

## Is It Fixed?

**A** while ago, the Johns Hopkins Medicine board of trustees was hearing a report on a wrong-site surgery when new chairman Michael Armstrong asked a pointed question. How do we truly know that we've reduced the risk of this happening again?

Most of the time, when a patient suffers unexpected harm while in our care, we develop a list of actions that we hope will avert similar events. This follows a lengthy review process in which a committee investigates the incident, interviewing the people involved and identifying its root causes and contributing factors.

It's a difficult enough task just to follow up on these action items—new policies, additional training and technological fixes—and make sure that they're completed. For that reason, we've begun appointing a department head or other senior leader as the champion of each action plan to provide any support needed to finish the tasks.

We'd be negligent not to make every reasonable effort to see that sentinel events don't repeat themselves. But the researcher inside of me has to acknowledge that we simply don't know enough about how well we've prevented future harm.

To help focus our thinking on the effect of these prescribed changes, Johns Hopkins University quality and safety researchers, in conjunction with our Health System's risk management office, have developed a tool that classifies the relative strength or weakness of each action item into four broad categories. We hope that by categorizing these tasks, we can determine what problems may require additional resources.

**Eliminate the error.** The strongest changes occur when a fix can stop a bad event from happening again. One of our precious few examples of this comes from anesthesiology. There have been cases

When a piece of medical equipment malfunctions, it should be removed from use. But what should caregivers do to make sure that it's examined and fixed?

This year, a Hopkins Hospital task force found that there wasn't a clear answer to that question. The group, formed to coordinate the implementation of new infusion pumps, noticed instances when the devices had safety-related problems, such as "tubing misloads" that can cause a medication to go unregulated through the device, posing the risk of overdoses. Following up on those cases, the group discovered that caregivers didn't always communicate the problems well, or at all.

"The devices would go to Clinical Engineering with labels that read 'broken' without a specific description of what's wrong," says task force member Dana Moore, a coach with the Center for Innovation. "Or people would put the devices in the soiled-equipment room and wouldn't label them." Unlabeled devices might get picked up, cleaned

and returned to use without clinical engineers being told that there was a problem at all.

This vulnerability spurred the Hospital to create two broken-equipment tags that, as part of new policy effective March 1, 2007, are expected to improve handling of potentially dangerous devices.

When a faulty device causes patient injury or is suspected of doing so, caregivers will attach an orange tag to it and report the event through the Hospital's online event reporting system, Patient Safety Net. The report will alert Clinical Engineering Services to pick it up and diagnose it. The tag also reminds the user of how to handle the device: keeping all tubings intact and cleaning the surface, for example.

White tags will be attached to possibly malfunctioning devices that aren't involved in patient injury. Instead of filling out a report online, users will describe the problems on the tag itself and put the devices in the soiled utility room. Those devices will be picked up later and transferred to clinical engineers. ■

when patients died after tubes meant to deliver oxygen were inadvertently connected to a nitrous oxide supply. The problem was that the tubes fit perfectly as if they were supposed to work together. Today, the industry has made those misconnections impossible by redesigning the connectors so they don't fit together.

**Make mistakes visible.** A weaker but still relatively strong change involves situations when you haven't made a mistake

impossible, but you can make it visible if it occurs. For example, there have been cases in which caregivers mistakenly connected epidural catheters to patients' intravenous lines—a potentially lethal mistake. Ideally, you would hope that we'd make it so that the two tube types weren't interchangeable.

But so far, the industry hasn't made that change. Therefore, at Hopkins we've made a policy to label the catheters with an orange sticker that says "epidural only."

**Mitigate the harm.** The third weakest of the four categories is to mitigate harm should it occur. A great example of this is the practice, at Hopkins Hospital and

elsewhere, of removing concentrated drugs such as potassium from the medical floors. This action doesn't stop us from giving an overdose, but it assures us that if a dosing mistake is made, it won't be nearly as harmful as if the concentrated drugs were used.

**Make policies and educate.** The last type of change is also very common. It involves adopting new policies, staff reeducation, training and communication. These kinds of changes don't guarantee that adverse events won't repeat themselves.

