

CASE  
**2**

# Holtz Children's Hospital: Reducing Central Line Infections

*Gwenn E. McLaughlin*

## INTRODUCTION

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Holtz Children's Hospital (HCH) is one of five hospitals in the Jackson Health System. The hospital is affiliated with the University of Miami's Leonard M. Miller School of Medicine's Department of Pediatrics and has more than 110 attending physicians and specialists. With 254 licensed beds, it is among the largest pediatric teaching hospitals and research centers in the country.

Holtz Children's Hospital shares a campus with Jackson Memorial Hospital. First opened in 1918, Jackson Memorial Hospital is an accredited, tax-assisted, tertiary teaching hospital with more than 1,000 licensed beds located in Miami's urban center. The Jackson Health System provides a wide range of patient services, educational programs, a clinical setting for research activities, and a number of health-related community services county-wide. It is governed by the Public Health Trust, a team of citizen volunteers acting on behalf of the Miami-Dade County Board of County Commissioners, tasked to ensure that all residents of Miami-Dade County receive a high standard of care regardless of their ability to pay.

### *Background*

The 100,000 Lives Campaign launched by the Institute for Healthcare Improvement (IHI) insisted that central vascular line infections could be substantially reduced to levels approaching zero. “Vascular catheter-associated blood infection” was one of the 11 complications for which Medicare would no longer make incremental payments after October 1, 2008. The state Medicaid programs were expected to adopt the same rule, and a number of private insurers were also following suit. Holtz Children’s Hospital was heavily dependent on Medicaid payments.

Although pediatric settings historically had higher infection rates, many institutions believed, despite sparse literature to support the notion, that these settings were also an area for potential improvement. The National Association of Children’s Hospitals and Related Institutions (NACHRI) launched Phase I of its catheter associated–blood stream infection (CA-BSI) prevention intervention in October 2006. In two years, the 27 institutions involved reduced the rate of infections per 1000 catheter days by 45% (from 5.9 to 2.3), far better than the 6.6 infections per 1000 catheter days previously reported as the pooled national rate between 1995 and 2003 (NHSN).

### *Quality Improvement in the Pediatric Intensive Care Unit (PICU)*

The HCH PICU quality-improvement team had been tracking and attempting to reduce catheter-associated blood stream infections for a number of years. It already taught, although did not monitor, compliance with sterile insertion techniques and used Biopatch<sup>®</sup> antimicrobial devices on all central lines. In addition, either betadine or alcohol and nonsterile gloves were used during catheter entry. The PICU had created its own central line database and collected blood culture and tip culture results for years and adopted other approaches recommended in the literature, such as discussing each episode of catheter-related bacteremia as a sentinel event, to reduce catheter-associated bacteremia.

Despite these efforts, the Infection Control Surveillance program required by The Joint Commission reported a catheter-associated blood-stream infection rate in the PICU for the fourth quarter of 2007 as 9.1 episodes for 1000 line days, virtually at the 90% percentile of CDC’s National Healthcare Safety Network (NHSN) pooled survey for such

units. As pediatric critical care division's director of quality improvement, Dr. Gwenn McLaughlin, an intensivist and professor of clinical pediatrics, was frustrated with this lack of improvement but had heard through her colleagues at other institutions of Cincinnati Children's Hospital's initial success and its planned expansion through NACHRI. In order to participate in the NACHRI Phase 1 project, hospitals were expected to:

1. Commit a senior leader—who may be the same person as the physician champion—to support and promote the team working on the collaborative improvement project.
2. Send two (required) or three (recommended) team members who have authority to drive change, including the physician champion and, ideally, a nurse and/or infection control professional to learning workshops (travel costs are covered by the hospital).
3. Provide resources and support to the hospital's team (includes attending workshops, devoting time to data entry, testing and implementing changes in the PICU, and promoting active senior leadership).
4. Work to involve all of their staff as appropriate with the aim of helping the multidisciplinary clinical team become competent in safety and quality improvement.
5. Perform prework activities to prepare for the workshop.
6. Connect project goals to the broader patient safety work in the hospital.
7. Implement the standardized database collection tool to track patients and their care and submit at least monthly.
8. Agree to implement central line insertion bundle in a uniform approach and test changes in at least two areas related to maintaining central lines.
9. Participate in calls and a discussion list to share with and learn from others.
10. Make well-defined measurements at least monthly that relate to their aims, plot them over time for the duration of the collaborative

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improvement project, and share them with other teams in the collaborative.

11. Share information with collaborative participants to evaluate impact of changes.
12. Maintain responsibility for IRB requirements for a quality-improvement project (with option to publish aggregate data) (NACHRI, 2010).

