California HealthCare Foundation

Improving Efficiency:
Management Engineering Comes to the Safety Net

ISSUE BRIEF

December 2007

Introduction

California's safety-net hospitals—public, rural, critical access, and disproportionate share—are central to California's health care system because they serve populations that would not otherwise have access to care. This critical role demands continual innovation to ensure patient safety, achieve excellent clinical outcomes, and maximize efficiencies.

In this issue brief, efforts are described to improve efficiency in safety-net hospitals through the application of management engineering, a systematic method for diagnosing and correcting problems in service delivery. Management engineering offers the opportunity to improve care delivery by improving productivity, thereby improving access to care and reducing, or at least controlling, costs and patient wait times.

How Other Industries Improve Capacity and Utilization

Management engineering has transformed the quality and productivity of many complex industries, such as telecommunications, transportation, and manufacturing. These industries have used management engineering to optimize scheduling, staff at levels that match demand, and reduce waste in production processes. Management engineering improves efficiencies through systematic measurement and analysis of system performance, coupled with action plans that aim for continual improvement.

The health care sector has been slow to embrace management engineering for both cultural and financial reasons. While management engineering can help a hospital reduce costs and improve service, it also requires investment, both in people and in systems to measure, monitor, and respond to performance. Safety-net hospitals in particular often lack the resources to make such investments. Just as important, health care clinicians and administrators are typically not trained in management engineering and operate in a regulatory environment that does not demand efficiency.

Despite these challenges, management engineering methods are becoming more widespread, through the efforts of the Institute for Healthcare Improvement to build multi-hospital collaboratives, as well as through the support of the California HealthCare Foundation and other organizations. Management engineering methods have been successfully used by clinicians, care teams, and administrators in large and small health care organizations in all steps of care delivery, including outpatient, emergency department, surgery, medical testing, bed assignment, and patient discharge.

The role of the management engineer is to be a change agent who helps hospitals quantify specific problems, design needed interventions, and recommend solutions. A management engineer works in partnership with administrators and clinicians in all of these steps and provides guidance in the implementation of change. However, successful management engineering cannot be viewed as a one-time project, but rather as a way to engage health care workers in continual

review and improvement, both raising their awareness of the problems experienced by patients and empowering them to make changes that improve care.

To stimulate the adoption of management engineering, the California HealthCare Foundation commissioned the University of Southern California to complete a set of demonstration projects at a group of California safety-net hospitals. The research and management engineering work were performed by faculty and students from the Viterbi School of Engineering in cooperation with hospital staff. This issue brief summarizes the research conducted at the three safety-net hospitals and presents its main findings.

Patient Flow and Management Engineering Basics

Patient flow is the process by which patients are served through multiple stages of care. Good patient flow is represented by short waits at registration, examination, diagnostic testing, surgery, placement in beds, and discharge. When patient flow is handled well, patients experience a shorter length of stay, because they are not waiting for these critical steps to occur. A shorter length of stay translates to increased capacity for serving more patients, making it possible to improve access to care.

Poor patient flow is a symptom of inefficiencies in care delivery, including a poor staffing plan, inability to use critical resources at maximum capacity, and a lack of synchronization between discharging and receiving departments. There are numerous instances of long patient waits coupled with under utilization, which ought to be an obvious sign of inefficiency. Yet these inefficiencies only became apparent after the introduction of management engineering, which identified how inattention to no-shows, poor patient transfer, and unbalanced resources cut productivity by 50 percent.

Management engineering can address these problems through a cooperative approach that engages staff in a systematic process of continual improvement. An individual management engineering project includes five basic steps: (1) problem identification, (2) measurement, (3) analysis, (4) solution, and (5) intervention. However, it is more important to view a management engineering project as a teaching experience that builds a culture that motivates continual improvement. Toward this end, the management engineer needs to be both a motivator and teacher, and needs to help develop systems that sustain change once he or she moves on to another project.

The case studies that follow examine individual processes within diagnostic imaging departments. Keep in mind, however, that the biggest opportunities for improvement often come through systematic change spanning multiple departments, such as improved coordination between emergency departments and hospital wards to speed up the placement of patients in beds. Management engineering can be at least as effective in addressing these more complex problems.

