

ACTIVITY-BASED COSTING: A PRACTICAL MODEL OF COST CALCULATION IN PSYCHIATRIC HOSPITALS

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ABSTRACT

The aim: This paper is an analytical and descriptive study of the use of the Activity Based Costing (ABC) system in mental healthcare institutions for the allocation of overhead costs of auxiliary units that provide non-medical services. The realistic estimates obtained using this costing system will help improve the allocation of resources, especially in the conditions of increased number of patients, and to control overhead costs, ensuring the reduction of non-productive expenses, increasing the efficiency and effectiveness of the mental health and psychosocial support institution.

Materials and methods: The study describes and uses ABC as a system and method for calculating inpatient care costs in 2022. The cost of medical services will be calculated as the sum of direct and overhead costs. Overhead costs into inpatient care consist of medical support units overhead costs and non-medical support units overhead costs. Overhead costs in non-medical support units were allocated to the cost of services within the cost centers: hospital departments that specialize in the treatment of specific mental health conditions. Expert opinion regarding the alignment of the cost allocation base with the factors identified for the allocation of each group of overhead costs in the mental health and psychosocial support facility was taken into account.

Results: Calculations showed the impracticality of using a single tariff for psychiatric care medical services for adults and children in inpatient conditions, since there are cost centers, namely, clinical departments of health care institutions, which consume a larger amount of resources. In particular, these are the departments providing the treatment of psychotic disorders caused by taking psychoactive substances, as well as schizophrenic, organic disorders, including symptomatic, mental disorders). Accordingly, the tariff for such medical services should be higher.

Conclusions: ABC is applicable in mental health care institutions and can help to efficiently cost processes, and thereby overcome a key challenge: to overestimation or underestimation of costs into a medical services. Cost assignment through ABC generated more accurate cost estimates, which suggests that model of cost calculation ABC is more able to address complexity in mental health care institutions.

ABC should be gradually incorporated into an estimated approach to costing leads, to progressively bring reliable cost-accounting practices to mental health care institutions

KEY WORDS: activity-based costing, inpatient care costs, cost centers, cost driver, cost management system of mental health care in Ukraine

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INTRODUCTION

The war in Ukraine has largely contributed to the intensive growth of the number of people who will likely have problems with mental health. According to global estimates, the experience of military conflict is the cause of mental health problems in 20% of the population [1]. A sociological research shows that in the conditions of the active phase of the military conflict, at least 50% of the population of Ukraine experiences a potentially traumatic experience [2]. Internally displaced persons, military personnel, veterans and their family members as well as those who have experienced the loss of a family member as a result of hostilities constitute the largest share. The most common mental problems and

disorders currently recorded in Ukraine include long-term stress, depressive disorder, anxiety disorder, and post-traumatic stress disorder [3-5].

Despite the significant increase in the number of people in need of mental health care, the functioning of mental health and psychosocial support institutions in Ukraine and their funding have remained the same. In particular, despite the transition to the Strategic Procurement Concept [6] according to which the tariff for medical services has been formed, mental health care and psychosocial support institutions are still under estimated funding. That is, institutions develop an approximate plan of needs based on the expenses of the previous year, adjust them according to the changes in prices and volumes of activ-

ity, without any comprehensive analysis of the activities of their institution. Therefore, the funds are not always used efficiently and are often insufficient to cover the expenses of the reporting period. This process, despite its time-consuming nature, does not provide any opportunity to clearly calculate the cost of medical services received by patients and to manage the funds of health care institutions, avoiding unproductive costs.

The dominant factor in avoiding unproductive expenses, in particular, when calculating costs in mental health care institutions, is the use of innovative approaches to the formation of management systems. These approaches are aimed not only at the additional attraction of budget funding in connection with the increase in the number of services provided, but also at the creation of new cost-optimizing approaches to management.