To encourage participation, the American Board of Pediatrics stated that involvement in the NACHRI project met the standard for “Physician Participation in a QI Project” as required for maintenance of certification. Due to financial constraints, the HCH PICU could not participate in the NACHRI study, but they could use the same approach without NACHRI involvement.

First, the PICUs multidisciplinary quality-improvement team reemphasized through education a commitment to the Institute for Healthcare Improvement’s Central Line Bundle. Its key components are:

- Hand Hygiene
- Maximal Barrier Precautions Upon Insertion
- Chlorhexidine Skin Antisepsis
- Optimal Catheter Site Selection, with Avoidance of the Femoral Vein for Central Venous Access in Adult Patients
- Daily Review of Line Necessity with Prompt Removal of Unnecessary Lines

The last item on the checklist was addressed by the HCH PICU through the creation of a “daily goals” checklist to prompt practitioners to evaluate the need for all indwelling catheters on a daily basis.

### **The Importance of Hand Hygiene**

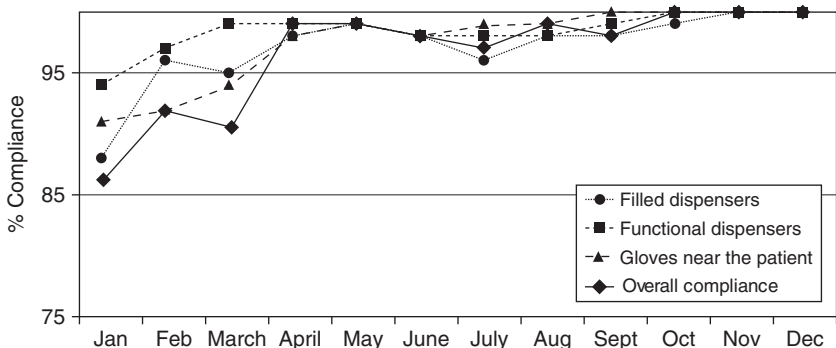
During this period, Dr. McLaughlin, who led the PICU quality-improvement team for several years, became the Hospital’s Chief Quality and Safety Officer. To improve her skill set, she attended IHI’s Patient Safety Executive Development Program. The IHI approach emphasizes that quality improvement requires identifying the drivers of both good and

bad outcomes. Realizing that hand hygiene was key to catheter insertion and maintenance, she began by looking at the available data from the Nursing Department, which showed a 40% compliance rate by all health-care workers with the existing hand-hygiene standard. The medical and nursing staff easily identified the following as barriers to hand-hygiene compliance:

- There were not enough ethanol-based dispensers.
- Available dispensers were often empty.
- There was no venue to educate other disciplines (transporters, technicians, etc.) about the importance of hand hygiene.

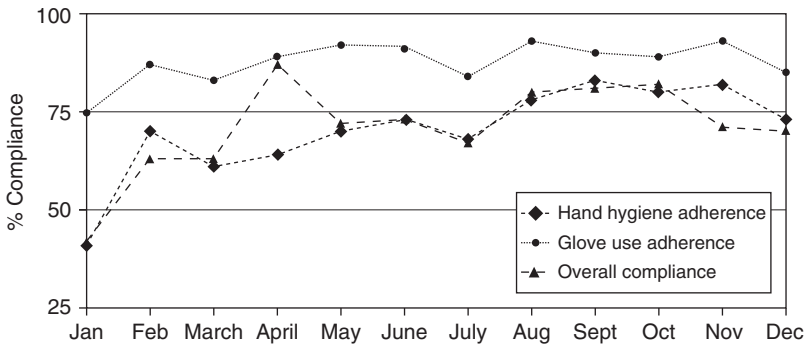
The team agreed to implement changes to make sure that the supplies for hand hygiene were adequate and situated appropriately to “make it easier to do the right thing.” In the PICU, dispensers were procured and placed at the entrance to the units and patient rooms. Everyone, not just housekeeping staff, was given access to hand-sanitizer refills and everyone was expected to restock the dispensers and other supplies. Figure 2–1 shows the availability of supplies during 2008.

At the start of the year, overall availability of gloves near the patient and filled and functional dispensers was around 86%. The team’s efforts led to a corresponding compliance figure by the last quarter of the year of 100%. Similarly, overall compliance with hand-hygiene standards improved from 40% to over 70% by the end of the year, as shown in Figure 2–2.



