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Lean Healthcare: Improving Surgical Process Indicators Through Prioritization Projects

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Abstract:

Purpose: Implementing process management methodology through Lean Management and Design Thinking provides a new way to manage surgical blocks, maximize efficiency and adapt to the high variability of demand. This article presents our experience of implementing a set of improvement actions within the surgical process in the context of Lean Healthcare Processes. The project involved a total of 900 healthcare professionals over a 3-year period (2017-2019) and has impacted over 38,000 surgical patients each year at the Vall d'Hebron University Hospital in Barcelona, Spain.

The purpose of this article is to present a set of improvement projects within the surgical process and show the indicators that monitor its evolution. These projects have been implemented successfully in a hospital with high surgical complexity and indicate how health care professionals and process engineers can work together as a team to improve healthcare resources.

Design/methodology/approach: To evaluate the effectiveness of the actions presented, we propose a series of standardized indicators showing how our findings increase the efficiency of the surgical process. We also indicate Lean projects that can reduce patient waiting times and increase capacity. Below is a management model for the surgical process that considers industrial production criteria such as resource planning, optimizing the use of operating rooms and professionals' time and generating the best surgery combinations.

Findings: Projects that have increased efficiency in the surgical block the most have been standardized and converted into a model of action. This is designed to adapt to any level of complexity within the hospital process. The set of improvement projects has been divided into 6 stages: Programming, Material logistics process, pre-surgical stage, intra-surgical stage, post-surgical stage and transversal projects; each affecting a different area of the general hospital (not only the surgical unit). Furthermore, a visual flow chart was designed using the results of the project.

Findings from the study have led to a 15% increase in surgical capacity without the need for new resources. The average hospital stay also dropped from 7.2 days to 4.1 days. The flow vision in the care process improves the experience of both patients and health care professionals, who see their participation as part of the whole health care process.

Research limitations/implications: the projects were mainly developed at the Vall d'Hebron University Hospital. Although several of these projects have been carried out in other hospitals in Spain by the same team of process engineers, results may be biased when the team provides support within its own process department, compared to when it supports the local team in another hospital temporarily.

Another important limitation is that it takes several months to implement and consolidate the improvement projects and demonstrate improved indicators in a sustainable way over time. This matrix of projects is more than a specific action, a cultural change with the entire surgical department.

Originality/value: This study sets out a proposed practical example of applying surgery management tools in the surgical process. Our proposal can offer hospital managers and surgical coordinators an orderly, streamlined project guide for overall surgical performance indicators.

The main results from developing the model include the degree of satisfaction shown by healthcare professionals and the determined commitment from the center's management team to promote process management using Lean methodology. This commitment continued despite the challenges of shifting the organizational structure towards process management, which is a complex task requiring a period of adaptation and learning.

Healthcare management has always prioritized increasing surgical patient safety and satisfaction. Patient flows are increased and resources used more efficiency by shifting the focus to the patient and the processes gone through during their hospital stay. This improvement project provides us with the best example of Lean methodology implementation if reinvested in bettering healthcare. This in turn increases the value perceived by patients, which is the ultimate purpose of the process.

Keywords: improvement process, efficiency, Action Research, strategy, value-based healthcare, operating rooms, scheduling

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1. Introduction

Within the healthcare environment, process management has already been implemented in the majority of large European hospitals. However, the enormous potential of Lean methodology for improving processes became evident when it was integrated into healthcare management (Mahmoud, Angelé-Halgand, Churruca, Ellis & Braithwaite, 2021). Processes management is underpinned by 3 key factors: guaranteeing and maximizing patient and professional safety, improving clinical practice, and streamlining processes to make them more efficient (D'Andreamatteo, Ianni, Lega & Sargiacomo, 2015; Dahlgaard, Pettersen & Dahlgaard-Park, 2011; Souza-Gomes dos Santos, Cunha-Reis, Gomes de Souza, Leão dos Santos & Figuereido-Ferreira, 2020; Tlapa, Zepeda-Lugo, Tortorella, Baez-Lopez, Limon-Romero, Alvarado-Iniesta et al., 2020).

