Systematically Improving Operating Room Patient Flow

Through Value Stream Mapping and Kaizen Events

by Dennis Delisle

Jefferson University Hospitals

At a Glance …

- Value stream maps (VSMs) are effective tools for facilitating incremental improvements to complex healthcare processes.
- Thomas Jefferson University Hospitals utilized the VSM approach to identify and execute seven lean projects within the perioperative department over four years.
- Results include preadmission testing reduction in length of visit from 110 to 92 minutes, 36 percent reduction in preoperative patient waiting, and an improvement of on-time first-case starts from 56 to 67 percent.

The focus of hospital senior leaders on operations expense reduction and management has been spurred by increases in costs of pharmaceutical and medical supplies, revenue movement from inpatient to outpatient settings, and malpractice insurance.[1] Key to addressing these issues is successfully utilizing performance improvement methodologies to improve quality and decrease variation, which saves money.[2] At Thomas Jefferson University Hospitals, inpatient and outpatient operating room (OR) activity accounts for a large percentage of total patient revenue. The majority of OR cases occur at the academic medical center known as the Center City campus.

As part of the perioperative (the department responsible for all surgical procedure activities) strategic plan overview, a team of certified lean practitioners was assigned to analyze and improve the OR patient flow process. Given the existing high volume of procedures and strategic vision to increase case loads, it was critical to ensure consistent flow throughout the system. From preadmission testing through the post-anesthesia unit, the entire process was wrought with inefficiencies (i.e., delays in preoperative patient processing, cases not starting on time, and slow OR turnover case to case) and bottlenecks that had compounding effects on the overall department.

Representatives from all related disciplines and departments converged to tackle the complex problem. Facilitated by the lean team, a value stream mapping (VSM) event was held in August 2010 to determine how to strategically solve key issues.

About Thomas Jefferson University Hospitals

Thomas Jefferson University Hospitals (Jefferson) is a 969-acute-care-bed healthcare facility located in Philadelphia, PA. Jefferson provides a full range of patient care in all specialties and subspecialties. The southeastern Pennsylvania, New Jersey, and northern Delaware region includes more than 11 million people. Annually, Jefferson clinical operations include nearly 50,000 admissions, more than 120,000 emergency department visits, and almost a half-million hospital-based outpatient visits.

Dennis Delisle, operations support director for Jefferson University Hospitals, discussing a pay-off priority matrix with team members.

OR Kaizen 6 Team – Improving OR Patient Flow From SPU to Holding Area

Why Quality?

Committed to lean thinking since 2008, in 2010 Jefferson hired a certified lean master to develop a robust education and process improvement program. As part of this program, more than 50 certified lean practitioners who are imbedded in various clinical and nonclinical departments volunteer their time for improvement projects. In addition to the formal university-based lean thinking and certification program, Jefferson offers staff department-level training that emphasizes application of simple, yet effective tools (i.e., 5S, visual management, process mapping) and leads to project execution on a smaller scale. Jefferson is dedicated to providing world-class care, and approaches like lean thinking enable staff to contribute value-adding services while reducing wasteful efforts.

The consumer-driven healthcare market demands a high degree of customer service and responsiveness. As such, Jefferson leaders identified a need to streamline the perioperative department's processes. The perioperative department engaged a team of certified lean practitioners to strategically evaluate opportunities and facilitate change. Operating room patient flow is a complex process that involves multiple areas, including:

- Physician offices
- OR scheduling
- Preadmission testing
- Registration
- Pre-procedure preparation
- Patient transportation
- Holding area unit
- Operating room
- Environmental services
- Post-anesthesia care unit

Given the numerous levels, functions, and responsibilities involved, leaders determined that the best approach to initiate the project would be a VSM event. The full-day facilitated effort included the lean team working with a group of process experts throughout the entire OR patient flow process.

Jefferson's Quality Journey

Prior to initiation of the VSM event, the lean team conducted voice of customer interviews with representatives from management and frontline staff. The interviews focused on qualitative analysis of key issues and barriers to patient flow. Throughout the discussions, several themes became apparent: constant changes to the OR schedule the day before or day of surgery, poor communication among perioperative units, excessive processes and patient travel due to poor layout, inadequate technology for decision making and monitoring flow, and workflow variation across all disciplines.