How Management Engineering Can Benefit: Three Case Studies

A wide variety of hospitals responded to the California HealthCare Foundation's request for proposals to apply management engineering methodologies to expand capacity. Out of 20 proposals received, three hospitals were selected, all with need for process improvement in their diagnostic imaging departments. While the imaging modalities varied somewhat among the three sites, the departments had many problems in common: excessive waiting times, low patient satisfaction, low staff and physician satisfaction, and underuse of equipment. The goals of the effort were to improve hospital operations in a meaningful way, improve access and cost-effectiveness, and evaluate the results and use the experiences for demonstration and education at other hospitals.

The projects were launched in January 2007, with recommendations for change and improvement made in April and May. The initial projects were completed

in July. In individual examples from the three hospitals chosen:

- Radiology department patient visits were increased by up to 46 percent
- Rates at which patients rated their service as "excellent" were doubled and growing
- Productivity was improved by up to 29 percent
- No-show rates were reduced by up to 20 percent.

These results are being followed up at the individual institutions with new projects, ongoing work by staff, extended targets, and implementation support.

Arrowhead Regional Medical Center

ABOUT THE HOSPITAL

Arrowhead Regional Medical Center, in Colton, California, is the county hospital for San Bernardino County, the largest county, in terms of area, in the United States. It has 354 beds and had 290,000 outpatient visits in 2005 (excluding emergency department visits). It is one of the Inland Valley's top health care facilities and features several specialty centers, including a Level II trauma center, burn center, and outpatient care center. The hospital's mammography department has two mammography exam rooms, both film-based.

PROBLEMS

The mammography exam areas were experiencing backlog and low throughput and productivity. The patient backlog was four months. The mammography department saw 19 patients per day, spending a total of 2.4 hours per patient.

The head of diagnostic imaging had succeeded in making significant improvement in patient flow in most modalities, but not mammography. He felt that the productivity of the mammography department could be improved and had made recent changes toward that end, but these changes were not accompanied by improvement in throughput.

INTERVENTION

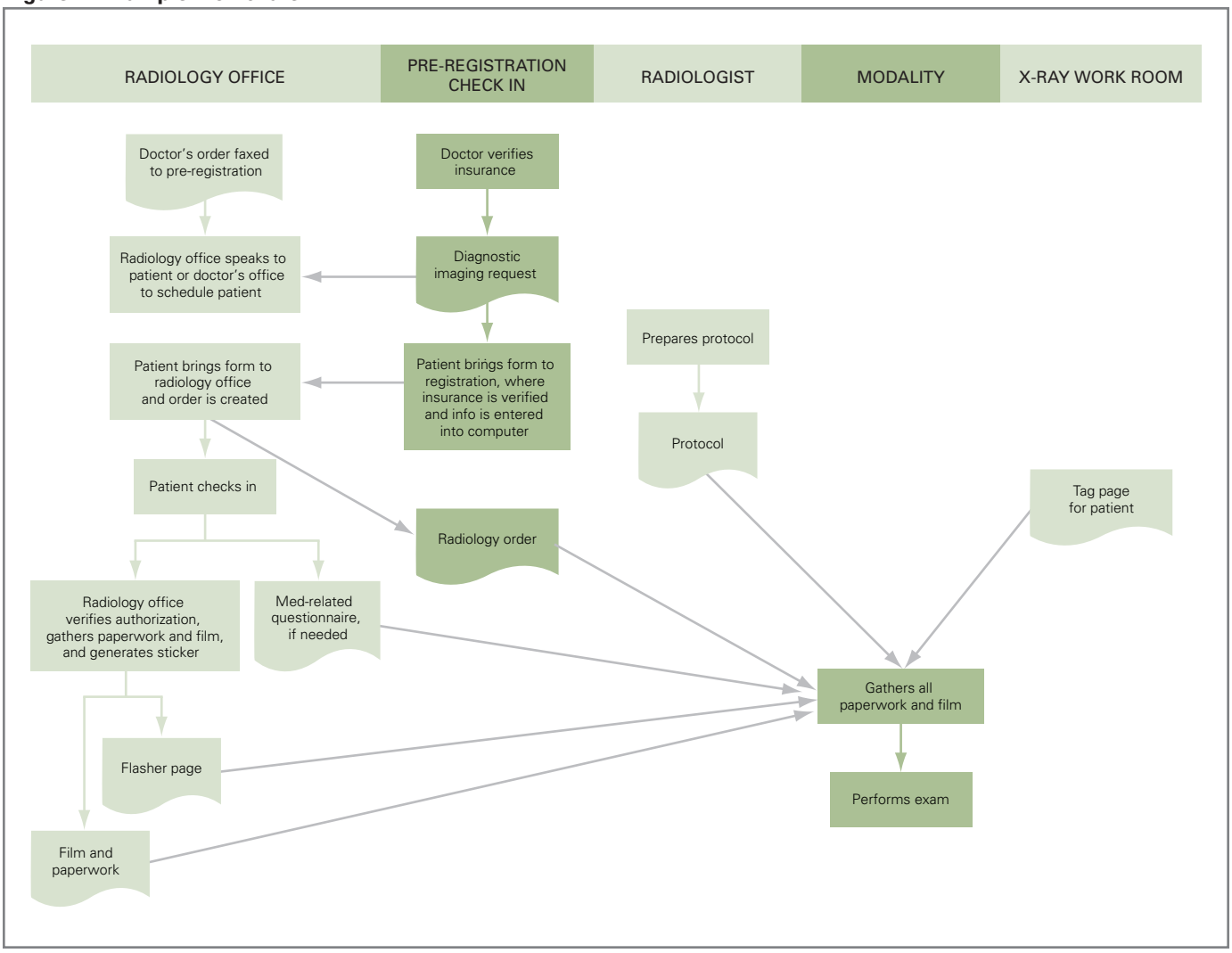
After charting the flow (see example flowchart in Figure 1) and making comparisons to performance benchmarks, the management engineers established targets for improvement, such as an increased number of exams completed per day. Work loads were measured in detail to reengineer the jobs of the technicians so they could deal with each patient in a shorter cycle time. Through work flow analysis, the USC engineers identified process improvements and the elimination of unnecessary tasks, such as assisting patients with questionnaires and not having patients occupy exam rooms while films were being developed.