Increasing the efficiency of processes involves analyzing how different hospital flows are managed. Although this primarily concerns patient flow, it also includes internal and external communication flow and the integral logistics of flows of materials and equipment (Dahlgaard et al., 2011; Fiorillo, Sorrentino, Scala, Abbate & Dell'aversana Orabona, 2021; Marin-Garcia, Vidal-Carreras & Garcia-Sabater, 2021).

This article details the experience of introducing a set of actions to improve the surgical process in the context of Lean Healthcare Processes at the Vall d'Hebron University Hospital (VHUH). Over a four-year period, these actions involved 900 healthcare professionals working in 51 operating rooms and an annual throughput of 38,000 patients undergoing complex surgery. Vall d'Hebron University Hospital is a reference center for high-complexity surgeries and in Spain, a forerunner for organ transplants. The authors form part of the hospital's management team and have headed healthcare management and led the process strategy and at the hospital with considerable success. VHUH is the first hospital in Spain to set up a Hoshin Kanri panel to carry out improvement projects.

Improvement projects involving various working groups were introduced to solve problems detected. The projects increased overall efficiency and surgical activity, showing a remarkable improvement in indicators. The procedures and processes introduced in the surgical process have now been working for 4 years, proving that it can be maintained over time. Furthermore, the culture of change acquired constantly generates new opportunities which benefit both patients and professional healthcare workers.

The improvement projects have been ongoing for 4 years, and the results of the new Surgical Process can now be measured through their impact. Operational indicators show reduced patient waiting lists and increased efficiency of surgical resources.

Over the past 20 years, a large number of improvement projects using Lean methodology have been implemented in the health sector. Several hospitals in the US and UK have provided literature on the potential of process management to make hospitals more efficient and economically sustainable (Akmal, Greatbanks & Foote, 2020; Lega, Prenestini & Spurgeon, 2013; Tlapa et al., 2020). However, few of these articles examine the real impact of Lean actions on improving process efficiency within a healthcare environment. This is because impacts are usually determined in the long-term, but it is difficult to sustain the effort needed to maintain improvement teams and motivate staff to continue using Lean actions in their routines. Over time there is generally little continuity, making these projects impossible to sustain.

A literature review of improvement projects implemented in surgical areas highlights the lack of published data on this topic (Cardoen, Demeulemeester & Beliën, 2010; Visintin, Cappanera, Banditori & Danese, 2017). It also indicates reasons for difficulties faced when implementing Lean projects and maintaining them over time (D’Andreamatteo et al., 2015).

The present study consolidates the management system used in the VHUH project, using it to apply the Lean management model to the surgical process. This was initiated by creating work teams to detect Process needs (Sales & de Castro, 2021) and determine priorities within the projects according to various effort-impact levels.

The aim of this research is to analyze the impact of implementing improvement projects on surgical block management. The projects, based on Lean principles, were led by the hospital administration’s health policy and proved sustainable over time. They provide an example of value-based healthcare (VBHC), with the same goal of delivering value to patients, defined as health outcomes achieved per euro spent (van Staalduinen, van den Bekerom, Groeneveld, Kidanemariam, Stiggelbout & van den Akker-van Marle, 2022).

The improvement projects presented respond to problems detected during the process of developing a Surgical Process Model based on Lean Principles (Sales-Coll, de Castro & Hueto-Madrid, 2021). The following requirements set by healthcare institutions are considered: (1) surgical block management is based on coordinating a large number of resources (human, technological, material and healthcare). These resources must match the demand of the surgical intervention patient waiting list and fit management and hospital resources; (2) public hospitals have a duty to care for the maximum number of patients with the resources available, and have the potential to maximize the efficiency of their teams to meet unlimited demand. Now, in 2023, in a post-pandemic context for COVID-19 such as the current one, it is even more necessary to provide centers with planning tools to optimize the efficiency of resources, and for this reason the departments of operations and processes can provide the necessary knowledge to deal with it (Marin-Garcia, Garcia-Sabater, Ruiz, Maheut & Garcia-Sabater, 2020).

2. Material and Methods

To evaluate the effectiveness of the actions outlined, we propose a series of standardized indicators showing how the efficiency of the surgical process is increased. We also point to Lean projects (Moraros, Lemstra & Nwankwo, 2016) that can reduce waiting times and increase capacity (Gómez-Ríos, Abad-Gurumeta, Casans-Francés & Calvo-Vecino, 2019).

