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The impact of changes in the organisational structure of the health care system in Hungary on health care institutions

Doctoral (Ph.D) thesis booklet

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1. INTRODUCTION

In Central Europe, in Hungary, the state guarantees access to healthcare and basic health services partly through the Semmelweis Plan adopted in 2011. The primary objectives of the Semmelweis Plan include the optimisation and transformation of the healthcare system, the first steps of which started with the integration of hospitals and the state ownership of municipal hospitals in 2012 (Beneda, et al., 2011) . The transformation of the health system may have an impact on health services and thus on meeting the needs of the population (Szivós, et al., 2024) .

Nowadays, the integration processes in hospitals are slowly reaching their full potential, and numerous studies have been carried out on the principles, necessity and expected effects of integration, but the achievement of the goals set, the effectiveness and efficiency of integration, which is a fundamental requirement, have not yet been studied.

Hungary is still in the early stages of effective integration, but this study can inform health policy and decision-makers in Hungary.

On 1 February 2013, the Szent Kereszt Hospital in Kalocsa and the Kiskunfélegyházi Hospital were integrated into the Bács-Kiskun Vármegyei Oktatókházházház (hereinafter BKVOK), instead of the functional integration as defined in the Semmelweis Plan, a full integration was achieved, thus it was the first model in Hungary where several hospitals were integrated together at the same time.

The dissertation presents the effects of integration mainly through the operation of the Kalocsa site. The site provides inpatient care for the nearly 72,000 residents covered by its regional responsibility in 425 active, chronic and rehabilitation inpatient beds. It provides specialised outpatient and diagnostic care, as well as a Health Promotion Office, which is involved in prevention, health promotion and health protection, offering patients and residents a virtually complete portfolio of health services.

Integration in 2013 was an opportunity to help the then heavily indebted hospital recover. In addition, the Institution took advantage of the EU project TIOP 2.2.6 B for building renovation and equipment upgrading, which was only available to hospitals participating in the integration.

Twelve years have passed since integration, so this dissertation can provide an objective picture of how the goals set out in the Semmelweis Plan have been achieved.

2. OBJECTIVES OF THE STUDY

2.1 My first study was a comparative analysis of the accessibility of certain specialties (Orthopaedics, Hand and Shoulder Surgery). We wanted to find out whether the integration of the specialised practices under study has increased the accessibility of patients without having to travel to a distant city, thereby reducing regional inequalities and health inequalities.

2.2 In my second study, which also used comparative analysis, I aim to demonstrate the effectiveness of integration through access to CT diagnostic tests. I will investigate whether there has been an increase in the number of residents who have accessed CT diagnostic services, which also has a number of positive benefits, such as a reduction in health inequalities, travel time, costs and waiting lists.

2.3 In my next study, I looked for a link between integration and effective treatment of decubitus ulcers. The aim of my research is to demonstrate that the Semmelweis Plan, through joint procurement procedures in the context of hospital integration, will give the sites access to the highest quality smart dressings for the treatment of pressure ulcers, which are expected today and which will help to improve the effective management of pressure ulcers.

2.4 In my fourth study, I examined the impact of integration in terms of caseloads in outpatient specialist care. The aim of my research is to find a correlation between the integration of hospitals and the number of people (cases) using outpatient services.

2.5 I conducted a statistical analysis to answer the question whether there is a correlation between bed occupancy in inpatient wards and integration. The elimination of the duplication expected by the integration, as set out in the Semmelweis Plan, could not be achieved due to the distance between the two sites, but the Territorial Supply Obligation (hereinafter referred to as the TIO) was unified. The aim of my research is to find a correlation between integration and bed occupancy in inpatient wards. I conducted a statistical analysis of five inpatient wards.

2.6 My final analysis in my thesis is based on a cost analysis. My research objective is to investigate whether, following integration , costs show a downward trend in terms of weights for inpatient wards. I am also investigating the cost-effectiveness expected from the integration of hospitals, as formulated in the Semmelweis Plan.

3. HIPOTHESIS

- H1 For some specialised practices, integration has increased the possibility for patients to access them without travelling to a distant city.

- H2 Access to modern diagnostic services has increased thanks to integration.
- H3 Integration improves the chances of recovery for patients with decubitus ulcers (pressure ulcers).
- H4 The number of outpatient cases has increased following integration.
- H5 Integration has no significant impact on bed occupancy rates.
- H6 When projecting costs by weight, the trend for active inpatient wards shows a downward trend after integration.