The management engineers next created a spaghetti diagram—an aerial depiction of staff and patient paths through the process—to show where certain steps should be changed. A list of recommended improvements was provided, including revising standard appointment times, changing daily targets, designing a dashboard report, calling patients earlier to remind them about their appointments, double-booking patients when there is a high probability of no-shows, relocating the patients' clothes changing area, having staff (non-tech) escort patients, changing break times and lunch hour policy, revising supervisor's responsibilities, providing staff recognition for productivity improvements, and creating new reports from the information system. Through focus group meetings, the staff agreed to changes and specific productivity improvement targets. A computerized simulation was created to identify bottlenecks and to confirm the expected throughput potential in patients seen per day.

IMPACT

Improvements were seen in capacity, backlog, and no-show rate. Other areas show promise and have inspired longer-term process improvement efforts.

Figure 1. Example Flowchart



Patients per day. At start of year, Arrowhead's mammography department examined about 19 patients per day. By April, that number was 27 to 35 per day, a 42 percent increase.

Backlog. The wait for an available appointment had not been rigorously measured, but the hospital is now doing so. It has reduced the backlog from four months to one month.

No-show rate. The no-show rate declined from 40 percent in February to 27 percent in April.

Initial changes included reassignment of tasks related to patient flow, such as having patients filling out their questionnaire before entering the exam room rather than during, having patients change clothes outside the exam room, and double-booking exams when there was a high probability of no-shows. A dashboard report was created for patient flow outcomes so that the staff had a sense of progress about the project.

Ongoing changes. The USC engineers continue to contribute to a staff committee that is implementing additional changes. These ongoing changes include revising work procedures, such as assigning more clerical tasks (e.g., mailing) to clerical staff rather than technicians, and a more logical mix of diagnostic and screening exams in the weekly schedule.

LESSONS

The staff's resistance to, and fear of, change was overcome when it was demonstrated that increased productivity, rather than reduced staffing, would be the result. Although the Viterbi team's research initially showed that the department was seeing half as many people as they could, the staff's impression was that they were extremely busy. The engineering students addressed those concerns in part by identifying unnecessary tasks that could be eliminated to increase productivity, rather than reduce staffing, and soliciting staff support and ideas through focus group discussions.

