Don't Lose Patients

Hybrid approach helps hospital **streamline key process**

by Todd Creasy and Sarah Ramey

CLINCH VALLEY MEDICAL Center—a for-profit, 175-bed hospital operating in western Virginia and part of a healthcare organization with operations in 18 states—has been undertaking lean Six Sigma initiatives for about three years.

During its continuous improvement efforts, the hospital employed the principles of 6TOC[1]—a combination of lean Six Sigma and the theory of constraints (TOC)[2] in which organizations resolve process flow constraints or bottlenecks in a service-delivery system with lean and Six Sigma tools.

The hospital's senior management team decided to focus on the preadmission testing (PAT) process as part of the hospital's continuous improvement initiative. PAT evaluates, assesses, educates, and prepares patients and families for a successful and safe hospital experience. Along with the emergency department, these services are a cornerstone to hospital revenue.

PAT is the front door to a patient's experience in any hospital and provides patients their first impression of the hospital and services rendered. Nearly all outpatient procedures are considered elective surgery in that patients can select the hospital organization at which they wish to receive the surgical procedure. A poor PAT experience can send the potential patient elsewhere.

PAT is also a vital part of the process for operating room (OR) clinicians. During PAT, all of a patient's pertinent information is collected—medical history, current medications, lab results and electrocardiograms. Without a streamlined process, one or more of these aspects can be inadvertently omitted. This omission can result in delayed surgery or cancellation, leading to lost revenue.

In 50 Words Or Less

- Concerned about inefficiencies in a key process, a hospital combined lean Six Sigma and the theory of constraints to identify and eliminate bottlenecks.
- As a result, the hospital cut wait time for its patients by 70% and eliminated the main cause of customers seeking other providers.

Hearing voices

The PAT process at Clinch Valley Medical Center begins with the patient's physician contacting the hospital and scheduling a surgery appointment. It concludes with the patient arriving home from the hospital after having health and prescription reviews, procedures scheduled, and any necessary X-rays and laboratory tests conducted.

The list of stakeholders for the PAT process includes patients, physicians, nurses, PAT assessors, lab technicians, OR schedulers, the medical records department, hospital admissions and other employees in the physician's office.

Based on the fact that customer experience can enhance an organization's revenue and margins, and can help organizations differentiate themselves through total customer experience,[3] voice of the customer (VOC) data were collected from these PAT stakeholders. It was determined the process had six areas of concern:

1. **Patient education.** Patients didn't understand their financial obligations and weren't being educated about the preadmission process and ultimate outcome.
2. **Effective communication.** Throughout the process, there wasn't effective communication that included the external physician, PAT nurse, hospital coordinators and patient.
3. **Patient scheduling.** Patients were visiting the hospital in very erratic patterns and not in a consistent flow.
4. **Waiting**. Patients were experiencing excessive waiting, and their time in the hospital was not being managed well.
5. **Documentation.** Documents were being reproduced two and three times for various departments in the hospital.
6. **Bottlenecks.** The process produced excessive amounts of work-in-process information backups and patient delays.

As a result of these problem areas, the PAT process was determined to be time-consuming and potentially contributing to patient dissatisfaction.

Process exploration

With three months to improve the process, the hospital collected a sample size of 62 consecutive patient experiences during one week. The PAT process had an average unnecessary patient wait time of about 20 minutes (standard deviation of about 18 minutes), with some waits exceeding an hour. The goal of the PAT project was to reduce patient wait time by 30%.

The improvement drive continued with the construction of a high-level process flow chart that included a suppliers, inputs, processes, outputs and customers (SIPOC) diagram (Table 1). The critical-to-quality areas within the SIPOC dealt primarily with patient education, pre-screening accuracy, stakeholder communication and scheduling of the surgical procedure.

The column in the table marked "Process" affords a high-level view of the PAT procedure. The rule of thumb for SIPOCs when initially considering the process column is not to exceed four to seven horizontal levels. This type of process documenting activity can lead to a better understanding of the process and identify possible improvement alternatives.

With a room full of PAT stakeholders following the 6TOC principles, the process was dissected at a high level (Figure 1, p. 46). A process flowchart was created indicating natural process break points and which Green Belt (GB) team would attend to that portion's improvement needs.

When this process was mapped, the stakeholders were asked to identify bottlenecks within the process. This is where TOC and its five basic tenets proved useful:

1. Identify the bottleneck.
2. Exploit the bottleneck (get the most out of it).
3. Subordinate the system to the speed of the bottleneck's flow.
4. Alleviate the bottleneck (make significant changes that reduce or eliminate the bottleneck).
5. Begin identifying more bottlenecks.

