Volume **11** / 2023 ISSN 2344-102X
Issue 1 / **February** 2023 ISSN-L 2344-102X

OPTIMISING EXPENDITURE IN HOSPITAL UNITS

Sorinel Toderaş SIRETEAN
Stefan cel Mare University of Suceava, 720229, Romania
sorin.siretean@usm.ro
Veronica GROSU
Stefan cel Mare University of Suceava, 720229, Romania
veronica.grosu@usm.ro
Anamaria-Geanina MACOVEI
Stefan cel Mare University of Suceava, 720229, Romania
anamaria.macovei@usm.ro
Simona Maria BRÎNZARU
Stefan cel Mare University of Suceava, 720229, Romania
simona.brinzaru@usm.ro

Abstract
In today's healthcare context, effective management of hospital units is essential for controlling expenditure and ensuring the quality of healthcare services. The study explores how management practices influence the evolution of hospital expenditure, examining resource allocation strategies and the impact of technology and health policies on financial efficiency. The aim is to provide insights into the efficient use of scarce resources, thereby contributing to improving the quality of hospital care in a changing economic and social environment.

Keywords: *efficient management; expenditure; multiple regression.*

JEL Classification: M41

I. INTRODUCTION

For the sustainable development of a nation, it is essential that its health system (Kruk et al., 2018) is efficiently structured and well organized. A robust and effective health system not only improves the overall health of the population but also contributes to the economic and social progress of the country. A well-planned health infrastructure and adequate resources ensure access to quality health care, reduce the incidence of disease and increase life expectancy, which in turn boosts labour productivity and economic growth.

The general economy and health policy have a significant influence on hospital budgets. Periods of economic recession or government budget cuts can limit the funds available to hospitals, affecting their ability to invest in equipment or hire sufficient, qualified staff. Health policies, such as health reforms, can have a major impact on how hospitals manage their spending. Health reform (Stoian, 2013), has generated changes that have reflected a trend towards improving the efficiency of the health system and the quality of care provided, with a focus on performance and outcomes.

The evolution of expenditure in a hospital is a complex subject involving many aspects, from changes in medical technology to economic and political influences. This study will explore the main factors influencing hospital expenditure, their impact on the quality of care, and the challenges hospital administrations face in managing budgets. In order to successfully achieve the objectives set by the specified objectives, publications from the literature will be drawn upon. Relevant statistical data will be used to be analyzed and interpreted through an econometric model. This approach will allow a thorough understanding and detailed evaluation of the study, providing a sound basis for reliable and well-informed conclusions.

II. LITERATURE REVIEW

Effective hospital management is crucial to optimizing resource utilization (Pirbhulal et al., 2019), ensuring the quality of care, and maintaining financial stability, and must assess the potential cost and benefits of investments, ensuring that they will improve the quality of care and operational efficiency. It requires strategic planning, including budget allocation (Coleman, 1986) and expenditure forecasting. By carefully planning budgets, hospital managers can ensure that resources are used in the most efficient way (Öker & Özyapici, 2013), avoiding waste and investing in areas that add the most value. Hospital managers are responsible for monitoring

DOI: 10.4316/EJAFB.2022.11117

Volume 11 / 2023 ISSN 2344-102X
Issue 1 / February 2023 ISSN-L 2344-102X

and controlling costs (Duckett & Breadon, 2014). This includes negotiating with suppliers to obtain the best prices for equipment and materials, optimizing resource consumption, and identifying opportunities to reduce costs without compromising the quality of care. Decisions on investments in technology and infrastructure are critical (Dahlgren & Leung, 2015).

Hospital staff management, including recruitment, training and retention of qualified staff, directly influences expenditure (Lippi Bruni & Mammi, 2017). Effective management aims to maximize employee productivity while promoting a positive and efficient working environment and maintaining a high standard of quality care. This reduces the risk of medical errors and complications, which can lead to significant additional costs. Hospitals must comply with a range of regulations and standards (Rosenbaum, 2015). Effective management includes ensuring compliance, thus avoiding penalties or fines that can affect the budget. In a changing healthcare environment, adaptability and innovation are essential. Management must be proactive in adopting new practices and technologies that can streamline operations and reduce long-term costs (Lu & Su, 2010).

