

# Creating Value in Health Care: The Case for Lean Thinking

Christopher S. Kim, MD, MBA, David A. Spahlinger, MD, and John E. Billi, MD

## Abstract

- **Objective:** To describe how Lean Thinking, an industry-based quality management model, offers health care organizations a methodologic and strategic approach to provide greater value to patients.
- **Methods:** Commentary with review of the literature.
- **Results:** The Lean Thinking model is built on a foundation of creating stability within the health care organization and standardizing the process steps involved in providing clinical care where possible. This allows for continuous learning through implementation of the PDSA cycle. The ongoing Lean Thinking work is supported by the ideas of just-in-time production and built-in quality, which help to produce the right work in the right quantity at the right time. The focus of Lean Thinking is to foster an organization that is committed to finding better ways to serve and care for its patients. Workers are encouraged to be mindful of problems that can arise and empowered to explore their work processes further to identify opportunities to improve.
- **Conclusion:** The future is likely to place greater pressures on health care organizations to meet specific quality, safety, efficiency, service, and appropriateness measures. Lean Thinking may provide the means for organizations to create greater value in their health care delivery mission.

In 2006, U.S. health care spending topped \$2 trillion for the first time, accounting for 16% of the gross domestic product [1]. Health care spending is expected to double over the next decade [1,2]. Despite huge fiscal expenditures, quality of care is lacking [3]. Given this discrepancy, health care organizations (HCOs) will be challenged to balance the rise in costs while maintaining a focus on improved quality, safety, efficiency, and appropriateness of health care services.

Previously, quality management models from other industries have been adopted by some HCOs to drive organizational change [4–7]. More recently, a strategic approach called Lean Thinking has gained prominence, with several

examples of health care success [8–14]. The future of health care is likely to place only greater pressures on the individual HCO to meet specific quality, safety, efficiency, service, and appropriateness measures. Lean Thinking may provide the framework as organizations seek to deliver health care services with greater value.

## What Is Lean Thinking?

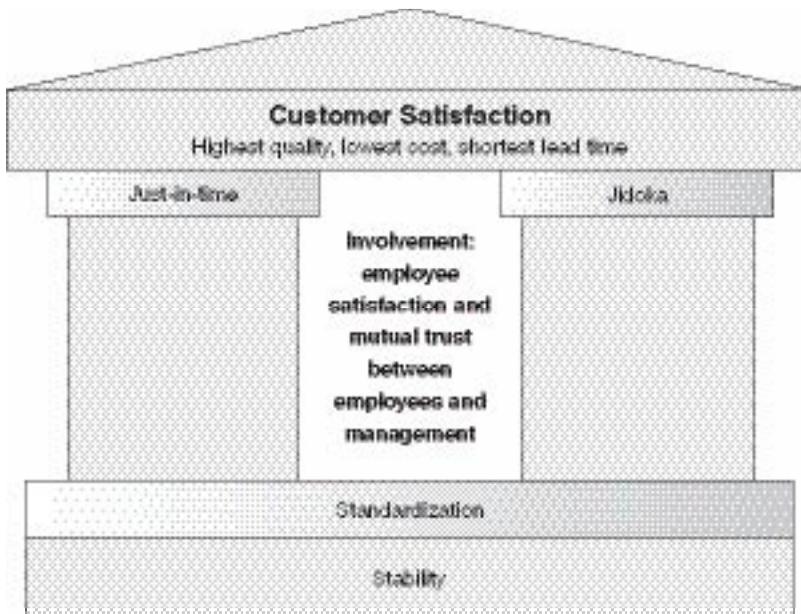
Lean Thinking, also referred to as the Toyota Production System, is a management philosophy with its roots in the manufacturing sector [15]. In 1990, Womack and colleagues [16] published their research findings on the manufacturing processes of several automobile companies from around the world. In their book *The Machine That Changed the World*, they reported that Japanese manufacturing plants produced better quality cars with less defects while at the same time utilizing fewer resources, including employee time and space. Because these companies were able to do “more with less,” Womack and colleagues coined the phrase “lean production” to describe this manufacturing management model [16].