The bottlenecks were identified as:

- Step 6—Surgeon's office informing patient of PAT date and surgery information.
- Step 8—Patient time in waiting room with beeper.
- Step 10—Pre-registration and the collection of patient information or payment.
- Step 15—Start of patient assessment.
- Steps 18-19—Direction and education regarding laboratory test and X-rays.

This process is similar to the explanation of healthcare as a chain of handoffs.[4] Bottlenecks were considered along with natural breaks in the process to portion out the smaller segments that comprise the larger PAT process.

Before the groups of stakeholders were released and GBs formally assigned to each section of the process, the team explored early improvement ideas by using a functional deployment matrix (FDM). Similar to a prioritization matrix,[5] an FDM is a quantitative method for brainstorming necessary inputs and desired outputs using a simple, two-dimensional format.

Table 2 (p. 47) lists the key process input variables and key process output variables as determined by the PAT stakeholders who constructed an FDM during an all-day meeting.

Improvement initiatives

The PAT improvement team pursued bottleneck exploitation or elimination using lean Six Sigma tools and followed these seven improvement steps:

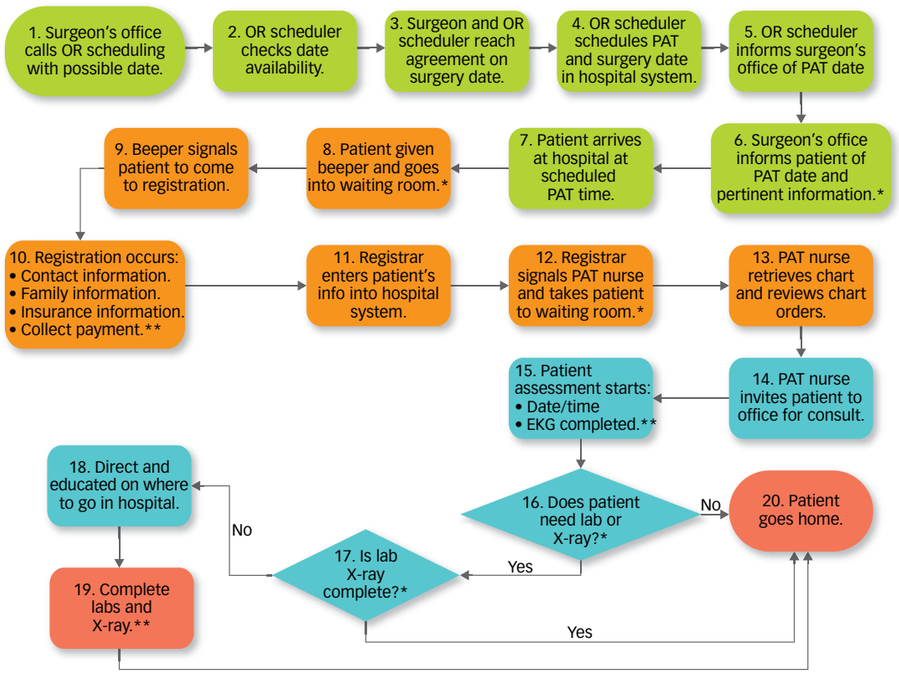
1. Three paper-based forms each containing two pages and one computer-based form were combined into a single computer-based form. This eliminated work redundancy by the PAT nurse and also sped up the process time for each patient, thus reducing total time in the PAT system.
2. Because there was an information gap between the local, referring clinics and the hospital's internal practices and processes, the patient information booklet was revised and reformatted for use with surrounding clinics. Based on clinician VOC, a communication guide was constructed to enable office administrators and clinicians to better understand the hospital's internal process needs and to educate patients.
3. The delivery process by which local clinics forward patient charts to the hospital was changed. Formerly, the patient was responsible for delivering the chart to the hospital, which resulted in administrative delays. By using VOC from one of the clinics, this chart

