



“Quest for Excellence”
**Criteria: Process Management/
Organizational Performance Results**

**Reducing Central Line-associated Bloodstream Infections
in a Pediatric Intensive Care Unit**

**Children’s Hospital
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Overview

From 2001 through 2004, the rate of central line-associated bloodstream infections in our hospital's Pediatric Intensive Care Unit (PICU) was 8.7 per 1000 device days; in 2004, the rate had reached an all-time high of 12.4 per 1000 device days (Figure 1). This was important because:

- while our rate was within the range reported by the Centers for Disease Control and Prevention (2.8 to 12.8 infections per 1000 device days), it was higher than desired and had not shown significant improvement despite continued infection control surveillance, ongoing action/change strategies and ongoing communication with PICU area leaders;
- literature reports that these infections cost \$39,219 each and result in a 10-20% increase in patient mortality (Elward AM, Hollenbeak CS, Warren DK, Fraser, VJ: Attributable cost of nosocomial primary blood stream infection in pediatric intensive care unit patients. *Pediatrics* 115(4): 868-72, April 2005.).

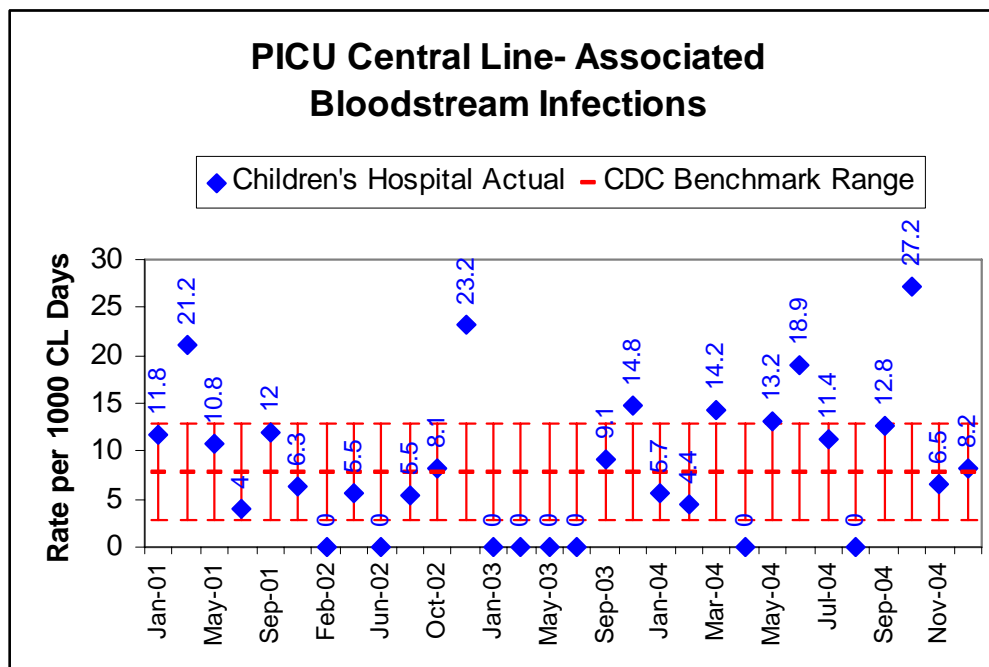


Figure 1

Since March 2003, staff had implemented process change strategies intended to reduce infection including:

- March 2003 Central line insertion and maintenance procedures changed to be consistent with CDC guidelines;
- May 2003 Skin prep changed from betadine to 2% chlorhexidine;
- January 2004 Frequency of Infection Control surveillance of CVL BSI was increased to monthly, from every other month;
- July 2004 Alcohol-based hand sanitizer wall mounted in patient care areas throughout the facility;
- December 2004 Product standardization: one antimicrobial soap (2% chlorhexidine) available for handwashing on all patient care units.

These process changes had not resulted in the desired reduction in the rate of CVL bloodstream infections. We elected to focus on this issue now because the Child Health Corporation of America (CHCA), working with the Agency for Healthcare Research and Quality (AHRQ), offered a collaborative approach for reducing the incidence of central line associated bloodstream infections. The collaborative included 28 free-standing, non-competing, pediatric specialty hospitals from across the country. The overall collaborative goals were: (1) to reduce CVL BSI rate by 50% at each participating hospital (Children's Hospital Omaha goal rate was 6.2 per 1000 line days); and (2) to double the number of days between CVL-related bloodstream infection occurrences (Children's Hospital goal was 26 days between occurrences) by December 2005, the end of the one year collaborative period. The collaborative offered an opportunity to learn from nationally recognized experts, to engender use of evidence-based practices related to line insertion and maintenance, to share knowledge and change strategies among participating hospitals. Stakeholders included: staff and physicians working in the PICU; Operating Room staff, surgeons and anesthesiologists; the Hospital Epidemiologist and Infection Control Practitioners; Hospital Administration and Board of Directors; third party payers; and, most importantly, patients and their families.