The cost management system of mental health care and psychosocial support institutions in Ukraine in the face of the growing number of patients is of decisive importance. It should be aimed at the correct and accurate calculation of the cost of the provided service. Due to the specificity of mixed funding of health care facilities, it is impossible to calculate the cost of both the medical service and the finished case of patient treatment.

The use of an estimated approach to costing leads to overestimation or underestimation of costs due to the inability to reconcile the bases of cost distribution with the factors that determine them. Activity Based Costing (ABC) is a costing system that helps calculate the actual costs associated with the provision of health services and connect them to the resources they consume [8-9]. It also contributes to determining priorities in cost management, providing more detailed information about activity costs, which, as a rule, leads to the elimination of unproductive costs.

THE AIM

Accurate calculation of the cost of services is very important for reducing expenses. Thus, using the potential of the ABC system, this study aims at calculating the costs of responsibility centers for inpatient care in the allocation of overhead costs of auxiliary units that provide non-medical services, using the example of the «Regional Clinical Psychiatric Hospital No. 3» Communal Non-Profit Enterprise of the Kharkiv Regional Council (hereinafter - «Regional Clinical Psychiatric Hospital No. 3» KRC CNE).

MATERIALS AND METHODS

This study is an analytical-descriptive research conducted through studying of open-access financial documents of “Regional Clinical Psychiatric Hospital

No. 3” KRC CNE.

The study of the cost of services was conducted using the ABC method based on financial information for 2022. The ABC estimates costs using activities as the basis for calculations.

The steps of data analysis (using ABC) in this study divided into three major: (1) using the primary data to determination of the types of Activities of the Hospital’s Responsibility Centers; (2) classifying of the Activity of Responsibility Centers; (3) Identifying the overhead costs into inpatient care, which accumulated in non-medical units and the allocation of overhead costs of non-medical units to the medical services.

RESULTS

Calculation according to ABC costing was carried out in several stages described below.

1. DETERMINATION OF THE TYPES OF ACTIVITIES OF THE HOSPITAL’S RESPONSIBILITY CENTERS

The ABC process begins with the development of a map of the activities of the mental health and psychosocial support institution and the division of provided services into:

- basic medical and diagnostic services directly related to the diagnostic and treatment process;
- non-medical services: public, administrative, and support services that ensure the functioning of the hospital, but are not related to the main services to patients.

The list of the main services provided by the core units of the health care institution was determined in accordance with the Program of Medical Guarantees (PMG), «Inpatient Psychiatric Care». Based on the classification of core and non-core units, one can distinguish the main responsibility centers that perform certain types of medical activities. It simplifies the process of allocating overhead costs accumulated by non-core units of the hospital.

On the example of the “Regional Clinical Psychiatric Hospital No. 3” KRC CNE, we identified three units of the functioning of the mental health care and psychosocial support institution. Within the scope of meeting the need for obtaining basic services, the following are highlighted (Fig. 2):

(1) major cost centers: hospital departments that specialize in the treatment of specific mental health conditions; (2) auxiliary medical units that offer additional services for the diagnosis, treatment, and prevention of mental health disorders and provide for