Suppliers, inputs, processes, outputs and customers / TABLE 1

Supplier	Input	Process	Output	Customer	CTQ
Physician Patient	1. Physician. 2. Patient. 3. Ailment. 4. Doctor's office – administration.	Physician schedules surgery appointment.	1. Surgery date established. 2. Instruction booklet is given.	1. Patient 2. CVMC. 3. Scheduler.	1. Date – correct. 2. Instruction – correct and concise. 3. Surgery – correct procedure.
Physician Patient	1. Physician. 2. Patient. 3. Ailment. 4. Physician's office – administration.	OR scheduler schedules PAT appointment.	1. PAT date/time. 2. Process education.	1. Patient. 2. Physician. 3. PAT nurse.	1. Patient knows PAT date/time. 2. Patient knows process.
Patient Scheduler Physician's office	1. Patient. 2. PAT schedule.	Patient arrives at hospital and registers.	1. Patient is pre-registered. 2. Patient pays money. 3. Insurance information is acquired. 4. Patient receives directions.	1. Patient. 2. PAT nurse. 3. Hospital. 4. OB.	1. Patient knows where to go. 2. PAT nurse notified timely. 3. Payment to CVMC. 4. Correct insurance company information.
Physician Patient	1. Patient. 2. Correct physician orders. 3. Consent form.	Patient is assessed (EKG and H&P).	1. History—surgery/patient education completed. 2. EKGs completed. 3. Anesthesia assess completed.	1. Patient. 2. OPS. 3. OB. 4. Anesthesia.	1. Correct patient history. 2. Correct patient education. 3. Correct chart to OPS.
Physician Patient OR scheduler	1. Patient. 2. Physician orders (via PAT nurse).	Patient is transferred for ordered tests (labs or X-rays).	1. Copy to patient (lab and X-ray). 2. Patient education.	1. Patient. 2. Laboratory. 3. X-ray.	Timely, completed, accurate and obtained/scanned.
Patient OR Scheduler	1. Patient. 2. OR schedule.	Patient leaves discharged with surgery date/time.	1. Schedule surgery date and time. 2. Patient education.	1. Patient 2. OPS and OB.	Correct patient information.

CTQ = critical to quality
CVMC = Church Valley Medical Center
EKG = electrocardiogram
H&P = history and physical
OB = obstetrics
OPS = operations
OR = operating room
PAT = preadmission testing

PAT pre-improvement process flowchart / FIGURE 1



* Data collected including wait time
** Standard operating procedure needed?
Colors denote four different Green Belt teams.
EKG = electrocardiogram
OR = operating room
PAT = preadmission testing

acquisition bottleneck was alleviated. A courier now picks up all patient charts daily from surrounding clinics and delivers them to the hospital. Reducing chart delivery variation in this process has resulted in no lost patient charts or paperwork.

4. The internal method by which the patient's chart travels from hospital registration to the PAT nurse was changed. Previously, the PAT nurse would retrieve the chart from registration and escort the patient to a doctor's office. In an effort to reduce patient waiting time, a member of the registration group walks the patient and pertinent chart to the PAT nurse after completion of patient registration. This process standardization has eliminated the bottleneck, improved communication and dramatically reduced wait time.
5. Patient transport was redesigned. Formerly, the patient would travel from the PAT area to radiology or the lab for X-rays or specimen collection. Adhering to lean principles, a patient-movement step was removed. Now, the PAT nurse draws the specimen, thus eliminating specimen collection bottlenecks, and transports the patient to radiology if necessary.
6. The process for collecting patient-prescription information was altered. Formerly, if the patient did not bring a complete list of current medications to the hospital, the PAT nurse would call local pharmacies and construct an accurate list while the patient waited. With the new standardized process, the PAT nurse schedules time at the end of the day to contact the pertinent pharmacies for specific patient information. Not requiring patients to wait while making calls reduced patient wait time.
7. Within the hospital's IT group, a custom-built patient tracking system was developed to serve as a signaling device. This system alerts the nurses in outpatient surgery of a bottleneck in the PAT area. After being notified, a nurse arrives to alleviate the bottleneck and associated stress. Applying human resources in times of peak patient inflow exploits the bottleneck's capacity for service, thus reducing patient wait times.

Functional deployment matrix / TABLE 2

	Key process output variable (KPOV) *	Correct, complete information and education	PAT properly scheduled	Friendly patient service / diplomatic	Waiting time	Complete assessment		
	Patient (customer) priority Rank *	9	7	9	9	6		
	Key process input variable (KPIV) *						Calculated rank	Calculated percent rank
1	Physician office has information.	8	9	3	3	3	207	13.69
2	Information and process is correct.	9	9	3	5	8	264	17.46
3	Patient knows where to go.	9	7	6	7	2	259	17.13
4	Standard operating procedure.	10	5	6	8	9	305	20.17
5	Communication tool.	9	4	9	3	5	247	16.34
6	Employee scheduling.	2	8	8	6	5	230	15.21

* KPIVs, KPOVs, rankings and non-calculated numbers were acquired from stakeholder opinions in all day team meeting.
PAT = preadmission testing

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Removing process steps or combining steps for synergy's sake are a tenet of lean. The new process has 17 steps (Figure 2, p. 48) compared with the former, which had 20.

