Pittsburgh Regional Healthcare Initiative

PRHI Executive Summary

DIABETES & DEPRESSION RESOURCES SHOWCASE
see address panel

Sharing what we learn

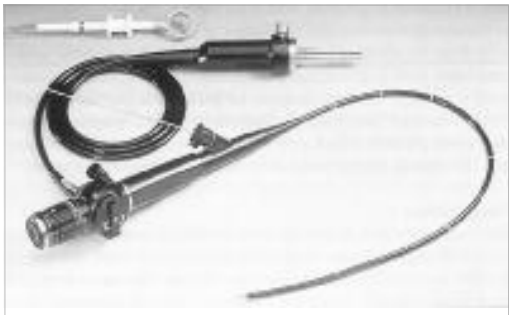
Anatomy of a medical error

Guest columnist, Richard M. Shannon, MD

The problem had been solved, hadn't it? Investigation into the outbreak of pseudomonas-related pneumonia at Allegheny General Hospital (AGH) last fall yielded a probable cause: problems with chemical sterilization. Changes were made.

"At 99.9% of hospitals, that would have meant 'case closed,'" said Mark Schmidhofer, MD, PRHI Board member.

In this essay, Richard Shannon, MD, AGH Chair, Department of Medicine, examines a much deeper inquiry that the problem-solving team pursued—and the revelations that resulted.



A bronchoscope, a small, flexible tube, is threaded into a patient's the lungs to let doctors view the lungs and remove specimens for culture or biopsy. While it was the initial focus of AGH's investigation, a deeper look revealed other opportunities for improvement.

On October 18, 2002, sixteen patients at Allegheny General Hospital (AGH) were found to have pulmonary infections related to pseudomonas. The source appeared to be three contaminated bronchoscopes.

AGH immediately assembled a problem-solving team to find the root cause as quickly as possible. The investigation revealed that the likely cause of the contamination was defective chemical sterilization. Using the Steris System I automatic endoscopic reprocessors, we observed that there were both defects in the "quick connect" component of the sterilizer, as well as potential problems with the sterile water filters, which were essential to the creation of sterile water for the rinse cycle. While the proximate cause of the error appeared to involve sterilization, our team investigated further.

Looking Deeper: the Five Whys

Several members of the AGH staff had recently completed an intensive one-week course, offered through the Pittsburgh Regional Healthcare Initiative. The course, the Perfecting Patient Care University, taught principles of system improvement derived from the Toyota Production System.

Our team decided to apply the principle of the "five whys" to further understand the root cause of the problem. In applying the "five whys," we extended our understanding far beyond that which was evident from the immediate cause. The illustrations on page 7 summarize the "five whys," and the net results.

In short, we were using chemical sterilization because of its rapid turnaround in time. However, its efficacy is less than the "gold standard" of sterilization, ethylene oxide gas sterilization. The hospital's use of chemical rather than gas sterilization reflected its need for speedy turnaround, but why was speed so important?

This question led to the discovery that AGH was performing an increasing number of bronchoscopies. The reason why some of the bronchoscopies were being performed appeared to be an increased incidence of ventilator associated pneumonia. In turn, the ventilator associated pneumonia increase appeared to relate to a more recent change in antibiotic regimen designed to prevent or reduce the duration of ventilator associated pneumonia.

Failure to follow the "five whys" would have led us to the correct, but incomplete, conclusion that the chemical sterilization process was the root cause of the contaminated bronchoscopes. However, the real clinical problem driving the use of chemical sterilization was the increase in the incidence of ventilator associated pneumonia. We can now focus on reducing ventilator associated pneumonia, and refining the antibiotic protocol to reduce the incidence and the duration of such complications.

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AUGUST 2003

Inside:

Sharing what we learn

A Grand Experiment in making cardiac patients safer

Guest columnist, Dennis Schilling, PharmD

PRHI's Cardiac Working Group created the PRHI Cardiac Registry to track care processes for patients undergoing Coronary Artery Bypass Graft (CABG) surgery. Representatives from the region's 12 cardiac centers now convene regularly to develop and discuss new hypotheses about which processes of care produce the best outcomes for patients. Here, one hospital shares an important hypothesis.*

Shadyside primes the pump

PRHI's Cardiac Registry data, shared at the April Cardiac Forum, supported the findings of the NNE registry on this measure: *Patients whose hematocrit does not fall below 21 have better outcomes.* UPMC Institute for Performance Improvement also added avoidance of anemia to its performance measures.

