

## Article

# Impact of changes of hospital integrations spanning a decade in Hungary: Modern diagnostic services: CT care based on a Hungarian sample

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## CITATION

Szivós E, Hegedűs M, Balogh S, et al. (2024). Impact of changes of hospital integrations spanning a decade in Hungary: Modern diagnostic services: CT care based on a Hungarian sample. *Journal of Infrastructure, Policy and Development*. 8(6): 4215. <https://doi.org/10.24294/jipd.v8i6.4215>

## ARTICLE INFO

Received: 14 January 2024

Accepted: 14 March 2024

Available online: 3 June 2024

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**Abstract: Introduction, purpose of the study:** In Central Europe, in Hungary, the state guarantees access to health care and basic health services partly through the Semmelweis Plan adopted in 2011. The Health Plan aims to optimize and transform the health system. The objectives of hospital integration, as set out in the Plan, started with the state ownership of municipal hospitals in 2012, continued with the launch of integration processes in 2012–2013 and culminated today. The transformation of a health system can have an impact on health services and thus on meeting the needs of the population. We aim to study the effectiveness of integration through access to CT diagnostic testing. Our hypothesis is that integration has resulted in increased access to modern diagnostic services. The specialty under study is computed tomography (CT) diagnostic care. Our research shows that the number of people receiving CT diagnostic care has increased significantly because of integration, which has also brought a number of positive benefits, such as reduced health inequalities, reduced travel time, costs and waiting lists. **Test material and method:** Our quantitative retrospective research was carried out in the hospital of Kalocsa through document analysis. The research material was comparing two time periods in the Kalocsa site of Bács-Kiskun County, Southern Hungary. The number of patients attending CT examinations by area of duty of care according to postal codes was collected: Pre-integration period 2014.01.01–2017.11.30. (Kalocsa did not have CT equipment, so patients who appeared in Kecskemét Hospital but were under the care of Kalocsa), post-integration period 2017.12.01–2019.12.31. (period after the installation of CT in Kalocsa). The target group of the study consisted of women and men together, aged 0–99 years, who appeared for a CT diagnostic examination. The study sample size was 6721 persons. Linear regression statistics were used to evaluate the results. Based on empirical experience, a SWOT analysis was carried out to further investigate the effectiveness of integration. **Results:** As a result of the integration, the CT scan machine purchased in the Kalocsa District Hospital has enabled an average of 129.7 patients per month to receive CT scans on site without travelling. The model used is significant, explaining 86% of the change in the number of patients served ( $F = 43.535$ ;  $p < 0.001$ , adjusted  $R^2 = 0.860$ ). The variable of integration in the model is significant, with an average increase in the number of patients served of 129.7 per month ( $t = 22.686$ ;  $p < 0.001$ ) following the introduction of CT due to integration. None of the month variables representing seasonal effects were found to be significant, with no seasonal effect on care. The SWOT analysis has clearly identified the strengths, weaknesses,

opportunities and threats related to the integration, the main outcome of which is the acquisition of a CT diagnostic tool. **Conclusions:** Although we only looked at one segment of the evidence for the effectiveness of hospital integration, integration in the study area has had a positive impact on CT availability, reducing disparities in care.

**Keywords:** delivery of health care; efficiency; Europe; health services accessibility; public health systems research; tomography; X-ray computed; health tourism

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## 1. Introduction

Hungary, situated in Central Europe within the Pannonian Basin, spans an area of 93.027 square kilometers and had a population of 9,599,744 permanent residents as of 1 January 2023, according to the Hungarian Central Statistical Office. It is a unitary, parliamentary republic and a member of various international organizations, including the European Union, NATO, OECD, World Bank, UN, and the Schengen Area.

### 1.1. Background

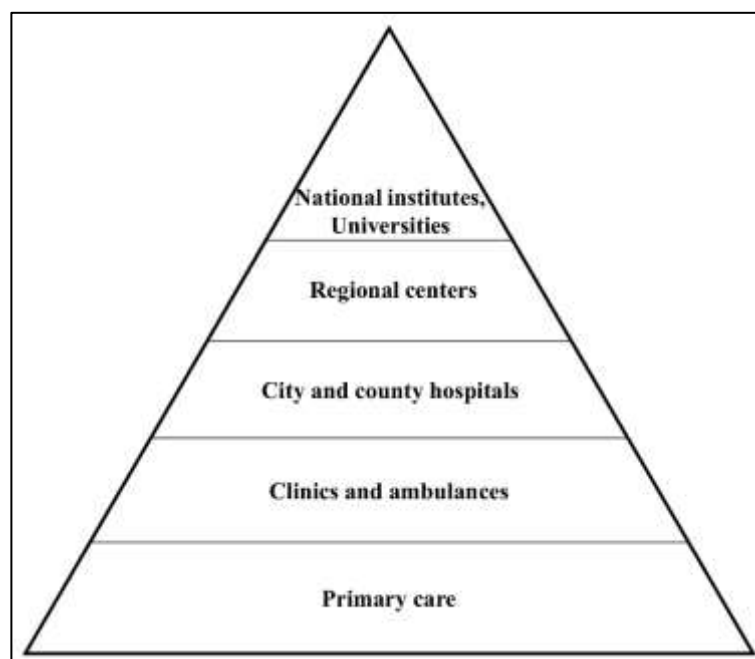
Health systems vary in their organization and financing structures, with Hungary's system characterized by high centralization under the central government's responsibility. Historically, Hungary implemented the Bismarckian system of solidarity in 1891, aligning with other European countries. This system, funded through social security contributions shared between employees and employers, emphasizes equity by providing services based on need rather than contribution level.

