

IMPROVING MEDICAL PROCESSES IN HEALTHCARE FACILITIES IN POLAND

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Purpose: The work aimed to identify problems occurring in a Polish medical facility, and then to take action to improve its functioning to improve the quality of services and staff satisfaction with work in standard conditions and a crisis.

Design/methodology/approach: The research identified communication bottlenecks and delays caused by them. The action was taken focused on improving communication between employees and at the level of the medical facility - patient. A strategy of actions improving logistic and organizational processes for the medical facility was adopted.

Findings: The implementation of Lean Management (LM) tools in a medical facility improves its functioning, which is also evidenced by literature studies of completed projects.

Research limitations/implications: The medical staff of the medical clinic was examined: communication problems were found that hinder the work and quick service of patients were found. The problems at the facility were found to be due to a lack of standards.

Practical implications: Improving the efficiency of a medical facility is of particular importance during a pandemic, when work is carried out in an increased sanitary and time regime, most often with a shortage of medical staff.

Social implications: The use of lean tools in health care improves the efficiency of medical staff, making them more efficient and more focused on the patient. This ultimately improves not only the comfort of work but also its safety.

Originality/value: The training game for medical facilities (Koromo LeanHealthcare) developed during the research will be a tool supporting the efficient implementation of LM tools in professional medical practice.

Keywords: Lean Healthcare, Lean Management, Six Sigma, Koromo Lean, flow efficiency.

Category of the paper: Research paper.

1. Introduction

The aim of the project, the course and results of which are described in the article, was to support the health service during the crisis of the COVID-19 pandemic. After analyzing the domestic and foreign literature (Wiśniewska, Konieczńska, 2011; Reijula, Tommelein, 2012; Byrne, 2013; Modig, Alstrom, 2014; Preś, Dudek, 2018; Koczor, 2020; AB, 2022; Góral, 2022 and others), it was found that standards, improve its functioning at all levels. It was found that these standards are not commonly used, but only in those institutions that have undertaken training among medical and medical-related personnel, implementing quality tools in the field of Lean Management. Lean Management once again turned out to be a universal philosophy that reduces all waste and can be applied in every aspect of human activity, both in production systems and in services.

Based on good examples of the implementation of lean tools and the effects achieved for small medical facilities (e.g. Koczor, 2022), an attempt was made to implement lean tools in the NZOZ Nasza Poradnia Sp. z o.o. in Chorzów. After the audit and interviews with the employees of the facility, the biggest problem with communication on two levels was found: employee-employee and medical facility-patient, and it was decided to improve them.

The brainstorming allowed us to generate a research question: "Will the implementation of at least one lean tool in the facility significantly improve communication?".

Due to the sanitary regime, the examinations were carried out with great restrictions, each time allowing a small number of employees and team members to contact each other, in compliance with all recommendations of the Sanitary Inspectorate. Therefore, training was conducted several times in small groups: staff was familiarized with the theory of lean philosophy and examples of its functioning in medical facilities; Lean workshops were conducted with the use of the Koromo Leanhealthcare training game improved as part of the project.

To accurately diagnose communication problems in the facility, surveys were conducted: directly among the employees of Nasza Poradnia and via the Internet among potential patients of the medical clinic. The results made it possible to isolate the main problems of the facility, which turned out to be: communication within the facility and communication between the facility and the patient, which directly affects the diagnosed problem of too frequent prescription complaints.

To solve the diagnosed problems, it was proposed to use a simple Visual Management tool in the facility, namely a "meeting board" (board), which involves the organization of weekly, very short organizational meetings and the purchase of a magnetic board on which reported problems and people responsible for solving them will be recorded. It would seem that this is a trivial and easy-to-implement method. In practice, it is completely different, because such a new practice involves a change in the habits of the staff and forces them to take the trouble to

introduce a new way of functioning. An additional challenge is the fact that each medical facility is characterized by a different specificity of functioning, therefore, no detailed studies are reporting step-by-step how to implement such a change in a very diverse environment of employees within one medical facility.

A board was purchased, weekly meetings were initiated and the arduous process of implementing a new way of communicating in the facility began, periodically checking the effects during the project and after.

2. Literature review

2.1. Lean Healthcare

Healthcare costs are rising around the world, so there is a need to bring them down by improving traditional ways of treating patients. Many healthcare processes are poorly designed with unnecessary duplication of services, long wait times, and delays, which impact treatment outcomes (DeKoning, Van Den Heuvel, Does, 2006). There are various methods of improving traditional ways of treating patients, but the concept of lean deserves special mention (Reijula, Tommelein, 2012).

Lean Healthcare is a philosophy dedicated to medicine, in which people are the most important: both patients and healthcare professionals. Lean Healthcare tools use the achievements of Lean Management (LM) and Six Sigma. The goal is to meet the expectations of the patient (client), who, as in any business venture, is placed in the center of interest in activities improving the quality functioning of the medical facility. Through the patient's perspective, the following effects are achieved directly: an increase in process efficiency and elimination of waste, and thus - a reduction in the number of errors until their complete elimination, a shortening of waiting time for a service, and improving patient and staff safety. It all translates into the improvement of financial results and continuous development of the medical unit (Preś, Dudek, 2018). Improving efficiency through LM tools focuses on reducing bottlenecks, which improves the work of medical staff, but at the same time requires continuous improvement in internal communication through the use of multiple tools: from the simplest, organizational, to professional IT systems dedicated to medicine, which bind the entire system. Attempts to implement Lean Management tools in medical facilities have been going on since the 1990s. and are widely described in the literature. An example is the Seattle Children's Hospital in Washington (Preś, Dudek, 2018), where the implementation of the LM concept saved 180,000. dollars for hospital expenses. Virginia Mason Medical Center Hospital in Seattle, which started implementing LM tools in 2001 (Byrne, 2013), can boast such achievements as, for example, that nurses currently spend 95% of their time with the patient,

with the average Seattle, which started implementing LM tools in 2001 (Byrne, 2013), can boast such achievements as, for example, that nurses currently spend 95% of their time with the patient, compared to the hospital average of 35%; waiting time by patient response to test results was reduced by 85%, and the cost of medical supplies was reduced by \$1 million per year, and many others showing, above all, shortening the duration of procedures and reducing the cost of their implementation. Effect changes are mutually beneficial: for the patient - shortening the time of contact with the facility, and for the facility - lowering the cost of patient service, but also huge profits: the hospital's income of \$ 700,000 in 2000 is now \$ 40.9 million in 2010, which translates into to higher quality of services and higher salaries for employees.

