

Industrial Techniques Help Reduce Hospital-Acquired Infection

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References to aspects of other industries that could serve as models for addressing healthcare issues abound in the patient safety literature. For example, the Aviation Safety Reporting System has been considered a model for error reporting programs. A model from industry that has not been particularly apparent in the literature is the Toyota Production System. This model may seem an unlikely means for addressing healthcare issues; however, its application by the Pittsburgh Regional Health Initiative (PRHI) has dramatically enhanced patient safety in a variety of ways. The changes are the products of the insights and ingenuity of nurses, biomedical engineers, and other staff who are close to the patient. This article describes how addressing one issue using the Toyota model adapted for healthcare lead to identifying and effectively solving several problems that not only enhanced patient safety and quality of care, but also improved the ease with which the staff provide care. Additional examples of successes using the model can be found at the PRHI website www.prhi.org.

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Southwestern Pennsylvania provides a unique learning lab for healthcare improvement, since healthcare is the region's largest economic sector, employing one in eight workers and conducting more than \$7.2 billion in business. The region is a national healthcare microcosm, as it struggles with high healthcare costs, a malpractice crisis, increasing numbers of uninsured people, and issues of patient safety.

In 1997, the Pittsburgh Regional Healthcare Initiative (PRHI) convened an array of the region's healthcare stakeholders to ask: Could Southwestern Pennsylvania, working and learning together as a region, make healthcare safer and better? PRHI has since become a community resource, a consortium of 44 hospitals, four major insurers, dozens of large and small business healthcare purchasers, corporate and civic leaders, and elected officials, working toward the goal of improving healthcare quality for patients, and improving the financial picture for those who pay for it.

Introducing Industry to Medicine: Perfecting Patient Care

One of the advantages of this regional coalition was the ability of non-healthcare CEOs, from banks and small businesses to industrial giants like Alcoa, to exchange ideas with hospital CEOs and medical practitioners. The conversation led to a bold hypothesis: perhaps the tenets of an industrial model like the Toyota Production System could be adapted to improve quality and reduce waste and error in healthcare as dramatically as it has done in industry. The world's leading auto manufacturer, Toyota, produces cars renowned for quality by focusing on solving every problem that occurs on the assembly line as soon as possible, giving a great deal of discretion to the person closest to the work. Alcoa used the Toyota model to help make its workplace the safest in the world, and saw a corresponding rise in quality and profit. This industrial model involves a disciplined way of solving problems, one by one, in the course

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of work, always aiming for perfection instead of an arbitrary benchmark. Learning how to apply it involves thinking about problems differently and learning continuously.

PRHI adopted this industrial model when it stated its goal for Southwestern Pennsylvania to become the region that achieves the world's best patient outcomes by identifying and solving problems, one patient at a time. The Toyota adaptation, which PRHI created and now teaches, is called Perfecting Patient Care™.

Using Techniques Against Hospital-Acquired Infection

A few hospitals stepped forward, eager to try Perfecting Patient Care, among them the Veteran's Administration Pittsburgh Healthcare System (VAPHS). The Centers for Disease Control and Prevention (CDC), also intrigued with the idea of trying out this method of problem solving, agreed to help fund the effort on one unit at the VA, if it focused on eliminating methicillin-resistant *Staphylococcus aureus* (MRSA) infections. While the VAPHS's rate of MRSA was no higher than at other community hospitals, the CDC and PRHI believed it could come close to the goal of zero on the pilot post-surgical unit, 4 West, and then introduce the techniques across the VAPHS hospital and the hospitals in the region.

The CDC's interest in eradicating MRSA in the nation's hospitals springs from some startling facts:

- 95% of *S. aureus* infections worldwide do not respond to first-line antibiotics.
- Over 40% of all *S. aureus* infections are methicillin-resistant.
- Certain European and Scandinavian countries have all but wiped out MRSA. Americans admitted to hospitals in these countries are automatically put into isolation.
- Costs to treat a hospital-acquired MRSA infection are \$3,700 higher per patient than for a non-resistant strain (\$31,400 vs. \$27,700).¹
- The death rate from MRSA is 2 ½ times higher than for non-resistant strains.¹

The attempt to eliminate MRSA on 4 West using techniques of Perfecting Patient Care led in various directions, all dictated by the needs of patients as per-

ceived by their caregivers. Solutions were conceived and carried out by those closest to the work, not imposed from a far away conference room by people

disconnected from the actual work. The team leaders included a registered nurse, perceived as a leader on the unit; and a PRHI employee, a former Alcoa engineer trained in the tenets of Toyota-style improvements who turned out

to be a quick study in medical issues. They observed actual work and noted problems as they occurred, then created problem solving teams with the workers confronting problems, using a disciplined form of brainstorming and helping them implement solutions.

