How Lean Design for Healthcare Can Improve Your Hospital's Bottom Line

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Abstract

The lean process enhances efficiency by eliminating waste such as instrument processing and distribution of supplies. A panel discussion was held in March 2011 at the American Society of Healthcare Engineers Professional Development Conference in Tampa, with panel moderator Alan Sullivan, AIA, ACHA, and three panelists chosen for their diverse backgrounds and their involvement with similar approaches to cutting costs in healthcare environments. Sullivan is director of the healthcare studio at KZF Design in Cincinnati and works with functional concepts during early planning stages to plan efficient departmental adjacencies and sharing of common services in a "just in time" methodology. Mike Smith Sr. (Col. USAF Ret.) led the U.S. Air Force's continuous process improvement program (AFSO21), which focused on increasing Air Force operational effectiveness and business efficiency. This work included facilities, base infrastructure, acquisition, aircraft maintenance, healthcare, and training/ operations as well as base realignment for increased efficiencies. Mary Ann Derr, RN, MBA, works with clinical lean process to reduce workplace waste and inefficiencies as well as identify patient safety and infection control issues. W. Patrick Davey, MD, MBA, worked as a managing partner for an eightphysician dermatology surgery practice in the design of a new lean process surgery center/ clinic, the largest freestanding dermatology surgery center in the country. This paper is a summation and further analysis of the discussion among these four professionals and demonstrates how lean design for healthcare can improve hospitals' operational efficiency and cost effectiveness.

Healthcare Reform and Lean Process

Healthcare costs are being scrutinized from every angle. With costs escalating out of control, hospital systems and operations are reviewing internal processes and options to streamline efficiency, productivity, and workflow, contributing to quality patient outcomes and cost savings. This challenge brings multiple perspectives to improve facility responses to cost control by evaluating, reviewing, and containing the existing processes to achieve this goal.

There has been a good deal of discussion about healthcare reform. As they did nearly two decades ago, hospitals are aggressively purchasing physician groups and attempting to reel in their practices. We have been through the Balanced Budget Act of 1992 and the rise of managed care. It is time to embrace a new era of cost reduction while increasing quality of patient care, which is indeed a monumental challenge. These are noble objectives. Medicare and Medicaid reimbursements have been minimized, and hospitals are suffering financial deficits.

Discussions focus on the cost savings realized by lean planning and functional reorganization of a facility to bring those dollars to a hospital's bottom line. This initiative is targeted either by department or by an overall program to examine the entire hospital. Focus on key areas that have operational inefficiencies stand to gain the most. The lean process enhances efficiency by eliminating waste such as instrument processing and distribution of supplies. However, it must be noted that the best way to implement a program for lean design is to undertake a comprehensive program with complete buy-in by the "C–Suite."

Transitioning Air Force and Toyota Processes to Healthcare

Since his retirement, Mike Smith has used his experience with the Air Force and now as president of Total Systems Development (TSD) in lean design of hospitals and manufacturing facilities by applying the Air Force process with Toyota and auto industry techniques to the hospital environment. The Air Force AFSO21 program was able to incorporate lean process into Air Force hospitals and clinics and has applied the lessons learned to develop more efficient patient care delivery while improving operational costs.

The application of lean in a hospital design setting requires drilling down into the operational processes early in the planning stages to determine how work is actually accomplished in each area. Once these processes are mapped, inefficiencies can be identified and "planned out" of new or existing departments. This early process can be applied to hospital master planning, and results may include determining appropriate departmental adjacencies, improving patient and staff flow by decreasing distances traveled, and designing flexible shared space. A business plan can then be prepared with a more accurate foundation since operations can represent as much as 70 percent of project cost. In the old planning process, the foundation was to simply guess and wait for results. Applying lean design and its principles to the planning process will produce better results.

This improvement is based on five guiding principles of lean:

- Value
- Value stream
- Flow
- Pull
- Perfection

Value is determined in the eyes of the customer. The value stream is the set of activities for each product/process that produces value. Flow is the progressive achievement of value without interruptions such as queues, stoppages, or backflows of products, information, or services. Flow is created by removing waste from processes. The "pull" is a system in which a supplier produces nothing until a customer signals the need. The principle is to always compete against perfection, not just your current competition. Perfection comes from the perspective of the customer.

