



Pittsburgh Regional Healthcare Initiative
White Paper Series #1



Anatomy of a Medical Error

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August 2003

Pittsburgh Regional Healthcare Initiative

The problem had been solved, hadn't it? Investigation into the outbreak of pseudomonas-related pneumonia at Allegheny General Hospital (AGH) in the fall of 2003 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.

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



A bronchoscope, a small, flexible tube, is threaded into a patient's 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.

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

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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.

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:

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.

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.

The Five *Whys*

1. *WHY*

... were the bronchoscopes contaminated?

Defects in the chemical sterilization process (*Steris System 1 AER*)

2. *WHY*

... were we using chemical sterilization?

It allowed for rapid turn around (gas sterilization takes 24 hours)

3. *WHY*

... did we need such rapid turnaround?

We were performing increasing numbers of bronchoscopies

4. *WHY*

... were we performing so many procedures in the ICUs?

We had increased numbers of ventilator-associated pneumonias (VAP)

5. *WHY*

... did we have an increase in VAP?

We were using a prophylactic antibiotic regimen in intubated patients

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

PRHI is a collaborative of the institutions and individuals that provide, purchase, insure and support healthcare services in the 12-county region of Southwestern Pennsylvania. Together we are working to achieve the world's best patient outcomes; through superior health system performance; by identifying and solving problems at the point of patient care.

PRHI differs from other reinvention models in an important way: it is experimenting with a way to embed continuous learning and improvement in the system of day-to-day work. Called the Perfecting Patient Care (PPC) System™, PRHI's approach is derived from one of the most successful business improvement models in the world—the Toyota Production System (TPS). To learn more about the PPC System™ under way at Allegheny General Hospital, contact:

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