4. MATERIAL AND METHOD

Method of data collection: a quantitative retrospective survey was conducted using document analysis. Location: the Holy Cross Hospital in Kalocsa. Study period was defined per study. Written permission to use the data was obtained from the then Director General. Ethical approval was not required during the studies. Data obtained from the hospital's MedWorks medical and MedKontroll controlling system were filtered according to various criteria and converted into an Excel spreadsheet. In the case of TEK, identification and sorting was based on postal codes

4.1 Examining the possibility of access to specialised clinics. Selection criterion: patients attending orthopaedic and hand and shoulder surgery specialties on the basis of TEK. Exclusion criterion: Patients outside TEK, other specialties. Target population: women and men aged 0-99 years. Sample size for the Orthopaedic Speciality: 4,308 patients, for the Hand and Shoulder Surgery Speciality: 2,997 patients. Period studied: I.

Patients attending the Orthopaedic and Hand and Shoulder Surgery Specialist Clinics of the BKVOK (Kecskemét), Kalocsa TEK. II. from 01.09.2016 to 31.12.2019, the number of patients treated by specialists arriving from BKVOK to the Kalocsa site during the locally provided specialist care, also based on postal codes.

4.2 Investigating access to diagnostic care (CT).

Inclusion criterion: patients with TEK who have undergone a CT diagnostic study. Exclusion criterion: patients who have undergone other diagnostic tests than TEK.

Target group: women and men aged 0-99 years. The total study sample was 6,238 patients.

Period under investigation:

I. Number of patients treated (based on the postal code of the patients of Kalocsa Hospital under TEK in BKVOK) in the period 01 January 2014 - 30 November 2017.

II. between 01 December 2017 and 31 December 2019, the number of patients who had a CT diagnostic examination at the Kalocsa site, also based on postal codes

4.3 The research involved the processing and subsequent analysis of data on decubitus patients from the electronic nursing records of the Kalocsa site, a study covering 14 years. Target group: women and men aged 18-99 years. Exclusion criterion: patients outside TEK, Infant and Children and Neonatal Unit, so patients under 18 years were not included in the sample. Inclusion criteria: TEK, any stage of decubitus. The 7 years before integration, from 01 January 2006 to 31 December 2012, were compared with the 7 years after integration, from 01 January 2013 to 31 December 2019, which allowed us to perform independent samples t-test, Chow test and linear trend calculations in SPSS.

The study sample size was 4,456 people.

4.4 The impact of the integration in the Holy Cross Hospital in Kalocsa was examined in terms of the evolution of the number of cases (number of patients served) in the Outpatient Department. Inclusion criterion: number of patients admitted to the Outpatient Department of the Kalocsa site during the period under study. Exclusion criterion: Inpatient care, patients outside TEK. Period studied: 01 January 2007 to 31 December 2019. The period before integration: 01/01/2007 to 31/12/2012 was compared with the period after integration: 01/01/2013 to 31/12/2019, so that 13 years of outpatient turnover data were processed.

4.5 For the analysis, we carried out a statistical analysis of five inpatient wards over 13 years to ensure that we had sufficient information for our research. The number of beds in inpatient wards did not change over the period analysed.
In the Holy Cross Hospital in Kalocsa, the impact of integration was studied by analysing bed occupancy in the Intensive Care, Internal Medicine, Chronic Internal Medicine, Chronic Psychiatry and Surgery Departments. In all cases, percentages and not absolute numbers were used. Selection criterion: number of patients admitted to the inpatient ward under study only. Exclusion criterion: patients admitted to other wards. Period studied: pre-integration period: 01/01/2007 to 31/12/2012 and post-integration period: 01/01/2013 to 31/12/2019.

4.6 The impact of integration in the Holy Cross Hospital in Kalocsa was studied by projecting costs by weight for active inpatient wards. Data were obtained from the MedKontroll controlling system used by the hospital. When analysing the data for the active inpatient departments separately, we found that some departments showed a slight increase when projecting costs by weight, while other departments showed a decrease, so we examined the results overall, i.e. we treated the costs of the active departments together when projecting costs by weight over the period under study. Given the sensitivity of the data, the 'raw' data have not been presented. Period considered: pre-integration period: 01.01.2007 to 31.12.2012 and post-integration period: 01.01.2013 to 31.12.2019.

5. Results

We set a threshold of $p<0.001$, which has become increasingly accepted in the medical and health sciences, rather than $p<0.05$, to reduce the risk of type I error (false positive), to meet more stringent scientific requirements, and to make $p<0.05$ easier to achieve in larger samples, but to make truly significant effects more likely to be significant. If the p-value in a study is less than 0.001, it is considered a highly significant result, meeting the prerequisite of $p<0.05$.

