The Nebraska Medical Center is a 735-bed nonprofit hospital in Omaha. Made up of two merged facilities—Clarkson Hospital and the University of Nebraska Medical Center—it is the largest teaching hospital in the state, with both academic and private practice physicians. It began implementation of Six Sigma in December 2002, with this definition as a guide: Six Sigma is “a statistical measure of performance of a process or product; a goal that reaches near perfection for performance improvement; and a system of management to achieve lasting business leadership and world-class performance.”

The Nebraska Medical Center’s interventional radiology department was selected as one of the first areas of focus through the hospital’s project selection process. With a staff of 12 to 15 nurses, radiology technicians and physicians, this department performs a wide variety of invasive procedures, including placing urethral stents, transjugular liver biopsies, and procedures using fluoroscopy and chemoembolization.

In October 1997, physician loss and process inefficiencies were causing patient volume to decline. By 2002, it still hadn’t improved, as dissatisfied referring physicians were sending patients to other hospitals. Patients who remained were experiencing delays in their treatments, another problem. The interventional radiology department was well aware this was hurting the medical center’s revenue and the satisfaction of patients and referring physicians.

In 50 Words Or Less

- The Nebraska Medical Center used quality methods in its interventional radiology department to turn around a decline in patient volume.

- The result was more patients and more satisfaction for patients, employees and referring physicians.
Defining the Problem

A Six Sigma project team was assembled to address problems in the department’s scheduling process (see Figure 1) and increase both the number of patients seen and the volume of procedures the department was conducting. Key project team members included the lead nurse scheduler, lead technologist and department manager.

The lead nurse scheduler speaks to the referring physicians and clinics to schedule patients for procedures. The lead technologist and other technologists are responsible for setting up the surgical area where procedures are done, running the equipment and assisting the interventional radiologist doing the procedure. The technologists know the supplies needed for each case and are able to pull whatever is needed for the physician while keeping everything sterile. The department manager is a former technologist.

Physician involvement was also initiated early in the process with ongoing input and information sharing from the two physicians on staff. Two additional physicians joined the department after the initiation of the project and were added as valuable resources to the team.

During the first phase of the define, measure, analyze, improve, control (DMAIC) cycle, it became clear scheduling was a primary concern for referring physicians. Physicians who referred a high volume of patients expressed difficulties their clinic staff had reaching the interventional radiology scheduler: The current process involved calling a pager first, phone calls were often placed on hold, and it sometimes took multiple attempts to set up an appointment time. Referring physicians wanted appointments scheduled in one call.

The referring physicians also had many patients who lived out of town, and once a patient left a clinic, it was often difficult to reach him or her. Setting an appointment time for the interventional radiology procedure would be much easier if it could be done while the patient was still in the office. With clinic nurses waiting for the nurse scheduler to return phone calls, it was clear easier communication was needed.

At the time, the nurse scheduler was also the lead nurse for the department, which often resulted in him or her being pulled from scheduling duties to help in the holding room, an area where the staff nurses perform pre-procedure tasks for the patients, such as starting intravenous peripheral lines, completing nursing assessments and giving medications. The duality of the role created stress in the position, and other nurses in the department were often frustrated when they needed to cover the scheduler’s role. There were ample opportunities for improving processes and increasing job satisfaction.

Along with the referring physicians and nurses in the department, the interventional radiologists and technologists also experienced frustration with scheduling. Both groups said the scheduling information form was inadequate, with information slots on the form left blank or pertinent information missing. Often the nurse scheduler knew the information from the clinic interaction, but the information was not consistently written on the form because of time constraints and the belief that some items on the scheduling form were redundant or not necessary.

