



APPLYING LEAN PRINCIPLES TO IMPROVE HEALTHCARE QUALITY AND SAFETY



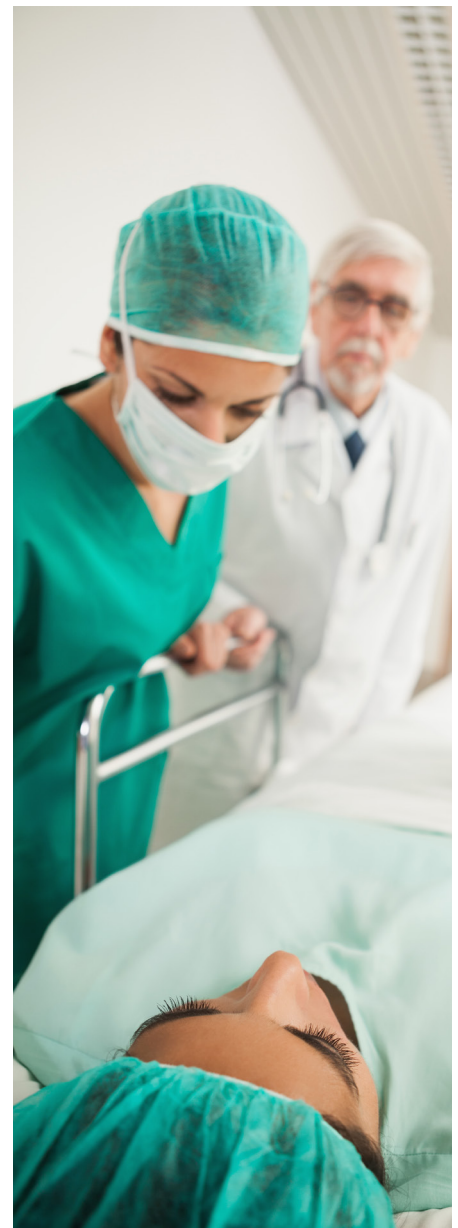
Applying Lean Principles to Improve Healthcare Quality and Safety

As a percentage of its gross domestic product (GDP), the U.S. spends more on healthcare than any nation in the world. According to a 2012 report from the Organization for Economic Cooperation and Development (OECD), the U.S. annually spends 17.6% of its GDP providing healthcare services. This compares with 12% for the Netherlands, the country with the second largest annual spend on healthcare services as a percentage of GDP, and an average of just 9.5% of GDP for other OECD countries.¹

At the same time, the rising cost of healthcare has not directly resulted in better patient care or improved patient outcomes. According to the same OECD report data, while average life expectancy in the U.S. has increased by almost nine years since 1960, the current U.S. average of 78.7 years is a full year below the OECD country average of 79.8 years. Further, according to a landmark study conducted by the Institute of Medicine, preventable medical errors are estimated to result in as many as 98,000 patient deaths each year, with a projected annual cost as high as \$29 billion.² Medical mistakes are believed to be one of the leading causes of death in the U.S., on a par with automobile accidents, breast cancer and AIDS.

In this context, healthcare institutions and professionals are exploring innovative approaches and methods that reduce preventable medical errors, improve patient care and safety and decrease healthcare costs. Increasingly, healthcare institutions are implementing lean operational principles and practices pioneered at Toyota and other industrial companies in the 1990s. By applying lean methodologies to existing systems and procedures, major healthcare institutions are achieving significant improvements in patient safety while also reducing costs.

This UL white paper provides an overview of the application of the lean continuous improvement framework in the healthcare environment. The paper begins with a discussion of the issues and challenges facing healthcare institutions related to patient safety. The paper then presents a brief history of lean principles as applied at Toyota and other industrial companies, before moving on to a review of the lean framework and its application. The white paper also offers brief summaries of specific healthcare cases in which lean methods have been implemented and concludes with a business case for continuous improvement and innovation.