2.1. Methodology

Participatory Action Research (PAR) Methodology was used (Cornwall & Jewkes, 2010; Peacock, Mitton, Bate, McCoy & Donaldson, 2009) as it has systematically led to improvements in surgical block management based on Lean principles (Sales & de Castro, 2021; Zidel, 2006).

PAR is often used to explore intervention, development and change within organizations. It is a form of social research in which all relevant stakeholders in a group, community, or organization actively examine current actions with a view to changing and improving them. PAR is used to investigate actions then to modify them before re-investigating. In this case, it focuses on getting decision makers and healthcare professionals to work together to improve processes to obtain better results.

Design Thinking methodology is also employed as an active tool for participating healthcare professionals (Martínez Ibáñez & Ochoa de Echagüen-Aguilar, 2020). In addition, Agile methods are used to manage the team in the hospital's Processes Department.

The improvement teams comprized 368 participating healthcare professionals. These were organized into teams of 6-14 people who undertook basic training in processes and Lean methods. All participants partook in four 2-hour work sessions aimed at detecting Process needs (Sales & de Castro, 2021) and organizing how to implement improvement actions. The project then moved to the Hoshin Kanri stage, where the teams analyzed operational indicators to detect and correct deviations from the standard. It is noteworthy that the active participation of all stakeholders from the outset was crucial for the project to be successful and sustain the changes implemented. (Fournier, Chênevert & Jobin, 2021).

2.2. Introduction to the Surgical Process Model

The management model for the Surgical process proposed (Fig. 1) is based on the 5 principles of Lean Thinking methodology (Womack & Jones, 1997): 1) adapting resources to patient demand, 2) detecting the value provided at each stage of the process, 3) identifying patient flow, 4) highlighting the value flow, and 5) involving the healthcare professionals to participate in the continuous improvement of the process. Value Stream Mapping (VSM), a Lean tool that documents every step of the process, was used as a basis for communication and to analyze patient flow, data used to build the model of the whole surgical process.

This model summarizes the generic flow stemming from improved processes at VHUH, classified into 4 stages:

- Surgical Planning Stage: Demand Management, Adapting Resources to Demand and Flexible Operating Room System
- Pre-Surgical Stage: Continuous Operating Rooms
- Intra-Surgical Stage: Efficient Operating Rooms
- Post-Surgical Stage: Short Surgical Stay Units focused on clinical processes

Figure 1 takes the form of a "kaizen burst" and shows the (numbered) problems detected at each stage of the deployment of the surgical process. These problems become opportunities for improvement when the surgical process projects are executed.

The surgical process is initiated by notifying the patient of Surgical Intervention (SI). The patient is added to the Surgical Waiting List (SWL) and joins a pool of patients the hospital has to manage while complying with the maximum waiting times guaranteed by the Department of Health.

Our new approach emphasizes the planning and programming phases, which are key for the next stages to be designed efficiently. For patient flow, SWL must be organized according to priority of care and the set of procedures defined by each surgical service. This involves standardizing patients' specific needs and drawing up a detailed plan of the professional and material resources required for surgery.

This leads to the Planning Stage. The number of patients on the SWL of all surgical services determines the number of operating room sessions required by each service to meet demand. Planning means distributing available surgical slots in temporary scenarios so that the operating rooms are evenly distributed among the various services and the guaranteed deadlines can be met.