In 2012-2013, the Romanian health system underwent significant changes. In 2013, the then Minister of Health, Eugen Nicolăescu, announced a profound reform of the health system, with the main aim of increasing the quality of healthcare. An important aspect of this reform was to change the way hospitals were funded. Starting in 2013, hospitals began to be paid according to their performance, taking into account the complexity of the cases treated, a change from the previous system. There was also an initiative for a new law on medical staff salaries, which aimed to remove doctors from the budget grid and pay them according to performance (Stoian, 2013).

The objective of the analysis that we are going to carry out is to determine the dependence relationship of total expenditure on the dynamics of several influencing factors staff expenditure, expenditure on goods and services, development expenditure and capital expenditure using a multiple linear regression model of the type:

$$TE = \alpha + \beta 1 * SE + \beta 2 * EGS + \beta 3 * DE + \beta 4 * CE + \varepsilon \quad (1)$$

where: TE (Total expenditure) is the dependent variable of the model, the independent variables are SE (Staff expenditure), EGS (Expenditure on goods and services), DE (Development expenditure) and CE (Capital expenditure), α, β1, β2, β3 and β4 are the parameters of the regression model and ε is the random error variable.

III. ECONOMETRIC MODEL OF HOSPITAL COSTS

Spending in a hospital is not only an operational necessity but also an important factor in ensuring quality care, promoting innovation and maintaining long-term sustainability (Shediac-Rizkallah & Bone, 1998). This study aims to analyze the evolution of total expenditure according to different types of expenditure such as staff expenditure, expenditure on goods and services, development expenditure and capital expenditure in a hospital unit over the period 2012-2021. The data used in this analysis are taken from the Strategic Plan of a hospital unit in Romania.

The evolution of total expenditure over the period analyzed is shown in Figure 1:

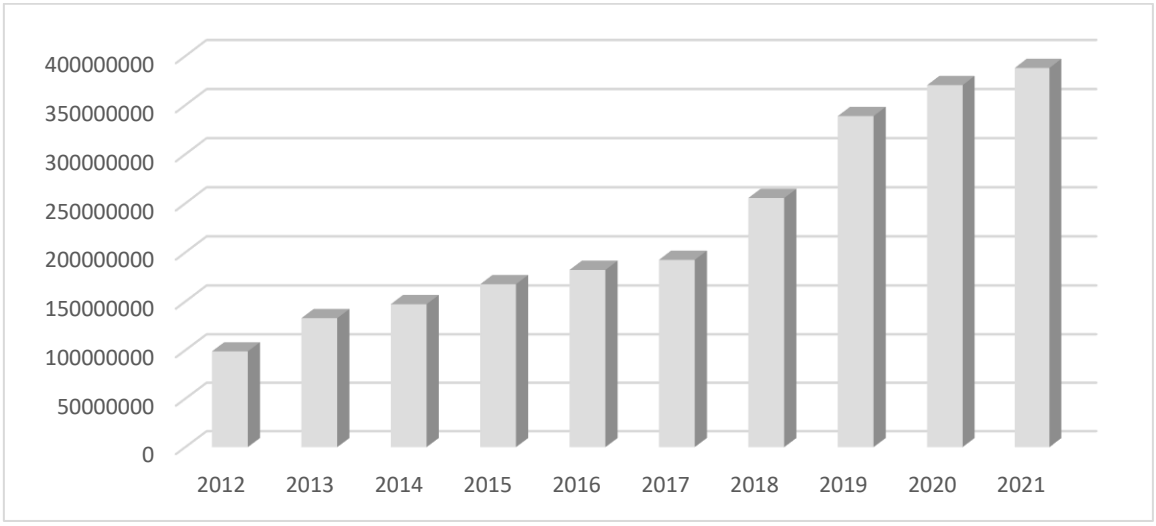

Figure 1 - Evolution of total expenditure 2012-2021
Source: Prepared by the author in Excel using data **

Analyzing Figure 1 we observe that over the whole period, there is an increase in total expenditure in the hospital of 292.30%, this is due to the increase in the number of continuous hospitalizations, an increased turnover

DOI: 10.4316/EJAFB.2022.11117

Volume **11** / 2023 ISSN 2344-102X
Issue 1 / **February** 2023 ISSN-L 2344-102X

of patients on the wards, the provision of modern state-of-the-art equipment as well as investments in hospital infrastructure.

