CMCD's Lab Draws on Academics, Automakers, and Therapists to Realize Its Own Vision of Excellence

JIM ADAMS AND MARK GRABAN

Focused on transforming the laboratory at Children's Medical Center Dallas into a learning organization, the lab's leaders looked beyond benchmarking to develop a customized approach—measured against their own ideal state—to achieve operational excellence. By applying lean principles, systems thinking, and family system theory; improving the facility's physical layout; and, most important, redefining the role between supervisors and staff workers, the lab has cut its turnaround times, improved service to patients and physicians, and evolved into a work environment that fosters personal and professional development. © *2011 Wiley Periodicals, Inc.*

Many organizational leaders are tempted by the idea that improvement comes easily by studying others and then copying those discovered best practices. But what happens when virtually everybody in your sector has similar processes and technology, equally educated people—and the same levels of performance? For example, how could General Motors possibly have benefited from benchmarking only Chrysler and Ford in the late 1980s?

In the period leading up to late 2005, Children's Medical Center Dallas thought it had a good, if not above average, hospital laboratory. It conducted all the required quality control activity and documentation. Compliance with regulatory and accrediting agencies was a high priority. And the lab almost always hit desired performance levels. For instance, 90 percent of urgent ("stat") test results were verified within industry-accepted time frames.

After an internal analysis using lean principles that originated in the automotive industry, however, the lab staff learned to quit relying on benchmarking other labs. Rather, they learned to compare themselves against their own ideal state, benchmarking against perfection. The lab's previous benchmarking experience made it easy for staff members to feel smug about being good. But the fact was that, with a few notable exceptions, the lab industry benchmark was actually mediocre. Once the lab's leaders became aware of the possibilities of a truly excellent process, they had a new benchmark and goal: an ideal vision of the lab itself. This vision comprised three dimensions:

Patient-Focused Operational Excellence: To be nationally recognized for excellence in laboratory medicine, combining the latest in innovation with efficiency and quality testing in a customer-focused environment.

Purpose and Commitment: To have every employee in the laboratory act and work as though the child at the end of the test was his or her own.

Creative Community: To incorporate the minds and talent of all laboratory personnel to formulate together a vision that would represent the heart of the laboratory and the hospital.

But now they had to create a process to achieve their unique view of excellence; it was not something that could be copied from others. Through the process that ultimately was crafted, the lab at Children's has improved quality and productivity, and has reduced

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the turnaround time required to get test results to physicians and, therefore, to the patients, all while improving morale among laboratory staff. Although the Children's lab team members were inspired by methods and a mind-set from outside the industry, they have created a management system and improvement process that they truly own—because it is their own.

Taking a Three-Pronged Approach to Becoming a Learning Organization

Children's Medical Center is a private, not-for-profit pediatric health-care provider in North Texas that sees more than 300,000 patients each year and includes a hospital in Dallas that is licensed for 559 beds. One of the ten largest children's hospital systems in the United States, it has been recognized as one of the top pediatric providers by *U.S. News & World Report*. Children's also holds the prestigious "Magnet" status, the highest national recognition granted for nursing excellence.

Since 2006, the medical laboratory at Children's has aspired to become a learning organization—that is, one that continuously transforms itself to provide the best possible patient care while being a preeminent workplace. Under the leadership of Jim Adams, senior director for lab operations and the lead author of this article, and Dr. Beverly Rogers, the lab's medical director, the lab embarked on a learning journey that synthesized three distinct approaches:

- systems thinking, as taught by Peter Senge;
- Toyota's lean management approach; and
- family systems theory, a theory of human behavior developed by Murray Bowen, MD.

Essentially, those involved in the improvement effort innovatively applied lean principles to transform the lab into a learning organization, which Senge (1994, p. 3) defines as one "where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together."

Although the various lean tools and techniques that the lab team employed were helpful, the adoption of a new way of thinking ultimately led to higher levels of sustained performance. Lean was a means to an end: becoming a learning organization in order to provide the best patient care. To establish the culture necessary to effect change, the staff at the Children's lab:

Although the various lean tools and techniques that the lab team employed were helpful, the adoption of a new way of thinking ultimately led to higher levels of sustained performance.

Implemented lean principles and methods into operational processes,

Reconfigured the physical layout to promote the application of lean principles, and

Trained leaders and staff about lean principles so that they would understand how the relationship between leadership and staff had to fundamentally change.

Activities supporting all these areas have occurred simultaneously over the past four years, each taking center stage at different times.

Recognizing the Opportunity for Improvement

In September 2006, Adams was introduced to lean concepts via the semiannual Laboratory Directors' Forum of the Child Health Corporation of America. He heard from two lab directors representing laboratories who had experience with lean: LeBonheur Children's Hospital in Memphis, which was just starting its lean initiative, and Seattle Children's Hospital, which was already many years into its lean

improvement efforts. Both these presentations described the lean philosophy and fundamental principles, such as defining value from the perspective of the patient, as well as tools used to identify waste, such as value stream mapping and spaghetti diagrams. The presentation from Seattle Children's showed decreases in lab turnaround times of more than 50 percent for critical tests.

