

# Lean and Kaizen Application in the Healthcare during the COVID-19 Pandemic

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## Abstract

The COVID-19 health crisis has revealed numerous critical issues and bottlenecks in existing healthcare systems throughout the nation. Hospitals and healthcare facilities have recently dealt with numerous issues surrounding capacity, resources, and training protocols. As cases surge throughout the nation, many institutions are searching for more effective methods of improving inefficiencies in their workflow due to increasing demand and shrinking budget. The application of lean methodology in existing systems will greatly facilitate in this endeavor. Lean manufacturing concepts have historically been applied across various industries to improve overall production and efficiency by reducing waste and getting the most out of resources.

More specifically, the application of Kaizen is paramount in increasing efficiency and problem solving in the healthcare sector. Kaizen is a core lean tool that focuses on the concept of continuous improvement in every aspect throughout the workforce. In the health sector, small, continuous improvements can lead to significant changes in efficiency, quality, safety, waiting times, and workplace culture. A fully inclusive training approach is one of the key factors that distinguishes Kaizen's potential when applied to the health sector. It is crucial for healthcare facilities to adopt Kaizen tools such as value stream mapping and 5S in their existing systems and procedures to remove clutter and improve organization to streamline overall workflow. This presentation provides an analysis of various Kaizen applications in healthcare facilities and how they would be critical to the transformation of healthcare systems during the COVID-19 pandemic.

## Keywords

lean, manufacturing, healthcare, kaizen, hospitals

## 1. Introduction

Lean methodology is defined as a way of thinking which involves the overall removal of wastes within a process or a system. These concepts, originally developed for manufacturing optimization purposes, are widely implemented across various industries to remove waste, and increase overall efficiency. Likewise, lean has also shown to have benefitted the healthcare sector. In the health sector, small, continuous improvements can lead to significant changes in efficiency, quality, safety, waiting times, and workplace culture. As hospitals are constantly put under pressure to streamline their practices, they often struggle with budget management, and increasing demand.

Organizations such as Mayo Clinic, Robert Wood Johnson Foundation, Partners in Health, Ascension, The Joint Commission all stand to benefit from this endeavor of implementing lean into the day-to-day. It is crucial for hospitals, especially those that are non-profit, to apply lean practices for the overall and betterment of hospitals. This paper examines various Lean applications in the health sector through various case studies. One case study goes over a model applied in an intensive care unit which upholds several principles of lean in healthcare named 'Healthcare Lean Six Sigma'. This model integrates both Lean and Six Sigma, another crucial aspect of Industrial Engineering to workflow to the post anesthesia care unit. This case study is used to measure various benefits that these methodologies bring about by tying lean and six sigma methodologies together. In another article written by Amy Butler, this paper will contain an in-depth argument on the very present inequalities in the nonprofit healthcare sector utilizing acquired wage data.

## 2. Lean Implementation in the Healthcare Sector

Lean implementation is crucial, as it poses many solutions to many possible incidents occurred in the healthcare sector and serves to prevent many of the incidents in question. These problems may be safety related or resulting from various leadership/executive issues. This will be further proven and backed up from various case studies. However, the main takeaway here is that lean implementation brings about various solutions in this case.

Several nonprofit organizations today mismanage tend to mismanage their day-to-day tasks, along with overall security and budgeting. This can lead to extreme issues and instances of waste in the workplace. In these current times, especially due to the ongoing COVID-19 health pandemic, it has become crucial for these healthcare organizations to really optimize their workflow to give the most to patients. In an era where mass death from a disease of the very scale of COVID-19 is increasing severely. It is crucial for hospitals to step up, and really demonstrate to the public that they have the capability of flattening the curve by optimizing workflow in every way possible; this is all achieved through the implementation of lean management.

Kaizen is a core lean tool that focuses on the concept of continuous improvement can play an important factor in optimizing businesses and organizations throughout the nation due to the very nature of its principles. This concept is applied will be further proven through its application on a case study, referencing various charts to further prove the case. Kaizen also tends to generally benefit the workplace, as small, continuous improvements applied on a regular basis will enhance workflow and remove wastes in a rather effective and efficient manner.

