

**Improving planning efficiency in operation theatre by using Lean Thinking****Abdelrahman E.M.Ezzat MBBCH, MS (ENT), MRCS, DOHNS***ENT Dept., Faculty of Medicine, Al`Azhar University- Cairo-Egypt.***ABSTRACT**

Operation rooms face problems with crowding, delays, cost containment, and patient safety. To address these and other problems, the operation theatres increasingly implement an approach called Lean thinking. This study described the implementation of Lean in operation theatre and the core questions about, how to design a Lean and how Lean can be best implemented in operation theatre. Also the effects of Lean on work structures and processes, patient care, and staff employees, as well as the factors on which Lean's success is contingent.

**Key words:** operation theatre, Lean thinking, patient safety

**Introduction**

*Lean production started by Toyota* became a model for many other companies in many different industries (Heineke, 1995).

Lean thinking is a bundle of concepts, methods, and tools derived from the Toyota Production System, the production philosophy of Toyota Motor Corporation. Lean was first implemented in US auto manufacturing in an attempt to replicate Toyota's success and has subsequently spread to other manufacturers (eg, Boeing), to service industry (eg, Tesco), and to the public sector (eg, UK National Health Service) (Holden, 2011).

Lean thing is explained by King, *et al.* (2006) as "an approach to the organization of complex processes that derives from industrial manufacturing experience." Furthermore, they state: "A key element in Lean Thinking is the practice of starting, not with a potential solution, but with the development of a detailed understanding of how a complex process is actually undertaken." Or as Harrison and van Hoekin 2005 describe: "Lean Thinking is based around the simple philosophy of eliminating waste." With this they mean that in the Lean Thinking approach it is of interest to look at the total patient flow, not only within several departments, but in the whole hospital, to understand where the efficiency can be improved.

*Differences between manufacturing and healthcare organisations:*

**Table 1:** General differences between manufacturing and healthcare organisations (adopted from Rosmulder, 2011)

Item of comparison	Manufacturing	Healthcare
Value creation	Physical products: inventoried before consumption; low customer interaction; quality directly measured	Service: simultaneous production and consumption; customer fully involved; quality is perceived and difficult to measure
Process type	Mass production: production process not affected by different product variants	Professional service: production process tailored to "product"; low volume and higher variation
Technology type	Long-linked: actions follow each other logically once started	Intensive: actions based on combination of capabilities based on feedback from "product"
Competitive mechanism	Clear price-product relation; positive-sum competition triggers improvement	Unclear price-service relation; zero-sum competition; access to service important

*Lean Thinking, how does it work?:*

in the past different methods were used in trying to improve the efficiency of planning, such as benchmarking, business process reengineering and total quality management, but the one proven to be most effectively was the Lean Thinking method, this opinion is being shared by King, *et al.* in 2006.

Lean thinking consists of five principles (Lean Enterprise Institute, 2009): Specify *value* from the standpoint of the end customer in terms of a specific product. Identify all the steps in the *value stream* for each product family, eliminating whenever possible those steps that do not create value. Make the value-creating steps occur in tight sequence so the product will flow smoothly toward the customer. As flow is introduced, let customers

*pull* value from the next upstream activity. As value is specified, value streams are identified, wasted steps are removed, and flow and pull are introduced, begin the process again and continue it until a state of *perfection* is reached in which perfect value is created with no waste.

*Lean Thinking and planning in operation theatre:*

Tools and Methods see figure 1:

1. Specify *value* from the standpoint of the end.
2. Identify all the steps in the value stream, by diagramming and otherwise describing (eg, timing) current and desired future process steps including the flow of products, information, and materials.

Then a Short-cycle continuous improvement sessions and eliminating whenever possible those steps that do not create value, this done through Six Stages in the Problem-Solving Process: Identify and define the problem, Discover and analyze causes of the problem, Identify possible solutions, Select the best solution, Make an action plan, Implement the solution, monitor and evaluate,

3. Work standardization based on assessment of the presumed “best way” to do the work (includes standard operating procedures and time-on-task specifications).