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**FIGURE 1**

High Level Process Flow

- Referring physician call
- Patient scheduled
- Hospital arrival
- Holding room arrival
- Procedure room in
- Procedure room out
- Dictation
- Report finalization
Measuring the Current Process

During the measure, phase the project team members collected data on the scheduling process. They discovered it took an average of 1.4 calls to schedule an appointment. But the biggest problem was the amount of variability—it could take up to seven calls, with a standard deviation of 0.989. Additionally, scheduling an appointment took an average of 32.17 minutes, and at times up to 298 minutes, depending on the procedure (standard deviation of 59.36 minutes). There were often prior x-ray or treatment films to be reviewed or schedule time coordination needed with the computerized tomography (CT) department. It was clear too much time and effort were being spent on processes that could be streamlined.

Changes in the Scheduling Process

In the analyze and improve phases, the project team and department staff started to identify changes that could be made for process improvement early on. To address scheduling concerns, a Work-Out was held with seven high volume referring clinics, the interventional radiology nurse scheduler and the department manager to determine what they needed to streamline the scheduling process and make scheduling easier.

The Work-Out concept was originally developed at General Electric and consists of highly facilitated sessions. There are three main steps:

1. A sponsor challenges key individuals who know a process best—people who actually use the process as part of their jobs—to solve a problem.
2. This team of process experts is allowed to create solutions while being led by a facilitator trained in specific change process dynamics and team facilitation tools. This facilitator is often called a change agent.
3. At the end of the Work-Out, the sponsor returns, examines the proposed solutions and renders a decision of yes, no or needs more information.

When done right, Work-Outs have the ability to rapidly drive decision making and change through an organization to overcome everyday problems and identify critical to quality (CTQ) needs. CTQ needs are expectations by customers based on what matters most to them.

Assembling the Work-Out team was a valuable experience for all involved. People who had never worked together were able to meet and collaboratively address common problems. Silos that existed between the clinics and the interventional radiology department began to break down as concerns were discussed face-to-face.

From the Work-Out it was discovered communication in scheduling with the department was not the only CTQ need. Clinics were uncertain which procedures were scheduled directly through the interventional radiology department and which procedures went through centralized scheduling for other radiology departments. A quick win determined early in the Work-Out was to make available a complete list of procedures that occurred in the interventional radiology department. Clinics could refer to this list to know which procedures were scheduled through the department and use it as a tool in training their new employees.

Another CTQ need in the scheduling process was to give clinics the ability to reach an actual person when they called for scheduling. The current process involved calling a department pager number, with the scheduler returning the page to the clinic. If the scheduling nurse was with a patient or in the holding room, it could be a while before the call was returned.

The number of calls to schedule was also identified as a concern by the clinics. The project team was not so much concerned about the average of
With the maximum number of calls at seven, they were most concerned with reducing the variability in the process.

The clinics were also uncertain of what information would be requested when scheduling was done. Different information could be asked for depending on the individual scheduler. Clinics sought consistency and awareness of what information would be required when they called so they could readily provide it.

Collaboration Leads to Improvement

The Work-Out spurred further discussions and team building opportunities for the interventional radiologists, technologists, nurses and scheduler. They examined and redesigned the scheduling slip—more informational items were added—and agreed on how the form was to be consistently filled out. Copies of the revised form were sent to the high volume referring clinics so they would know in advance the information that would be requested. The clear and complete scheduling slip also made things easier for the nurses who covered for the regular scheduler.

Another difficulty was scheduling CT scanner time, since this required additional coordination and calls. CT scans are needed for any patient undergoing a biopsy. The Nebraska Medical Center revisited this issue using its new change management methodologies. Based on the current volume of cases requiring CT scanner rooms, the CT department agreed to allocate two one-hour time slots per day exclusively to the interventional radiology department. This change reduced the number of calls necessary to schedule time in the CT department and guaranteed available time.

Further improvement was made by the interventional radiology physicians reaching consensus on time allocation for procedures and lab work needed prior to procedures. This allowed for continuity of lab work requested and the amount of procedure time allocated by the scheduler. The consistency helped the scheduler know what lab work to tell the clinics was needed independent of the interventional radiologist, who was often not assigned until the day of the procedure.