**Figure 2–1** Availability of Supplies for Hand Hygiene Over Time

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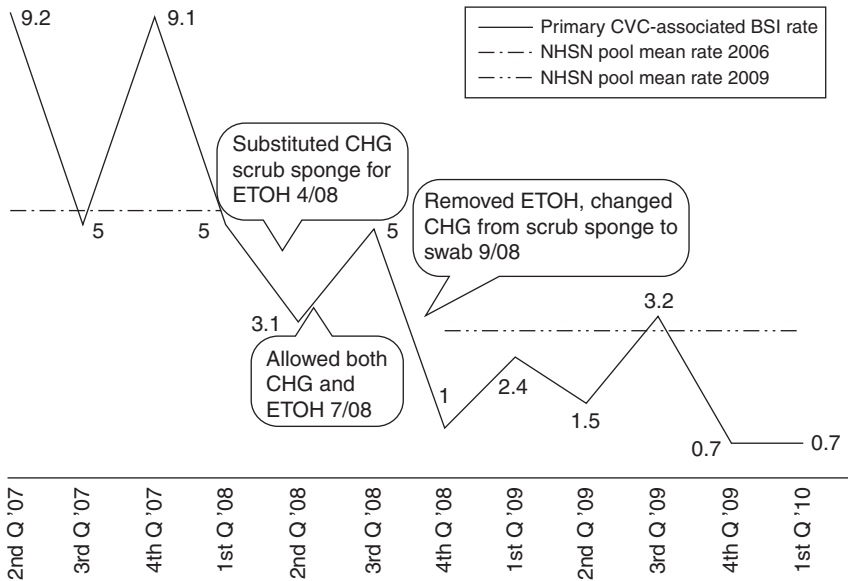


**Figure 2–2** Compliance with Hand Hygiene

### Scrubbing the Hub

The PICU examined its own surveillance data noting that most central line infections occurred after the first week of hospitalization. Given that the current PICU infections did not seem to occur during the insertion period, the team decided to focus on maintenance practices. Knowing that the NACHRI project was justified by the initial success in reducing catheter-associated bloodstream infections at Cincinnati Children's Hospital, Dr. McLaughlin implemented a similar “scrub the hub” campaign based on policies and procedures from Cincinnati Children's Hospital (<http://www.cincinnatichildrens.org/about/measures/system/cvc.htm>). These policies emphasized the aseptic technique every time a catheter hub was exposed to the environment. The hub was required to be scrubbed for 15 seconds with 2% Chlorhexidine Gluconate with Isopropyl Alcohol (CHG) impregnated swabs (ChloroPrep™).

In setting “how much by when” objectives, Dr. McLaughlin wanted to achieve 100% compliance with ChloroPrep™ use immediately. Because this was a change that would meet some staff resistance, the team decided to conduct a small experiment and report the results rapidly to educate the staff about the effect of the change in methods. Each pediatric ICU bed had its own small cart, which was stocked with regularly-used equipment, such as gauze, catheters, and ethanol and betadine swabs. To “make it easy to do the right thing,” and hard to do the wrong thing, the ethanol swabs were removed from the bedside and replaced with CHG impregnated sponges. The PICU nursing manager, Carrie Feinroth, RN, acquired CHG impregnated sponges already available in the hospital as surgical skin prep and on April 8, 2008 removed the ethanol swabs from



**Figure 2-3** CVC-Associated Infection Rate: PICU

the bedside and replaced them with the ChloroPrep™ sponges. The nurses and physicians were instructed to scrub the hub of the catheter for 15 seconds prior to the each hub entry. Some coaching was required to explain that 15 seconds really meant 15 seconds of forceful scrubbing and not a quick wipe. In the next quarter, the infection rate, as determined by the hospital infection control committee, dropped drastically.

This improvement was shared with the nursing staff through posters throughout the PICU. Because the ethanol swabs were still being used to access peripheral IVs and for other tubing access away from the hub, they were returned to the bedside on July 8, 2008. Subsequently, the infection rate rose sharply. Feedback was requested from the nurses about why they might choose ethanol over ChloroPrep™ for hub entry cleaning. The nurses expressed concern that the “scrubbers” would not adequately clean the crevices present in the stopcocks and caps and therefore some were still using the ethanol swabs. After receiving staff feedback, nursing management obtained the CHG swabs and removed the ethanol swabs from the bedside again. As Figure 2-3 shows, the infection rate dropped once again over the following two quarters.

The PICU was able to maintain the levels achieved during the experimental period, and during the second quarter of 2009, had the lowest CA-BSI infection rate of any ICU on the Jackson Memorial Hospital campus.