The resulting data were processed with the help of statisticians using SPSS Statistics 25 software and Python programming language (linear regression model, independent samples t-test, Chow test).

5.1 Linear regression model: the model is significant for the Orthopaedic Specialty, explaining 80.7% of the change in the number of patients ($F=29.873$; $p<0.001$, adjusted $R^2=0.807$). The variable of the specialty that appeared in the model due to integration is significant, with **an average increase of 42 patients per month** after the start of the specialty ($t=16.643$; $p<0.001$). Among the variables of the months representing seasonal effects, the month of August ($t=-5.623$; $p=0.001$) and December ($t=-3.634$; $p=0.001$) were significant, indicating that,

on average, 34.4 fewer patients were treated in August and 22.3 fewer in December compared to January.
The model is significant for the Hand and Shoulder Surgery Specialty, explaining 89.3% of the change in the number of patients served (F = 58.719; p<0.001, adjusted R^2 = 0.893). The variable of the specialty that appeared in the model due to integration is significant, with **an average increase in the number of patients served of 53.8 per month** after the specialty started operating (t = 25.745; p<0.001).
Of the variables for the months representing seasonal effects, those for July (t = -2.706; p = 0.009) and August (t = -2.809; p = 0.006) were significant, indicating that, compared to January, the average number of patients seen in July was 13.7 fewer and in August 14.3 fewer. The comparison clearly shows that the number of patients attending the Hand and Shoulder Surgery Specialist Clinic in Kalocsa has increased significantly, so it can be assumed that patients used other specialist care providers in addition to the specialist care in Kecskemét until the care was available locally.

5.2 Linear regression model: when examining access to CT diagnostic tests, 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 R2 = 0.860). The integration variable included in the model is also significant, with **an average monthly increase in the number of patients of 129.7** after the introduction of CT at the Kalocsa site (t = 22.686; p < 0.001). None of the monthly variables representing seasonal effects were found to be significant, with no seasonal effect in care.

5.3 ***In the analysis of the mean number of arrivals*** when examining the chances of recovery for patients with decubitus (pressure ulcer)***:*** t-tests showed significant differences at stages I, III and IV of decubitus. For stage I, $t(166) = -5.222$, $p < 0.001$; for stage II, $t(166) = -0.536$, $p = 0.593$; for stage III, $t(166) = 9.858$, $p < 0.001$; and for stage IV, $t(166) = 2.351$, $p = 0.02$.

The results show that before and after hospital integration there are significant differences in the number of patients with different stages of decubitus arriving at the hospital, especially for patients with stage III and IV decubitus. However, the number of patients with stage I decubitus increased, whereas there was no significant change for stage II decubitus.

In the analysis of the average number of discharges: t-tests showed that the number of patients leaving the hospital at different stages of decubitus after integration was significantly reduced. For stage I, $t(166) = 9.047$, $p < 0.001$; for stage II, $t(166) = 15.629$, $p < 0.001$; for stage III, $t(166) = 18.692$, $p < 0.001$; for stage IV, $t(166) = 14.484$, $p < 0.001$.

The results of the t-test clearly show that the number of patients discharged from hospital with different stages of decubitus after hospital integration decreased significantly. This decrease was most pronounced for patients with more severe stages III and IV.

When analysing the difference between the average number of patients arriving and leaving the hospital with decubitus, the t-test showed significant changes after integration for the difference between the average number of patients arriving and leaving the hospital with decubitus at different stages of decubitus. For stage I $t(166) = -16.872$, $p < 0.001$; for stage II $t(166) = -19.928$, $p < 0.001$; for stage III $t(166) = -10.078$, $p < 0.001$; and for stage IV $t(166) = -14.066$, $p < 0.001$.

Patients presenting to hospital with decubitus can be classified according to the stage of decubitus as follows:

For stage I decubitus: the Chow test indicated a structural fracture in January 2013 ($F (1, 166) = 6.95$, $p = 0.001$). Before the structural break, the model significantly predicted the number of patients ($F (1, 166) = 23.86$, $p < 0.001$, $R^2 = 0.225$). After integration, the model lost its predictive power ($F (1, 166) = 0.491$, $p = 0.485$, $R^2 = 0.006$).

There is evidence that a structural break occurred in January 2013, indicating that hospital integration has had a significant impact on the arrival of stage I decubitus patients.

Before integration, the model was statistically significant and explained about 22.5% of the variance. After integration, the model lost its predictive ability and explained less than 1% of the variance.

The change suggests that although integration has improved the quality of care (reflected in a reduction in the number of stage I patients), the change in the model means that the number of stage I decubitus patients did not change significantly from month to month after integration.

