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ORIGINALNI NAUČNI RAD / ORIGINAL SCIENTIFIC PAPER

COMPARISON OF FINANCIAL PERFORMANCE INDICATORS OF HOSPITAL HEALTHCARE INSTITUTIONS

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Abstract: *This paper focuses on determination of statistically significant difference between income, expenses, liabilities, receivables, and business results realised by hospital healthcare institutions involved in the research, and compares those data between general hospitals and clinical hospital centres, clinical hospitals and clinics.*

Research methodology includes the Shapiro-Wilk normality test. Continuous data are described by the median and the limits of interquartile range. Differences in continuous values between general hospitals and clinical hospital centres/clinical hospitals/clinics are tested by the Mann-Whitney U test, whereas the Wilcoxon test, or the Friedman test (Post hoc test Conover) are used for testing of data according to business years of general hospitals or clinical hospital centres/clinical hospitals/clinics. The research results indicate that there is a statistically significant difference between income, expenses and business results, as well as receivables of general hospitals in comparison to clinical hospital centres, clinical hospitals and clinics. The due liability ranks of general hospitals compared to clinical hospital centres/clinical hospitals/clinics do not differ significantly.

Based on the analysis of available data and analysis of financial indicators of clinical hospital centres, clinical hospitals, clinics and general hospitals, this research confirms two of the three hypotheses. In general, all hospitals as healthcare institutions should continue to increase income and undertake measures to reduce business expenses in order to provide for stable and sustainable financial operations.

Keywords: hospitals, quality, indicators, liabilities, business results

JEL classification: I11, I19, M49

INTRODUCTION

Clinical hospital centres, clinical hospitals¹ and clinics are funded from the state budget, whereas general hospitals² are funded from budgets of local or regional self-government units. As of the Article 86 of the Act on Amendments to the Health Care Act, entering into force on 1 January 2024, local self-government units and the City of Zagreb ceased to be founders of general hospitals, transferring the founding rights to the Republic of Croatia.

All hospitals as healthcare institutions are registered in the Register of budgetary and extra-budgetary users of the state budget and budgetary and extra-budgetary users of the budget of local and regional self-government units.

Hospitals run their business in accordance with the Health Care Act, they provide health care services, specialist and consultative activities with specialist diagnostics, day clinics and medical rehabilitation. They also supply drugs and medical products, and perform radiological and laboratory diagnostics. Some of the hospitals in the Republic of Croatia also perform scientific and research activities, teaching and educational activities, whereas all hospitals have organisational units dealing with professional and administrative tasks.

In addition to the financial indicators of hospitals, natural business indicators are also recorded and summarised in the annual report of stationary healthcare institutions, which shows the situation as of 31 December of the current fiscal year.

In 2022, data related to the number of beds, number of beds per 1,000 inhabitants, number of doctors, number of discharged patients and number of days of hospital treatment were higher in clinical hospital centres, clinical hospitals and clinics than in general hospitals, except for the data referring to the number of beds per doctor with an achievement index of 87.25, and the turnover interval with an achievement index of 69.93, which were lower if compared to general hospitals.

The contracted number of beds for clinical hospital centres, clinical hospitals and clinics was 9.717, while for general hospitals it was 6.060 beds. Differences in patient turnover affect differences in the business operations of hospitals, since clinical hospital centres have larger bed capacities and are therefore able to accommodate more patients, which reflects in the increase in other business indicators.

The largest portion in income of all hospitals is provided by the Croatian Health Insurance Fund. The agreed maximum amount of funds for the provision of hospital and specialist-consultative healthcare is determined in the Agreement concluded with the Croatian Health Insurance Fund.

Hospital healthcare, which includes hospital treatments and specialist-consultative healthcare, realized a higher amount of expenditure in 2022 if compared to the previous year. Greater expenses refer to the amount billed in invoices issued by hospitals for performed services. The difference to the amount transferred to hospitals that they did not justify with delivered healthcare services in form of invoices issued to the

¹ One clinical hospital is owned by the City of Zagreb

² Upon the transfer of founding rights on 14 March 2020, the Republic of Croatia is the founder of the Vukovar General County Hospital, i.e. the National Memorial Hospital in Vukovar. The National Memorial Hospital in Vukovar provides health care services as a general hospital in accordance with the provisions of the Health Care Act.

Croatian Health Insurance Fund, are reported as advance payments and represented as receivables of the Croatian Health Insurance Fund, i.e. they represent liabilities of hospitals.