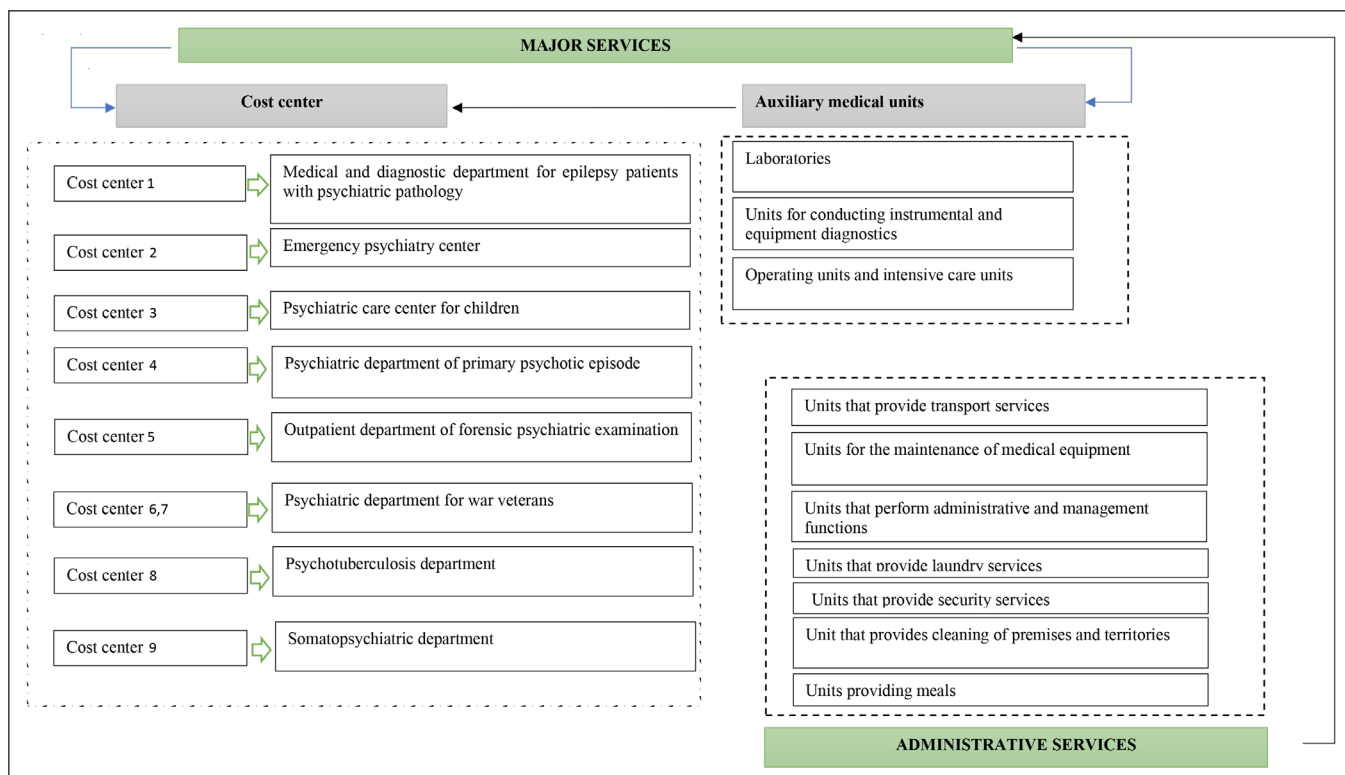


Fig.1. Defining Activity Centers in «Regional Clinical Psychiatric Hospital No. 3» KRC CNE.

the activities of responsibility centers; (3) auxiliary units that offer non-medical services, namely, administrative and maintenance services.

2. ANALYSIS OF THE ACTIVITY OF RESPONSIBILITY CENTERS

At this stage, all costs accumulated by the cost center of basic services are divided into direct costs, which are directly related to the cost of the medical service, and overhead costs.

Direct costs that can be obtained from the hospital's data systems should include only the labor costs of the treating physician and the cost of medicine if it is included in the Medical Guarantee Program.

All other costs incurred by the healthcare facility will be overhead costs and therefore need to be allocated using a cost driver (allocation factor) to be included in the cost of the healthcare service.

In accordance with the cost items, the cost driver is calculated for each item of indirect costs for each responsibility center. A cost driver is a numerical multiplier that characterizes the proportion of the allocation of certain costs to one or another responsibility center. Cost drivers determine the cost of each service in the responsibility center.

The allocation of medical overhead costs within the main clinical departments can be performed by the

direct allocation method (VBC method), where the cost driver is the number of patients who received medical services during the reporting period. These costs will include salaries of junior medical staff, depreciation costs of medical equipment and devices used in the department, etc.

3. ALLOCATION OF COSTS IN AUXILIARY AND ADMINISTRATIVE SERVICE CENTERS

As for overhead costs outside the responsibility centers (costs of auxiliary medical units and administrative service units), we can use the ABC method to further transfer the costs formed in these units to the cost of the final medical service, which is formed in the responsibility center.