PRHI Cardiac Registry*
highlights four specific processes of care that have produced significant improvements in patient outcomes following CABG surgery:

- ✧ Uniform use of the internal mammary artery as a harvest site
- ✧ Use of pre-operative aspirin
- ✧ Sufficient beta blockade pre-op—pulse rate less than 80 BPM at induction of surgery
- ✧ Avoidance of anemia due to blood dilution on coronary bypass (nadir hematocrit not below 21).

UPMC Shadyside soon began calculating each patient's risk of blood dilution before starting the cardiopulmonary bypass pump (CBP, or heart–lung machine), and they closely track patients' hematocrit while on the CBP.

Increased scrutiny alone helped the team reduce the number of patients with a nadir hematocrit of less than 21 while on pump. But they wanted to do more.

Hematocrit *is the proportion, by volume, of the blood occupied by red blood cells. A low hematocrit level indicates anemia, which reduces the amount of oxygen the blood can carry to body tissues. Hematocrit can be reduced if the blood becomes diluted with a large volume of intravenous solutions (hemodilution). Keeping hematocrit at the proper level while the patient is on the heart bypass pump is associated with better outcomes.*

A perfusionist's goal is to maximize the perfusion of the patient's tissues with oxygen, using scarce blood supplies appropriately and avoiding unnecessary transfusions. At Shadyside, perfusionists worked with cardiovascular surgeons to reinstitute a process called ***retrograde autologous priming*** (RAP) in an effort to reduce blood dilution when the pump was first started. The hematocrit measure improved greatly.

What is RAP?

The pump must be pre-filled, or primed, with a physiologically compatible solution, usually an electrolyte solution. Priming the pump prevents the introduction of an air bubble to the circulation that could critically obstruct blood flow.

But perfusionists face a challenge: their patients are not to gain more than 1,500 milliliters of fluid during the surgery—about three-quarters of a 2-liter bottle. In the '80s and '90s, pumps required up to 2,500 milliliters of priming solution. When a patient's blood circulation was connected to these pumps, there was an immediate possibility of excessive blood dilution.

RAP was developed to protect against this dilution. During RAP, some of the patient's own blood is withdrawn and used to displace the electrolyte solution before the circuit is connected. As pumps evolved—they now require less than 1,200 milliliters of priming solution—RAP use decreased. But recently, perfusion professional literature and presentations by perfusionists from the Cleveland Clinic have again begun to warn against hemodilution, even with the newer pumps.

When perfusionists from St. Francis Hospital relocated to UPMC Shadyside they encouraged the reconsideration of RAP for smaller or anemic patients at risk of hemodilution. After close internal study of aligned process measures, the perfusion department suggested the following hypothesis:

Hemodilution may be a better marker of adverse patient outcomes than transfusion and fluid gain alone.

Continued, page 6

**based on the registry created by the Northern New England (NNE) Cardiovascular Disease Study Group. NNE has a 16-year history in improving regional outcomes following advanced cardiac procedures.*

Central Line-Associated Bloodstream Infections

CLAB infections: telling it like it is

Last month's PRHI Executive Summary *disclosed a potentially encouraging development in the region's quest for zero hospital-acquired infections (CLABs). Recent regional reports show a decline in the number of central line-associated bloodstream infections. We asked: Could it be that fewer patients were contracting CLABs? Or could the decline be indicating some unintended consequence—such as narrowing the definitions of CLAB, or placing more lines of the type that are not tracked?*

PRHI partners selected CLABs as a target area for 2003. On the way to eliminating all hospital-acquired infections, partners were challenged to: 1) eliminate CLABs in ICUs, and 2) reduce CLABs in other areas of the hospital by 50%.