Table 1 - Descriptive statistics of the analysed cases

	Mean	Std. Deviation	N
TE	227477963.900	104405553.4771106800	10
SE	108993367.000	58867387.722960785	10
EGS	81130771.900	25698071.538956974	10
DE	29165519.000	29955439.8833812700	10
CE	32136862.600	26067762.200601645	10

Source: Author's calculations using IBM SPSS Statistics, version 24

According to Table 1 during the period under review the average total expenditure is 227477963.900 lei, the average expenditure on staff is 108993367 lei, the average expenditure on goods and services is 81130771.900 lei, the average expenditure on development is 29165519 lei and the average expenditure on capital is 132136862.600 lei. Analysing their evolution, we observe that during the period under review total expenditure has increased from one year to the next. The percentage evolution of these annual increases is shown in Table 2:

Table 2 - Evolution of percentage increase in total expenditure

Total expenditure	2013	2014	2015	2016	2017	2018	2019	2020	2021
%	34.62	10.70	13.80	8.71	5.62	32.70	32.67	9.26	4.71

Source: Author's calculations with Excel using the data **

It is noted that the lowest annual increase is 4.71% corresponding to 2021 and the highest is 34.62% corresponding to 2013 due to the reform of the health system, with the main aim of increasing the quality of health services.

The evolution of staff expenses, goods and services expenses, development expenses and capital expenses in the Emergency County Hospital during the analyzed period are represented in Figure 2:

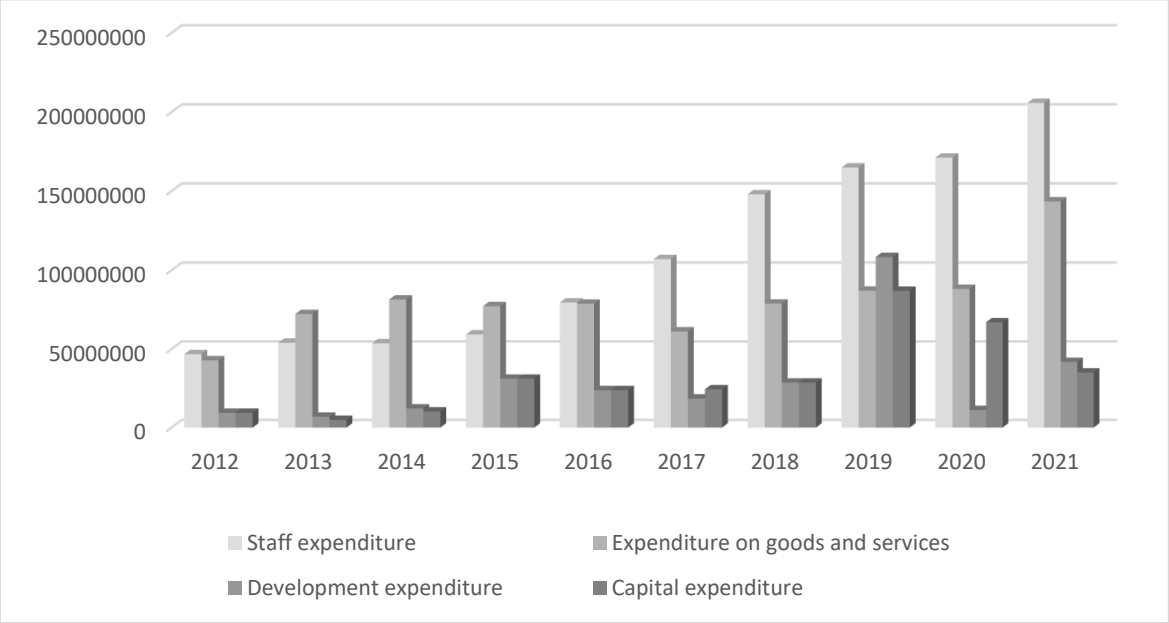

Figure 2 - Expenditure evolution 2012-2021
Source: Prepared by author in Excel using data **

Analyzing the evolution of the data in Figure 2, we can see the upward trend in staff expenditure and increases and decreases in expenditure on goods and services, development expenditure and capital expenditure. We observe that during the period 2013-2015, staff expenditure is lower than expenditure on goods and services and during the period 2016-2021 the situation changes, staff expenditure is higher than expenditure on materials and services. During the period under analysis, personnel expenses tripled and this is due to salary increases and