That doesn't mean that we should abandon them. However, it does mean that, whenever we can, we should find methods to add strength to these approaches. For instance, when medical equipment training follows a sentinel event, regular audits can ensure that staff retain that knowledge and are properly using the device involved in harm. The weaker the solution, the more evaluation needs to be done.

Across health care, the recommendations that follow investigations simply aren't very effective. We often go a mile wide and an inch deep. To truly fix a defect requires significant infrastructure and investment. This means that we have to prioritize what fixes we can make. We also need to take a more scientific approach to finding out what works. ■



## Getting on the same page

Operating rooms across the United States have adopted the practice of time-outs to improve communication and prevent patient-harm events such as wrong-site surgery.

At Hopkins Hospital that basic concept has been expanded into more detailed briefing and debriefing procedures. This allows clinicians from several disciplines to share their concerns, avoid complications that may arise and postoperatively review any problems.

"It gets consensus in the room," says Surgeon in Chief Julie Freischlag.

Created by Hopkins safety and quality researchers, the briefing uses a checklist to guide caregivers through a one- to two-minute conversation after a patient has been anesthetized but before an incision is made. Team members identify themselves by name and verify the patient's identity, the procedure and the surgical site. After the surgeon describes the critical steps of the procedure, the team members discuss their concerns. The checklist guides them through key issues, such as glucose management, deep-vein thrombosis prevention, and the availability of blood products and the right equipment.

The conversation opens the lines of communication between disciplines.

"Sometimes what the surgeon is thinking hasn't been communicated to everybody else," notes Paul Sponseller, head of pediatric orthopedics at the Hospital. "So this really mandates that those things are discussed."

After the procedure, the surgical team conducts a two- to three-minute structured debriefing to review the procedure. The team makes sure that all specimens have been properly labeled, verifies sponge, needle and instrument counts, and goes over anything that could be done differently.

The debriefing can also help the patient make a safe transition in care. An anesthesiologist might note that the patient had a difficult airway and flag the medical chart for future intubation attempts, while a nurse arranges for the patient to have a "difficult airway" bracelet. ■

# QualityUpdate

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# Quality Update

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## A Reconciliation Safety Net

A study highlights problems at patient discharge—and the ability of a small, dedicated team to fix them.



Aside from reviewing the accuracy of all discharge medications on the AIDS service, nurse Deborah Michell also makes sure that patients understand their regimens.

**A**s caregivers prepared to discharge a patient from the Polk unit, Hopkins Hospital's inpatient AIDS service, a resident unknowingly wrote an order that could have had harmful consequences. The physician prescribed two individual generic drugs without realizing that the person was taking the same medications at home under one brand-name combination pill. The unsuspecting patient might have left the Hospital, continued his at-home regimen and gotten twice the needed dose.

In the past, such mistakes often went unnoticed on the unit. Instead, it was one of many intercepted by a nurse assigned, as part of a safety project, to check the accuracy of discharge medications.

"These were errors that could cause a lot of trouble downstream," explains physician assistant Jo Leslie, who works on the Polk unit and spearheaded the patient safety effort. Too much of HIV drugs can prove toxic, she adds, while too little can encourage resistance to the virus and eliminate treatment options.

Leslie's project, which she undertook as part of a leadership course in the Hopkins Business of Medicine MBA program, improved awareness of the impor-

ance of medication reconciliation. The process of reviewing a patient's past and current drug regimens to write correct orders for the next transition in care has been a problem for health care organizations everywhere.

The project also demonstrates the power of a small multidisciplinary team to tackle complex problems and quickly make improvements.

Leslie came up with her focus after hearing about complaints that patients were being discharged with prescription errors. The mistakes were caught and relayed by the outpatient Moore Clinic, which would see the same people returning for treatment.

She began by mapping the complicated discharge medication system to identify steps where errors could crop up. The process started when a resident typed medications and other instructions into an electronic worksheet. The medications on the worksheet were then transcribed by the resident into handwritten prescriptions, which a social worker would get filled, and also transcribed by a nurse into instructions for patients to take home.

However, no one was looking over the whole process to make sure that the bag of medications and the take-home paper-

work matched and were, in fact, the proper regimen. Leslie likens the threat to soccer balls flying at the patient with no goalie to fend them off.