4. Make the value-creating steps occur in tight sequence, so the service will *flow* smoothly toward the patient. As flow is introduced, let customers pull value from the next upstream activity.

5. Work done by multi-skilled work teams, then As value is specified, value streams are identified, Wasted steps are removed, and flow and pull are introduced, begin the process again and continue it until a state (Mistake-proofing/failure prevention)

Through these cycles 5 items are identified and reduced the waste: as show in table 2.

The fifth step, pursuing perfection, requires this continuous loop of all workers improving everything they do, every day.

The hardest of all the steps, pursuing perfection requires an organization to commit to process improvement and the elimination of defects and waste on a daily and permanent basis (Womack and Jones, 2003)

Hines and Rich in 1997 identified and characterized a total of seven different value stream mapping tools: 1. Process (activity) mapping, 2. Supply chain response matrix, 3. Production variety funnel, 4. Quality filters mapping, 5. Demand amplification mapping/Forrester effect mapping, 6. Decision point analysis, 7. Overall (physical) structure mapping (by volume or value)

Process activity mapping (sometimes also more generally referred to as process mapping) is a technique for streamlining workflow. Supply chain response matrix, this tool was first developed and applied in the time compression and logistics industry and is also known by a variety of different names (e.g., time-based process mapping). Production variety funnel, this approach originates from operations management. Quality filter mapping, this mapping technique is a rather new tool designed to identify where quality problems exist within a supply chain.

Demand amplification mapping/Forrester effect mapping “if demand for products is transmitted along a series of inventories using stock control ordering, then the demand variation will increase with each transfer”. Decision point analysis is of particular use for supply chains and industries that exhibit similar features. Physical structure mapping, this rather new tool has been developed to elucidate what a particular supply chain looks like at an overview industry level (De Bucourt *et al.*, 2012).

**Table 2:** Seven critical wastes in healthcare that are addressed by Lean (adapted from Womack and Jones, 2003)

Excessive motion	<ul style="list-style-type: none"> <li>• Incorrect floor layout (e.g., inefficient emergency department patient flow)</li> <li>• “Searching” for information (e.g., lack of operability of EMR)</li> </ul>
Waiting time	<ul style="list-style-type: none"> <li>• Waiting for paper work</li> <li>• Waiting for response/approvals/beds</li> </ul>
Over production	<ul style="list-style-type: none"> <li>• Planning full utilization of assets/labor</li> <li>• Large batches of material and supplies inventory</li> </ul>
Unnecessary processing time	<ul style="list-style-type: none"> <li>• Fragmented workflow</li> <li>• Unnecessary processing steps</li> </ul>
Defects	<ul style="list-style-type: none"> <li>• Cost of patient readmissions</li> <li>• Hospital acquired conditions</li> </ul>
Excessive resources	<ul style="list-style-type: none"> <li>• Non-optimized resource leveling</li> <li>• Redundant activities (e.g., excess administrative costs)</li> </ul>
Unnecessary/Ineffective handoffs	<ul style="list-style-type: none"> <li>• Verification loops</li> <li>• Unnecessary approvals</li> </ul>

