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Utilizing lean tools to improve value and reduce outpatient wait times in an Indian hospital

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Abstract

Purpose – This paper aims to demonstrate how lean tools were applied to some unique issues of providing healthcare in a developing country where many patients face challenges not found in developed countries. The challenges provide insight into how lean tools can be utilized to provide similar results across the world.

Design/methodology/approach – This paper is based on a qualitative case study carried out by a master's student implementing lean at a hospital in India.

Findings – This paper finds that lean tools such as value-stream mapping and root cause analysis can lead to dramatic reductions in waste and improvements in productivity. The problems of the majority of patients paying for their own healthcare and lacking transportation created scheduling problems that required patients to receive their diagnosis and pay for treatment within a single day. Many additional wastes were identified that were significantly impacting the hospital's ability to provide care. As a result of this project, average outpatient wait times were reduced from 1 hour to 15 minutes along with a significant increase in labor productivity.

Practical implications – The results demonstrate how lean tools can increase value to the patients. It also provides are framework that can be utilized for healthcare providers in developed and developing countries to analyze their value streams to reduce waste.

Originality/value – This paper is one of the first to address the unique issues of implementing lean to a healthcare setting in a developing country.

Keywords India, Healthcare, Developing country, Lean thinking, Value stream mapping

Paper type Case study

1. Introduction

Christensen *et al.* (2009) state the healthcare industry is prime for disruptive innovation that will change the landscape of how care is provided. Applying lean to the healthcare industry has yielded many improvements (Brandao de Souza, 2009) and can provide a basis for disruptive innovations. However, the body of research is almost exclusively focused on the healthcare industry in the USA, the UK and other developed countries (Brandao de Souza, 2009). Our experience shows that patients and providers in a developing country can have different needs, requirements and constraints. Thus, examining the impacts of these challenges and how they are being overcome is an important element in advancing this topic.

This paper examines how an MBA student in a Lean Supply Chain Management class applied the lessons learned to a project at Help Hospital in Vijayawada, India. The

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project reduced outpatient waiting time from over 1 hour to 15 minutes and improved labor productivity by 114 per cent. This example shows that with the right tools, even someone with limited exposure to the principles of lean can produce significant results.

We begin by providing a brief overview of lean thinking (Womack and Jones, 1996) and the lean tools used during the project and illustrate how value stream mapping and root cause problem-solving were utilized to capture and analyze wastes. Next, we identify some unique challenges to providing healthcare in India and factors that impact changes to work practices. Then, the background of the situation at Help Hospital and the implementation the future state map are discussed. Finally, we discuss how these improvements can be replicated at hospitals across the globe.

2. Literature review

2.1 Lean concepts

Lean thinking (Womack and Jones, 1996) derives from the Toyota Production System (Ohno, 1988). It focuses on increasing value through five principles:

(1) identification of customer value;

(2) management of the value stream;

(3) developing a flow production;

(4) using pull techniques; and

(5) striving to perfection (Womack and Jones, 1996).

The principles are operationalized through a variety of means, and one of the most common means is to eliminate waste (Liker and Meier, 2006), which is applicable across a wide spectrum of industries including healthcare (Chalice, 2007; Graban, 2008; Kollberg *et al.*, 2007; Spear, 2005). Examples of waste reduction in healthcare are reducing errors (Grout and Toussaint, 2010), reducing patient wait times (Gijo *et al.*, 2013), decreasing the distance patients travel in the hospital (Chiarini, 2013) and improvements in information technology systems (Lazarus and Andell, 2006).

The lean healthcare literature can be categorized into case studies and theoretical. The case study research can be divided into four categories: manufacturing-like, managerial and support, patient flow and organizational. The categories can be further classified into two taxonomies: direct and indirect reductions of waste from the viewpoint of the patient (Brandao de Souza, 2009). This classification is important in identifying wastes because only focusing on direct wastes can keep more inclusive solutions from being implemented, which could be a deciding factor in a patient returning to a particular hospital in a competitive marketplace.