## 3. Literature Review

Lean methodology involves the principle that any expenditure of resources for any action that does not create value is considered waste and should be eliminated as such. In lean-thinking, value is defined as any action that benefits the customer. In the health sector, patients are considered customers, and the end goal is to enhance the overall efficiency of hospitals by 3 improving process flow and speed through the elimination of waste. It has been brought up that the very logic of managerialism within hospitals has replaced 'logic' in professionalism in the very social organization of healthcare [6]. Lean healthcare, a term referring to lean implementation in the healthcare sector, represents a unique focal point that establishes organization in this sector. Scholars Justin J. Waring and Simon Bishop depicted a case study that was carried out by the National Health Service (NHS) in the United Kingdom. This study was initiated in 2008 in two NHS facilities and is currently being implemented in two other hospitals as services are being re-configured to adapt lean philosophy [6]. This study lasted 12 months in duration in one hospital, spanning from 2008 and 2009. Findings included observations of clinical activities, operating theaters, recovery rooms, and an overall observation of activities in the facility. Data was collected and extracted, and interviews were conducted, transcribed, and interpreted [6]. One of the most prominent concepts involves the interpretation of lean manufacturing rhetoric when it comes to how it could be applied within the healthcare sector.

Generally, lean thinking has been centralized around the implementation of waste, which is further categorized into seven different types of wastes including transportation, inventory, waiting, overproduction, over processing and defects. Five main concepts of lean thinking involve the notion of value and value stream maps, process flow, demand (or pull), and the strive for perfection (or Kaizen). However, when it comes to the health sector it is very important to note. The concept of rhetoric, defined as a persuasive language comes greatly into play over here. Rhetoric involves the adaption of language to satisfy & appeal to reason (logos), emotion (pathos), and values (ethos). It is used to depict how specific arguments should be articulated. The authors of case studies were very attentive in the ways the managers interpreted lean in its' implementation across the healthcare sector [6]. For example, a meeting named 'Productive Theatre' took place in which managers and staff from various departments discussed the various aspects of the implementation of lean, and what changes it might bring about such as implementation of 5s, charts, process mapping of patients throughout the hospital, as well as delays and efficiencies in workflow. Departmental work was reconfigured; this included the streamlining of booking systems, changing in bleep responsibilities and reconfiguration of clinical pathways. 5S methodology was also implemented to ensure all necessary surgical resources were appropriately organized and categorized [6]. This resulted in a positive outcome, as a 20% increase in throughput was discovered, as well as an 4 overall greater team stability, a revised booking procedure, and less reliance on agency staff. This is just one example of a notable case study in which core lean principles were interpreted and adapted to benefit a hospital setting.

Similarly, another case study Pamela Mazzocato and her team of five in a Swedish hospital indicated overall improvement upon application of a core lean tool. This case study focused specifically on the interpretation and application of only one core lean tool- Kaizen. Kaizen is a core lean tool that focuses on the concept of continuous improvement in every aspect throughout the workforce. Continuous improvements can lead to significant changes in efficiency, quality, safety, waiting times, and workplace culture. It is very important to use Kaizen tools such as 5s to remove clutter and improve organization in medical facilities to streamline overall workflow in the healthcare sector. In this case study, 186 Kaizen structured improvement suggestion documents were analyzed and categorized through use of directed content analysis. (Mazzocato et al, 1). This involves divisions by type of situation, type of process addressed, complexity level, and outcomes aimed for. Note that the aim of the study itself is to describe various types of issues and improvement suggestions; a concept highly tied in with rhetorical discourse. Results showed that 72% of improvement suggestions were in-fact reactions to a perceived problem. Going further in-depth, support, technical & administrative, and primary clinical processes were involved in 47%, 38% and 16% of the overall suggestions, respectively (Mazzocato et al, 1). These results are further proof that lean implementation in the healthcare sector will only bring positive outcomes, given the successful interpretation and application of rhetoric to this sector.