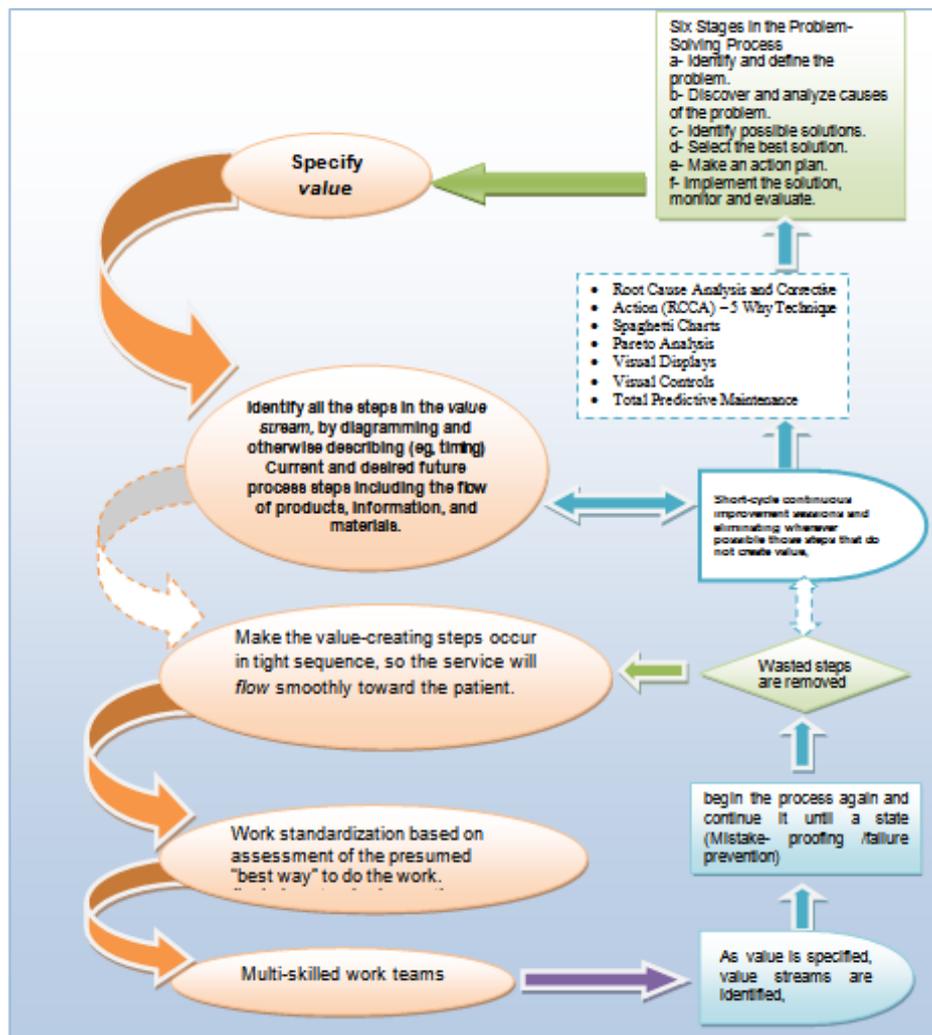


Fig. 1: A model of the steps of Lean thinking in operation theatre, cycles of planning development.

Effects of Lean thinking in operation theatre (see figure 2):

According to Jones and Mitchel (2006), “Lean focuses the improvement effort on things that matter to patients and clinicians and on the things that cause them stress and get in the way of care.” Furthermore he states that there are four categories of improvements that can be made by using the Lean Thinking approach, namely: quality and safety, delivery, throughput and accelerating momentum (having a working environment that is stable and has clear standardized procedures, to keep improving).

Clinical and nonclinical staff members who are given the encouragement, training, and time to make meaningful improvements in how the work is done are unlikely to want to retreat to an earlier period when formalized effort to improve existing processes was outside their domain of responsibility (Toussaint and Berry, 2013).

Employees can be affected in 2 distinct ways, indirectly and directly, but most reviewed studies tended to avoid measuring those effects or even discussing their possibility (Holden, 2011).

As staff members gain confidence in their problem-solving skills and as they witness positive changes, momentum for even more improvement work is likely to build. This is Lean at its best; employees keep raising the bar, the organization becomes increasingly innovative, more staff wants to be directly involved, and an attitude of continuous improvement becomes the driving force behind all work (Toussaint and Berry, 2013).

Disregard of Lean’s employee effects reveals an underestimate of the power of Lean to empower workers and to improve working conditions. In parallel, Lean implementers and researchers should be aware that Lean can increase workload, threaten autonomy, and bring about anxiety (Holden, 2011).