As a result of the combination of two groups of two tools (Lean Management and Six Sigma), the Canadian Lean Healthcare Six Sigma project achieved very spectacular results. In 2011, the Canadian Ministry of Health implemented a project in Quebec, obtaining: reduction of patient registration time by 42%, increased the number of operations per day by 3, shortened the patient's waiting time in the emergency room by 75%, and the time of the patient's stay there was shortened by an average of 20%; a very significant decrease in absenteeism among staff and a reduction in the number of costly overtime hours by almost 50% was achieved (AB, 2022).

Both in Polish and British realities (Góral, 2022), projects aimed at reducing the financial problems of medical facilities have proven that cost reduction consisting in dismissing employees or limiting purchases, used as the most popular ways of dealing with financial problems, do not lead to positive changes, but only create inconvenience, mainly for patients (longer waiting time for treatment). Experiences of these institutions that have implemented LM tools, prove that the positive effects of changes are achieved through proper organization of work, and not only costly investments. The use of lean tools in medicine focuses on improving flow efficiency, which is most evident in shortening the time of consulting patients from the first contact with the facility to obtaining a full diagnosis, which only makes it possible to start the proper treatment process. As the examples described in the literature show (Modig, Alstrom, 2014), this time can be significantly shortened, e.g. from 42 days to 2 hours. The results also show a significant reduction in waiting time for surgery, which was shortened, for example, at Theda-Care Hospital in Appleton, from 14 weeks to 31 hours. Ian Glenday stated that "50% of all patients present with conditions that require only a few types of medical procedures (exactly 5% of all performed in a given facility)" (Góral, 2022). At the same time, it was indicated that the demand for the health service is predictable, and all patients can be classified into several groups of medical procedures, the frequency of which can be very precisely determined.

Successful attempts to implement Lean Management tools in the healthcare sector are indicated by researchers of the subject in numerous examples from Great Britain, Spain, Sweden, Italy, the USA, and Australia (Wiśniewska, Koniecznyńska, 2011), as well as from countries such as Japan or aforementioned Canada (Koczor, 2020). Koczor particularly

emphasizes the possibility of implementing LM in small medical facilities with the same success as in large ones, and cites such experiences, especially in Poland: reduction of laboratory testing costs by 50%, increase in monthly revenue from the sublease of offices for private services, or a decrease in the number of missed telephone calls by 67%. For both small and large facilities, it will be important to note the undeniable fact that the implementation of LM in a medical facility translates into a 10-20-fold return on each zloty spent in the next 5 years of operation, which is confirmed by numerous project experiences and literature reports (Koczor, 2020).

The scale of savings is always an interesting topic, but especially here, because it can be analyzed from the point of view of the facility itself, which can redirect the saved money to, for example, very expensive equipment or other needs, but also from the point of view of insurance companies.

Due to the constantly growing costs of medical services, the possibilities of cost reduction by using methods that do not require high-investment investments are very attractive, hence the pressure to implement them, which has been observed for many years, e.g. in American hospitals (Byrne 2013). Byrne points to the huge role of communication in the process of implementing LM tools. Without proper communication, i.e. a uniform system that supports the entire health service, it is practically impossible, but above all, it may result in errors that endanger human health and life. Efficient communication is like a nervous system that logically connects all the stages of treatment that the patient must go through. It combines them into a fluid stream of value.

Examples of Lean Management implementation in Polish medical facilities indicate only positive aspects of such a change. One of them is the implementation of LM in the Medical Services Center DIALIZA Sp. z o. o. (Preś, Dudek, 2018). As a result of the introduced changes, the clinical risk was reduced by 90% compared to the initial state, the inventory level was reduced by 30%, and overprocessing - by 50%, which was achieved by reducing the number of steps necessary to perform specific processes. Expenses were reduced by 40%, and the savings achieved in this way are over 78% compared to the expenses incurred in the previous year in the main processes of the facility (warehousing and cleaning processes). An example of a positive implementation of LM tools only in the operating theater at the EMC Regional Health Center in Lublin is an incentive to extend the project area to the entire hospital, as well as an inspiration for other facilities (Leśniewski, 2017). The problem in the operating block was the poor flow of information and unclear communication, which resulted in problems with the flow of surgical instruments between the block and the sterilization ward - they did not appear in the block on time, as well as incomplete or poorly marked sets. Of course, the implementation of LM required the involvement of all employees of the sterilization block and ward in the process, who defined the bottlenecks and proposed solutions themselves. Lean Management is a process of continuous improvement. One success and the involvement of some employees is the beginning of changes, especially because it forces changes in subsequent areas where

disorganization and lack of effective action are successively exposed. Successes involve more and more employees because each one of them observes and feels the clear benefits of changes in the LM area.

2.2. Lean Six Sigma methodology in medicine

Lean Management has great potential, but it is very difficult to implement in the Polish reality, in the health care system, which is neglected in many respects. Another problem is that the LM methodology is popular in production systems (Lean Manufacturing). A serious barrier is a mental barrier of hiding behind the specificity of the medical industry, and its approach to the patient. But it turned out that typically production concepts, such as: "takt time", "standardized work", and "pull system" (Byrne, 2013), also characterize the way the medical industry works. Implementing them gives the same results as in production in terms of eliminating waste, saving time, and introducing flow. Because the same goal guides every organization: "obtaining ever better results in terms of both efficiency and quality" (McLaughlin 2022). It is vital for hospitals to emulate the Toyota Production System model of adapting what they learn to their own situation and developing methods to solve all sorts of problems. It's important to learn from other hospitals and other lean companies in other industries (Graban, 2016).