Following the interviews, the lean team began observations. A critical element of lean thinking is gemba walks. Gemba is a Japanese term that stands for the place of action, or where the work takes place.[3] The approach is simple: Go to where work is being done, observe the processes and workflow, and talk with staff to understand their challenges.[4] Gemba walks also enable

OR Kaizen 5 Team – Improving On-Time, First-Case Starts

the team to document process steps in the current state, a key input in the VSM event. Additionally, observations were supplemented by the OR information system database providing key performance indicators such as on-time, first-case starts, OR turnover times, and cycle times across the patient flow process. Together, these data helped shape the current state.

The lean team developed a comprehensive agenda that included current state validation, brainstorming and prioritizing issues and barriers, future state design, and creating an improvement plan for incremental progress over time. Managers and perioperative department leaders participated. Inclusion of the right stakeholders (i.e., process expert, influential leader, creative problem solver, etc.) is a critical element of successful improvement efforts. The OR vice president and management team helped choose a group of individuals to represent the broader department.

Figure 1 depicts the validated current state at the time of the event. Participants went through a facilitated brainstorming session to determine the key drivers of quality and efficiency issues. The problem-solving process used by the lean practitioners can be seen in Table A.

The group then began the solution development process. The proposed solutions were prioritized based on impact (high/low) and ease of implementation (easy/difficult). Figure 2 shows the current state, with proposed solutions represented as kaizen bursts.

This led to final recommendations of where the team should focus (Figure 3: Proposed Action Plan). At the conclusion of the event, the entire team presented the findings and recommendations to leadership, along with the timeline for implementation.

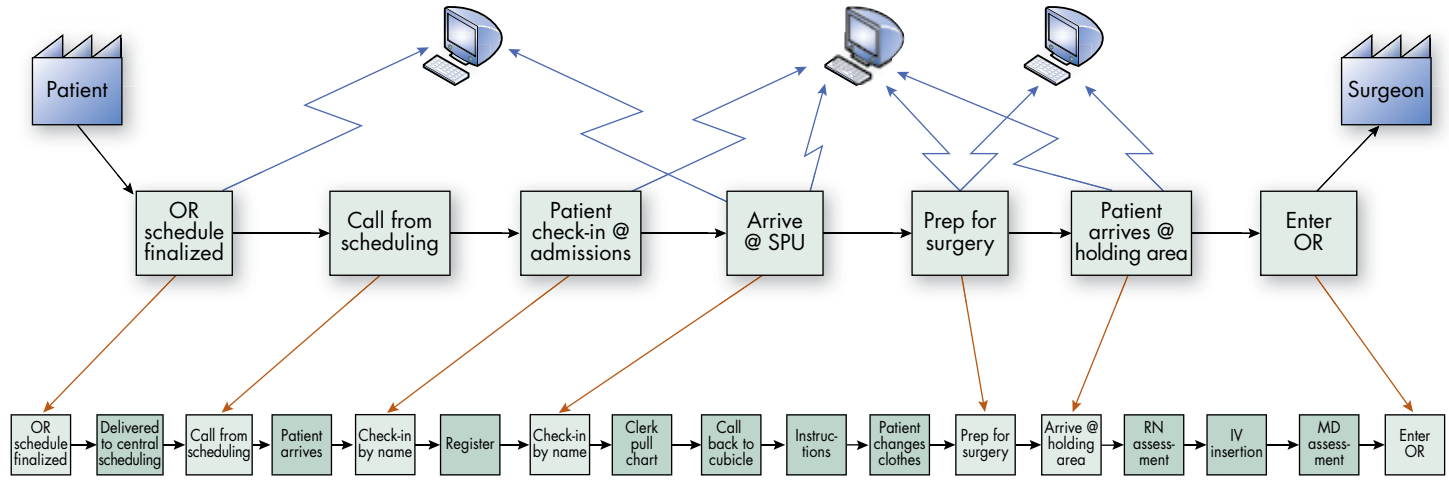
Lean thinking emphasizes incremental improvement over time. These improvement efforts are typically known as kaizen events. Kaizen, a Japanese term, represents "change for good." Lean teams facilitate kaizen events with process experts in order to rapidly develop and implement solutions. Jefferson lean teams utilize the define, measure, analyze, improve, and control (DMAIC) project structure to execute initiatives. The main deliverables for each phase can be seen in Table B.

