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MODERN CONCEPTS OF IMPROVING PROCEDURES AND PROCESESS IN HEALTHCARE FACILITIES – EFFECTS OF THE LEAN CONCEPT

SAVREMENI KONCEPTI UNAPREĐENJA PROCEDURA I PROCESA U ZDRAVSTVENIM ORGANIZACIJAMA – UTICAJ LEAN KONCEPTA

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Summary

Introduction. Lean principles have been successfully adapted to the healthcare environment, enabling hospitals and clinics to streamline their operations and focus on value as perceived by their patients. Many healthcare facilities have implemented lean principles to improve their efficiency. The subject of this paper is the lean concept, the essence of which is implementation of methods that affect the efficiency and quality of providing health services. Our aim was to point out the necessity of applying modern concepts in healthcare. **Material and Methods.** The primary sources of data were obtained through research on the opinions and possibility of applying the lean concept in hospitals in Bosnia and Herzegovina. We presented the results on the effectiveness of the lean concept in hospitals that apply it. **Results.** After implementation of the lean concept in an Italian hospital, the results showed a positive impact on the waiting time for admission, faster discharge, and faster flow of information. The results of the research in Bosnia and Herzegovina showed that there were positive attitudes towards the effects that would be achieved by implementing the lean concept. **Conclusion.** The implementation of the lean concept would reduce medical waste, which would positively affect the quality of health care services.

Key words: Health Services; Delivery of Health Care; Quality Improvement; Efficiency, Organizational; Evidence-Based Medicine

Sažetak

Uvod. *Lean* principi su uspešno prilagođeni zdravstvenom okruženju, omogućavajući bolnicama i klinikama da pojednostave svoje poslovanje i da se fokusiraju na vrednost koju vide njihovi pacijenti. Mnoge zdravstvene organizacije su implementirale *Lean* principe, kako bi poboljšale svoju efikasnost. **Predmet istraživanja.** Predmet istraživanja ovog rada je *Lean* koncept čija je suština određena primenom metoda koje utiču na brzinu i kvalitet pružanja zdravstvenih usluga. Cilj rada je da se ukaže na neophodnost primene savremenih koncepata u zdravstvenim organizacijama. **Materijal i metode.** Primarni izvor podataka su podaci dobijeni istraživanjem o mišljenju i mogućnosti primene *Lean* koncepta u bosanskohercegovačkim bolnicama. Prezentirani su rezultati o efikasnosti *Lean* koncepta u bolnicima koje ga primenjuju. **Rezultati.** Rezultati nakon implementacije u italijanskoj bolnici pokazuju pozitivan uticaj na vreme čekanja na prijem, brži otpust i brži protok informacija. Rezultati istraživanja u Bosni i Hercegovini pokazuju postojanje pozitivnog stava o efektima koji bi se postigli implementacijom *Lean* koncepta. **Zaključak.** Implementacija *Lean* koncepta smanjila bi „medicinska rasipanja", što bi pozitivno uticalo na kvalitet zdravstvenih usluga.

Ključne reči. zdravstveni sistem; pružanje zdravstvene nege; unapređenje kvaliteta; organizaciona efikasnost; medicina zasnovana na dokazima

Introduction

Lean concept is a system of leadership, management and organization of the work process, with a focus on eliminating all types of waste (resources, time, energy). The basic premise of lean management (LM), which has its origins in the automotive industry, is that greater efficiency can be achieved through a process of continuous improvement aimed at eliminating waste and maximizing value-adding activities [1–4]. The expected effect of the lean concept implementation is to reduce business costs, through the elimination of wastage. Implementation of modern models at the level of tertiary health care is particularly popular. Khamidullina and Puryaev claim that companies that are world leaders in their industries actively apply the lean concept [5]. It first appeared in production [6]. Pro-

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Abbreviations

BH – Bosnia and Herzegovina
LM – lean management
5S – Sorting, Simplifying, Sweeping, Standardizing, Self-Discipline
VSM – value stream mapping

duction and health care differ in many ways, but there are also similarities that enable the application of lean principles when providing health services.

The lean concept (suppliers, inputs, process, outputs, customers) has found application in the management of various organizations [7, 8], but the challenge is to apply it. Despite the successful implementation of the lean concept, many obstacles have also appeared in its application. Elkhairi et al. [9] refer to the research of Bajjou and Chafi [10] emphasizing that they classified these barriers into three different categories: economic, managerial and technical, and social. Managerial and technical barriers include lack of planning, lack of expertise, lack of top management commitment, lack of strategic perspective, and lack of understanding the lean production. The economic barrier means limited resources, and social barrier means resistance to change.