In addition to the agreed maximum (monthly) amount, the Croatian Health Insurance Fund provides additional financial means to hospitals for performed health services, such as explants, transplants, interventional cardiology, interventional neurology and neuroradiology, medical insemination, cochlear implants, special materials, interventional gastroenterology and personalised medicine.

The Ministry of Health and the Croatian Health Insurance Fund provided assistance funds to hospitals for the purpose of settling obligations towards suppliers of drugs and consumable medical materials. Hospitals were obliged to prepare a document³ that includes an analysis of the current financial situation for the budget year and to propose measures to eliminate identified practices that affect negative business operations. One of the significant measures included in the document is the rationalisation of operations, analysis of the usage of drugs and consumable medical materials, as well as the control of other expenses, of which current and investment maintenance services are identified as significant expenditure.

All hospitals are required to adopt a work plan for the budget year, which contains goals and measures that contribute to positive business operations, such as capital projects, business rationalisation measures, and revenue-increasing measures necessary for responsible, efficient, transparent, and sustainable operations.

The research questions, objectives and hypotheses are as follows:

Research question 1.: Is there a statistically significant difference in the achieved business results of general hospitals and clinical hospital centers, clinical hospitals and clinics?

Research objective 1.: It is necessary to establish the existence/non-existence of a statistically significant connection or difference in the achieved result of operations of general hospitals compared to clinical hospital centers, clinical hospitals and clinics

Hypothesis 1: Statistically significant difference is identified in the achieved business results of general hospitals compared to clinical hospital centres, clinical hospitals and clinics

Research question 2.: Is there a statistically significant difference between the receivables of general hospitals and clinical hospital centers, clinical hospitals and clinics

Research objective 2.: It is necessary to determine the existence/absence of a statistically significant connection or difference between the receivables of general hospitals compared to

clinical hospital centres, clinical hospitals and clinics.

Hypothesis 2: Statistically significant difference is identified between the receivables of general hospitals and receivables clinical hospital centres, clinical hospitals and clinics

Research question 3: Is there a statistically significant difference between the total due liabilities of general hospitals and clinical hospital centres, clinical hospitals and clinics?

³ Some of the hospital healthcare institutions have published those documents on their websites

Research objective 3: It is necessary to determine the existence/absence of a statistically significant connection or difference between the total due liabilities of general hospitals compared to clinical hospital centres, clinical hospitals and clinics.

Hypothesis 3: Statistically significant difference is identified in the total due liabilities of general hospitals compared to clinical hospital centres, clinical hospitals and clinics

This paper deals with data referring to clinical hospital centres, clinical hospitals, clinics and general hospitals, excluding special hospitals. Comparison of financial operations refers to income, expenditure, business results, liabilities and receivables of the observed hospitals, as mentioned above.

Referring to specificities of services provided by the hospital healthcare system with an emphasis put on the continuous increase of total liabilities, as well as overdue liabilities of hospitals and the necessity to resolve them, this paper focuses on clinical hospital centres, clinical hospitals, clinics and general hospitals in the Republic of Croatia.

The financial performance results show the surplus/deficit of income in relation to the expenditure of hospitals for the period of 2021 and 2022. The liabilities and receivables observed in this paper for 2021 and 2022 do not only refer to the mentioned years, i.e. the period from January to December for 2021 and 2022, since such data represent cumulative values related to the overall financial operations of hospitals. Liabilities and receivables include amounts that arose in 2021 and 2022, as well as in previous budget years.

The structure of the paper includes the following: the first part of the paper, Literature Review, provides an overview of previous research. The second part includes the research methodology, as well as empirical data. The third part presents the research results and discussion. The Conclusion of the paper analyzes the research results based on the hypotheses set, as well as recommendations for further research.

LITERATURE REVIEW

A review of literature sources related to research into financial operations of hospitals that distinguishes between types of hospitals, i.e. that compares general hospitals with clinical hospital centres, clinical hospitals and clinics in the Republic of Croatia, indicated scarce availability of literature sources. Available papers mainly focus on the quality of healthcare system related to the provision of health care and the efficiency of health care provided by hospitals.

Slijepčević evaluated the technical efficiency of hospitals. Analysis of the technical efficiency of hospitals refers to determination of space for rationalisation of operations or for improvement of quality, as well as for the increase in number of services provided. The emphasis is put on conducting additional analyses with the aim of improving the efficiency of hospital work, rational use of resources and establishing an efficient organisation. Evaluation of technical efficiency is important for assessing the success of the health policy in the Republic of Croatia. According to the results of measuring the technical efficiency of hospitals in 2010, the average efficiency of clinical hospital centres, clinical hospitals and general hospitals was 81.30% .