Issues and Challenges in Healthcare Today

No other industry places as high a premium on quality of service as healthcare. Leading companies in other industries often boast that their service quality differentiates them from competitors. But only in healthcare does quality of service have a direct impact on the health and safety of those served. Indeed, service quality that does not meet the minimum required standards of healthcare providers can mean the difference between life and death.

Given the essential requirement of quality of care in the healthcare industry, one would reasonably expect healthcare providers to lead the way in initiating and maintaining effective quality management systems. In fact, healthcare industry leaders have worked for decades to improve patient care through a myriad of quality programs. Unfortunately, many of these quality improvement efforts have fallen short of expectations.

One measure of this shortfall is the human and financial cost from deaths and illnesses attributable to medical errors. According to one study, approximately 200,000 Americans die each year from preventable medical errors and facility-acquired illnesses, at a direct cost of nearly \$20 billion. In addition, the broader economic impact from medical errors may well approach \$1 trillion annually when lost economic productivity due to death or illness is calculated.³

The healthcare environment is also increasingly unsafe not just for patients but for healthcare workers as well. In 2011, one of out every 20 full-time U.S. healthcare workers experienced a nonfatal injury or illness, an incident

rate second only to workers in agriculture, forestry, fishing and hunting occupations. During that year, healthcare workers reported more than 631,000 incidents of injuries or illnesses in connection with their work.⁴ One estimate puts the cost of worker injuries and illnesses in the healthcare workplace at over \$10 billion annually.⁵

These and other statistics clearly illustrate the human and financial consequences when healthcare institutions fail to consistently deliver the highest possible quality of care to patients. They also highlight some of the inherent limits in healthcare's traditional approach to quality management. These limits include: a reliance on a host of individual projects, rather than a coordinated system-wide approach to quality management; a quality strategy formulated and handed down from senior management without input from the employees responsible for service delivery; and the failure to properly align an institution's approach to quality management with its mission and strategy.

The American healthcare industry is currently undergoing an unprecedented transformation, as healthcare providers are actively engaged in efforts to bring their practices into compliance with the requirements of the 2011 Patient Care and Affordable Care Act. As a result, healthcare providers are under pressure to increase access and reduce costs while improving the quality of patient care. Successfully overcoming the limitations of legacy quality programs while also addressing today's challenges requires new approaches to quality management, approaches that can directly lead to better quality of care through improved work flow and increased operating efficiencies.

UL's Involvement in Lean

As part of its commitment to assist healthcare organizations in the application of lean principles and practices, UL has established the Center for Continuous Improvement & Innovation (CCII). The Center trains, certifies, assesses and advises organizations and individuals in the principles of continuous improvement, leveraging years of experience in the application of lean and Six Sigma principles to accomplish one mission: improve value for the customer by providing higher quality and safety with less waste.

To further the mission of the CCII, UL has also formed strategic relationships with other organizations championing the use of lean principles in healthcare. For example, UL has partnered with the ThedaCare Center for Healthcare Value to sponsor Toyota Production System (TPS)/Lean in Healthcare research. UL is also a sponsor of the Healthcare Value Network, a consortium of healthcare providers committed to providing high-quality, cost-effective care through the application of lean concepts.

UL also collaborates with Value Capture, a leading healthcare advisory firm founded by Paul O'Neill, former secretary of the U.S. Treasury and former CEO of Alcoa. Value Capture's proprietary advisory model for healthcare institutions has resulted in significant reductions in healthcare workplace injuries and illnesses while speeding the delivery of services and eliminating waste. The collaboration between UL and Value Capture strengthens UL's existing advisory services by providing UL customers with access to a proven quality and safety improvement model based on lean principles.

Finally, UL is an authorized educational partner of The Shingo Prize for Operational Excellence, a not-for-profit organization located at Utah State University working to establish the global standard of excellence in every industry. The Shingo Prize is named in honor of Japanese industrial engineer Shigeo Shingo, one of the world's thought leaders on the Toyota Production System.