2.2 Healthcare in India

There are many differences in healthcare provision between the Organization for Economic Co-operation and Development (OECD) countries and India (Esposito *et al.*, 2012), such as the number of physicians, nurses and other physical assets. However, one surprising difference involves the level of private vs public payment of services. In India, patients pay for 70 per cent of their healthcare expenditures themselves; it is only 55 per cent in the USA and 18 per cent in the UK (WHO, 2013). This burden on the patient causes additional challenges, as healthcare providers need to take the payment ability of the patient into account before services begin and as they prepare treatment plans that

must stay within the patient's budget. If the patient is unable to afford the treatment, they can apply for a government payment plan, if they are eligible, but this may delay care while the application is being processed.

2.3 Lean implementation in developing countries

As lean thinking strives for perfection in healthcare, many potential obstacles must be overcome. Das *et al.* (2008) highlight one obstacle in developing countries is the amount of time doctors spend with each patient. Their results from India show that "low-effort" doctors spend 1.9 minutes per patient and "high-effort" doctors spend 6.15 minutes per patient. As a comparison, doctors in the UK spend 9.4 minutes with each patient. The type of facility and the incentives explain much of this variance in the system. For instance, public primary care doctors are often secure in their jobs and from a higher social status, so they exert low levels of effort. On the other hand, the private physicians typically exerted high effort, due, in part, to the incentive systems and the patient's ability to choose another provider. Therefore, the type of facility, i.e. public vs private, can have an impact on the effort taken by the physicians and may have a role in the quality of the care.

Other country-level factors, such as culture and power distance (Hofstede, 1991), can also influence the adoption of new work practices (Ollo-Lopez *et al.*, 2011). High power distance cultures, such as India, have an influence on a lower-level worker's job autonomy and upward communication because workers are more likely to do only as they are told and not to question authority. In a healthcare setting, both of these factors can be important to a successful lean implementation (Grout and Toussaint, 2010) because everyone in the process must be responsible for quality and have the ability to make the necessary changes to improve value (Womack and Jones, 1996).

2.4 Lean tools

The following is a brief discussion of some of the principles of lean and implementation tools the student learned during the lean supply chain management class and used at the hospital. It is not intended to be an inclusive discussion but an overview of some of the most useful tools.

2.4.1 Process maps. The principle of lean thinking (Womack and Jones, 1996) is to manage the value stream; however, before the value stream can be managed, it must be identified. One common tool used for this task is value stream mapping (Liker and Meier, 2006; Womack and Jones, 2005). The first step is to map the current state of the process to capture what is happening within the system and to provide a benchmark to measure future improvements against. The second stage is to create a future state map that reduces wastes to create more value for the customer and the provider.

One type of process map that helps to capture the two main stakeholders, i.e. patient and hospital, and their communication and information flows, is Womack and Jones' (2005) lean consumption process map. One improvement in their map is that it explicitly includes the interactions and information flows between the patient and the hospital. This inclusion is important to identify and address the wastes created from the interactions and information flows. Once all steps in the process are captured, the non-value-added ones can be identified for elimination, if possible (Clothier, 2010). For example, even though patient documentation and filing of paperwork may not create value, these steps cannot be eliminated in the future state because of regulations and

other requirements. Once the future state map is completed and the flow of the process is improved, it becomes the outline of the implementation plan.

2.4.2 Push vs pull. The next stage is to create a process where the patients are pulled through the process instead of being pushed (Liker and Meier, 2006; Womack and Jones, 1996). A primary means of accomplishing this goal is to have patients in the system only when the healthcare staff is ready to provide service. A pull system will also strive to have the steps of the process in sync to reduce unnecessary queues of patients waiting for service.

2.4.3 Root cause problem-solving. To have greater confidence that the changes between the current state and the future state address actual problems instead of treating a symptom, root cause analysis (RCA) is used. A common RCA tool is the 5 Whys (Conger, 2011; Liker and Meier, 2006). The application of 5 Whys, as its name suggests, involves the use of the question "why?", typically five times, until the root cause of the problem is uncovered. An example 5 Whys used in the project is shown in Figure 2.

3. Lean implementation at help hospital

Help Hospital is a private hospital located in Vijayawada, India, which is a city of approximately 1,500,000 people. On average, 150 patients visit the hospital every day for emergencies, appointments and walk-in treatment. This number varies greatly, especially when more patients seek care during the monsoon season. It has 70 beds for inpatients, four emergency units, four operating theaters, two intensive care units with six beds each, two intensive coronary care units with six beds each, a pharmacy department and laboratory and imaging units. On average, there are 80 people working at the hospital: five chief doctors, eight MBBS-degreed junior doctors (a resident/attending MD in the USA), 30 nurses and the remaining are staff and technicians.