The goal is not to reduce a number: the goal is for zero patients in Southwestern PA to contract a central line-associated bloodstream infection … and for no unintended consequences to result.

The goal is not to reduce a number: the goal is to see how close we can come to having zero patients in Southwestern Pennsylvania contract bloodstream infections due to contamination of a central line. Ultimately, the goal is to eliminate all hospital-acquired infections, without creating unintended consequences.

The Infection Control Advisory Committee (ICAC) has discovered variations across the region in the processes of care for the insertion, care and removal of central lines. Other PRHI committees, such as the Cardiac Working Group, have concluded that variations in care processes correspond to variations in patient outcome. That conclusion serves as the basis for the Cardiac Registry, *(article, facing page).*

Through the ICAC, the region's infection control practitioners have created suggested protocols, CLAB kits, and "progress notes" to reduce variation, minimizing the chances of any patient's contracting a bloodstream infection.

Will these measures, or others specific to individual hospitals, help to reduce the actual number of patients getting infections? It's a hypothesis that needs to be measured through the accurate reporting of all bloodstream infections.

Focusing solely on lowering numbers can create unintended consequences like:

- ✧ Failure to capture all central line data—including that for femoral artery placement, for example.
- ✧ Increasing use of other types of lines that will not be counted.
- ✧ Failure to examine all central line infections, whether or not they meet an arbitrary "definition."
- ✧ Inability to understand whether progress is being made, and to learn from reporting.
- ✧ Failure to make patients safer.

It is likely that the best way to combat infection is to: a) investigate breaks in practice; and b) investigate infections as soon as a patient's blood culture tests positive. The cause of an infection can be more quickly and accurately determined when it is investigated as close as possible to the time and place it occurs. When it is reported, the entire region learns.

If CLAB numbers are declining because the standard of care has improved and process variations have decreased, and if a learning system is in place, then we can believe that hospital patients are indeed safer. But infections must not be excluded from the count in an attempt to improve the numbers. And our attention must not drift from the larger goal of eliminating ***all*** hospital-acquired infections. As a community endeavor, PRHI values people over numbers, and accuracy over news that may only seem good.

Pittsburgh to pilot NHSN system

Eight PRHI partner hospitals will soon begin working with the CDC to pilot the National Healthcare Safety Network (NHSN) Blood Stream Infection (BSI) Prototype. NHSN is an expansion and enhancement of National Nosocomial Infection Surveillance System (NNIS). The new system will give the PRHI pilot sites an opportunity to measure central line insertion practices. The process measure component of NHSN will capture:

- ✧ *Reason for insertion*
- ✧ *Insertion technique*
- ✧ *Skin prep technique*
- ✧ *Location site (jugular, subclavian, femoral or brachial)*
- ✧ *Catheter type*

"Seeing can be unbelievable"

Improving hand hygiene requires leadership, collaboration

Semmelweiss discovered 150 years ago that caregivers with clean hands are far less likely to transmit pathogens among susceptible patients. Yet developing and maintaining the "hand hygiene habit" continues to challenge hospitals worldwide. In October 2002, the CDC issued new hand hygiene recommendations, which included a strong call for the use of alcohol-based hand rub.

For LifeCare employees seeing is believing in this very visible demonstration of hand hygiene. ICP Lynette Smith created the inservice for the LifeCare team 3 years ago. Her quest was reinforced after observing similar work at the VAPHS.

LifeCare meets the VA

LifeCare's Infection Control Practitioner, Lynette Smith, recently visited 4 West at the Veterans Administration Pittsburgh Health System (VAPHS). With assistance from PRHI and funding from the CDC, the 4 West Learning Line is examining ways to improve and sustain hand hygiene and eliminate the spread of infection, particularly antibiotic resistant strains.

At 4 West, Ms. Smith observed ways to streamline routines, allowing more opportunity for proper hand hygiene.

Noted Ms. Smith, "I saw some encouraging things at the VA. You don't have to run around to eight places to find the things you need to get your job done."

Ms. Smith's observations led her to make some low-cost, low-tech improvements at LifeCare that make work just a little easier—and make patients just a little safer.

