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The Lean Enterprise Meets Health Care

By Jeff McAuliffe, Tom Moench and Joan Wellman

Taking a cue from the Toyota Production System, several medical centers in the Pacific Northwest are achieving dramatic performance improvements.



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Imagine an increase in surgical case-cart assembly accuracy of 118 percent, or a reduction in IV pump cleaning costs from $12.50 to 67 cents. Such dramatic improvements are commonplace in the lean health care enterprise. Health care executives are experiencing renewed hope as lean practices from the Toyota Production System bring dramatic improvements of 50 to 100 percent in employee satisfaction, quality, safety and costs.

Where It All Began

Soon after World War II, Toyota decided to address its reputation as a low-quality manufacturer. Taiichi Ohno, a Toyota plant manager, observed that waste in human effort, materials and time were the obstacles to faster, less costly production. Ohno envisioned a waste-free system of work and spent the next four decades developing the Toyota Production System (TPS). (See *The Toyota Production System*, by Taiichi Ohno [Productivity Press, 1988].)

Today, Toyota is not only the undisputed quality leader in its industry, it is the undisputed low-cost producer, able to respond to market demand with lightning speed, and the envy of manufacturers worldwide. James P. Womack and Daniel T. Jones chronicled the TPS, calling it the "lean organization" in *Harvard Business Review* ("Beyond Toyota: How to Root Out Waste and Pursue Perfection," Sept/Oct 1996).

The TPS and Health Care

As industrial organizations achieved dramatic performance breakthroughs using the lean strategy, executives associated with health care in the Pacific Northwest took notice. They knew that health care was beset by unacceptable levels of medical errors, a public demanding higher quality, scarce resources and no clear models for re-inventing the workplace.

In 1995, Ken Graham, CEO of Overlake Hospital Medical Center in Bellevue, Wash., hired consultants from Boeing Commercial Airplane Group's lean initiative. Two years later, CEO Curtis Roberts at PeaceHealth in Eugene, Ore., began implementing the lean organization as a fundamental strategy. (See Chris Rauber, "1999 Up & Comers," *Modern Healthcare*, 9/13/99, p. 60.) By 2001 the lineup of prestigious Pacific Northwest health care organizations using lean thinking included Virginia Mason Medical Center, Children's Hospital and Regional Medical Center, Swedish Medical Center, The Fred Hutchinson Cancer Research Center and the University of Washington Medical Center, all in Seattle.

The Lean Way

Lean implementation, whether in the manufacturing or health care setting, begins with education of the entire staff on the six practices of the lean organization:

Eliminate waste. The mantra of a lean organization is to "relentlessly search for and eliminate waste." Why is waste seen as the root of all evil? Wasteful steps add cost, increase time to respond to patients, and multiply opportunities for errors. This single practice successfully tackles cost, time and quality simultaneously. Below are some examples of waste:

- Over-processing--completing work before the patient needs it, scheduling patients to arrive before services are available, batching surgical case carts the night before operations, excessively checking consents, and repeatedly collecting history and physicals;
- Correction--dealing with patient complaints, medical errors and all their aftermath;
- Inventory--work-in-process as well as idle supplies and materials;
- Waiting time--patients or staff having to wait for anything;
- Searching time--time spent looking for information, people, supplies and equipment;
- Transport--needless movement of patients, supplies and information (e.g., a medical record);
- Space--storage of unneeded or excess supplies;
- Complexity--adding workarounds, specialized forms or nonstandard order sets to work processes.

The early work at Overlake Hospital Medical Center found that 91 percent of the time spent getting a first-unit dose of medication to a nursing unit was waste. The vast

majority of this waste of time was due to the order's sitting idle in a queue. At Swedish Medical Center, only four minutes of a 21-hour pump cleaning cycle were value-added. The rest of the time, the pump was waiting to be taken for cleaning, was being transported to cleaning, was in line to be cleaned or was being transported clean back to the nursing staff for patient use.

Install visual systems. The adage "a place for everything and everything in its place" is foundational for managing a lean organization. In messy work areas, unneeded items are removed to make inefficient space more productive. Needed supplies, information and equipment are reorganized for fast retrieval. Work process steps are made visible so abnormal conditions and barriers are easily detected and corrected.

A manager can rapidly ascertain the pace and quality of work performance through a simple, visual sweep of signs, supply and equipment demarcations, work-in-process locators and other visual cues in a more ordered work environment. (see figure 1 below)

Ensure quality at the source. Because human inspection is always subject to error, lean organizations build quality into the process rather than rely on inspection further down the line. Mistake-proofing techniques are used to prevent errors. Where mistake proofing is not possible, quality is ensured by identifying and eliminating errors before they are passed on to the next person.

One Seattle hospital experienced a high level of filling errors and stock-outs in automated (Pyxis) medication dispensing machines located on its nursing units. Using lean principles, a team of pharmacists and pharmacy technicians standardized work methods--including checking for accuracy at the point where medications are picked from pharmacy inventory (rather than further downstream on the nursing units). As a result, calls from nurses regarding stock-outs were reduced by 45 percent. Pyxis station misfills were reduced by 40 percent. Technician-picking errors were reduced by 86 percent.