Several other case studies conveyed similar results. "Lean healthcare in developing countries: evidence from Brazilian hospitals" by Luana Boome and her team in the Department of Industrial Engineering in the Federal University of Sao Carlos, Brazil depicts a case study of the implementation of lean healthcare in the operations of two major Brazilian hospitals. The study is focused on the reality of the Brazilian healthcare system and our intention is to understand a contemporary and important phenomenon — the effects of lean implementation on the performance of hospitals [9]. This study was first based around various questions which allowed for a greater understanding of further applications of lean implementation. It was centered around two hospitals, the first one consisted of 140 internment 5 beds and 40 intensive care beds and contained a medical staffing of more than 300 doctors. In this hospital, lean implementation occurred in three months performed by an internal team, utilizing the DMAIC methodology, which is a core lean tool. Overall results after lean were implemented included a 64% in sterilization machine capacity and a 78% reduction in cost, as well as a 94% reduction in delayed surgery. Similar results were depicted in the second hospital, which comprised of a psych ward and depicted a 33% increase in monthly revenues, 23% increase in the number of chemotherapy applications, and a 42% reduction in patient lead time, among others. [9]. This further proves how lean implementation in healthcare settings are very viable.

Similarly, author Richard J. Schonberger's paper "Reconstituting Lean in Healthcare: From Waste Elimination toward 'queue-less' Patient-focused Care," focuses on a targeted interpretation of lean techniques when it comes to the application across the healthcare sector [10]. He argues how lean techniques utilized in manufacturing mainly focus on operational efficiency through waste elimination, and the due to the very nature of healthcare, a more customer-focused implementation must take place.

The last research article, however, greatly contradict the findings of the previous four. Scholar Leo McCann and his team conduct a case study in which the introduction of lean techniques was not effective in a hospital in the UK. In fact, this case study also took place in the NHS, albeit in a different hospital [11]. However, employees misinterpreted lean philosophy and portrayed it in a very ambiguous manner so much so that it rendered the entire philosophy ineffective and was rejected by analysts. "Ultimately, the shift to illogicality undermined lean fatally, both as an effective 'gold standard' management technology and in its more limited, informal, utility as a 'mechanism of hope'. The 'reality' of lean adoption at Milltown was increasingly 'decoupled' (Heusinkveld et al., 2013) from primary concepts. This saw lean ultimately fall into a state of being a superficial, largely rhetorical, phenomenon just another in a 'succession' of NHS management fads" [11]. The overlying concept here lies in successful interpretation of lean concepts. If lean concepts are interpreted literally and deemed to be a 'gold standard', most likely it will not construe any benefit. To provide value, lean concepts need to be interpreted appropriately, taking into consideration the system in question.

Another further case of proof is depicted in the case study provided by Ade Diminan, and Anne-Valerie Ohlsson [2]. Entitled "Hospice Care Association: Turnaround of a Healthcare Nonprofit Organization" and published in the Asian Case Study Research Journal, this article a case study based in Singapore of a non-profit healthcare organization in need of dire assistance. This was due to funding changes from the Singapore government. Additionally, there were significant staffing issues which trust various employees into a big frenzy [2]. In this article, Dr. Akhileswaran is introduced to a leadership position which proved to be dire, he was not able to successfully execute the duties of his position in an efficient manner. For situations such as these, lean methodologies often offer various solutions to those

who are aware of their very existence. For example, in this case study, top-down leadership is most employed. However, lean methodology often discourages the use of this type of leadership for this very reason. In fact, the managers are always supposed to properly communicate with their employees, so this type of mistake does not happen [2]. Even though this study takes place in a different country, it is very important based on the outcomes presented and the key take away, which all lead to the very important conclusion that led implementation is crucial in for the overall benefit of the hospital, and also the community at large.

#### 4. Applications in the COVID-19 Pandemic

The onset of the COVID-19 pandemic brought about various pressing issues to healthcare facilities throughout the year. Various hospitals experienced severe shortages in testing kits, personal protective equipment, and many other essential supplies as cases surged throughout the nation. By March 31, 2020, more than 800,000 cases of COVID-19 were recorded, and hospitals were increasingly reaching capacity. As PPE was utilized at an increased rate, and issues with the supply chain consecutively arose.

