Application of lean Management Principles in Hospitals in Slovakia

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Abstract:

Introduction: Healthcare worldwide is struggling with many problems that have been escalated by the Covid-19 pandemic and the military conflict in Ukraine. The gap between the possibilities and the needs in the provision of health services is opening more and more. Therefore, it is necessary to look for ways to streamline processes at the level of the hospitals themselves and their management.

Research aim and objectives: The aim of the research was to examine the mutual connections between the use of lean management principles and the ratings of hospitals in the Slovak Republic and to identify the influence of external and internal factors in this relationship. The sample consisted of 175 managers from 35 hospitals.

Methods: To verify the hypotheses, the SEM method was used in the Smart Pls 3.3 software at a significance level of 0.05.
Results: We discovered that there is a statistically significant connection between the use of lean principles and hospital ratings. If other variables enter the model, the overall effect of the mentioned variables is significantly increased. The stakeholder demands variable has a significant mediating effect ($\beta = 0.470$; $p=0.000$). The social lean climate variable has a lower indirect effect in the Slovak environment ($\beta = 0.291$; $p=0.000$).
Conclusion: Our research shows the unequivocal importance of applying the principles of lean management in healthcare. There is ever-increasing pressure to increase quality and improve process efficiency from various stakeholders as well as pressure from within hospitals.

Biography of the first author

I graduated from the Faculty of Medicine of the Slovak Medical University in Bratislava in 2021. After finishing school, I completed management specialization studies and received a professional MBA degree. I currently work as a doctor in the Radiology Department of Bory Hospital in Bratislava. I am in the first year of doctoral studies at the Faculty of Public Health of the Slovak Medical University in Bratislava.

Introduction

Healthcare is currently going through significant challenges. On one hand there are technological developments, innovations, demographic trends and changing lifestyles of residents, and on the other there are limited financial resources. These are the real conditions that healthcare managers at all levels must face in order to satisfy the needs and demands of patients and residents. The available research results show that the demands for improving healthcare and the related costs will increase in the future. It seems that the solution to this problem lies in innovation, the management of healthcare in new directions more efficiently, better quality and lower costs (1). Healthcare managers in a variety of positions encounter situations that require the ability to respond immediately and appropriately. This not only applies to medical interventions in the provision of health care, but also to problems of a different nature that require the ability to be prepared to manage crisis situations and emergency events in a healthcare facility (2). Macroeconomic challenges have an impact on healthcare facilities themselves, which are struggling with problems of all kinds of resources, whether material, financial or human. The turbulent environment, also marked by the recent Covid-19 pandemic and the war conflict in Ukraine, places high demands on the skills of healthcare managers (2,3). Their primary role is to find solutions to maintain a high-quality, high-performing healthcare workforce with limited financial resources. Therefore, one of the solutions is the constant streamlining of processes, which is part of quality management. The goal of quality management is to achieve continuous improvement of the quality of the provided healthcare with regard to patient and employee safety (4). It turns out that slow approaches to quality improvement, which have been successfully implemented in the business world for many years, are also the way to go for the healthcare sector (5). These approaches can not only solve problems at the level of individual facilities, but according to the authors Suárez Barraza and Miguel-Dávila (6), they can contribute to building a culture of continuous improvement at the level of municipalities, cities, regions and countries. They are based on the fact that change comes from within. It is therefore better accepted because it is linked to the commitment of employees and is communicated, not mandated by formal non-transparent regulations (7). Many studies have pointed to the positive effects of such implemented changes for improving patient care and outcomes,

operational performance, employee satisfaction and population health (8).

For many years the healthcare sector was dominated by the opinion that professional and clinical knowledge is sufficient for managing healthcare organizations. Uncertainty, complexity and ambiguity in the external environment require deep managerial and organizational awareness with the aim of an effective patient journey while ensuring safety and quality (9).

In line with the above and with slow improvement methodologies, lean management is one of the ways to achieve this goal. Many countries already have positive experiences with the implementation of this methodology - Denmark, Sweden, Great Britain, the USA, etc. The healthcare sector in the Slovak Republic is no exception. Despite the initial resistance of workers, an ever-increasing number of healthcare organizations have been reporting the results achieved for some time in renowned healthcare periodicals. Therefore, there is no a priori reason against the implementation of lean thinking even in the Slovak conditions of mandatory implementation of quality management systems based on the principle of procedural management in healthcare facilities.

