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# Lean Transformation in Healthcare: A French Case Study

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**Abstract.** Evidence from current publications mainly US, UK, Canada and recently Europe has highlighted the relevancy of Lean healthcare in improving patient pathway efficiency. The aim of this case study is to demonstrate how the French public hospital succeeded at using Lean thinking, and how, using the Lean tools with the team's involvement, it improved the quality of health services delivered to the patient. Emergency complaints dropped by 50%, length of stay reduced by 30%. This paper highlights how Lean was implemented to revolve around the patient, creating valuable results which improved the global performance, whilst maintaining employees' involvement and satisfaction. Two Lean experiences in hospital units are described showing the reduction of wastes and the possible monitoring of KPI to sustain Lean pillars Jidoka and JIT. These two first Lean experiences are not alone, more hospital services have been experiencing Lean approaches and more results will be communicated soon in wider publication.

**Keywords:** Lean implementation, Lean practices, innovative organization, Lean drivers, case study.

## 1 Introduction

The first documented implementations of Lean thinking in healthcare were in the National Health Service NHS in the UK (2001) and in Virginia Mason Production System VMPS Hospital in the USA (2002). Although the Lean healthcare literature is rich in case studies such as from the Virginia Mason Medical Center USA hospital [1] ThedaCare; Brazilian hospitals [2] Swedish hospitals [3]; Denmark [4], Spain [5], India [6], and the UK [7], [8], successful French case studies are almost inexistent. [9] was the only French publication to deal with Lean thinking, and it approached the concept from an engineering view point. Furthermore, the study was a literature review, and not a case study. The aim of this article is to fill this void and to disseminate the impact of Lean implementation in French hospitals, which is gaining national interest. Grenoble hospital is among the first successful case studies in France, reporting significant results and findings. The objective, beyond the presentation and description of the case study, is to analyze how the applied Lean experiences utilized the Lean principles,

how they contribute to waste elimination, and what the main drivers of success were, to help future healthcare interventions to successfully implement lean management.

## 2 Literature review

When dealing with Lean in the organization of healthcare, patient satisfaction has been reported to be the main target to keep in mind – representing the client from the Lean point of view. The Lean transformation should be built around the patient and be made efficient for the patient [10]. Eliminating waste from patient pathways is a powerful initial analysis to improve the delivery of healthcare processes [11] and improve clinical processes [12], [13], reduce errors and inappropriate procedures [14], paying careful attention to the transformation of the mind-set and the organization. [15] evoke the importance of creating better service for patients through implementing “improvement culture”, to create a mind-set focused on quality improvement. The study does not merely deal with cutting costs, but above all deals with the quality of processes, of care services, ensuring that quick response with time to care is qualified as the primary objective of healthcare services whilst maintaining security, safety for the patient along their pathways and reducing length of stay [7].

When trying to integrate Lean thinking, no matter the sector concerned (manufacturing, service, healthcare), the dominating idea in leading successful Lean conversion is “the cultural mindset” to put into place rather than the “tool box” [15], [16]. Moreover, leadership becomes a prevailing factor and consistent driving force that can shape an adequate problem-solving environment [8], [17], [18].

Authors in [8] [19] [20] have argued the need for new research and findings about Lean implementation. [9] found that 59% of articles published that deal with Lean in the healthcare sector do not describe, or only very little, the content of the implementation approach (qualified as having low methodological maturity), only results are reported without details from an engineering point of view. Articles do not provide any information to understand how it was applied. Among articles studying the Lean approach, a majority (70.7%) have struggled to provide a structured method and effective management guidance [9],[16], [21].

## 3 Problem Statement

The research methodology considered here is a qualitative single case study. It is an interesting and in-depth exploration of Lean healthcare to thoroughly address the following research questions: *How was lean introduced, implemented and sustained in public French hospital?* Author in [22] highlighted that case study design becomes relevant to focus studies on the questions “how” and “why”. Using a unique case study, [23] allowed a review of the organization over an extended time period; it is not always possible to capture the changes using an alternative methodology. [24] analyzed more than 109 papers on Lean healthcare and found that the Lean implementation process and its sustainability remain under investigation.

The objective of this case study is to browse the different Lean techniques that hospitals have experienced in the Operating room and the Sterilization Service Department with the aim of revealing implementation with a possibility of transposition to other similar healthcare contexts.

## 4. Lean implementation in Grenoble hospital

The Grenoble hospital is a middle-sized public French university hospital comprising 8000 medical and administrative staff, with almost 2000 beds and a budget of 600 million euros. It provides around 86 000 emergency admissions, 35 000 operations in operating rooms and 90 000 hospitals stays per year.

**Data Collection.** Data were essentially acquired from the former Quality / Performance Director of the hospital. Conference documents, implementation plans from internal elements were collected, reviewed and analyzed to track the necessary actions. Moreover, interviews with the quality director of the hospital reinforced the case description to allow a documented publication.