More importantly, a post-improvement sample size of 61 consecutive patients during the course of one week—two months after the project was initiated and improvements began—revealed the average patient wait time dropped from about 20 minutes to just under six minutes, a reduction of around 70%.

In addition, the standard deviation narrowed from 18.9 minutes to just under 6.3 minutes, a 67% reduction. The effect of these process changes is illustrated in Figures 3 (p. 48) and 4 (p. 49) in the form of box plots.

Proving improvement

Practitioners of process improvement are sometimes perplexed at the outcomes resulting from their labors. They wonder whether the performance after the improvement change is truly different than the baseline data or is simply a process operating on a good day.

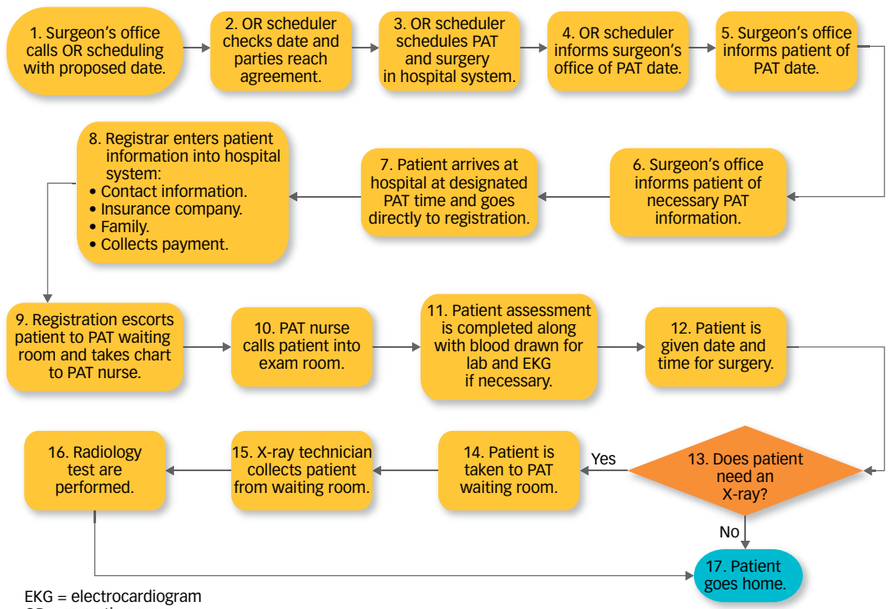
The answer lies with a two-sample t-test,[6] which analyzes data under the assumption the populations from which the samples are drawn are not different (the statistical difference between the population's mean is zero), and therefore the process hasn't changed statistically.

A p-value of greater than 5% (assuming a 95% significance level) indicates the comparator samples may actually be from the same population—hence no significant change in the process. P-values of less than 5%, however, are indicative of the data sets not being taken from the same population and suggest the post-process improvement sample is significantly different.

This test quantitatively illustrates what all improvement practitioners desire to know: the process has improved, and the time and energy invested were not in vain.

After examining the results of the two-sample t-test, Clinch Valley Medical Center discovered the p-value was 0 (confidence interval for mean difference = 8.52, 18.61). A test of equal variance (hypothesizing the variations were the same) provided a p-value of 0 for two other

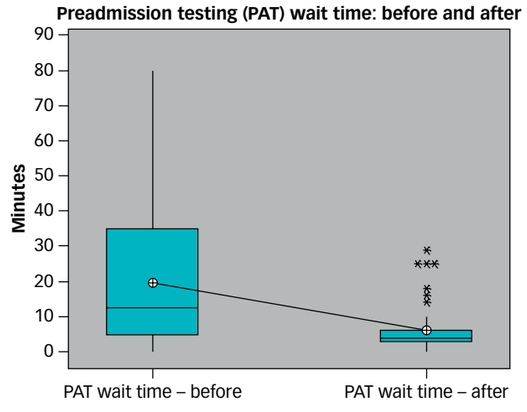
PAT post-improvement process flowchart / FIGURE 2



statistical tests: an f-test and a Levene's test.

Again, this suggests the samples came from different populations, implying the GB team made a difference in the hospital's PAT process. Figures 3 and 4 provide graphical evidence of this outcome.

Box plot comparisons / FIGURE 3



What did we learn?

The hospital took away five lessons from this project:

1. An easy solution is not always a good solution. What is considered straightforward may not account for all the dependencies within a process. For example, the stakeholder departments relied heavily on the PAT nurse to manage the process. Although straightforward, this was not the best solution.

