

Reducing Wait for MRI Exams Gives Akron Children's Hospital Competitive Edge

by David Chand and Anne Musitano

At a Glance . . .

- Akron Children's Hospital used Lean Six Sigma to increase MRI exam volumes and reduce patient wait times.
- A two-day kaizen event allowed a multidisciplinary team to identify a system of root causes, develop a set of countermeasures, and rapidly implement changes.
- Wait times for exams were significantly reduced after the kaizen. Days and weeks were eliminated between scheduling and the exam day. Shorter patient wait times and increased weekly exam volume continue to be sustained.
- \$1.2 million in incremental revenue was earned the year following the project.

Introduction

The problem in the Radiology Department at Akron Children's Hospital in 2009 was two-fold. First, the addition of a second MRI machine in 2007 did not lead to a proportional increase in the average number of daily exams (Figure 1). Second, and more important to patients and their families, wait times for MRI scans were excessive. In fact, the wait time for a multiple-exam study with contrast was 25 days. If the patient required sedation, the wait time was six to eight weeks. This represented a common dilemma seen throughout healthcare: the inability to meet customer demand despite the presence of excess capacity.



Designing countermeasures to this problem was important to the leadership at Akron Children's. Access to patient care is a key measure of quality, one of the four key pillars of the hospital's strategic plan. Rapid access to radiologic exams is a significant advantage for a children's hospital in a highly competitive market.

Addressing this issue presented an opportunity to enhance revenue and increase the return on the investment from a second MRI scanner. Furthermore, improving access to patient care became imperative because the hospital's service area had grown and the department was confronted by a 23-percent increase in patients.

About Akron Children's Hospital

Akron Children's is the largest pediatric healthcare provider in northeast Ohio, with two pediatric hospitals and services at more than 80 locations across the region. It offers care in all pediatric subspecialty areas that draw more than half a million patients each year, including children, teens, and adults from all 50 states and around the world. The hospital also provides more than 100 advocacy, education, outreach, and research programs to children and their families throughout the region.

The hospital has earned the Gold Seal of Approval from The Joint Commission and Magnet Recognition Status from the American Nurses Credentialing Center. It is a founding member of the Austen BioInnovation Institute in Akron, a collaboration of research, education, and health institutions designed to pioneer the next generation of life-enhancing and life-saving innovations.

Number of beds: 253 at main campus
 50 at Mahoning Valley campus
 6 at Robinson Memorial Hospital

Medical staff: 738

Number of employees: 4,127

Service area: 25-county region, including
 all of northeast Ohio and
 western Pennsylvania

Annual radiology procedures: 100,000

Admissions (2010): 8,756

Total outpatient visits (2010): 604,357

- **A3:** An eight-week formal training program that teaches frontline staff the basics of Lean, culminating in the completion of a project in the participant's home department.
- **Green Belt:** A formal training program and project that lasts six to 12 months, following the DMAIC (**d**efine, **m**easure, **a**nalyze, **i**mprove, and **c**ontrol) format.
- **Kaizen:** Events lasting two to five days, resulting in rapid implementation of countermeasures.
- **Blue Belt:** Training for managers and departmental leaders focusing on daily management in a Lean enterprise through tools, processes, and systems.
- **Black Belt:** Twelve-month projects involving large value streams, using more advanced Lean Six Sigma tools.

To increase MRI exam volumes and reduce patient wait times, the hospital formed a multidisciplinary team comprised of:

- Radiology technologists
- Radiologists
- Nurses
- Exam schedulers
- Representatives from the Authorization & Registration Center (ARC)
- Executive leaders
- Members of the hospital's COE