Post-World War II, Hungary adopted the socialist healthcare system of the former Soviet Union, characterized by strong state dominance and state-exclusive financing. Following the regime change in the 1990s, Hungary transitioned back to the Bismarckian, solidarity-based system, akin to other Eastern European socialist countries, dismantling the socialist healthcare system.

Hungary operates a tax-funded universal healthcare system, where residents pay social security tax deducted from their wages to access state healthcare services without additional charges. Funding methods have evolved over time, shifting from base funding to performance-based funding, with taxes primarily financing the system.

The healthcare structure in Hungary distinguishes between public and private providers, with private healthcare services requiring payment. Major public providers include national institutes, teaching hospitals, regional centers, city and county hospitals, clinics, ambulances, and primary care facilities. Outpatient care is provided at primary care facilities, clinics, and ambulances, while inpatient care is available at higher-level institutions (Boncz, 2011; Boncz and Sebestyén, 2013; Szigeti et al., 2019; Hegedűs, 2021a).

Below them are the regional centers; city and county hospitals; clinics and ambulances; and primary care (**Figure 1**). Outpatient care takes place at the level of primary care, clinics, and ambulances while in those above, in addition to outpatient care, inpatient care also operates. Primary care includes family doctor care, nurse service, occupational physician service, school doctor service, and dental care.



**Figure 1.** The structure of the health service in Hungary.

Based on the Statista database in Hungary, a total of 161 public hospitals provide health care to the population. Hungary's health expenditure as a share of GDP is the sixth lowest in the EU after Luxembourg, Romania, Poland, Ireland, and Slovakia, with 7.3% of GDP spent on health in 2022. The other Visegrád Countries will spend 7.6% of their GDP on health, compared to an EU average of 9.1%, which allows for high quality and efficiency of healthcare in developed countries.

## **1.2. Theoretical framework**

The aim of the present study is to answer the question of whether the objectives of the Semmelweis Plan mentioned earlier have been achieved in the context of the launch of hospital integration models, such as efficiency, equity, and reduction of regional disparities in care.

Integration is seen as an opportunity to reform health systems worldwide. Looman's study of 17 case studies from 8 European countries identified 10 mechanisms for successful implementation of integrated care, including: successful implementers, the use of a growth model that is gradually scaled up, a balance between flexibility and formal structures for integration. Leadership and governance, involving all stakeholders, using collaborative governance and sharing leadership at all levels of the system, were important among the mechanisms identified. Implementers were able to develop a multidisciplinary team culture through mutual recognition of each other's roles. New roles and competencies were built in as incentives. Long-term funding was favoured rather than fragmented funding and innovative payments were emphasized. Cooperation and communication were promoted rather than administrative procedures. There was an emphasis on continuous feedback monitoring. They succeeded in coordinating the different actors and levels of the health and social care system (Looman et al., 2021; Troisi et al., 2022; Smeets et al., 2023).

Compared to the results of the above study, Hungary is still at the very beginning of the effective implementation of integration, but it can be an example for health policy makers and decision makers in Hungary.

By examining a small segment of the feasibility of the efficiency factors expected in the context of integration in Hungary, we aim to show that, through the results of this research, it has been demonstrated that the integration model itself, even if not fully developed, already contains elements that can support its efficiency and serve as a model for further integrated hospitals and can be seen as a result by decision-makers.

The present study is aimed at an area of the health services arena that ensures equal access to diagnostic tests.

On the basis of further studies abroad, there is still scope to examine the elements of the failure of integration that they have identified and to build on them to address problems such as: power imbalances, political fragmentation, distrust, lack of clarity on reform efforts, mismatch of existing funding with the new model, governance gaps, multiple actors not on the same platform, inadequate and unclear definition of common objectives, lack of continuous feedback, all of which need to be addressed primarily at the meso level. These problems have been identified mainly in Belgium (Steel, 2022).

The current system is at the limits of its capacity to cope with an aging population, an increase in the number of patients, and a shortage of human resources in the health sector and is no longer sustainable under the same conditions (Hegedűs, 2017; Menyhárt et al., 2018; El Archi et al., 2023).

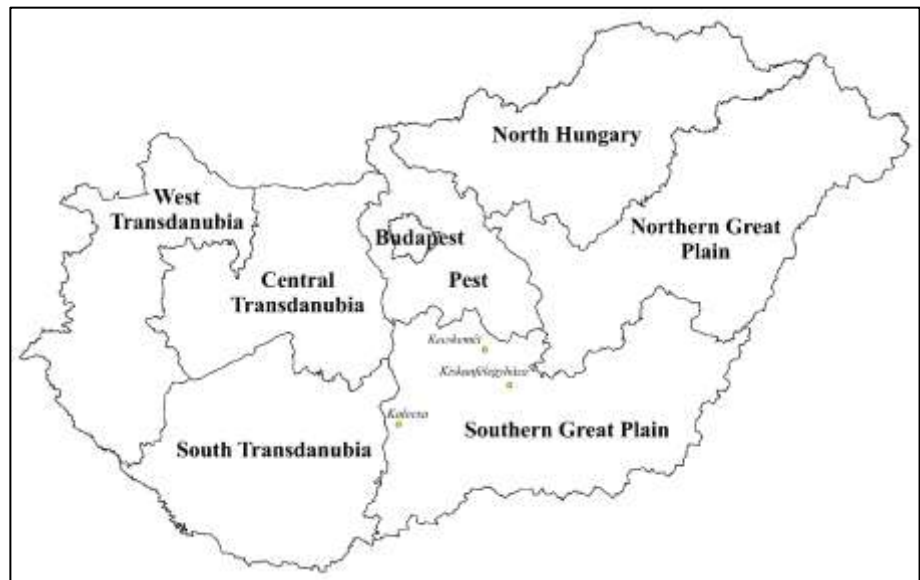
In recent decades, the high quality of health care has played a prominent role in the increase in life expectancy, but it has also become a source of problems due to funding and structural difficulties. Technical and technological progress and the introduction of new procedures have led to an increase in costs in the health sector, while healthcare institutions are struggling to finance the additional costs of replacing depreciation rising wages, and other costs.