DOI: 10.4316/EJAFB.2022.11117

Volume **11** / 2023 ISSN 2344-102X
Issue 1 / **February** 2023 ISSN-L 2344-102X

especially the salary of medical staff, while capital expenses increased 13 times due to investments related to high-performance medical equipment as well as the rehabilitation, refurbishment, and construction of new medical premises at the Emergency County Hospital. Development expenditure has an upward trend until 2019, after which it decreases. The percentage evolution of these increases, i.e. the annual decreases in staff expenditure, material and services expenditure and capital expenditure, over the period 2013-2021 is shown in Table 3:

Table 3 - Evolution of percentage increases in different types of expenditure

Percentage increases	2013	2014	2015	2016	2017	2018	2019	2020	2021
Staff expenditure	15.53	-0.70	10.55	34.32	34.45	38.27	11.44	3.80	20.22
Expenditure on goods and services	68.93	12.78	-5.18	2	-22.38	29	10.33	1.29	62.69
Development expenditure	-26.68	76.51	155.66	-23.41	-22.45	55.16	278.25	-89.72	274.60
Capital expenditure	-48.23	109.93	204.47	-23.41	2.37	17.54	133.85	-22.99	-47.69

Source: Author's calculations with Excel using the data **

Analyzing the above table we observe that the highest percentage increases in personnel expenses are in the period 2016-2018 and are due to the number of health personnel hirings, and in 2018 the percentage increase is the highest, 38.27%, due to the entry into force of the law on salary increases Framework Law no.153 of 28/06/2017 (2017). In the analyzed period there are increases and decreases in material and service expenses depending on the number of patients discharged and the influence of the number of days of hospitalization on the expenses with sanitary materials and specialized outpatient consultation services. In 2014, 2015, and 2019 there are percentage increases in capital expenditure, years in which massive investments take place, and in 2019 and 2021 there are the highest percentage increases in development expenditure.

The correlations between expenditure types are shown in Table 4.

Table 4. Correlations

		TE	SE	EGS	DE	CE
Pearson Correlation	TE	1.000	.972	.761	.524	.793
	SE	.972	1.000	.725	.503	.711
	EGS	.761	.725	1.000	.331	.339
	DE	.524	.503	.331	1.000	.755
	CE	.793	.711	.339	.755	1.000
Sig. (1-tailed)	TE	.	.000	.005	.060	.003
	SE	.000	.	.009	.069	.011
	EGS	.005	.009	.	.175	.169
	DE	.060	.069	.175	.	.006
	CE	.003	.011	.169	.006	.

Source: Author's calculations using IBM SPSS Statistics, version 24

According to Table 4, there is a very strong correlation between total expenditure and staff expenditure of 0.972, as salaries and benefits of medical staff account for the largest share of total expenditure. In health facilities, it is vital to employ highly qualified staff, which often entails higher costs. In order to have quality staff, health facilities offer competitive salaries and attractive benefits, which leads to higher staff costs. The value of the correlation coefficient between total expenditure and capital expenditure is 0.793, indicating that there is also a strong correlation between them, which will have a direct impact on the quality of healthcare services, operational efficiency and patient satisfaction. There is also a strong correlation between total expenditure and expenditure on goods and services, at 0.761. Ensuring that hospitals have high quality materials and services are key to improving the quality of care, ensuring compliance with industry regulations, increasing efficiency and promoting a safe and attractive working environment for health professionals. The weakest correlation is between total expenditure and development expenditure. There is an average correlation of 0.524 between them.

The estimated parameters of the multiple linear regression model are presented in Table 5:

DOI: 10.4316/EJAFB.2022.11117

Volume **11** / 2023 ISSN 2344-102X
Issue 1 / **February** 2023 ISSN-L 2344-102X

Table 5 - Table of coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-7541776.939	4361491.719		-1.729	.144
	SE	.965	.045	.544	21.342	.000
	EGS	1.113	.078	.274	14.310	.000
	DE	-.624	.065	-.179	-9.529	.000
	CE	1.797	.099	.449	18.128	.000

a. Dependent Variable: TE

Source: Author's calculations using IBM SPSS Statistics, version 24

According to Table 6, the estimated model equation has the form:

$$TE = -7541776.939 + 0.965 * SE + 1.113 * EGS - 0.624 * DE + 1.797 * CE \quad (2)$$

