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LEAN HOSPITALS AS A CONCEPT SUPPORTING THE SUSTAINABLE DEVELOPMENT OF HOSPITALS

LEAN HOSPITALS JAKO KONCEPCJA WSPOMAGAJĄCA ZRÓWNOWAŻONY ROZWÓJ SZPITALI

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Summary: Hospital management is an interdisciplinary issue, combining economic, technical, legal and IT aspects. The situation requires the application of complex management methods, which also include the concept of Lean Management (LM). The Lean Management concept applied in healthcare facilities is known as Lean Healthcare (LH) whereas in hospitals – Lean Hospitals. The aim of the article is to present the possibilities of using selected LM tools in improving the functioning of hospitals in the context of their sustainable development. The article focuses mainly on describing the advantages resulting from the application of the 5S method in hospitals, which contributes to saving hospital resources and to eliminating waste. This work is based mainly on secondary sources of information. The applied research methods such as Desk Research and non-participant observation confirmed the validity of using LM to improve the functioning of hospitals.

Keywords: Lean Healthcare, Lean Hospital, 5S, waste, sustainable development.

Streszczenie: Zarządzanie szpitalem jest zagadnieniem interdyscyplinarnym, łączącym w sobie aspekty ekonomiczne, techniczne, prawne i informatyczne, przez co wymaga stosowania złożonych metod zarządzania, do których zaliczyć można *Lean Management* (LM). Koncepcja LM zastosowana w placówkach ochrony zdrowia nosi nazwę *Lean Healthcare*, natomiast w szpitalach – *Lean Hospitals*. Celem artykułu jest przedstawienie możliwości stosowania wybranych narzędzi LM w usprawnianiu funkcjonowania szpitali w kontekście ich zrównoważonego rozwoju. W artykule skoncentrowano się głównie na identyfikacji korzyści wynikających z zastosowania metody 5S w celu maksymalizacji oszczędności zasobów szpitali oraz eliminacji wszelkich form marnotrawstwa. W pracy wykorzystano głównie wtórne źródła informacji oraz zastosowano takie metody badawcze, jak: *Desk Research* oraz obserwacja nieuczestnicząca, które potwierdziły zasadność stosowania koncepcji LM w celu usprawnienia funkcjonowania szpitali.

Słowa kluczowe: *Lean Healthcare*, *Lean Hospitals*, 5S, marnotrawstwo, zrównoważony rozwój.

1. Introduction

Due to the difficult situation of healthcare facilities and the limited possibilities of additional subsidies, it seems appropriate to search for alternative solutions that may lead to significant improvements in the functioning and continuous enhancement of healthcare providers, as well as their perception among the public. Apart from the expected systemic changes, what may contribute to improving the situation in Polish healthcare facilities is the implementation of the Lean Management concept that, due to the character of the place of implementation, also known in this sector as Lean Healthcare, whereas in hospitals – as Lean Hospitals (LH). This is a relatively new issue in world literature, although attempts at using methods applied in production management were undertaken almost 100 years ago, and the development of the Toyota Production System, TPS, which was the basis for developing the Lean Management concept, started in 1945. The advantages resulting from the implementation of LM in hospitals, which include among others saving resources, reducing waste and increasing the quality and safety of the provided services, may also support the sustainable development of the facilities, not just in the economic dimension, but also in ecological and social terms. The aim of the article is to present the possibilities of using the LM concept in improving the functioning of hospitals, with particular emphasis of its role in the sustainable development of healthcare providers.

2. The origins of Lean Healthcare

Lean Healthcare is a term referring to the implementation of the Lean Management concept, developed based on TPS principles and tools in the management of a healthcare facility. Although the Lean Healthcare concept has become popular in the last few decades, aspects connected with lean management methods in healthcare were studied, among others, by Frank and Lillian Gilbreth, as well as Henry Ford who already in 1922 described attempts at utilizing production methods that he devised in a hospital in Dearborn (Graban, 2011, pp. 2-3).

The Gilbreths conducted studies into tiredness and movements of workers (Stoner, Freeman, and Gilbert 1999, p. 50). At first they applied the so-called cyclographics in order to create the cyclographic technique that allows to (Kozłowski and Piotrowski 2001, p. 629):

- identify necessary and redundant (for elimination) movements and operations
- establish the proper order of executed operations,
- combine movements into bigger structures, as a result – reducing the time of executing an operation.