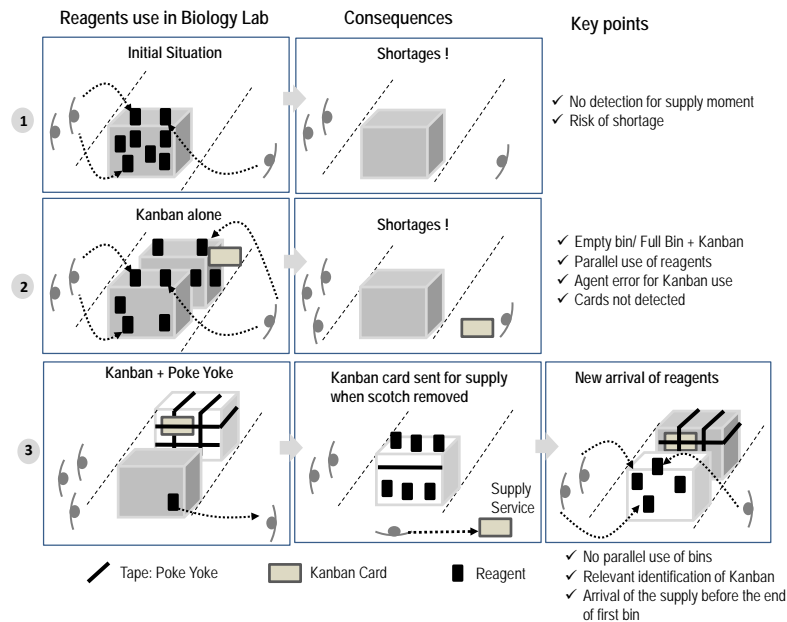
### 4.1 Sterilization Service Department (SSD): Jidoka, crosstraining, Visual Management, and Pull flow implementation

The SSD is in charge of cleaning/sterilizing Medical Devices (MD) and surgery instruments required by the surgical teams in the Operating Rooms (OR). The SSD has to ensure the availability of MD to 120 care units and 39 ORs in the hospital. The materials are provided in different boxes with an average use rate of 2.5 boxes by surgical act. In fact, we reported 300 sterilized boxes / day (boxes of MD) and 800 sterilized bags / day (bags for specific instruments) provided for the different care units and ORs. The most recurring problem was the *unavailability of sterile surgical materials* in ORs. A long and variable Instrument Availability Delivery (IAD) was noticed. The IAD is the time between the moment when the used (dirty) instruments leave the OR and the moment when they come back again, clean and sterile. Besides the postponement of some operations by surgeons due to the unavailability of materials, there is also patient cancellation which causes re-planning. Usually several boxes (A type and B type) are opened at the same time making the remaining instruments non sterile, requiring again a sterilization cycle. When asked for the origin of this shortcoming and such high IADs, the SSD revealed that the boxes of instruments arrived at the SSD mixed up between the two box types (instruments of A type and B type) and it was time consuming to sort them before starting. The sterilization process begins with a full placement of MD to the correct place (type A or B), which is obviously an No Value Added (NVA) activity. The first improvement was to ensure the *pre-sorting of the MD* very early in the process, meaning “as soon as the operation is done” to ensure the Jidoka principle in Lean. It was assigned to the OR nurse who is able according to the standards and classification of tools to put them back in the right box before sending them to the SSD. The initial reaction was skeptical due to the added load of perceived work. The chief nurse plays an important role because after a VSM deployment the significant role of rearranging

the instruments early on (by the end of surgery) was revealed to have a high potential for improving the system. Often less than five minutes were required by them to do that, moreover, the OR nurse was able to recognize the instruments and their boxes quickly. If a nurse of lower level was in the operating block, a standardized document was provided to carry out these verifications. That first action reduces the NVA of sorting at SSD and allows the flow of sterilization to start easily and without mix ups. Another problem was the *de-synchronization of the cleaning process*. Some cleaning “operators” were launching different boxes of various MD in parallel creating a mixture of orders. An increased amount of Work In Progress (WIP) was noticed at the conditioning area because the last operator of the flow had too much work rearranging the MD per patient requirements. It created a queue and became bottlenecked, preventing the MD from arriving on time to the OR. It took them a long time to rearrange the MD per patient and constitute the batches to send to the OR. The generated Lean corrective action was to stop the cleaning process and deploy a multi-skills cleaning agent coming from upstream phases (cleaning unit) to help the rearrangement of the MD with the conditioning agent. Identified places with *visual paintings* on the ground based on Kanban system were also implemented to ensure the right positioning of the WIP coming to the conditioning area. When the cross-trained operators come from the cleaning area, they clean their hands, wear specific material and enter the conditioning area to rearrange the materials and the boxes. By increasing competencies with training, the multi-skills agent becomes able to increase the rate of instruments rearrangement per box at the conditioning area, smoothing the flow of outputs.