Table 1. Arrowhead Regional Health Center at a Glance (Mammography Department), 2005

Hospital type:	County, serving largest U.S. county, by area
Hospital size (beds):	354
Department:	Two mammography exam rooms, film-based
Annual outpatient visits:	290,000
Problems:	Backlog, throughput, productivity

IMPROVEMENTS	BEFORE	AFTER
Backlog	4 months	1 month
Patients per day	19	27 to 35
No-show percentage	40 percent	27 percent
Productivity	2.4 hours per patient	1.7 hours per patient
Cycle time (mammography)	60 minutes	40 minutes

Other improvements as a result of this project:

- Developed daily benchmark targets
- Revised assignment of tasks and patient flow
- Revised scheduling policies
- Tech workflow simplified

White Memorial Medical Center

ABOUT THE HOSPITAL

White Memorial Medical Center is an urban, not-for-profit, faith-based teaching hospital in Los Angeles with 354 beds, and 110,000 outpatient visits (excluding emergency department) in 2005. White Memorial provides a full range of inpatient, outpatient, emergency, and diagnostic services to communities in and near downtown Los Angeles. It is part of Adventist Health, headquartered in Roseville, California, which operates health care facilities throughout California, Hawaii, Oregon, and Washington, and includes 19 hospitals with more than 2,800 beds, 18,000 employees, numerous clinics and outpatient facilities, 16 home care agencies, and three joint-venture retirement centers.

The hospital's diagnostic imaging department has a full range of modalities. Imaging is digitized and includes a separate registration and check-in.

PROBLEMS

A high rate of no-shows, underused equipment and staff, and unnecessarily long waiting times for patients after check-in persisted in the department. As a result, White Memorial suffered from low patient satisfaction, low productivity, and a shortage of operational data. The diagnostic imaging department, an important revenue source for the center, is in a new building with relatively new equipment. The expectation had been that these would automatically yield high patient satisfaction, but patient and physician satisfaction surveys told a different story. The case study showed excessive wait times for the patients and difficulty in getting desired appointments by the doctors for their patients.

The physical layout of the new building was a problem, as it was difficult to locate patients and staff in the convoluted set of corridors and rooms. There was no visibility between check-in, registration, dressing rooms, exam rooms, and waiting rooms. The department's

patient tracking information system was no help, as it was difficult to use.

INTERVENTION

Based on flowcharts and productivity measurement, it became apparent that changes to certain workflow, particularly administrative tasks in check-in, registration, and patient escorting, would improve productivity. The USC engineers recommended changes in workflow based on observation and analysis of jobs in the department and patient flow. These included simplifying patient tracking, earlier availability of appointment data, earlier phoning of patients to remind them of appointments, development of a dashboard report, comparison to industry benchmarks, preparation of inpatients at units, research into no-show causes, reporting of exam start and end times by technicians, incorporating actual procedure time averages for patient scheduling, and a new patient tracking system. Processes improvements eliminated registration tasks, such as data entry. The management engineers also developed benchmarks for a departmental dashboard—a report that includes key indicators for the department—that highlighted productivity targets for supervision.

IMPACT

As a result of the intervention, no-show rates, patient tracking, productivity, use, and scheduling improved. Patient satisfaction lagged, but began to increase as additional changes were implemented.

No-show rate. During the project, the no-show rate declined from 45 percent to 40 percent. This was accomplished by phoning more patients in advance than had previously been the practice. By changing the paper flow, the department is now able to call four days prior to appointment and is also able to reach more patients, nearly 100 percent. The department is also tracking a "registration complete" percentage that records the percent of appointments that are ready in time for phoning. This has improved from about 20 percent to more than 90 percent.

Patient tracking. Tracking patients had been a problem in the radiology area due to a physical layout that made it difficult to observe patient flow, and because a patient tracking information system was extremely difficult for staff to use. At the USC engineers' suggestion, the system's corporate office canceled the contract for its tracking system, which freed staff for other duties. This past July, the hospital decided to deploy radio frequency identification (RFID) technology, which automatically reports on the patient's location, much like a global location tracking device. The planned system will be installed at a later date.

Patient satisfaction. This figure started out very low, but is climbing steadily. In early 2007 the percent rating the department as "excellent" was 5 to 15 percent. By May it was 19 percent.

Room use. With high use being a primary objective, all agreed the lack of use measures was hurting the hospital. The department took the difficult step of putting a measurement process in place. Room use rates were discovered to be 60 percent in computerized tomography and 70 percent in magnetic resonance. The department's implementation committee has set a target of 80 percent.

Productivity. Staff time per patient declined from 1.8 hours before the project to 1.5 hours.

Ongoing changes. The implementation committee has designed a dashboard, which it now produces monthly. Specific functional staff areas are responsible to enter their own data and a summary report is produced. The department is implementing additional changes, with a task force of managers and technicians meeting every two weeks to review their progress.

Record actual exam times for use in patient scheduling. The staff had recorded exam times previously, but not accurately. The supervisors and technicians have now made accuracy a priority, and are

working to use the information for tracking and better scheduling based on accurate cycle times.