The area surrounding the hospital is still developing which created specific problems for the patients and the hospital that would not be faced in most developed countries. As previously stated, approximately 70 per cent of the patients (WHO, 2013) were paying for their healthcare via direct cash payment to the hospital, which is due before the patient leaves the hospital. To reduce issues, the hospital's practice was to understand the patient's ability to pay for the service before undertaking any non-emergency treatment to stay within the means of the patient's ability to pay. However, as will be discussed, many operational issues were affecting the hospital's ability to do so.

A second issue was illiterate patients, who account for approximately 20 per cent of the appointments and walk-ins each day. These patients required much more person-to-person contact during the admission's process to fill out the necessary paperwork, as they could not be given a form and be expected to complete it. This process puts more workload on the receptionist to fill out the paper work for the patients and led to errors in the transcribed information.

A third issue was that many patients did not have readily available transportation and walked many miles from the surrounding villages to visit the hospital, which limited a patient's ability to revisit the hospital on multiple days for a single issue. When multi-day care was required, many of the patients would spend the night outside of the hospital because they could not afford to rent a room for the night. Typically, there would be at least ten patients and their families sleeping on the sidewalk, creating a public relations issue for the hospital. If the number of people grew too large, local

television and newspapers would show images of these people. Thus, the hospital and the doctors needed to provide treatment in a single day whenever possible.

3.1 Identifying stakeholders

Once some of the challenges facing the patients were identified, the first stage of the implementation was to identify the primary stakeholder(s) in the process (Womack and Jones, 1996). This initial analysis found a complex healthcare system, with internal stakeholders such as physicians, nurses and patients that were often times at odds with the external stakeholders such as regulators, government and third-party payers. Adding to the complexity was that all stakeholders had different views of what constitutes value and waste. Thus, defining the primary stakeholder(s) for the analysis was critical (Radnor *et al.*, 2012). It was determined that the focus of the project would be only on the internal stakeholders because trying to include the external stakeholders explicitly would complicate the project. However, they would still implicitly be part of the project because any changes would still need to be compliant with their requirements.

Within the internal group, there can be differences in how patients, nurses, doctors and the hospital administration view value. After discussing this issue with the director of the hospital and the chief doctors, all of whom have an equity stake in the hospital, the patient was determined to be the primary stakeholder, especially because they were the payers in the majority of cases. This focus on a primary stakeholder helped ensure consistency of value across the system from entry to discharge (Radnor *et al.*, 2012). When a conflict arose between the patient and the other stakeholders, the patient's value was given the highest priority.

3.2 Current state mapping

After deciding on the initial scope of the project and the stakeholders involved, the next phase was to create a current state map to capture how patients flow through the process (Liker and Meier, 2006; Womack and Jones, 2005). The outpatient process was selected because it represented the largest portion of the hospital's patients. The process began when the patient entered the hospital and ended when the patient left the hospital for that day. While some patients were admitted or required more involved spanning several days, this initial implementation only focused on the typical outpatient.

3.3 Collection of data

The author collecting the information for the current state map had worked at the hospital during her undergraduate studies, as a physical therapist and administrator after college, and thus was familiar with the overall system. The data were collected at the beginning of the summer break during her internship with the hospital. It was decided that the first phase of the data collection was to observe the patient's flow and to conduct interviews with the key internal stakeholders to obtain more detailed information. Observations were gathered over two weeks and across varying times of the day to capture the outpatient process at different demand levels. To insure that a bias did not enter into the mapping process, the data and observations gathered were verified with the patients, nurses, technicians, support staff and doctors via interviews. After the current state map, as shown in Figure 1, was completed and validated, it was shared with the managing director of the hospital.