Various healthcare facilities throughout Massachusetts and the Northeast reported a shortage in PPE resulting in staff having to re-utilize supplies such as N-95 masks, and face-shields. Additionally, there were various issues in communication & procedural inconsistencies as healthcare facilities struggled to provide optimal care to affected patients while simultaneously working to decrease risk of potential outbreaks (Fig. 1). As displayed by Figure 1, various departments and facilities both on the regional and national level are involved and impacted in a joint effort to contain the virus.

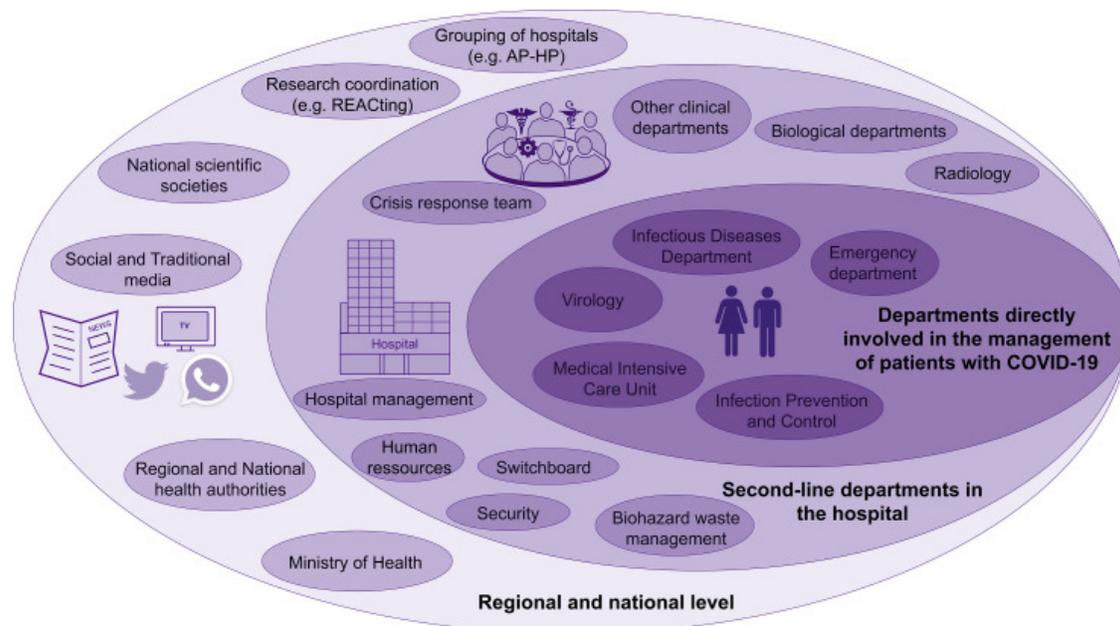


Figure 1: Departments involved with affected COVID-19 patients.

To obtain a clearer insight into the various issues in healthcare facilities brought upon by the onset of the COVID-19 pandemic, an online survey was conducted to several front-line Boston Medical Center (BMC) hospital staff. This survey contained various questions pertaining to complaints and the procedural/supply chain issues brought about by the pandemic. This data was then analyzed, a pareto chart was created to adequately display the results of this study [8]. This information was collected over a 4-week period, involving front-line workers from various departments.