According to the estimated equation of the multiple regression model (2) we can conclude the following. If personnel costs increase by one leu and the other three variables remain constant, then total costs increase on average by 0.965 lei. Medical and ancillary staff are an essential component of expenditure in a hospital. Increasing costs for salaries, benefits and continuing training of medical staff is another major source of increased expenditure. On top of this, there is an increasing demand for qualified specialists, which can lead to an increase in recruitment and retention costs. If expenditure on goods and services increases by 1 lei and the other three variables remain constant, then total expenditure increases by an average of 1.113 lei. Hospital administrations face the challenge of balancing the need to provide quality health care with the need to keep expenditures within a reasonable budgetary framework. This requires careful planning and sometimes difficult resource allocation decisions. The way a hospital manages its expenditure has a direct impact on the quality of healthcare provided (Mosadeghrad, 2014). Proper investment can lead to significant improvements in the quality and efficiency of care, while inefficient management of resources can have a negative effect on patients. If development expenditure increases by 1 leu and the other three variables remain constant, then total expenditure decreases by 0.624 lei on average. Technological progress is an important driver of expenditure growth in hospitals. The introduction of state-of-the-art medical equipment, such as MRI scanners or robotic systems for surgery, brings significant improvements in diagnosis and treatment. However, these advanced technologies are costly to purchase and maintain. This increase in expenditure can lead to improvements in the quality of medical care, and put pressure on hospital budgets, but can also bring in revenue for hospitals through the rental or use of the equipment in fee-based consultations. If capital expenditure increases by one leu and the other two variables remain constant, then total expenditure increases on average by 1.264 lei.

An analysis of Table 5 shows the influence of expenditure on each category in relation to total expenditure, as follows: personnel expenditure has the greatest influence on total expenditure, followed by capital expenditure, expenditure on goods and services, and development expenditure. From the estimated equation of the multiple regression model, it can be seen that the largest increase in total expenditure is due to capital expenditure. This is due to investments in the structure of the hospital, such as the construction of a new floor for the cardiology department, the construction of a new building to serve the integrated outpatient department, a building with an area of 4,000 square meters, arranged on 5 floors with consultation and day hospital treatment spaces for 23 medical specialties.

Table Summary of the regression model analyzed reports the intensity of the relationship in the model and the three independent variables, staff costs, material and service costs, and capital costs, and the dependent variable total expenditure.

Table 6 - Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	1.000[a]	.999	.999	922337.2036854776	.900

a. Predictors: (Constant), CE, EGS, DE, SE
b. Dependent Variable: TE

Source: Author's calculations using IBM SPSS Statistics, version 24

DOI: 10.4316/EJAFB.2022.11117

Volume **11** / 2023 ISSN 2344-102X
Issue 1 / **February** 2023 ISSN-L 2344-102X

The value of the correlation ratio is approximately 1, which indicates the existence of a very strong correlation between the variables of the model analyzed. According to the model obtained personnel expenditure, expenditure on goods and services, development expenditure, and capital expenditure in the period 2012-2021 influence total expenditure. The determination ratio has a value of 0.999 and shows that 99.9% of the variation in total expenditure is explained by the variation in the independent variables: personnel expenditure, expenditure on goods and services, development expenditure, and capital expenditure. Resident grants and projects with European funding influence total expenditure. The year 2019 is the year in which the hospital according to the income and expenditure budget receives European funds amounting to 20,051,491 lei for the construction of the integrated outpatient building.

Table 7 - ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	98035732505102976.000	4	24508933126275744.000	1777.456	.000[b]
	Residual	68943866653393.984	5	13788773330678.797		
	Total	98104676371756368.000	9			

a. Dependent Variable: TE
b. Predictors: (Constant), CE, EGS, DE, SE

Source: Author's calculations using IBM SPSS Statistics, version 24

According to the data presented in Table 7 the largest variation in total expenditure is explained by personnel expenditure, expenditure on goods and services, development expenditure, and capital expenditure for the model obtained, and the four independent variables are key elements in the expenditure management of hospital units.