For stage II decubitus: the Chow test showed a significant structural break in January 2013, $F (1, 166) = 9.81$, $p < 0.001$. Before the structural break, the model significantly predicted the number of patients arriving, $F (1, 166) = 23.52$, $p < 0.001$, $R^2 = 0.223$. After integration, the predictive power of the model decreased, $F (1, 166) = 3.75$, $p = 0.056$, $R^2 = 0.044$.

The Chow test confirmed a significant structural change in the trend of patients presenting with stage II decubitus in January 2013.

Before integration, the model was highly significant, explaining about 22.3% of the variance. However, after integration, the predictive power of the model decreased significantly, explaining only 4.4% of the variance. This suggests that after hospital integration the number of patients arriving did not change significantly from month to month.

For stage III decubitus: the Chow test confirmed a significant structural change in the trend of patient admissions in January 2013 ($F (1, 166) = 3.76$, $p = 0.025$).

Before integration, the model significantly predicted the arrival of patients ($F (1, 166) = 48.21$, $p < 0.001$, $R^2 = 0.37$). After structural breakage, the model lost most of its predictive power ($F (1, 166) = 8.67$, $p = 0.004$, $R^2 = 0.096$).

Despite this decrease, the trend remained statistically significant, albeit weaker, suggesting that the number of patients continued to fall, albeit to a lesser extent.

For stage IV decubitus: significant structural fracture was confirmed for arrivals of patients with stage IV decubitus in January 2013, $F (1, 166) = 7.32$, $p = 0.001$.

The model for the period before structural change explained 19.6% of the variance, $F (1, 166) = 20$, $p < 0.001$, $R^2 = 0.196$.After integration, the model lost its predictive power, explaining only 0.4% of the variance, $F (1, 166) = 0.3362$, $p = 0.564$.The trend parameter was not statistically significant after integration, suggesting that the decline in the arrival of stage IV patients was not continuous.

Evolution of the number of patients discharged from hospital with decubitus according to the stage of decubitus:

For stage I decubitus patients discharged from hospital: significant structural change was detected in January 2013, $F (1, 166) = 56.71$, $p < 0.001$. Before the change, the model was significantly more powerful, explaining 38.5% of the variance, $F(1, 166) = 51.43$, $p < 0.001$. After the integration, the explanatory power of the model decreased, capturing only 18% of the variance, $F(1, 166) = 17.97$, $p < 0.001$.

While the number of stage I decubitus patients increased every month before the structural change, it started to decrease after the integration, highlighting a significant change in hospital dynamics.

For stage II decubitus patients discharged from hospital: significant structural change was detected in January 2013, $F(1, 166) = 55.28$, $p < 0.001$. The model prior to the change explained 13% of the variance and showed an increasing trend, $F(1, 166) = 12.28$, $p < 0.001$. The explanatory power of the model after the structural break was significantly weakened, capturing only 1.5% of the variance, $F(1, 166) = 1.216$, $p = 0.273$.

It is noteworthy that while the number of patients with stage II decubitus increased every month before the structural change, no significant trend was observed after the integration, demonstrating the effect of hospital integration.

For stage III decubitus discharged from hospital: significant structural change was observed in January 2013, $F(1, 166) = 31.83$, $p < 0.001$. The model for the whole period was highly explanatory, explaining 56% of the variance and showing a decreasing trend, $F(1, 166) = 211.1$, $p < 0.001$. The explanatory power of the pre- and post-integration models was low, $F(1, 166) = 1.041$, $p = 0.311$ and $F(1, 166) = 2.02$, $p = 0.159$, respectively, indicating no detectable monthly variation.

These results underscore the significant impact of the structural change in 2013 on the hospital's patient dynamics for stage III decubitus.

For stage IV decubitus patients discharged from hospital: highly significant structural change in January 2013, $F(1, 166) = 23.46$, $p < 0.001$.

The model for the whole period was robust, with 52.3% of the variance and a monthly decrease in the number of patients of 0.0178 units, $F(1, 166) = 181.7$, $p < 0.001$.

The R-squared values for the models before and after integration were 20.1% and 2.2%, respectively, indicating a significant change in trend after the structural break, $F(1, 166) = 20.61$, $p < 0.001$ and $F(1, 166) = 1.813$, $p = 0.182$.

The results point to the key role of the structural change in January 2013 in changing the monthly patient dynamics of stage IV decubitus.

Trends in the difference between the number of patients arriving and leaving:

For stage I decubitus: there was a highly significant structural change in patient dynamics (arrivals minus departures), $F(1, 166) = 36.51$, $p < 0.001$.