This initial exposure to lean piqued Adams's interest and created some urgency to accelerate improvement efforts at the lab. Children's lab had just finished a year-long team study of Peter Senge's seminal work on systems thinking, *The Fifth Discipline* (1994), and had a broad goal of becoming a learning organization. Prompted by Ron Somers-Clark, the hospital's director of pastoral care and a co-leader of the book study, the team also had studied some chapters from *Generation to Generation* by Edwin H. Friedman (1985), which introduces family systems theory. This is a systems-thinking approach to organizational leadership through self-differentiation and understanding of the emotional dynamics of the workplace. Briefly, leadership through self-differentiation has three major components:

> Stay connected with staff by being available and communicating at more than a superficial level.
>
> Take nonreactive, clearly conceived, clearly defined positions.
>
> Understand that resistance is natural; do not take it personally.

But the question facing the lab leaders was: How to make that high-minded concept and lofty goal of becoming a learning organization a reality? What were the practical methods to put that vision into operation in the lab? What type of leadership was needed? Adams and Rogers began reading and discussing books about lean, including *Lean Thinking* by James Womack and Dan Jones (2003) and *The Toyota Way* by Jeffrey Liker (2003). Lean seemed to provide the necessary operational method, along with a philosophy that was highly aligned with engaging everyone in a continually improving, patient-focused, learning organization.

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Mapping Out a Strategy to Reap the Benefits of Being a Learning Organization

Adams and Rogers had a tight connection and alignment in terms of management philosophy, despite their different backgrounds. Adams had had a 21-year career in the US Army, retiring in 1992 as a lieutenant colonel, and Rogers was an oft-published, internationally regarded pediatric pathologist who performed groundbreaking work in the area of molecular diagnostics and genetics testing. They wanted their department and team to develop into a learning community that:

- was self-managing (that is, its members did not rely on senior leaders to tell them exactly how to meet their goals),
- understood the context in which it functioned,
- focused on providing the best patient care, and
- provided an environment of creativity and growth for all.

The lab leaders believed that their role was to provide direction on the "what" and the "why," while leaving the "how" to the front-line staff. They believed that as the lab evolved into a true learning organization, the staff would contribute more to the "what" discussion using what is often described in both lean and systems thinking circles as a "catch ball" process—one that is neither strictly top-down

nor exclusively bottom-up in defining strategy and tactics.

Their initial goals were to improve the laboratory workplace environment and to instill a higher sense of community, collaboration, and teamwork, rather than focusing exclusively on the end performance measures. Adams and Rogers thought that improving the ability of the managers to understand and employ a systems-thinking approach to challenges and promoting a collaborative culture would lead to those results. They also believed that tapping into the intelligence and motivation of their employees, rather than pressuring people over measures, would lead to better long-term performance.

At that point, however, Adams and Rogers often felt that, as the directors, they were personally the obstacles to improvement—the "rate-limiting step," in biological testing terms. When team members noticed problems in the workplace that they did not think were problems for the directors, they typically did not address them. Adams and Rogers were committed to having the lab staff no longer think of them as the "customer," and to shift that focus to the patients. Their reading of the lean and Toyota literature convinced them that a lean environment would be one in which everybody participated in improvement and leaders served as coaches instead of being the ones with all the answers.

The 14 principles in *The Toyota Way* are divided into four sections, with each providing guidance for Children's lab's quest to behave as a learning organization. Adams and Rogers found strong connections to the other philosophies they were learning, as noted below.

- *Long-Term Philosophy*—It was crucial to incorporate the insights learned from Senge, particularly that delays between cause and effect are too often unappreciated or ignored.
- *Process Focus*—Implementing the insights learned from both Bowen and Friedman's family systems theory and Senge's systems thinking, the shift was made from a focus on individuals, which has a significant emotional component, to one on processes, which is based on reason.
- *Developing Your People and Partners*—Organizations that foster staff members' growth, both professional and personal, help them answer basic questions that better define their roles and potential, and remind them that only they can have primary responsibility for their own behavior and performance. According to Hardwiring Excellence by Quint Studer (2004), these questions include "Who am I at work?" "Why am I here?" and "How does working here help me achieve purpose, worthwhile work, and to make a difference?"
- *Drive Organizational Learning*—The work culture should not rely on constant direction from the top. Rather, individuals should be empowered to understand the context in which they function and the implications of their behavior and performance for the customer on multiple levels. Then they can use that awareness to make good, patient-focused, minute-to-minute decisions and to improve work processes.

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Although culture was important, the lab leaders foresaw a future in which their core performance measures would have to improve. They feared that if the lab did not "go lean," it would:

- not improve its level of service to lab users and patients,
- not develop the environment that engaged staff to help them understand themselves and their work in the context of delivering the best possible care to their patients, and
- continue to function with a silo-based definition of success. This meant they would continue to feel good about themselves and their work, while remaining unaware that they were contributing to the frustration of other caregivers by not realizing their potential to provide truly great care.

Adams and Rogers had heard about dramatic turnaround time improvements at other labs, such as at LeBonheur and Seattle Children's, and sensed that the application of lean would offer the best way to realize the desired operational improvements. Their initial lean assessment removed all doubt.

Initial Lean Assessment Reveals Systemic Waste

ValuMetrixServices, a consulting arm of Johnson & Johnson's Ortho-Clinical Diagnostics, was brought in to perform a three-day assessment of the existing core lab operations (which include the highest-volume and most time-sensitive blood and urine testing capabilities, approximately 80 percent of their testing volume). The assessment examined existing processes and workflow in detail, observing the end-to-end flow of the testing process from specimen receipt in the lab to the point when those results were sent electronically to the physician via the electronic medical record system.