According to the ABC method, indirect costs Z_i are allocated to the service K_n on the basis of cost driver D . That is, all overhead costs formed in administrative units should be allocated by combining the cost factor (A) and cost driver (D). That is, we assume that for the provision of a certain medical service K , there are n indirect types of activities that accumulate aggregate costs Z ($i=1,..n$) at the end of a period of time. That is, when planning for the next reporting year, the hospital management determines the total costs for each cost item, which must be included in the cost of the medical service in the future (Tables I-II).

Table I. Overhead Display Matrix by Responsibility Centers

Indirect cost item	Amount of overhead costs	
	<i>m</i>	
1	Z_{1m}	
2	Z_{2m}	
3	Z_{3m}	
...		
<i>n</i>	Z_{nm}	

Table II. Accounting data of the “Regional Clinical Psychiatric Hospital No. 3” KRC CNE regarding the amount of overhead costs

Indirect cost item	Amount of overhead costs, in 000, USD
Costs of non-medical raw materials and basic materials	314
Expenses for food for the patients	300
Fuel costs	11
Electricity costs	150
Sanitation costs	153
Heat supply costs	606
Administrative expenses	225

Table III. Matrix of Cost Factors

Cost factor	Responsibility centers				
	1	2	3	...	<i>m</i>
ΣA_1	A_{11}	A_{12}	A_{13}	...	A_{1m}
ΣA_2	A_{21}	A_{22}	A_{23}	...	A_{2m}
...				...	
ΣA_n	A_{n1}	A_{n2}	A_{n3}	...	A_{nm}

Table IV. The results of the agreement of experts’ opinions on the selection of the cost factor for the group of overhead costs

Indirect cost item	Cost factor item	Concordance coefficient	Pearson’s test, χ^2	Appropriateness
Costs of non-medical materials	Planned number of patients	0,644	15.45 \geq 7.81473	+
Expenses for food for the patients	Planned number of bed-days	0,7	16.8 \geq 7.81473	+
Fuel costs	Planned number of hospitalized patients	0,31	7.41 $<$ 7.81473	-
Electricity costs	Area of the premises	0,64	15.38 \geq 7.81473	+
Current repair costs	Area of the premises	0,64	15.38 \geq 7.81473	+
Heat supply costs	Area of the premises	0,64	15.38 \geq 7.81473	+
Administrative expenses	Planned number of bed-days	0.794	19.05 \geq 7.81473	+

There is also a cost factor, which is the basis combined with overhead costs, and the amount of overhead costs may depend on the value of the cost factor (Table III).

The complete collection of data used in ABC is almost impossible in some cases. In costing processes, collecting data for cost drivers is the most time-consuming and expensive step, especially when there are many activities and corresponding cost drivers. In the medical sector, this process is less labor-intensive than in manufacturing, since the most significant cost factor

for treatment and diagnostic services is the number of patients.

Since there is currently no clearly formalized evidence of the impact of a certain cost factor on the value of indirect costs in the scientific literature, we will use the judgment of 8 expert managers of medical institutions within the scope of this study. When asking for expert evaluations to calculate the dependencies between the cost factor and the value of the hospital’s indirect costs, we faced the problem of their consistency. We obtained a

Table V. Matrix of cost factors for «Regional Clinical Psychiatric Hospital No. 3» KRC CNE

Indirect cost item	Cost factor item	Cost factor sum	Cost factor values								
			1	2	3	4	5	6	7	8	9
Costs of non-medical materials	Planned number of patients	3024	30	700	200	400	350	420	320	252	352
Expenses for food for the patients	Planned number of bed-days	345	33	51	53	30	22	45	43	46	22
Fuel costs	Planned number of hospitalized patients	3024	30	700	200	400	350	420	320	252	352
Electricity costs	Area of the premises	2627	137	480	220	475	242	348	225	198	302
Current repair costs	Area of the premises	2627	137	480	220	475	242	348	225	198	302
Heat supply costs	Area of the premises	2627	137	480	220	475	242	348	225	198	302
Administrative expenses	Planned number of bed-days	345	33	51	53	30	22	45	43	46	22