The VSM team identified two areas as the priority focus based on the majority of opportunities and solutions identified through the VSM event. The first piece was patient arrival. Next, the

Table A — **Problem-Solving Process**

Step	Description	Deliverable
Brainstorm issues and barriers	Through various brainstorming activities, participants discuss and document all issues and barriers related to the problem being addressed.	Documented list of all issues and barriers that contribute to inefficiencies and poor quality.
Prioritize issues and barriers	The team determines which issues and barriers are within their control. These filtered issues are subsequently prioritized through voting.	The highest priority issues/barriers (usually two to four in total) are selected for solution development.
Brainstorm potential solutions	Through brainstorming activities, the team discusses and develops potential solutions to address the prioritized issues and barriers from the prior step.	Documented list of all potential solutions to address the prioritized issues.
Prioritize solutions	The team prioritizes solutions based on impact on the problem (high or low) and ease of implementation (easy or difficult).	All solutions are prioritized, highlighting the high-impact and easy-to-do ideas.
Develop action plan	A detailed action plan is developed for all solutions that fall within the high-impact, easy-to-do or low-impact, easy-to-do categories.	The action plan consists of what, who, when, required resources, and expected outcome. Plans are executed within a six-week timeframe, often with pilots occurring during the actual kaizen event.

Figure 1 — **OR Patient Flow VSM**



SPU = short-procedure unit

Figure 2 — OR Patient Flow VSM With Proposed Solutions

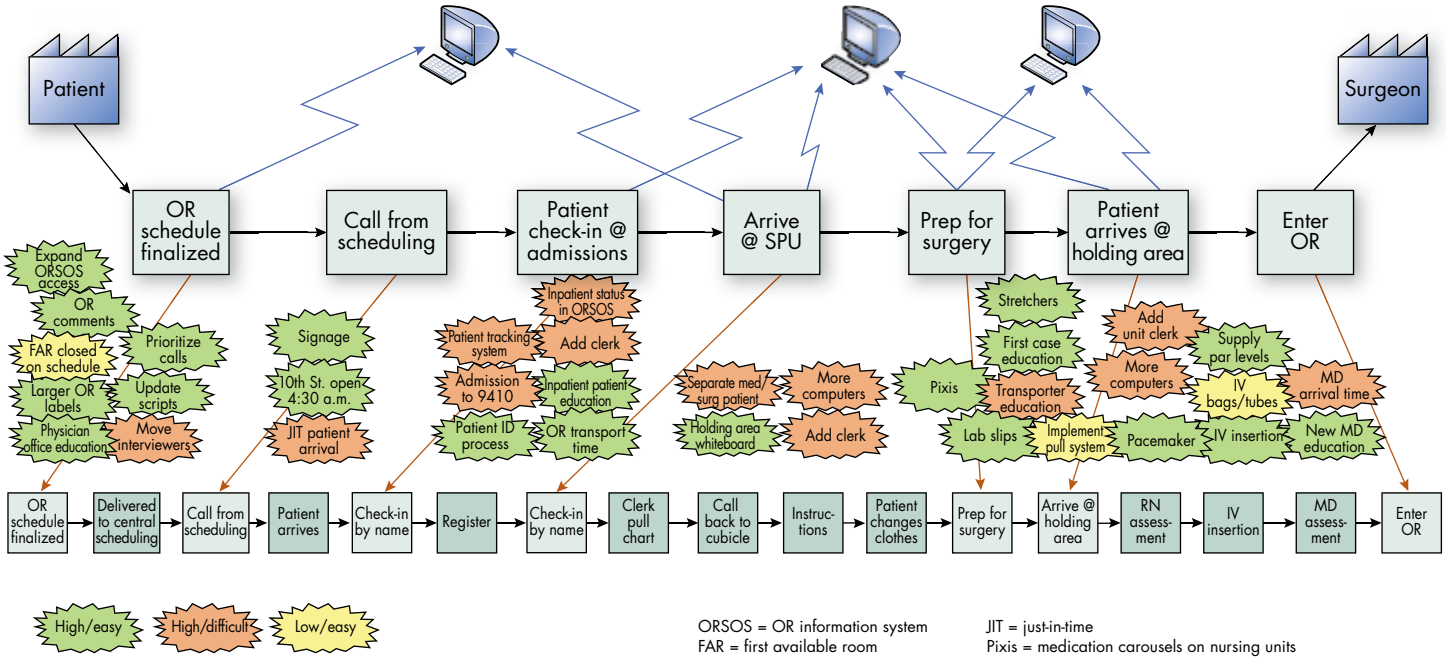


Figure 3 — OR Patient Flow VSM With Proposed Action Plan

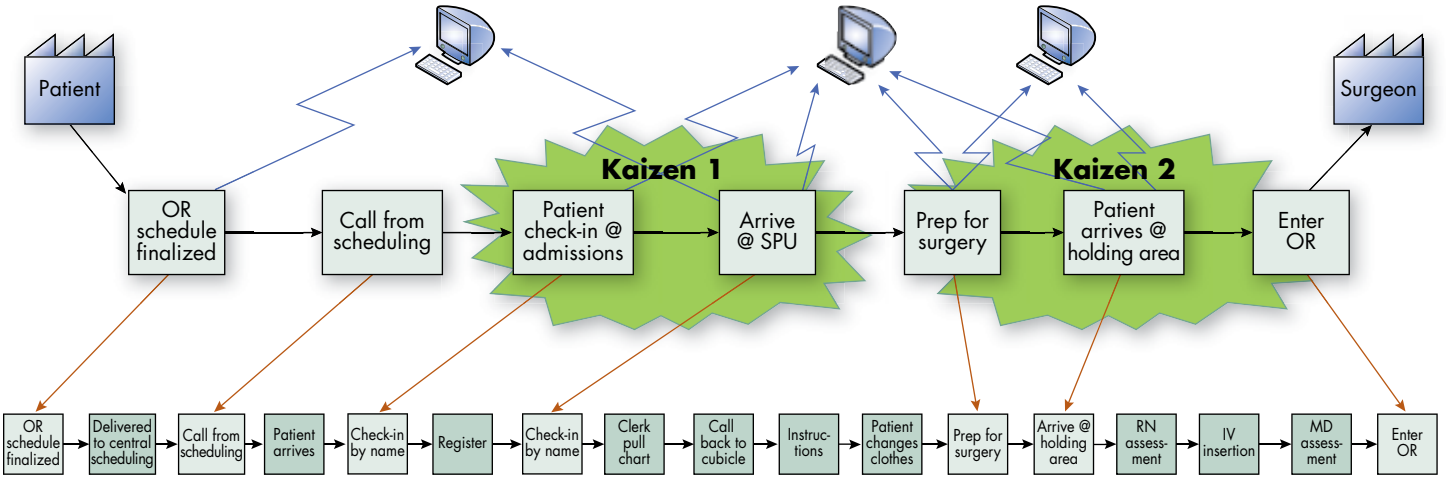


Table B — DMAIC Steps

Phase	Main Deliverables
Define	Project charter, voice of customer interviews, waste walks, high-level process mapping