Track room utilization as a measure of scheduling effectiveness. Department management lacked information on use. The management engineers worked with staff and the hospital's information technology department to create useful measures. They then set goals to improve the use of these expensive resources. This has become part of the dashboard used to manage the department.

Table 2. White Memorial Medical Center at a Glance (Diagnostic Imaging Department), 2005

Hospital type:	A not-for-profit, faith-based, urban teaching hospital
Hospital size (beds):	373
Department:	Full range of modalities; CT, MRI, others, digital images, includes own registration and check in, in new building
Annual outpatient visits:	110,000
Problems :	Patient satisfaction, productivity, operational data

IMPROVEMENTS	BEFORE	AFTER
Patient satisfaction*	20 percent	45 percent
No-show percentage	40 percent	20 to 30 percent, (varies by modality)
Productivity	1.8 hours per patient	1.5 hours per patient

Other improvements as a result of this project:
- Eliminated unnecessary data entry tasks
- Developed cycle time data for scheduling
- Developed and implemented a dashboard
- Initiated patient tracking system
- Simplified office workflow

*Measured monthly as "percent excellent" rating on surveys.

Mendocino Coast District Hospital

ABOUT THE HOSPITAL

Mendocino Coast District Hospital is located in Fort Bragg, California. It is a rural, critical access hospital district with 25 beds and had 25,000 outpatient visits (excluding emergency department) in 2005. The hospital is in the process of financial turnaround and its diagnostic imaging department is very important to the hospital's viability. The 12-person diagnostic imaging department offers a full range of modalities, is film-based, and includes a separate check-in.

Hospital leadership was concerned about the department's productivity, as well as satisfaction with its services by physicians and patients.

PROBLEMS

The USC engineers initially identified low patient satisfaction, low productivity, a high no-show rate, and high wait times as key problems. Patient satisfaction was not measured prior to the management engineering project, but was believed to be poor. The department saw 40 patients per day, which the hospital believed was below capacity. Although the no-show rate was not methodically measured, it was recognized as being too high. The productivity was 1.8 hours per patient.

Mendocino felt it important to improve the patient experience, as well as the cost effectiveness of the department. Underlying issues included: a problematic physical layout, mistrust of management by the staff, a relatively high level of staffing for the patient volume, and poor workflow.

The hospital collected limited operational data. It suspected low patient satisfaction rates, but did not have the data to measure or improve it. The physical layout of the department was also a problem. Outpatients had to walk a relatively long distance from the hospital entrance to the department through a busy corridor that ran down the middle of the department with offices on either side.

This layout complicated supervision and gave patients a poor impression.