### *Spreading Change*

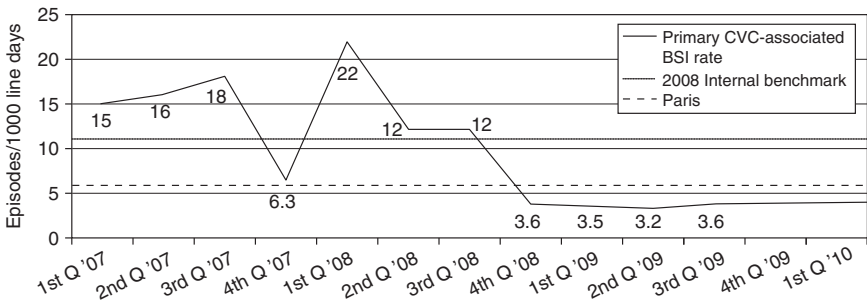
After reviewing this data with the staff, the Children's Hospital changed its procedures and manuals to require the CHG swabs on CVC hubs. But changing a policy is much easier than changing a practice. Holtz's large transplantation surgery service also had its own intermediate post-transplant surgical unit (PTSU). This unit had a high infection rate that concerned the PICU QI team because many of these patients required PICU care due to sepsis. Dr. McLaughlin first approached the transplant unit's Nursing Director about this issue and presented the data and the PICU's success. The initial response was that the patients in the PTSU were sicker and that CA-BSI's were unavoidable. Given that there were no published benchmarks for infection rates in pediatric transplant ICUs, it was difficult to argue against this response. However, Dr. McLaughlin enlisted the assistance of the PTSU's new Medical Director, Dr. Lesley Smith, who contacted units outside of the United States with similar patients and obtained data on their rates that were indeed lower than those of the PTSU. Furthermore, the success of the effort in the PICU had made the PTSU Medical Director much more conscious of the opportunities for improvement. After further discussion to acknowledge the work patterns of the existing staff members, the PTSU staff agreed to a number of changes led primarily by one nurse champion and the nurse educator. These included:

- Reducing the frequency of blood drawing.
- The Scrub the Hub procedures using Chloraprep™ rather than the ethanol swab to promote the concept of scrubbing.
- Selecting a day for dressing changes.
- Having two individuals involved when dressings are changed.

The involvement of two caregivers for dressing changes had been cited in the literature as a way to reduce catheter-related complications and made sense to the PTSU staff because:

- It was much easier to follow all the proper steps with two pairs of hands.
- The site was less likely to become contaminated.
- It was often necessary to handle young patients who, unlike the ICU patients, were not heavily sedated and therefore active.





**Figure 2–4** CVC-Associated Infection Rates: PTSU

Because this process was more involved than the simple substitution of one product for another, as was the case in the PICU, it took longer to implement. All nurses were reeducated about the procedures involved in dressing changes and evaluated for competency by a nursing educator. Figure 2–4 reports the infection rates in the PTSU during the planning period and after implementation.

Then the team’s orientation shifted toward ways to sustain the gains already made and to seek out new alternatives for further improvements.

## CASE ANALYSIS

The West Florida case, which precedes this one, is an early example of a quality-improvement system with an informal or “shadow” organizational structure. The Holtz Children’s Hospital case shows action by a designated hospital quality and safety officer. You might consider and contrast the two approaches. Using your other knowledge about line- versus staff-management positions in professional-service organizations, consider the possible impacts of three loci of initiative for improvement: a quality council of top managers, a designated staff quality-improvement position, or the line management of the delivery unit. There are also contrasts with the earlier case in terms of the resources available to implement and then institutionalize a quality-improvement program.

## ASSIGNMENT QUESTIONS

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1. Why would one question whether the well-documented improvement efforts in CA-BSI in adult ICU settings are transferrable to pediatric settings?
2. Why might some PICU staff members resist implementing the central line bundle given its success elsewhere?
3. This case takes place in a resource-constrained environment. What approaches were used to overcome these limitations?
4. What would be your response if the chief of the transplant service had said, "We don't seem to be doing too badly, certainly not any worse than our local competitors."
5. Discuss the relative merits of each of the alternative approaches available for reducing line infections in addition to improved care and maintenance:
  - Discussing each infection as a sentinel event.
  - Using a daily goals checklist.
  - Using insertion practices, such as sterile insertion techniques.What factors might lead you to emphasize one over the others?
6. What are the merits of using a forcing tactic, such as removing the ethanol swab materials from the bedside?

## CLASS EXERCISE

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Use the Internet to follow up on the latest approaches to reducing central line infections in both children and adults. What low levels have organizations been able to maintain? What new wrinkles have been added to motivate continuing improvement?

## ACKNOWLEDGMENTS

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