Six Sigma, in turn, is a methodology that uses statistical tools, striving to achieve perfection, assuming the identification of mistakes and errors before they appear (McLaughlin, 2022; Mydlarz, 2017; Ingaldi, 2019). The reduction of costs resulting from faults, errors, shortages, etc. takes place by excluding them. The starting point is the measurement of defectiveness as a deviation from the central value. A 6sigma deviation is the probability of a few defective products (processes) per million produced, which is considered to be an acceptable level (Mydlarz, 2017).

The Six Sigma implementation process must always follow strictly defined stages: defining the problem (using relevant data), measuring using statistical methods, analyzing them to detect the causes of errors and sources of variation, making improvements (reduction of the level of deviations), monitoring to maintain the achieved results. Changes in processes are implemented in a Six Sigma approach using a fixed life cycle (DMAIC): Define, Measure, Analyze, Improve, Control (Ingaldi, 2019), according to six principles: 1-customer direction, 2-information-based management, 3-process, management and improvement, 4-active management, 5-unlimited cooperation, 6-excellence, tolerance for failure.

Implementation of Lean Management tools in an organization also follows a set logic that can be defined in the same way as the DMAIC flowchart. The inclusion of statistical analysis in the process facilitates the diagnosis of errors, accelerates the process of changes, and enables constant monitoring of processes. Six Sigma was created precisely to improve the management system by constantly identifying errors and constantly eliminating them (Ingaldi, 2019).

The combination of methods translates into specific benefits (Świtek, 2016): it guarantees "statistical control" of loss reduction processes implemented using LM tools.

In the first stage of LM implementation, it is necessary to map the processes and select those that will be improved. In the next step, responsible and committed teams should be created and the tools and techniques to be used should be selected.

Using Six Sigma tools, each subsequent step brings us closer to achieving perfect quality. The use of Six Sigma and LM methodology together, as stated, makes great sense, because it doubles the achieved effects (Kamińska, 2021).

Production and service companies of various industries have been successfully using the Lean Six Sigma methodology for many years, developing their unique ways of proceeding (Świtek, 2016). The medical industry, using Lean Six Sigma, checked the usefulness and application of individual tools. Lean Six Sigma tools most often used in healthcare projects (Wiśniewska, Koniecznyńska, 2011; Bukowska-Piestrzyńska, 2018; Preś, Dudek, 2018; Koczor, 2020; Złotowska, 2020; Kamińska, 2021; McLaughlin, 2022): Visual Management (VM), Value Stream Mapping/Analysis (VSM/VSA), 5S method, Kanban, 5 Why, Kaizen (Action list), Poka-Yoke, Ishikawa diagram, and many others.

Visual Management is a technique for visualizing and evaluating all processes. For this purpose, the following are used: boards, charts, work instructions, marking of workstations, storage areas, tool storage places (e.g. using shadow boards), and failure reporting systems (signaling).

VM helps in identifying problems and irregularities by introducing solutions that will effectively increase the transparency of processes and how they are performed.

An example of visual management in health care is, for example, the patient identification system - Triage (Wiśniewska, Preś, 2011), which consists of categorizing patients using colors indicating the level of injury and the minimum time to assist. VM is also the use of all kinds of maps (VSM/VSA - mapping/value stream analysis), which facilitate the management of the ward, e.g. identification of free places for patients (beds, treatment equipment, etc.), allowing for the illustration of all processes. The map contains a chronological description of the ongoing processes, their duration, the number of people involved in individual processes, the way information flows, and the amount of resources moving between processes. To optimize processes, two maps are created: a map of the current state (which requires an audit) and a map of the future state, where changes are introduced to improve the efficiency of the process. The audit, necessary to be carried out in the first stage, supports the identification and increase of added value in the improved activities; supports the creation of process diagrams, which allows, among others, to improve internal communication at all levels (Dziembała, Pańkowska, 2017).

The 5S method - is a tool that allows you to organize and maintain order in the workplace; in medical facilities, often implemented through the use of VM tools, e.g. shadow boards (Preś, Dudek, 2018), but mainly through organizing workplaces, preparing instructions, plans and procedures, and continuous improvement (Wiśniewska, Preś, 2011).

Kanban - a logistics management system that allows you to maintain the right amount of all resources necessary for the implementation of processes (Preś, Dudek, 2018), electronically supported and cooperating with the 5S method, elements of visualization, and Just in Time (Wiśniewska, Preś, 2011).

5Why - a simple research method in which the source of the problem is reached by asking the question "why?", which ultimately allows you to take appropriate action to eliminate it (Preś, Dudek, 2018).

Kaizen - a philosophy based on the assumption that LM tools can bring the expected results through the commitment of all employees and their pursuit of excellence. It is a constant introduction of changes and improvements with small steps (Bukowska-Piestrzyńska, 2018; McLaughlin, 2022,) and specific actions, which are: audits ensuring compliance with labor standards, consisting in the observation and evaluation of processes; ongoing measurement of process performance indicators, which enables immediate feedback and helps to eliminate root causes of problems; daily short team meetings to present the current situation and collect suggestions for improvement follow a specific pattern and last 5-10 minutes; management of suggestions – implementing improvements on an ongoing basis to improve everyday work, using tools such as Poka-Yoke, which helps to eliminate errors by introducing the principle "processes are responsible for mistakes, not people", or the Ishikawa diagram, a tool for identifying a problem in terms of cause and effect (Kamińska, 2021).

Lean Management methods improve internal audits of the management system and enable changes to be made by the following course of action: defining the expected goal, establishing a value stream eliminating redundant elements, creating an integrated coherent fluid sequence of value-creating activities, continuous improvement (Sobczak, Rydlewska-Liszkowska, 2012). The most important stage of the audit concerns the identification of inefficiency: lack of coordination of activities in time, causing patients to wait, defects in services, e.g. poorly performed examination, etc., unnecessary activities, omissions or delays in their performance (e.g. lack of promotion and prevention), bad organization (wastes of time and energy), overburdening employees, as well as burdening them with unnecessary duties. The following reasons for the implementation of LM tools in the health service are rising costs of health services, legal and organizational difficulties in obtaining funds for the health service, inappropriate practices in the management of medical facilities, lack of incentive systems for employees, lack of internal coordination, problems in the use of modern equipment: coordination at the medical and technical level, the discrepancy between the need to introduce standardization and the need for an individual approach to each patient.