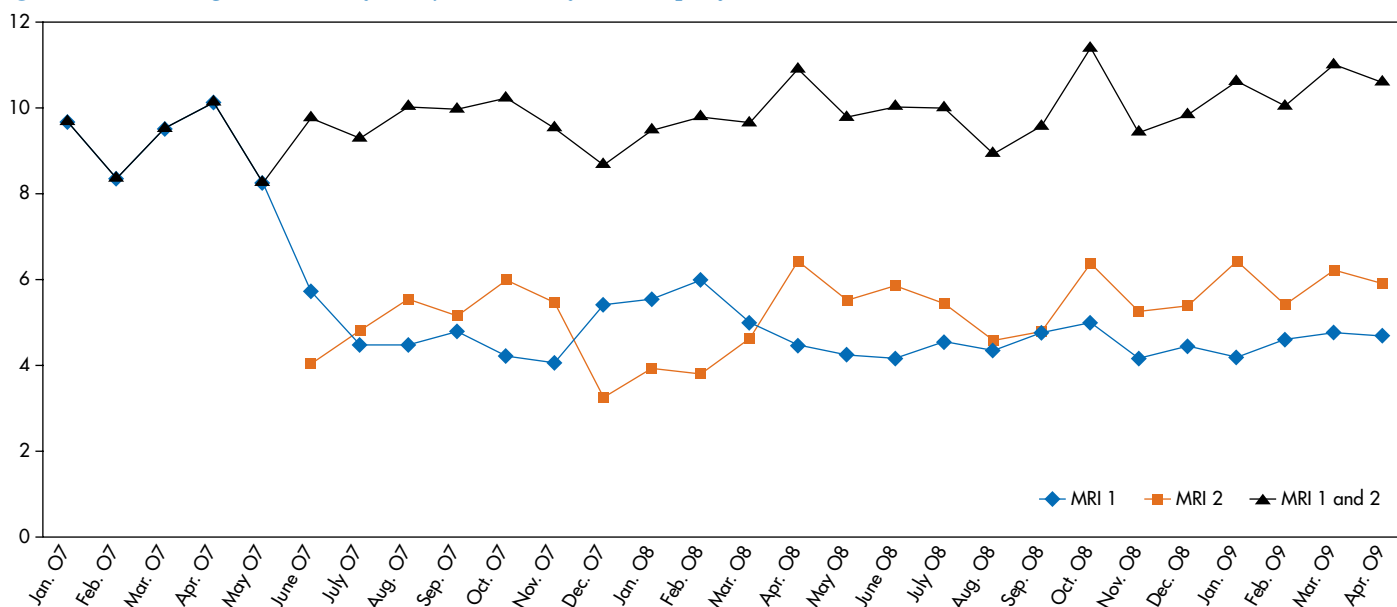
A two-day kaizen (Japanese for "change for the better") helped reveal the system of root causes and a series of countermeasures to address the issues identified. The MRI kaizen was successful for many reasons. The team was selected to include representatives from all the affected stakeholder groups. As change can often be difficult, making sure that stakeholders are engaged in the process was essential for a successful outcome. The Department of Radiology has participated in four of the five aforementioned programs, allowing the culture of continuous

Quality Journey

This MRI project truly embodied the culture necessary to complete a successful Lean Six Sigma project. Quality improvement projects are led by the Center for Operations Excellence (COE) at the hospital. The COE came to fruition in 2008, championed by Mark Watson, now president of the Akron Children's Regional Network, who saw Lean Six Sigma as the edge that would allow the hospital to thrive in a highly competitive market. Now comprised of a senior director, five project leaders, one data analyst, and an office coordinator, the COE has facilitated projects in nearly every department across the organization.

The COE's philosophy can be summarized succinctly by the phrase "Process Improvement Through People Development™." In other words, the key to successful continuous improvement is to develop the people who do the work to change the work for the better. The operating system at Akron Children's revolves around five major programs:

Figure 1—Average number of daily exams before the project



improvement to permeate the department. The kaizen followed A3 and Green Belt projects. After the kaizen, the department became the first to participate in the Blue Belt program.

The A3 and Green Belt projects led to several key improvements: standardization of the ordering, scheduling, and communication processes; standardization of the exam protocols by the radiologist; and identification of the 75-minute timeslot as the ideal duration to maintain patient flow. Despite these changes, more work was required to improve patient wait times.

Figure 1 illustrates that the addition of a second MRI scanner did not lead to the expected increase in the number of exams completed. The stated goal of the kaizen was to increase the number of weekly exams (Monday through Friday) performed on MRI #1 and MRI #2 from 86 to 112 by August 24, 2009, representing a 30-percent improvement.

A capability analysis revealed that the current process was not capable of reaching the stated goal (Figure 2). The team used a fishbone diagram and ease/impact chart to identify contributing factors and prioritize potential countermeasures. The master schedule and the insurance authorization process were identified as the two major factors to address.