The expected improvements resulting from the implementation of the lean concept are intended for: patients, healthcare workers, and healthcare institutions.

Patients [11]:
– Decrease in the time spent in hospital
– Increase in satisfaction
– Decrease in waiting time
– Improvement of service quality
– Decrease in the number of errors
– Improvement of information flow;

Healthcare workers [12]:
– Elimination of waste
– Decrease of overtime
– Decrease of the workload
– Increase in satisfaction
– Peaceful and better organized work environment;

Healthcare institutions [13]:
– Decrease in equipment
– Increase in the number of examined patients
– Decrease in costs
– Improvement of information flow.

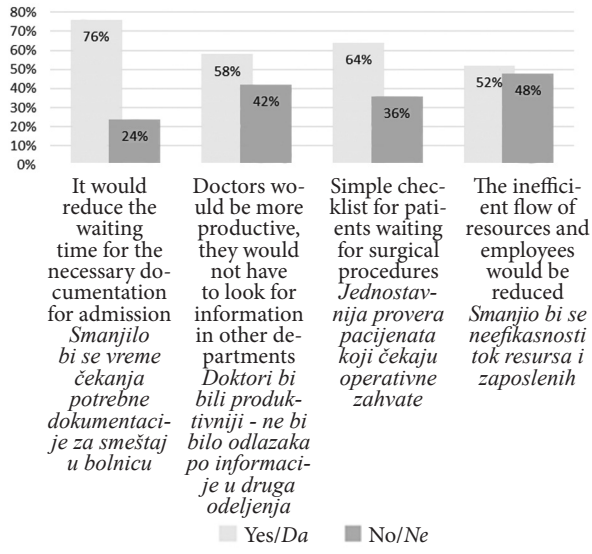
Generally, the lean concept is considered to be the "antidote" to waste in organizations [14]. Lean consists of a set of tools in identifying and eliminating waste with value stream mapping (VSM), Sorting, Simplifying, Sweeping, Standardizing, Self-Discipline (5S), Single-Minute Exchange of Die, and standardized work that focuses on aspects of the manufacturing process to eliminate waste, improve quality, reduce time and cost. Among these tools, VSM gets more attention for using process improvement with a systematic approach [15]. The VSM method is widely used in the efforts to reduce waste [16]. The research was conducted [17] by VSM approach.

Material and Methods

Data were collected from the latest relevant scientific articles and books, and health systems applying modern concepts of optimization of clinical processes were analyzed. The methods used in this paper are analytical and synthetic. The analytical method was used for the purpose of analyzing the available literature that deals with the given subject of research, and for the purpose of analyzing the obtained research results. The inductive method was used as a logical reasoning procedure, based on the analysis of research problems and research results. The deductive method was used for making conclusions about whether the goal of the research was achieved and making general conclusions reached during the research. The synthetic method was used in order to connect all elements into an integral whole and reach the general conclusion of the paper. The primary sources of data were obtained through research on the opinions and possibilities of applying the lean concept in hospitals in Bosnia and Herzegovina (BH).

Results

Graph 1 presents the opinions of healthcare workers about the effects that would be achieved by implementing the lean concept. The highest agreement is about the reduction of the waiting time for documents necessary for admission. One of the fundamental principles of the lean concept is the satisfaction of end users, in this case of patients. The second-ranked effect according to the respondents is a simple checklist for patients waiting for surgical procedures. The lowest degree of agreement among respondents is about the reduction of the inefficient flow of resources and employees **(Tables 1 and 2)**.



Graph 1. Opinions of healthcare workers about the effects that would be achieved by implementing the lean concept
Grafikon 1. *Mišljenje zdravstvenih radnika o efektima koji bi se postigli implementacijom lean koncepta*

Table 1. Examples of waste at the Department of Oncology
Tabela 1. *Primeri medicinskih rasipanja na odeljenju onkologije*