Successful implementations of Lean Six Sigma in medical facilities indicate that such projects analyze current processes with great accuracy and indicate areas where costs can be reduced and efficiency improved. Such a solution, seemingly easy to implement, was implemented at the Mater Hospital in Dublin and consisted in replacing the entire fleet of printers (OKI, 2022). The extensive IT and communication network of the hospital posed a challenge for the implementers with a high degree of complexity, covering all departments of the hospital. Only this one area of change allowed to fully optimize the management of consumables, significantly reduce the costs resulting from, among others, color printing and reducing energy consumption, and improve communication by integrating all devices and enabling remote management of equipment and materials.

The report on the improvement of processes in the service sector (Horbal, Drozd, Góral, 2022) indicates that in the opinion of employees and managers, the most important disruption in the work environment is stopping the IT system. In fact, it turned out to be the least significant disruption in terms of lost time. The productivity of companies was improved using two tools – A3 Sheet and TWI (Training Within Industry) methods.

Processing time, i.e. performance of activities that meet customer demand, was reduced by 46%, productivity (calculated as the number of orders processed by one person per day) was increased by 81%, and the number of operations that make up the order fulfillment task was reduced by 48%.

2.3. Lean Healthcare training

Implementing Lean Management tools in an organization, just like any change, is always associated with changing old habits among employees and management. The implementation of this most difficult task, concerning human resources, is carried out as part of training. Their organization, frequency, and manner of carrying out pose many difficulties. What must be overcome is the natural resistance to change of employees who must engage in the training process by devoting their working time and private time to it. For the training to be effective, its form must be attractive, adapted in every respect to various employee groups, and as little interfering with other duties as possible.

Training conducted as part of such programs as e.g. Healthcare Lean Management (Koczor, 2020) or Lean Lider of Healthcare Academy (Złotowska, 2020), aims to combine the transfer of knowledge in the field of LM with practical training in identifying and eliminating waste and constantly improving operational efficiency in the area of customer service. The aspiration is to create the foundations of a new culture, based on the principles of LM, which will be subject to continuous improvement at every level of functioning. For this to be possible, employees must join the changes. Such an opportunity, apart from the training program, is provided by the employee suggestions program - employees can submit proposals to improve their workplace and other areas and processes in the organization. To motivate all employees to cooperate, it is first necessary to diagnose the so-called "low-hanging fruits", i.e. those changes that will

be possible to implement immediately, at no cost, or with a very low financial outlay, using already existing organizational habits. Such changes are easy to implement, and since they are proposed by the employees themselves, they are implemented by them at their workplaces. Employee motivation is best supported by the ideas bonus system. Here, employers have at their disposal a whole range of possibilities, from cash gratification to a whole range of in-kind prizes (shopping vouchers, entertainment passes, tickets to events, and others).

A training game can be used to speed up and make the process of acquiring knowledge in the field of LM more attractive. An example is the Polish game "Koromo-Japanese workshop" (koromo.pl, 2022). It is a training simulation game in which participants improve their work and at the same time learn LM methods and tools. Koromo's proprietary training program has been developed since 2015 and constantly improved based on hundreds of competitions conducted, during which several thousand employees from various industries were trained.

The first version of the game is about improving the car workshop. Participants of the simulation game repair vehicles, and during the game, problems and challenges are solved by gradually introducing LM methods and tools, such as: Just in Time, Standardization, Kaizen, Kanban, Jidoka, Visual Management, and TPM. In addition to the fact that games are conducted as a proven training method, teaching the rules of LM using the Koromo game is also introduced by the Polish Universities of Technology in Warsaw, Silesia, Białystok, and Opole. Currently, as a result of conducted research, the game also has a second version - dedicated to the health service. After that, tests were carried out in two medical facilities: Non-public health care facility Nasza Poradnia Sp. z o. o. and the Public Psychiatric Health Care Center - Doctor's Stanisław Deresz Hospital in Choroszcz, it was possible to develop a full version of the game for the medical community. The final version of the game was very well evaluated by doctors and staff.

One of the definitions of "lean management" cited in the literature (Wiśniewska, Konieczńska, 2011) implies, above all, the need to carry out profound changes in the culture of the organization, i.e. those that will change the way of thinking and thus the functioning of all its members so that they are involved in continuous cost reduction and quality improvement from they think about meeting the expectations of customers (patients) as much as possible while adapting to changing environmental conditions. This approach is complemented by the message quoted by other definitions (Wiśniewska, Konieczńska, 2011) of avoiding all kinds of waste through the process of continuous rationalization of the company and its relationship with the environment, consisting in reducing the scope of the company's internal functions to necessary activities. The patient is interested in quick diagnostics and then providing professional help (from diagnosis to cure, then rehabilitation/follow-up visits/maintaining the effect of treatment, or further diagnostics). The most strategic period in the entire complex process is the time from the patient's reporting to the facility (by phone or in person) to full diagnosis, which enables the launch of the next process, which is providing the patient with professional assistance. In the entire process, activities that do not add value to the services

provided should be eliminated. Therefore, the essence of action in Lean Healthcare is understanding the needs of the client/patient (Wiśniewska, Koniecznyńska, 2011), and then identifying and eliminating waste. In every medical facility, there are the same typical wastes related to processes specific to the medical industry (Wiśniewska, Koniecznyńska, 2011).

The effect of the changes implemented with the use of Lean Six Sigma tools is standardization, which in health care is understood as an activity aimed at achieving an optimal degree of order by developing and establishing requirements, standards, rules, characteristic conditions, technologies, work, services used in the medical industry (Wiśniewska, Preś, 2011). Standardized work consists of the development and implementation of procedures describing the most effective and at the same time the simplest way of performing individual activities (McLaughlin, 2022). The standard enables proper functioning from the point of view of both the medical facility and the patient. However, standardization in medicine has many limitations, and research shows (after Zuiderent-Jerak, Maroń, 2018) that unified, universal standardization in medical facilities does not work, and even fails. It is possible and even desirable, but only in identifying places where it will improve the operation of medical care.