Methods

Children's Hospital uses the Plan – Do – Study/Check - Act model in our performance improvement initiatives and this methodology was used by the collaborative (Figure 2).

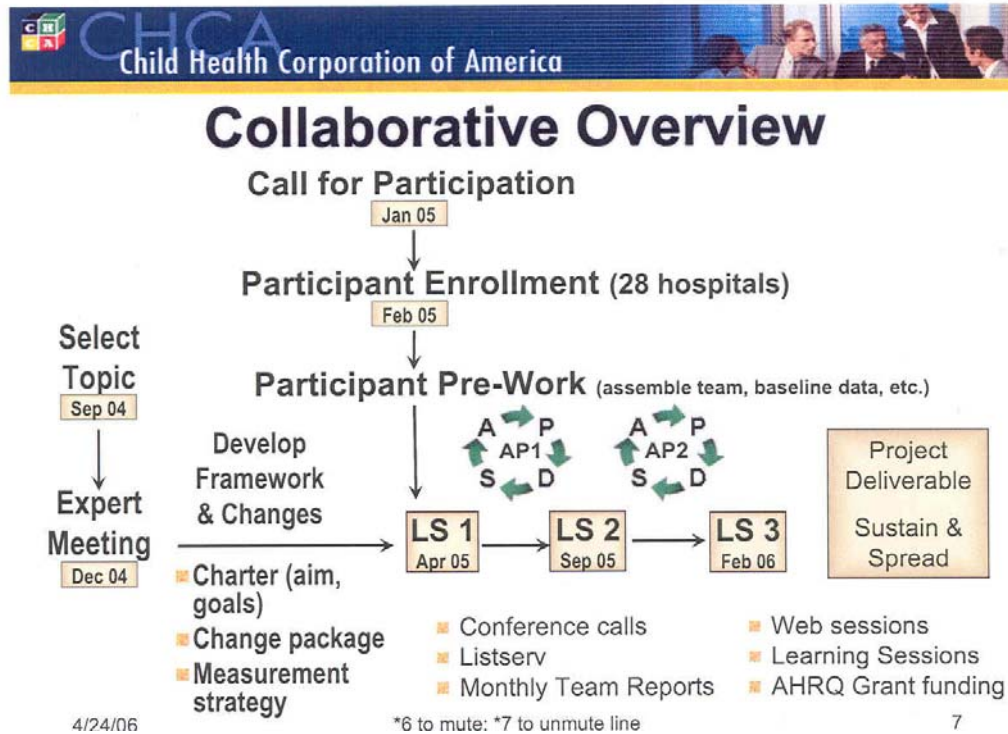
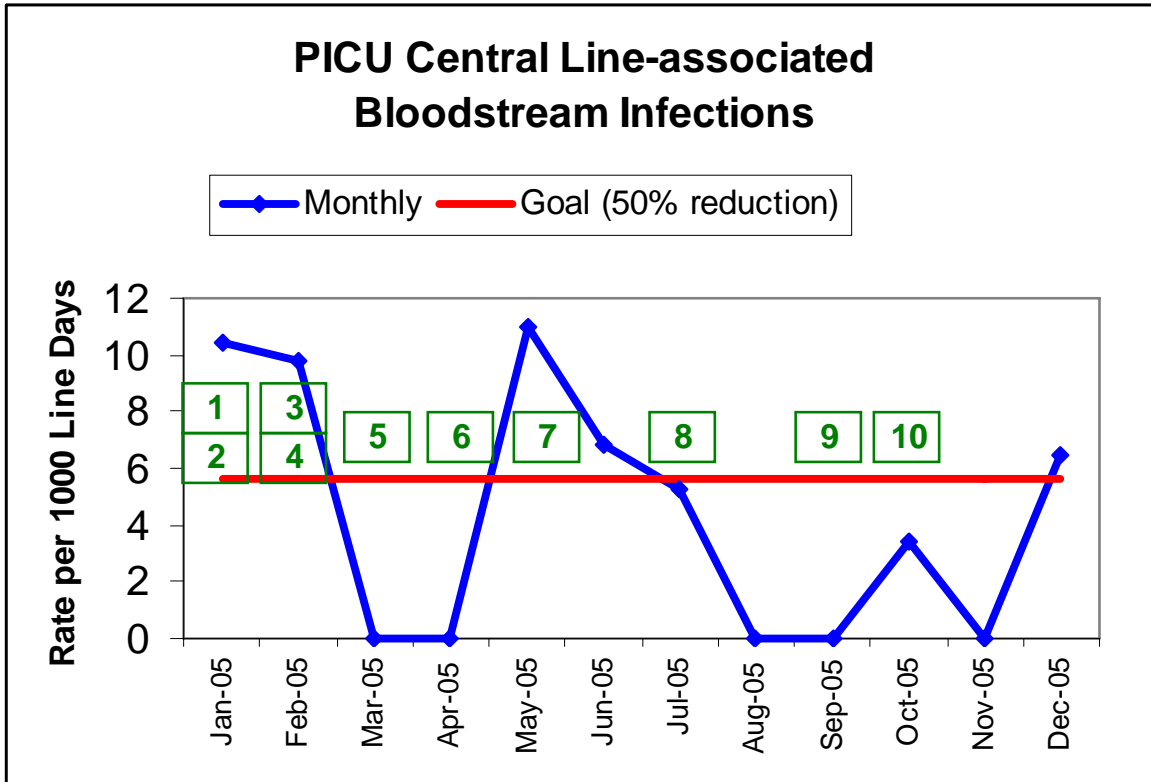