Type of wastage *Tip rasipanja*	Mislabeled tubes *Pogrešno označene epruvete*	Oncology patients *Onkološki pacijenti*
Errors/*Greške*	Unused tubes *Neiskorištene epruvete*	Inadequate therapy for the patient *Neadekvatna terapija za pacijenta*
Excess production *Višak proizvodnje*	Different sampling and testing sites *Različita mesta uzimanja uzoraka i testiranja*	Waiting for chemotherapy *Čekanje hemoteraija*
Transport/*Prevoz*	Waiting for the sample to be tested *Čekanje da se uzorak testira*	Distance between the place of residence and the place of chemotherapy/*Udaljenost između mesta stanovanja i mesta hemoterapije*
Waiting/*Čekanje*	Test reagents have expired *Isticanje roka reagensima*	Expired chemotherapy drugs *Istekli rokovi lekova za hemoterapiju*
Supplies/*Zalihe*	Too many reagents *Previše reagenasa*	Delay of patients due to overcapacity of doctors/*Kašnjenje pacijenata zbog preopterećenosti lekara*
Motion/*Kretanje*	Label printing time *Vreme štampanja nalepnica*	Nurses searching for misplaced medical supplies/*Medicinske sestre u potrazi za medicinskim materijalom*
Redundant processing *Suvišna obrada*	Repeating the entire examination due to one bad result/*Ponavljanje celog pregleda zbog jednog lošeg rezultata*	Time spent creating a schedule that is not followed/*Vreme utrošeno na kreiranje rasporeda koji se ne poštuje*
Human potentials *Ljudski resursi*	Ignoring employee ideas *Ignorisanje ideja zaposlenih*	

Table 2. Examples of successful lean implementation in hospitals [18]
Tabela 2. *Primeri uspešne implementacije lean koncepta u bolnicama [18]*

Organization/*Organizacija*	Impact/*Uticaj*
Scotland Cancer Treatment Center *Škotski centar za lečenje onkoloških bolesti*	Reduction in patient waiting times for the first appointment from an average 23 to 12 days/*Skraćivanje vremena čekanja pacijenata na prvi pregled u proseku sa 23 na 12 dana* Patient flow time improvement by 8%/*Poboljšanje usluge pacijentima za 48%*
Royal Bolton Hospital *Kraljevska Bolton bolnica*	Direct savings of £3.1 millions/*Direktne uštede 3.1 mil. funti* Reduction of time taken to process important categories of blood from 2 days to 2 hours/*Skraćivanje analiza krvi sa dva dana na dva sata* Average turnaround time in pathology from over 24 hours to 2 - 3 hours *Prosečno vreme patoloških pretraga sa preko 24 sata na 2 - 3 sata*
Nebraska Medical Centre *Medicinski centar Nebraske*	Reduced staff walking distance/*Smanjivanje prostorne udaljenosti administrativnog osoblja* Reduced lab space and specimen processing turnaround time by 20% *Smanjenje vremena laboratorijskih obrada za 20%* Reduced manpower and their transfer to other critical points/*Smanjeno premeštanje osoblja na druge kritične tačke* Decrease average patient stay from 6.29 to 5.72 days/*Smanjen prosečan boravak pacijenata sa 6,29 na 5,72 dana*
Pittsburgh General Hospital *Opšta bolnica u Pitsburgu*	Intensive care unit cost reduction by almost $0.5 million per year/*Smanjenje troškova intenzivne nege za skoro 0,5 miliona dolara godišnje* A 90% reduction in the number of recorded infections after 90 days of using a changed procedure for intravenous line insertion/*90% smanjenje broja evidentiranih infekcija nakon 90 dana primene izmenjene procedure za intravensko uvođenje linije*

Discussion

The lean concept also focuses on processes that do not add value [19]. Health care systems in BH are focused on traditional business processes. They are more precisely focused on business processes that add value. The basic principle of the lean concept is to learn to see waste. The first to observe medical wastage were Dutch and British hospitals [20, 21]. By comparing research, differences in ranking types of wastage according to priorities and according to the frequency of occurrence were analyzed. Based on the comparison of results, it can be concluded that the emphasis in Dutch and British hospitals is on improving efficiency (speed of service), while in BH health institutions, the emphasis

is more on effectiveness, i.e. on the mode of operation (reduction of defects).

The aforementioned results confirm the necessity of improving the efficiency of providing health services in BH. In BH healthcare institutions, a common obstacle to the implementation of modern models is the lack of motivation. In British and Dutch hospitals, recognized wastages are eliminated through modern improvement concepts and integral indicators are applied: process efficiency and workforce productivity. In BH health institutions, it is necessary to work more on determining indicators, above all the productivity of the workforce, which is aimed at reducing defects that are part of everyday work according to the results of the research.

According to characteristics of the situation and problems in health care systems, the solution lies in the implementation of modern business process improvement concepts [22, 23]. In support of this, the results in **Graph 1** show how employees at the tertiary level of health care see the implementation of the lean concept. The effects that the respondents expect to achieve through the implementation of the lean concept to a significant extent coincide with the effects that are evident in hospitals that apply the lean concept.

Beyond the limited range of research conducted on the human outcomes of lean concept in healthcare, the review also reveals the lack of both methodological diversity and rigor that characterizes the existing literature. Most of the included studies lacked a theoretical conceptualization of the staff related to outcomes of lean concept and were constrained by reporting descriptive results with relatively limited analytical reach.