- ✧ Cupboards or dedicated areas now contain baskets with everything the nurse needs to obtain a blood culture through a central line.
- ✧ Shared patient equipment, like capillary blood glucose machines and bladder scanners, now have bright pink tags to let staff know who must clean the equipment (the user) and how.

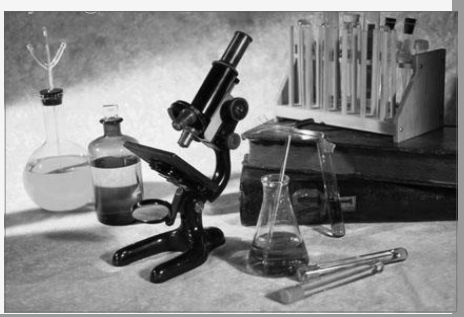
A sesquicentennial of note

Last year marked the 150th anniversary of a sentinel medical discovery. In 1847, Ignaz Semmelweiss, a Viennese physician, discovered that fatal infections were spread among patients, particularly women post-partum, by doctors who failed to wash their hands between examinations. Semmelweiss promoted a disinfecting procedure requiring physicians to wash in a chloride of lime solution after autopsies and with soap and water between patient visits. Doctors also had to change into clean lab coats before examining patients. As a result, hospital mortality rates from infectious diseases declined from 18% to 1%.

A century and a half after Semmelweiss' discovery, studies at hospitals worldwide over the past three decades show that many clinicians do not routinely follow hand hygiene procedures.

Infectious diseases remain the leading cause of death and disease worldwide and the third leading cause of death in the United States. The U.S. Centers for Disease Control and Prevention (CDC) estimates that 2.4 million Americans acquire an infection in hospitals each year, and that hand hygiene could prevent at least half of them. Furthermore, hospital-acquired infections cause or contribute to 100,000 deaths annually.

By improving the system of health care, PRHI partners aim to achieve 100% hand washing among healthcare staff and its corollary—dramatically fewer infections.



What are CDC's hand hygiene recommendations?

http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5116a1.htm

1. *When hands are visibly dirty or contaminated with proteinaceous material or are visibly soiled with blood or other body fluids, wash hands with either a non-antimicrobial soap and water or an antimicrobial soap and water.*
2. *If hands are not visibly soiled, use an alcohol-based hand rub for routinely decontaminating hands in all other clinical situations…Alternatively, wash with an antimicrobial soap and water [in those clinical situations].*

Excerpt from ***Guideline for Hand Hygiene in Health-Care Settings,*** John Boyce, MD, Hospital of San Raphael, New Haven, CT, and Didier Pittet, MD, Université de Genève, Geneva, Switzerland, October 25, 2002/51 (RR16)

"Hands Across LifeCare"

To renew employees' commitment to hand hygiene, infection control and UPMC laboratory personnel at LifeCare Hospital presented the third annual hand washing in-service with a "visible" difference—***Hands Across LifeCare***. They cultured the hands of 50 randomly selected employees and planted those cultures in petri dishes. UPMC lab personnel provided rapid identification, gram-staining each plate after the specimens were incubated for 48 hours.

The results were exhibited along a wall, art gallery- style, alongside educational posters and displays. When Ms. Smith brought the staff together to show them the results, the shock was palpable. The staff was amazed at the plethora of organisms living on their "clean" hands. Seizing the "teachable moment," Ms. Smith administered a simple infection control post-test for her fellow employees.

Hands Across LifeCare has become an annual event, in part to re-inspire long-time staff members, and in part to ensure that all new staff members are exposed to this powerful learning. No matter how often it's repeated, the exercise provokes a strong response.

Ms. Smith said, "At the *Hands Across LifeCare* inservice, employees receive first-hand confirmation of something that's been known for more than 100 years. And yet, even today, seeing can be almost unbelievable."

Employees receive first-hand confirmation of something that's been known for more than 100 years. Yet even today, seeing can be almost unbelievable.