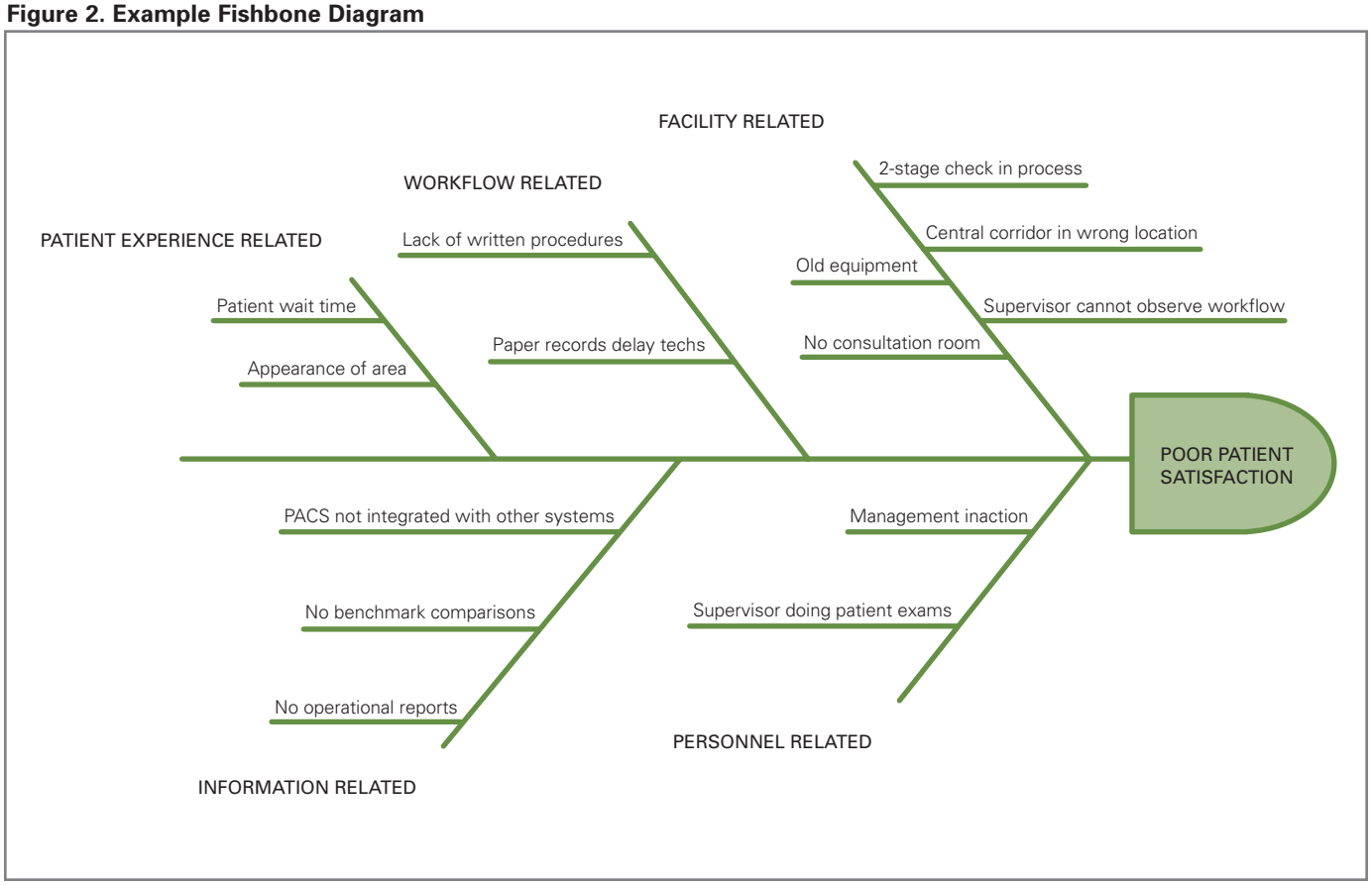
INTERVENTION

As in the other projects, flowcharts and focus groups were key tools. The engineering students first developed a flowchart to analyze the processes for each of the radiology modalities to identify likely problems. Several focus group meetings were held with the entire staff to gather input and enlist their support for future changes. The USC engineers discussed key issues and utilized a fishbone diagram to determine the causes of the problems (see Figure 2). A dashboard with key metrics was developed to show where patient flow could be improved. Considering patient and staff walking patterns and time delays, the layout of the building needed to be changed. The management engineers recommended changes in facility layout based on patient flow data.

The first round of changes involved collecting information. The hospital commenced a patient satisfaction survey to measure the perception of service and to let patients know that the hospital cares about their experience and wants to meet their needs. It also began capturing data about patient flow. Finally, a dashboard report was established that listed productivity indicators such as:

- Patients per day, per room or exams done per day, per room.
- Throughput in the various radiology modalities (mammography, MRI, etc.).
- Room use (or room idle time) as a percent of the available day.
- Patient wait time.
- Backlog.

Figure 2. Example Fishbone Diagram



- Patient satisfaction (as the percent who rate the service as "excellent").
- No-show rate, as a percent of scheduled appointments.

The USC engineers uncovered problems with the department's paperwork flow. Radiology technicians, rather than clerical staff, were collecting the needed paperwork (chart and orders, for example) before they could conduct the exam, thereby causing a delay. The staff and management worked together to revise paperwork and film flow. The management engineers' work is now being incorporated by architects into plans for construction of a new diagnostic imaging department.

IMPACT

Mendocino experienced improvement in the area of patient and physician satisfaction, patient throughput, paperwork flow, productivity, and wait times.

Patient satisfaction. A patient satisfaction survey for radiology was designed and implemented. About 80 percent of the patients surveyed rated the department as "excellent." The hospital believes this is an improvement, but such measurement was not done before the various changes.

Patient throughput. The department was seeing about 40 patients per day in February, and by June this increased to about 57 per day. This growth may be influenced by increased visits to the area during summer months but improved productivity meant the volume could be accommodated with existing staff. Concurrently, the hospital downsized by 50 percent from the prior year, making it difficult to compare productivity improvement.