Observing the health sector in Hungary, one can see its continuous change, and one of the keywords, based on the experience of recent years, is the integration of institutions.

The Semmelweis Plan, written in 2011, which is also the handbook for the implementation of hospital integration in Hungary, describes that in order to achieve good health, the preconditions for health, effective health promotion, health protection, disease prevention and treatment of sick people must be ensured. This is inconceivable without an effective healthcare system that provides high-quality services, reflects the state of the art, and is accessible to all inhabitants of the country on a nearly equal basis. (Benda et al., 2011). ‘The Semmelweis Plan is in line with Western European efforts to focus on disease prevention, same-day care, patient-centered, cost-effective care, centralized in its approach and autocratic in its style.’ (Hegedűs and Pataki, 2013; Hegedűs, 2019). The importance of integration has already been articulated by the Systems Analysis Department of the Institute for Quality and Organization Development in Pharmacy and Healthcare (currently: National Institute of Pharmacy and Nutrition) in a 2012 paper, which stated that integrated care facilitates collaboration between providers, thus enabling mandatory cost savings in healthcare (WHO, 2008).

In 2013, the integration of outpatient care further complicated the tasks of individual institutions and increased the need for expert support. It was hoped that, with the necessary collaboration and effort, the development of software to support the audit work of healthcare providers would become feasible. It also called for a unified approach, transparent data reporting, measurable performance, the development of an evaluation principle, support for each other's work, and the raising of the professional status of budget-certified auditors (Hegedűs, 2013). Unfortunately, it has now become apparent that the integration processes have not always been effective. The measures taken to reduce the debt, such as frequent changes of direction, constant changes in legislation, and its over-regulation and rigidity, have prevented the natural development of the health economy (Hegedűs, 2015; Hegedűs, 2021b).

The present study explores the results of the joint integration of three healthcare institution in Hungary. This structural transformation took place in the Southern Great Plains region of Hungary with the merger of three hospitals, the Kalocsa Szent Kereszt Hospital, the Kiskunfelegyháza Hospital and the Bács-Kiskun County Hospital (BKMK) on 1 February 2013, thus being among the first integration models in Hungary (**Figure 2**). The period since the integration can provide an objective picture of the feasibility and effectiveness of the Semmelweis Plan. We have examined the achievement of the objectives mainly from the Kalocsa side. The cross-section of the present study focuses on the assumption that access to modern diagnostic care has increased as a result of integration, and the present study is limited to Computer Tomography (CT) diagnostic care.



**Figure 2.** Map display of the investigated cities.

Among the many advantages of computed tomography (CT) are that it is fast, reliable, accurate, painless and low-risk. Its main purpose is to provide a CT scan to confirm a suspicion when physical examination, ultrasound, and X-ray cannot give a definitive diagnosis (Bazug, 2011). Accurate diagnosis is essential for the further development of the patient's condition, as it influences effective therapy, the appropriate choice of treatment options, and the number of years of health and quality

of life of the patient, which, in its entirety, has a social impact from a distant perspective. The state often sees health expenditure as a short-term investment and is only now beginning to recognize that investment in health can be a key element of economic growth (Byrne, 2004).

### **1.3. Results**

Welfare systems are only partially able to adapt to change due to a lack of resources, and therefore health integration alone cannot be evaluated (Josep et al., 2008). In interpreting the functions of the health system, attention must be paid to the financing of health services, the quality of care, the development of resources, and the appropriate level of government intervention (Carrin, 2003).

In agreement with the above findings, the present study can nevertheless be considered effective on the basis of our examination of only one segment of integration so far.

However, the direct effects of integration have not yet been tested through real-life examples.

According to the well-known Maslow pyramid, human needs are hierarchical and progression to higher levels can occur when the previous one is fulfilled. The second level is security, which includes the protection of health (Maslow, 1943). In their research, Bummi and his colleague argue, in agreement with Maslow's model, that the satisfaction of all these needs is necessary for the individual to function properly, and that meeting these needs is critical for physical and mental well-being. Unfortunately, health inequality also occurs in developed countries. This can be the result, for example, of long traveling distances, a lack of infrastructure and staff, or a lack of individual health-related knowledge. It is very important to highlight that these factors can indirectly lead to the deterioration of an individual's health, which can reduce productivity (Bummi and Samuel, 2022). The European Union is also paying close attention to the issue of health inequality and smart health tourism, which can be solved by broadening and making the healthcare institutional system more accessible (El Archi et al., 2023).