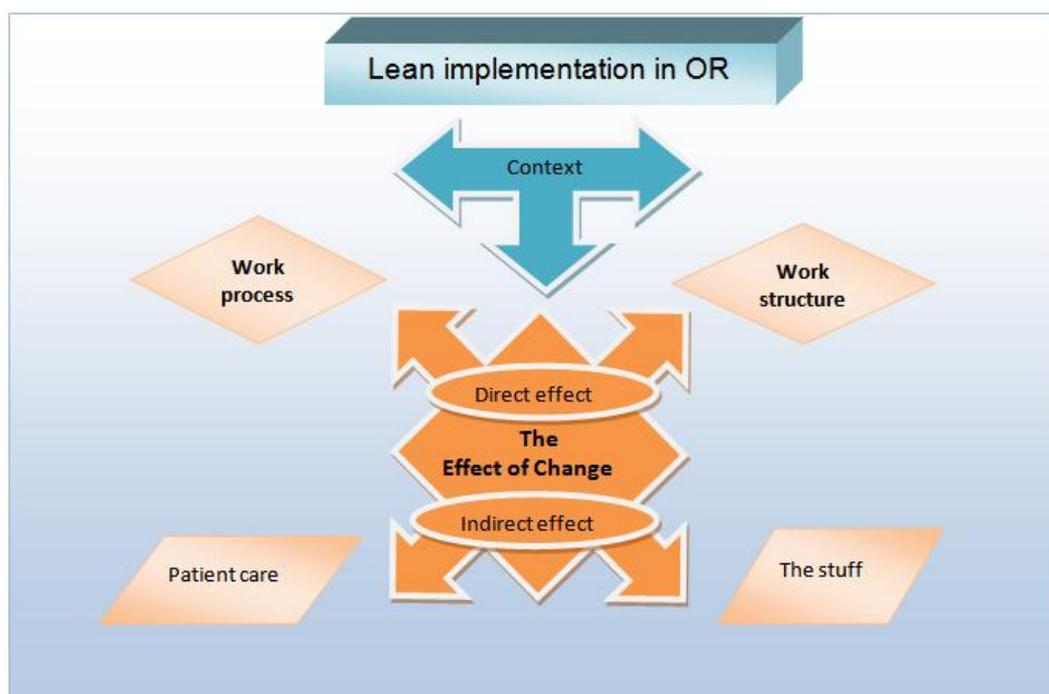
Lean, in a sense, turns leadership upside down, with front-line workers doing much of the innovating and managers trusting them to do it and supporting them. Respect for the potential of front-line workers to have the

brainpower and commitment to improve the work must pervade the organization. Respect flows downward, not just upward. A Lean transformation from the top of the organization demands perseverance (because setbacks are inevitable as are pockets of resistance) and humility (because Lean exposes many problems, some of which are caused by the senior leaders themselves). Lean has the potential to turn an organization into a community of innovators. However, this can happen only in a culture of respect (Toussaint and Berry, 2013).

The underlying goal of Lean in health care is to improve value for patients. Doing so should also benefit other health care stakeholders. Fewer medication errors, fewer nosocomial infections, less nursing time away from the bedside, faster operating room turnover time, improved care team communication about patients, and faster response time for emergent cases not only benefit patients but also physicians, nurses, health care organizations, payers, and the community (Joosten *et al.*, 2009).

Patient care typically improved as a result of Lean-driven process and structure changes, implying the possible value of Lean. One would expect improvements in length of stay, waiting times, and other commonly reported efficiency measures to be accompanied by improved patient health, fewer errors, or more appropriate care. Indeed, a recent study found a link between ED crowding and medication errors (Kulstad *et al.*, 2010).