The classic Toyota system and the Air Force identify eight kinds of waste to benchmark and evaluate processes:

- Transportation
- Inadequately used intellect
- Motion
- Excess inventory
- Nonstandard work
- Waiting
- Overproduction
- Defects

The benefits of continuous process improvement (CPI) are to reduce lead time, improve the speed of the process, lower costs, improve quality and safety, develop an agile response to change, and engage people to solve the root causes of problems.

The Air Force's massive enterprise transformation, called AFSO21, involved more than 700,000 people across 83 installations worldwide. The process included more than 5,000 aircraft and more than 50 percent of the total U.S. government energy consumption. The annual budget is \$127 billion, and its personnel and leadership team are in constant motion.

The Air Force has strategic imperatives that require seeking operational improvements and business efficiencies. These imperatives include congressional budget pressure, a highly dynamic global war on terrorism, increasing fleet age (the average aircraft is now more than 26 years old), rising costs of personnel and healthcare, and a 31 percent increase in fuel cost in the past several years. The outcome of applying lean was a streamlined process in which the number of steps was reduced from 20 to nine by standardizing work and eliminating duplicate data entry. AFS021 represents a fundamental transformation in how airmen work. Early objectives of the program included increasing the productivity of people, the USAF's most valued asset. Another objective was to see a significant increase in availability rates of key USAF assets as well as to improve response time and agility. Other key objectives were to sustain safe and reliable operations while improving energy efficiency. The final results were to establish a resilient CPI foundation.

The Air Force's eight-step problem-solving methodology can easily be translated into a hospital environment.

- 1. Clarify and validate the problem
- 2. Breakdown the problem and identify performance gaps
- 3. Set improvement targets
- 4. Determine root causes
- 5. Develop countermeasures
- 6. Implement countermeasures
- 7. Confirm results and process
- 8. Standardize successful processes

Case Studies from the Air Force

The examination of the healthcare component developed several case studies from the Air Force initiative. The east coast port realignment saved \$42 million annually because of more efficient routing of aircraft traffic. This kind of global mapping can be used to track and reduce nursing staff travel and improve time management for an overworked nursing staff.

The Air Force studied the vehicle registration process at one of its European bases. The average wait time was reduced by 76 percent while simultaneously decreasing the need for multiple patient visits. This can be directly applied to the hospital registration processes. In one USAF hospital, new electronic medical record requirements and non-value-added activities resulted in appointments scheduled for 20 minutes actually taking up to 40 minutes to complete. Staff was staying late and patients were unhappy. The outcome of applying lean was a streamlined process in which the number of steps was reduced from 20 to nine by standardizing work and eliminating duplicate data entry. The room setup was tailored and standardized, reducing setup time. A nurse was engaged in the process of managing the appointment scheduling system to ensure that the patients scheduled were the ones with the most pressing medical issues. Satisfaction levels increased from 85 percent to 95 percent, and a 20-minute appointment now takes 19 to 20 minutes to complete. The staff now leaves on time and patients are satisfied.

Decreasing pharmacy wait time at Goodfellow and Tyndall Air Force Bases became the subject of an improvement activity. These clinics reduced prescription wait times and dispensing errors by redesigning the prescription process. Part of this redesign included adding automated dispensing machines to fill more common prescriptions. As a result, the average prescription process went from 35 minutes to 15 minutes on over 90 percent of all prescriptions. In addition, the capacity and speed in the pharmacy refill process increased by 600 percent. Automation was a key component in eliminating errors as well as filling prescriptions with increased efficiency.

Getting airmen back on the job was the goal for a surgery project that virtually eliminated the backlog of patients waiting for orthopedic surgery, increasing OR usage from 73 percent to more than 90 percent. There was a 16 percent overall increase in productivity representing more than \$2 million in surgical output per year. This result was achieved without increasing resources or the number of personnel. In a similar case study the Keesler AFB ambulatory surgery unit decreased patient admission time 56 percent, from 172 minutes to 75 minutes, and reduced staff 71 percent, from 14 to four.