Also, patients were asked to bring their own paperwork with them to the hospital. This resulted in incomplete or missing information. A daily courier service to each patient's primary-care physician remedied this problem.

2. It's the process, not the people. Professional staff working within a process—often for years—can take ownership, which can translate to professional identity. Tweaking the process means adjusting their responsibilities or covertly conveying they have been doing it wrong for years. Tact and finesse are required to overcome this obstacle.

For example, the PAT nurse had been managing the process alone for more than five years and had been a hospital employee for about 30 years. Initially, he wasn't open to suggestions or process modifications. He took pride in his responsibilities and had difficulty seeing the need for improvement. Focusing on the process rather than the person helped change that perspective.

3. Good data are key. Data have a way of draining all the emotion out of the room. But valid data enable team productivity. The PAT nurse heavily associated his identity to his work tasks. One week of initial wait-time data, with subsequent weekly data follow-up for two months, helped convince him of the need for change.

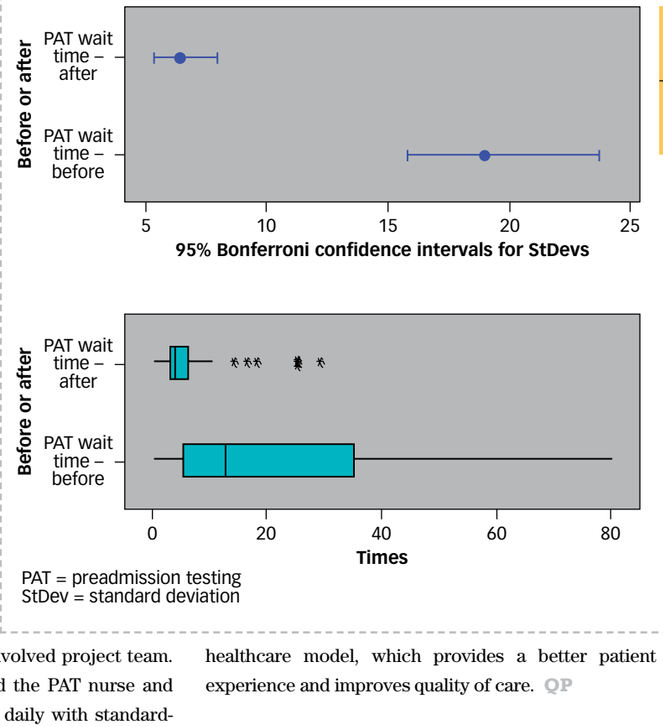
4. Get your hands dirty. Unless you get involved with the day-to-day operations, you may never get an accurate assessment of the inner workings of a process. Few solutions can come from an uninvolved project team. GBs from the team accompanied the PAT nurse and collected process wait-time data daily with standardized forms.

5. See the results quickly. Success breeds momentum. As is often the case with processes that have multiple transfer points, momentum is required to reach the tipping point and beyond. Throughout the improvement process, patient wait-time data were collected weekly, trended and reported to the PAT nurse and his supervisor. This constant process attention through data proved to be invaluable.

In the future, hospital reimbursements from Medicaid and Medicare will align even further with improved performance standards. With the advent of the consumer-patient concept due to the rising popularity of consumer-driven health plans, hospital patients will start becoming more price-centric.

This will force hospital administrators to focus intently on all improvement opportunities to help drive down price, thus attracting patients while enhancing quality efforts to receive maximum reimbursement from the U.S. government. The 6TOC approach can aid administrators in their quest to deliver a better healthcare model, which provides a better patient experience and improves quality of care. QP

Test for equal variances for times / FIGURE 4



F-test	
Test statistic	0.11
P-value	0
Levene's test	
Test statistic	29.77
P-value	0

PAT = preadmission testing
StDev = standard deviation

REFERENCES

1. Todd Creasy, "Pyramid Power," *Quality Progress*, June 2009, pp. 40-45.
2. Jeff Cox and Eliyahu M. Goldratt, *The Goal: A Process of Ongoing Improvement*, North River Press, 1986.
3. John Goodman, "Taking the Wheel," *Quality Progress*, February 2012, pp. 42-47.
4. Edward Chaplin, "Reengineering in Health Care," *Quality Progress*, October 1996, pp. 105-109.
5. Jack ReVelle, "Making the Connection," *Quality Progress*, July 2010, pp. 36-44.
6. David Freedman, Roger Purves and Robert Pisani, *Statistics*, third edition, WW Norton and Co., 1998, pp. 127-129.

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