Redesign for steady flow to meet the customer's demand. When steps that add value are differentiated from wasteful steps, the process is redesigned to eliminate work queues and bottlenecks and to improve timeliness of service. Products and services are "pulled" by customer demand at a steady-flow pace so that customers receive just what they want, when they want it and at the desired quantity.

Swedish Medical Center put an end to its batch-processing model in which a day's worth of case carts were assembled the day before surgery. The new steady-flow process is a "pull" system: carts are called for and assembled just in time for the next surgery. This change reduces the assembly lead time from 20 hours to just 10 minutes and eliminates problems associated with surgery schedule changes.

Establish standard operations. Standard operations is the effective choreography of people, information, supplies and equipment into reliable processes that deliver better quality, in a safer manner, at less cost. Toyota's rapid process improvement (RPI)

methodology, a key method for installing reliable processes for standard operations, asks stakeholders to define improved work sequences explicitly. Managers then ensure that everyone consistently follows the process and applies single-point accountability--so that the process can be revisited every 90 days.

Ron Kirshner, M.D., chief of cardiac surgery at Rochester General Hospital in Rochester, N.Y., was an early adopter of lean concepts in medicine. He says: "We are crazy about standardization. We standardize everything and then standardize our standardization. It is like money in the bank." (See the Institute for Healthcare Improvement Cardiovascular Collaborative videotape series, 5/21/99.)

An RPI at Swedish demonstrated "money in the bank" when it redesigned and standardized the patient room cleaning process to incorporate intravenous pump cleaning. As a result of this work, IV pumps were no longer traveling throughout the hospital to the basement for cleaning. And dramatic improvements were obtained in the cost of pump cleaning and the lead time for pump availability. (See figure 2 below.) Infection control factors were also improved because soiled equipment no longer left the nursing floors.

Engage and respect everyone's expertise. While some executives rely on "lean experts" to implement lean practices, most executives in Pacific Northwest health care organizations take their lead from Toyota. In addition to educating all staff, Toyota's lean practices rely heavily on the RPI workshop to engage staff. This approach not only trains staff quickly on lean principles and methods that are immediately used to redesign their work processes and workspaces, but RPI participants also achieve dramatic, sustainable performance breakthroughs in one week or less with increased commitment and ownership of the work. Empowered employees at Overlake Hospital Medical Center have used the RPI methodology to improve the unit-dose pharmacy process by 50 to 100 percent. (See table 1 below.)

When Dr. Gary Kaplan, CEO of Seattle's Virginia Mason Medical Center, reported significant financial success (with net operating income rising from a $2 million loss in 1999 to $22.8 million in the black in 2001 and 2002 as a result of lean practices), he also noted that "more than half of our 5,000 employees have been trained or at least introduced to the tools of lean [practices] and the tenets of waste reduction." (See *Puget Sound Business Journal*, 12/18/00 and 9/15/03.) Dr. Kaplan's leadership included taking physicians and hospital executives to Japan to learn about lean practices first hand on Toyota's manufacturing floor. Because the health care environment is largely composed of knowledge workers, such an approach is good for staff morale: it improves the bottom line.

Lean Turnaround

The promise of the lean organization brings renewed hope for the entire health care industry. Imagine our health care organizations with errors near zero, where everyone has quick access to diagnosis and treatment, where year-by-year costs are stable or even decreasing, and where revenues are rising. Sound like a fantasy? The early

pioneers in lean manufacturing envisioned a similar "fantasy." Those who were bold enough to embrace the lean revolution early have left their competitors behind.

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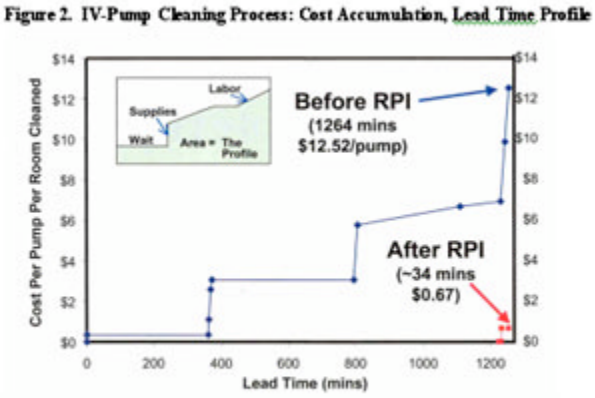
Figure 1. Machine Room #3, Swedish Medical Center, Seattle

Before


After

Figure 2. IV-Pump Cleaning Process: Cost Accumulation, Lead Time Profile



The cost accumulation, lead time profile shows a 95 percent reduction in processing cost and a 97 percent reduction in lead time.

Table 1. Results of the Unit Dose Pharmacy RPI Workshop, Overlake Hospital Medical Center, Bellevue, Wash.

General	Before	After	Change
# of process steps	25	9	64% reduction
# of value-added steps	4	4	No change
Total process cycle time	70 min.	> 20 min.	71% reduction
# of feet traveled	680-1,130	500	> 50% reduction
Total value-added time	6.5-11.5 min	Same	No change
% non-value-added time	83-91%	57.5-67.5%	26-31% reduction
Number of queues	11	3	73% reduction
Work in process	132 orders	39	70% reduction
# of handoffs	10	5	50% reduction
# of inspection steps	4	2	50% reduction
Variation in methods	High	Low	100% improvement
Variation in cycle time	High	Low	100% improvement

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