Lean is a tool to aid in achieving the goal of cost savings and making a direct contribution to the bottom-line budget of a hospital.

Using Lean in the Clinical Process

Mary Ann Derr uses lean processes to streamline workflow, eliminate waste, enhance throughput, organize the clinical work space, and provide quality training, all of which inspires staff, improves morale, and contributes to quality patient outcomes. Lean is a tool to aid in achieving the goal of cost savings and making a direct contribution to the bottom-line budget of a hospital.

Ergonomics and safety are areas of great concern for hospitals. Back strains are one of the most often reported injuries for clinicians. The use of lean processes made it possible to identify these potential areas and eradicate them, saving thousands of dollars and protecting staff. Other concerns include needle sticks, cross-contamination, joint deterioration, and stress-related diseases. These issues are very costly for hospital operations, because they have a negative impact on employee satisfaction and challenge recruitment and retention efforts.

Again, cost savings are realized by importing lean processes. Lean processes in healthcare help reduce accidents, prevent crosscontamination of nosocomial infections, and reduce ergonomic stress by identifying and removing barriers to the safest and most efficient delivery of patient care. The lean approach affects all of these by optimizing processes and work space organization. Lean also decreases the cost associated with risk.

A culture that has fully adopted the leanest process by eliminating waste will accomplish the goal with the fewest resources. These are the hospital facilities that will stand in the face of economic, political, and regulatory constraints. Fully adopting lean processes allows hospitals to compete for excellence in this tough and strained healthcare market.

The categories of waste found in healthcare environments vary depending upon the specialty unit and the acceptance of improved situation awareness. Lean allows us to consider these major categories of waste and opens the perspective of adopting improved lean processes. Areas of major waste include confusion, motion, waiting, processing, inventory, rework, overproduction, transport, and unused employee creativity. Productivity is increased by reducing wasted motion and time and allows nurses to accomplish more in less time, thus contributing more time and attention to patients.

When errors in medication administration became an issue, the nursing process developed the Five Rights. The adoption of this critical yet simple process resulted in an overall improvement in medication administration without error. This is an example of identifying a need and developing an improved process, such as lean. The Five Rights of medication administration are the following:

- 1. Do we have the right patient?
- 2. Do we have the right medication?
- 3. Do we have the right dosage?
- 4. Are we administering the medication by the right route?
- 5. Are we administering the medication at the right time?

Just as in any other routine process, identifying the Five Rights leads to fewer errors, better quality patient care, and better outcomes. Essentially, this leads to potential savings in lives and dollars. Lean process contributes to getting it right!

The average hospital contains more than 40 separate departments. The most efficient hospitals use lean process to reevaluate departmental boundaries, adjacencies, opportunities for shared services, and elements that contribute to evidence-based design through data collection. This is an excellent platform for cost savings from every angle. Fully adopting lean processes allows hospitals to compete for excellence in this tough and strained healthcare market.

Leadership in Lean

Most scholars of healthcare reform believe there will be three elements in the future for healthcare: performance measurement, "value" based on quality and cost, and teamwork. The development of performance metrics has already begun in the government's Product Quality Research Institute (PQRI) program, which many subspecialty organizations have begun to help develop.

The "value" equation is yet to be defined because quality is so difficult to measure. The cost of providing a healthcare service will be in the formula. Healthcare services will no longer be provided by one physician in isolation but rather by an integrated team of providers. This future approach to healthcare provision will have facility design implications, and the lean process will have to adopt these future trends. The third fact is that improvement in performance requires teamwork across disciplines, and superior coordination is required to achieve performance goals while sharing information.

Leadership is the ability to tell people where they should go and why. Management is the ability to get people there. To implement a lean process, management must set up the process and ensure its implementation and successes.

At Virginia Mason Medical Center, physicians and staff come second to the patients. For example, in the cancer center, physicians and staff come to the patient, who stays in a room with natural light and artwork. The physicians who bought into this process engineered a financial turnaround, and Virginia Mason developed national prominence. The Toyota production system that eliminates waste and improves the return on investment was used by Virginia Mason as a tool in its financial turnaround.