One of the solutions offered by the Gilbreths was to enhance the operation by the active involvement of a nurse whose task was to pass the proper instruments to the surgeon. Before, such an activity had been executed by the doctor who left the

operating table in order to pick the needed instruments, thus leaving the patient (Grabau, 2011, pp. 2-3). The method offered by the Gilbreths is currently widely used in hospitals all over the world (Grabau, 2011, p. 3).

According to L.B. de Souza (2009, p. 122), the exact date of the first implementation of the Lean concept in healthcare is not confirmed. However, one may find in literature information regarding the first works that presented reflections on the possibility to use one of the TPS keystones (just-in-time) in order to decrease material stocks in a hospital (Heinbuch, 1995, pp. 48-56).

According to Jackson, the first significant implementation of the Lean concept in the healthcare sector started in 2001, when a member of Virginia Mason Medical Center in Seattle involved production engineers from Toyota and Boeing to indicate possibilities to use TPS in providing medical services (Jackson, 2013, p. 7). After a few years, similar implementations occurred in Park Nicollet Health Services in Minneapolis and in other facilities, such as ThedaCare in Wisconsin. Examples of the implementation of the Lean concept in healthcare are described in the book "The Toyota Way to Healthcare Excellence. Increase Efficiency and Improve Quality with Lean". One of its authors, John Black, is the aforementioned consultant employed at Boeing (Black and Miller, 2008, p. 3).

The topic of applying methods and tools typical for production management also in healthcare appeared in the papers by Jacobs and Pelfrey (Jacobs and Pelfrey, 1995, pp. 47-52) and Whitson (1997, pp. 32-37). However, the topics were not connected with Lean Management in any of these works (Souza, 2009, p. 122). The first publication on the use of Lean Management methods in healthcare regarded the mapping of the value stream of the treatment process of patients in Progressive Healthcare, an American group of facilities (Bushell and Shelest, 2002, p. 20). Analyzing the number of publications available through Google Scholar, the specialized search engine, it must be stated that since the aforementioned article was published, the number of publications regarding Lean Healthcare concept has increased to more than 4,000, whereby the highest increase (by almost 600 publications) occurred in 2018. In the Polish-language literature it was difficult to find articles devoted to this topic (using the aforementioned search engine Google Scholar one may encounter only 30 articles). Spreading the possibilities to implement Lean Healthcare in the Polish healthcare may occur through the contribution of e.g. the results of the research project "Lean Management in Healthcare", whose executive director in the pilot phase was the author of this publication. The project, financed by the National Centre for Research and Development was executed by the science and research consortium set up by the Polish Association of Healthcare Economics, Warsaw Medical University and the Institute of Psychiatry and Neurology in line with contract number IS-2/200/NCBR/2015.

3. The 5S method in reducing waste in hospitals

The Lean Healthcare concept is founded on the idea of Kaizen (in Japanese “kai” means “to take apart” and “zen” means “to make good”) (Jackson, 2013, p. 13). The most frequently applied methods and tools in Lean Healthcare are: 5Why, 5S, VSM, and work standardization, and their implementation improves work organization, eliminating waste, minimizing time wasted e.g. as a result of misidentification of medical documentation, materials and medical instruments (Lisiecka, Burka, 2016, p. 30). Failure costs as a category of quality costs constitute a significant problem regarding quality improvement and they force effective action that facilitates the functioning of healthcare providers.

There are eight types of waste in hospitals (Table 1). It is worth adding that the process in healthcare is understood as “a sequence of cycles of work, called operations, needed to produce and deliver a treatment or healthcare service to a patient – to transform a patient from the state of unhealthy to healthy” (Jackson, 2013, p. 16). The first step in waste identification in the whole healthcare service production is determining the value stream defined as “all the activities in a healthcare organization that are needed to organize and produce a treatment or service and deliver it safely to patients” (Jackson, 2013, p. 16). The main tasks in Kaizen implementation are adding value and reducing waste in the value stream.