Although Children's lab considered itself above average in lab performance, the assessment showed Adams that 90 percent of what the lab did could be considered waste—basically the activities and time that did not provide value to patients. This showed the lab leaders the potential for improvement when they measured their performance against an ideal process instead of relying on benchmarking data from labs whose processes included similar systemic waste. For example, the assessment data showed that for a common, high-volume blood test, only 4 percent of the time needed was value-added (the actual time to run the test). So, of the nearly 27 minutes of elapsed time taken to provide the results, only 64 seconds added value to the patient.

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The lean assessment also revealed how even inefficient or ineffective existing work processes and layouts were often accepted as "the way things have always been"—a common mind-set at many hospitals and other types of organizations. By helping them appreciate just how far they were from perfection, the assessment provided Adams and Rogers with a burning platform. In their view, it no longer mattered that they measured well against other children's hospitals. They were now driven to provide the best patient care they possibly could—which meant that reducing turnaround times as much as possible was an important goal.

Shorter turnaround times affect patient care and broader hospital performance in a number of ways. First, faster (and accurate) test results mean more timely and better decision making by doctors, nurses, and pharmacists. Studies show that up to 80 percent of the medical record that influences medical decisions is composed of laboratory test results and reports. Second, faster test results can help enable the timely discharge of patients, shortening their length of stay, which reduces risk to patients and makes them and their families happy. From the hospital standpoint, shorter length of stay helps minimize cost while freeing up bed capacity for other patients.

The awareness that turnaround times could be potentially 50 percent to 80 percent faster, while improving quality and reducing stress on the laboratory staff, revealed a significant gap between the lab's current state and its desired state, which was aligned with the team's purpose of providing the best patient care for children. There was no outside pressure from accreditation bodies or from the hospital to improve. This came from the lab leadership team's internal desire to improve. Whereas many executives would not have spent money on education and consultants to fix an area that was not "broken," Brett Lee, vice president of ancillary services for Children's, was supportive of the improvement efforts. When presented with the assessment data, he strongly supported the implementation of lean in the laboratory.

Adams started laying the groundwork for change by gaining insight into the needs of the lab customers—the departments that ordered tests for their patients. He learned that leaders could not assume that they knew what their customers want. For instance, even though he was an experienced lab professional, he learned that a test called C-Reactive Protein (CRP) was particularly important to the emergency department in a children's hospital setting because ER physicians use the CRP result to differentiate between children with asthma and those with an upper respiratory infection (URI). (An indicator of chronic inflammatory process, CRP will be elevated in an asthma patient and normal for a URI patient.) This test result allows the physicians to quickly begin the correct treatment; therefore, speedy processing is essential.

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Conversely, the lab staff members also learned that, in some cases, they were racing to deliver test results more quickly than was needed. For example, the lab had been focused on providing gram stain results on cerebral spinal fluid (CSF) specimens within 30 minutes but found out through meeting with the emergency room staff that 45 minutes would be just as good because of the need to gather other information to assess the patient. The training efforts that lay ahead would help teach the lab staff to rely on facts rather than on assumptions in all aspects of their operations.

Introducing Lean as a Management System

In March 2007, Mark Graban was brought in as a consultant from ValuMetrix to lead the core lab transformation project. The initial scope was expected to last about 12 weeks, consisting of:

- training and understanding the current state (four weeks),
- designing a future state (four weeks), and
- establishing the new process, layout, and workflow (four weeks).

Although this initial effort was considered a "project," heavy emphasis was placed on lean as a management system and as an ongoing way of thinking and living, in line with Adams's and Rogers's goal of transforming the lab into a learning organization.

Adams and Rogers selected a team of six front-line lab professionals from different specialties and roles: two medical technologists and two lab assistants from the core area, as well as two sets of "outside eyes"—a technologist from microbiology and one from histopathology, two areas that were outside the initial scope. Their input would ensure that the internal team would not get stuck on "the way things had always been done" and that training in lean methods and principles could be transferred to their areas. The team of six was dedicated to this

project as a full-time job; 100 percent of their time would be spent on the analysis and redesign of the lab. This was a different approach than the week-long kaizen events commonly used in many lean efforts. To free up their time, Adams had to authorize additional hours for other staff to cover mission-essential activities.

Although the project team was dedicated to the lean process full-time, they were not the only staff members who had a voice in it. While conducting their observations, team members talked with their colleagues to identify problems in the existing workplace and brainstormed ideas about what could be done differently.

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The first week was focused on team building, project and goals definition (drawing on input from the team as well as Adams's direction), and training on the basics of lean. Early stages of lean education for health-care staff typically focused on two major "why" statements: why does lean apply in health care, and why does the department want to improve? Examples were shared from other hospital laboratories, but these were viewed as a source of inspiration and not as a set of best practices to copy. It was important for the team to develop its own improvements for the sake of ownership and sustainment. Focusing on patient care, the team rallied around reducing turnaround times while also creating a better functioning and less frustrating workplace.