The project team didn't grasp the extent of the errors until they assigned a nurse, Deborah Michell, to monitor discharge medications. Michell, who routinely made rounds with physicians and also heard nurses' reports in the morning, would look for discrepancies or questionable orders and then ask doctors to resolve them. When necessary, she

**"We can protect the patient by understanding the process, realizing where we're vulnerable and putting a block there."**

—Jo Leslie

also scrupulously assembled accurate lists of the patients' preadmission regimens by getting records from other hospitals, methadone clinics and elsewhere.

What she found was alarming. Twenty-five percent of the discharges in January had errors that likely would have reached patients were it not for the additional oversight. The errors included incorrect doses, wrong dosing frequen-

cies and prescriptions added without corresponding paperwork changes.

"The system that they had was broken," says Richard "Chip" Davis, the instructor of Leslie's course and director of the Center for Innovation in Quality Patient Care. "There were disconnects. As I understand it, nobody had an opportunity to look at the process as a whole in a long time."

Just by assigning Michell to intercept the errors, the mistakes reaching patients dropped from 100 percent before the project to zero. She continues to monitor discharges.

"We can protect the patient by understanding the process, realizing where we're vulnerable and putting a block there," Leslie notes.

The team also revamped the process to prevent errors in the first place. Fortunately, the Hospital's computerized provider order entry (CPOE) team was piloting a new discharge worksheet. One section of the worksheet allows physicians to select medications from a list of drugs that the patient was taking while in the hospital. The worksheet automatically converts the medications into plain-language instructions for patients. In addition, POE was enhanced so that brand names of combination pills appear next to the names of their generic equivalents.

These and other interventions have brought true results. By March, 5 percent of the discharge medications reviewed by Michell had errors, and none were reaching patients.

The Polk unit's problems may be common. In a follow-up study, Leslie found that about 30 percent to 40 percent of the discharges on three of the Department of Medicine's firms (resident services) had errors.

Brad Drummond, former assistant chief of service on the Thayer firm, says that his group was shocked to hear the results of the one-week survey. The firms have adopted the new worksheet and taken similar steps to reduce mistakes. In addition, Drummond says there's been a paradigm shift.

"The focus of inpatient care has always been on treating with the right medicines in the hospital," says Drummond. "And now, we're paying more attention to the medicines we send home with the patient." ■

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## Translating Tools for Health Care

Richard "Chip" Davis, Ph.D.  
Executive Director

For years, if you wanted to learn Lean Methodology or Six Sigma approaches to health care improvement, it helped to be a good translator. Because these methods for eliminating defects and waste have been used extensively in manufacturing, course materials were full of examples familiar only to people in that field.

As a result, health care workers struggled to understand how reducing the variability in the thickness of a donut's glaze, for instance, could apply to efforts to reduce wait times or eliminate medication errors.

Recognizing a need to put these lessons into a format for the health care industry, the Center for Innovation in Quality Patient Care has created a unique curriculum for this method that is tailored to our field.

The Lean Sigma Prescription for Health Care course was introduced this fall after more than a year of hard work by the Center's staff and consultants from Medtronic Process Solutions, a firm that has piloted the use of these methodologies in health care with us. This curriculum pulls from the experiences of our own trained staff members, who have led and conducted dozens of quality improvement projects at Hopkins.

Lean Sigma combines two powerful improvement techniques, Lean Methodology and Six Sigma Methodology. The goal of Lean Methodology is to

reduce waste, optimize flow and increase speed in systems. One of its most notable applications is the Toyota automobile production system. Six Sigma, used extensively by GE, Motorola and others, focuses extensively on reducing defects in systems.

The course, conducted in Baltimore and offered through the Office of Continuing Medical Education, is intended for a wide range of health care workers, including executives, physicians and nurses. It consists of three one-week sessions, which are spread out over three to four months to give students time to work on their quality-improvement projects. Clinicians will get the added benefit of earning CME and CEU credits. The first external class offering began Feb. 12.