The interventional radiologists also agreed on approval types for needed procedures. Procedures could require either front-end approval (interventional radiologist approval needed before scheduling an appointment), no approval or a new category—back-end approval. With back-end approval interventional radiologists still needed to approve the case, but an appointment time could be given when the referring clinic called to schedule. This category was for cases that just required additional film review prior to patient arrival. These cases could be scheduled immediately and discussed the following day during the department physicians’ morning meeting.

Since calling the pager was a concern for the clinics, the process was changed to calling a direct department phone number. If the scheduler was not at the desk, then the call was rerouted to the pager. This change streamlined the process and reduced the variability in how many calls were needed to schedule an appointment.

The responsibility of coordinating patients from the holding room into the procedure room, previously held by a nurse, was given to a tech, which allowed the nurse scheduler more time for scheduling. The tech understood the functionality of equipment in the procedure rooms and could give more attention to the job. This change ultimately decreased overall patient time spent in the holding room.

As another process improvement, the team developed patient information sheets and gave them to the high volume referring clinics. These sheets outlined items that were important for the patient to know about their procedure, aiding com-
munication between the patient and the department. On the back of the information sheets were maps illustrating the location of the interventional radiology department for the day of the procedure.

**Achieving Successful Results**

Although the average number of calls to schedule remained unchanged, the maximum number of calls was reduced from seven to three, with the standard deviation decreasing from 0.989 to 0.52 calls (Figure 2). The referring clinics felt the change, and the department recognized additional reduction in the average number of calls could be harmful to patients, as further collaboration between referring physicians and interventional radiologists was sometimes needed when scheduling more complex cases.

Minutes to schedule increased from 32.17 to 33.18 on average. However, with the changes in the scheduling slip, better quality of information was obtained at the time the clinics were calling to schedule, which reduced the need for calling back for additional information. The extra minute allowed for exchange of all necessary information during the first call, reducing the need for subsequent calls back the department.

With all the changes implemented (Table 1 and Figure 3), complaints from the referring clinics were

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**TABLE 1**

**Interventional Radiology Changes**

<table>
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<tr>
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<tbody>
<tr>
<td>Scheduling slip re-examined and redesigned to capture pertinent information.</td>
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<tr>
<td>Agreement on how to fill out the scheduling slip.</td>
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<tr>
<td>Reduction in calls to schedule through obtaining block time from the computerized tomography department.</td>
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<tr>
<td>Interventional radiologists agree on allotted procedure times.</td>
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<tr>
<td>Interventional radiologists agree on lab work to be done for procedures.</td>
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<td>Interventional radiologists agree on approval type needed for procedures.</td>
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<tr>
<td>Room coordination role changed from a nurse to a radiology tech.</td>
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<tr>
<td>Patient information sheets designed with maps on the back.</td>
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<thead>
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<th>Work-Out</th>
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<td>Clinics received a list of procedures done in interventional radiology.</td>
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<tr>
<td>Ability to call into a person rather than dialing a pager.</td>
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<td>Clinics received copies of scheduling information needed.</td>
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One clinic staff member noted, “It’s much easier to reach the scheduler, and calls are returned sooner.” Similar comments were made by high volume referring physicians to the department. One said, “After the Six Sigma project, scheduling for procedures is going much better. I don’t have problems now.”

By using Six Sigma tools, the department was able to collaborate with referring clinics and its own staff on improving its scheduling process. Many of the changes not only improved efficiencies, but also strengthened relationships between the department and referring clinics.

The Work-Out between the external clinics and department staff allowed individuals to meet face-to-face and begin to build relationships through better communication of what each needed to perform his or her job well.

Job satisfaction was improved by making the position of the scheduler easier, establishing clear expectations of which lab procedures would be required and standardizing approval type and amount of time a procedure needed to be scheduled. Not being pulled to different job functions created a win for both the nurse scheduler and the clinics impacted by the process.

Most importantly, in the fiscal year 2003-04, the interventional radiology department saw 4,649 patients, a more than 21% increase over the 3,829 patients served in the previous fiscal year that reflects improvements in patient and referring physician satisfaction and process efficiencies.

REFERENCES

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