For the next few weeks, the team participated in a detailed study of their existing processes. Again, this entailed a decidedly different approach than simply benchmarking and copying others. It might seem easier to just copy the successful tactics at another lab, but each hospital lab has unique properties, including their equipment, patient populations, and mental models. A children's hospital lab, for example, would be badly served by copying a lean design from a general population hospital. The team needed to understand what worked (and what did not work) in their existing process before they could think effectively about improvement.

Graban taught the team some basic lean analysis tools, including product flow analysis and spaghetti diagramming. Team members followed dozens of patient specimens either from the point of collection in the patient room or from the arrival at the lab all the way through the communication of the test results through the hospital's computer system. This product flow was analyzed to determine, as had been done during the assessment phase, what percentage of time the specimen was being worked on and what percentage of time was spent waiting. Discovering how much waiting and batching there was in the process was very eye-opening to the team members. This helped them understand the opportunity to dramatically reduce turnaround times without pressuring people to work harder or faster. Removing waste, waiting time, and delay from the process would be more effective than working faster.

Additionally, the team shadowed fellow lab staff, tracing their walking patterns in the lab (to create the spaghetti diagrams), identifying what percentage of their time was spent on value-adding activities, and identifying what waste or problems the medical technologists and lab assistants encountered in their work. Video cameras were used to help document what was happening in the workplace, allowing for detailed analysis and reflection.

Although it might seem strange or uncomfortable for lab personnel to be shadowed and followed, there were a few factors that distinguished this effort from the old-fashioned "efficiency expert"

following people with a clipboard and a stopwatch. First, people were being shadowed by trusted peers who deeply understood the work being done. Second, Adams and the other leaders emphasized the fact that the observation was not an attempt to assign blame or to identify problems with certain individuals. The focus was on identifying waste and problems that interfered with people being able to provide the highest-quality and most timely patient care—that is, the focus was on fixing the system, not blaming the people. Finally, the videotapes were shared and viewed with those who had been taped, so they could watch themselves work and participate in the improvement discussion. This level of openness and participation helped alleviate concerns that employees were being spied on or secretly evaluated.

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As the team identified waste, problems, and opportunities for improvement, Graban taught lean methods that the team could use immediately, including 5S for organizing the workplace and kanban for managing materials. During their observations, the lean team noticed that inconveniently located supplies and equipment forced the medical technologists to do an excessive amount of walking. The extra movement not only ate up valuable labor time and resources, but also kept the technologists away from their workbench or machine, which delayed getting the test results to the physicians.

Team members were able to take immediate action at a few workbenches, working with their colleagues to make small improvements. For example, the chemistry workbench was rearranged to ensure that the most frequently used supplies were right on top of the bench. Previously, the technologists often had to bend down to open a lower cabinet door to retrieve needed items. In fact, the doors were taken off the cabinets—which illustrates how something that "has always been this way" could be challenged. Rearranging a workbench with the 5S method did not amount to a million-dollar savings. But it demonstrated that lean was a method for making people's work easier in terms of time and ergonomics, which also led to benefits for the patient. The 5S exercise also provided the team with practice in change management skills: how to engage their colleagues, how to consider their input, and how to communicate change. In many cases, these were new soft skills for the highly technical lab professionals.

In conjunction with the workbench redesign, Graban taught the team how to create a kanban system for resupplying materials to the point of testing. The team noticed that the lab professionals had to frequently interrupt their work because they had to walk to the stock area to replenish reagents and supplies—again, interrupting testing and not making the best use of their talents and education. With the kanban system, the better-organized workplace was restocked in a standardized, consistent way. This helped ensure that the technologists always had what they needed at the place of work to perform their value-adding work for the physicians and patients. Kanban was yet another example of a lean support system that replaced frequent fire fighting and reduced frustration for the team.

Physical Layout Changes Aid Customer Response

As the team proved they could make small improvements, they set their sights on fundamentally changing the physical layout of the lab—a move that would potentially affect job descriptions, staffing patterns, and more. Life in the lab would change dramatically—and all for the benefit of the patient.

By observing lab operations, the team learned that the existing configuration promoted an inefficient,

siloed operation. Waste was just baked in as a result. The lab embarked on a redesign effort based on lean principles to achieve a configuration that would support lean processes, decrease waste and stress, and improve lab performance.

One immediate change the team proposed was the movement of three blood gas analyzers. This type of testing is very time-sensitive, yet specimens often sat in the lab for up to 15 minutes before they were moved to the analyzer. Turnaround times were reduced by 75 percent by incorporating two changes to the space and process flow.

The easiest decision was to move the tabletop analyzers to a bench that was much closer to the point where specimens were received. This reduced the need to batch the transport of specimens to the analyzers and eliminated the need for lab workers to frequently walk back and forth. In a traditional management environment, supervisors might lecture the lab assistants on the need to reduce the amount of time spent walking, but in this case, Children's lab changed the system by moving the analyzers. This might seem like an obvious solution, but it goes to show the power of "the way things have always been" mentality before the lean effort started.

The second alteration to the physical space required a more significant change in the way people worked. In the front end of the process, lab assistants received specimens into the computer, placed bar code labels on the tubes, and centrifuged the specimens, if needed. Under the previous "the way things have always been" system, the receiving/labeling and centrifuging were handled on separate benches, by different sets of people located about 25 feet apart. This was another perfect opportunity for rational batching. Since the assistants were all cross-trained in these different tasks, the lab reconfigured the work system so that individuals at any bench, working in parallel with each other, could perform all the steps of the operation using the concept of single-piece flow, thereby avoiding any batching delays.