The philosophy of lean thinking is a systematic attack on waste in any form. Waste is the key to understanding efficiency and the target of cost-saving activities in an effort to increase the value of the activities performed. The way to this goal is the five principles of lean thinking, which, according to studies, lead to an increase in the performance of hospitals and other healthcare facilities. The basis of lean philosophy is the identification of activities that create value and the elimination of activities that do not create value. After identifying the value, the next step is the 5S method and visualization in the workplace. Thanks to these two pillars, we can introduce other lean methods into healthcare. Lean thinking can help hospitals and other healthcare facilities, especially in the area of cost savings and when it comes to improving the efficiency and timeliness of service delivery and quality. At the same time, emphasis is placed on high-quality healthcare and patient safety. Foreign medical facilities that have implemented lean thinking methods have significantly increased the number of their clients and at the same time achieved savings in costs and investments. They also noted a reduction in the number of errors in diagnosis and treatment at the level of tens of percent.

Research goal

The main goal of our research was to examine the interrelationships between the use of lean management principles and the hospital rating of hospitals in the Slovak Republic and to identify the influence of external and internal factors in this relationship. External factors are stakeholder pressures that can incite cost reduction initiatives. Our assumption takes into consideration the stakeholder theory, according to which relevant parties are the decisive factor in solving economic, social and other issues in healthcare (10). Internal factors represent efforts to reduce costs and waste from within hospitals by the employees themselves. This is a supportive climate in hospitals, which, according to Viinikainen (11), helps managers implement the principles of lean management and enables employees to gain a sense of co-responsibility for the results achieved. Based on the theoretical research of proven connections, we verify the following hypotheses:

H1: We assume that the use of lean principles in a healthcare facility is positively related to the rating of this facility.

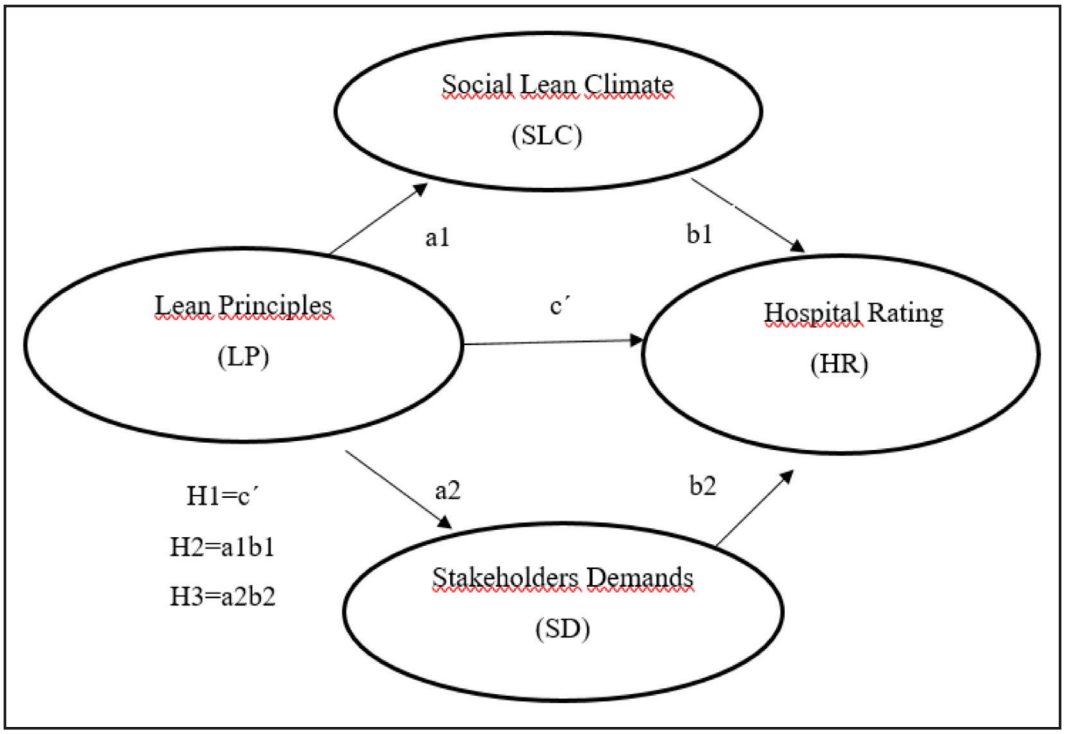
H2: We assume that the relationship between the use of lean principles in a healthcare facility and the rating of this facility is mediated by the pressure of stakeholder requirements.