Lynnette Smith, RN
Infection Control Practitioner
LifeCare Hospital

PRHI Infection Control Advisory Committee

PRHI's Infection Control Advisory Committee (ICAC) comprises infectious disease physicians and infection control practitioners from partnering institutions, and representatives from the Centers for Disease Control and Prevention (CDC). This committee is responsible for establishing a region-wide nosocomial infection reporting system. ICAC also develops and conveys practice interventions based on the National Nosocomial Infection Surveillance (NNIS) system.

Chairs:

Carlene Muto, M.D.*, Hospital Epidemiologist/Director, Assistant Professor of Medicine, University of Pittsburgh School of Medicine, Division of Infectious Diseases*

Cheryl Herbert, RN, CIC*, Director, Infection Control, Allegheny General Hospital*

PRHI contact:

Patricia Zurawski, *Administrative Manager, Infection Control 412-535-0292, ext 119,* ***pzurawski@prhi.org***

PRHI Scorecard 2003

Hospitals continue to state 2003 goals

University of Pittsburgh Health System

Donald Wolff, Board Member, UPMC
Loren Roth, MD, MPH, Senior Vice President, Medical Services

PRHI 2003 Targets

PRHI's overall goal remains zero nosocomial infections, zero medication errors and the world's best outcomes in five clinical areas. On the way to the goal, PRHI challenges partners this year to:

- *Eliminate CLABs in ICU's; reduce all CLABs, MRSA, and others by 50%.*
- *Report all medication errors and eliminate 50% of them.*
- *Reduce in-hospital mortality following CABG surgery by 50%.*
- *Share every major event or learning regionally as soon as possible.*

See other responses in May, June and July's PRHI Executive Summary .

- Increase reporting of medication errors system wide. Increase varies from 20-72%, depending on hospital
- All reported medication errors reviewed by Expert Panel, solved to root cause
- Reduce CLABs by an average of 43% in ICUs; to NNIS 25th percentile or better
- Reduce mortality following CABG by an average of 45% in the five system hospitals where it is performed.

These targets were established by each hospital, and reflect system wide improvements in the 40-60% range. Independently, UPMC is also undertaking *additional* quality initiatives addressing care processes and patient outcomes in the areas of :

- Heart failure
- Coronary artery bypass grafting
- Outpatient diabetes management
- Reduction of nosocomial infections

Grand experiment for cardiac patients — *Dennis Schilling, PharmD* — from page 2

RAP has now been adopted as the standard of care for patients at risk of hemodilution where the surgeon agrees it can safely be done. Anesthesiology has also been critically examining the fluid load for any patients going on CBP.

Since these process changes, 93.9% of patients on CBP have had their hematocrit maintained at 21 or greater, up from 71.7%. While no statistically proven difference yet exists in the patient outcomes, the team is encouraged by what they see. Patients are well perfused on CBP, without hemodilution.

Clinically, these patients appear to do better when the CBP is removed and the patient's own heart and lungs begin to function at the conclusion of surgery.

"The Grand Experiment"

What is the grand experiment of the Cardiac Working Group? It is every discipline learning about processes and outcomes from every patient every day. It will be a long, time- consuming process to prove any hypothesis of change from local experience, but by forming a regional learning community, small ripples are made obvious in the larger pool of data.

The power of *this* story

This story of the partners of UPMC Shadyside is not intended to prescribe or promote any particular type of procedure. As a story it is purely descriptive. It is, however, a powerful story of a team working together to understand things that they can and cannot change, and developing a hypothesis that a change they have made is providing better outcomes for their patients. Small changes or major procedural shifts such as this provide learning opportunities for all partners of the Cardiac Working Group.

The power of *your* story

If your team has a story you wish to share, please contact Dennis Schilling at **dschilling@prhi.org** so that we can share it with other partners. What we choose to do as we learn from each other advances the grand experiment of regional improvement every day.