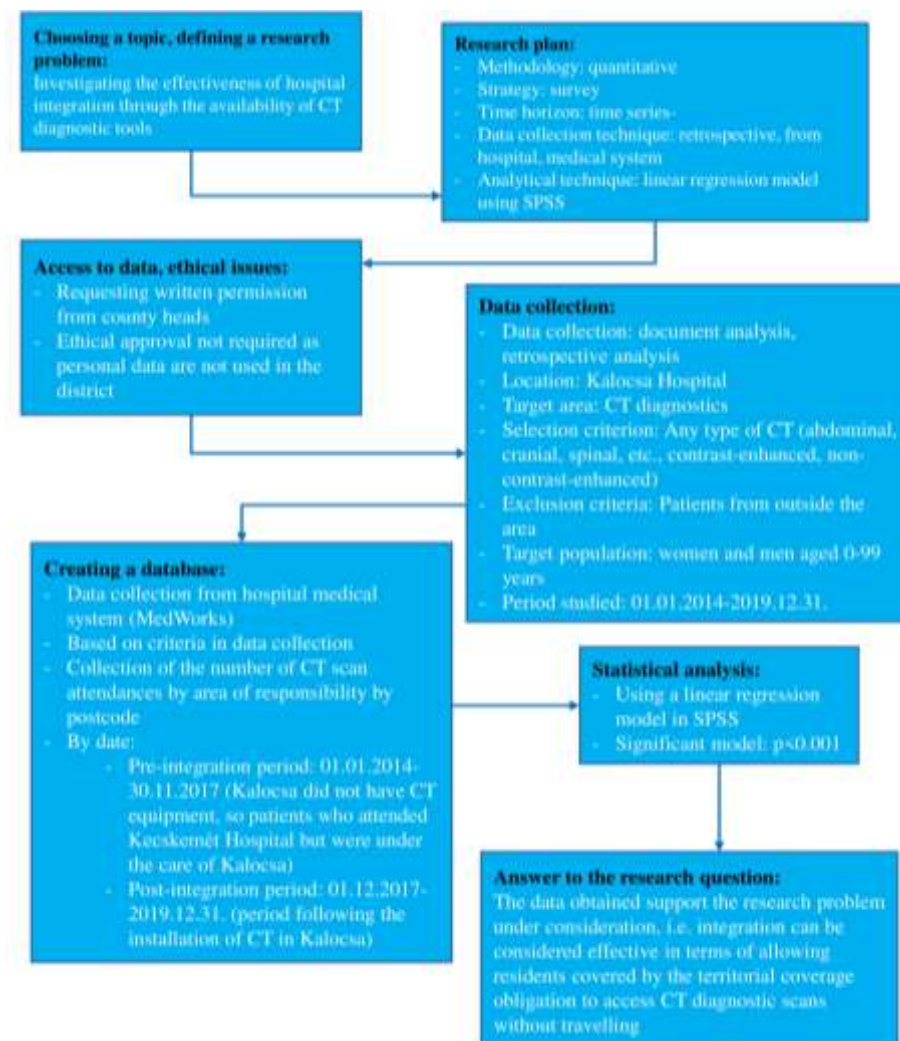
The above studies can support the present study, which may reduce health inequalities by ensuring the availability of this diagnostic tool to reduce travel distance, early diagnosis may reduce deterioration and thus promote productivity. The state guarantees access to health and basic health services (Gulyás, 2013). Gulyás's previous study is supported by the present research, as bringing the availability CT tools closer to the population can help to maintain health and access to health services, which the state guarantees in the basic requirements of integration launched under the Semmelweis Plan, thus confirming its effectiveness.

## **2. Materials and methods**

The process of our research is illustrated in **Figure 3**.

Our quantitative, retrospective research was conducted at the Szent Kereszt Hospital in Kalocsa, Hungary, and the research data were obtained from the Medworks medical system. The medical system used by the hospital is an internet-independent medical system that contains all the patient test records that are presented to the

hospital. The data was filtered based on criteria in the research process and then processed using Excel. The resulting data were converted into SPSS software with the help of a statistician, where the actual statistical analysis (linear regression model) was performed.



**Figure 3.** The process of the research.

Source: own compilation.

The total study sample size was 6238 patients. Data collection was performed by documentary analysis, including patients who went under CT scan in Bács-Kiskun County Hospital in Kecskemét and Kalocsa, between the period 1 January 2014–30 November 2017. The patients have belonged to the territorial care obligation presented in **Table 1**. Based on the postal codes, a comparison was made with the number of patients treated during the period from 1 December 2017 to 31 December 2019 at the Kalocsa site, also based on the postal codes, which are presented in **Table 2**.

**Table 1.** Kecskemét CT Diagnostic Specialist Clinic of the Kalocsa site Number of patients covered by the Territorial Care Obligation of the Kalocsa site.

<b>Bács-Kiskun County Hospital (Kecskemét) CT Diagnostics</b>				
<b>Months</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
January	41	65	39	61
February	43	49	107	50
March	41	64	25	47
April	41	64	42	40
May	40	58	52	74
June	43	53	46	47
July	32	50	35	67
August	35	54	43	60
September	60	58	56	65
October	58	53	44	66
November	41	67	55	71
December	32	50	42	0
Altogether	507	685	586	648

Source: own compilation.

**Table 2.** Number of patients attending the CT Diagnostic Department of the Holy Cross Hospital of Kalocsa, 2017.12.01–2019.12.31.

<b>Kalocsa CT Diagnostics</b>			
<b>Months</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>
January	0	118	201
February	0	100	165
March	0	124	178
April	0	114	187
May	0	52	207
June	0	138	178
July	0	155	212
August	0	139	175
September	0	136	189
October	0	172	165
November	0	170	197
December	74	149	117
Altogether	74	1567	2171

Source: own compilation.

The evolution of the number of patients receiving CT diagnostic care in Kecskemét and Kalocsa was analyzed using a linear regression model in SPSS. We have built a trend analysis model using linear regression in SPSS for understanding the evolution of the number of patients receiving CT diagnostic care in Kecskemét and Kalocsa.