H3: We assume that the relationship between the use of lean principles in a healthcare facility and the rating of this facility is mediated by the social lean climate.

Collection and methodology

Our research was conducted in the form of a questionnaire. The case study included 11 university hospitals and 33 general hospitals in Slovakia, which are evaluated annually by the Institute for Economic and Social Reforms (INEKO) using a set of defined indicators. Each hospital thus has an objective indicator of the quality of its activity, and based on the evaluation, it is in a certain place in the ranking. Hospital representatives who manage quality processes were approached. From each hospital, there were several respondents from managerial positions,

Figure 1 Theoretical study model



an average of five respondents from one hospital. In total, the sample consisted of 175 respondents from 35 hospitals. The survey took place in the year 2023, taking into account the evaluation of hospitals for the year 2022. Participants expressed their opinions on all variables on a 5-point Likert scale (1=strongly disagree, 5=strongly agree). Individual variables are listed in Table 1.

Results

In the first step, we validated our theoretical model. All the standardized loadings are greater than 0.70. At the same time, the indicators of internal construct reliability meet the established requirements. Cronbach's alpha and composite reliability are in the range from 0.7 to 0.95 for all constructs. Rho_A is also satisfactory and, based on the theory, should be between Cronbach's alpha and CR. Using the average variance extracted (AVE) calculation, we verified the convergent validity, which was higher than 0.5 (Table 2).

To measure discriminant validity, we used the heterotrait-monotrait correlation ratio (HTMT), which indicates the degree to which the latent variable is empirically different from the other variables in the structural model (Table 3).

Since not all values are below 0.9 (12), we applied cross-loading in order to verify the loadings of indicators into latent variables. From the results of the analysis, we can conclude that, according to the application of cross-loading, a specific indicator has a higher loading on its own latent variable compared to other latent variables in the study. Based on the above, discriminant validity is established.

The SEM method examines the connections between individual variables. We verified our model's ability to predict these paths by calculating R2 (the value is higher than 0.1) and Q2 (the value is higher than 0) values, the obtained values of which indicate the predictive significance of the model and significance of paths.

The individual relationships and the verification of the hypotheses are shown in the following table.

Discussion

Healthcare worldwide is facing increasing pressure to improve quality, reduce costs and

Table 1 Latent variable categories and descriptors

Lean principles (LP)		**Social lean climate (SLC)**	
LP1	Identify customers and specify value added.	SC1	Employees have confidence in other employees' intentions and behavior.
LP2	Identify and map value streams.	SC2	Employees are skilled at collaborating with each other to diagnose and solve problems.
LP3	Create flow by eliminating waste.	SC3	Employees view themselves as partners in charting the direction of the organization.
LP4	Organize according to customer pull.	SC4	Employees share information and learn from one another.
LP5	Improve continuously.	SC5	Employees are aware and committed to the purpose and collective aspirations of the organization.
Stakeholder demands (SD) – pressures from stakeholders to implement lean practices		SC6	Employees apply knowledge from one area of the organization to solve problems and opportunities that arise in another.
SD1	Patients	SC7	Employees in the organization share a commonality of purpose and collective aspirations with others at work.
SD2	Government	SC8	Employees in this organization have relationships based on trust and reciprocal faith.
SD3	Employees	SC9	Employees interact and exchange ideas with people from different areas of the organization.
SD4	NGOs/Society	SC10	Employees interact with customers, suppliers, partners, etc., to develop solutions.
SD5	Others		
Hospital Rating (HR)			
HR1	Quality	HR4	Patient satisfaction
HR2	Surgical experience of doctors	HR5	Economic management
HR3	The difficulty of patient diagnoses	HR6	Transparency
HR3	The difficulty of patient diagnoses	HR6	Transparency

For data analysis, we used partial least squares structural equation modeling (PLS-SEM) using SmartPLS 3.3 software.

