From Toyota to the Bedside
Nurses Can Lead the Lean Way in Health Care Reform

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The advent of health care reform means new pressures on American hospitals, which will be forced to do more with less. In the next decade, increased use of “Lean” principles and practices in hospitals can create real value by reducing waste and improving productivity, costs, quality, and the timely delivery of patient care services. In 2010, the Institute of Medicine recommended that nurses lead collaborative quality improvement efforts and assume a major role in redesigning health care in the United States. In this article, we provide an overview of the use of Lean techniques in health care and 2 case studies of successful, nurse-directed Lean initiatives at the Robert Wood Johnson University Hospital. The article concludes with some lessons we have learned and implications for nursing education in the future that must include the concepts, tools, and skills required for adapting Lean to the patient care environment. Key words: Lean practices, Lean principles, nurse-directed Lean initiatives, productivity, quality improvement

The first decade of the 21st century will be remembered as the decade when American hospitals began the long, difficult process of becoming “Lean” by reducing waste, synchronizing work flows, and reducing variability in work processes. In the decade ahead, the pressure for all American hospitals to really be Lean will be real and intensifying.1 Lean is simply doing more with less. In the economically stressed US health care system, the use of Lean principles, practices, tools, and techniques means greater benefits for patients by reducing waste through improved quality, efficiency, and safety.2 As health care reform officially begins in 2019, more hospitals will be using the Lean toolbox, which already includes more than 100 tools for reducing waste and improving efficiency.3

Lean is based on the 1960s success story of the Toyota Production System in Japan and the seminal work of quality gurus W. E. Deming and Henry Ford. At the time, Toyota faced scarce resources, an economy that could not support the traditional way of producing a service, and a lack of models for reinventing the way work was done—conditions that are similar to health care today. Lean evolved a management strategy for evaluating organizational processes, determining which add value, and then removing waste in areas such as overproduction (production not associated with demand), waiting (time between value-added production steps), transportation (movement of products unrelated to production), motion (unnecessary or excessive movement of equipment or people), inventory (too many components on hand), over processing (unnecessary procedures), and defective products (time required for the detection and repair of defects).4-7

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According to the Institute for Healthcare Improvement (IHI), the use of the Lean approach in industry has resulted in improvements in direct labor and productivity (45%-75%); reduction of costs (25%-55%); increases in flow and throughput (60%-90%), and significant reductions in defects and scrap (50%-90%), inventory (60%-90%), space (35%-50%), and lead time (50%-90%). These impressive results led the IHI to conclude that “Lean principles hold the promise of reducing or eliminating wasted time, money, and energy in health care—creating a system that is efficient, effective, and truly responsive to the needs of patients, the ‘customers’ at the heart of it all.”

Since 2005, Lean has been used tactically for discrete, departmental problems in hospitals. Lean techniques have been used to improve the performance of hospital administration, specialty clinics in dermatology and gastroenterology, health plans and medical practices, heart and vascular centers, oncology clinics, radiology, emergency departments, and entire hospital systems.

Increasingly, Lean has been used as a system-wide operating framework within health care systems that have emerged as early adopters in the diffusion of Lean as a major innovation in health care. According to Rogers, early adopters typically include opinion leaders who are respected by peers and who help to trigger critical mass after they successfully adopt an innovation. In the UK National Health Service, for example, Lean was used initially to improve processes in pathology testing and hospital discharge, and more recently, to address system-wide issues, such as financial deficits, hospital infections, capacity constraints, general inefficiency, high levels of delayed discharges, and public concern about long elective waiting lists, waiting times and costs.

Similar work to incorporate Lean’s business principles into hospital management has been reported in Thailand and Singapore, Canada, and throughout the United States at St. Charles Health System in Oregon; Virginia Mason Medical Center in Washington; ThedaCare, Inc, health delivery system in Wisconsin; the University of Michigan Medical Center in Michigan; in Minnesota, in a small rural hospital; and at Denver Health in Denver, Colorado. Some health care researchers in the United States and the Netherlands have successfully combined the Lean total system approach with the signature approaches of Six Sigma—quantitative analysis and cost-reduction techniques—to demonstrate reduction of waste and unnecessary consumption of time in hospitals. It has been reported that 50% of all American hospitals are currently engaged in some type of continuous improvement initiative that incorporates Lean techniques.