Referring to the analysis of natural indicators of hospital healthcare institutions, Buljan and Šimović reported that the number of available beds in hospitals in the Re-

public of Croatia was above the average of the European Union, which affected the increase in expenditure and did not contribute to the achievement of better health treatment outcomes.

Financial assistance to hospital healthcare institutions indicated a problem of financial sustainability of hospital system. Given the failure to pay received invoices within sixty days, clinical hospital centres and general hospitals owned by counties or local and regional self-government units were the main generators of debt.

According to the report of the in-depth analysis of expenditure, the potentially negative impact of individual measures was limited to the achieved level of quality and accessibility of healthcare, and attention was given to the improvement of the system efficiency. That analysis included the expenditure of ten hospital healthcare institutions funded from the state budget: Clinical Hospital Centre Split, Clinical Hospital Centre Zagreb, Clinical Hospital Centre Osijek, Clinical Hospital Centre Rijeka, Clinical Hospital Centre "Sestre Milosrdnice", Clinical Hospital Dubrava, Clinical Hospital Merkur, Clinic for Children's Diseases, Clinic for Orthopedics Lovran, Clinic for Infectious Diseases

Based on data obtained from the audit of hospitals in 2011, business operations of hospital healthcare institutions were analysed by Včev and Mahaček to confirm the influence of financial statements on decision-making process. Improvement of business performance should be based on increasing of income, collecting receivables, reducing expenses, settling and reducing existing liabilities, and establishing an organisational structure that would make rational use of funds.

Buljan and Šimović concluded that despite numerous financial supports given to hospital healthcare institutions from the state budget, the dynamics of incurring new debts is greater than the provision of financial supports, so it is clear that debt incurred by hospitals will continue to grow in the future.

Budimir and Lutilsky analysed relevant models for measuring of hospital business performance and proposed definition of performance indicators in four areas: healthcare provision process, patients, organisational health and development, and resources. "Measuring performance in the Croatian healthcare system is becoming important for the quality improvement strategy and for the increased budget allocations for healthcare, which shall result in more efficient management of healthcare institutions".

In the paper of Rabar, efficiency of 63 Croatian hospitals was assessed by using the data limitation analysis. It is a set of models and methods based on mathematical programming. Based on the obtained results, the author made projections of inefficient hospital institutions to the efficient limit, and determined the amounts of their inefficiency.

Šimović and Primorac pointed out the most important segment related to expenses of hospital healthcare institutions. Hospitals could manage their revenues and expenses to a greater extent through a clearer definition and implementation of payments according to the economic price of provided healthcare services. Since the debts of hospitals are continuously being remedied by the Republic of Croatia, the authors proposed key measures that should affect the long-term fiscal sustainability and stability of the healthcare system.

The impact of earmarked assistance funds for general hospitals in the Republic of Croatia to settle part of their due liabilities to suppliers of drugs, consumables and

implantable medical materials (in 2021 and 2022) was positive, since it reduced the debt that hospital healthcare institution accumulated in previous years. This paper also shows the amounts of earmarked funds for the years 2021 and 2022 for all general hospitals founded by counties or local and regional self-government units.

The indicators resulting from the above-mentioned researches show that it is necessary to conduct additional analyses in order to improve efficiency not only of hospitals, but also of the entire healthcare system.

Operating conditions of hospital healthcare institutions

Financial operations of hospitals shall be in line with national legal regulations, as well as with internal acts, and those acts should have a positive impact on financial operations.

The contracted maximum amount of financial means to be provided to hospitals by the Croatian Health Insurance Fund for hospital and specialist consultation healthcare services (hospital limits) is not aligned with due liabilities in hospital healthcare institutions. Considering the increase in expenses for employees, as well as the change in market conditions that include the increase in prices of energy, drugs, medical consumables, as well as services for ongoing maintenance, it is necessary to consider the increase of hospital limits (the established prices of diagnostics and therapy procedures and costs per day of hospital treatment do not increase proportionally to the increase in amounts of hospital limits).

Most hospitals are unable to charge the maximum possible amount of costs for provided hospital and specialist consultation healthcare to the health insurance, because of which liabilities for less work performed towards the Croatian Health Insurance Fund are increasing. According to the Healthcare Employers Association, it is expected that hospitals will continue with negative business results due to the pricing determined unilaterally by the Croatian Health Insurance Fund and an established system in which low prices paid for services to hospitals do not cover the real costs of delivered services.