The full-period model was extremely robust, explaining 55.8% of the variance and predicting a monthly increase in the net number of patients of 0.0328 units, $F(1, 166) = 209.3$, $p < 0.001$. The models before and after the structural break were significantly different, with R-squared values of 3.1% and 28.8%, respectively. This suggests that structural fracture plays a key role in influencing patient dynamics in stage I decubitus. Importantly, after structural change, the net number of patients with stage I decubitus increased significantly by 0.0296 per month, $F(1, 166) = 33.16$, $p < 0.001$.

For stage II decubitus: a highly significant structural change in patient dynamics (arrivals minus departures) was observed, $F(1, 166) = 31.88$, $p < 0.001$.

The model for the whole period was robust, with 61.7% of the variance and a net increase in the number of patients per month of 0.0293 units, $F(1, 166) = 267.8$, $p < 0.001$.

The models before and after the structural break differ significantly. The R-squared of the pre-integration model was 0.7%, while the post-integration model explained 11.3% of the variance. Importantly, after the structural change, the net number of stage II decubitus patients increased by 0.0143 per month, $F(1, 166) = 10.4$, $p = 0.0018$.

For stage III decubitus: a significant structural change in patient dynamics was detected, $F(1, 166) = 36.80$, $p < 0.001$. The model for the whole period was relatively weak but significant, explaining 18.3% of the variance in net patient number, $F(1, 166) = 37.25$, $p < 0.001$.

It is noteworthy that before the structural change the net number of patients decreased by 0.0156 units per month, $F(1, 166) = 13.59$, $p < 0.001$.After the structural change the model lost most of its explanatory power, there was no significant monthly change in the net number of patients, $F(1, 166) = 1.649$, $p = 0.203$.

For stage IV decubitus: a significant structural break in patient dynamics was observed, $F(1, 166) = 26.73$, $p < 0.001$. Overall, the model was quite robust, explaining 41.1% of the variance in net patient number, $F(1, 166) = 116$, $p < 0.001$. Prior to the structural change, the model had little explanatory power, with no significant monthly variation in net patient count, $F(1, 166) = 1.681$, $p = 0.198$.

After the structural break, the net change in the number of patients per month decreased marginally significantly by 0.0046 units, $F(1, 166) = 3.932$, $p = 0.051$.

Three t-tests were conducted to examine the number of patients before and after integration at these stages. These tests were followed by Chow tests and multiple linear regression models for each stage, evaluating changes in the number of patients leaving the hospital and the net change in patients (arrivals minus departures).

The hypothesis is that hospital integration affects patient dynamics, potentially creating a structural break in the data. This hypothesis was robustly supported by the Chow test across all stages, with highly significant p-values indicating structural breakage. Although the explanatory power of the regression models varied (R-squared values ranged from 0.007 to 0.617), they generally supported the change in patient dynamics after integration.

For stages I and II, the number of patients leaving hospital increased after integration, while for stages III and IV the trend was more complex. For patients with stage IV, both the number of patients leaving hospital and the net change in patients showed a decrease after integration, although this was only marginally significant. This indicates an improvement in quality of care for patients with advanced stage disease, leading to longer hospital stays.

The net difference between patients arriving and leaving also showed remarkable changes after integration for each stage. For example, in stage I the trend increased by 0.0328 patients per month, while in stage IV there was a marginal decrease. These trends suggest different systemic changes in patient management strategies, resource allocation or quality of care.

5.4 Linear regression model: the change in the number of cases in the outpatient department is significant based on the model used. It explains 9.2% of the variation in the number of seen ($F = 2.304$; $p < 0.001$, adjusted $R^2 = 0.092$). The variable of integration in the model is significant, with **an average increase in the number of patients seen of 12.9 per month** after integration ($t = 4.291$; $p < 0.001$). None of the variables of the months representing seasonal effects were found to be significant, with no seasonal effect on the number of patients seen.

5.5 Linear regression model: model used to test the variation in bed occupancy rates is significant, explaining 12% of the variation in **ICU** bed occupancy ($F = 2.756$; $p = 0.002$, adjusted $R^2 = 0.120$). The integration variable in the model is significant, with **an average increase in ICU bed occupancy of 8.8 per month** after integration ($t = 4.558$; $p < 0.001$). None of the variables for months representing seasonal effects were found to be significant, with no seasonal effect on weights.