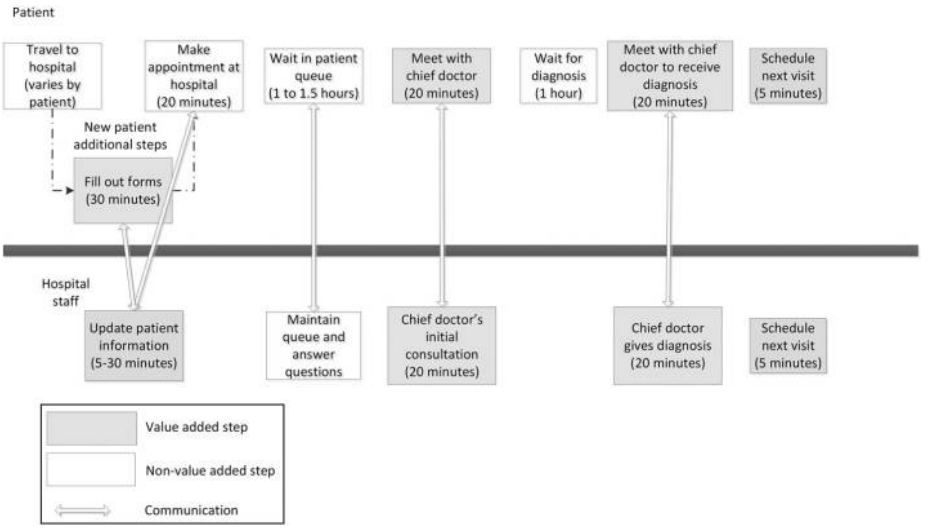

Figure 1.
Current state map for outpatient process

3.4 Analyzing the data

The completed current state map was a surprise for the director and many people at the hospital. They intuitively knew that there were issues with the process, but it was not until they saw the map that they realized the extent. For example, even existing patients do not make an appointment before they arrive at the hospital unless it is a follow-up from a previous visit. This "arrive and schedule" flow created waste for the hospital because the staff have little visibility on the potential patient load and needs. For the patient, it resulted in a longer queue, as they waited to see the chief doctor for their initial consultation. During this consultation, the chief doctor often realized that additional information, such as laboratory work or an X-ray, would be needed to complete the diagnosis. Thus, the patient would need to enter a queue to have the tests performed and then enter another queue to see the chief doctor for the final diagnosis. This redundant waiting was seen to be a significant source of patient wait times and causing patients to need to come back the following day.

One of the most important but probably least recognized issues was the lack of information flow due to the arrive and schedule flow. The receptionist required a great deal of time to enter the admission's paperwork into the system, update information and schedule an appointment before the patient could see a doctor, especially for illiterate patients. This issue was exacerbated because many patients arrived at the opening time, which created a bottleneck of people waiting to have their paperwork completed, increasing the average wait time. The receptionist also felt pressured to complete the process as quickly as possible to alleviate the bottleneck, which often resulted in errors that would not be detected until later in the process.

With the initial analysis of the entry of patients into the hospital, it was observed that the billing system was also creating many issues because the main power for the hospital would be lost for hours at a time during the day – this was an almost daily occurrence. The walk-in clinic was powered by a back-up generator, but the billing system computer was not. Thus, the hospital would neither know if the patient had

third-party insurance nor would they be able to estimate the bill for cash paying customers before treatment. In addition, patients who were finished with their visit would not be able to pay their bill and would have to wait until the power was restored to do so.

The current state mapping also brought forth another waste that no one had identified previously: that chief doctors were conducting initial consultations as opposed to the junior doctors. Historically, the chief doctors had conducted these consultations because they were the original doctors at the hospital and had retained this role as the hospital grew. However, these doctors were the specialists (cardiology, orthopedics, neurology and pulmonology) and represented more value to the hospital when practicing their specialty. While they were busy most of the day, the process was generating a lot of waste and causing the hospital to be underutilized.

3.5 Improving value for the future state

After analyzing the current state, it was determined that the primary driver of waste in the system was the inflow of patients and the lack of scheduling. This realization was not a surprise to the hospital, but the secondary effects that it caused were. For example, the resulting chaos created situations where patient files would be improperly updated with someone else's information, resulting in further wastes as patient files were corrected. This also led to potential defects of patients being billed for someone else's healthcare. Attempts at improving the patient file system had been tried and yielded some improvements in error rates, but it was still an issue. Upon reflection of the concepts of push vs pull and RCA, the efforts were only treating the symptom. To address the root cause, a 5 Whys, shown in Figure 2, was performed on this problem, and it shows why the previous efforts did not eliminate the errors.