This so-called situated standardization, which introduces the integration between universal and individualized (patient-centered care/medicine) approaches, is so necessary for each patient. The need for such an approach is a major challenge. Not without significance here is the implementation of management systems according to ISO 9001 and accreditation by the requirements of the Quality Monitoring Center in Krakow, increasingly commonly implemented in Polish medical facilities (Wiśniewska, Preś, 2011).

3. Research part

3.1. Introduction

The research (Project Based Learning - PBL) was carried out as part of the project "Silesian University of Technology as a Center of Modern Education Based on Research and Innovation" by a team of tutors (teaching and research and teaching staff of the university), experts/practitioners and students. PBL, i.e., Project Based Learning – project-oriented education, consists in replacing part of the classes with interdisciplinary projects conducted in small groups on authentic research material.

The main assumption of the conducted research was to improve the functioning of selected medical facilities to improve the quality of services, patient safety, and staff satisfaction in standard conditions and a crisis. Due to the ongoing pandemic and the related restrictions, one facility was selected - a medical clinic (Nasza Poradnia Sp. z o.o. in Chorzów - Fig. 1).



Figure 1. Non-public health care facility Nasza Poradnia Sp. z o.o.

Source: own photo.

The processes implemented there were analyzed in terms of problems in functioning, to improve the way services are provided, reduce delays, and eliminate sources of waste. The goal was to improve access to medical care, reduce the waiting time of patients for a visit/procedure, streamline processes supporting the main value streams - which was assumed to translate into lower operating costs of the facility, as well as improve its functioning in extreme conditions (in any crisis related to the natural or industrial disaster. As part of the research, it was assumed to develop a strategy that would increase the efficiency of a medical facility, assuming that employees would not be overloaded with work, but would have a more rational workload, and the client (patient) would be provided with a product (service) as expected. The research was also supposed to contribute to the development of a simulation game dedicated to the diagnosed problems.

To achieve the assumed goal, a six-stage research methodology was developed:

- 1) Analysis of problems in a selected medical facility during the COVID-19 pandemic - surveys;
- 2) Identification of losses in terms of work organization and logistic flows - audit and survey results;
- 3) Identification of losses in terms of the quality of patient service and patient and staff safety - audit and survey results;
- 4) Suggesting ways to eliminate waste - audit and survey results;
- 5) Designing a simulation game dedicated to healthcare;
- 6) Development of analysis results and formulation of conclusions.

3.2. Selection of research methodology and tools

The research began with an audit of a selected medical facility. Nasza Poradnia Sp. z o.o. is a medical clinic located in Chorzów, Poland. The facility (family counseling center) operates from 7 a.m. to 4 p.m. during the week. The patients during the PBL project (Covid-19 pandemic) were seen by family doctors on a teleconsultation basis. The gynecological (and to the midwife nurse) patients were admitted without changes by contact, also all the patients to vaccinated. The employees of the facility always work in two shifts: from 7 am to 12 am (family doctors, registration - first shift - two nurses) and from 1 pm to 4 pm (specialist doctors, registration - second shift - two nurses and technical and cleaning workers); additionally, a midwife nurse is on duty from 12-13. The organizational structure of the clinic consists of: President - supervising and managing functions and Vice-President – a coordinator of the facility and the employees: doctors (8), nurses and midwives (6), and maintenance workers (2), in a total of 20 people. Doctors are employed on a mandate contract; other employees have employment contracts. The facility also uses the services of external entities e.g., an accounting office.

The audit of the facility consisted in conducting interviews with the management and selected employees; the premises of the facility and the layout of the equipment were also reviewed; the functioning of employees during work was observed; a survey was then carried out and the selected employees were interviewed again during the final audit. The aim was to identify the functioning of the facility, organizational structure, communication channels, relationships, and duties of individual employees.

Input information was provided by the management of the Clinic. The audit was carried out during four visits to the facility. During the first visit, a detailed interview with employees was conducted. The results of the interview were communicated to the entire team during the meeting. Based on the observations and conclusions from the interview, a questionnaire was developed, which was handed over to the employees of the facility during the second visit to the clinic (Questionnaire no. 1: Questionnaire of an employee of the clinic Nasza Poradnia Sp. z o.o.). During the third visit, the questionnaires were collected and a detailed vision of the entire facility was made. Based on the survey results, interviews with selected employees were deepened and observations for selected processes during the fourth visit to the clinic were made in detail. The performance of duties and the flow of communication between employees was observed every time during each visit to the Clinic. The findings were discussed with the team at weekly meetings.

During the research, a situation related to the unusual functioning of the facility due to the ongoing pandemic and lockdown was observed. Particular attention was paid to the resulting changes in the functioning of the facility, restrictions and their observance, and unusual and exceptional situations.

Due to the pandemic, it was not possible to survey the patients of the researched medical facility. Therefore, a decision was made to conduct surveys via the Internet. 24 people responded. It was assumed that each of the respondents uses the services of medical facilities that function in the Polish healthcare system. In addition, every patient, regardless of the choice of medical facility, has the same expectations of medical care when they are forced to use its services (Questionnaire No. 2: Patient opinion during the COVID-19 pandemic) and everyone is facing the same problems due to the ongoing pandemic.

3.3. Research and results

Based on the initial interview and observation, problems with communication between employees and at the following levels: facility - patient, patient - facility were diagnosed. Two most important problems faced by the clinic have been identified: prescription complaints and patient service hindered due to the pandemic (the so-called "difficult patient"). A series of detailed interviews led to the determination of the main cause of the diagnosed problems, which turned out to be communication. After conducting interviews with employees servicing the reception desk during two shifts (four nurses), operating on the first line of communication between the patient and the medical staff, it turned out that all information is recorded in a special notebook, on sheets of paper stuck to the reception counter or is passed on orally. According to what the employees signaled, the information provided in the manner described above does not always reach the employees working on the second shift (it happened that it was not written down, a piece of paper peeled off and got lost, or an employee forgot to provide the information). In addition, it was established that the management communicates with all staff on an ongoing basis - daily, in person on-site, and by phone with employees working remotely.