The model is significant, explaining 15.3% of the change in bed occupancy in **the Internal Medicine Department** ($F = 3.342$; $p < 0.001$, adjusted $R^2 = 0.153$). The model does not include the variable of integration as a significant variable. The variables for the months representing seasonal effects were found to be significant for July ($t = -2.953$; $p = 0.004$), August ($t = -3.329$; $p = 0.001$), April ($t = -2.082$; $p = 0.039$), May ($t = -3.086$; $p = 0.002$), June ($t = -3.206$; $p = 0.002$) and December ($t = -4.995$; $p = 0.001$). **Bed occupancy decreased** by 10.9 in July, 12.3 in August, 7.7 in April, 11.4 in May, 11.9 in June and 18.5 in December.

The model is significant, explaining 15.7% of the change in bed occupancy **in the Chronic Inpatient Unit** ($F = 3.409$; $p < 0.001$, adjusted $R^2 = 0.157$). The model variable of integration is significant, with **an average increase in bed occupancy in the Chronic Inpatient Unit of 7.2 per month after integration** (t

=5.012; $p < 0.001$). Among the variables of the months representing seasonal effects, July ($t = -2.050$; $p = 0.042$) proved to be significant, with a 7.2 % **decrease in bed occupancy in the Chronic Internal Medicine Unit in** July.

The model is significant, explaining 56.3% of the change in bed occupancy **in the Chronic Psychiatric Unit** ($F = 17.626$; $p < 0.001$, adjusted $R^2 = 0.563$). The variable of integration in the model is significant, with **an average increase in bed occupancy in the Chronic Psychiatric Unit of 25.9 per month after integration** ($t = 14.323$; $p < 0.001$). None of the variables of the months representing seasonal effects were found to be significant, with no seasonal effect on weights.

The model is significant, explaining 17.8% of the variation in bed occupancy **in the Surgical Department** ($F = 3.806$; $p < 0.001$, adjusted $R^2 = 0.178$). The model does not include the variable of integration. Among the variables for the months representing seasonal effects, August ($t = -3.695$; $p<0.001$) and December ($t = -3.523$; $p = 0.001$) were found to be significant. In August, **the bed occupancy rate in the Surgical Unit decreased** by 10.3 and in December by 9.9.

5.6 Linear regression model: the model used in the model to explain the evolution of costs by weight is significant, explaining 71.9% of the evolution of costs by weight ($F = 15.103$; $p < 0.001$, adjusted $R^2 = 0.719$). The integration variable in the model is not significant, with an average annual reduction in costs by 8882.6 per year after integration ($t = 0.200$).

6. CONSULTATION

6.1 In the past, the Holy Cross Hospital in Kalocsa was unable to provide Hand and Shoulder Surgery and Orthopaedic Specialist

Services to the population due to a lack of specialists, which was remedied with the help of the BKVOK following the integration. The County Hospital has been referring its own medical specialists to the Kalocsa site on a weekly basis, thus ensuring that the population covered by the TEK can receive specialist hand and shoulder surgery and orthopaedic care. In terms of the specialised practices examined, the population's access to services has improved, without having to travel to a distant town, and they have access to the same quality of care locally.

6.2 Our research shows that the number of people receiving CT diagnostic care has increased significantly as a result of integration, which has also had a number of positive benefits, such as reduced health inequalities, reduced travel time, reduced travel costs and reduced waiting lists.

Before the integration of the hospitals, Kalocsa was unable to provide on-site CT scans to residents under the TEK due to a lack of CT diagnostic equipment, which made patient care significantly more difficult. A Social Infrastructure Operational Programme supporting the integration enabled the purchase of a 12-slice Philips CT scanner using European Union funding (TIOP2.2.6B), which ensured immediate diagnosis of patients arriving at the site. The results of the CT scans are interpreted remotely by the specialists of the Kecskemét site, and the findings are then made available through the shared medical system. Following the installation of the CT equipment in Kalocsa, it became clear that during the research period (01 December 2017 - 31 December 2019) a significant number of patients in the Kalocsa hospital area did not have to travel 90 km to receive CT diagnostic services.

As one of the central issues of this study was the accessibility and availability of CT diagnostic tools and the approach to health inequality, this is considered the primary demonstration of the research findings. It is also a feedback to health policy makers developing the Semmelweis Plan that the benefits expected from integration are demonstrable and tangible. Patient journeys have been shortened in both distance and time. Residents were able to access tests sooner, receive results sooner and start effective treatment in a timely manner, greatly increasing patients' chances of recovery and significantly reducing health inequalities.

6.3 The results clearly indicate a significant impact of hospital integration at different stages of decubitus. The structural break revealed by the Chow tests and supported by the regression models indicates that hospital integration had a significant impact on the quality of care for patients with decubitus. Although the exact nature and consequences of these changes require further investigation, the study highlights the critical role of organisational change in healthcare institutions and its after-effects on patient care.