According to different researchers, there are positive and negative classifications of the effects achieved by the implementation of the lean concept in healthcare organizations. According to some researchers, positive outcomes are: teamwork, communication, coordination learning, innovation and personal development, morale, motivation, and job satisfaction [24–28].

Furthermore, despite examining the use of multiple LM tools and techniques, only one of the studies considered lean holistically, as an organizational, system-wide approach designed to target waste and improve the production of value [29, 30]. Negative outcomes are: work intensification, job strain, anxiety, stress, and dehumanization [31, 32].

The results of this review are reflective of the broader literature on lean concept and its impact on staff working in other industries. A recent review also pointed to the restricted number of studies focusing on the impact of lean concept on employees [33]. They highlighted the inconsistent nature of the research findings on this topic. Further research that holistically examines lean concept and encompasses its socio-technical and human dimensions is therefore crucially needed, especially given the demonstrated potential of this approach that can help increase the capacity and improve the efficiency of health systems. The contribution of this research is updating the topic of the necessity of implementing modern business process improvement concepts in order to improve health services for patients at the tertiary level of health care. Based on the principles of lean thinking, the medical directorate of the Cardarelli Hospital in Naples decided to review the patient's path from arrival to the ER to admission, recovery and discharge. This path is transversal to several operating units and includes processes pertinent to hospitals and others of territorial relevance. In detail, a re-engineering process that improves the management of medical reports and the creation of a web application that provides notifications on the arrival of reports in real time have been employed and/or developed to reduce the waiting time related to the doctors' consultation.

A study by Dickson et al. on the implementation of the lean methodology at emergency departments of four public hospitals in Massachusetts, Worchester, Orlando, and Iowa City, showed that with help of the lean methodology, the patients' waiting time was reduced. The decreased waiting time directly affected the increase in the satisfaction of patients [34].

A study by Zoe Radnor showed that the implementation of this methodology at the Scotland Cancer Treatment Center resulted in a reduction of waiting time for examinations, as well as in the improvement of patient flow through the system of service provision by 48% [35]. Based on the review of the literature dealing with the research topic of the present study, a research hypothesis was formulated: application of lean concept can positively affect the efficiency of the clinical process.

The results of this review are reflective of the broader literature on lean concept and its impact on staff working in other industries. In a recent review, authors [36] also pointed to the restricted number of studies focusing on the impact of lean concept on employees. Improvements in teamwork were also self-reported by staff after LM was applied to the perioperative otolaryngology workflow in an American university hospital [37].

Whilst piecemeal implementation of the lean concept could be effective in reaching desired performance and efficiency goals, there is little evidence on the long-term sustainability of such gains [38].

Improving patient workflow was also targeted in a study performed at the Department of Radiology, Medical College of Wisconsin, USA [39]. Application of lean principles to screening mammography workflow has improved the efficiency and decreased patient waiting time. The implementation of the lean philosophy started with patient-centered approach, analyzing patients-defined valuable activities and problems to be solved. The lean tools included VSM, identification of waste, 5S tool, creation of process map, and visual management based communication. Among other things, portable electronic devices were used to verify patient identifiers, electronic work lists were formed, and images were digitized before patient`s appointment. After implementation of the lean philosophy, patient waiting time was reduced by amazing 70% (from 11.1 to 3.3 minutes). Also, total

visit length was reduced by 23.4% (from 33.7 minutes to 25.8 minutes) and reading time of a mammogram by 40% (from 4.8 minutes to 2.9 minutes per case).

The observed healthcare systems, obviously, had a high level of organization and management in the initial phase, yet they realized remarkable results thorough the lean concept, which should serve as inspiration to all the others, regardless of their present condition and performances.

The motivation and job satisfaction of healthcare workers are the basis for providing quality healthcare [40].

Conclusion

The implementation of the lean concept would reduce medical waste, which would positively affect the quality of healthcare services.

1. Reduce patient wait times (Solutions include moving to in-room testing instead of transporting patients around a facility and delivering test results via technology).

2. Manage inventory (Health care facilities can use tracking systems to understand what supplies are in high demand and order accordingly or rely on an automated order system).

3. Decrease errors (The names of tests, prescriptions, and diagnoses can often be similar. One way to reduce errors is to switch to a technology-based information system. Doctors and nurses can track patient records without relying on patient recall which may not always be accurate).

4. Elimination of overproduction (In healthcare, overproduction includes ordering unnecessary tests, providing higher levels of care than required, or having doctors perform tasks that can be done by other qualified health care providers that charge less per encounter).

5. Limit movement (Movement looks at how inventory, information, and staff move between floors and departments).

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