Under a larger space redesign, the lab's high-level layout was reimagined. The lab had a very traditional layout, where subspecialties of machines and people were in their own silos, hampering the overall flow and teamwork of the lab. Again, although the medical technologists were generally cross-trained, people kept to their own areas, which led to imbalances of work and poor flow.

With Graban's assistance, the lean team experimented with different layouts by using paper cutouts representing equipment and workbenches in a scaled-down blueprint model. Multiple layouts were evaluated on their impact on specimen flow, people flow, and information flow. As the best layout continued to evolve, the team shared the highest-rated possible layouts with their managers and teammates and sought input from architects and facilities managers.

Although creating the new layout is a major endeavor, most labs are able to have this sort of construction finalized within a few months' time. In the case of Children's, however, the core lab reconstruction was combined into much-needed flooring replacement and space renovations for other parts of the lab. This, along with a few other factors, led to a lengthy delay before the new layout could be realized. About four years later, the full reconstruction project is almost complete. Although the new configuration in the highly automated, high-throughput core cell has allowed many improvements, it has also highlighted inefficiencies that were not readily apparent in the old configuration. For example, an order for lab tests that takes longer than 60 seconds to enter (something that happens frequently, because of interruptions) is registered as two separate orders by the lab information system. Consequently, when the specimen is "received" into the lab, two accession labels are printed, requiring the lab tech to either split the specimen into two portions and run each through the instrument separately or run the same specimen through the instrument twice,

relabeling the specimen between runs. Clearly a very wasteful process, it had been tolerated.

The most important changes affected the way the lab evaluates what it does and how it does it, keeping the customers in mind and supporting the staff members who are doing that important work. These initial patient-centered mind-set changes led to a new series of questions—not just about what the people in the lab do, but how they relate to others. Thanks to the adoption of lean management practices, the lab was able to start "thinking lean" well before it was "physically lean." Despite the delays in physical improvement, the lab was able to begin its transformation to a learning organization that had everyone engaged in small improvements each day.

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From Suggestion Boxes to Daily Kaizen

During the initial phase, Graban taught the team about the principles of kaizen, or continuous improvement. During one of these sessions, a team member brought in the traditional suggestion box that had been hanging on the wall outside the lab's restrooms. The box was locked, so one of the team members went to get the key. While she was gone, the group sarcastically chuckled about the lock and the apparent need to protect the suggestions from theft. When she came back, some 20 minutes later, there was a look on her face that combined frustration and embarrassment as she proclaimed, "We've looked everywhere and nobody can find the key!"

Hospitals commonly have a suggestion box that does not effectively engage employees in improvement. People often drop complaints (sometimes targeted at co-workers) into the box, and even good ideas might be reviewed by managers only on a monthly basis, at best. In these traditional systems, suggestions (often anonymous) are approved or rejected without any discussion with the person who submitted the idea. Managers often see these suggestion boxes as a waste of time, and employees, who feel as though their contributions are ignored, become cynical.

With the support of Adams, Graban and the team experimented with a more effective approach—a visual idea board (as described in David Mann's Creating a Lean Culture [2005]). Here, employees write down a problem statement and an idea that would address that problem. These ideas are then displayed on a bulletin board that all team members and leaders can see. Managers were taught to discourage anonymous ideas so that the cards could be the starting point for a dialogue. Rather than merely approving or rejecting ideas, supervisors, managers, and directors were expected to play the role of coach and mentor—working to understand the problem and the ideas and working together to find a mutually agreeable change that could be made sooner rather than later.

The idea board provided a visual way to track the progress of ideas, from initial idea generation through implementation, allowing for communication with and input from others in the lab. Unlike the old suggestion box, if new ideas came in that were not being followed through on, Adams would be aware of this and could coach his managers about participating in kaizen with employees.

The lab also started holding daily team huddles, stand-up meetings that lasted just five to ten minutes. Typically led by a senior technologist, these huddles were a means of communication as well as a forum for bringing up new ideas, either verbally or on a card. Each huddle included a quick review of new daily performance measures, showing the team

how they were performing on key measures, such as turnaround time for important tests.

Before lean, performance measures were summarized and posted on a monthly basis outside the lab in a hallway. The new daily measures, however, were posted right in the lab, on a board near the visual idea board where the team members met for their huddles. The measures were intended to provide visibility to performance, and not to reward or punish staff on a daily basis. Graban taught the managers about statistical process control (SPC) and the application (from Donald Wheeler's Understanding Variation [1993]) that managers should not react to every daily upward or downward movement of the measure. Managers were taught to look for meaningful shifts rather than waste time chasing noise in the system.

One day, a medical technologist told Graban, "The managers are very careful to say 'It's just the system, we're not blaming you' when we have a bad day, but when we have a good day, they pat us on the back and tell us we're doing a great job. Isn't it always the system, on a good day or a bad day?" With this feedback, Adams was able to coach the managers on the need for consistent focus on the process, rather than on praising individuals for any single day's "good" outcome that fell within expected variation. It would be more appropriate and meaningful to praise people for making suggestions that had the potential to systemically improve the process, even if that effort did not result in the expected improvements.