The scheduling of patients allowed the receptionist to better collect the patient's personal and billing information through a more standardized process. In conjunction, the consistent flow of patients allowed a nurse to be added to the admissions process. The nurse was able to review the file with the patient and ask questions that provided more medical insight about the visit. Concurrent with these changes, the billing system's power was rerouted to the generator circuit so that power outages would not delay the patients from obtaining their billing status or leaving the hospital after receiving services.

Initial Problem Statement: Wrong patient chart is pulled	
Why?	Nurse pulls wrong patient chart
Why?	Confusion at admission's desk
Why?	Too many active files
Why?	Too many patients are queued at the same time
Why?	There is no schedule
ACTION:	Implement scheduling system to manage in-flow of patients

Figure 2.
Example 5 Whys analysis for patient flow

The second major driver of waste was using chief doctors for the initial consultation. The chief doctors are required to sign-off and approve all diagnoses; therefore, it was assumed that it would be better for them to manage the entire process. As mentioned during the current state discussion, while this technically still adds value, the chief doctors can add more value elsewhere. With the help of the author, it was realized that the junior doctors' roles could be expanded from their current one of inpatient care to include conducting initial consultations. If required, the junior doctors could also order the appropriate lab work or tests so that the chief doctor would have the necessary information to make the final diagnosis. The resulting future state map is shown in Figure 3.

3.6 Making the future state a reality

The managing director and chief doctors were anxious to begin all phases of the implementation process, but this enthusiasm was tempered by the author's experience that implementation is usually best accomplished through incremental stages. It was decided that the first step in the implementation would be to reduce the chief doctor's role in the initial consultation because this step was under the direct control of the hospital. The patient scheduling would be implemented later, as this step would take time to inform the patients.

A second issue that needed attention was the cultural issues of authority between the doctors and the nurses and job autonomy. Before lean, the nurses had little upward communication and only focused on doing only what was instructed. After the lean implementation, the communication between the nurses and doctors was still the same. Addressing power distance was viewed as a very difficult issue to overcome because of long-held cultural norms and will be addressed in the future. Job autonomy was viewed as a feasible change and was addressed by coaching the nurses to take ownership of their jobs. For example, they were shown how they could improve their work practices by implementing new procedures such as carrying common supplies with them at all times. This relatively simple change illustrated to the nurses that they had control over

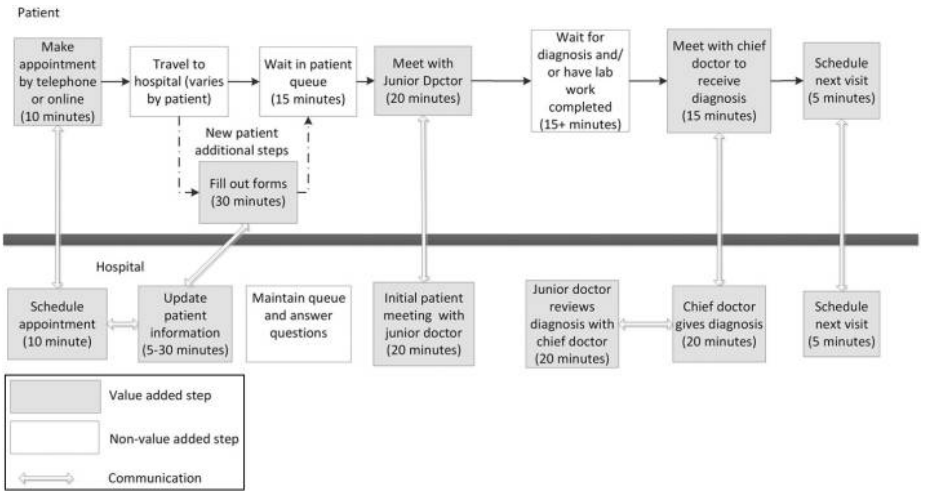

Figure 3.
Future state map for outpatient process

their jobs and gave them a sense of ownership and that they were responsible for quality. After this change, the nurses accepted the modifications to their work practices and they began to provide more feedback on how to improve the system.