The dependent variable of the model is the number of patients treated (patient/month) in period 1 January 2014–31 December 2019. December, the results are presented in **Tables 3** and **4**.

Independent variables in the model:

- the dichotomous variables for each month (January–December) (the variable for January is dropped from the models and the other months are compared).
- dichotomous variable for the start of CT scanning at the Kalocsa site from 01.12.2017 (due to integration) (Integration: 0 = month before integration, 1 = month after integration).

**Table 3.** Summary Statistics of the Linear Regression trend Analysis Model About the Number of Patients Attending CT Diagnostic Specialist Clinics ( $N = 72$ ).

CT										
Model Summary <sup>a,c</sup>										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.938 <sup>b</sup>	0.88	0.86	25.939	0.88	43.535	12	71	0	1.281

a. Class = CT

b. Predictors: (Constant), December, Integration, November, October, September, August, July, June, May, April, March, February

c. Dependent Variable: Case number

Source: own compilation.

**Table 4.** Analysis of the number of patients attending the CT Diagnostic Specialist Clinic using linear regression in SPSS.

Coefficients <sup>a,b</sup>										
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics		
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF	
	(Constant)	50.253	10.106		4.973	0	30.102	70.403		
	Integration	129.743	5.719	0.934	22.686	0	118.34	141.147	0.994	1.006
	February	9.286	13.865	0.037	0.67	0.505	-18.361	36.932	0.545	1.833
	March	-8.429	13.865	-0.034	-0.608	0.545	-36.075	19.218	0.545	1.833
	April	-13.143	13.865	-0.053	-0.948	0.346	-40.789	14.503	0.545	1.833
	May	-2.857	13.865	-0.011	-0.206	0.837	-30.503	24.789	0.545	1.833
1	June	1.143	13.865	0.005	0.082	0.935	-26.503	28.789	0.545	1.833
	July	8.714	13.865	0.035	0.629	0.532	-18.932	36.361	0.545	1.833
	August	2.429	13.865	0.01	0.175	0.861	-25.218	30.075	0.545	1.833
	September	10.571	13.865	0.042	0.762	0.448	-17.075	38.218	0.545	1.833
	October	12.143	13.865	0.049	0.876	0.384	-15.503	39.789	0.545	1.833
	November	11.571	13.865	0.046	0.835	0.407	-16.075	39.218	0.545	1.833
	December	-20.535	13.889	-0.082	-1.478	0.144	-48.229	7.16	0.544	1.84

a. Class = CT

b. Dependent variable: Case number

Source: own compilation.

The integration at the Kalocsa site took place in February 2013, in connection with which the resources supporting the integration became available, so the operation of the CT equipment at the Kalocsa site started on 01.12.2017, after its installation, so the comparison period is 2014. 01.01.2017–2017.11.30-Number of CT examinations performed in Kecskemét for patients belonging to the Kalocsa Area, with the period from 01.12.2017 to 31.12.2019-using the locally available, installed CT scanner in Kalocsa for patients also belonging to the Kalocsa Area.

The study was based on a measure specifically aimed at improving health care based on a Hungarian government plan. Furthermore, within this, diagnostic care with CT equipment is at the center of the research.

### 3. Results

Our results show that the model is significant, explaining 86% of the change in the number of patients ( $F = 43.535$ ;  $p < 0.001$ , adjusted  $R^2 = 0.860$ ). The integration variable in the model is also significant, with an average increase of 129.7 patients per month in the Kalocsa site after the CT was introduced ( $t = 22.686$ ;  $p < 0.001$ ). None of the month variables representing seasonal effects were found to be significant, with no seasonal effect in care, the results are presented in **Table 5**.

**Table 5.** Analysis of the number of patients attending the CT Diagnostic Specialist Clinic.

Analysis of the number of patients attending a CT diagnostic clinic		
Independent variable	Beta	t-value
constant	50.253	4.973 (***)
Integracio	129.743	22.686 (***)
February	9.286	0.67
March	-8.429	-0.608
April	-13.143	-0.948
May	-2.857	-0.206
June	1.143	0.082
July	8.714	0.629
August	2.429	0.175
September	10.571	0.762
October	12.143	0.876
November	11.571	0.835
December	-20.535	-1.478

$F = 43.535$  (\*\*\*), corrected  $R^2 = 0.860$   
 (\*\*\*)  $-p < 0.001$ ; \*\*  $-p < 0.01$ ; \*  $-p < 0.05$ )

Source: own compilation.

If we apply a SWOT analysis to the integration of Kecskemét and Kalocsa, the distance factor is evident among the weaknesses. The SWOT analysis is presented in **Table 6**. The distance of 90 km and the inadequate road infrastructure made it very difficult for patients to travel to the CT Diagnostic Centre of the Kecskemét Hospital. The travel costs paid by the State have decreased.