After reviewing utilization data, the master schedule was modified to better meet the needs of the customers, including outpatients, inpatients, families, and ordering physicians (Figure 3). The new schedule provided better flexibility and more accurately matched the customer demand.

The insurance authorization process was modified to allow authorization during scheduling, enabling the radiology schedulers to pull patients into the MRI schedule prior to the original appointment.

Figure 2—Process capability prior to the kaizen of MRI 1 and 2 (February 2009 – July 2009)

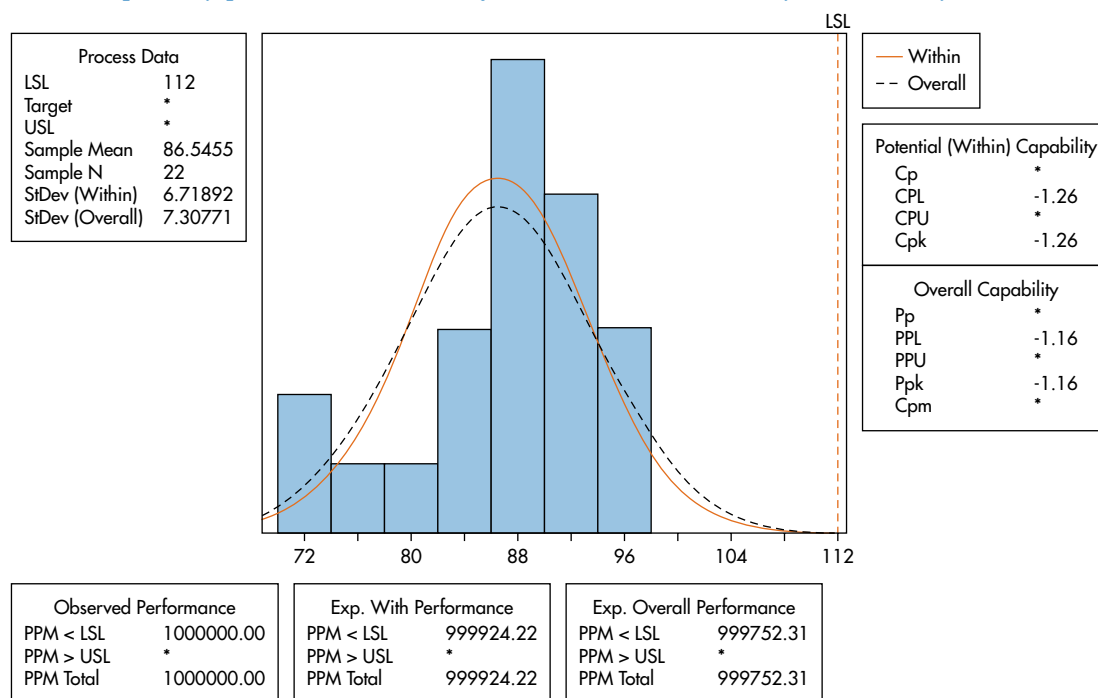


Figure 3—Master schedule modifications

MRI 1					
	Monday	Tuesday	Wednesday	Thursday	Friday
7:15	OP	OP	IP	OP	OP
8:30	OP-S	OP-S		OP-S	OP-S
9:45	OP-S	OP-S	OP-S	OP-S	OP-S
11:00	OP-S	OP-S	IP	OP-S	OP-S
12:15	OP-S	OP-S	W	OP-S	OP-S
1:30	OP-S	OP-S	OP-S	OP-S	OP-S
2:45	OP-S	OP-S	OP-S	OP-S	OP-S
4:00	OP	OP	OP	OP	OP

MRI 2					
	Monday	Tuesday	Wednesday	Thursday	Friday
7:15	OP 7:45	OP 7:45	OP 7:45	OP	OP
8:30	OP	OP	OP	OP	OP
9:45	IP		♥	OP	OP
11:00	IP	IP	10:00 – 12:00	IP	IP
12:15	W	W	♥	W	W
1:30	OP	OP	12:00 – 2:00	OP-S	OP
2:45	OP	1:30 – 3:30	♥	OP-S	OP
4:00	OP	OP	IP	OP/IP-S	OP
5:15	OP	OP	OP	OP	OP
6:30	W	W	W	W	W
7:45	L – 6:30 – 7:15	L – 6:30 – 7:15	L – 6:30 – 7:15	L – 6:30 – 7:15	L – 6:30 – 7:15
9:00	OP	OP	OP	OP	OP
10:15	OP	OP	OP	OP	OP