Measure	Baseline data collection, roll-out of communication plan, time study observations
Analyze	Data analysis, kaizen event agenda development and logistics
Improve	Kaizen event: develop and implement solutions
Control	Follow-up action plan meetings, data analysis, final project summary

recommendation was to look at the holding area process where patients have an IV line placed and are then interviewed by the surgical and anesthesia teams (interventions and outcomes of all efforts can be found in the results).

After execution of the first and second kaizen events, the lean team re-evaluated the VSM with perioperative department leadership to identify additional opportunities for improvement. Over the course of four years, the lean team systematically addressed issues and challenges through seven formal kaizen events. The scope of the subsequent improvement efforts spanned scheduling through post-procedure processes and can be seen in Table C.

The table shows the various kaizen events and scope of each. Various kaizen events tackled similar processes and areas. The nature of lean thinking is continuous improvement, and as such, improvements made early on were later evaluated and further streamlined. Along the OR improvement journey, many staff—from several different departments, including OR, transportation, patient access, and environmental services—were incorporated within the project team.

Kaizen team participants were chosen in a similar fashion to the VSM event. The lean team, along with OR leadership, targeted individuals with process expertise and an orientation of continuous improvement or known resistance to change. The last part is crucial in identifying and developing meaningful and realistic solutions. Active resistors oftentimes have valid reasons for their hesitation to get involved. The dissenting voice offers the group opportunities to challenge ideas, reflect on past success and failures, and build a stronger process. Many individuals participated in more than one kaizen given their interest, roles and responsibilities, and ability to implement action plans.