The Center isn't shy about borrowing performance and safety improvement techniques from other fields. Our teamwork and communications training is based on techniques successfully used by the aviation industry to reduce accidents. If we find a tool that works, in health care or in high-tech industries such as nuclear energy, we want to test it, find out how it might be adapted to health care and, as always, share those learnings with you. ■



A CONVERSATION WITH ED CAHILL

## A Dose of Reality

**Venture capitalist Ed Cahill is the first member of the Johns Hopkins Medicine board of trustees to participate in executive safety rounds. This program brings leadership support to a unit's safety efforts while familiarizing the executive with the realities of improving care. Cahill, who chairs the board's quality improvement committee, volunteers on Nelson 4, a general adult medicine service at Hopkins Hospital.**

### How often do you visit the unit?

We meet once a month. Since I live in Boston and have a job that takes me around the country, I can attend only about half of the meetings in person. But I join every one at least by phone. Charlie Reuland, the administrator for the Department of Medicine, Hospital Pharmacologist Brent Petty and other physicians and managers are also working closely with the group. They help provide the resources to make changes.

### What's your role?

One is learning more about the institution—what it's like to work there, what it's like to deliver patient care, and how you go about trying to advance quality and safety on a daily basis. Truthfully, the group can get things done without my help. However, using my background as a businessman, I add what I can to improve the content and process of the meetings.

### How do you do that?

People from the business world bring the concept of feedback loops—continuously measuring results and making sure that what you implement actually works. The board of trustees, for instance, gets reports about new sentinel events and also reviews old ones. We've asked that, at the one-year anniversary of a sentinel event, we hear what was done to prevent recurrences of events, and we try to get an idea if the changes have made a difference. We need the same kind of feedback on Nelson 4.

### How else do you contribute?

I try to make sure that we're taking advantage of all the knowledge at the Hospital and University. The management and clinicians on the unit's safety committee—not just trustees—are familiar with the problems that other groups have faced and the resources they used to make improvements.

### An example?

When this project began early this year, we surveyed everyone working on the unit about threats to patient safety. There were several comments that noise in the workplace could be a problem. The noise level is significantly higher than on many other units.

It turns out that some groundbreaking research has been done by Hopkins acoustical engineers showing the harmful effect of high noise levels on patient and employee stress and on outcomes. I reminded the unit's safety committee of this research, and we've since gotten the free services of some very smart Hopkins engineering students. They've just completed a study that we're reviewing now.

### How do you learn about the different resources that are out there?

At quality improvement committee meetings, we spend a good half of our agenda hearing about proactive movements within the Hospital to improve quality and safety. It's an opportunity to diffuse that knowledge into other areas. Just knowing that we have the resources of the Center for Innovation is useful.

### Your exposure to the unit must have helped your work as a board member.

It really has. I feel a lot more comfortable running the quality improvement committee meetings. I don't approach safety problems from the standpoint of, Well isn't that stupid? or How could this be happening? Once you acknowledge that a process is broken and when you also participate in trying to fix it, that opens your eyes to how difficult it can be to change things. It's also tremendous exposure to the work that the people on the floor do everyday to try to improve the quality of care and the safety of patients. It's a good dose of reality to go along with the theory. ■

## A Reduction in Noise

Caregivers depend on bedside monitoring devices to alert them to patients in trouble. However, if the devices "cry wolf" too often, there's a risk that clinicians will become desensitized to them.

The problem of nuisance alarms led a multidisciplinary group at Hopkins Hospital to try reducing the noise while making sure that true emergencies don't go unheeded. Halsted 4, a medical step-down unit experiencing dif-

iculties in this area, is the group's pilot site.

Over 18 days in January 2006, a computer counted 16,953 serious alarms on the unit, or one roughly every 90 seconds. The tally didn't include less serious, and much more frequent, "advisory" alarms, which sounded every several seconds.

"You can't just pick and choose which one you're going to follow up on," says Kelly Creighton, a group member and nurse clinician on the 15-bed unit.

On the 15-bed unit.

The group has made several changes in the parameters that trigger alarms.

The unit has also increased training to help nurses and others troubleshoot problems that may lead to unnecessary alarms. Strategies include hair removal and skin preparation to improve contact with monitor electrodes and positioning monitor lead wires so they're harder to dislodge. Trou-

bleshooting practices are part of a recently adopted Hospital policy for handling bedside monitors.