NURSE-DIRECTED LEAN INITIATIVES

Nurses have served as leaders of 2 very successful Lean initiatives at the Robert Wood Johnson University Hospital (RWJUH). Founded in 1884, RWJUH is a Magnet hospital that is the principal teaching hospital of the University of Medicine and Dentistry of New Jersey’s Robert Wood Johnson Medical School. Each year RWJUH’s 1300 physicians and 1500 nurses care for more than 200,000 patients. The first case study—“OR Lean”—details the Lean transformation of RWJUH’s operating room (OR). The second case study describes the remodeling of RWJUH’s emergency department (ED) with Lean principles and practices.

Case study 1: OR Lean

The need for improved efficiency in OR scheduling has been reported, although the number of Lean interventions in the OR reported in the literature is relatively small when compared with interventions in other hospital departments. Most recently in 2011, Villeneuve reported a 20% increase in OR productivity and capacity in a Canadian hospital that adopted Lean methods.

The transformation of the RWJUH’s OR used Lean approaches to increase overall
efficiency via improvements in scheduling and inventory management, decreased OR turnover time, reduced labor and supply expenses, and improved overall workflow and efficiency. The work used Lewin’s classic theory of change management that involves unfreezing (reassessing or diagnosing the organization’s status quo or current state), moving (making changes in attitudes, values, behaviors, processes, and structures), and refreezing (achieving an improved state in the future) (Figure).

The OR’s current state was assessed with performance metrics such as overtime, OR capacity, scheduling, inventory, and budget, assessments of employee satisfaction, employee perceptions of role clarity, and congruence between RWJUH’s OR standard operating procedures and best practices. Five rapid design teams conducted additional assessments of the 5 core components of the OR system: scheduling, materials, case cart, turnover, and central supply processing. Baseline assessment confirmed a pattern throughout RWJUH’s OR system—inefficiencies, inconsistent and vague processes, overly complex pathways, diminished OR capacity, limitations in the physician plant, wasted time and supplies, low productivity, high costs, and employee dissatisfaction.

After initial training, the 5 rapid design teams worked together in kaizen events, action-oriented work sessions designed to analyze current processes, and identify required changes. Kaizen means continuous, incremental improvement of an activity to create more value with less muda, or waste. This high engagement approach utilizes the principles of action research, which Lewin advocated as a democratic process in which problem solving and continuous improvement are conducted collaboratively by members of an organization for the improvement of the work they do with and for others. The approach reflects a key principle of the Toyota system, that is, that line workers are the experts at doing the real work and redesigning that work. Reliance on those closest to the work, that is, the RWJUH OR staff, helped develop the internal capabilities in employee knowledge and skills needed to sustain Lean work. According to the IHI, experts in Lean management believe that sustainability of new, improved processes depends on participants’ belief in the process. The high engagement of kaizen events provides the motivation and buy-in that converts skeptics into believers and champions of new ideas.

The 5 rapid design teams developed individual charters that described the case for action, sponsors, project description and scope, objectives, expected outcomes, and team members. The teams conducted current and future state analyses, completed process flow and value stream mapping to identify steps in a process, documented their sequence and duration, separated the value-added from the non-value-added steps, highlighted the location of flow disturbances and bottlenecks, and eliminated non-value-added steps. This approach to workplace reorganization is one of the “five pillars of the Lean enterprise.”

The OR staff sought a more efficient, effective OR system with improved standardization and accuracy, enhanced OR capacity, more clear roles and responsibilities, greater productivity, and improved staff satisfaction with OR operations. After 4 months of Lean work, waste and inefficiencies throughout the entire OR system have been replaced with new
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After 16 hours of training, the teams utilized classic principles and tools of reengineering and Lean flow to reevaluate the value of core ED work processes and overall work flow from admissions to discharge. The ED supply inventory and reordering systems were assessed, and an environmental scan was conducted to evaluate the proximity of supply locations to the point of care. Assessment of the inventory management system identified what our ED staff suspected: too few supply locations, unorganized and expired supplies, excessive inventory, excessive quantities of special order items, an unacceptable distance between supplies and the point-of-use, and inconsistent restocking that resulted in stock outs.