In 2022, hospital healthcare institutions achieved negative business results in the amount of 29,372,946 EUR, of which 5,685,522 EUR refers to clinical hospital centres, clinical hospitals and clinics, and 23,687,424 EUR refers to general hospitals.

Total liabilities of all hospital healthcare institutions as of 31 December 2021 amounted to 1,441,072,712 EUR, and as of 31 December 2022, that amount increased to 1,477,617,329 EUR. The share in the stated amounts referring to general hospitals was 35.44% in 2021, and 35.39% in 2022. When comparing the two years, the index of realisation of due liabilities of clinical hospital centres, clinical hospitals and clinics for 2022/2021 is 110, while for general hospitals that index of realisation is 80. For general hospitals, it is clear that the total due liabilities are lower in 2022 compared to 2021. The total liabilities of hospital healthcare institutions also include the amount of additional funds received from the Croatian Health Insurance Fund. In accordance with the instructions, those funds are recorded as advance funds since they have be justified by the invoiced realisation of healthcare services.

Regarding the comparison of liabilities, general hospitals have lower total liability in 2022 than in 2021, while clinical hospital centres, clinical hospitals and clinics have higher total liability in 2022 than in 2021.

In the structure of business expenses, the largest share refers to expenses for employees and material expenses (expenses for drugs, medical consumables and services). The consumption of drugs in the Republic of Croatia has increased due to the discovery and use of new, more effective drugs that enable partial or complete cure of seriously ill patients, introduction of new methods and treatment procedures and more effective use of particularly expensive drugs, the costs of which are covered by the obligatory health insurance.

Comparative analysis of general hospitals shows that the structure of total income and receipts consists of income from the sale of non-financial assets, and receipts from financial assets and borrowings. The analysis comprises trends in income, expenses, financial results and liabilities of 10 general hospitals (OB) in the Republic of Croatia, which are labelled as OB1, OB2, etc., in the period from 2017 to 2021. The structure of due liabilities for 10 general hospitals in 2021 is observed, and it is clear from it that the largest part of due liabilities consists of liabilities for material expenses.

Despite the allocated financial supports from the state budget, hospitals continue to generate negative financial results and increase in liabilities, which shall affect again negative business results in the next budget year.

METHODOLOGY

In this research, statistical methods are used to verify the set hypotheses. The normality of the distributions is tested by the Shapiro-Wilk test. Continuous data are described by the median and the interquartile range. Differences in continuous values between general hospitals and clinical hospital centres/clinical hospitals/clinics are tested with the Mann-Whitney U test, and differences between years for general hospitals or clinical hospital centres/clinical hospitals/clinics are tested by the Wilcoxon test or the Friedman test (*Post hoc test* Conover). All P values are two-sided. The significance level is set at $\alpha = 0.05$. Statistical analysis is performed in the MedCalc® Statistical Software version 23.0.6 (*MedCalc Software Ltd, Ostend, Belgium; <https://www.medcalc.org>; 2024*).

The Shapiro-Wilk test is used to check the normality of data distribution in statistical analysis. It tests the hypothesis that the sample comes from normally distributed set. The Shapiro-Wilk test helps to decide whether non-parametric methods should be used.

The Wilcoxon test is a non-parametric statistical test used to compare the medians of dependent variables when the data do not follow a normal distribution. Ranks are used in the calculation, which reduces the influence of extreme values.

The Friedman test is a non-parametric statistical test for analysis of differences between more than two related variables (dependent samples). This test is analogous to parametric analysis of variance for repeated measures (*ANOVA*), but is used when the data do not meet the assumptions of normal distribution or homogeneity of variance. Each group data is ranked for each variable, and then the difference in ranks between groups is analysed.

The set hypotheses are:

H1: There is statistically significant difference identified in the achieved business results of general hospitals compared to clinical hospital centres, clinical hospitals and clinics

H2: There is statistically significant difference identified between the receivables of general hospitals and receivables of clinical hospital centres, clinical hospitals and clinics

H3: There is statistically significant difference identified in the total due liabilities of general hospitals compared to clinical hospital centres, clinical hospitals and clinics.

EMPIRICAL DATA

The sample consists of 5 (five) clinical hospital centers, 3 (three) clinical hospitals, 5 (five) clinics and 21 (twenty one) general hospitals in the Republic of Croatia. Liabilities, receivables, income, expenses and business results of mentioned hospital health institutions are observed.

The structure of expenses is also analyzed (the financial data did not include the Dr.Ivo Pedišić General Hospital of Sisak because of the consequences of earthquake).