As the idea behind lean production spread across other industries, this managerial model came to be known as Lean Thinking. The fundamental message of Lean Thinking is to focus on “the endless transformation of waste into value from the customer’s perspective [17].” Waste is defined as any activity or process step that does not add value to the delivery of the product as desired by the customer [17], and value is “the capability to deliver the product to the customer, at the right time and at an appropriate price [9,17].”

As Toyota built up the Toyota Production System, the fundamental principles were illustrated through a model called “the house of Lean” (also called “house of Toyota”) [18,19] (Figure 1). Some HCOs adopting the Lean Thinking approach have modified this “house of Lean” for the health care sector (Figure 2). The foundation of the health care “house of Lean” is based on the ideas of stabilizing the processes of providing clinical care, standardizing these

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From the Department of Internal Medicine, University of Michigan, Ann Arbor, MI.



**Figure 1.** House of Lean as developed by Toyota and modified by other manufacturing organizations. Jidoka is a Japanese word that is defined as “automation with a human mind,” implying that workers are automatically directed to something that has led to an error and work to improve that part of the process right then and there.

process steps whenever possible, and allowing for continuous learning through the implementation of the Plan-Do-Study-Act (PDSA) cycle. The ongoing Lean Thinking work in the organization is supported by its 2 pillars of just-in-time production and built-in quality, which help to produce the right work in the right quantity at the right time and foster an environment where the workers can identify the things that go wrong and fix the problem as proximal to the situation as possible. The focal message of this model is to establish an organization that works to continually improve the process of delivering care for patients where quality, safety, efficiency, appropriateness, and service are the primary goals behind how we approach patient care (“the roof”). At the center of the model is the health care workers’ involvement in the processes of care—their dedication and motivation to find better ways to provide care to patients is what will continually drive the growth of a Lean HCO.

#### The Lean Thinking Model: A Closer Look Stability, Standardization, and PDSA

The foundation of a Lean Thinking organization is based on establishing stability and standard work within the work areas of interest. The goals of stability and standardization are to promote a working environment in which the health care workers are able to perform their daily work in a standard way that the workers created (not just the way work evolved), and to constantly be aware of the things that go wrong (as they usually do). One of the ways in which this can be accomplished is by applying standard Lean tools,

such as the 5S workplace visual management system, and standard operating procedures by sequencing work.

The 5S visual management system is designed to help the workers establish and maintain a clean and safe work environment that is easy to use and that makes it easy to recognize when something is out of the ordinary. 5S (short for Sort, Set in order, Shine, Standardize, and Sustain) is a routine maintenance procedure performed by workers to ensure that their environment supports the work they are trying to accomplish and leads to reduction in waste of time and potential errors. **Figure 3** shows before-and-after pictures of a 5S visual management change that helped vascular access nurses standardize their intravenous supply carts and reduce the amount of time spent looking for supplies and going back to the central supply room to stock something that should have been there. This change also improves patient safety by reducing the chances of administering a wrong medication that may have been previously unlabeled or mislocated [20].

In standard work, another Lean tool that can be utilized is establishing a standard sequence of work that is firmly followed every time that particular work needs to be done. In health care, there are areas where we do exceptionally well with this, and many areas in which we can improve. The benefit of implementing a standard sequence of work is to allow the workers to recognize when there is something wrong in real time and take action to fix the problem immediately.