Paperwork flow. The department was able to reduce waiting times by making sure that technicians had required paperwork before the start of each exam. Ideally, the department would be paperless, but given that this is not currently possible, the hospital instead adjusted staff job descriptions so that assembling paperwork would not be the technician's responsibility.

Productivity. In February, the staff hours per patient were about 1.8 hours, against a common benchmark of just under one hour (University Hospital Consortium). Mendocino's productivity level indicated overstaffing of at least one-third. During the summer, staffing changes, and increased patient volume reduced the apparent overstaffing by about 25 percent. Hours per patient dropped to 1.3.

Wait times. Mendocino lacked wait times measures, though long waits were recognized as a problem. A new computer report generates wait time and exam time for each modality. Having such timing data for each modality (see Table 3) provides management with a tool to accurately identify bottlenecks and address problems.

Physical layout. The department recognized that the physical layout needed to be changed. The department is considering alternative physical designs to eliminate the second check-in step and improve its appearance and functionality.

LESSONS

At the beginning of the project, the USC engineers faced a department whose staff often had low morale. This was exacerbated by a sense that management had not fulfilled previous promises to improve the building space and buy new equipment. The engineering students found that the hospital did not have information about some of the most basic and essential measures of productivity, such as exam length, the frequency of no-shows, or use of exam equipment. These challenges were overcome or are being eliminated through the team's efforts.

Table 3. Mendocino Coast District Hospital at a Glance (Diagnostic Imaging Department), 2005

Hospital type:	Rural, Critical Access, Hospital District
Hospital size (beds):	25
Department:	Full range of modalities; CT, MRI, others, film-based, includes separate check-in
Annual outpatient visits:	25,000
Problems:	Patient satisfaction, productivity, no-show rate, wait time

IMPROVEMENTS	BEFORE	AFTER
Patient satisfaction*	Not previously measured but believed to be poor.	80 percent, survey started and improving
Patients per day	40	57
No-show percent	Not measured	30 percent
Productivity	1.8 hours per patient	1.3 hours per patient
Cycle time†		Mammography: 27 minutes CT: 45 minutes MRI: 51 minutes
Wait time†		Varies; mammography: 16 minutes, x-ray: 50 minutes

Other improvements as a result of this project:
- Developed cycle time data for scheduling
- Designed and implemented patient satisfaction survey
- Improved building layout
- Developed dashboard

*Measured monthly as "percent excellent" rating on surveys.

†After the project, a dashboard was implemented that produced measurements such as cycle time and wait time, which were not previously available. Further improvement in times depends on forthcoming changes to the building and equipment.

Conclusion

Safety-net hospitals can improve patient satisfaction, increase productivity, and increase patient access through use of management engineering. Management engineering can launch a culture of innovation in tradition-bound departments by creating buy-in to the concept of improvement. Hospital staff in all three case-study hospitals quickly adopted the concepts and rose to the challenge, with the result that all three hospitals now have ongoing process improvement groups that meet regularly and are implementing and extending the initial recommendations.

The key to a successful management engineering intervention is:

- **Problem identification.** Identify an area where the hospital must improve its performance. A clear and measurable objective is needed, such as increasing the number of daily exams completed and attaining the level of the industry norms.
- **Measurement.** Accurately measure operational attributes related to the problem both before and after changes. The hospital's information technology systems may provide reports, but prior data may be limited to financial or clinical information, not operational information, so new measurement may be necessary.
- **Analysis.** Understand the system related to the problem by using a variety of management engineering tools. Often a model is created to consider alternative changes. The model may be a flowchart, a statistical analysis, or a simulation.
- **Solution.** Analyze alternatives to develop the most cost-effective change. In management engineering practice, brainstorming with hospital staff in a focus group setting is a good source of ideas. The management engineer can then analyze the expected effect of changes, select the preferred recommendations, and develop implementation plans.
- **Intervention.** Make the selected changes, monitor, and revise if necessary, based on the operational measures developed in the measurement step. Continuous improvement may occur by repeating these steps.

Management support is critical in management engineering projects. The three hospital cases had strong management support, reflected by management's involvement in the California HealthCare Foundation's application and selection process. There is continuing interest in the projects, manifested differently at each

of the three pilot institutions. At White, a committee consisting of supervisors, information technology personnel, and technicians meets regularly to review progress on the list of recommendations and has launched a training program. At Mendocino, the chief executive officer and chief compliance officer are quite involved in continuing the process improvement efforts. At Arrowhead a group of clinicians, technicians, and supervisors continue to monitor and implement change.