The financial statements of hospital health institutions consolidated in the Report of financial audits expressed in Croatian Kuna, are taken as a source of data on which the hypotheses are tested in this research. For the purposes of this analysis, the data are expressed in Euros.

RESEARCH RESULTS AND DISCUSSION

For the purposes of testing the Hypothesis 1: There is statistically significant difference identified in the achieved business results of general hospitals compared to clinical hospital centres, clinical hospitals and clinics, the analysis shall test the difference in income, expenses and business results between clinical hospital centres, clinical hospitals, clinics and general hospitals in the Republic of Croatia in the years 2021 and 2022. Testing is performed by the Mann-Whitney U test, to determine whether and to what extent the specified parameters differ between clinical hospital centres, clinical hospitals, clinics and general hospitals.

For the purposes of performing the test, two assumptions are defined:

H1.1: Ranks of business results and business income and expenses do not differ significantly.

H1.2: Ranks of business results and business income and expenses differ significantly.

The following table 1 overviews the values of means and dispersion of parameters by the types of hospital healthcare institutions, i.e. clinical hospital centres, clinical hospitals, clinics and general hospitals in the Republic of Croatia. Comparable parameters of healthcare institutions include income, expenses and business results, i.e. surplus or deficit of income.

Table 1. Differences in income and expenses between general hospitals and clinical hospital centres, clinical hospitals and clinics in the years 2021 and 2022

Median (interquartile range)					
	General hospitals	P†	Clinical hospital centres, clinical hospitals and clinics	P†	P*
Income					
2021	29.610.314,55 (14.381.003,32 – 46.979.636,87)	0,03	74.045.789,5 (24.336.583,55 to 216.927.897,0)	0,04	0,02
2022	31.129.813,66 (14.995.123,67 – 48.088.431,0)		79.060.672,51 (26.301.535,90 – 219.236.674,66)		0,01
Expense					
2021	32.246.215,0 (15.118.945,75 to 48.316.066,50)	0,06	75.036.301,0 (26.701.181,0 - 223.558.771,50)	0,06	0,02
2022	35.876.879,0 (16.067.511,25 - 50.198.384,25)		79.090.363,0 (27.669.583,0 – 217.774.063,50)		0,02
Surplus / deficit					
2021	-1.288.842,94 (-2.445.893,58 – 731.914,69)	> 0,99	-990.511,50 (-6.630.876,49 - -93.885,54)	0,13	0,51
2022	-1.138.940,0 (-2.488.354,50 - -411.570,25)		723.050,0 (-2.230.254,75 – 1.263.063,0)		0,22

Source: The Author (according to *Mann-Whitney U test;†Wilcoxon test)

In order to test the first hypothesis, the parameters of clinical hospital centres, clinical hospitals, and clinics are compared with the same parameters of general hospitals.

By testing the differences in incomes between general hospitals and clinical hospital centres/clinical hospitals/clinics, it is observed that income of general hospitals were significantly higher in 2022 than in 2021 (median 31.129.813,66 € vs. 29.610.314,55 €) (Wilcoxon test, $P = 0.03$). Furthermore, significantly higher incomes are observed for clinical hospital centres/clinical hospitals/clinics (median 79.060.672,51 € vs. 74.045.789,50 €) (Wilcoxon test, $P = 0.04$). When comparing incomes in 2021 and 2022 between general hospitals and clinical hospital centres/clinical hospitals/clinics, it is noticed that the median of income was significantly higher for clinical hospital centres/clinical hospitals/clinics than for general hospitals, both in 2021 (Mann-Whitney U test, $P = 0.02$) and in 2022 (Mann-Whitney U test, $P = 0.01$).

Referring to the expenditure, there are no significant differences between the years 2021 and 2022 either for general hospitals, or for clinical hospital centres/clinical hospitals/clinics. Comparison of expenditure in 2021 and 2022 between general hospitals and clinical hospital centres/clinical hospitals/clinics proves that the median of expenditure was significantly higher for clinical hospital centres/clinical hospitals/clinics than for general hospitals, both in 2021 (Mann-Whitney U test, $P = 0.02$) and in 2022 (Mann-Whitney U test, $P = 0.02$).

There are no significant differences in surplus/deficit in 2021 and 2022 between general hospitals and clinical hospital centres/clinical hospitals/clinics. Since the significance calculated by the Mann-Whitney U test is less than 0.05 for all indicators, it is conclude at a confidence level of 95% that there is statistically significant difference

between general hospitals and clinical hospital centres/clinical hospitals/clinics, so the H1.1 is not confirmed.