The teams reviewed various systems; tested several new systems and carts for short intervals, and analyzed the staff feedback after each trial. Queuing theory was used to study waiting time, and structural design principles guided the redesign of work unit structures or “pods” and the proximity of staff and supply carts to the point of use. The teams adapted the Lean approach to inventory management that involved moving supply carts closer to the point of care, increasing the frequency of restocking, and minimizing on-hand inventory. The supply room was reconfigured to match the new supply cart deployment. A color-coding system identified the commonly used items. The new system included kanban cards, which enable easier access and signal when an item needed replenishing. These cards list the items, item numbers, locations, need requirements, picture and bar code, and supplier contact information.

Demand management was addressed through the use of a full-capacity protocol, a strategy used for moving low-risk boarded patients out of the ED and for decreasing the disposition-to-discharge interval. To address the costly misalignment between staffing demand and actual staffing, 2 years of data were analyzed by patient arrivals by day and hour, patient holds by day and hour, and current

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staffing patterns for physicians, nurses, and other critical care staff.

A schedule template aligned with staff preference was created, and staff schedules were then adjusted to align staffing with actual demand. Throughout the pilot, LOS in minutes was monitored for all ED patients, according to acuity, and compared with control data. Preliminary data revealed an average 47-minute reduction in LOS during the initial pilot period.

LESSONS LEARNED

After launching 2 major Lean initiatives at RWJUH, we have learned much about health care reform that successfully uses Lean principles to remove waste and deliver health care more efficiently.

Leadership is critical for success

The literature emphasized the central role of committed leadership in the success of Lean work. According to Doss and Orr, leadership is “an integral part of the Lean Operating System, not an afterthought.” The support of leaders, they suggest, can “make the difference between superficial attempts at implementing Lean—where the tools and techniques are evident, but the behaviors haven’t changed—and full transformational deployments where the entire organization embraces Lean from the bottom up and the top down.”

At RWJUH, we agree. We owe much of our success in the uncharted territory of Lean work to the strong support from our hospital’s leadership. Our top leaders provided the long-term vision for the work, believed in the teams’ abilities, and remained engaged and accessible for advice throughout the entire process in which we transformed 2 major hospital departments without any shutdown of service. At the team level, the staff members were well supported in their Lean work by the chairs and cochairs, Lean subject matter experts, the project owner, and the executive sponsor.

Lean work is systems work

In their 2010 review, Machado and Leitner emphasized that Lean work is a whole system strategy that cannot be done piecemeal and that no single “silver bullet” solution, such as a new computer system or automated equipment, can achieve the same results. Systems thinking, the discipline of seeing wholes and interrelationships, is certainly not new. As Senge suggested more than 20 years ago, the systems perspective is badly needed in a world overwhelmed by rapid technologic change, changing demographics, shifting borders, and increasing complexity.

The 2 Lean initiatives at RWJUH represent real case studies in systems thinking. We knew that there was a direct link between the interdependence of all the project teams and the success of the Lean initiatives. From the beginning, we understood that our OR and ED were complex hospital systems in which changes in one subsystem were likely to influence the others. We knew that each team needed to not only understand the work of the other teams but also consider the impact of all proposed changes on many other parts of the system. Most important, our teams were committed to avoiding the pillowcase syndrome or the shifting of the burden scenario in which any organizational change can easily affect another interconnected element of the system, cause unintended consequences, and diminish the initial positive results.

Nurses are ideal leaders of Lean work

Leading a complex Lean transformation of a large hospital department is a natural role for nurses, who have experience leading multiple-disciplinary teams, are trained in assessment, and are system thinkers. Nurses also bring added advantages to the role of Lean leader—an uncompromising commitment to patient care and the natural ability to view hospital systems through the lens of the patient.

Change is difficult

Resistance to change is natural, expected, and difficult. As Senge explained, resistance
is a balancing force designed to maintain the status quo within a system. Resistance arises from threats to traditional norms and ways of doing things, Senge said. According to the IHI, the resistance to the change experienced in Lean work is unique because a core Lean principle is removing waste from a system. Any system working to become Lean requires employees to identify muda or waste in their own work in which they have invested time, energy, and personal ownership. It is natural for employees to want to feel their work is valuable and acknowledging waste in that work can be very unsettling and difficult. In addition, the IHI emphasized that staff commitment and engagement in Lean work can be related to concerns about “improving themselves out of a job.”