Lean principles are an essential element of UL's own operations and activities. Current UL President and CEO Keith Williams initiated the organization's first lean initiative in 2005 to improve the quality and timeliness of service to its customers. Today, professionals throughout UL embrace lean principles as part of a continuous improvement philosophy that has strengthened the organization and benefited its customers and employees.



The Origins of Lean Principles

Modern quality management programs are rooted in pioneering research conducted more than 100 years ago by Americans Frederick Winslow Taylor and Walter Shewhart. Taylor focused on studying existing workflow processes, experimenting with alternative processes that removed unnecessary or inefficient activities and adopting those processes that resulted in consistent production quality and improved worker productivity. Shewhart was the first to implement statistical process control, a quality control method in which data are regularly analyzed in order to identify anomalous production patterns.

Many of the efficiency assessment methods championed by Taylor and implemented by automotive icon Henry Ford in the U.S. were studied by manufacturers in other countries, including Sakichi Toyoda, a Japanese entrepreneur and textile manufacturer. Toyoda's efficiency investigations were later applied by his son, Kiichiro Toyoda, the founder of Toyota Motor Corporation, initially in the 1930s and especially in the late 1940s and 1950s. Around the same time, Edwards Deming, an advocate of Shewhart's quality control theories, was invited to Japan by the Japanese Union of Scientists and Engineers to train engineers and managers on statistical process control methods. Deming later worked with a number of Japanese corporations and lectured extensively in Japan, resulting in the widespread application of these principles.

At Toyota, it is Taiichi Ohno who is widely credited with developing the Toyota Production System (TPS) in the 1950s and 1960s. Based largely on Shewhart's and Deming's production

efficiency principles, the TPS is a comprehensive, systemic approach to manufacturing that reduces or eliminates waste and production inconsistencies to maintain or increase value to customers. The TPS also embraces a number of underlying principles, including the value of organizational learning as a tool for fostering continuous improvement. The principles and practices collectively known as lean production (or lean, for short) are largely derived from the philosophy and approach embodied in the TPS.

The promise of more efficient production with reduced overhead costs has spurred interest in lean principles for more than 20 years, and lean thinking has been successfully adopted and adapted by a wide range of international corporations at facilities worldwide. Increasingly, lean principles and practices are being applied in non-production environments as diverse as software development and education. More recently, efforts to introduce lean principles in healthcare have gained considerable traction, as healthcare institutions and providers seek initiatives that move beyond the limits of traditional production efficiency or quality management programs. Indeed, lean initiatives in healthcare offer the potential to achieve quality of care objectives, improve patient and worker safety, speed delivery of medical services, and lower costs.

Lean in Practice

At its core, the lean approach focuses on customer value by improving processes to reduce waste and eliminate inefficiencies. Regardless of the specific setting in which a lean thinking is espoused, the application of lean is based on the following five defining principles:

- 1. Specify value** — Define value from a customer's perspective. Learn what a customer values, and how their experience could be improved to support the best outcome.
- 2. Identify value stream** — Evaluate how all the steps of a process or procedure should be organized to deliver a seamless customer experience; eliminate any steps that do not directly contribute to achieving that goal.
- 3. Flow without interruptions** — Whenever possible, eliminate waste between steps of a process so that a product or service is delivered as efficiently as possible.
- 4. Customer "pulls" services** — Allow the customer to receive or request products or services if and when needed; do not push a product or service that a customer is not ready to receive.
- 5. Pursue perfection** — Continuously adapt to an ever-changing environment and customer needs in order to deliver a product or service of the highest possible quality.

The application of lean principles depends on an organization's commitment to continuously improving the value provided to a customer. In practice, a lean improvement system uses science-based problem-solving methods to identify root cause issues, and applies improvement tools to create new standard procedures that reduce waste and improve quality. The effectiveness of new procedures is monitored to assess results and changes are incorporated to further improve the process.