The table 2 presents expenditure structure u clinical hospital centres/clinical hospitals/clinics and in general hospitals in the Republic of Croatia for the year 2022. This structure includes expenses for employees, material and financial expenses and expenses for non-financial assets.

Table 2. Expenditure structure in 2022 in general hospitals i clinical hospital centres/clinical hospitals/clinics

	Median (interquartile range)		P*
	General hospitals	Clinical hospital centres/clinical hospitals/clinics	
Expenses for employees	21.612.493,0 (10.905.219,75 – 25.858.446,25)	43.200.229,0 (17.064.432,75 – 90.683.354,0)	0,04
Material expenses	9.755.965,0 (4.416.507,0-2,057.373,5)	37.577.621,0 (9.224.994,75 – 100.897.969,25)	0,008
Financial expenses	105.691,0 (64.360,25 -564.222,75)	255.517,0 (41.229,75 – 852.184,25)	> 0,99
Expenses for non-financial assets	1,393.105,0 (591.645,5 – 2,769.677,25)	4,545.483,0 (1.399.400,5 – 13,191.115,0)	0,06

Source: the Author (according to *Mann-Whitney U test)

Expenses for employees (median 43.200.229,0 € vs. 21.612.493,0 €) (Mann-Whitney U test, $P = 0.04$), and material expenses (median 37.577.621,0 € vs. 9.755.965,0 €) (Mann-Whitney U test, $P = 0,008$) are significantly higher in clinical hospital centres/clinical hospitals/clinics than in general hospitals. Financial expenses are slightly higher in clinical hospital centres/clinical hospitals/clinics ($P > 0.99$), as well as expenses for non-financial assets ($P = 0.06$), but without being statistically significantly different when compared to general hospitals.

In order to test the Hypothesis 2: There is statistically significant difference identified between the receivables of general hospitals and receivables of clinical hospital centres, clinical hospitals and clinics, this research examines the difference in total and due receivables between general hospitals and clinical hospital centres/clinical hospitals/clinics.

For the purposes of performing the test, two assumptions are defined:

H2.1 There is no statistically significant difference between receivables of general hospitals and receivables of clinical hospital centres.

H2.2 There is statistically significant difference between receivables of general hospitals and receivables of clinical hospital centres.

Dynamics of receivables are observed for the years 2021 and 2022.

Table 3. Total and due receivables in 2021 and 2022 in general hospitals and in clinical hospital centres/clinical hospitals/clinics

Median (interquartile range)					
General hospitals		p†	Clinical hospital centres/clinical hospitals/clinics	p†	P*
Total receivables					
2021	927.510,0 (474.634,75 – 3,100.703,0)	0,26	10,601.023,0 (4,123.461,0 – 17,025.895,25)	0,17	<0,001
2022	1,153.570,0 (511.069,5 – 3,038.204,0)		11,071.735,0 (5,658.365,5 – 18,106.949,5)		<0,001
Due receivables					
2021	416.766,0 (241.512,75 – 1,401.553,25)	0,76	3,043.414,0 (823.949,25 – 9,207.642,25)	0,17	0,02
2022	566.961,0 (170.055,75 – 1,228.920,0)		2,037.940,0 (921.723,25 – 9,002.531,0)		0,03

*Mann-Whitney U test; [†]Wilcoxon test; **Source:** the Author

The Wilcoxon test (a non-parametric statistical test used to assess the differences between pairs of data - the Wilcoxon test of ranks for dependent samples) shows that there is no significant difference in total receivables and in due receivables between 2021 and 2022, both for general hospitals and for clinical hospital centres/clinical hospitals/clinics.

When comparing total receivables in 2021 and 2022 between general hospitals and clinical hospital centres/clinical hospitals/clinics, it is observed that in 2021, the median of total receivables is significantly higher in clinical hospital centres/clinical hospitals/clinics than in general hospitals (median 10.601.023,0 € vs. 927.510,0 €) (Mann-Whitney U test, $P < 0.001$), as well as in 2022 (median 11.071.735,0 € vs. 1.153.570,0 €) (Mann-Whitney U test, $P < 0.001$).

For receivables due in 2021 and 2022, it is observed that the median of total receivables was significantly higher in clinical hospital centres/clinical hospitals/clinics than in general hospitals, both in 2021 (median 3.043.414,0 € vs. 416.766,0 €) (Mann-Whitney U test, $P = 0.02$), and in 2022 (median 2.037.940,0 € vs. 566.961,0 €) (Mann-Whitney U test, $P = 0.03$). The obtained significance is less than 0.05, therefore, it is conclude at a confidence level of 95% that there is statistically significant difference between general hospitals and clinical hospital centres/clinical hospitals/clinics.