Essentially, however, posting ideas on a board, having a daily stand-up meeting, or displaying daily measures were not the most important changes. The new mind-sets and philosophy—those thought patterns that drove manager interactions with front-line staff on a daily basis—made the largest impact. This redefinition of the relationship between leader and front-line staff is ultimately what promotes a lean culture. For this reason, Adams, Rogers, and Graban continued to educate managers about behaviors that would help create a true learning organization, as opposed to one that was just going through the motions of a lean initiative.

The Role of Leadership in Establishing a Lean Culture

In a hospital-based clinical laboratory, the pathologists and PhD clinical consultants (professional staff) are acknowledged leaders, regardless of their formal area of responsibility. Their influence drives the technical and medical quality of the lab. Adams and Rogers understood that the magnitude of the culture change required to successfully implement lean would necessitate complete alignment of thinking and strong support by the medical leadership, as well as those in the operational chain of command. Rogers took the lead to communicate the vision and galvanize the support of the pathologists and PhDs. It was essential that they not misinterpret any push-back resulting from significant change as evidence that the improvement process was not working.

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Rogers accomplished this by sharing her vision of how lean principles could be used to help the lab be a learning organization (as described in Senge's The Fifth Discipline [1994]). The pathologists and PhDs seemed easily to understand and appreciate the new direction, and in almost four years, their support has not wavered. Communicating the "why" and "what" behind the lean implementation secured the support and trust of the professional staff. More important, their understanding and backing helped them enable front-line staff to feel secure about the

"why" and "what" of the lean implementation, so that they could focus on the "how."

Senior leaders at Children's, most of whom are well versed in process improvement, supported the lean effort as a departmental, though not an organization-wide initiative. As the lean implementation in the lab began to yield notable operational efficiencies and improvements, awareness and support increased, and opportunities were made available to share the story with the entire senior leadership team and board of directors. The lab successes prompted Children's in early 2008 to ask Graban to lead a lean implementation effort in the radiology department's Magnetic Resonance Imaging (MRI) area, with a focus on processes to improve machine utilization and reduce the time patients had to wait for an MRI procedure.

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Of the 14 basic principles that Jeffrey Liker details in *The Toyota Way* (2003), the ninth one states: "Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others" (p. 171). For almost four years, there has been a sustained effort to do this at Children's lab. In early 2007, following a study of Peter Senge's *The Fifth Discipline* (1994) by the directors, managers, and some of the pathologists and PhDs, weekly book studies involving managers, supervisors, and interested front-line staff focused on works that were directly related to lean (including *The Toyota Way* [2003], *Creating a Lean Culture* by David Mann [2005], and *Lean Hospitals* by Mark Graban [2008]), plus books that encouraged understanding and behaviors compatible with and supportive of lean implementation (including *Leading Change* by John Kotter [1996], *The Anxious Organization* by Jeffrey A. Miller [2002], QBQ! *The Question Behind the Question* by John G. Miller [2001], *The Servant* by James C. Hunter [1998], *Managing to Learn* by John Shook [2008], and *Hardwiring Excellence* by Quint Studer [2004]). New employees are taught about the eight types of waste and other lean concepts and are encouraged to submit ideas to improve processes. Eight staff members are certified as Lean Six Sigma green belts.

Adams feels the biggest challenge in training leaders and staff in a way that promotes a successful lean implementation is redefining the relationship between managers/supervisors and front-line workers. To create an environment in which lean principles could take root and flourish, leaders had to learn to:

Stop over-functioning to allow staff members the "space" to take on greater responsibility;

Focus on performance of the processes, and not of specific individuals;

Avoid placing blame while increasing accountability; and

Encourage consistency while disallowing workarounds and "save the day" heroics.

This new relationship is encouraged by assigning new responsibilities, such as daily and weekly audits designed to focus supervisors and managers on processes and adherence to standard work, and leaders' follow-up on improvement ideas submitted by staff. Yet, this is an area where the most work is still needed. Traditional leader-follower roles and relationships are difficult to modify, for any change in this relationship involves defining success in a much different way.

Exhibit 1. The Three Fundamental Processes That Sustain Profound Change*

Reinforcing Process	*Characterized By/Results In*
1. Personal (Good for me)	Direct personal benefits
2. Colleagues (Good for you/us)	Perceived value, voluntary participation in informal networks, increased commitment
3. Business (Good for the organization)	Enhanced business results

*Concept taken from Senge, Kleiner, Roberts, Ross, Roth, and Smith (1999).

Beyond Leadership—and Toward Continuous Improvement

Leaders can play a direct role in changing the physical layout of a facility (for example, by garnering resources and support for the reconfiguration) and training the staff. But when it comes to putting lean into operation, a leader cannot drive sustained change that relies on others. The sixth law outlined in *The Fifth Discipline* (1994, p. 62), "Faster is slower," may well apply here.

Although Adams was eager to see lean principles used throughout the lab, he did not attempt to dictate a timetable for doing so or a particular way for changes to be made. His role was to encourage and support any efforts to implement lean. Consequently, there has been a slow, steady rollout of lean methods and application of tools in the lab, based on opportunity and perceived value by staff.