In both of our Lean projects, the RWJUH teams experienced some difficulty engaging some of the staff, obtaining feedback on new changes in operational systems, and convincing staff that the Lean improvements would produce the expected results and enable them to better meet patients' needs. Whenever possible, we tried to attach a real dollar value on wasted time. We worked hard to help the staff understand the fiscal significance of addressing many small issues, to be sure that employees knew what benefits they would realize from the change, and to directly involve them in the change effort, as Lewin had recommended. Finally, despite our enthusiasm, we tried to always remember that the turbo pace of change in Lean work can be both emotionally and intellectually challenging for hospital employees.

**Communication is critical to success**

From the outset of our Lean work, we knew that communication was the key to the short-term and long-term success of our work. As we had done with past quality improvement efforts, we regularly reminded the staff to keep the vision of the future state in mind because, as the anticipatory principle suggests, the image of the future is what guides the current behavior within an organization.

We created a new, monthly e-newsletter that described milestones and challenges, recognized individual and team efforts, and reinforced the accessibility of the leaders and their interest in staff suggestions for improvement. Frequent communication such as this is important because, as suggested in the literature, leaders typically undercommunicate by a factor of 10 during any change in an organization.

**IMPLICATIONS FOR NURSING EDUCATION**

Our experience at RWJUH confirms the IHI’s belief that Lean strategies provide hospitals like ours with a positive pathway through which our staff can improve productivity, cost, quality, and timely delivery of health care services. Our experience confirms that Lean work is complex and challenging. And, our work has illustrated that nurses can be very successful as leaders of complex, high-engagement, redesign initiatives that leverage the Lean principles, tools, and techniques developed by Toyota to improve hospital efficiency and improve patient care.

We know that Lean work is work for the long haul. Health care experts predict that it will take years to truly transform the US health care system and to “hardwire” Lean throughout hospitals. By 2019, the Affordable Care Act is expected to add approximately 32 million Americans to the health insurance rolls. Hospitals are already experiencing many new pressures on their operating margins in response to changes in payment rates to providers, especially under Medicare, and testing of experimental models with bundled payments. In this context, the Institute of Medicine recommended that “hospitals should reduce crowding by improving hospital efficiency and patient flow” and that nurses should be full partners, with physicians and other health care professionals, in leading collaborative improvement efforts, and redesigning health care in the United States. At RWJUH, our Lean work has brought both of
these Institute of Medicine recommendations to life in our 2 nurse-led Lean initiatives.

In response to the Institute of Medicine’s report on the future of nursing, 59,60 nursing leaders have spoken eloquently of the great opportunity that lies ahead for our profession—the chance to assume a major leadership role in the most significant transformation of our health care system in modern times.61-65 Many leaders hope that our profession will rise to the occasion, heed the call to action, and take its rightful place in the leadership of the health care reform movement.

If we are to heed this call to action, we must also recognize that nursing education, as we know it, must change. Nurses who aspire to be leaders need a robust fund of knowledge and a deep skills portfolio to do Lean work. This new knowledge and new skills go far beyond the traditional nursing curricula because they span a variety of disciplines such as organization development, Lean principles, quality improvement, inventory management, process consulting, value chain management, queuing analysis, diffusion of innovation, complexity science, and negotiation.63,66,67

Beyond changing the actual nursing school curricula and preparing new nurses for Lean work, our profession must also embrace a proactive stance that helps us overcome the burdens of the past perceptions and biases that associated nurses with lesser, service-oriented roles that carried out the instructions of others62 and that predicted that nurses were unlikely to have significant impact on redesigning the health care system.68 At RWJUH, our nurse leaders have led large, interdisciplinary project teams in 2 collective, complicated, energetic enterprises that have changed attitudes, values, structures, processes, behaviors, and our hospital’s bottom line. Lean work has helped us position nursing at RWJUH as a leader in the fundamental shift in the delivery of American health care.

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