The Wilcoxon test is used to compare total receivables between the years 2021 and 2022 for general hospitals, and the Mann-Whitney U test is used to compare the differences between general hospitals and clinical hospital centres/clinical hospitals/clinics in the years 2021 and 2022.

The alternative hypothesis H2 that there is a statistically significant difference between receivables of general hospitals and receivables of clinical hospital centres/clinical hospitals/clinics is accepted, and H1 is rejected.

In order to check the Hypothesis 3: There is statistically significant difference identified in the total due liabilities of general hospitals compared to clinical hospital centres, clinical hospitals and clinics, this research overviews the difference in due liabilities in the years 2021 and 2022 between general hospitals and clinical hospital centres/clinical hospitals/clinics and determines their dynamics for the period from

2018 to 2022. For the purposes of the test, the two assumptions are made:

H3.1: Ranks of due liabilities of general hospitals compared to clinical hospital centres/clinical hospitals/clinics do not differ significantly.

H3.2: Ranks of due liabilities of general hospitals compared to clinical hospital centres/clinical hospitals/clinics differ significantly.

Table 4. Due liabilities in 2021 and 2022 in general hospitals and clinical hospital centres/clinical hospitals/clinics

Median (interquartile range)					P*
General hospitals		P†	Clinical hospital centres/clinical hospitals/clinics		
Due liabilities					
2021	2,987.303,0 (1,444.376,0 – 8,824.286,50)	0,39	12.328.051,0 (5,085.175,0 – 19,958.877,0)	0,24	0,17
2022	2,811.290,60 (970.458,43 – 5,566.503,22)		15,967.706,28 (4,428.629,93 – 22,428.078,51)		0,07

*Mann-Whitney U test;†Wilcoxon test; **Source:** the Author

Due liabilities are tested for the years 2021 and 2022. From the obtained data, it is clear that there are neither statistically significant differences in due liabilities between general hospitals and clinical hospital centres/clinical hospitals/clinics for 2021 and 2022, nor there are any differences in due liabilities between the observed years in general hospitals or clinical hospital centres/clinical hospitals/clinics (Mann-Whitney U test for 2021 $P = 0.17$, for 2022 $P = 0.07$).

The following table presents the median with limits of the interquartile range for due liabilities in the period 2018-2022.

Table 5. Due liabilities in the period 2018-2022 in general hospitals and in clinical hospital centres/clinical hospitals/clinics

Median (interquartile range)					
General hospitals		P†	Clinical hospital centres/clinical hospitals/clinics	P†	P*
Due liabilities					
2018	8,170.422,0 (4,330.351,75 – 13,552.867,25)		21,903.806,0 (5,361.886,75 – 47,157.286,75)		0,13
2019	9,403.683,0 (5,665.603,75 – 15,709.559,25)		26,003.522,0 (7,379.127,0 – 58,472.502,0)		0,12
2020	13,998.069,0 (7,928.707,0 – 22,574.130,0)	<0,001§	38,683.689,0 (12,170.981,75 – 100,837.596,25)	<0,001‡	0,08
2021	15,742.665,0 (9,110.667,0 – 32,142.053,75)		38,933.279,0 (15,051.222,50 – 111,143.717,75)		0,12
2022	15,731.495,0 (10,479.492,25 – 35,979.406,25)		41,830.798,0 (14,751.305,75 – 115,714.476,50)		0,11

*Mann-Whitney U test;†Friedman test (Post hoc test Conover); ‡at the level $P < 0.05$ significant differences (2018) vs. (all other years); (2019) vs. (all other years); (2020) vs. (2022); §at the level $P < 0.05$ significant differences (2018) vs. (all other years); (2019) vs. (all other years); (2020) vs. (2021, 2022); **Source:** the Author

There are no significant differences in total due liabilities between general hospitals and clinical hospital centres/clinical hospitals/clinics in any year during the period 2018-2022.

As a test used to compare more than two related groups of data, the Friedman non-parametric statistical test is used to test differences in due liabilities between general hospitals and clinical hospital centres/clinical hospitals/clinics. This test is an equivalent to the one-way repeated measures (ANOVA) in nonparametric form. It is used when the data are not normally distributed. As an additional analysis, the *post hoc* Conover test is used to confirm statistical differences between groups. That test allows comparison of all possible pairs of groups in order to identify specific groups between which there is a significant difference. For general hospitals, total liabilities are significantly lower in 2018 and 2019 when compared to all other years, and in 2020 when compared with 2022. There is no significant difference in due liabilities of general hospitals between 2021 and 2022 (Friedman test, $P < 0.001$).