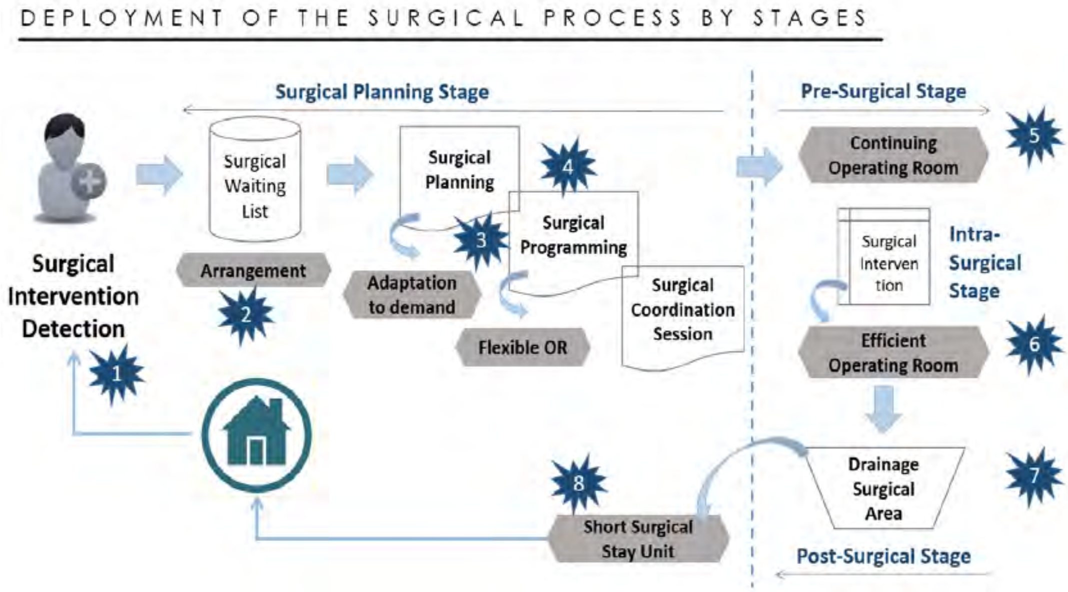

Figure 1. 4 Stages of the deployment of the global surgical process (8 Kaizen burst detected)

A Surgical Schedule is created by allocating operating rooms for the weeks ahead. Each slot is assigned a specific patient according to the expected length of intervention. The aim is to make the most of surgical time and increase occupancy rate.

Each service's programming proposal is shared at the weekly surgical session. Here the coordinator reviews the allocation and confirms the viability and efficiency of the surgical resources for the following week.

The Surgical Programming Center (SPC) then contacts each patient to confirm the day and time they have to report to the hospital. Generally, on the day of surgery the patient will first go to Hospital Admissions, and then proceed to the pre-admission area. This is where the Pre-Surgical Stage begins and the patient follows the flow of the process from the Intra and Post-Surgical Stages, to hospital discharge, and the return home.

3. Results

Following the VHUH 10-step methodology (Sales & de Castro, 2021), patient flow, communication between healthcare professionals and logistics circuits were analyzed to design the VSM of the current process. The problems numbered and detailed in Table 1 were detected using Lean tools and the different stages within the surgical process set out as a "kaizen burst" event. Each problem represents an opportunity to generate improvement projects within the different stages of the surgical process.

Various approaches to improvement projects were designed to address problems occurring during the surgical process (Figure 2). These are segmented by levels according to the degree of maturity of the process. Thus, disruptions to the flow making the process inefficient, unsafe, or unsatisfactory for patients or healthcare professionals can be dealt with and the process improved.

This hexagonal diagram of action projects is designed to fit the stage - or level of complexity - of the process in the surgical block where improvement is proposed. This led to dividing the set of improvement projects into 6 sections: 4 stages of surgical logistic processes and 2 transversal projects. The 6 sections are Programming Stage, Logistic Processes, Pre-Surgical Stage, Intra-Surgical Stage, Post-Surgical Stage, and Transversal Projects; each affecting a different area of the general hospital (not the surgical unit alone).

Each stage has 3 levels of projects. The ideal procedure is to follow a spiral system starting at the Programming Stage (Level 1), and following all the Level 1 projects in order of stages before moving on to Level 2 and Level 3 projects in succession.

Figure 2 shows the graphic visualization of the 4 stages of the Surgical Patient Flow Process, as well as 2 transversal and logistical stages that affect the entire surgical process.

Thus, the model implemented yielded a management model for improvement projects in accordance with efficiency of resources criteria, the maturity of the process team and the assurance that both the implementation and sustainability of the of the project would be successful.