Results

The systematic approach to improve OR patient flow yields steady gains over time. In four years, the various kaizens have produced a bandwidth of positive outcomes—from statistically significant and sustainable gains (e.g., Kaizen 3), to marginal, qualitative improvements (e.g., Kaizen 2). The complexity of systems and processes, along with personnel, make each project unique. Key lessons learned, such as those listed in Table D, are leveraged from one effort to the next while results are shared with participants and department staff along the way.

Though many gains have been realized, work remains. The VSM enables the team to effectively segment and attack small portions of the overall process. Gains realized from one effort contribute to the success of subsequent initiatives.

Jefferson's Continuing Commitment to Quality

To date, many of the outcomes achieved continue to sustain and improve. As depicted in Table E, the lean teams continue to circle back to address additional improvement opportunities in areas such as the short-procedure unit, the patient testing center, and the holding area. To drive results down to frontline staff, Jefferson has evolved its lean approach to incorporate a structured education program. Since Kaizen 7, a team of lean practitioners engaged a multidisciplinary group from the perioperative department. The eight-week education program emphasizes the application of lean thinking, and its associated tools, and concludes with a formal project proposal submitted by the participants.

These project ideas are subsequently evaluated by leadership (departmental and lean program) and then executed with the appropriate method (i.e., just do it, project management, full lean engagement, etc.). The goal of this revamped approach is to enable staff to solve their own problems at

Table C — **Kaizen Events**

Kaizen Title	Scope
Kaizen 1: Improving patient flow from arrival to holding area	Parking lot, registration, short-procedure unit (SPU)
Kaizen 2: Improving patient flow from arrival to holding area	Holding area
Kaizen 3: Improving patient flow in the patient testing center	Patient testing center (preadmission process for patients one to two days prior to surgery)
Kaizen 4: Improving OR turnover	Eight OR suites
Kaizen 5: Improving on-time, first-case starts	Scheduling to SPU
Kaizen 6: Improving OR patient flow from SPU to holding area	SPU and holding area
Kaizen 7: Improving patient flow in the patient testing center	Patient testing center

Table D — **Lessons Learned**

Theme	Lessons Learned
Change	• Let go of the past and embrace change • Think out of the box • A small group can actually drive meaningful change • There's always room for improvement • Keep an open mind to change
Teamwork	• Important to work as a team • Everyone melds ideas together to help create solutions • More aware of job responsibilities in other areas • Gained respect for other areas
Staff involvement	• Need to educate staff on changes early and often, communication/education is critical • Staff need to know how valued their role is within the process
Kaizens	• Stay focused on goals to impact change in short period of time • Kaizen is needed to focus on problems and make processes better • Have patience with the kaizen problem-solving process • Go from good to excellent in customer service by making patients a central focus of the process