An example of where sequenced standard work is being done well in health care is in administration of blood



**Figure 2.** House of Lean as modified by a health system. Other health systems that have implemented the method as part of their corporate strategy have developed similar conceptual models to help their workers better understand the ideas behind Lean Thinking in health care.

products to patients. While the absolute rate of a transfusion complication is low [21], the potential consequences associated with such an event could be catastrophic. Thus, health care organizations have developed a standard sequence of work that needs to be followed every time blood products are administered. A typical work sequence entails the following: (1) the health care worker confirms the need for a blood product by checking the lab value; (2) consent is obtained from the patient; (3) there is a process to type and cross match the donor's blood product with the patient; (4) the blood bank double checks to ensure the match of blood product to the patient and sends up the blood product to the nursing staff on the floor; (5) on the floor, 2 nurses check and cross-check each other to confirm the patient is the correct individual that is to receive the blood product, using a closed loop communication method; and (6) the patient is monitored with standardized vital signs over an established period of time. Following this process every time (with the possible exception of emergent situations) ensures that the likelihood of a mismatched blood product being administered to the patient is near zero. Any deviation from this standard sequence of work should raise a red flag to the workers involved in the patient's care to stop and consider whether an error may have occurred and fix the situation before the process can progress any further downstream to the patient.

The ability to work in an environment where stability has been established and standardized work is the norm allows the workers to practice routine PDSA cycles. This traditional quality improvement methodology needs to be a continu-

ous practice for any organization seeking to improve their patient care activities.

#### Just-in-Time Production and Built-in Quality

The 2 pillars in the "house of Lean" illustrate the ideas of just-in-time production and built-in quality. Just-in-time production refers to the idea of producing the right item at the right time in the right quantity [19]. To produce any more or any less, or too early or too late, may lead to a delay, waste, or safety issue. Batching is an extreme form of not producing just-in-time work, where a burst of work is done over a short period of time. This means that jobs pile up in queue waiting for the next spike of activity. Health care workers have traditionally worked in settings that have supported the model of batching, setting up the situation where error detection and treatment plans can be delayed. For example, as physicians, we "round" on all of our patients, then sit down to write all of our orders in a batch. This could lead to an unintended result of multiple patients' orders being written over a short period of time. This means that there is a batched set of orders going to nursing, pathology, radiology and other hospital support services. This imposes the cost of variability on these other services in the hospital. From a systems perspective, efficiency can improve if these activities can be done 1 patient at a time. **Figure 4** illustrates the idea of how just-in-time processing can help detect problems as proximal to the situation as possible.

The concept of built-in quality is to ensure that defects are not passed on to the next step(s) of the process, but if one is



**Figure 3.** After redesign and rearrangement of the “work place” by vascular access service nurses using the “5S” (Sort, Set in order, Shine, Standardize, Sustain) Lean tool, nurses were better able to recognize when their supplies were out of place, restock the necessary equipment in a more timely fashion, and identify any potential safety or quality issues with the cart.

passed on, the defect is identified and corrected right away as opposed to waiting until the work has already passed on to the next step(s) of the process or has reached the end of the process. An automated process that could be implemented to halt the work from proceeding when a defect or an error has been detected would be ideal. An example from the early days of Toyota was the invention of an automated loom machine that would stop if any threads had snapped [15]. This concept of not allowing the work to proceed as soon as the worker identifies that there is something wrong should be explored and adopted further in health care. An example in health care that demonstrates the concept of not allowing work to proceed if a defect has been detected in an automated way is the electronic tagging of surgical sponges [22,23]. In a commentary, Rattner [23] describes a scenario in which the patient’s surgical plan and course is “tracked” by small identifier devices that ensure that the correct patient

**A. Batch and queue**



6 process steps for the first patient to have tests ordered and blood drawn. 10 steps to complete work for all patients before the laboratory starts analysis.

**B. One-piece flow**



2 process steps for the first patient to have tests ordered and blood drawn. 6 steps to complete work for all patients before the laboratory starts analysis.

**Figure 4.** Just-in-time production refers to doing work for the right item at the right time in the most appropriate quantity, and moving this along to the next step of the process. Anything short of this goal can lead to delays and errors. (A) illustrates the traditional batch and queue work flow of a physician in the hospital ordering lab tests. She may order lab tests for all of her patients in one sitting, while the phlebotomist waits. After 5 process steps, the phlebotomist begins his work and collects the specimens from the patients. This type of work flow delays the total time for the first patient and all of the patients to have their labs drawn. The one-piece just-in-time flow (B) would allow for the first patient and all the patients to have their labs ordered and drawn.

undergoes the correct procedure, performed by the correct providers. Further, these devices would be able to ensure that the patient does not leave the operating room if there is any inconsistency in the count of surgical sponges or instruments. The technology is available and utilized in other industries, and HCOs need to explore whether this automated method of detecting errors can improve the work flow of the health care provider.