These interventions appear to have reduced unnecessary alarms. Over another 18-day span in July and August, the computer counted 12,897 serious alarms, a decrease of nearly 25 percent. The distracting beeps are still frequent, but the group hopes to reduce them further. ■

# Putting Safety into the Routine

Dedication to standards and multidisciplinary communication pays off for a burn unit.

In more than a decade working in the Johns Hopkins Burn Center, intensive care nurse Rowena Orosco had come to expect some inconsistency in how patients were treated. What kind of wound dressing to use, whether to prescribe antifungal medication, or when to start or discontinue antibiotics were decisions that often differed doctor to doctor. Nurses often didn't participate in discussions about patient care and often didn't know the plans for patients.

"We didn't have many protocols," Orosco observes. "We just followed what the physicians said."

Her observation was characteristic of caregivers on the burn intensive care unit (BICU) who were surveyed in spring 2004 as part of an eight-step patient safety program. Among other issues, the unit identified lack of evidence-based standards of care and communication breakdowns as significant barriers to better care. Compounding the situation, the burn center had a vacant director position.

Caregivers believed that too many patients were unnecessarily succumbing to their burns. Over the yearlong period ending April 2004, 21 patients had died in the 10-bed unit at Hopkins Bayview Medical Center, often from sepsis. They also wanted to better manage patients' pain and prevent infections to which burn wounds are vulnerable.

Those concerns shaped a project that has brought major safety improvements, including lower mortality rates, while demonstrating the value of getting everyone on the same page.

The group used the Comprehensive Unit-based Safety Program, a strategy developed at Hopkins that helps care



The burn unit has created standard procedures in more than 30 areas. Here, Director Stephen Milner and occupational therapist Lana Berkovich work with a patient's wrist.

teams to improve their workplace culture, bring hazards to the surface and develop new processes to improve patient care.

To bolster communication, the unit introduced several new rounds that encourage multidisciplinary input. Every day, all care team members participate in

**"In a unit where the residents change every month and where there's a constant change of staff, having protocols has been very useful."**

—Stephen Milner

patient care rounds. The group also adopted a daily goals sheet, which helps all providers to understand and participate in the plan for the patient's care for that day. Orosco assumed the new position of the unit's patient safety nurse.

In addition, the unit launched weekly multidisciplinary teaching rounds.

In May 2005, surgeon Stephen Milner became the center's director, bringing a zeal for greater standardization. For example, not long after he took the post, Milner made a visit to a neonatal intensive care unit and borrowed an overhead heater. Used to keep newborns warm, the heater also protects burn victims against dangerous drops in body temperatures that can occur during long surgeries.

A few months after his arrival, a new BICU protocol committee began meeting twice monthly to ensure consistent, evidence-based practice. To date, more than 30 protocols have been created, addressing issues such as nutrition, environmental services and infection control.

Now, when a patient is expected to be in intensive care for more than three days, physicians know to prescribe oral Diflucan, an antifungal medication. Other measures focusing on the elimi-

nation of ventilator pneumonia and central line-related bloodstream infections have also become the standard of care in the program.

"In a unit where the residents change every month and where there's a constant change of staff, having protocols has been very useful," says Milner.

Some of the new practices have gone against conventional wisdom. One of those is being more restrictive in the use of antibiotics, even in patients whose bodies are mostly covered in burn wounds. The unit added an infectious disease specialist, Jonathan Zenilman, a consultant who participates in the multidisciplinary rounds, evaluates patients' needs for antibiotics and checks lab culture results daily. In the past, caregivers might intuitively prescribe antibiotics to critically ill patients before signs of infection were present. Today, orders are based on the patient's clinical picture.

"Our approach has helped to reduce the rates of drug-resistant infections," says Milner. A second infectious disease specialist has since joined the unit.

Like many successful safety efforts, the changes on the burn unit required additional resources—the hiring of more intensivists, for example—and leadership support.

The burn unit has witnessed remarkable results. It recorded only two deaths from May 2005 to April 2006. The gains were achieved despite the fact that slightly more patients with serious burns were admitted in that period than in the year ending in April 2004.