To fully analyze the problems of the medical facility, a survey was conducted among its employees.

Based on the survey (Questionnaire No. 1), the following problems were identified, the causes of which were determined using the 5Why analysis:

- Problems finding items/tools for work. Such problems were signaled by a specialist doctor and a maintenance worker:
 - 1W:** Why is it difficult to find items/tools for work? Answer: Devices/tools/equipment necessary for work are shared by many people.
 - 2W:** Why don't shared items/tools have a specific place? Answer: they have, but they are not put back.
 - 3W:** Why aren't they put back every time? Answer: Existing job instructions and work standards are not sufficient and require changes, as indicated by the maintenance worker, employees do not follow the existing recommendations when it comes to doctors and do not put tools away where they are marked with special markings.

Conclusion: New workplace instructions should be developed, and shadow tables introduced; employees should be trained in the use of job recommendations; it is necessary to check and enforce compliance with the workplace instructions.

- The problem of prescription complaints was signaled by both the medical staff and the administration:

1W: Why do prescription complaints arise? Answer: Patients wait too long for prescriptions and mistakes in the content of prescriptions are often reported by patients.

2W: Why do patients wait too long for prescriptions and why do mistakes happen? Answer: at the doctor's and nurse's workplace, these activities are performed without the use of a computer system. The reason is the lack of skills in operating the computer system by medical staff.

3W: Why do doctors have trouble using the computer system? Answer: There has been a rapid shift in prescription dispensing since the pandemic - from traditional to digital - doctors have not been trained; when it comes to patients - some documents need to be printed for them because patients have not set up electronic accounts (Individual Patient Account - IKP).

4W: Why have doctors not been trained? Why didn't patients set up electronic accounts? Answer: due to time pressure, oversight, and lack of skill.

Conclusion: doctors should be trained to use the new system and patients of the facility should be encouraged to set up accounts, but also a simple instructions should be prepared for them, and help should be offered.

The survey results also provided information on:

- Changes in working conditions during the pandemic: differences typical for all medical facilities were identified: teleconsultations instead of contact visits to doctors, the need to use protective clothing, masks, and disinfectants; at the same time, there was no need to take any extraordinary measures due to operating in high-risk mode. All employees described their job security as very good, good, or average, but no change compared to the state before the pandemic.
- Information flow on the following levels: doctor - nurse, doctor - doctor, nurse - nurse. The suggestion to improve communication appeared in an open question in which the respondents could submit their observations regarding the improvement of the functioning of the facility.
- The other answers did not indicate any problems in the examined areas (patient registration, waiting time for admission, stocks).

Surveys have shown that from time to time (if necessary) meetings are organized in a medical facility, during which current topics are discussed, e.g., related to improving the workplace. To motivate employees to cooperate, the so-called "low-hanging fruits", i.e., changes that will be possible to implement immediately, at no cost, or with a very low

financial outlay, using already existing organizational solutions. It was proposed to implement visual management - a meeting board (Fig. 2) and change periodic organizational meetings to regular, weekly - organizational meetings of several minutes in the presence of everyone starting the shift, twice a week.



Figure 2. The meeting board and the place where it was placed - the main corridor next to the registration desk.

Source: own photo.

To fully diagnose problems in the field of patient service in medical facilities in Poland, a second questionnaire was developed and disseminated via the Internet (Questionnaire No. 2).

24 people (67% men, 33% women) took part in the study. 75% of the respondents are people over 39 years of age living in cities or on their outskirts. 62.5% of respondents declared that they are not chronically ill; 37.5% - that they are in constant contact with a family doctor. As the biggest inconvenience during the pandemic, patients report the so-called. "teleconsultations", the problem with calling the doctor, and very distant dates of direct contact with doctors. Only 30% declared that access to a family doctor is the same as before the pandemic. When it comes to access to specialist doctors, 37.4% of respondents indicated difficult to access during the pandemic and 25% interrupted treatment or diagnostics due to the pandemic. In 20.8% of the respondents, the lack of access to a doctor or delay in the visit resulted in health consequences.

70.8% of respondents know how to complete an e-prescription or e-referral; 8.3% do not know and their doctor does not issue such prescriptions. During the Covid-19 infection - 41.7% of respondents did not have any medical care, 20.8% were looked after only by their family; only 4.2% of patients had good medical care (1/3 of the respondents suffered from Covid-19, 21% do not know if they were ill because they did not take the test). 16.7% of the respondents did not receive an ambulance despite being summoned. Only 4.2% of people who contracted covid-19 were provided with rehabilitation care. 41% of respondents do not have an Internet

Patient Account (IKP), 12.5% have not heard of IKP, 8.3% cannot activate it; 41.7% of respondents do not know where to turn for help in activating it. Only 4.2% of respondents positively assessed the functioning of the health care system in Poland during the pandemic; the attitude of doctors during the pandemic was positively assessed by 41.7%, 25% had no opinion, and 34% - assessed it negatively. The last question of the survey concerned suggesting the direction of changes in the current patient service: the biggest problem for patients is the so-called "teleconsultation". Patients have indicated that they need real contact with a doctor.

Frequent complaints about prescriptions were identified as the most important problem, and at the same time possible to be eliminated in a short time. Complaints force patients to contact the medical facility again (difficult due to the pandemic), which causes conflicts and increases the risk of infection. The patient, who does not fulfill the prescription on time, does not take the medicine on time, which delays the treatment process and may lead to deterioration of health.

Ishikawa's cause and effect diagram was used to identify the causes of frequent prescription complaints (Fig. 3). Brainstorming was carried out, which allowed for a global review of each area that has a potential impact on generating the most significant problem, which is frequent prescription complaints. Potential causes that have a direct or indirect impact on prescription complaints were identified in four areas of the medical facility's operation: "Management", "People", "Environment" and "Methods".