Table E — **Kaizen Results**

Kaizen Title	Timeline	Countermeasures	Results
OR Patient Flow VSM	May – August 2010	• Facilitated full-day current and future state VSM session to identify and prioritize opportunities for improvement	• Verified and finalized VSM • Developed future state map • Identified 20 high-impact interventions along the VSM • Prioritized and determined Kaizen 1 and Kaizen 2 scopes
Kaizen 1: Improving Patient Flow From Arrival to Holding Area	September – November 2010	• Moved patient registration to the bedside • Standardized charge nurse desk patient monitoring process • Streamlined short procedure unit (SPU) work processes to coordinate with registration process	• Overall process time (patient arrival to ready for transport) reduced by 31.9 percent • Pre-kaizen: 56.9 minutes/Post-kaizen: 38.8 minutes (18.1 minutes overall). Waiting time was reduced by 35.9 percent (from 25 to 15 minutes), patient travel time was reduced by 63.3 percent (from 5 to 1.5 minutes), and patient check-in time was reduced by 63.6 percent (from 5 to 1.5 minutes).
Kaizen 2: Improving Patient Flow From Arrival to Holding Area	November 2010 – February 2011	• Installed whiteboards in all three holding areas as visual cue to missing patient information • Implemented "1" box surgeon checklist, replacing comprehensive, multidisciplinary checklist • Developed and implemented nurse scripting to address patient expectations about waiting • Developed surgeon on-time, first-case start performance report	• Holding area length of stay (LOS) around 30 minutes (avg. 55.9) • Less wasted motion for all staff • Patient satisfaction regarding wait times improving
Kaizen 3: Improving Patient Flow in the Patient Testing Center	March – August 2011	• Reduced the number of processing steps • Brought patients back to exam room upon arrival • Registration completed in exam rooms • Nurse practitioners performing EKGs and labs • Discharging patients from exam room • Installed whiteboard to monitor patient flow, status at flow desk	• Pre-intervention LOS (109.65 minutes)/ Post-intervention (92.33 minutes, p<0.000) • Pre-intervention achieved its daily target of 90-minute average LOS, 4.29 percent of the time. Post-intervention, the target was exceeded 35.0 percent of the time, marking a 715.9 percent improvement (p<0.000).
Kaizen 4: Improving OR Turnover	September 2011 – January 2012	• Developed nursing assistant team assignments • Implemented OR case room preparation checklist • Posted turnover results on whiteboard for prior week • Continued monitoring of cases exceeding 30-minute target in real time • Developed future state swim lane map to target opportunities for improvement	• Pre-intervention turnaround time was 48 minutes (standard deviation 6.7). Post-intervention turnaround time was 44.1 minutes (standard deviation 3.7) (p=0.003). By stabilizing the output, subsequent improvement efforts are positioned to favorably impact results. These data are now monitored and posted on a weekly basis by the OR charge nurse.
Kaizen 5: Improving On-time, First-case Starts	March – August 2012	• Increased bedside registration availability to 4:45 a.m. – 8:30 a.m. • OR schedule/mapping created a list of issues to identify potential barriers to on-time starts the day before • Perioperative department to make pre-surgery calls instead of general central scheduling, include scripting for reinforcing patient arrival time • Utilize newly created first-case starts tracking tool to monitor SPU/holding area (HA) cycle times	• Cycle times from patient arrival at SPU to surgery start were reduced in all four ORs. • Overall, the SPU to HA time reduced by 35 minutes and HA to start of case was reduced by nine minutes. • The time from SPU arrival to start of case was 44 minutes faster post-kaizen. • These operational efficiencies will help the SPU and HA staff to prepare patients for on-time starts.
Kaizen 6: Improving OR Patient Flow From SPU to Holding Area	December 2012 – July 2013	• Conducted detailed time study of registrar/nurse/transport in SPU to identify opportunities to streamline processes • Collaborated with transportation department to assign two additional transport aides at 5:30 a.m. • Incorporate schedule changes during mapping meeting day before surgery to anticipate patient needs	• The first cases pre-kaizen were on time 55.7 percent of the time. Post-kaizen, 67.4 percent of the first cases began on time. • Holding area arrival times had a modest improvement from 33.9 percent on-time to 36.8 percent. • Pre-kaizen cycle time from patient arrival at SPU to ready for holding area was 47.43 minutes. The post-kaizen cycle time was 44.94 minutes—achieving the 45-minute goal.
Kaizen 7: Improving Patient Flow in the Patient Testing Center	September 2012 – January 2013	• Registrar to receive OR schedule in advance to identify patients for preservice • Registrar to preregister patients 24 to 72 hours in advance of scheduled visit and clarify information during call (e.g., demographic information/insurance coverage) • Clerks preparing charts at least 24 hours prior to patient's scheduled visit • Upon arrival, the preregistered patient is taken to an open examination room and nurse practitioners and techs can begin testing immediately • The preservice model allows the registration staff to prepare the chart in advance of patient arrival, effectively decreasing patient LOS while increasing patient satisfaction	• The average LOS from May – November 2012 was 129.8 minutes. Post-intervention, the average LOS was 118.9 minutes. • Since September, LOS was reduced from an average of 131.6 minutes to 117.8 minutes (p<0.00).

the source and use experienced lean teams to address systematic, multi-departmental barriers and issues. The lean team's OR engagement success has been replicated in additional clinical areas, including the pharmacy and oncology services.

Organizations, both large and small, can leverage the powerful impact of lean thinking. Use of tools such as VSMs provides an objective way to approach complex issues and facilitate incremental improvement over time.

For More Information

- Contact Dennis Delisle at dennis.delisle@jeffersonhospital.org to learn more about this project.
- Find Thomas Jefferson University Hospitals online at www.jeffersonhospital.org.
- Find more case studies on quality improvement in healthcare in the ASQ Knowledge Center at asq.org/knowledge-center/case-studies.

Acknowledgements

Kaizen Participants

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