If, for example, practitioners were not sanitizing their hands appropriately every time, putting patients at risk of infection, the team leaders would probe the causes with the team members. The discipline of Perfecting Patient Care involves asking "Why?" five times, until the bottom line cause is revealed. The reason was not ill-intentioned workers; the reasons, revealed after the fifth, "Why?," included problems such as lack of soap, alcohol hand rub, gloves, gowns—in other words, no reliable supply line. Furthermore, caregivers often cited "lack of time" as a reason for taking shortcuts with known hand hygiene recommendations. As these problems were revealed, the problem solving team went to work to create a way for everything to be made available all the time. They also looked for ways to increase the time each caregiver had to perform the hygiene procedures. Among the major time robbers the team identified was the amount of time it took to find wheelchairs.

Wheelchairs: An Unexpected Opportunity

In tracking down and eliminating MRSA threats and returning caregivers' time to patients, wheelchairs became an unexpected source of potential improvement. They certainly had been a source of frustration, but the link to infection was new.

Any hospital worker will tell you that finding wheelchairs is a problem. They are generally unavailable when patients need them, and that lack of availability causes a cascade of inconvenience and waste that reverberates throughout the hospital. Observation of

“Caregivers often cited ‘lack of time’ as a reason for taking shortcuts with known hand hygiene recommendations.”

VAPHS escorts revealed that they required over 20 minutes to find a wheelchair. Patients didn't always get the right wheelchair for their condition. For example, diabetic patients may require leg supports to protect their vulnerable feet; other patients may require oxygen bottle holders. Because of these delays, patients were usually late to appointments, putting whole departments—physical therapy and radiology, for example—behind. But most distressing to the team on 4 West, the wheelchairs did not always seem clean and came to be viewed as potential MRSA threats.

Solving the wheelchair problem in all its complexity became a cause for the problem solving team on 4 West. Not only would they address the issue of wheelchair cleanliness, but by addressing the supply line and creating a way to get patients into wheelchairs in a timely way, they would return time to the caregivers—time needed to perform hand hygiene and spend with patients. Untangling the myriad causes and solving them, one by one, would take over a year.

To begin, the team leaders posed the question this way: “Why can't we provide a clean wheelchair for each patient immediately? What stands in our way?” In Perfecting Patient Care, the first question begins this way, rather than with the accusatory, “Why don't we?” or worse, “Why don't you?” The underlying assumption is that faulty procedures, not faulty people, are usually the underlying cause. The question seeks to identify barriers, not place blame. While they were at it, these team leaders expanded the wheelchair question this way: “Why can't we provide a wheelchair in the right size and configuration for each patient immediately?”

Methodically solving the wheelchair problem proved monumental because it involved three VAPHS locations in Pittsburgh: the acute care hospital, long-term care facility, and psychiatric facility. The problem itself had three components: 1) supply, having enough wheelchairs when and where needed; 2) fit, having a wheelchair of proper size and configuration; and 3)

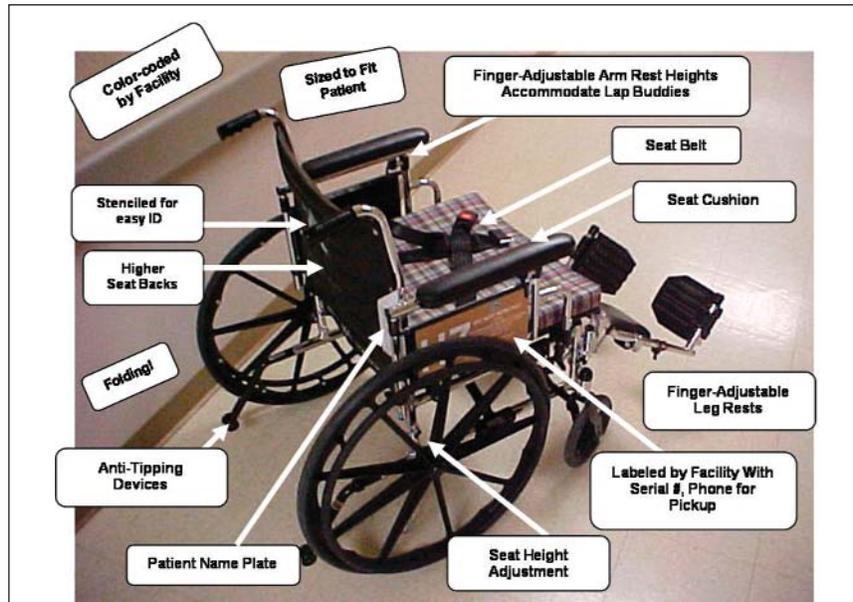


Figure 1. Wheelchairs differ according to use: these are configured for long-term care patients.