Referring to clinical hospital centres/clinical hospitals/clinics, their total liabilities are significantly lower in 2018 and 2019 when compared to all other years, and in 2020 when compared with 2021 and 2022. There is no significant difference in due liabilities in clinical hospital centres/clinical hospitals/clinics between 2021 and 2022 (Friedman test, $P < 0.001$).

Since there is no difference between general hospitals and clinical hospital centres/clinical hospitals/clinics, the H3.1 is accepted.

In addition to the analysed business indicators of hospital healthcare institutions, i.e. their comparison and ranking, it is necessary to conduct additional study into the business indicators of general hospitals in relation to clinical hospital centres/clinical hospitals/clinics, since general hospitals have become beneficiaries of the state budget since 1 January 2024..

Considering the complexity of the healthcare system and the specific nature of business operations of the observed healthcare institutions, it is necessary to compare the business indicators with other indicators and analyse whether the due liabilities of general hospitals have increased or decreased in the aforementioned period. In order to compare the indicators of healthcare institutions' business conditions more efficiently, it is necessary to investigate the impact of expenses referring to drugs and medical consumables.

In addition to the above recommendations for further research, it is necessary to include natural indicators of hospital healthcare institutions and investigate whether there is a statistically significant relation between those natural indicators and financial performance indicators that would influence business operations.

CONCLUSION

Referring to the current circumstances, the hospital healthcare system is specific as it comprises the business processes of all hospital healthcare institutions and controls material expenditures for the purpose of assuring rational and responsible business operations, i.e. fiscal sustainability of the healthcare system. Material expenditures have increased due to changes in market conditions and general increase in prices of drugs and medical consumables, which take up the greatest portion in material expenditures, as well as increase of costs of current and investment maintenance services.

In order to reduce the existing debt of hospital healthcare institutions and due to the increase in prices caused by macroeconomic conditions, the Government of the Republic of Croatia passed decisions by which additional budgetary funds were allocated to hospitals.

Despite the additional earmarked funds, hospitals continue to generate negative financial results, and accumulate new liabilities, which will again have a negative impact on business in the next budget year. The increased total liabilities of hospitals are also affected by increased liabilities for less work delivered towards the Croatian Health Insurance Fund, since the increase in hospital limits was not accompanied by an increase in due liabilities of hospitals.

Based on the available consolidated report on auditing of hospitals for 2021 and 2022, this paper presents comparison of financial operations, which includes income, expenditure, business results, liabilities and receivables of the observed hospital healthcare institutions.

In order to test the determined hypotheses, the financial performance indicators of clinical hospital centres/clinical hospitals/clinics are compared with the same indicators of general hospitals. When testing the H1, significance obtained by the Mann-Whitney U test is less than 0.05 for all indicators, so it is concluded with a confidence level of 95 % that there is statistically significant difference between general hospitals and clinical hospital centres/clinical hospitals/clinics referring to ranks of business income and expenditure. Compared to general hospitals, financial expenses are slightly higher in clinical hospital centres/clinical hospitals/clinics ($P > 0.99$), as well as expenses for non-financial assets ($P = 0.06$), but without statistically significant difference.

The Wilcoxon test is used to compare total receivables between the years 2021 and 2022 for general hospitals, and the Mann-Whitney U test is used for comparison of financial performance indicators of 2021 and 2022 between general hospitals and clinical hospital centres/clinical hospitals/clinics. Obtained significance is less than 0.05, therefore, with a confidence level of 95%, it is concluded that there is a statistically significant difference between receivables of general hospitals and receivables of clinical hospital centres/clinical hospitals/clinics.

There is no significant difference in due liabilities between clinical hospital centres/clinical hospitals/clinics and general hospitals in the years 2021 and 2022 (Friedman test, $P < 0.001$), so it is concluded that the ranks of due liabilities of general hospitals compared to clinical hospital centres/clinical hospitals/clinics do not differ significantly. The dynamics of total due liabilities in general hospitals is weaker than in clinical hospital centres/clinical hospitals/clinics.

Future research shall analyse and compare expenditure indicators, such as costs of drugs and consumable medical supplies, since they take up the greatest portion in material expenditures of hospital healthcare institutions. It is also necessary to investigate such statistical connection with business results with the aim of improving the business efficiency of hospital healthcare institutions.

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