**Table 6.** SWOT analysis.

SWOT	Help you achieve your goals	Inhibit the goals
<b>INSIDE FACTORS</b> (organisational characteristics)	<p><b>STRENGTHS</b> (Strengths)</p> <p>Providing patients with specialist services that we could not provide locally due to a lack of specialist staff, thus implementing the principle of equity, i.e. ensuring equal access for patients.</p> <p>Uniform protocols so that all patients receive the same care.</p> <p>Authorization to participate in training courses with support (travel, participation fees, tuition fees) from previously awarded TÁMOP grants.</p> <p>By taking advantage of the opportunities offered by the tenders, the staff of the Kalocsa site are professionally prepared and trained.</p> <p>Management and staff well adapted to the changes of recent years (change of management, state ownership, integration).</p> <p>A good working relationship has been established between the staff of the sites.</p> <p>Ct diagnostics, funded by the EU grant TIOP2.2.6B supporting integration.</p> <p>The use of a well-functioning IT system will allow telemedicine to be operated, using the expertise of specialists working in the BKMK to cover areas where there are not enough specialists available or where it is not necessary to “buy” specialists at a huge cost.</p>	<p><b>FACILITIES</b> (Weaknesses)</p> <p>The current management is not transparent.</p> <p>Slowing down the pace of business, creating more bureaucracy.</p> <p>County Hospital cannot provide adequate assistance in case of HR shortages.</p> <p>The division of labour between sites has not been sufficiently clarified.</p> <p>The 90 km distance between the two institutions does not allow for a rational organisation of logistical processes.</p>
	<p><b>FUTURE FACTORS</b> (environmental characteristics)</p> <p><b>OPPORTUNITIES</b> (Opportunities)</p> <p>Joint public procurement, leading to cost reduction and cost efficiency.</p> <p>Doctors working at the Kalocsa site can participate in surgery at the BKMK at any time, enabling them to learn new techniques to provide patients with the highest level of care.</p> <p>Developing a profile with the necessary capacity (doctor, specialist) that can lead to safer patient care.</p> <p>Winning additional TÁMOP-type grants to support training.</p> <p>Improving psychiatric rehabilitation.</p> <p>Use of our TIOP 2.2.6 resources.</p>	<p><b>THREATS</b> (Threats)</p> <p>If the infrastructural conditions to facilitate integration had not been implemented with the TIOP 2.2.6 funding, it would not have been possible to achieve efficient and economical operation, which would have jeopardized the sustainability of integration.</p> <p>More doctor emigration.</p>

Source: own compilation.

**Table 7** shows the number of patients who required CT diagnostic examinations at the Holy Cross Hospital in Kalocsa after the installation and operation of CT scanning during the period under review, i.e., from 01.12.2017 to 31.12.2019. The table shows that the number of patients served shows an upward trend compared to the number of patients treated at the Bács-Kiskun County Hospital before this period, which was under the territorial obligation of the Szent Kereszt Hospital in Kalocsa.

**Table 7.** Number of patients attending the CT Diagnostic Department of the Holy Cross Hospital of Kalocsa, 2017.12.01–2019.12.31.

<b>Kalocsa CT Diagnostics</b>				
Months	2017	2018	2019	Total
January	0	118	201	319
February	0	100	165	265
March	0	124	178	302
April	0	114	187	301
May	0	52	207	259

**Table 7.** (Continued).

<b>Kalocsa CT Diagnostics</b>				
<b>Months</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>Total</b>
June	0	138	178	316
July	0	155	212	367
August	0	139	175	314
September	0	136	189	325
October	0	172	165	337
November	0	170	197	367
December	74	149	117	340
Altogether	74	1567	2171	3812

Source: own compilation.

#### **4. Discussion**

In Hungary, one of the pillars of the Ministry of National Resources' State Secretariat for Health's structural reorganization plan was the development of a county-level integrated care system, with measures to improve patient care (EMMI, 2021). To achieve this, and to exploit the potential of modern medicine, CT diagnostics must support safe patient care in the facility where acute care is provided. The current system is at the limits of its capacity to cope with the aging of the population, the increase in the number of patients, and the shortage of human resources in the health sector, which means that the health system is no longer sustainable under unchanged conditions and is therefore being shaped by technological developments, the aging of the population and the increased expectations of the population (Mossialos et al., 2002).

Before the integration of the hospitals, due to the lack of CT diagnostic equipment, Kalocsa was unable to provide on-site CT examinations for residents subject to territorial obligations, which made patient care very difficult. The integration made it possible (TIOP2.2.6B) to purchase a 12-slice Philips CT scanner, which enabled the immediate diagnosis of patients arriving at the site. After the installation of the CT equipment in Kalocsa, it became clear that during the research period (1 December 2017–31 December 2019), a significant number of patients (3812 patients) under the territorial coverage of the Hospital of Kalocsa did not have to travel 90 km to receive CT diagnostic services, as shown in **Table 7**.

Since the central question of the present study was to demonstrate the effectiveness of integration and within the framework of which the accessibility and availability of CT diagnostic tools and the approach to health equity were the primary objectives, we see this as the primary demonstration of the research results. It is also feedback to the health policy makers who designed the Semmelweis Plan that the efficiencies expected from integration are demonstrable and tangible. More studies and feedback of this kind are likely to be needed in the future, as it now seems that health care organization and reorganisation experts around the world consider that integration could be a possible way of redesigning the allocation of resources and building a new health system that is more efficient, more responsive to patients' needs and more supportive of health equity.

This has changed access to care in a positive direction while reducing the burden of care at Kecskemét Hospital. Patient journeys have been shortened in both distance and time. Residents had earlier access to testing, received results earlier, and effective therapy could be started in time, which greatly increased patients' chances of recovery, significantly reducing health inequalities. As patients' chances of recovery and survival increase, economic effects can also be felt positively, such as shorter periods of sick pay and an early return to work, thus making the individual 'productive' again.

The correlation between health and economic growth is well-established, with healthy individuals being less likely to be absent from work and exhibiting higher levels of efficiency and effectiveness (Frenk, 2004). Thus, investments in healthcare infrastructure and initiatives like hospital integration not only improve health outcomes but also have ripple effects on economic performance, highlighting the interconnectedness of health and socioeconomic development.