Table VI. Calculation of cost drivers for each factor, the «Regional Clinical Psychiatric Hospital No. 3» KRC CNE

Indirect cost item	Indirect cost sum, USD	Cost factor item	Cost factor sum	Cost driver value
Costs of non-medical raw materials and basic materials	314108,1	Planned number of patients	3024	103,87
Expenses for food for the patients	300375,7	Planned number of bed-days	345	870,65
Fuel costs	11243,24	Planned number of hospitalized patients	3024	3,72
Electricity costs	149991,9	Area of the premises	2627	57,10
Sanitation costs	153097,3	Area of the premises	2627	58,28
Heat supply costs	606132,4	Area of the premises	2627	230,73
Administrative expenses	225400	Planned number of bed-days	345	653,33

comprehensive assessment of the consistency of experts' opinions using the concordance coefficient (general concordance coefficient). The results (Table IV) summarize the agreement of experts' opinions regarding the use of the cost factor for the distribution of overhead costs of a mental health care and psychosocial support institution. Matrix of cost factors for «Regional Clinical Psychiatric Hospital No. 3» KRC CNE is presented in Table V.

The cost drivers for each cost factor will be calculated according to the formula

$$d_n = Z_n / A_n$$

With a cost driver for each group of overhead costs, we can make the allocation of overhead costs by responsibility centers and calculate the cost per group of medical services provided in each responsibility center (Table VI).

With determined value of the cost factor for each cost center and the value of the cost driver for the group of overheads, it is possible to allocate costs by responsibility centers using the method of direct distribution (Tables VII-VIII).

That is, the largest share of indirect non-medical costs is accumulated by the Emergency Psychiatry Center: 18%.

Calculations showed that in the «Regional Clinical Psychiatric Hospital No. 3» KRC CNE, different responsibility centers accumulate different amounts of overhead costs, if we consider them through the prism of the cost factor, which was determined by selected experts in the medical field. Thus, 18% of the total annual overhead costs of the mental health care facility «Regional Clinical Psychiatric Hospital No. 3» KRC CNE should be allocated to medical services provided by the Emergency Psychiatry Center.

On analyzing the total number of patients treated by this facility in 2022, we can conclude that about 40% of the overhead costs were incurred for the treatment of patients with mental disorders caused by the use of psychoactive substances, and about 30% - for the treatment of patients with schizophrenia, schizotypal and delusional disorders (Table IX).

Thus, it is illogical to set a single tariff (in 2022, it was approximately \$330 USD) [6] for one treated case for all diagnoses treated in a mental health institution.

DISCUSSION

The existing system of reimbursement of costs for the provision of medical services determines a single tariff for the

Table VII. Determining the cost of service within the responsibility center

Indirect cost item	Indirect cost sum	Responsibility centers				
		1	2	3	...	m
1	Z_1	$\Sigma A_1 \times d_1$	$\Sigma A_2 \times d_1$	$\Sigma A_3 \times d_1$...	$\Sigma A_m \times d_1$
2	Z_2	$\Sigma A_1 \times d_2$	$\Sigma A_2 \times d_2$	$\Sigma A_3 \times d_2$...	$\Sigma A_m \times d_2$
3	Z_3	$\Sigma A_1 \times d_3$	$\Sigma A_2 \times d_3$	$\Sigma A_3 \times d_3$...	$\Sigma A_m \times d_3$
...
n	Z_n	$\Sigma A_1 \times d_n$	$\Sigma A_2 \times d_n$	$\Sigma A_3 \times d_n$...	$\Sigma A_m \times d_n$
Cost of service		S_1	S_2	S_3		S_m