Kaizen Burst	Problem Description	Projects that derive from it
Surgical Indication 1	High Variability in demand	Creation of the standardized SI Sheet
	There is NO standardization of the surgical indication process	
	There is NO Surgical Indication Sheet	
	Over-indication of surgeries (more inclusion in SWL)	
Waiting List 2	High Variability by Surgical Service	SPC (Surgical Programming Centre)
	Lack of Prioritization	
	Hidden SWL (no warranty period notified)	
Planning / Programming 3	Surgical Program NOT linked to prioritization of the SWL	Optimized Programming
	Operating rooms divided between surgical services by staff historical file	Strategic Planning
	Patient reprogramming	Surgical Coordination Session
	Lack of information for surgery	Continuing Operating Room
Pre-Operators 4	Made in a reactive and variable way	Telematic Preoperative Anaesthesia
	There is no standard	Preoperative Circuit OK
	Expirations and Repetitions	
	Overindications	
Pre-Admission 5	High pre-surgical stay	Admission on the day
	Inpatient variability and lack of patient information	Standardize processes
Intervention 6	Low surgical performance	Advance Patient Start Time / Rapid Change
	Cancellations of surgery	Communication Circuit
	Lack of material to perform the surgical interventions	Visual and 5S Management / Material Imputation / Intervention Packs / Custom Pack / Material Circuits / Fungible Kits
PACU (Post Anaesthetic Care Unit) 7	Lack of needs planning	Drainage in Hospitalization Standardized Clinical Pathways
	Collapses resulting in cancellations	
	Use of unsuitable spaces as critical beds	
	Longer stay time than necessary	
	Variability and Lack of information	
Hospitalization 8	Variability in hospital stay time	Short Surgical Stay Unit (SSSU)
	Lack of ward unit plan planning	
	Variability in discharge preparation	

Table 1. Diagnosis of the surgical process and detection of problems according to Kaizen Burst shown in Figure 1

Within the framework of the Surgical Process, the following set of improvement projects and/or actions is proposed.

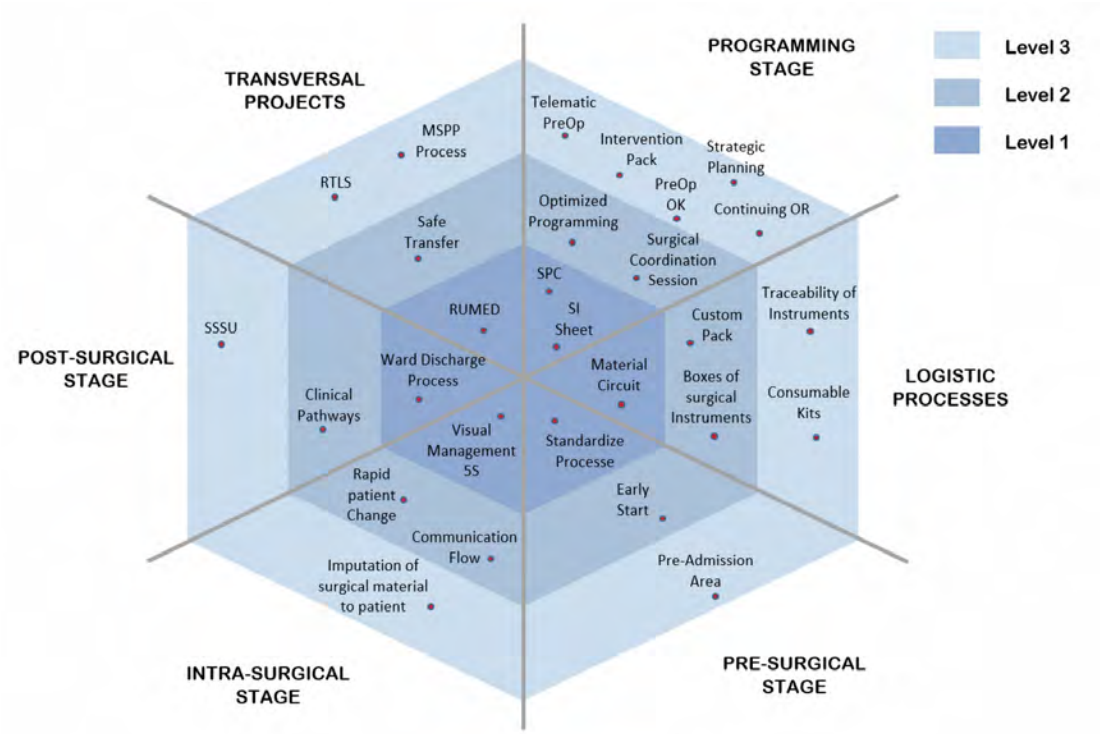

Figure 2. Surgical Process Projects by Levels and Sections

3.1. Programming Stage

This is the main phase in any improvement project as it standardizes the framework of the hospital's surgical activity. Starting at **level 1**, it defines the type of SI each service performs, thus generating a catalogue of procedures that define the characteristics required to plan all resources.