Value can be defined as “the worth of a healthcare treatment or service or related product such as medicines or medical devices delivered to a patient (the degree to which a patient requirement, need, or desire is fulfilled and may include quality, usefulness, functionality, availability, price, attractiveness, etc.)” (Jackson, 2013, pp. 16-18). Value-added activity refers to operations that changes information about the patient, medical know-how, medicines and supplies into value for the patient, while waste is any operation that adds cost or time without adding value (Jackson, 2013, pp. 16-18).

One of the LM tools is 5S (Figure 1) which ensures the proper organization and order at the workplace, necessary for the correct functioning. The 5S keystones include (Jackson, 2015, pp. 17-20):

- Sort (Seiri) – removing all unnecessary items from the location (in medical and non-medical ongoing activities and processes). Stockpiling of unnecessary equipment, drugs and other materials increases waste in all of the facility.
- Set in Order (Seiton) – putting the necessary items and marking them in order to facilitate finding, using and putting them away.
- Shine (Seiso) – particularly important, especially in order to prevent spreading of infections.
- Standardize (Seiketsu) is a method that aims at strengthening the first three keystones.
- Sustain (Shitsuke) – continuous compliance with proper procedures and maintaining the right conditions.

In the 7S concept, safety and supervision are also included (Munro 2009, p. 55).

Table 1. Eight types of waste in hospitals

Type of waste	Short description	Example in a hospital
Defects (shortages and errors)	Time spent on improper execution of an action correctly the first time, inspections and fixing errors, as well as shortages resulting from lack of tools, equipment or its unavailability.	Lack of instruments necessary to execute an examination, a surgery, patients receiving the wrong medicine or wrong dose, performing unnecessary procedures, repetition of examinations, lack of necessary information, infections.
Overproduction	Performing higher number of actions than what patients need or actions performed too early.	Performing unnecessary surgeries or too many actions (e.g. double registration), diagnostic procedures, engaging resources in the process of treatment that are unnecessary or improper at the specific moment or place, such as equipment, drugs, staff.
Transport	Unnecessary movement of patients and products in the system (samples, materials, instruments, equipment, machines etc.).	Incorrectly designed process causing additional movement. Wrong layout of rooms in the facility that requires e.g. long-distance transport and between different floors, returns to the previously visited places.
Waiting	Waiting for next action, examination, decision or the necessary resources.	Staff waiting due to wrong work schedule, patient waiting for the doctor or examination e.g. CT scan, waiting for the result, for the lift.
Inventory	Overstocking leading to freezing of funds, expired drugs and extra disposal costs.	Excessive stockpile in relations to the demand in many places, expired drugs that require disposal, generating too high number of samples.
Motion	Redundant movements of staff and processing.	Redundant movements resulting from wrongly designed workstations or room conditions and layout e.g. unnecessary walking, data processing.
Overprocessing	Executing work that has no value for the patient and for other workers.	Entering and saving data which have no value for anybody or executing the same actions in various places.
Loss of creativity (loss of human potential, talent)	Waste and losses resulting from hiring staff who lack knowledge and potential improvements, ignoring their ideas, no interest in their development.	Staff suffer from burnout, they do not see the commitment to implement the suggested changes, and stop submitting proposal for improvement.

Source: (Korkosz-Gębska and Gębski, 2018, p. 35).

The implementation of the 5S keystones (Figure 1) constitutes the beginning of improvement actions that aim at ensuring more accessible, proper and cheaper healthcare, which are necessary to improve productivity and flow, to enhance quality of services and to reduce operating costs of healthcare facilities (Jackson, 2015, p. 13). It is worth highlighting the fact that specific tools such as 5S ensure the sustainable development of hospitals.

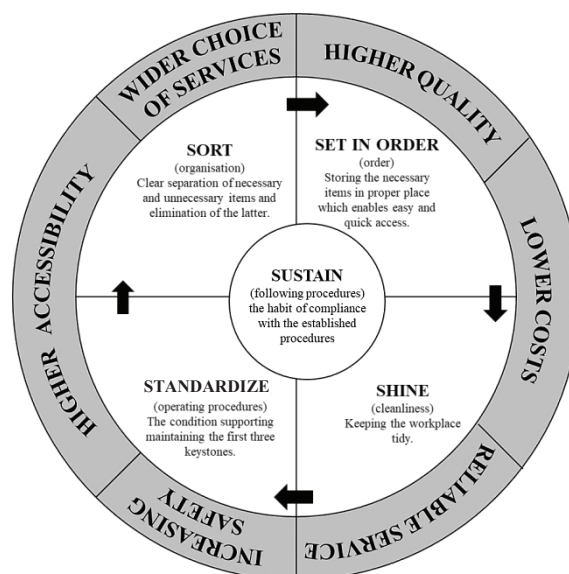


Fig. 1. Keystones of 5S

Source: (Jackson, 2015, p. 14).