This analysis provides a comprehensive picture of the complex dynamics that hospital integration introduces into more effective patient care and management.

In the study area, integration has had a positive impact on the effective care of decubitus (pressure ulcer) patients, reducing inequalities in care and promoting patient safety. In the context of the results obtained, these trends reflect different systemic changes in patient management strategies in addition to efficient allocation of resources and quality of care.

Before the integration of the hospitals, Kalocsa could not effectively care for patients with decubitus, which often led to death due to complications caused by the lack of smart dressings, common protocols, a dedicated financial framework and continuous training of staff. When indicators of the quality of care provided in hospital were calculated, the deterioration in the condition of the pressure ulcer showed shocking results, highlighting the need for immediate action without any delay.

6.4 In the past, Kalocsa City was unable to provide outpatient specialist care for the population in certain specialties due to a lack of specialists, which was remedied after the integration with the help of the Bács-Kiskun Vármegyei Oktatókházház. As a result of this measure and the wider extension of the TEK, the number of cases treated in the outpatient clinics of the Kalocsa site increased by an average of 13 per month after integration.

6.5 For the inpatient wards studied, the Intensive Care, Chronic Internal Medicine and Chronic Psychiatry wards showed an increase in bed occupancy in the years before and after integration, but the Internal Medicine and Surgery wards showed a decreasing trend in bed occupancy in the years after integration, so the impact of integration on bed occupancy is not always relevant.

6.6 When projecting costs by weight, the trend for active inpatient wards shows a downward trend following integration. Thus, the expected cost-effectiveness of integration in terms of cost per weight has been achieved. A "just in time" approach is essential in today's economic climate. Waste and misallocation of scarce resources can upset the balance of a relatively stable system. Inventories at the moment do not allow for accumulation, so individual units must plan in the light of their economic framework. Non-varying bed numbers, historical trends and funding should be taken into account when allocating a budget to units for management purposes, so that any accumulation can be prevented.

7. NEW SCIENTIFIC RESULTS

The model represents a pioneering integration initiative in the country. This unique context underscores the importance of the study, as it provides empirical evidence and feedback that is essential for evaluating the effectiveness of integration efforts, as outlined in the Semmelweis Plan.

In the course of this research, we have developed indicators that can help us understand integration efforts.

Results of our hypothesis testing:

Our hypothesis H1 is confirmed. The study period covered 7 years. Linear trend analysis demonstrated that after integration, the average number of patients per month increased by 42 for the Orthopaedic Speciality and by 53.8 for the Hand and Shoulder Surgery Speciality.

Our hypothesis H2 is confirmed. The number of patients at the Kalocsa site increased by an average of 129.7 patients per month after the introduction of CT, supported by linear trend analysis showing significant results after 6 years of data.

Our hypothesis H3 is confirmed. The data collection covered 14 years, with monthly breakdowns. The results of the t-test show that after hospital integration, the number of patients discharged from the hospital with decubitus at different stages decreased significantly. This decrease was most pronounced for patients with more severe stages III and IV, providing strong evidence that the quality of care improved significantly after integration.

Our hypothesis H4 is confirmed. The study period covered 13 years. A linear regression model with significant results showed that the number of cases treated in the Outpatient Clinics of the Kalocsa site increased by an average of 13 per month after integration

Our hypothesis H5 is partially confirmed, **we reject it**. It can be assumed that the type of care influenced the change in bed occupancy over the study period, during which 13 years of data were processed.

Our hypothesis H6 is confirmed. A linear model with significant results from a 13-year study showed that after the integration costs decreased by an average of 8,883 HUF per year per weight

Given the lack of similar studies and the key role of real data and feedback in shaping future integration strategies, the results of this study are of considerable value in increasing the body of knowledge on health integration. The insights gained from the study not only shed light on the concrete outcomes and consequences of integration at the level of individual hospitals, but can also serve as a basis for guiding future integration efforts in healthcare throughout Hungary.

This study, as the first major integration initiative in Hungary, provides valuable insights into the challenges, successes and opportunities related to hospital integration, thus laying the groundwork for future research aimed at comprehensively assessing the long-term impact and sustainability of integration efforts. Further studies exploring the different aspects of integration and its impact on health care and health equity in the future are essential for evidence-based policy making and refining integration strategies to optimize health care and promote equitable access to services in the Hungarian health care system (Szivós, et al., 2024) .