Of the achievement Orosco says, "When you have a team behind you working so well, and you communicate with each other, I'm not surprised." ■

## Extreme Makeover for Chemo Pharmacy

Using Lean Kaizen, a team overhauls its workplace and processes.

For cancer patients facing necessary but often harsh chemotherapy regimens, visiting the Hopkins Hospital adult outpatient chemotherapy clinic to receive these drugs could be a test of patience. Long waits prompted complaints from patients and their nurses.

A multidisciplinary team studying the overall chemotherapy administration process identified several contributors to wait times, including laboratory testing, medication processing and drug administration. In spring 2006, the team decided to attack one component: the 55-minute average drug processing time in the clinic's pharmacy.

The problem was too complex to be resolved overnight. But the multidisciplinary group, from Oncology, Pharmacy and the Center for Innovation in Quality Patient Care, recognized that it could take big leaps in several days using a system improvement tool that's gaining a foothold in health care.

Called Lean Kaizen, the tool combines a method for eliminating

waste with "Kaizen," a Japanese term for continuous improvement. The process starts with a workshop that brings together employees for a three- to five-day burst of activity aimed at finding solutions. In the case of the chemotherapy pharmacy, the core team consisted of 15 people who cleared their schedules for the workshop. In addition, organizers enlisted the help of Facilities, Information Technology and Environmental Services, who committed resources to be ready to perform any work orders quickly.

Aside from mending the existing system, the team wanted to prepare the pharmacy for future changes. Patient volumes are forecasted to increase by 40 percent over the next five years. And the pharmacy wanted to assure compliance with imminent regulations for guarding the sterility of chemotherapy that require technicians not to leave confined areas during drug preparation.

One of the group's first steps was conducting field observations. They found that pharmacists were

frequently interrupted by phone calls during critical work steps, often from nurses checking on the status of orders. "If pharmacists are double-checking doses and get a phone call, they can get distracted," notes Hanan Aboumatar, a coach with the Center. "And distractions are known to increase the chance of error."

The team also learned that technicians frequently left their workstations to gather chemotherapy supplies, posing problems to compliance with the new regulations. To quantify the waste, the team painstakingly diagrammed the path walked to put together one order and measured the total distance at 223 feet.

Poor workplace layout and cluttered counter space contributed to the problems, the group found. Pharmacists and technicians couldn't see each other due to a drywall barrier separating their work areas. Chemotherapy for different patients was sometimes prepared side by side, a situation that could lead workers to confuse medications. Laura Winner, the Center's



Virna Almuete says chemotherapy processing is less chaotic today than before the reorganization.

Lean Sigma deployment leader, says there were few visual cues, such as designated areas for orders awaiting quality checks, to signal to pharmacists what tasks to do next.

The team brought a bevy of changes to the pharmacy. The dry-wall barriers were replaced with Plexiglas, allowing pharmacists and technicians to see the process and communicate better. Several sections of counter where pharmacists did their checks were turned into one large counter, decreasing the clutter. They created signals by placing yellow- and blue-outlined squares on the counter indicating where trays of medications should be placed when ready for first and second checks. This simple organizational strategy has helped pharma-

cists track the progress of orders and avoid missing steps. To reduce the distance traveled to prepare an order, medication and supplies were made more accessible.

The group also created a new position known as a waterspider. This person skims the surface of the process, gathering supplies and handling phone calls that don't require pharmacists' input. This has improved compliance with the new regulations and has reduced distractions.

The pharmacy is waiting to see the effect of its changes on processing times. Low staffing, especially during the summer, has prevented the group from getting that assessment. One measure that shows the process has been streamlined is that the average chemotherapy order now takes only 53 feet of travel distance, a reduction of 170 feet. And Virna Almuete, the pharmacy's interim assistant director during the Kaizen project, says the changes and improved organization have helped the group to endure low staffing periods. "The process is much more visual. You can see at any given time where orders are," she notes. "You can see if orders are backing up, and it wasn't like that before." ■

**Cutting the Noise**

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Heart Devices and MRI**

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**Is it Fixed?**

**What an Idea!**