Toussaint and Berry reported in 2013, of spring 2012 generated from improvement events occurring between 2009 and 2011 at these 8 hospitals include the following: percentage of on-time starts increased from a baseline of 50% of total to a mean of 70%. Number of operating room cases per month increased from a baseline of 329 to a mean of 351. Operating room turnaround time decreased from a mean of 60 minutes to less than 40 minutes. Percentage of cases rescheduled due to late starts decreased from a mean of 21% to a mean of 4.4% of total cases. Same-day surgery cancellations decreased from 7% to less than 3% of total cases.



**Fig. 2:** A model of the effect of Lean thinking in operation theatre, proposing that Lean affects patient care and stuff indirectly and directly by changing work structure and process and patient care changes can affect the stuff and vice versa.

#### *Challenges of Lean Thinking:*

The application of management philosophy and operational concepts from the manufacturing industry to health care may be a conceptual stretch for many in the health care community. Hence, both cultural and practical barriers likely will have to be overcome before lean techniques can enjoy widespread use. On the cultural front, it will be necessary to overcome the most likely arguments against the applicability of lean manufacturing concepts to the health care sector such as “people are not automobiles” and “each patient is unique” (Kim *et al.*, 2006).

However, when the training is provided, the staff gradually understands that there is a great amount of waste in the processes and applying Lean principles could provide great benefits (Jones, 2006). The training itself is a challenge, however. There are few people in healthcare who have a well-founded knowledge of and experience in Lean production principles, methods and tools. There is a lack of qualified people inside healthcare to teach about Lean (Dickson *et al.*, 2008). Educators need to be hired from the manufacturing sector,

but they often talk manufacturing language and lack relevant examples from the healthcare sector (Poksinska, 2010). This makes more difficult for healthcare staff to accept the ideas and requires longer assimilation periods (Papadopoulos and Merali, 2008). Another problem is lack of clear focus on the customer. One of the basic Lean principles is to understand value as defined by the customer. The term of “customer” in healthcare is not straightforward, however. The primary “customer” in healthcare is the patient, but the patient is not a customer from the market economy perspective. The patient usually doesn’t pay directly for the service. Other customers, such as family members, caregivers, decision-makers, local communities and taxpayers, also need to be considered (Poksinska, 2010).

To understand what is value added there needs to be a clear view of the customer without confusion of conflicting requirements and priorities from different stakeholders. The ambiguous notion of the patient as customer and the dynamics between the different stakeholders are seen as a barrier in the Lean implementation process (Endsley *et al.*, 2006).

Another factor perceived as inhibiting Lean implementation was the organisational structure of healthcare. Professional knowledge is organisational power.

The healthcare structure is still very hierarchical, with physicians as the dominant decision makers. Physicians are highly trained individuals and they have been trained to act with autonomy. Lean culture requires teamwork, collaboration and good communication, skills that traditionally have not been emphasized in physicians’ professional training (Ballé and Regnier, 2007).

#### *Discussion:*

For Lean to take hold in an organization and transform its culture to one of continuous improvement, senior management must relinquish the role of master problem solver to those who are closer to the problems to be solved to benefit from their knowledge of the focal process, to give them hands-on experience in using Lean methods and to see first-hand the performance improvement and teamwork this can create, and to promote an attitude that what exists can likely be improved. Value stream maps are a principal Lean tool used to distinguish between discrete steps in a process that do or do not contribute value (Toussaint and Berry, 2013).

Process mapping is a structured activity modeling technique focused on defining the various decisions made and activities performed in the creation of an organization’s products or services. It is essential in identifying “what” work is being done and “how” that work is performed in order to successfully reduce waste (De Bucourt *et al.*, 2012).

“Adoption of Lean management strategies - while not a simple task — can help healthcare organizations improve processes and outcomes, reduce cost, and increase satisfaction among patients, providers and staff” (Miller *et al.*, 2005).