Table 8 - Residual values

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	96157336.000	387571360.000	227477963.900	104368861.1	10
Residual	-4390893.5	3727756.25	.0000000268	2767748.115	10
Std. Predicted Value	-1.258	1.534	.000	1.000	10
Std. Residual	-1.182	1.004	.000	.745	10

a. Dependent Variable: TE

Source: Author's calculations using IBM SPSS Statistics, version 24

According to Table 8 the lowest residue value is -4390893.5 reached in 2015, and the highest is 3727756.25 reached in 2013, the year in which they have deep reform in the health system.

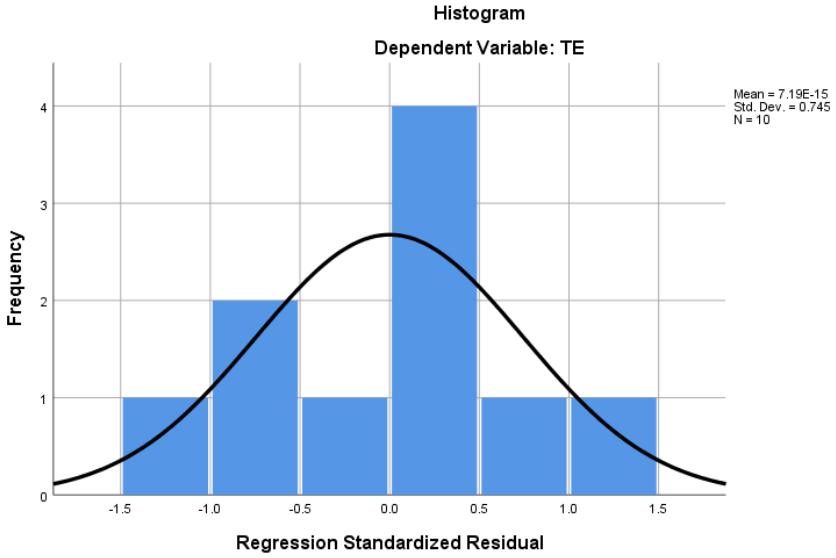

Figure 3 - Histogram
Source: Author's calculations using IBM SPSS Statistics, version 24

DOI: 10.4316/EJAFB.2022.11117

Volume **11** / 2023 ISSN 2344-102X
Issue 1 / **February** 2023 ISSN-L 2344-102X

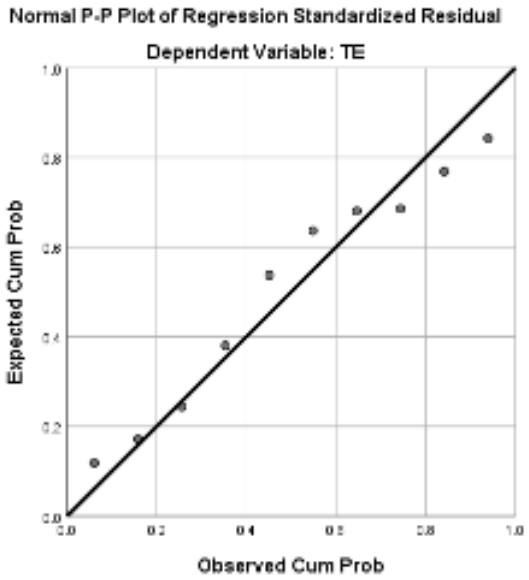

Figure 4 - Normal P-P plot of Regression Standardized Residual
Source: Author's calculations using IBM SPSS Statistics, version 24

IV. CONCLUSION

In the dynamic world of healthcare, effective hospital management plays an important role in optimizing resources and ensuring quality care. Hospital units aim to improve the health status of the Romanian population as well as to achieve a modern and efficient health system, compatible with the European Union health systems, permanently at the service of the citizens, with a complex structure of medical and surgical specialties and providing specialized medical care including for serious cases in the county that cannot be solved at the local hospital level. The current financial climate, marked by economic pressures and rising patient expectations, is transforming the way hospitals manage spending.