Although the impact on patient flow can be quite large, with perhaps a 50 percent increase in throughput, management engineering methods extend beyond analysis of operational issues. The management engineer, or those trained in management engineering techniques, is a resource to instigate change in hospitals. The need for change may be apparent, but internal organizational inertia or culture often prevents change from occurring.

Process and operations improvement projects are a way to disseminate innovation from one department to another. In the hospitals described in this brief, the data gathering procedures developed for one hospital were transferred and used at a second hospital, reducing the time to perform this most time-consuming task. This dissemination can apply as easily to departments as to facilities.

These factors favor the use of management engineering techniques in California's safety-net hospitals. However, challenges remain. Finding qualified staff is a challenge. Clinicians can be trained in the methods of management engineering, and management engineers can be trained in health care delivery to increase the pool of health care management engineers. In addition, participation in management engineering projects can prepare staff in the basics of management engineering, and help build a long-term commitment within hospitals. Finally, hospital administration must promote management engineering internally. Staff may see the arrival of a management engineer or the implementation of these methods as a threat to established procedures and job descriptions. Administration must show staff that process improvement is an opportunity to make their work more productive and satisfying and their patients happier and healthier.

Management Engineering Tools

Benchmark: Operations indicators, such as patient satisfaction or staff productivity that may include standards, critical success factors, and metrics based on industry averages or best practices at comparable hospitals. It allows the hospital to see how it is performing in comparison to others and what might reasonably be achieved.

Dashboards: A periodic management report, primarily to administration, but also to staff, that describes the performance of a functional area, such as a radiology department. Like a car dashboard, it provides the information needed to steer the department by displaying current, clear, important measurements that are easily understood.

Facility layout: The process of studying the physical configuration of departments, staff workstations, service areas, material storage areas, offices, and patient flow patterns to produce the best possible physical arrangement or building design. Minimizing travel distances, improving patient satisfaction and improving the quality of care are often the objectives.

Fishbone diagram: A graphic to show the causes of an event, such as a problem. It is useful to identify the range of multiple factors, such as the reasons for delays in patient flow or the causes of a quality issue.

Flowchart: A schematic representation of a process. It depicts inputs, outputs, and a sequence of activities. It can represent an entire process at a high level or can describe detailed steps. The resulting flowchart may, for example, represent a patient visit or a radiology procedure.

Focus group: People gathered together to discuss their opinions about a topic, such as service or process. Questions are asked in a group setting where participants are free to talk along with other group members. It is a useful way to get a prompt picture of an issue when multiple people and organizational units are involved.

Management Engineering Tools, continued

Patient satisfaction survey: Use of a questionnaire to obtain ratings from patients about the degree to which services received from a health care provider meet their expectations, usually performed on a confidential basis. Such surveys can be used to measure physician or community satisfaction.

Process improvement: A systematic approach to making an activity better by reducing its cycle time, reducing its variability, improving its quality, or making it more effective or efficient.

Process modeling: Prescribes how things should happen in contrast to the process itself or what really happens. In hospitals, this reveals how patients are currently served, determines where inefficiencies exist, and prioritizes future changes. Process modeling can reveal unnecessary repetition, miscommunication, and inconsistency in methods.

Productivity measurement: The ratio of measured outputs over measured inputs, usually labor (i.e., patients served per staff-hour or exams completed per technician hour).

Simulation modeling: Use of a computer program (representing a mathematical model) to simulate an actual sequence of events over time, such as a process being done in a hospital area. It can be used to evaluate new processes, to understand and demonstrate the current causes of delay, and to forecast bottlenecks. Process models of implementing a new appointment system, or a new electronic patient record system, can be simulated to predict delays before and after.

Work measurement/re-engineering: Redesign, often radically, of how work is done by measurement and analysis of jobs, such as the time and sequence of individual tasks. It has been used to design work such as a radiology procedure, patient registration, and surgery.

Workflow: The sequence of tasks. A workflow describes the order of a set of tasks performed by various individuals to complete a given procedure within an organization.

Authors

David Belson, Ph.D., senior research associate and lecturer, Daniel J. Epstein Department of Industrial and Systems Engineering, Viterbi School of Engineering, University of Southern California, Los Angeles.

For more information contact

California HealthCare Foundation
1438 Webster Street, Suite 400
Oakland, CA 94612
tel: 510.238.1040
fax: 510.238.1388
www.chcf.org