	New OP spots
	Flipped IP/OP spots

OP, Outpatient; IP, Inpatient; W, Wild Card; -S, Sedation needed; ♥, Cardiac MRI

Moving authorization upstream in the process created an effectively larger pool of patients who were eligible to fill the available slots. One of the most powerful effects of the kaizen was that it allowed people from various steps along the value stream to work together, face-to-face, to solve the issues they identified.

Figure 4 shows the immediate impact of the project, as wait times for exams rapidly decreased, the improvement in access times continued to be sustained. The results in Figure 5 demonstrated that the process was now capable of achieving the project goal, as evidenced by the C_{pk} of -0.17, compared with C_{pk} of -1.26 before the project. The histogram of exams per week is shifted to the right, compared to Figure 2, with some totals exceeding the project goal. The sustainability is best demonstrated with the control chart in Figure 6. The mean number of exams per week steadily increased after each Lean Six Sigma project.

Figure 4—Improvements in patient access times

Reporting period/date	Simple exam (no contrast/sedation)	Single exam (with contrast)	Exam with sedation
January – June, 2009	~ 4 – 5 days	25 days	6 – 8 weeks
July 13, 2009	4 – 5 days	25 days	27 days
September 17, 2009	3 days	3 days	6 days
October 2, 2009	1 day	3 days	10 days
November 6, 2009	1 day	3 days	8 days
November 27, 2009	1 day	2 days	9 days
Now, whether contrast is scheduled or not, access times are the same			
February 28, 2010	Same day		7 to 11 days
May 29, 2010	Same day		1 to 16 days
July 17, 2010	Same day		2 to 14 days
October 23, 2010	Same day		2 to 10 days
December 11, 2010	2 days		3 to 12 days
January 1, 2010	Same day		3 to 16 days
February 5, 2011	2 days		2 to 14 days

In October 2010, 13 months after the kaizen, 126 exams were completed in one week, exceeding the project goal by 14 exams. The average wait time for a single study was reduced to same-day, a multi-exam study with contrast was five to 11 days, and about 14 days if sedation is needed.

In February 2011, 17 months after the kaizen, results continue to be sustained with 114 exams completed in one week. February's wait time for a single study was same-day, eight days for a multi-exam study with contrast, and about two to 14 days if sedation was needed.

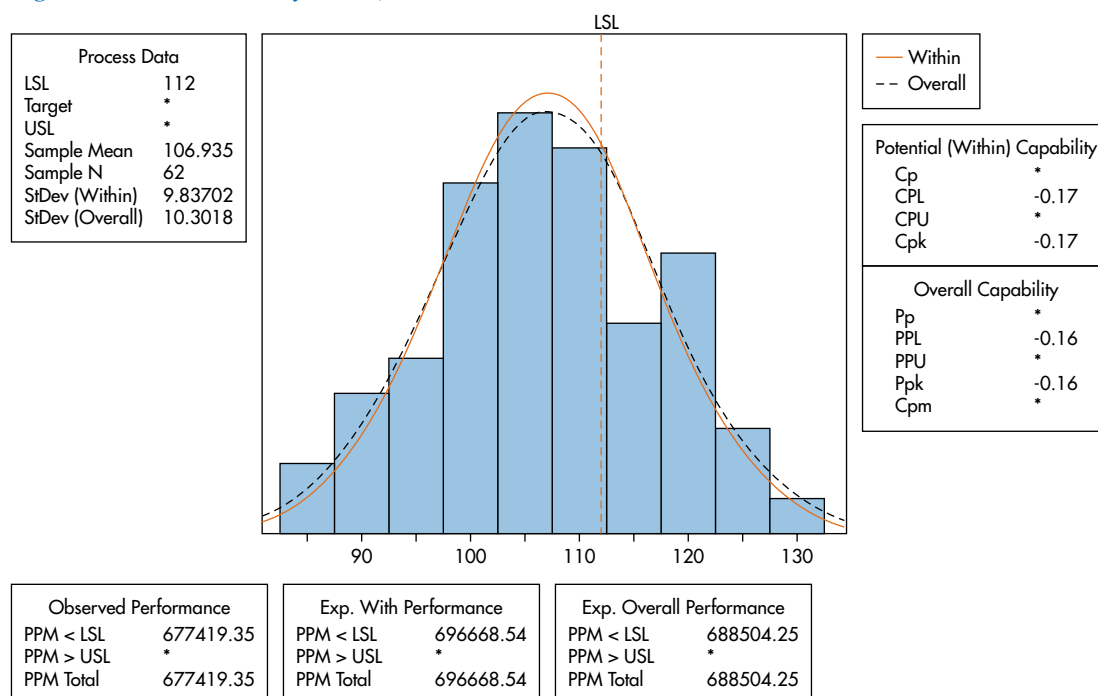
While improving patient access to care was the driver of Akron Children's project, the hospital earned \$1,271,603 in first-year incremental revenue.