cleanliness, ensuring that the wheelchairs are unlikely to transfer contaminants. The team made headway by breaking the problem down to much smaller components, then devising and testing little “fixes” until one worked. This rapid cycle of experimenting with improvements is at the core of Perfecting Patient Care.

Described in the following case studies are some of the problems, experiments, and solutions.

Problem: Not Just Any Wheelchair

A correct wheelchair is more than a matter of comfort: it can affect patient health and safety. Getting patients out of bed and maintaining their physical activity using wheelchairs can play a vital role in reducing the risk of respiratory and urinary tract infections, as well as improve their mental outlook.

Understanding individual patient needs is the first step in improving safety. Larger patients require wider wheelchairs. Patients undergoing hip replacement need wheelchairs with reclining backs to avoid postoperative dislocation. Women, increasing in numbers at VA hospitals, may require smaller wheelchairs. At the long-term care facility, patients who spend their days in wheelchairs require the comforts of substantial padding, high backs, and correct size. Altogether, the VAPHS, with its multiple facilities, requires wheelchairs of about a dozen different configurations.

Problem: Supply and Demand

On an average day, 4 West, the MRSA pilot unit, serves about 25 post-surgical patients who need transportation to more than 40 appointments—from physical therapy to hemodialysis. At most hospitals, because wheelchairs are shared, long waits and searching are the norm. Delays accrue across the entire hospital, accounting for many lost work hours.

Problem: Missing Wheelchairs

Of five reclining wheelchairs purchased just months earlier at the acute-care hospital, only one remained. The problem solving team discovered that, when patients had been transferred to the long-term care facility, they had been transported in those reclining wheelchairs, which then stayed on the receiving end. In fact, both long-term and psychiatric facilities had a plethora of wheelchairs that were generally the wrong kind for their patients. Their problem was finding storage for the unwanted wheelchairs because no procedure was in place to return wheelchairs to the acute-care hospital.

Problem: Hiding Wheelchairs

At hospitals everywhere, concerned healthcare workers may hide wheelchairs to ensure that their patients have one when they need it. When they cannot rely on the supply chain to give them what is needed when it's needed, workers learn to distrust it. The problem is that even if there are technically enough wheelchairs in a hospital, hiding can actually create a wheelchair shortage.

Solution: Clean Wheelchairs

The wheelchair problem had come up in the first place because some of those circulating to the MRSA pilot unit on 4 West had not been clean. Because the goal was to eliminate MRSA on 4 West, and because wheelchairs are shared among all units, the first order of business was to thoroughly clean every wheelchair in the three-hospital VAPHS, beginning with the acute-care hospital. The group hit upon the idea of using a cart washer in another unit to clean the wheelchairs thoroughly. The cart washers, enclosed units similar to dishwashers, use high-pressure hot water to clean the chairs thoroughly. During off hours, the wheelchairs were processed one by one, and in 12 days, the whole fleet had been washed.

The effect was dazzling—wheelchairs that looked brand new. Not only were staff members proud of the way the wheelchairs looked, they knew they were clean and safe for their patients. Unexpectedly, the sparkling

wheelchair became a visual reminder or “advertisement” for infection control.

But borrowing washers from another unit wasn't a long-term solution. Bringing 100 wheelchairs to one place in the hospital for cleaning was unrealistic. Instead, the team tried a portable cart washing unit capable of turning out a clean wheelchair every four minutes. A portable washer could be moved to the wheelchairs, instead of vice versa. In the end, only two portable cart washers were needed to service the entire wheelchair fleet. One is housed at the main acute care hospital; the other is at the long-term care facility.

Wherever the portable cart washer is used, plumbing and electricity are required. In some units, plumbing was readily available. In others, a simple plumbing retrofit met the need. The procedure began to work: the wheelchair cleaners called ahead of time, giving the unit advance notice of when the cart washer and two-person team would arrive.