Spending in hospitals is a complex issue with many layers and influencing factors. Managing this expenditure effectively requires not only a good understanding of medical needs and technological innovations in the field, but also of the economic and political context in which the hospital is located. Ultimately, the balance between expenditure and quality of care is essential to ensure the health and well-being of patients. This study explores the complexity of the relationship between management practices and the evolution of expenditure in hospital units, as well as, the analysis and evolution of total expenditure according to different types of expenditure such as personnel expenditure, expenditure on goods and services, development expenditure and capital expenditure in the hospital over the period 2012-2021. Through a detailed analysis of the management strategies adopted in different hospitals and their impact on the expenditure structure, the study aims to identify efficient resource allocation models. This analysis is essential not only for hospital managers but also for health policy formulation, ensuring that scarce resources are used in the most efficient way to improve the quality of care provided to patients. The high correlation between total expenditure and staff expenditure reflects the fact that the workforce is an essential and often the most costly component of many organizations' operations (Darnall & Edwards, 2006). This correlation is influenced by operational needs, quality requirements, and regulations in various sectors, as well as labor market dynamics.

This study therefore provides valuable insight into how strategic management can shape the future of hospital care in a changing environment. The management of hospital units plays a vital role in the effective management of expenditures. Through informed decision-making, strategic planning and implementation of effective management practices, hospitals can improve the quality of care provided, while controlling and optimising expenditure.

REFERENCES

1. Coleman, J.W. (1986). Planning and resourse allocation management, New Directions for Higher Education, pp.53-61.
2. Dahlgren, E., & Leung, T. (2015). An optimal multiple stopping approach to infrastructure investment decisions, Journal of Economic.
3. Darnall, N., & Edwards, D. (2006). Predicting the cost of environmental management system adoption: the role of capabilities, resources and ownership structure, Strategic management journal, https://doi.org/10.1002/smj.518.

DOI: 10.4316/EJAFB.2022.11117

Volume **11** / 2023 ISSN 2344-102X
Issue 1 / **February** 2023 ISSN-L 2344-102X

4. Duckett, S., & Breadon, P. (2014). Controlling costly care: a billion-dollar hospital opportunity, Analysis & Policy Observatory, https://apo.org.au/node/38293.
5. Kruk, ME., Gage, A.D., Arsenault C., Jordan, K., Leslie, H.H., & RodeDeWan, S. (2018). High-quality health systems in the Sustainable development goals era: time for a revolution, The Lancet Global Health Commission, 6 (11), pp. 1196-1252, https://doi.org/10.1016/S2214-109X(18)30386-3.
6. Lippi Bruni, M., & Mammi, I. (2017). Spatial effects in hospital expenditures: A district level analysis, Health economics, https://doi.org/10.1002/hec.3558.
7. Lu,Z., & Su, J. (2010). Clinical data management: Current status, challenges, and future directions from industry perspectives, Open Access Journal of Clinical Trials, pp. 93-105, https://doi.org/10.2147/OAJCT.S8172.
8. Mosadeghrad, A.M. (2014). Factors influencing healthcare service quality, International journal of health policy and management, 3(2), pp. 77-89, https://doi.org/10.15171%2Fijhpm.2014.65.
9. Öker, F., & Özyapici, H. (2013). A New Costing Model in Hospital Management Time-Driven Activity-Based Costing System, *The Health Care Manager* 32(1), pp. 23-36 , *DOI:* 10.1097/HCM.0b013e31827ed898.
10. Pirbhulal, S., Samuel, O.W., Wu, W., Sangaiah, A.K., & Li, G. (2019). A joint resource-aware and medical data security framework for wearable healthcare systems, Future Generation Computer Systems, 95 (june), pp. 382-391, https://doi.org/10.1016/j.future.2019.01.008.
11. Rosenbaum, S. (2015). Additional Requirements For Charitable Hospitals: Final Rules On Community Health Needs Assessments And Financial Assistance, Health Affairs Forefront, https://www.healthaffairs.org/do/10.1377/forefront.20150123.044073.
12. Shediac-Rizkallah, M.C., & Bone, L.R. (1998). Planning for the sustainability of community-based health programs: conceptual frameworks and future directions for research, practice and policy, *Health Education Research*, Volume 13, Issue 1, pp. 87–108, https://doi.org/10.1093/her/13.1.87.
13. Stoian, N. (2013), Major changes in the health system, accessed in 23.04.2022, https://www.romania-actualitati.ro/stiri/romania/schimbari-majore-in-sistemul-de-sanatate-id45247.html.
14. Framework Law No 153/2017 on the salaries of staff paid from public funds, Legea-cadru nr. 153/2017 privind salarizarea personalului plătit din fonduri publice/.
15. **https://spitaluljudeteansuceava.ro/fila-buget/.

DOI: 10.4316/EJAFB.2022.11117