Continuing Commitment to Quality

The Department of Radiology exemplifies continuous improvement. Every Monday, the director of radiology and his supervisors review exam volume and access time data from the previous week. If targets are not reached, for example, if less than 95 MRI exams were completed in a week, a root cause analysis is performed to understand the contributing factors and countermeasures are generated. This process is driven by daily huddles, identification of improvement opportunities, and the use of displayed metric boards.

The multidisciplinary team was recently recognized by the International Quality & Productivity Center (IQPC) with an Honorable Mention award in the "Best Project Under 90 Days" category at the 12th Annual Lean Six Sigma & Process Improvement Summit of 2011.

Figure 5—Process capability after the kaizen of MRI 1 and 2 making goal of 112 exams per week (August 2009 – February 2011)



Key Learning Points:

- The true success of the project is that the department understands the importance of continuous improvement, which has allowed them to sustain the gains they had achieved.
- The kaizen has exemplified how focusing on improving the customer experience, in this case by reducing patient wait times, leads to financial benefits and support of the corporate strategy.
- A key success factor was the selection of team members, ensuring that all stakeholders along the value stream were represented.
- The systematic, data-driven approach to quality improvement embodied by the Lean Six Sigma methodology provides a competitive advantage in a highly competitive market.

For More Information

- Please contact David V. Chand (dchand2@chmca.org) or Anne Musitano (amusitano@chmca.org) for more information about the Center for Operations Excellence at Akron Children's.
- The website for the Center for Operations Excellence is <https://www.akronchildrens.org/cms/site/e0e103f1c27ca6fa/index.html>.
- Learn more about Lean Six Sigma in healthcare at <http://asq.org/healthcaresixsigma/>.
- Read more case studies showing examples of process improvements in healthcare at www.asq.org/healthcare-use/why-quality/case-studies.html.

About the Authors

David Chand, MD, is a pediatric hospitalist and Lean Six Sigma project leader at Akron Children's. Prior to joining the hospital in 2008, Chand was a business management consultant for McKinsey & Company, where he focused on growth strategy and operations for healthcare providers in North America. He earned his bachelor's and master's degrees from Johns Hopkins University and his doctor of medicine degree at Harvard Medical School and The Massachusetts Institute of Technology. He completed his residency and chief residency in pediatrics at Rainbow Babies & Children's Hospital in Cleveland, OH. In 2009, he earned his Green Belt in Lean Six Sigma from the Center for Innovation in Quality Patient Care at Johns Hopkins University. Chand is working on a master's degree in business operational excellence at The Ohio State University.

Anne Musitano, PharmD, is a Lean Six Sigma project leader at Akron Children's. She joined the hospital in 2001 as a staff pharmacist in the outpatient pharmacy after graduating from The Ohio State University with a bachelor's degree in pharmacy. In 2004, she became the supervisor of the pharmacy and returned to Ohio State to earn her PharmD degree. In October 2008, Musitano helped build the program that has now become the Center for Operations Excellence (COE) at Akron Children's. She completed her master's degree in business operational excellence at Ohio State in 2010.

Figure 6—Sustained results in weekly exams MRI 1 and 2