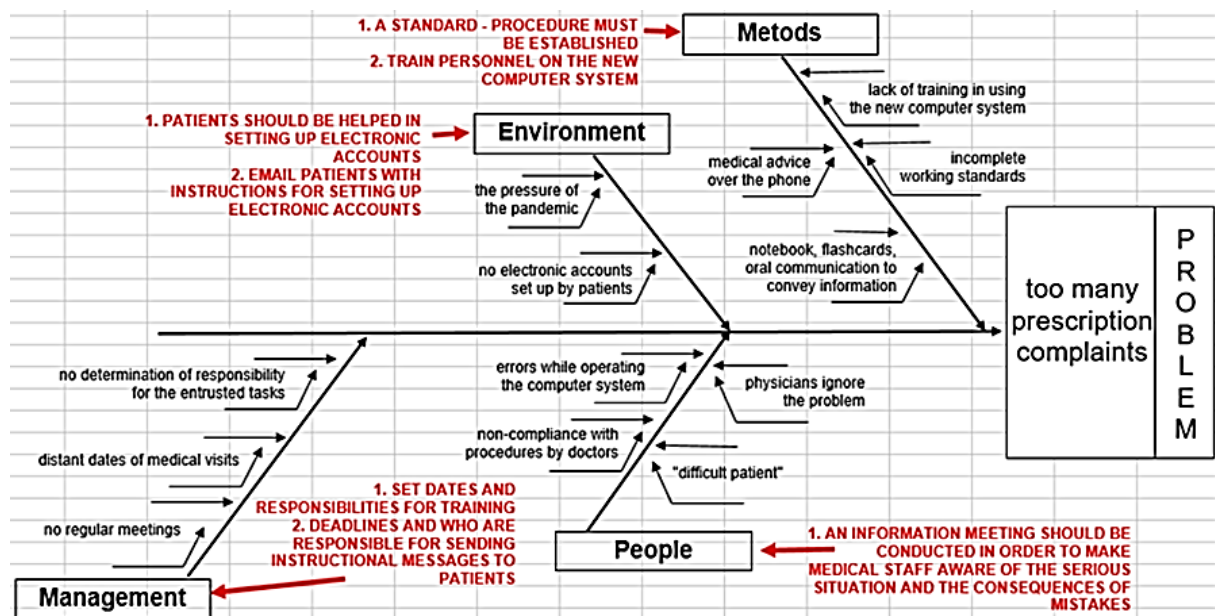


Figure 3. Ishikawa's cause-and-effect diagram for the problem of too frequent prescription complaints.

Source: own elaboration.

Solutions were generated for each group of problems:

- In the "Methods" area, first of all, staff should be trained in the use of the new IT system, and then supplemented with work standards that will improve communication within the facility (was a suggestion to organize regular meetings of employees, several minutes a week, with the meeting board located in the administrative part of the facility; the following will be recorded on the board: the most important indicators regarding the number of unrealized visits, the number of prescriptions advertised, tasks for the current week, those responsible for their implementation and deadlines);
- In the "Environment" area, assist patients in setting up IKP by sending instructions via e-mail;
- In the "Management" area, set the dates for training and those responsible for conducting them among the staff of the facility, and the dates and responsible for sending instructional messages to patients via e-mail;
- In the "People" area, employees should be informed about the adopted procedure as soon as possible.

3.4. Staff training

Training meetings for employees of the medical facility were divided into two parts: the theoretical part, during which the employees were familiarized with the idea of Lean Management, and the practical part, conducted using the Koromo training game in the demo version. For the development of the full version of the game for medical services, information on the specificity of the functioning of the medical industry was particularly important. Modified game proposals have been verified by the creators of the Koromo game. The prototype copies of the game were tested. Another more refined version was used to train the medical staff of the facility: NZOZ Nasza Poradnia Sp. z o.o. in Chorzów. Soon, a basic version of the Koromo Health game was created, which was used in the second part of the training for the employees of Nasza Poradnia - in the practical part of the training (Fig. 4). The practical part of the training at NZOZ Nasza Poradnia was carried out in four sessions due mainly to pandemic restrictions, but also because the Koromo game allows you to simulate a group of up to 12 people and that the employees of the tested facility work in two shifts. Thus, employees were divided into four training teams (4 x 5 people), which were supplemented by project participants also divided into four teams. Each training session was therefore attended by a maximum of six people, a trainer, and an assistant trainer.



Figure 4. Koromo Health game prepared for practical training and two of the game participants during the training.

Source: own photo.

The Koromo game, dedicated to the medical service, deals with issues related to the Lean Management system, but embedded in the medical reality. The main principles discussed in the game are Just in Time (patient service time) and Jidoka (approach to process quality, patient satisfaction, and problem-solving). All elements of the game were developed by the above assumptions. The game is distinguished by simple and clear rules, enabling participants to focus on the subject of the training, and not on trying to understand the game.

The use of the Koromo game enabled the trained employees of the medical facility to solve problems by the LM concept. They showed great interest in participating in the game and very quickly became involved in the competition between the teams. Very fast learning of the rules of the game and understanding of the operation of LM tools in terms of their usefulness in the medical area was observed. In the future, it will be worth confronting reflections on the game of medical staff of various institutions trained with it.

4. Discussion

The implementation of Lean Healthcare in a medical facility and the development of standards increase work efficiency, which leads to time savings that medical staff can spend on direct contact and patient care. In this way, the level of safety of clinical processes is mainly increased, which is of particular importance during the increased sanitary regime. The standards ensure that the organizations operate without any visible disturbances during crises, while the lack of them, during such situations, is particularly severe, causing disorganization and the creation of procedures "quickly". During crises, standards are crucial for the efficient

organization of work, which must then proceed with an increased time regime, in situational stress, and also requires quick training of a large number of volunteers.

There is a lot of “wastes” in medical facilities. We can call “wastes” that activities do not add value. We divide them into two types. Type I are necessary losses, i.e. those that must be made due to the process, but do not add value in the process (e.g. time of transporting the patient to the facility, preparing the workplace, printing documents, etc.). Type II is the so-called unnecessary losses, i.e. all activities that should not occur (e.g. correcting errors in prescriptions, documents, patient records, waiting time for various materials, postponing work "for later").