Level 1 involves creating a standard SI Sheet for each surgical procedure with all the information required. Surgical Planning Center (SPC) administrative staff specialized in surgical services are also trained at this stage to use time optimization criteria for surgical scheduling.

Level 2 involves developing a standard patient Programming process for the slots assigned to each service, and creating the "Surgical Coordination Session", where the various block leaders meet weekly to review programming incidents from the previous week, analyze the status of SWL patients approaching the maximum waiting deadline. At the session, the program for the following week is revised and assessed as to whether it is feasible and contributes to the equitable distribution of operating rooms. This is based on meeting the deadlines of all surgical services.

Level 3 requires considerable involvement from surgical services due to the complexity of the projects. This includes a Pre-Surgery Telematic Anesthesia procedure for low-risk diagnoses; Standard Intervention Packs that ensure high operating room occupancy rates and patient rotation; "OK" pre-operative anticipation standards, set prior to confirmed scheduling; developing a Continuing Operating Room scheduling system that ensures an uninterrupted continuous patient flow through the morning and afternoon shifts; and Strategic Planning for long-term operating room allocation to ensure resources match future SWL demand.

3.2. Logistics Processes

Level 1 of the logistics stage involves analyzing all the internal material distribution circuits inside the blocks, ensuring at all times that the clean/dirty circuits do not overlap and stock replenishment times in internal warehouses are optimized.

Level 2 proposes standardizing the materials needed for surgical intervention from a "Custom Pack" of different kind of materials provided by a single supplier; for example, boxes of surgical instruments, and linking them to the catalogue of procedures, thus optimizing their use by planning what is needed in each box in advance.

Level 3 involves carrying out two high impact projects that require maximum effort. This first is "Consumable Kits", which contain the specific materials needed for each procedure in one single box and is the only logistical reference. The kit is agreed by each team and has a variety of products from different providers. The second is Instrument Traceability. This means that each surgical instrument is coded and the logistics process controlled from their arrival at the operating room to their deposit in the sterilization center. Allocation of prostheses or implants proceeding from hospital boxes to individual patients is also controlled.

3.3. Pre-Surgical Stage

Level 1 proposes standardizing the patient communication process and the various ways to access the preoperative stage and begin the intervention. This involves unifying criteria from the different surgical services and simplifying the admission process.

Level 2 improves the procedures for receiving patients in the surgical area, operating room preparation, and the surgical field for early start, thus optimizing onset time (Phieffer, Hefner, Rahmanian, Swartz, Ellison, Harter et al., 2017).

Level 3 proposes increasing the percentage of patients admitted for intervention on the same day, improving pre-surgical hospitalization rates and ensuring an optimal flow regarding patient preparation in the Pre-Admission area.

3.4. Intra-Surgical Stage

The **Level 1** project uses Visual Management tools to facilitate internal communication, warehouse organization (5S), supply carts, and supply of materials.

The **Level 2** project has a significant impact on healthcare professionals' job satisfaction. Prolonged operating room turnover time erodes patient and employee satisfaction and value. Rapid patient turnover time (TOT) (Cerfolio, Ferrari-Light, Ren-Fielding, Fielding, Perry, Rabinovich et al., 2019) refers to the shortest possible time period between the patient exiting the operating room, cleaning the operating room, and entry and preparation of the next patient on each operating room's surgical shift. This project proposes improving communication flow between the healthcare professionals managing the turnover of patients coming from different surgical areas. Communication between surgeons and patients' relatives is also enhanced through monitoring apps and screens in virtual waiting rooms.