#### **4.1. Limitations and future directions**

Despite the promising outcomes observed in this study, it is essential to acknowledge its limitations. The research period (1 December 2017, to 31 December 2019) may not capture long-term effects or potential changes in patient demographics and healthcare needs. Additionally, while the study focuses on the impact of CT diagnostic equipment integration, other factors influencing healthcare delivery and patient outcomes may not have been fully accounted for.

Future research should explore the sustained effects of hospital integration on patient care outcomes beyond the initial implementation phase. Moreover, investigating the broader implications of healthcare system reorganization, including the integration of additional diagnostic and treatment modalities, could provide comprehensive insights into building a more resilient and patient-centered healthcare system. While this study highlights the tangible benefits of hospital integration in enhancing patient care and promoting health equity, further research is warranted to fully understand its long-term impact and inform future healthcare policy and practice.

#### **4.2. Relevance**

The study on a single hospital in Hungary, which indeed holds significant relevance as it represents the pioneering integration initiative in the country. This unique context highlights the importance of the study in providing empirical evidence and feedback crucial for evaluating the effectiveness of integration efforts, as outlined in the Semmelweis Plan.

Given the absence of similar studies and the pivotal role of real-world data and feedback in informing future integration strategies, the findings of this study hold considerable value in contributing to the body of knowledge surrounding healthcare integration. The insights gleaned from this study not only shed light on the specific outcomes and implications of integration at the individual hospital level but also serve as a foundation for guiding subsequent integration endeavors across Hungary's healthcare landscape.

As the first major integration initiative in Hungary, this study offers valuable insights into the challenges, successes, and opportunities associated with hospital

integration, thereby laying the groundwork for future research endeavors aimed at comprehensively assessing the long-term impact and sustainability of integration efforts. Moving forward, additional studies exploring various facets of integration, its effects on healthcare delivery, patient outcomes, and health equity, are essential for informing evidence-based policymaking and refining integration strategies to optimize healthcare delivery and promote equitable access to services across Hungary's healthcare system.

## **5. Conclusion**

This study aimed to demonstrate the achievement of equal access to healthcare services through the implementation of hospital integration, initiated in 2013 in Hungary's Southern Great Plain Region, specifically benefiting the city of Kalocsa and its nearly 70,000 inhabitants. The integration effort resulted in the provision of previously unavailable imaging examinations and CT equipment, eliminating the need for residents to undertake long journeys to access such services in neighboring municipalities. Our research underscores the critical role of creating conducive health conditions at the micro-level to enhance productivity and, subsequently, macro-level economic performance (Bloom and Canning, 2000).

Notably, this study represents a decade-long specialized investigation within Hungary's healthcare sector, focusing on the significant benefits of expanding access to CT scans for diagnostic purposes. Our statistical analyses support the multiple advantages of making such equipment available to a broader patient base, with a pivotal moment being the integration of rural healthcare institutions, leading to increased availability of CT services. This localized provision of modern diagnostic tools contributes to reducing health inequalities, a priority highlighted by the Commission of the European Communities in Brussels.

Through hospital integration, our research demonstrates that access to modern diagnostic services can be substantially enhanced, thereby reducing health disparities, improving timely access to appropriate care for a larger patient population, and expanding the scope of locally available healthcare services. Moreover, the integration has resulted in tangible benefits such as reduced travel time and costs, as well as decreased absenteeism among working-age individuals, thereby mitigating spatial disparities in healthcare delivery.

In alignment with the Semmelweis Plan's objectives of promoting efficiency, equity, and reducing territorial disparities in care, hospital integration has effectively enabled the local population to access high-quality CT diagnostic services without the need for extensive travel. The realization of equal access, as highlighted in our study, has become a feasible outcome, leveraging the opportunities afforded by integration initiatives.

Importantly, our findings suggest that integration has a positive impact on reducing health inequalities by making specialized care locally accessible, facilitating early disease detection, and expediting patient recovery, ultimately fostering a quicker return to the labor market and contributing to macroeconomic growth.

In conclusion, the integration of healthcare services has substantially improved the quality of patient care and access to healthcare, underscoring its significance in

addressing health disparities and promoting economic prosperity at both micro and macro levels.

**Authors contributions:** Conceptualization, ES and MH; methodology, AG; software, SB; validation, LDD, FZD and ES; formal analysis, ES; investigation, MH; resources, LDD; data curation, LDD; writing—original draft preparation, ES; writing—review and editing, LDD; visualization, AG; supervision, FZD; project administration, ES. All authors have read and agreed to the published version of the manuscript.

