

# ENHANCING OPERATING ROOM EFFICIENCY IN A TERTIARY CARE HOSPITAL USING LEAN MANAGEMENT

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ARTICLE INFO	ABSTRACT
<p><i>Keywords:</i> Lean, Operating Room, Hospital, Efficiency, Performance Improvement</p> <p><i>Article History:</i> Received: 11 Jan 2021 Revised: 10 Feb 2021 Accepted: 02 Mar 2021 Available Online: 13 Apr 2021</p>	<p><b>Background:</b> Operating Rooms are complex departments in a hospital that require proper management to ensure efficiency. Lean management is known to eliminate waste and increase productivity and patient satisfaction. When the hospital faces financial difficulties the matter becomes more urgent. Fixing broken processes would enhance patient and staff satisfaction</p> <p><b>Methodology:</b> This intervention research was done in a tertiary care operating room hospital in Lebanon. A multidisciplinary medical, nursing and quality representatives studied the root causes of problems and took appropriate actions. The advancement was measured by performance indicators over the period of 6 months.</p> <p><b>Results:</b> The process re-design resulted in a major improvement of all indicators. Patients were better satisfied, and the flow of work become smoother.</p> <p><b>Conclusion:</b> Lean Management increased OR efficiency, workflow, financial performance and patient satisfaction. Process re-design to reduce waste and ease work has resulted in a win-win situation for all stakeholders. More time is needed to achieve high level of performance. These results can be utilized to other areas of the hospital.</p>

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## 1. BACKGROUND

This intervention research was done in a multi-specialty tertiary university hospital in Lebanon. The hospital adopts a Total Quality Management (TQM) system supported by standardized processes. Bordered by poor financial support, high costs, misutilization of resources, under productivity and low revenue generation, the clinical and administrative internal processes became extremely impaired. Consequently, customers are currently dissatisfied and the hospital is under strong pressure to improve and survive. The Board of Directors supports the organizational mission, vision and objectives. The Board creates an environment which promotes participative management including human resources, quality management and budget elaboration. The hospital management believes that Lean would significantly improve the three dimensions of surgical services delivered to patients which are structure, process and outcomes. This improvement, using the Lean method, would result in better patient satisfaction, high level of patient safety and many other advantages as well as to achieve financial surplus.

### 1.1 Problem Statement

The various wastes and inefficiencies identified in the operating room processes which constitute potential opportunities for improvement are as follows:

- Frequent changes in the schedule leading to the necessity of urgent modifications always disturbing and not easy to perform.
- Delay in the first morning case to start
- Delayed OR procedures
- Incomplete documentation with a non-compliance of the pre-procedure checklist
- Long waiting time in the PAU pre-scheduling for medical clearance visit
- Improper supply management expanding the time for needed surgical items to be provided before surgery.
- Cancellation of procedures
- Lack of concerned staff knowledge in operating room recommended utilization.
- Low patient satisfaction rate

## **1.2 Objectives**

The main objective of this intervention research is improve efficiency of the Operating Room process the Lean Thinking methodology. In addition, this research aims at engaging people in a continuous improvement methodology that will enable rapid change as well as incremental improvement of the capacity, advancing utilization and allowing for a smooth flow of the Operating Room (OR) processes. Also, it will be make the OR able to respond to any projected future increase of demand efficiently.

## **2. LITERATURE REVIEW**

### **2.1 Health Care Processes and Lean Thinking**

Healthcare systems all over the world are challenged to be affordable, accessible, safe, thorough, efficient and cost effective as much as possible (Poksinka, 2010). Work structures and processes have not kept pace with the changes in technology, demographics, and business objectives (De Wit & Meyer 2010). The processes do not reflect an efficient sequence of tasks and employ complex mechanisms to track its progress (Hammer, 1990). Even the employees, employers and other purchasers paying for this care are losing “patience” with the slow pace of change in getting rid of this mess (Binder, 2013). Thus, leaders are intensely calling for urgent improvements and redesign of health care delivery. There is a need to look for new and more efficient ways of providing care. Process mining is becoming highly recommended in order to respond to the increased level of demand among customers, the required short lead times, and the variety of choices in order to survive in the current competitive global market. On the other hand, the challenges for applying process mining to healthcare processes delimit smooth changes (Mans et al., 2013). Challenges refer to the complexity of the processes, their multi-disciplinarily, and that they are subject to continuous external and internal forces (Mans et al., 2013).