3.7 Routing patient flow through junior doctors

The chief doctors were initially reluctant to change their role, but once they saw the potential to reduce patient wait times and increase the patient's value, they agreed to the future state. In addition, the current state map highlighted many of the other operational issues that were a result of these wait times. In part, this process was easier than it otherwise might have been because of the financial incentives of treating more patients.

The implementation began with the addition of junior doctors to the outpatient process and was completed in four stages. The first stage involved two junior doctors being reassigned from inpatient care to the outpatient area. Each junior doctor was assigned a chief nurse to assist in a variety of tasks. Before Stage 1, the average waiting time for the patient was approximately 1 hour and could be much longer during the monsoon season. After implementation, when no time-intensive testing was required, the patient could see the chief doctor within 15 minutes after seeing the junior doctor. If a longer test was required, the patient was scheduled for a time slot to see the chief doctor instead of reentering a queue, creating more certainty when their treatment would be completed and allowing them to more easily arrange transportation. As a result, it is rare that a patient needs to stay overnight. If they do, the hospital modified old inpatient rooms for the patient and their family to stay in, instead of sleeping outside.

After the changes in the first stage of implementation, the average outpatients seen per day increased from 40 to 60, and the chief doctors were able to spend 25 per cent, or about 2 hours, performing additional surgeries or consults based on their specialty. In addition, the two junior doctors removed from the inpatient area were not replaced, which increased the overall efficiency of the hospital. In each of the next three stages, two additional junior doctors and chief nurses were added to the outpatient area. Each stage was implemented in two-week intervals to allow the processes in the outpatient area time to grow and adapt to the additional staff and as a response to the increase in outpatients coming to the hospital. As the implementation began to show promise and the number of patients being treated in a day increased, with shorter wait times, the hospital began to market and advertise their new capacity, resulting in more patients seeking care. It is believed that word-of-mouth by the patients was also a large driver of growth.

The results after the first stage were not limited to the reduction of patient wait times. The patient's literacy rate necessitated that little information could be transferred in written form and the doctor could not give the patient a pamphlet to be read later. Thus, the junior doctors could now spend more time educating the patients on preventative healthcare. For example, if a patient came in to the hospital because they drank contaminated water, the doctor could take time to teach the patient about better sanitation practices, preventing future visits. These extra efforts allowed the doctors to be high effort and provide better quality care (Das *et al.*, 2008) which was vital in a competitive market.

Throughout the stages, it was noticed that the number of patients that were seen by the hospital increased by approximately 20. Initially, this did not seem like an improvement in productivity, as for every two junior doctors, 20 more patients were

seen. In addition, in the second stage, because of the increase in patients, the chief doctors no longer had their 2 hours of additional time due to the increase in the number of final diagnoses needed. However, when the labor productivity was assessed using the relative wage rates, with the junior doctor as the standard wage, the results were viewed differently. Removing the waste created by the chief doctors conducting the initial consultation yielded a 114 per cent improvement in the number of patients seen with respect to the wages spent, as shown in Table I. For purposes of the labor productivity calculation, it is assumed that the chief doctors make about seven-times that of the junior doctor and the junior doctors make about two-times that of a chief nurse.

3.8 Process redesign for scheduling

The scheduling process was a multi-pronged effort that began with creating awareness in the patient population. The first step was working with the patients who used the hospital as their primary care provider. They were known entities to the hospital and were reached through mailers and other direct contact methods. Many of the other patients, however, were not known to the hospital before they walked in, so reaching this patient base required a broader marketing and advertising campaign via billboards and other mass media messaging. These efforts resulted in over 70 per cent of patients pre-scheduling their appointments. At the end of the implementation, the patients were given a specific appointment time and were asked to show up 15 minutes beforehand to update records and fill out any new forms.

3.9 Synergies of the future state

As the implementation progressed, additional wastes became evident such as a lack of priority or triage scheduling. For example, certain testing, imaging or more extensive laboratory work required more time to complete. Thus, the junior doctors were able to identify these patients based on the reason for the appointment and by conducting a brief interview as the patients arrived. With this information, a prioritization of patients was created to enable those patients with the longer time requirements to be processed first. Prior to this change, the patients would often need multiple days to address their problems and as previously stated this was to be avoided. The results of these improvements are shown in Table II.