Figure 2

Key measures related to outcomes, processes and balances were tracked including CVL BSI rates and number of days between infections (outcomes); compliance with “insertion bundle” and “maintenance bundle” practices (Appendix A and Appendix B) and daily goal prevalence (processes); central venous catheter prevalence (balance indicator to assess overall stability or change in patient/unit demographics that could influence outcomes and processes). Additional change strategies were implemented and evaluated for effectiveness over the one year collaborative period (Figure 3).



1. CHCA Collaborative initiated
2. Children's Hospital Senior Leadership selected PICU CVL BSI as organization priority for improvement in 2005
3. Opportunity for improvement and action plan presented and discussed with Children's Hospital Board of Directors
4. Implemented in-person ICP monthly report of CVL BSI rates to Shared Governance PICU Area Action Council
5. Implemented PICU Daily Goals, including daily assessment of central line necessity by multidisciplinary team during morning rounds (Appendix C)
6. Introduced concept of CDC prevention "bundles" for line insertion and maintenance
7. Began direct observation monitoring of line maintenance "bundle" compliance in PICU by Clinical Nurse Coordinators
8. Implemented in person reporting at PICU Staff meetings
9. PICU Staff celebration of success, including candy bar and t-shirt rewards (Appendix D)
10. Initiated research project to determine influence of line cap types (valve versus split-septum) on infection rates

Figure 3

Results

Children's Hospital in Omaha has achieved target goals and has demonstrated sustained reduction in the rate of central line-associated bloodstream infections in PICU. (Figure 4 and Figure 5). In April 2006, Children's Hospital was recognized by CHCA as being one of eleven collaborative participant hospitals that achieved and sustained greater than 50% reduction in the rate of central line-associated bloodstream infections (Appendix D). These results are just the beginning of this improvement. The PICU staff has been energized by this initiative that reinforced the positive impact of basic, uncomplicated practices by individual staff members. They have become strong and vocal advocates for effective infection control practices across the facility. With their support, additional changes and actions have been implemented or are planned following the close of the collaborative:

- January 2006 "Toilet papers" (bathroom posters) used as a communication tool for PICU staff
- April 2006 Central line "bundle" components were introduced to and implemented in Neonatal Intensive Care Unit (NICU)
- June 2006 Direct observation monitoring of line insertion "bundle" compliance in surgical services
- July 2006 Direct observation monitoring of line insertion "bundle" compliance in PICU
- July 2006 Implemented use of stabilization device for peripherally inserted central catheters (PICC lines)
- July 2006 Individual CVL BSI infection patient case studies presented to PICU staff via Area Action Council, in addition to infection rate
- August 2006 Direct observation monitoring of line insertion "bundle" compliance implemented in NICU
- August 2006 Hand hygiene campaign initiated throughout the facility including education (demonstration and return demonstration) at time of pre-employment health screening for all new employees, at general orientation, at clinical/patient care orientation and again for clinical staff during department/unit-specific orientation
- September 2006 Research project evaluating the influence of line cap types (valve versus split-septum) has been completed and is being prepared for publication; preliminary analysis indicates that practice, not product, has more impact on the prevention of central line-related bloodstream infections
- October 2006 Infection Control Practitioners will develop and conduct annual, mandatory skills validation for nursing staff related to IV line maintenance and basic hand hygiene practices