Any changes that the leaders felt were clearly indicated but were skeptically received by the staff (because of perceived inconveniences or sheer resistance to change) were usually rolled out as pilot projects. For example, when the manager and supervisor in the specimen processing area realized that implementing single-piece flow of specimens and testing would require the removal of chairs to minimize unnecessary batching and delays, it was done as a pilot project in order to prove that the benefit to the patient was worth the inconvenience and perceived discomfort to the staff. Although there was much initial resistance, the pilot project resulted in such a dramatic improvement in testing turnaround times that the change was maintained and, eventually, accepted as permanent.

Adams also wanted the lean implementation—with its profoundly better, but different, way of viewing and performing work, and the accompanying significant behavior changes needed at all levels—to eventually define the new culture. He knew a genuine transformational effort would require voluntary buy-in, participation, and promotion by almost every individual. Long after taking this approach, Adams discovered a good model to describe what he had attempted to do in *The Dance of Change* (1999). In it, Senge, Kleiner, Roberts, Ross, Roth, and Smith write, "Nothing can grow in a self-sustaining way unless there are reinforcing processes underlying its growth" (p. 42). The authors suggest that there are at least three fundamental reinforcing processes that sustain profound change by building on each other. These are summarized in **Exhibit 1**. According to the authors, "Each of [the three reinforcing] processes operates simultaneously, generating a distinct set of forces that can sustain growth, albeit with different speeds due to the different delays in each process" (p. 54). These processes are also interdependent, since change in one can increase the effects of others.

Adams and Rogers believed that even though activating the personal reinforcing process would take years, it was the only way to ensure that the lean implementation would truly transform Children's to allow it to realize the full benefits that a successful lean implementation offers. Although reconfiguring the equipment and arranging the training was

something Adams and Rogers could drive directly, they realized that putting lean principles into operation would require them to take a coaching, supportive role, and to be patient. They also realized that the skills, knowledge, and behaviors required of all levels of staff to develop the relationships that promote a successful lean culture would take time. But the wait would be worth it. It would eventually allow all staff to view the lean culture with the same positive assumptions, for all the right reasons, that this is "the way work needs to be done."

> Adams and Rogers believed that even though activating the personal reinforcing process would take years, it was the only way to ensure that the lean implementation would truly transform Children's to allow it to realize the full benefits that a successful lean implementation offers.

Senge's model of reinforcing processes also showed how important it was to redefine the role of supervisor and manager from controller and "person-in-charge-with-all-the-answers" to someone who strives to completely understand and meet the needs of the staff as they perform their tasks. Both supervisors and staff workers needed to be completely vested in each other's success. Adams wanted the operational managers and supervisors to engage the front-line staff, so they could together experience and be motivated to apply lean methods and tools, prompted by the value and benefit to the patients, lab users, and to them, personally. This collaborative, respectful, helpful relationship is necessary to activate the personal reinforcing process. As noted in *The Dance of Change* (1999, p. 46), "It is inherently satisfying to work in a team where people trust one another and feel aligned to a sense of common purpose. Given the choice, very few people would not elect to be part of a team where there is excitement, commitment, perseverance, willingness to experiment, genuine appreciation of one another's gifts (and limitations), and the ability to effectively tackle complex issues."

The various components of the lean toolkit, such as 5S, single-piece flow, standard work, metrics boards, shift stand-up meetings, training matrices, increased cross-training, and idea boards, were used at different times with a different emphasis in the different areas of the laboratory. Gradually, ideas and activities that added value in one area were used by others when the group was ready to do so, adding their own variation to the method or tool.

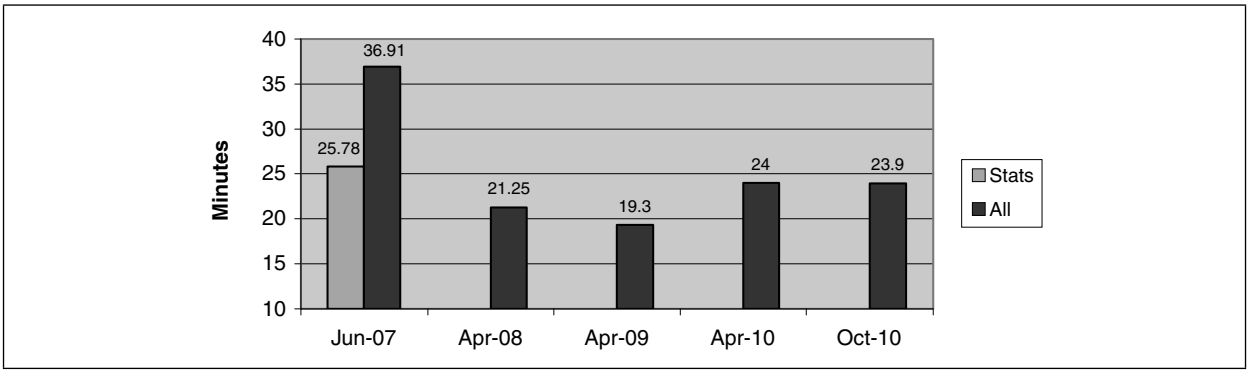
Another, more traditional way in which Adams encouraged the understanding and use of lean was to modify all the lab job descriptions and the performance evaluation forms. All lab job descriptions were changed to contain the following statement in the job summary: "Actively promotes a Lean work culture by performing team member duties to ensure consistent use of Lean principles and processes and continuous process improvement." A similar, but more detailed expectation is included on the performance evaluation form. Including an expectation of an adherence to lean principles in the job description and evaluation form does not automatically translate into the needed behaviors, but it does set the standard and gives leaders the ability to more easily recognize and reward the behaviors and performance that promote a lean work culture.