**Conflict of interest:** The authors declare no conflict of interest.

## References

- Beneda, A., Bíró, M., Burány, B., et al. (2011). State Secretariat for Health: Semmelweis Plan to Save Health Care - A Professional Concept 2011 (Hungarian). Available online: [Semmelweis-TervSZKT-20110511\\_vevleges\\_kozig\\_egyeztetesre\\_3\\_](https://www.kormany.hu/vevleges_kozig_egyeztetesre_3_) (kormany.hu) (accessed on 14 January 2024).
- Bloom, D. E., & Canning, D. (2000). The Health and Wealth of Nations. *Science*, 287(5456), 1207-1209. <https://doi.org/10.1126/science.287.5456.1207>
- Boncz, I. (2011). Basic knowledge of health care financing, management and quality assurance (Hungarian). Pécsi Tudományegyetem. Egyetemi tankönyv. Budapest. Medicina.
- Boncz, I., Sebestyán, A. (2013). Basics of health insurance and health financing (Hungarian). Pécsi Orvostudományi Egyetem Általános Orvostudományi Kara. pp. 414-415.
- Buzug, T. M. (2011). Computed Tomography. In: Kramme R, Hoffmann KP, Pozos RS (editors). Springer Handbook of Medical Technology. Springer Handbooks. Springer. [https://doi.org/10.1007/978-3-540-74658-4\\_16](https://doi.org/10.1007/978-3-540-74658-4_16)
- Byrne, D. (2004). Enabling Good Health For All. A reflection process for a new EU health strategy. Commissioner for Health and Consumer Protection. European Communities. pp. 1-11.
- Carrin, G., & Hanvoravongchai, P. (2003). Provider payments and patient charges as policy tools for cost-containment: How successful are they in high-income countries? *Human Resources for Health*, 1(1). <https://doi.org/10.1186/1478-4491-1-6>
- El Archi, Y., Benbba, B., Nizamatinova, Z., et al. (2023). Systematic Literature Review Analysing Smart Tourism Destinations in Context of Sustainable Development: Current Applications and Future Directions. *Sustainability*, 15(6), 5086. <https://doi.org/10.3390/su15065086>
- Emberi Erőforrások Minisztériuma(EMMI)-Egészségügyért Felelős Államtitkársága (2021). Healthy Hungary 2021-2027 (Hungarian). Budapest, Hungary.
- Frenk, J. (2004). Health and the economy: a vital relationship. OECD Observer.
- Gulyás, D. (2013). The Hospital Integration Process (Hungarian). Available online: [a kórházintegráció folyamata - pdf free download](https://adoc.pub/download/a-korhazintegracio-folyamata-pdf-free) (adoc.pub) (accessed on 14 January 2024).
- Hegedűs, M., Pataki, L. (2013). Health care reform and financing issues (Hungarian). Growth and Equilibrium. Gyula Kautz Memorial Conference.
- Hegedűs, M. (2013). Methodological issues in the audit of healthcare providers (Hungarian). *Számvitel adó könyvvizsgáló: Szakma*, 55(2), 83-85.
- Hegedűs, M. (2017). The dilemmas of transforming health care (Hungarian). In: Fata I, Kissné Budai R (editors). *Oknyomozó tudomány: Tudományos Mozaik. kötet, Budapest, Magyarország: Tomori Pál College*. pp. 86-105.
- Hegedűs, M. (2019). The economic situation of the health sector and the role of the health-care allowance. *Wealth and Society*, 12(4), 5-30. <https://doi.org/10.21637/GT.2019.4.01>
- Hegedűs, M (2021a). The Effects of the Covid-19 Pandemic on the Hungarian Health Care (Hungarian). In: Kissné BR, Kromják L, Pál MÉ (editors). *Kultúrák találkozása a tudományban - Jövőformáló tudomány: Tanulmánykötet a Magyar Tudomány Ünnepe alkalmából. Budapest, Hungary: Tomori College*. pp. 140-151.
- Hegedűs, M. (2021b). Bankruptcy model analysis of healthcare providers (Hungarian). *Acta Carolus Robertus*, 11(1), 13–26. <https://doi.org/10.33032/acr.2571>

- Josep, F., Martin, M., Suszy, L., et al. (2008). Health systems, health and wealth: assessing the case for investing in health systems: background document 3. World Health Organization. Regional Office for Europe, European Observatory on Health Systems and Policies. pp. 1-80.
- Looman, W., Struckmann, V., Köppen, J., et al. (2021). Drivers of successful implementation of integrated care for multi-morbidity: Mechanisms identified in 17 case studies from 8 European countries. *Social Science & Medicine*, 277, 113728. <https://doi.org/10.1016/j.socscimed.2021.113728>
- Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, 50(4), 370–396. <https://doi.org/10.1037/h0054346>
- Menyhárt, O., Fekete, J., & Gyórfy, B. (2018). Demographic shift disproportionately increases cancer burden in an aging nation: current and expected incidence and mortality in Hungary up to 2030. *Clinical Epidemiology*, 10, 1093-1108. <https://doi.org/10.2147/clep.s155063>
- Mossialos, E., Dixon, A., Figueras, J., Kutzin, J. (2002). Funding health care: options for Europe. World Health Organization. Regional Office for Europe, European Observatory on Health Systems and Policies. pp. 1-16.
- Omodan, B. I., & Abejide, S. O. (2022). Reconstructing Abraham Maslow’s hierarchy of needs towards inclusive infrastructure development needs assessment. *Journal of Infrastructure, Policy and Development*, 6(2), 1483. <https://doi.org/10.24294/jipd.v6i2.1483>
- Smeets, M., Baldewijns, K., Vaes, B., et al. (2022). Integration of Chronic Care in a Fragmented Healthcare System Comment on “Integration or Fragmentation of Health Care? Examining Policies and Politics in a Belgian Case Study.” *International Journal of Health Policy and Management*, 12, 7143. <https://doi.org/10.34172/ijhpm.2022.7143>
- Steele, G. C. (2022). Overcoming political fragmentation: the potential of meso-level mechanisms: Comment on “Integration or fragmentation of health care? Examining policies and politics in a Belgian case study.” *Int J Health Policy Manag.*
- Szigeti, S., Evetovits, T., Kutzin, J., et al. (2019). Tax-funded social health insurance: an analysis of revenue sources, Hungary. *Bulletin of the World Health Organization*, 97(5), 335-348. <https://doi.org/10.2471/blt.18.218982>
- Troisi, R., De Simone, S., Vargas, M., et al. (2022). The other side of the crisis: organizational flexibility in balancing Covid-19 and non-Covid-19 health-care services. *BMC Health Services Research*, 22(1), 1096. <https://doi.org/10.1186/s12913-022-08486-1>
- WHO. (2008). Integrated health services-what and why? WHO Technical Brief.