Anatomy of a Medical Error

Richard Shannon, MD — from page 1

Enduring lessons

Thoroughly examining the process of care surrounding the pseudomonas infections was extremely important, in more ways than were initially apparent. Among the things we learned:

The Five *Whys*

1. *W H Y*

... were the bronchoscopes contaminated?
Defects in the chemical sterilization process (*Steris System 1* AER)

2. *W H Y*

... were we using chemical sterilization?
It allowed for rapid turn around (gas sterilization takes 24 hours)

3. *W H Y*

... did we need such rapid turnaround?
We were performing increasing numbers of bronchoscopies

4. *W H Y*

... were we performing so many procedures in the ICUs?
We had increased numbers of ventilator-associated pneumonias (VAP)

5. *W H Y*

... did we have an increase in VAP?
We were using a prophylactic antibiotic regimen in intubated patients

Analysis can be done quickly

This examination showed that while medical errors are indeed complex, problems can be solved to root cause within a finite period of time (72 hours in this case) when a dedicated team is focused on the effort. As complicated as medical errors may seem, they can be understood when the investigation is conducted in real time and in close proximity to the reported event. Thus, reporting errors promptly and investigating them completely in "real time" constitute the single most important step to a successful resolution.

Public notification is essential

The second lesson from this episode is that public notification of such a problem is extremely important in preventing what are likely to be similar circumstances in other institutions. However, public notification does not come without risk: the complexities of medical errors may be difficult to convey, and may result in the temptation to sensationalize. Having an established relationship with reporters and providing them with an explicit, straightforward explanation of the problem at hand are essential to ensuring maximum accuracy of the public message.

The risks of misunderstanding can be further mitigated by reliance on existing partnerships with respected public entities. The Pittsburgh Regional Healthcare Initiative and the county and state health departments offered invaluable assistance in conveying the information to the public in this instance.

Net results

1. New sterilization process
2. New pre-procedure checklist
3. Standardized procedure *documentation*
4. >50% reduction in the number of procedures (bronchoscopies)
5. Decrease in number of ventilator days

Analysis yields fringe benefits

"Halo effects" can ripple through an institution following a thorough and complete investigation of a complex medical error.

- First, employees feel confident to volunteer additional details about medical errors when the investigation is conducted in a blame-free environment.
- Second, the bronchoscope examination at AGH has now resulted in a 50% reduction in the number of bronchoscopies performed at the institution. During that time, we have seen a modest decline in ventilator associated pneumonia, and the number of ventilator days in selected intensive care units (ICUs) in the institution where the outbreak existed.
- Finally, the application of Perfecting Patient Care principles of the "five whys" allows not only the opportunity to solve to root cause the immediate problem, however complex, but also to examine the work more deeply, to identify the forces that can foster error.

Calendar, September 2003

Tuesday, September 2	Infection Control Advisory Committee Centre City Tower, 5th Floor	8—10 a
	QB Working Group PRHI offices, Centre City Tower, 2150	5–7p
Mon, Sept 8—Thurs, Sept 11	Perfecting Patient Care University*	7:30a—5 p
Tuesday, September 9	Leadership Obligation Group Location *tba*	2—4p
	Medication Safety Advisory Committee PRHI offices, Centre City Tower, 2150	3—5 p
Mon, September 15	***Depression and Diabetes Resources Showcase*** PPG Wintergarden (see address panel)	10 a—2p
	Diabetes and Depression Work Groups	5—7p
Tues, September 16	Perfecting Patient Care Information Session* PRHI offices, Centre City Tower, 2150	6—9p
Weds, September 17	Hospital Learning Line visit* Allegheny General Hospital	8a—12p
Thurs, September 18	Buying Healthcare Value Committee Jewish Healthcare Foundation, Suite 2300	2:30—4 p
Weds, September 24	Board of Directors Location *tba*	4–6p

For further information call Helen Adamasko, 412-535-0292, ext. 100

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PRHI Executive Summary is also posted monthly at **www.prhi.org**

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PRHI Diabetes and Depression Resources Showcase

September 15, 10am-2pm
PPG Wintergarden

- Kickoff press conference featuring Paul O'Neill and PPG CEO, Raymond LeBoeuf
- How PRHI partners—businesses, providers and plans—plan to improve chronic care
- Community resources that are ready to help
- Consumers, purchasers, healthcare workers urged to attend!

Pittsburgh Regional Healthcare Initiative

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