From Mediocrity to Operational Excellence

At the Children's Medical Center Dallas's laboratory, the application of lean principles and values initially revealed its mediocrity and state of delusional excellence but eventually led to personal and professional development for those involved—as well as better results for patients, physicians, and the hospital. These included improvements in turnaround times and employee morale.

Exhibit 2 shows the pre-lean turnaround times (TAT) for a common coagulation test. Since

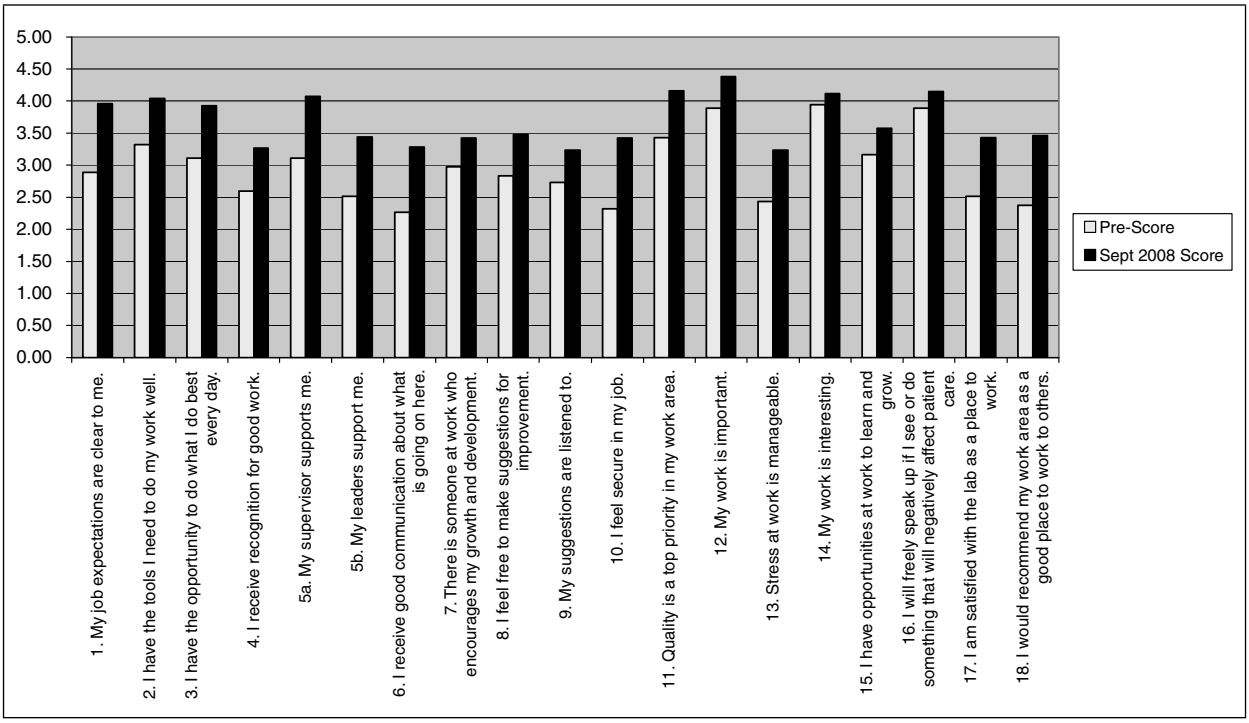
Exhibit 2. Comparison of Pre- and Post-Lean Coagulation Test (Prothrombin Time) Turnaround Times



implementing lean, the lab has maintained an average TAT for all specimens that is faster than the pre-lean average for "stat" priority testing, and substantially faster than routine priority testing. Building on the sustained improvement from the use of single-piece flow, the lab has handled all specimens with the same immediate priority for more than three years, reducing some of the effort previously required to sort and expedite the "stat" specimens.

Exhibit 3 shows across-the-board improvement on an employee survey conducted before and 18

Exhibit 3. CMC Dallas Laboratory Employee Survey: March 2007 vs. September 2008



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months into the lean implementation. Of special note are the significant increases in scores related to job expectations, supervisor support, communication, job security, and workplace stress.

A previous study of systems thinking enabled lab staff members to appreciate how lean offered the philosophy, principles, values, behaviors, and operational tools that not only provided a way out of mediocrity but could help them begin their journey toward operational perfection. Meanwhile, family systems theory enabled them to avoid the most common implementation pitfalls by helping them understand that most lean implementations fail because traditional, command-and-control leadership behaviors are not compatible with a successful lean structure. Family systems theory also provided guidance on forging successful leader-follower relationships to maximize the contributions of both—an essential, but rarely appreciated element of a successful lean implementation.

Certainly, the experience at Children's lab can be of use to other organizations that are contemplating or currently implementing lean or another program toward excellence. For Children's lab, the unique application of lean, systems thinking, and family systems theory helped craft a roadmap to becoming a highly effective, learning organization. Every lean implementation, however, requires a customized approach that addresses the particular needs, environment, and goals of the organization.

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