### **2.2 Toyota Production System**

The Toyota Production System (TPS) has its roots derived from Toyota Corporation. It is a collection of ideas, techniques, and procedures developed by Toyota mainly after World War II. The focus is to produce cars that satisfy customers and fits their requirements (Wickramasinghe & Al-Hakim, 2014). The principles are producing cars with best quality at the lowest costs and with shortest lead time through systematic elimination of waste and improving performance (Wickramasinghe & Al-Hakim, 2014). Toyota Corporation was first established in 1918 as Toyoda Cotton Spinning and Weaving Company by Sakichi Toyoda. Key principles of the Toyota Production System had their origins in these early textile operations. Toyota Motor Company was established as a separate entity out of Toyoda Automatic Loom Works in 1937 (Scoville & Little, 2014). After several training seminars, a new concept was introduced, the Ueno’s concepts of waste — muda, mura, and muri — were abomination to the ideal of efficiency, and later appeared as key concepts of the Lean value stream (Wickramasinghe & Al-Hakim, 2014). Today TPS is a World-Class system; it is an essential part of what makes Toyota different. TPS concerns address the expectations of its customers and offers to them (Toyota, 2017).

### **2.3 Lean Thinking: Principles, Rules and Techniques**

The term “lean” is used because the lean production uses less of everything compared to other production systems. In healthcare, Lean thinking identifies the least wasteful way to provide better, safer healthcare to patients - with no delays. It's about being able to do more with the resources available. The aim of lean thinking is to provide what the customer wants, quickly, efficiently, and with little waste (Joosten, Bongers, & Janssen, 2009). It aims to substantially smooth the flow and drastically reduce waste and process variations (Joosten, Bongers, & Janssen, 2009). Once waste has been identified in the current or existing state, a plan is formulated to eliminate waste and attain the required free of waste future (Joosten, Bongers, & Janssen, 2009). By definition, customer value is a reference to activities which from the view- point of the customer add value and the customer is ready to pay for (Anvari, Ismail & Hojjati, 2011). Five principles of lean thinking enhance the quality of healthcare by improving flow in the patient journey and eliminating waste. Those principles are sequential steps that organizations can use to add value, reduce waste and continuously improve (“kaizen”) in an ever-repeating process (Anvari, Ismail & Hojjati, 2011). In their book entitled *Lean Thinking: Banish Waste and Create Wealth in the Corporation* (Womack and Jones 1996), James Womack and Daniel Jones specify these principles that respect the “sociotechnical” aspect of lean production as it applies to health services (Liker, 2004).

The focus of Lean is not only on “muda” (waste) alone. Muda is one of three interrelated concepts which are “mura” or “unevenness” that refers to instability and variation in the process and “muri” that relates to “excessive strain” and claims for good working conditions in order to prevent worker injuries and stress reducing absenteeism and increasing satisfaction at work place (Kaufman, 2014). The systematic problem solving approach used by Lean carefully frames the problem, identifies all the possible root causes, develop needed countermeasures and uses experiments to test these measures. Those activities can be divided to three basic phases: assessment, improvement, and performance monitoring (Radnor, Holweg, & Waring, 2012).

## **2.4 Lean thinking and healthcare**

'Lean thinking', developed from the Toyota Production System, has been applied in many competitive sectors and the literature emphasizes its applicability to healthcare services (Teich & Faddoul, 2013). Such thinking is increasingly being applied to health services in many countries and overseas to improve the quality of patient care, improve safety, eliminate delays, and reduce length of stay whilst using no more resources (Teich & Faddoul, 2013). Originally, the application of lean at Toyota was a process-oriented concept. Currently, lean extends beyond the original Toyota operational shop floor concept to include "respect-for-human system" aspects besides the technical aspects of the system under study (Joosten, Bongers, & Janssen, 2009). In other words, application of lean looks to the system as "sociotechnical" system in which human factor engineering and technology plays the central role. In fact, Womack and Jones have coined their principles with the term "lean thinking" with emphasize to applicability of lean thinking to service industry including healthcare services (Wickramasinghe, & Al-Hakim, 2014). Although some healthcare professionals may argue that lean thinking is more suitable to manufacturing and does not translate well to healthcare services; Bowen and Youngdahl (1998) show how it does apply to healthcare by providing case studies for lean applications (Wickramasinghe, & Al-Hakim, 2014).

Leading health care organizations, notably Virginia Mason Medical Center in Seattle, ThedaCare in Wisconsin, and the Pittsburgh Regional Health Initiative in Pennsylvania, have adopted TPS as their model for management and improvement, with widely recognized success (Scoville & Little, 2014). Since 2005, Many hospitals in the US began the long process of becoming Lean rushed by the pressure that the economic situation is putting; the scarcity of healthcare resources and the health care reform that will officially begins in 2019 (Johnson, Smith, & Mastro, 2012). It has been reported that currently 50% of all American hospitals are engaged in incorporating Lean as an important management for continuous improvement, waste reduction and better quality, efficiency, and safety (Johnson, Smith, & Mastro, 2012). These pioneering organizations shared their stories at the first Global Lean Healthcare Summit in the UK in 2007, which in turn triggered many more experiments around the world (The Lean Enterprise Academy, 2017). Since then, interest has grown very rapidly to adopt Lean in the UK National Health Service (Johnson, Smith, & Mastro, 2012). Many other cases through the literature have been also reported from Thailand, Singapore and Canada. Many studies reporting successful Lean application delineate the most common areas of improvement that includes time-savings, timeliness of service, cost reductions, increase of productivity and several quality aspects and dimensions including reduction in errors (Mazzocato et al., 2010).