At the Cleveland Clinic, CEO Delos M. Cosgrove, MD, MBA, has stated that "patients first" means a serious commitment to measuring outcomes and has demonstrated that commitment to the world on the clinic's Web site. He has established "institutes" defined by patient conditions; for example, the Heart and Vascular Institute is staffed with cardiologists, cardiac surgeons, and vascular surgeons.

W. Patrick Davey, MD, MBA, was managing partner for a new 45,000-square-foot dermatology clinic/ambulatory surgery center. Dr. Davey used lean principles to develop what was the largest freestanding dermatology center in the United States. "We began by considering how the patients would most efficiently move through the building. Once that was established we had to consider how to station the staff and equipment needed to optimally serve the patient's needs." The lean process was incorporated into this design-build surgery center to bring two offices together into one building with a common culture and an emphasis on patients as "clients." The lean process starts with the client goals and focus. This project was to be designed and built on established time and budget constraints agreed to by all the physicians as stakeholders.

Design features incorporated into the lean process included treatment "pods" for each physician. Each pod had three exam rooms and a treatment room that could be shared with another pod to maximize efficiency. By designing for the future with electronic medical records, the paper medical records were moved to the basement level until the electronic medical record system could be developed and implemented. Moving medical records off the clinic floor allowed maximum efficiency in building stacking between clinic and surgery floors. Every exam room had daylighting, and offices for physicians were located on interior walls. A split-level building made efficient use of the site and acted both as wayfinding and a barrier between the clinic and surgery patients for privacy.

Dr. Davey's EMBA team at the University of Michigan's Ross School of Business evaluated the space utilization for an operations course by using a time study and the surgery center's financial documents. The team analyzed areas for improvement in the surgical process that would have a positive impact on patient satisfaction.

Healthcare services will no longer be provided by one physician in isolation but rather by an integrated team of providers. According to Davey, "We identified ways to increase the efficient use of key resources so that patient flow could be improved giving us the ability to treat more patients daily." From this analysis, the team developed a value stream model to identify the affect of process changes on each process step, patient wait times, and resource utilization. Davey continued:

We found that the patient wait time was decreased and patient satisfaction increased by eliminating patient batching. By staggering the patient arrivals the patient care was completed in a shorter period of time. An additional patient could be added to the surgical schedule. In order to further increase the patient load the surgery center would have had to increase laboratory personnel which did not make financial sense. By using this design and evaluating the surgical process with lean techniques there was increased customer satisfaction, more efficient and effective patient care, and as a result increased profitability.

Lean and the Future of Healthcare

A brief look at the development of our healthcare system over the centuries will help provide an understanding of where healthcare and lean design for healthcare facilities are headed in the future. Medicine has gone through five identifiable phases: physicians began with bedside observation; wrote descriptive accounts of what was seen, heard, and felt; moved patients into a hospital setting; worked to improve public hygiene; developed laboratory testing; and now are moving to today's healthcare system.

The lean process is a useful tool for today's hospital, but we are seeing the emergence of the Medical Home, which allows primary care physicians to coordinate the patient's care, and Accountable Care Organizations, which tie healthcare reimbursement to providing quality patient care based on performance metrics. How does lean fit into this new model? With lean process, the quality of care improves the patient experience as the processes and organizational competency improve. Nurse satisfaction and retention are improved with workplace and workflow improvements. Lower costs and higher margins will allow the organization to do more with fewer resources.

The lean process can be used at the macro level to streamline an entire system of various components and eliminate waste. At the micro level, lean can be used to improve the efficiencies of the individual workplace. Lean can also be used to eliminate errors in processes and improve quality—both important issues in today's cost-driven environment.

However, the best benefit of lean design is to begin at the top with management "buy in" and create goals for improvement. From there, the design and planning team can incorporate the value stream at the earliest level of planning when the space program is being generated. By discussing operations hand-in-hand with design, your organization can achieve the best and most cost-effective solution, while continuing to improve at the micro level of operations.

Resources

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