#### **4.2 Biology laboratory: Kanban and Poka Yoke implementation**

The Biology lab is in charge of more than 80% of analysis. A recurrent problem was a lack of reagents for vital medical analysis generating rushed orders and inducing stress to employees because of the criticality of some patient cases and the absolute necessity to obtain the reagents. One of the main pillars of the Toyota System is the “Pull System”. How to create a continuous flow using reagents without ordering too much, and without forgetting to order at the right moment and undergo shortages? The Pull System taught us how to inform with visual signals the need to order. Kanban was suitable (Figure.1): two bins were installed; one with the first reagents to use, and the second behind with reagents to use only when the first one is empty, the signal to launch the order. Another problem remained: as the reagents can be checked by many people in the hospital, often the parallel use of reagents in both bins makes the system fail. The Lean team idea was to put “tape with a Kanban card” on the second bin to avoid parallel use of the bins and ensure the intentional opening of the bin through removing the tape and putting the Kanban card in the collector so that the logistician can transmit the order for supply.



**Figure 1 – Kanban and Poka Yoke in Biology lab for continuous flow**

The cost dimension was rarely the objective (table 1), even obvious financial gains became subsequent to restructured, organized and efficient processes in services. Keeping the patient focus leads the healthcare leaders to absorb and treat the patient flow. Being Lean means achieving wastes reduction as showed in the table 1. We sum up the different waste that was encountered.

Service Unit	08 Wastes ( W1..W8)	
Sterilization service	- Inventory of Mixed medical devices (W2)	W1: Transportation
	- Waiting time at OR for medical devices (W4)	W2: Inventory
	- Overproduction at cleaning unit (W5)	W3: Motion
	- Cleaning agent ability not fully used (W8)	W4: Waiting
Biology Lab	- Stocks of reagents to avoid shortages (W2)	W5: Over Production
	- Motions for getting reagents in emergency (W3)	W6: Over processing
	- Risk of defective care if analysis missing (W7)	W7: Defect
		W8: Non utilized Talents

**Table 1 – Wastes solved by Lean transformation and KPI monitoring**

The different wastes were palliated thanks to the different Lean features of the project. The analysis as demonstrated in this paper did not start with waste analysis (like it is often done in the industry). In hospital, patient focus is the prevalent objective around which the analysis is gravitated. When different Lean actions are implemented through the described Lean experiences, we naturally witness a decrease of those different

wastes. Moreover, the used KPI to monitor are really sustaining the two Lean pillars: Jidoka (doing the quality at the origin) and JIT (Pull system to not overload). The table 2 is summarizing this idea.

Lean Pillars	KPI sustaining Lean Pillars	
	Sterilization Service	Biology Lab
JIDOKA	<ul style="list-style-type: none"> <li>▪ Medical devices reliability</li> <li>▪ Increase rearranged medical devices</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reagents availability</li> <li>▪ No more shortages</li> </ul>
JUST IN TIME	<ul style="list-style-type: none"> <li>▪ Decrease Instruments Availability Delay (IAD)</li> <li>▪ Speed up rearranged medical devices</li> <li>▪ Decrease OR delay</li> </ul>	<ul style="list-style-type: none"> <li>▪ Relevant moment of reagents supply</li> </ul>

**Table 2 – KPI monitoring based on the two pillars of Lean**

## 6. Conclusion

Before the Lean implementation, 70% of boxes were rearranged at the SSD and 30% underwent rearrangement in the OR. After, the SSD became an efficient service providing 98% of rearranged MD to the hospital. The WIP is now under control with visual management and paintings on the ground. U cells were suggested to respect the flow direction from the cleaning to sterilizing process. The variability of the IAD decreased significantly (-50%), the quality of rearrangement increased (no missing instruments, to the right assignments), the non-conformity rate dropped by 30%, and the increase of SSD capacity rose about 10%. To conclude with the necessary changes in the SSD, it is important to remember that surgery cancellation due to missing MD is one of the main threats in the hospital.

In Biology Laboratory, the kanban solution was interesting required only a little training using one biologist and two agents to lead the team to understand the system and sustain the applicability of the Kanban in daily use. No more shortages were noted in the following years. Kanban and Poka Yoke (tape is error proof) installed in the Biology laboratory resulted in a much smoother ordering cycle, reducing mental stress for agents and no missing reagents for the whole hospital.

The strategic target in hospital is focusing on patient care. Around the patient are built the provided care processes and activities with an identification of different blocking points that slow down the patient flow either for a quality problem, security or human and technical resources availability. Interestingly, the Lean principles were relevantly adapted and transmitted through training to the staff. For hospital leaders and



practitioners, this paper comes as a testimony and feedback containing foremost insights to sustain the Lean healthcare approach. From the Gemba to the Lean techniques and lean principles application, waste elimination, to finish with monitoring KPI, those steps can be used as a benchmark for other healthcare managers and practitioners in service field as Healthcare.

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