The **Level 3**, allocation of surgical material to the patient directly impacts economic management. Here, linking real-time patient monitoring within the block is proposed (RTLS, real time location system) so all the material required for each intervention is allocated automatically. Thus, in addition to guaranteeing precise, safe knowledge on consumption of the specific material used by each patient, future needs for surgical material can also be planned as they are linked to the catalogue of procedures. Using this consolidated, planned SWL means that schedules for the future purchase of material for each surgical service can be set, and running out of stock avoided.

3.5. Post-Surgical Stage

Level 1: Surgical Ward Discharge Process. This project aims to ease handling patient discharge between the operating room and bed assigned in a hospital ward. This ensures optimal patient occupancy times in the recovery area (avoiding lengthening this unnecessarily in a space that is uncomfortable for patients). It also prepares the nursing team for receiving patients on the ward efficiently and includes maximum information on the patient's condition.

Level 2: Clinical Pathways and Hospital Discharge process. This ensures a minimum, efficient hospital stay. This process goes from care procedures that are part of the clinical pathway for each diagnosis through to standardizing the patient's recovery process and executing a discharge process that guarantees pre-noon patient discharge and avoids incidents at exit points.

Level 3: Short Surgical Stay Unit (SSSU). This involves combining the number of short-term recovery hospital beds. This improves clinical practice by drawing on multipurpose surgical nursing. These units ensure a minimum post-surgery stay, which improves patient recovery and generates a high level of satisfaction for patients and their families. (Ortiga, Bartolome, Acebes, Viso, Marca & Garcia, 2013).

3.6. Transversal Projects

These actions affect the surgical process, and overlap with other hospital processes or departments.

The **Level 1** project involves working together with **RUMED** (Medical Device Reprocessing Unit) healthcare professionals to link the processes of washing and sterilizing instruments, assembling boxes for the daily surgical program, as well as monitoring high performance instruments and handling provisions of specific equipment from suppliers, or from prostheses and implant boxes.

The **Level 2** project involves the **Safe transfer** of patients from areas of resuscitation, ICU, or the surgical block. These are critical transfer processes for the patient and require a high level of coordination between the large number of healthcare professionals who accompany the patient from the operating room to intensive care recovery areas.

The **Level 3** project comprises two major high performance surgical projects that require high investment: 1) The Multimodal Surgical Patient Preparation Process (MSPP Process). The initial evaluation of patients ready to undergo an operation greatly informs the postoperative recovery process. It also enhances patient satisfaction, accelerates postoperative recovery, and ensures good hospital stay indexes as well as lowering the number of patients that have complications during the surgical process, or are re-admitted. 2) The Real-Time Location System (RTLS) locates each patient in the surgical block and provides direct knowledge of the time spent at each stage of the patient flow. This gives fundamental information on the scope of the improvement projects implemented, and the indicators proposed are used to determine new priorities. This essential tool facilitates internal communication, not only between healthcare professionals, but also between healthcare professionals and patients' families. It also provides additional patient safety management, as the patient can be monitored at all times via the automatic identification system.

Often, when a hospital chooses to develop a process management strategy, it does not have enough time as this long-term strategy suggests. Even so, one can contemplate developing a concrete action of high impact in one of the 6 stages in a short period of time. In this case, the deployment must go through the 3 levels in a focused manner, as each level consolidates the next within each sub-process.

Regarding indicators, we must highlight that results from the 2018 model implemented at VHUH show that surgical activity at the hospital has increased continually since 2014. Results also confirm that the hospital and has increased its outpatient surgery capacity, thus avoiding hospital admission.

In parallel to the hospital's increased overall surgical activity, demand has also grown. Data from the general surgery operating theatre (excluding the operating rooms of traumatology and maternal and child) show that the number of patients on the SWL rose by 23.5% between 2014 and 2018 (from 9,000 to 11,117). This confirms the hospital's high capacity and efficiency of resources, as it was able to absorb the increased activity without needing additional operating rooms. Also, worth noting is the fall in the number of patients exceeding the maximum guaranteed surgical waiting time: Between 2014 and 2018, a substantial effort was made to reduce the number of patients exceeding the guaranteed maximum waiting time for surgery. This reached a rate of 1.1% (129 patients) in 2018, while in 2014, 12.2% (1,096 patients) were still waiting for surgery after the maximum guaranteed waiting time.