**Focus on the Patient by the Workers**

The inherent goal of adopting and implementing the concepts of stability, standardization, PDSA cycle, just-in-time productivity, and built-in quality is to serve the needs of our patients. Their expectation is to receive care that is built on quality, safety, efficiency, and appropriateness, with service. HCOs that can successfully emulate the model developed by Toyota in the manufacturing sector may be able to indeed meet the needs of patients with these attributes in mind.

The core driver behind this model, however, is the

engagement of the workers. Toyota has been successful in most part due to the culture they have been able to establish that encourages its employees to focus and improve on the stability, standardization, PDSA cycles, just-in-time production, and built-in quality concept. It is their belief that the cars that they make are not just means to an end but a service that they have the privilege to provide for their customers. Health care workers have the privilege to care for the patients who place their lives in our hands. By tapping into the imaginative and resourceful minds of the health care workers within each HCO, there is a tremendous opportunity to improve the way we provide care to our patients.

The ultimate goal of a Lean HCO is to have its frontline workers monitor their workflow, stay alert to the things that can go wrong in their work processes, and work together to fix the problem—not only for that occasion, but for potential future occurrences by getting to the root cause(s) of the problem. If individual health care workers can stay aware of their work processes, then anything that occurs contrary to how work should flow is immediately revealed to them as an opportunity to improve.

#### Critical Elements/Challenges

HCOs with an interest in adopting a Lean Thinking approach to their clinical quality, safety, and efficiency improvement initiatives should consider some specific factors and challenges prior to getting started [20]. As with all change management models, a critical element for a Lean Thinking initiative to be effective is support from senior management. Their commitment not only initiates the movement but also helps remove barriers identified as the projects progress. For organizations just getting started in a Lean Thinking initiative, they should consider seeking out expert guidance for their initial projects. Another key element is the need for a well-structured set of metrics that will be used as targets and used to drive change by the frontline workers. These measurements should be made on a regular basis and be readjusted based on the most recent findings [24]. Aligning the individual goals, projects, and metrics so they improve the patient's experience requires planning, with lots of conversations at all levels in the organization [25]. Last, Lean organizations and units must provide the flexibility for frontline workers to experiment with improvement ideas at the site and time they identify a problem. Frontline management need to avail themselves to the area so that pragmatic experimentation and changes can take place in as close to real time as possible [26,27].

#### Conclusion

In summary, the focus of Lean Thinking in health care is to foster a working environment where the frontline workers (1) perform the daily work in a standard way that we cre-

ated (not just the way work evolved); (2) remain constantly aware of the things that go wrong, as they usually do; (3) fix the problem as close to the event as possible; and (4) find and fix the root causes of the problem, so that it never happens again [27]. The health care "house of Lean" provides an illustrative model of how and why health care workers need to constantly stay focused on the needs of our patients.

Lean Thinking has been demonstrated to be a successful process and quality improvement method in the manufacturing industry [16,17], and it offers HCOs the opportunity to achieve higher quality and safer health care. Improvements in efficiency and appropriateness in health care can lead to savings in both financial and human resources, which in turn can be used to provide more timely access or to redirect resources to improve other areas of health care. Lean Thinking provides a framework for workers to collaborate more closely and to address problems immediately using onsite experiments. The future of health care is likely to place only greater pressures on the individual HCOs to meet specific quality, safety, efficiency, service, and appropriateness measures. Lean Thinking may provide the means for organizations to create greater value in their health care delivery mission.

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*Corresponding author: Christopher S. Kim, MD, MBA, 3119 Taubman Center, Box 5376, 1500 E. Medical Center Dr., Ann Arbor, MI 48109, seoungk@med.umich.edu.*

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