The most successful lean initiatives are: systematic and not project driven; implemented by employees coached by organization leaders and not staff experts; and consistent with an organization's mission and strategy, rather than a reaction to a specific condition or event. Taking this approach, the application of lean principles contributes to the creation of an organizational culture in which continuous improvement is the rule and not the exception.

An essential element of an effective, lean-driven culture is lean leadership. Lean leadership is the commitment of an organization's leaders to empower its employees to continuously identify and implement changes that will improve customer value. In the most successful examples, lean leadership starts at the highest levels of an organization and requires a willingness to ask questions rather than provide answers so that others can develop and implement effective and lasting changes based on their direct experience. Lean leadership also requires an ongoing commitment to training and development so that all employees have the knowledge and the skills necessary to identify root cause issues and to implement changes that improve value. Finally, lean leaders must make sure that the mission and values of their organizations are aligned with the goal of increasing customer value through continuous improvement.

Lean Results in Healthcare

Lean principles and practices are being successfully applied in daily processes used by healthcare leadership and staff at a number of healthcare institutions. In one urban hospital, for example, lean

principles have been applied as part of an effort to eliminate medication errors. The hospital estimated that nearly one-third of pharmacy staff time was spent resolving problems related to incomplete, unclear or illegible medication orders, placing patients at risk and costing approximately \$155,000 per year just to clarify problem medication orders.

In this instance, the application of lean principles resulted in process changes to post-operative and medicine unit orders. These changes have reduced the average amount of time required to process a medication order to less than five minutes. More important, the

changes have dramatically reduced the number of medication orders placed on hold for further clarification, from 2% of all orders to just 0.02%. Problems with post-operative medication orders have dropped from 34% to 10%, thereby decreasing the amount of time patients wait to receive medication following surgery. And the percentage of unclear post-operative medication orders has been reduced by 42%. These improvements have also resulted in a reduction in the time hospital pharmacists spend resolving problems with medication orders, allowing them to focus more time on value-added activities.⁶





In another case, a Florida dental practice applied lean principles as part of its effort to reduce patient and clinician wait times. As a result of its lean initiative, the practice reports an average 79% reduction in the number of visits and a 95% reduction in the time required to return a patient to full health. These changes have allowed the practice to increase by 35% the number of patients seen while also reducing treatment rooms and staff requirements by 40% (achieved without layoffs). And clinicians have seen their available time increase by 82% on a weekly basis, allowing them to spend time with new patients.⁷

Here are summary results from selected other lean healthcare initiatives:⁸

- A children's hospital applied lean principles to empower their staff to eliminate activities that did not add value to the patient experience, reducing costs by over \$8 million during a two year period, while shrinking appointment access waiting times by nearly 75,000 days.
- A breast cancer screening center used lean practices to implement an interdisciplinary approach to screening, diagnosis, biopsy and treatment processes. The changes reduced from 10% to 5% the patient call back rate for unnecessary biopsies, and 35% reduction on breast biopsy-related costs.
- Emergency room employees at nine northern Virginia hospitals used lean principles and practices to reduce emergency room waiting times. The consortium reported

a 31% drop in average waiting time, and a four-fold reduction in the number of patients who left the emergency room without being seen by a medical professional.

- A Midwestern hospital deployed a lean implementation team to redesign the hospital lab process, consolidate redundant equipment and reconfigure personnel roles. The changes resulted in a 53% improvement in turnaround time for patient blood test results and nearly \$500,000 in annual savings.