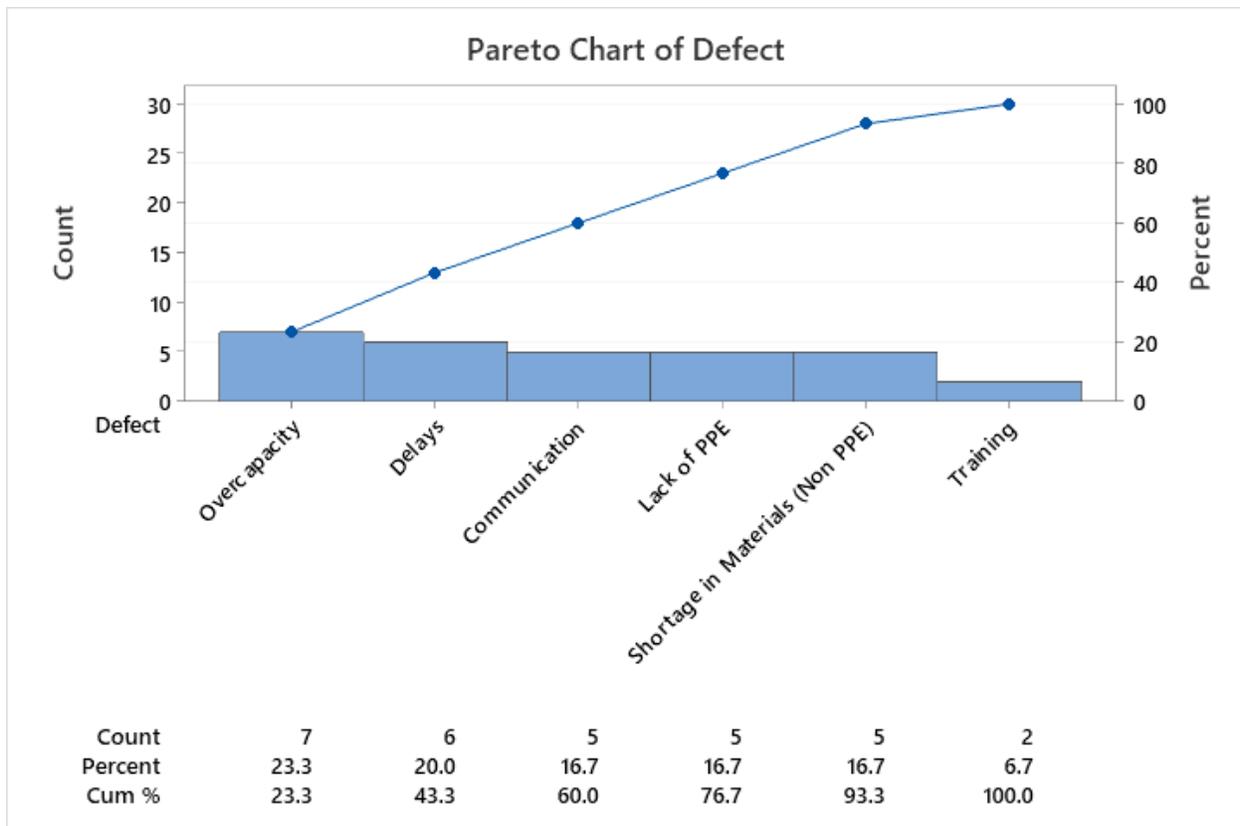


Figure 2: Pareto Chart Analysis – Common procedural bottlenecks in BMC due to the pandemic

As displayed by Figure 2, overcapacity has remained among one of the most common issues throughout the pandemic. This is due to the surging number of cases in the nation, and increasingly limited resources contained by hospitals.

This can consequently lead to delays in patient care, as displayed by Figure 2. These all represent critical safety issues brought about by the COVID-19 pandemic that have severe & adverse potential affects on lives and the community at large. Therefore, it is essential for lean implementation to mitigate these issues.

## 5. Conclusion

Based on the results five case studies, a clear interpretation of lean is required in the application to the healthcare sector. Lean methodology, originating from the manufacturing industry, is used by various organizations to eliminate waste, cut costs, and increase overall efficiency. Regarding the healthcare sector, it is crucial that lean rhetoric must be properly interpreted, and tailored to the respective facility, as depicted in McCann’s study in the NHS. A successful implementation will result in an increased efficiency and workflow in the healthcare sector. This was clearly indicated from the four out of five case studies that indicated positive results upon the application of lean methodology to their corresponding healthcare facilities. Wait time and cost were severely decreased, while overall machine capacity and revenue were increased. Such a drastic benefit in healthcare facilities can potentially mean more lives saved. During a global health pandemic, such as the COVID-19 crisis society is currently facing, hospitals & their respective staff should be better trained and equipped with lean tools to provide the best service possible to patients. This could possibly lead to a decrease of overall COVID-19 cases while remove excess waste in hospital processes.

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## Biography

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