While Lean has proven successful in reducing healthcare waste and increasing provider profitability, surveys of hospital leaders continue to find full deployment of Lean in healthcare very low. A survey by the American Society for Quality (“ASQ”) in 2009, the same organization that administers the prestigious Malcolm Baldrige National Quality Award, disclosed that only 4 percent of U.S. hospitals reported a full deployment of Lean. However, 53% of the 77 hospitals responding reported some level of use of Lean in their organization. So why is the full deployment of Lean within healthcare so low? According to ASQ respondents, the key reasons are: Lack of resources (59% of respondents), Not enough information (41% of respondents), Lack of buy-in from leadership (30% of respondents). The results of this survey stand in stark contrast to the successful implementations of Lean in healthcare organizations throughout the world.

Three key factors that contribute to the success of Lean implementation in healthcare are recurring in several papers. First: commitment and participation of healthcare staff in the improvement processes. Empowered staffs are more eager to realise their ideas as opposed to a reluctant staff feeling forced to carry out top-down process improvements. Second: to focus on developing people before developing organisation. It is essential to provide training and give responsibility to employees, so they will be able to take initiative to make improvements on their own. Third: support from managers at all levels (Poksinska, 2010).

Nelson-Peterson and Leppa in 2007 mention daily presence of top management on the unit as necessary condition for success of Lean implementation.

A Lean leadership and management system differs from a hierarchical system in which higher-level managers and supervisors tell lower-level personnel what to do and how to do it (Barmas K. 2011).

A key senior management role in Lean is to prioritize and clearly communicate a small number of strategic goal categories that are relevant throughout the organization and that have the most promise to strengthen the organization and create stakeholder value. Ideally, all Lean improvement projects fit within this strategic framework. Specific improvement projects (the “how”) move the organization forward in its prioritized goal categories (the “what”). Management uses a process called “catchball.” From chief executive officer to front-line supervisor, a series of conversations is constantly occurring. These conversations are documented on a

single sheet of paper and changed each time different team members' ideas are gathered (Toussaint and Berry, 2013).

The Lean message is 100 percent positive; Lean can improve safety and quality, improve staff morale and reduce costs – all at the same time. By freeing human potential it can add value to patient care and improve quality, and create a virtuous circle rather than perpetuating vicious ones. But Lean won't just happen on its own. It needs leadership and leaders. People willing and able to gather colleagues around them, find out how to do it and win senior management support. It needs managers with the vision to give staff license to experiment (Jones and Mitchell, 2006).

Additionally, implementers can devise measures—observational, surveys, interviews—that assess specific employee effects of Lean (eg, the extent to which workers think they are able to suggest or initiate changes, acceptance of Lean). Once employee effects are appropriately measured, it will be possible to assess links between employee effects and patient care effects of Lean (Holden, 2011).

The management philosophy of lean production methods has ties to other operational and quality-improvement models such as total quality management (TQM)/continuous quality improvement (CQI), developed by W. E. Deming and Six Sigma, and developed by Motorola and General Electric. Although there are several overlapping points of philosophy and techniques, a feature distinguishing lean from these other models is its value stream approach to driving change and eliminating waste within the process of providing a product for the customer.

Lean is unique in its focus on the specification of value from the customer's perspective and on the identification and categorization of waste and its transformation to value using specific tools. The lean approach encourages individuals within the organization (from top to bottom) "to learn to see" the flow of their product's process and thus to help to identify areas of waste, with the ultimate goal of creating a product with built-in quality with the least amount of waste. Both Six Sigma and TQM/CQI focus on the delivery of a high-quality product (Kim *et al.*, 2006).

#### Conclusion:

The Tools for Managing Project Quality are a lot, they are either tool for collecting and understanding project data, cause analysis tools, understanding project processes, idea creation tools or analyzing project processes, solving project problems, but lean thinking is a tool of multipurpose.

So, Lean is a proven methodology that answers the most frequently asked question of the day – how an operation theatre is going to be able to do more with fewer resources. It is, therefore, important for the operation theatre manager to apply Lean thinking with a formal Lean infrastructure that can respond to the internal and external challenges coming each and every day.

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