increase efficiency. This is why in recent years there have been efforts to implement lean management in the healthcare sector as well. Hospitals in Slovakia are evaluated by a very complex and sophisticated evaluation system through indicators of the quality of provided services based on e.g., the number of performed surgeries, the difficulty of diagnoses, patient satisfaction, economic management and transparency. This variable was the dependent variable in our

Table 2 Reliability and validity of latent variables

Variables	Cronbach's Alpha	rho_A	CR	AVE
LP	0.741	0.759	0.837	0.563
HR	0.842	0.898	0.892	0.676
SLC	0.885	0.912	0.929	0.814
SD	0.898	0.907	0.916	0.524

Notes: LP= Lean principles, HR= Hospital Rating, SLC= Social lean climate, SD= Stakeholder demands

study. We investigated whether there are connections between the obtained hospital rating and lean management principles and whether this connection is mediated by other external and internal factors.

The hypothesis of a direct effect between the use of lean principles and hospital rating was confirmed ($\beta = 0.356$; $\beta = 0.567$, $p=0.000$). In accordance with other conducted studies (13), (7), (14) that also took place in hospitals in Slovakia, the influence of the use of lean management principles on the functioning of hospitals is obvious. This is primarily because this tool allows us to identify waste in processes, map value streams and make them more efficient. The study also showed that the overall effect between the use of lean principles and the hospital rating was higher ($\beta = 0.826$; $p=0.000$) when the variables stakeholder demands and social lean climate were included as mediators of this relationship. However, the indirect effect is much higher for the variable stakeholder demands ($\beta = 0.470$; $p=0.000$) than for the variable social lean climate ($\beta = 0.291$; $p=0.000$). Both are statistically significant, and thus Hypotheses 2 and 3 are confirmed. In Slovak conditions, there still seems to be more pressure to improve quality from various included parties compared to pressure from within the hospitals. Although the employee climate, which would lead to higher efficiency of hospital processes, mediates the relationship between lean principles and the hospital rating, the mediation is not complete. The social lean climate's contribution to the overall effect is only 35 percent. The recommendation for healthcare facilities when implementing lean management, which is essentially a project for a change in organization and represents a bottom-up approach to innovation, also reflects this area. Such an approach is not forced, it allows the creativity and potential of individuals to be used, and it also uses the effective policy processes that exist in every organization. The initiator of the change is part of the implementation of the change, therefore the momentum effect is not lost. The change in this case does not need to be laboriously justified and "sold" within the organization to overcome resistance to something new. Modern hubs inspire other individuals.

Conclusion

In the Slovak Republic and abroad, the current healthcare industry is struggling with many problems related to the constant widening of

Table 3 Discriminant validity - HTMT

Heterotrait - Monotrait Ratio (HTMT)				
Variables	LP	HR	SLC	SD
LP				
HR	0.623			
SLC	0.884	0.644		
SD	0.689	0.971	0.740	

Notes: LP= Lean principles, HR= Hospital Rating, SLC= Social lean climate, SD= Stakeholder demands

Table 4 Path coefficients, total effects results, direct and indirect effects results

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
Mediation via SD					
LP -> HR (total effect)	0.826	0.827	0.017	55.732	0.000
LP -> HR (direct effect)	0.356	0.358	0.062	4.172	0.000
LP -> SD -> HR (indirect effect)	0.470	0.472	0.053	12.065	0.000
LP -> SD	0.896	0.898	0.012	82.868	0.000
SD -> HR	0.644	0.646	0.058	11.608	0.000
Mediation via SLC					
LP -> HR (total effect)	0.826	0.828	0.016	55.734	0.000
LP -> HR (direct effect)	0.567	0.568	0.057	9.890	0.000
LP -> SLC-> HR (indirect effect)	0.291	0.290	0.063	4.654	0.000
LP -> SLC	0.625	0.626	0.061	10.187	0.000
SLC -> HR	0.907	0.908	0.011	83.499	0.000

Notes: LP= Lean principles, HR= Hospital Rating, SLC= Social lean climate, SD= Stakeholder demands

the gap between financial possibilities and the demands of society. System measures are often only partial and are influenced by political factors. Therefore, it is advisable to focus on solutions that are often simple with a significant and, above all, sustainable benefit for the medical facility that increase the efficiency of its processes. One highly functional tool in industry is lean management. It is gradually reaching the healthcare sector, and the results of our research show that it has a positive effect on improving the quality of hospitals.

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