8. LIMITATIONS OF RESEARCH

The research period (1 January 2006 to 31 December 2019) does not necessarily capture long-term effects or potential changes in patient demographics and health needs. Furthermore, although the study examines the impacts of integration from different aspects of a hospital, other factors that affect health care and patient outcomes were not fully considered.

A further limitation of the survey is the selection by postcode, with permanent address being taken into account but not residence. For a larger municipality, this would skew the results considerably, but for the present research this number is negligible.

Future research should explore the lasting effects of hospital integration on patient care outcomes beyond the initial implementation phase. In addition, examining the wider implications of health system restructuring, including the integration of additional diagnostic and treatment modalities, can provide comprehensive insights into building a more flexible and patient-centred health system. Although this study highlights the tangible benefits of hospital integration in improving patient care and promoting health equity, further research is needed to fully understand the long-term effects and to inform future health policy and practice.

9. SUGGESTIONS

The primary proposal is that hospitals in Hungarian healthcare institutions that have already been integrated should also carry out their own efficiency studies, which could in the future be complemented by process and time management studies.

A further proposal is to develop performance indicators that can be managed in a uniform way by the integrated institutions to measure the effectiveness of integration: continuity of care pathways, patient satisfaction indicators.

Further examination of the use of resources and cost optimisation for integration processes can also support the Semmelweis Plan's fundamental ambitions for integration.

In the future, it would be important to complement further studies with an assessment of cooperation skills and teamwork, which are based on communication, as their absence has a profound impact on the success of integration.

The recommendations can provide useful results on their own, but when combined and carried out as a whole, they can provide a comprehensive picture of the effectiveness of hospital integration processes and areas for improvement.

After the above has been achieved, it will be possible to prepare a feedback report and study based on the examination of uniform efficiency indicators, which will evaluate the achievement of the objectives of the Semmelweis Plan at national level and allow for international comparison.

A further study could be based on an examination of the organisational structure of the integrated institutions and its effectiveness. At present, the County Institutions are the managing institutions, in which, in my opinion, the representation of the interests of the localities is not sufficiently emphasised. Instead of a functional organisational structure, a divisional structure could provide a stronger representation of the interests of the units involved in the integration, over which a specialist in the former role of Area Supply Director would prosper.

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PUBLICATION LIST

Publications related to the topic of the doctoral thesis

1. Mihály, Hegedűs; **Etelka, Szivós**; Ioannis, Adamopoulus; Lóránt, Dénes Dávid. Hospital integration to improve the chances of recovery for decubitus (pressure ulcer) patients through centralised procurement procedures. Journal of Infrastructure Policy and Development 8: 10 Paper: 7273, 22 p. (2024). Q2. IF: 0.7
2. **Etelka, Szivós**; Mihály, Hegedűs; Sándor, Balogh; Fanni, Zsarnóczky-Dulházi; Ádám, Gyurkó; Lóránt, Dénes Dávid. 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 pp. 1-16. Paper: 4215, 16 p. (2024). Q2. IF:0,7

3. **Sucks, Etelka**. Analysis of the effectiveness of hospital integration. Controller Info 10: 2 pp. 26-32, 7 p. (2022)
4. **Sucks, Etelka**. The relationship of the organizational structure of hospital integration models with the principles of efficiency, transparency and equity, and resource allocation issues. Wine, gastronomy, culture - Value-creating science : Study booklet on the occasion of the Hungarian Science Day. Budapest, Hungary: Tomori Pál College (2020) 205 p. pp. 147-153. 7 p.
5. **Szívós, E**; Mócza, Gy. Experiences on integration. Doctors' Journal 3 pp. 32-34. 3 p. (2017)

Further publications

1. Lóránt, Dénes Dávid; **Etelka, Szivós**; Al, Fauzi Rahmat. Perspective of ecocycles for human well-being and health: a bibliometric analysis. Ecocycles 10: 2 pp. 26-39. , 14 p. (2024). Q4. IF: 0.82.
2. Gelléri, D; Lénárd, L; **Szivós, E**. The past, present and future of rheumatic heart disease: or could the number of rheumatic patients requiring valve replacement increase? Cardiologia Hungarica 47 pp. 7-8. 2 p. (2017)

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1. **Sucks, Etelka**. The relationship of the organizational structure of hospital integration models with the principles of efficiency, transparency and equity, resource allocation . Wine, gastronomy, culture - Value-creating science on the occasion of the Hungarian

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Other conference presentations

1. **Szívós, E.** HR problems of "small town" hospitals (2017). Presentation, XLVIII National Congress of Health Care Professionals 2017-06-28 [Kecskemét, Hungary],