## **2.5 Improved Operating Room Through the Literature**

After it has been clear that Lean principles can deliver better quality and safety and better patient experience (less waiting time and rework), using same existing resources, treating more patients and improving the staff work satisfaction, it is obvious to look at those areas where Lean implementation have been the most applicable and effective (Jones, 2015). Actually, view that the argument "we don't make cars" is true; the operational challenges in lean applicability are to reach desired results while enhancing patient perceived level of quality, safety and efficiency. In healthcare, the patient directly experiences the process and the time is the most intricate variable that is sensed by the patient to evaluate the response to requested care (Jones, 2015).

The operating room relies on timely schedule and timely services in order to be the most productive and flowing. Mapping the flow of value also allows managers to see that unless attention is paid to the timely operating and discharging of patients, the admission for surgeries will only lead to longer queues waiting for beds (Jones, 2015). Secondly, what is known about Lean management is its focus on developing the capabilities of the front-line workers (doctors, nurses and support staff) to manage and continuously improve their work. The operating rooms are mostly organized and build on interdisciplinary group activities that require team work and high level of collaboration. (Jones, 2015). Many inspiring Lean transformation examples shows how the operating room which absorbed personnel, resources, and time without adding value to the overall process or to the end user of the service or product was totally improved in order to efficiently produce a service that is perceived as of high value to those who use it. An intervention was done at Mayo Clinic showed that the patient waiting time decreased at the admissions desk, improved efficiency, increased daily OR capacity to accommodate incremental surgical case volume (Cima et al., 2011). In addition, an unexpected consequence of this initiative was a reduction in the number of nursing and allied health staff required for daily operations despite an increase in surgical volumes (Cima et al., 2011).

## **3. METHODOLOGY**

A multidisciplinary team is created to work on the project. The team includes the OR Nurse Manager, Chairman of Surgery, Chairman of Anesthesia, Nursing Quality Manager and a Patient Advocate. The multidisciplinary team used the Lean Management methods to understand OR processes in order to recognize and analyze broken processes, study methods to make the processes move more efficiently, set accurate mistakes detection tools to prevent harm and to implement change while avoiding bottlenecks. The current project examines the entire surgical process from admission to discharge focusing on patient scheduling and operating phases. The team studied each of the following work streams:

- Unplanned surgical operations
- Pre-admission processes

- Non-operative time
- Redundant patient information
- Employee engagement
- Patient satisfaction

The project started in July 2019. The team met on a bi-weekly basis. Performance indicators were measured to monitor advancement.

#### 4. RESULTS

OR delay was improved at the beginning of the schedule at 7:45 am from the first case. Documentation was followed-up at the time of intervention to avoid incomplete data. The PAU and discharge management procedures were reviewed to minimize redundancy and repetition. Rigorous coordination with the material management department resulted in minimization of delay of supplies. As a result, patients became more stratified. Most indicators have approached their targets.

Indicator	June 2019	Set Target	January 2020
Delayed OR procedures	42%	20%	31%
Incomplete documentation	50%	10%	30%
Waiting time in the PAU	35%	15%	12%
Waiting time for patient discharge	23%	10%	13%
Delay in supply management	31%	15%	15%
Cancellation of procedures	36%	15%	17%
Patient satisfaction rate	65%	80%	81%

#### 5. CONCLUSION

Lean management has improved the OR processes tremendously in a short period. Continuous improvement needs more interventions that will be implemented by activation of the multidisciplinary committee. It is worth mentioning that a major challenge for healthcare providers in today's century is the transition from the chaos that is threatening the care processes to the practice of a continuous improvement culture dominated by the participation of all involved people from the upper stream level to the lowest bottom front liners. Despite the best available evidence that supports health care interventions, a large gap remains between the evidence and today's practice in the real world. Translation to a better practice is a main experiment that health care providers should dare and Lean has been proven as a useful bridge to fasten the advent of a new efficient health care epoch. The ability of sustaining the achieved levels of improvement is a common concern addressed by many researchers investigating Lean implementation. Through literature review critical factors have been identified to sustain the achieved Lean implementation results. Leadership, communication, and workforce engagement are seen as essential elements for Lean successful implementation. On the other hand, literature has stated that respect for employees; executive leadership, continuous improvement teams, effective organizational structure and smooth change management are also the basics for Lean implementation and sustainability. For Bahaitham (2011), the various efforts of healthcare organizations to sustain Lean can be quantified based on the defined sets of critical success factors of Lean implementation. Those factors include: process stability, process standardization, patient flow streamlining, mistake proofing, continuous improvement, leadership, culture and involvement, respect for employees, change management...

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