Based on the research results and information collected in the medical facility, losses were identified in terms of work organization and logistic flows, quality of patient service, and patient and staff safety, as well as losses in terms of eliminating waste. It was found that there are serious communication and organizational problems within the facility. They result from various reasons: lack of standards regarding the functioning of the reception desk, improper communication with doctors - as employees on a mandate contract, doctors impose their way of functioning by failing to comply with the established rules, which causes organizational problems (failure to put tools away causes problems with finding tools for work, failure to comply with the requirements of the new way of dispensing prescriptions - lack of training - causes frequent complaints about prescriptions and extends the waiting time of patients for the service, failure to report shortages causes logistical problems with replenishment of stock).

From the patient's point of view, the main purpose of communication, resulting from the restrictions related to the pandemic, is to introduce the so-called "teleconsultation". Visits to the doctor are possible only in exceptional situations and for a limited period. Patients understand that medical advice must be provided over the phone, but they do not accept that the registration in the clinic sometimes doesn't answer the phone, but when it does, registration books them for a very long waiting time appointment. Many patients (questionnaire no. 2 - over 40%) do not have an Internet Patient Account, which hinders the prescription dispensing system. Older people often do not know how to report a shortage of medicines or make an appointment online. Any protections are necessary for the safety of both patients and medical staff but that can't make communication difficult. During the pandemic, security measures were introduced, such as: hand disinfection, protective masks, and disposable gloves, which were used before in exceptional situations, e.g. interventions, and vaccinations; health questionnaires were introduced, which patients must complete before entering the clinic (surveys replace documents, which relieves staff from completing additional documents), designation of safe distance zones, use of special curtains enabling safe conversation.

The solution that was used to improve internal communication in the facility was the purchase and launch of a meeting board, which was placed in a place visible to all employees and on which any problems that should be communicated to all employees are recorded. The board is one of the Visual Management tools that can facilitate communication and it is

worth using it for this purpose. Importantly, the information must be factually correct. Falsification or lack of information leads to wrong decisions and ineffective actions.

The last action is the introduction of cyclical, weekly staff meetings near the board. As a result of this, it is possible to quickly and easily identify deviations of results from the assumed goals, and thus identify the factors that influenced them. The team meeting is also an effective way to communicate the progress of work and the opportunity to launch improvement actions aimed at achieving goals. According to the LM concept, the use of the board was to improve the functioning of the facility. The effects of the changes introduced for a longer time perspective are planned to be analyzed in the next project.

Nevertheless, the possibility of implementing LM in a small medical facility was confirmed. It was found that the implementation of changes depends primarily on the favor and motivation of the management staff. The biggest problem in maintaining changes lies in the habits of the staff, which is problematic and takes time, but with consistent implementation, it brings the expected effect. The greatest resistance was caused by the change in the area of medical staff - the lack of motivation of this most important group of employees is a serious challenge for managers when it comes to all processes in the area of a medical facility. Each medical facility is interested in reducing operating costs, and so are its employees, except doctors who are not permanently employed in a given facility and which is why perform its tasks without getting involved in its internal problems. The creation of standards in the facility to which the doctor will have to adapt must be taken into account before signing the contract with a given person and accepted by him. It will then be important to create a training system that will raise awareness of the newly adopted standards - what is their role and how their implementation affects the improvement of work comfort and efficiency. Awareness of the benefits of implementing LM in the facility will encourage you to get involved, as evidenced by the numerous examples of implementations cited earlier.

The benefits of the changes introduced in Nasza Poradnia in Chorzów will be confirmed after a longer time. Any results showing a decrease in its operating costs will be interesting. For Nasza Poradnia, these will be, for example, the costs of laboratory tests, monthly income from the subletting of offices for private services, a decrease in the number of missed telephone calls, a decrease in the number of prescription complaints, and an increase in the number of declared patients.

The main author of the project has planned further research, in which the effects achieved in this project will be related to the achievements of another facility that has already implemented quality tools and developed operating standards and can be an example of properly introduced changes. The comparison will be carried out mainly to create know-how for medical facilities that will want to implement lean tools as quickly and smoothly as possible.

5. Summary

In the examined medical facility, to minimize the diagnosed losses (waiting, unnecessary movements, excessive processing, shortages), solutions such as training with the game "Koromo Lean in Medicine" were used, which taught employees how to implement the lean tools and quick solutions to problem situations, and also weekly meetings at a board that was purchased and placed in a visible place, on which all current problems are written and people who are ordered to. According to the LM concept, these solutions are designed to improve and optimize the functioning of the facility, mainly in the area of internal communication, because this problem was selected as the most urgent to be removed.

The implementation of the meeting board (Visual Management tool) in Nasza Poradnia improved internal communication:

- enabled the liquidation of the three existing methods of communication between the first and second shifts of staff - through a notebook, yellow sticky notes placed on the reception desk, and verbally;
- recording the problems occurring in the facility and those responsible for their solution which contributed to more efficient and faster elimination of them;
- recording the number of prescription complaints on the board at weekly intervals and discussion during weekly meetings at the board highlighted the problem and enabled the joint generation of factors influencing its escalation and ways to minimize it.

The introduced changes will also be analyzed after the time has elapsed, which will allow the medical staff to function properly in the new reality, translating into real, measurable effects.

It is planned to regularly check the implementation of the changes introduced in the area of communication in the Nasza Poradnia in Chorzów.

Unresolved problems in the facility, such as the need to prepare/extend workplace instructions, e.g. with shadow boards, the need to train employees in the application of workplace recommendations, and in the longer term - checking and enforcing employees to comply with workplace instructions, were left to be implemented by the facility manager. Their implementation will be confirmed in the longer term.

The need to train doctors in the use of the new system due to the lack of cooperation on the part of the medical staff has not yet been resolved.

The lack of online accounts for some patients turned out to be a temporary problem.

Interest in the results of the research, as well as cooperation on the part of medical institutions, mainly in the direction of training with the use of the Koromo LeanHealthcare game, inspired the project supervisor to submit another PBL, which will enable the continuation of the research. The planned comparison of the effects of implementations and planned changes in our clinic with the effects achieved in the same area by a selected medical facility that is

successful in implementing lean tools and developing know-how will be a set of valuable tips for medical facilities that want to streamline processes, improve efficiency and, above all, become more patient-friendly.

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