Table VIII. The cost of services within the responsibility centers of the "Regional Clinical Psychiatric Hospital No. 3" KRC CNE

Indirect cost item	The cost of a service within the responsibility centers, 000 USD								
	1	2	3	4	5	6	7	8	9
Costs of non-medical materials	3,1	72,7	20,8	41,5	36,4	43,6	33,2	26,2	36,6
Expenses for food for the patients	28,7	44,4	46,1	26,1	19,2	39,2	37,4	40,0	19,2
Fuel costs	0,1	2,6	0,7	1,5	1,3	1,6	1,2	0,9	1,3
Electricity costs	7,8	27,4	12,6	27,1	13,8	19,9	12,8	11,3	17,2
Current repair costs	8,0	28,0	12,8	27,7	14,1	20,3	13,1	11,5	17,6
Heat supply costs	31,6	110,8	50,8	109,6	55,8	80,3	51,9	45,7	69,7
Administrative expenses	21,6	33,3	34,6	19,6	14,4	29,4	28,1	30,1	14,4
Cost	100,9	319,2	178,4	253,2	154,9	234,2	177,8	165,7	175,9
Share,%	6,0	18,0	10,0	14,0	9,0	13,0	10,0	9,0	10,0

Table IX. Distribution of costs of the Emergency Psychiatry Center by disorders of treated patients

Names of disorders	% to the total number of patients in the department	Total cost per medical service in 000 USD
Organic, including symptomatic	16,62	53,04
Caused by psychoactive substances	37,63	120,12
Schizophrenia, schizotypal and delusional disorders	28,99	92,55
Mood disorders (affective disorders)	4,70	14,99
Neurotic, stress-related and somatoform disorders	5,27	16,82
Syndromes of behavioral disorders associated with physiological disorders and physical factors	0,17	0,54
Mature personality and behavior disorders in adults	1,04	3,33
Mental retardation	5,58	17,80

provision of inpatient medical care in mental health care institutions. This hinders the creation of a reliable model of cost management in hospitals, since, as the results of our study show, the costs of treating some disorders are overstated, and on the contrary, understated for others.

The analysis of theoretical perspectives showed that scientists consider the ABC costing system an alternative to the traditional costing system [8-11] and a tool for cost analysis and control in the patient care chain [13-14]. One of the disadvantages of this system is that it is time-consuming [15]. However, in health care institutions that consume a significant amount of budgetary resources, its benefits override the costs of its implementation [12-13].

The results of the calculations showed that the calculation of the cost of a separate medical service, that is, the treatment of a certain disorder, can be carried out in several stages. At the first stage, one should determine the centers of formation of costs of the main activity. These are the units of the hospital within which medical services are provided. At the second stage, direct costs can be calculated within the cost center for each patient based on the hospital's existing data base. We suggest that only the salary of the attending physician and the costs of medicines provided under the Medical Guarantee Program, are included in the direct costs. All other costs are overhead costs and need to be apportioned. Those overheads that arise within the cost

center should be allocated to the number of treated patients, and overheads that arise in administrative and service units should be allocated using the ABC system.

CONCLUSIONS

The ABC provides inpatient psychiatric care with a tool to estimate the cost of treatment for each category of patients. This information is especially important for setting tariffs for psychiatric care and monitoring the use of resources for patient treatment. However, in order to get a complete overview of costs for different categories of patients, it is necessary to understand where costs are generated and what factors influence the amount of overhead non-medical costs throughout

the treatment process. The most important and most expensive element of the implementation of the ABC system is the determination of cost factors. In this study, we used the opinions of experts and for each item of overheads, we chose the appropriate factor that made it possible to calculate the cost driver and distribute the overheads by cost centers. On obtaining the values of the cost drivers for each cost center in the financial plan, we can calculate the cost of treating patients for each mental health disorder or for a group of related diagnoses. This creates a basis for improving the efficiency of resource use throughout the entire chain of inpatient psychiatric care and shows that ABC could be used in mental health and psychosocial support institutions in Ukraine.

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