4. Discussion

Implementing lean in developing countries can pose unique challenges and can lead to different outcomes than would be encountered elsewhere. One of the primary differences

Stage	Total of patients per day	Chief doctors	Junior doctors	Chief nurses	Patients per doctor	Patients per standard wage[a]
Current state	40	4	0	4	10	1.33
Implementation – Stage 1	60	3	2	6	12	2.31
Implementation – Stage 2	80	4	4	8	10	2.22
Implementation – Stage 3	100	4	6	10	10	2.56
Implementation – Stage 4	120	4	8	12	10	2.86

Notes: [a]Chief doctor = 7; junior doctor = 1; chief nurse = 0.5

Table I.
Labor productivity measures for implementation

is that the majority of patients pay their bill in cash, which must be paid before they can leave the hospital. Thus, if the hospital has any issues in processing the patient's bill, the patient's waiting time in the hospital increased. Another key issue is the illiterate patients, who require more time for the hospital staff to gather and enter their information into the computer system. These patients also require more education time with the doctor. These issues, when coupled with the lack of transportation and any other issues that delay service, led to patients staying overnight outside the hospital. These challenges are not likely to be encountered in OECD countries, but the lessons learned and improvements experienced at Help Hospital can yield improved healthcare processes across the globe.

One potential hurdle to increasing value and reducing wastes can be the understanding of how to use lean tools. However, as we show, a student with one semester's training in lean produced significant results when the framework of lean thinking (Womack and Jones, 1996) is followed. We found that the first step of identifying the primary stakeholder was vital to the implementation. If stakeholders were not clearly identified, then the likelihood of arriving at the desired result would have been in jeopardy. It must be noted that there is a balance between the stakeholders that will change depending on the payment models in different countries (Radnor *et al.*, 2012). The Indian pay model necessitated a focus on the patient, but this can be very different when the government is the primary payer.

Next, it was necessary to create the value stream map to communicate the key issues facing the hospital leadership. This map helped everyone understand the extent of the problems and the opportunities for improvement. The map needs to include the information transfers to bring these issues to the forefront (Womack and Jones, 2005). As we show in our study, this map helped to highlight the waste created by the chief doctors' over-involvement. This finding coincides with the proposal by Christensen *et al.* (2009) that providers need to examine who is providing the care at all levels to increase value. As we show, by examining who provides the service, we improved labor productivity by 114 per cent.

The doctor usage was a key waste to hospital, but it was a secondary issue with regards to the patient waiting time. The primary issue was the inability of the hospital to control patient arrivals. With the visibility of patient appointments, the hospital was able to identify patients that required specific care and alert the junior doctors so that they could better manage the flow. In addition, the pulling of patients through the process made the incoming patient flow manageable, allowed the receptionist to capture illiterate patients' information more accurately and eliminated the clutter at the nurse's station that led to the mixing of patient records. In total, these improvements enabled the hospital to control what was happening instead of being controlled by patients seeking care on their own schedule.

Table II. Before and after lean implementation metrics

Stage	Total patients per day	Average wait time	Schedule accuracy	Average patients staying overnight
Before lean	40	> 1 hour	NA	> 10
After lean	120	15 minutes	15 minutes	< 1

5. Conclusion

As we show, the lean tools required to improve patient care are not inherently difficult to learn and use. One of the most challenging parts is the identification of the proper stakeholder to create a common definition of value (Radnor *et al.*, 2012) upon which the entire implementation is based. After this step, most of the remaining steps were using the available information to capture the current state and communicating the key wastes in the process to the director and chief doctors. Without this clear articulation of the wastes in the process, utilizing the junior doctors would not have been identified and the level of improvements to the patients wait time, the number of patients seen in a day, and the profitability to the hospital would have been substantially less. In addition, addressing and overcoming cultural issues, such as the majority of patients paying for their healthcare, literacy rates and the nurses' lack of job autonomy, were important parts of the lean implementation. In the end, the most useful tool was being able to analyze the current state and to suggest potentially disruptive improvements.

As a follow-up to the initial implementation, the changes outlined in this paper were not temporary and the reduction of patient waiting time has been maintained since the original implementation, which was completed in July. During the monsoon season, the average wait time was maintained at 15 minutes without the much longer wait times – those exceeding 1 hour that were typically experienced in previous years.

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