the management staff and the remuneration policy of the direct executors (providers of medical services);

– Control over costs abuse and ineffective use of subventions from the state budget;

– Further objectification and standardisation of collecting, generalising and analysing data to develop concepts of influence and management in healthcare;

– Raising awareness of the patient and working on the priority of the patient's interests before administration.

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