A Business Case for Lean in Healthcare

As these cases illustrate, the application of lean principles and practices in healthcare settings can dramatically improve the delivery of patient services and the quality of patient care. But lean initiatives in healthcare can also provide important business advantages for healthcare institutions, including the following benefits:

- **Improved patient outcomes** — Lean initiatives can increase value for patients by providing better healthcare services that more effectively treat medical conditions and reduce rates of recurrence. Such results can prevent unnecessary readmissions and the associated added costs or reduced reimbursement rates.
- **Increased patient satisfaction** — Patients are becoming more knowledgeable consumers of healthcare services. Satisfied patients are more likely to remain with healthcare providers

who provide quality services in a timely manner and are less likely to change healthcare providers.

- **Reduced operating costs** — Lean initiatives typically result in greater operating efficiencies that lead to reduced staffing and facilities requirements. Employees can be deployed to perform more value-added functions and facilities can be redesigned to offer new or expanded services.
- **Stronger financial performance** — By increasing productivity and reducing costs, healthcare institutions can achieve stronger financial results, thereby building a more solid financial base and providing financial resources for further investment.
- **Greater employee engagement** — Lean initiatives depend on empowering employees to increase patient value. Empowered employees are more engaged, and are likely to exhibit higher levels of job satisfaction. These results can lead to increased employee retention and reduced turnover rates.

Unlike other quality initiatives, improvement efforts based on lean principles are not capital intensive. Instead, they are built on alignment of an entire workforce focused on continuously improving patient value. Successful lean initiatives stimulate service improvements that benefit patients as well as the healthcare institution and its employees, often with little or no direct financial investment.



Summary and Conclusion

The business of healthcare is undergoing a significant transformation as healthcare institutions and leaders seek innovative ways to improve quality of service and reduce costs. Traditionally applied in production settings, lean principles and practices are now being implemented in non-production related settings including healthcare environments. Lean offers significant advantages over legacy quality improvement models by increasing efficiency and reducing waste while simultaneously improving quality of patient care. With its focus on increasing value, lean has the potential to help balance the cost associated with healthcare, increase the job satisfaction of healthcare professionals, and fundamentally improve the health of our communities.

For additional information about UL's lean advisory services, contact Juan Amador, Director, Continuous Improvement, UL Knowledge Services at juan.amador@ul.com.

¹"U.S. Healthcare system from an international perspective," PowerPoint presentation of OECD Health Data 2012, June 28, 2012. Web, January 21, 2013, http://www.oecd.org/els/healthpoliciesanddata/HealthSpendingInUSA_HealthData2012.pdf.

²"To Err is Human: Building a Safer Health System," Institute of Medicine, November 1999. Web, January 21, 2013, <http://www.iom.edu/~media/Files/Report%20Files/1999/To-Err-is-Human/To%20Err%20is%20Human%201999%20%20report%20brief.pdf>.

³"The Economics of Health Care Quality and Medical Errors," Charles Anel, Stephen L. Davidow, Mark Hollander and David A. Moreno for Wolters Kluwer Law & Business, October 15, 2012. Web, March 4, 2013, <http://health.wolterskluwerlb.com/2012/10/the-economics-of-health-care-quality-and-medical-errors/>.

⁴"Workplace Injuries and Illnesses - 2011," News Release, Bureau of Labor Statistics, U.S. Department of Labor, October 25, 2012. Web, April 11, 2013, <http://www.bls.gov/news.release/osh.pdf>.

⁵"Lost-time employee injuries cost healthcare billions," Knowledge at Work, Underwriters Laboratories, January 14, 2013. Web, February 11, 2013, <http://www.knowledgeatwork.com/lost-time-employee-injuries-cost-healthcare-billions/>.

⁶"Client Success Stories," ValueCapture, LLC. Web, May 31, 2013, <http://valuecapturellc.com/success.html>.

⁷"A Trip to the Dentist That You'll Enjoy," Lean Enterprise Institute, November 3, 2009. Web, May 31, 2013, <http://www.lean.org/shook/displayobject.cfm?o=1318>.

⁸"Success Stories," TheDaCare Center for Healthcare Value. Web, March 19, 2013, <http://www.createvalue.org/delivery/success-stories/>.