At the main hospital, the group quickly discovered that evenings—when clinics were closed—were the optimal time for cleaning the chairs; there were fewer calls for wheelchairs and the hospital was less congested than during the day.

At the long-term facility, the housekeeping staff also established a schedule for regularly washing and inspecting every wheelchair. If a wheelchair needs immediate attention, the housekeeping staff comes promptly to clean it, having created a special procedure for doing so.

Solution: Labeling and Returning Wheelchairs

It was too easy to misplace wheelchairs because they were not labeled. The problem solvers, in this case the team leaders and members of the housekeeping staff, applied colored labels to each chair—one color signifying the main hospital, one for long-term care, and one for the psychiatric hospital. They stenciled address and return information on the side panels and seat backs. This way whenever a stray wheelchair was spotted on a unit or in a parking lot, workers would immediately know where it needed to be returned. The identification on the wheelchairs has already paid off: dozens have been returned that would have been lost in the past.

When a patient is transferred from one facility to another, the wheelchairs are now cleaned and collected



Figure 2. Wheelchair Courtesy Points for clean wheelchairs. Color-coded stencilled labels show correct location.

at transfer points near the loading docks. Twice a week, a truck that brings supplies also returns wheelchairs to their home facilities.

Solution: Wheelchair Courtesy Points

The problem solving team next identified convenient public places for wheelchairs to be placed between uses. At the acute-care hospital, the group studied the hospital layout, identifying traffic patterns, congregating areas, and other logistical details. They worked with people in every unit, from inpatient nursing to nuclear medicine, to define the best places to locate wheelchairs. Together they designated 30 convenient Wheelchair Courtesy Points throughout the hospital. The most significant storage areas are near the main entrance, in a large elevator lobby, and in a recreation room. Escorts now return wheelchairs to the forward staging areas in a predictable pattern.

At the long-term care facility, physical therapists assess patients' wheelchair needs within 24 hours of arrival and issue appropriately configured chairs to meet their individual needs. When a patient is discharged, housekeeping staff clean the wheelchair; mechanics check it and return it to physical therapy for re-issue. The VAPHS did make a substantial one-time investment in new wheelchairs to ensure sufficient number and variety of wheelchairs to meet the needs of all patients. However, the data show that recirculation and Wheelchair Courtesy Points are working. Because wheelchairs are readily available, patients typically are

on time for their appointments, and patient comfort and worker satisfaction have improved.

Results Shared Regionally

The safety and comfort of patients guided these improvements. Although it began as an infection control project, fixing the way wheelchairs are cleaned and supplied continues to make a positive difference for patients and workers alike. Not only are patients more comfortable, they arrive at appointments on time in clean equipment. Workers recover time that had been spent searching and waiting for wheelchairs, freeing up time to concentrate on infection control and patient care. Workers report satisfaction with this new system for wheelchair cleaning and procurement and continue giving their input to fine tune it.

Most important, the wheelchair initiative was an important contribution to the MRSA reduction work on 4 West. Along with improved supply lines and worker education came dozens of additional ideas conceived and implemented by frontline staff. The net result of all the work was an 85% reduction in MRSA infections on 4 West—a rate that has been sustained for three years and continues to decline.

Representatives from hospitals across the region visit the VAPHS to learn about the MRSA work, including the impact of the wheelchair improvements. Perfecting Patient Care techniques are now being taught across the VA and Southwestern Pennsylvania, with PRHI the disseminating and educating entity.

The consortium of healthcare institutions comprising PRHI is now asking itself the next audacious question: “Why can’t we wipe out MRSA in Southwestern Pennsylvania?” ■

References

1. **Rubin, RJ, Harrington CA, Poon A, Dietrich K, Greene JA, Moiduddin A.** The Economic Impact of Staphylococcus aureus Infection in New York City Hospitals. *Emerging Infectious Diseases* 1999; 5(1).
2. **Neu HC.** The crisis in antibiotic resistance. *Science* 1992;257:1064-72.
3. **Panlilio AL, Culver DH, Gaynes RP, Banerjee S, Henderson TS, Tolson JS, et al.** Methicillin resistant Staphylococcus aureus in U.S. hospitals, 1975-1991. *Infect Contol Hosp Epidemiol* 1992;13:582-6.
4. **NNIS System Report,** Centers For Disease Control and Prevention, 2000.
5. **Vandenbroucke-Grauls, CMJE, MD, PhD,** Methicillin-Resistant Staphylococcus aureus Control in Hospitals: The Dutch Experience. *Infection Control and Hospital Epidemiology*, August 1996; 17:8, 512.