When this delay is systematized and the hospital cannot meet demand, the usual solution is to execute a "shock plan". This provides a temporary extra boost of resources aimed at increasing the capacity of operating rooms dealing with specific diseases or surgery. This aims to shorten the SWL and put it back on target, despite the high cost for the hospital.

Improving start time indicators, operating room occupancy and patient rotation per slot is critical and considerably more important than simply providing more operating rooms. Table 2 shows a summary of the results for the proposed indicators.

Indicator		2014	2018	Comment
1	Evolution of surgical activity in one of the surgical blocks of the Vall d'Hebron (number of Surgical interventions in 14 OR)	17,254	21,111	The increase in activity has not led to an increase in operating rooms (22.4%)
2	Evolution of the Waiting List (patients)	9,000	11,117	Despite the increase in the SWL, the average waiting time has decreased
3	Surgical Occupation	73%	84%	The employment rate has risen as well as the patient turnover rate
4	Start time before 8:30 a.m.	9:38 a.m.	8:27 a.m.	The start of the cut is made before 8:30 a.m.
5	Average Pre-Operative Stay	1.4 days	0.33 days	The average preoperative stay is reduced to the minimum hours for the preparation of the first patient
6	Reprogramming Index	24%	3%	The allocation of flexible OR to urgent demand along with the reservation of holes in the surgical program has facilitated the reduction of rescheduling
7	Rapid Patient Change	38min	16min	Drastic reduction in patient turnover times in all operating rooms
8	Average Hospitalization Stay	7.2 days	4.1 days	The management of clinical pathways together with the SSSU facilitates the drastic reduction of the average hospital stay

Table 2. Results by indicators

Each indicator has a positive impact on the efficient management of the surgical block and contributes to shortening SWLs and improving the efficiency of surgical resources.

4. Discussion

The "shock plan" solution appears ideal from a Lean point of view, as a one-off increase in capacity meets peak demand, but without having to be sustained over time. In the long run, however, this often leads to more problems rather than finding solutions. In this case, when the principle of equity between services is considered, the service granted a shock plan (an increase in paid activity) is effectively "rewarded" even though it has underperformed in its normal annual surgical schedule. Opening an extra operating room, even if only in the afternoons, always destabilizes the overall scheduling of the service, and productivity generally suffers. A shock plan can only be justified if operating room performance is already optimum in the service affected, otherwise it is not effective and can be considered a waste of operating room time. This negatively affects the indicators, particularly the budget for surgery.

One of the main results of the model developed is the degree of satisfaction shown by healthcare professionals and the determined commitment from the center's management team to promote process management with Lean methodology. This commitment continued despite the challenges of shifting the organizational structure towards process management, which is a complex task requiring a relatively long period of adaptation and learning.

The activity indicators show that the hospital's surgical block increased its activity between 2015 and 2018 (Table 2) significantly reducing patient waiting times. This increase was achieved by only implementing internal management changes as the number of operating rooms or staff is unchanged.

This increase is explained by changes and increased efficiency in the following areas: organizing and effectively adjusting demand to the surgical program to make the most of surgical time; starting surgery punctually at the scheduled time; reducing the number of surgeries cancelled and having to be rescheduled; managing patient entry efficiently and effectively through the pre-admission areas; anticipating and standardizing the intra-surgical process involved in preparing material and equipment to always have what is needed, when needed, during surgery and eliminating anything that does not add value to the process.

5. Conclusion

The priority of healthcare management should always be to increase surgical patients' safety and satisfaction (Kenney, 2010). In parallel, patient flows must be improved and available resources used more efficiency by shifting the focus to the patient and the processes they go through during their hospital stay. This improvement capacity provides us with the best example of successful Lean methodology implementation if reinvested in increased healthcare. This in turn increases the value perceived by patients, which is the ultimate purpose of the process.

We believe that it is pertinent to highlight real examples of Lean implementation of continuous improvement in hospitals to disseminate this methodology and encourage the health sector to promote this type of initiative.

The objectives set initially have been exceeded. However, a limitation of the study can be the high level of commitment required by hospital management to get the project on track and involve a large part of the staff.

Good Processes = Good Results = Value Based Healthcare

Declaration of Conflicting Interests

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