The 5S system is sometimes underestimated due to its apparent simplicity. However, it is worth remembering that keeping the healthcare facility clean and tidy may enhance productivity, decrease the number of errors and medical defects, limit patients' waiting time for the beginning of examination and increase work safety (Jackson, 2015, p. 16).

4. Lean Hospitals in the sustainable development of hospitals

The concept of sustainable development (SD) assumes that environmental and development objectives may be achieved only provided that the consequences of ecological, social and economic dependencies have been properly taken into account (Kryński, Kramer, and Caekelbergh, 2013, p. 70).

The best-known definition is by the Brundtland Commission which states that SD means "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Rogall, 2010, p. 240).

A hospital is an institution that provides medical services, whose aim is to fulfil social goals (apart from economic ones), ensure social interest and fulfil the goals of the country's health policy as well as conducting curative activities (Zaleska and Wallis, 2008, p. 213). It must be noted that the financial aspect in public hospitals (especially regarding the evaluation of financial performance) is not of key importance, since health constitutes the highest priority (Kister, 2018, p. 25).

Therefore, the economic dimension of hospital SD should be executed mainly through the sound management of resources and avoiding any form of waste such as (Jackson, 2015, p. 18):

- surplus stocks that generate extra costs of stockpiling area and stock management, increasing the risk of incorrect separation of necessary and unnecessary materials, and leading to medical and administrative errors,
- unnecessary transport (of patients and materials) that requires extra beds, wheelchairs and sheets etc.,
- unnecessary equipment (redundant items hinder the provision of medical services on a daily basis and they impede the proper use of the facility).

According to J. Touissant, President of ThedaCare Health System, the improvements brought about by the implementation of 5S allowed to limit the waste of nurses' working time from 3.5 hours to 1 hour during an eight-hour shift (Grabau, 2011, p. 120). Keeping the hospital clean and tidy, as a result of the application of the 5S method, reduces medical errors and other defects, decreases the time of patient's admission and starting treatment, lowers costs of healthcare and enhances the well-being and morale of the patients and staff (Jackson, 2015, p. 24).

The implementation of Lean Healthcare at the operating theatre in Santo António Hospital, described by Masaaki Imai, increased process efficiency by 5% and decreased failure by 60%, and led to a decrease in the number of waiting patients by 9% and the waiting list (in order of regular priority) by 75% (Imai, 2018, p. 322).

5. Conclusion

The research methods applied in the presented paper are desk research and non-participant observation. Analysis of the available data from various sources, such as the database of scientific publications, the press and the Internet, addressed general issues connected with the possibility to adopt the Lean Management concept in healthcare, with particular emphasis on the 5S method, often underestimated due to its apparent simplicity. Non-participant observation was made possible by the implementation of the aforementioned project that involved the performance of the so-called Gemba Walk in five hospitals of the Mazowsze Voivodeship.

Based on the collected information, it was found that the LH concept is a new issue in the global literature, and the number of publications on the topic is increasing dynamically each year. Due to the huge scope of possibilities to implement the methods and tools typical for TPS in healthcare, the paper focuses exclusively on the description of advantages resulting from the application of the 5S method. The results of observations conducted during reference visits in hospitals confirm the need to implement the LH concept in Polish hospitals which, due to current difficulties, need such improvements.

Striving for a sustainable healthcare system in Poland requires the measurement and comparison of hospital quality and efficiency. The idea to boost the measuring system and to reconstruct the philosophy of the healthcare system, where producing services is abandoned in favour of health results, quality and the patient experience (Kowalska, 2018, p. 1), is feasible thanks to the application of the Lean Healthcare concept.

The LH concept may also support hospitals in all the dimensions of SD, by enhancing the quality of the provided services, improving the safety of the staff and patients, decreasing the number of complaints and increasing patients' trust, and reducing staff turnover.

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