Lessons learned

- Support of the Board and Hospital Senior Leadership is important; real and sustained improvement requires staff time and training
- Direct observation monitoring is difficult and time-consuming
- The earlier outcome measure results can be shared with staff, the earlier they will become engaged in process change
- Periodic, in person communication of measures and results is effective and gives staff an opportunity to voice concerns and ask questions; leave the staff with written results that they can read and discuss again
- Staff will enthusiastically share successes; find a success, communicate it and let the staff be the advocates
- Celebrating and rewarding success is effective
- Communicating CVL bloodstream infections using patient case reviews, in addition to numbers, helped the PICU staff analyze contributing factors and internalize the data
- Because the number of CVL BSIs occurring within seven days of insertion was very low, our surgeons, anesthesiologists and surgical services staff were not enthusiastic about direct observation monitoring of insertion “bundle” compliance; we delayed monitoring of this process measure until mid-2006
- Adding a prompt to the PICU Daily Goal sheet encouraged the Team to consciously consider the continued necessity of the central line at least once daily

Physician Observation - CVL Insertion

Date _____
 Inserted by _____ Monitored by _____
 Patient name _____

Hand Hygiene

- Hand wash for 15 seconds followed by use of hand sanitizer
 15-second chlorhexidine (CHG) 2% wash - in NICU this will be with CHG impregnated scrub brush

Geographic Location of Insertion

- Bedside (room #) _____ Operating Room Radiology
 NICU surgical procedure room Treatment room Cares

Barrier Protection for Catheter Inserter(s)

- Sterile gloves Sterile drape
 Mask Cap
 Sterile gown

Barrier Protection for Assistant at Bedside

- Mask for all who are in the room**
 Sterile gloves for all who are involved in holding, crossing over, or touching the child or the sterile field
 Cap for all who are involved in holding, crossing over, or touching the child or the sterile field
 Sterile gown for all who are involved in holding, crossing over, or touching the child or the sterile field

Catheter Type (long or short catheter)

- UAC Skin Sutures Broviac
 UVC PICC Femoral
 Sutureless Subclavian Jugular

Catheter Material

- Antibiotic impregnated Polyurethane
 Not antibiotic impregnated Silicone

Skin Prep

- CHG, utilizing back and forth motion and allow to dry – if child is < 2 months old follow CHG wash with saline swab in a circular motion from inside to outside

Aseptic Technique

- Sterile field maintained (ie. palpation of insertion site should not be performed after the application of antiseptic unless aseptic technique is maintained)

Comments:

Copies of this observation tool are available from the CNC. Please return completed tool to Performance Improvement.

CVL Maintenance Monitoring Form

Monitor Name _____ Day / Night
(Circle Shift)

DIRECTIONS:

Dressing Change				Accessing Lines			
Patient Name _____	yes	no	Comments	Patient Name _____	yes	no	Comments
Date _____				Date _____			
Unit _____				Unit _____			
Secure hair away from work area				Wash hands with soap or hand sanitize			
Put on mask				Access port is soiled with blood or medication, aseptically replace cap before administration			
Wash hands with antimicrobial soap or wash hands with soap followed by hand sanitizer.				Scrub the hub for a minimum of 10 seconds with alcohol			
Put on non sterile gloves and open tray				Allow alcohol to dry			
Remove old dressing and assess site for color, swelling, odor, wetness and security of sutures or Steri-Strips				Utilize aseptic technique when accessing line (do not lay tubing down on bedside stand, linen etc.)			
Remove non-sterile gloves				Accessing line multiple times, hub is scrubbed between administrations			
Wash hands with hand sanitizer				Wash hands or hand sanitize			
Put on sterile gloves				Changing CVL Tubing or Injection Cap			
Clean Site with ChloroPrep <input type="checkbox"/> Back and forth in a motion large enough to cover outside borders of dressing <input type="checkbox"/> Completely wet the area for 30 sec. <input type="checkbox"/> Allow to dry, minimum of 1 minute <input type="checkbox"/> If < 2 months of age, remove Chloro Prep from skin with sterile saline pad, wiping from center to outside in a circular motion and not recontaminating prepped field.				Patient Name _____	yes	no	Comments
				Date _____			
				Unit _____			
				Wash hands with soap or hand sanitize			
				Don non-sterile gloves and mask			
				Cleanse outside connection separating with alcohol and allow to air dry			
				Separate catheter from tubing. Removing old IV tubing/cap. Connect new sterile tubing or cap ensuring ends stay sterile and attachment is secure			
				Remove gloves and wash hands or hand sanitize			



Patient Label

PICU MULTIDISCIPLINARY DAILY GOALS

DATE: _____

<p align="center">CARE MANAGEMENT REVIEW</p> <p><i>Directions: Each of the following items should be "reviewed" during AM Rounds as appropriate. Check the items reviewed.</i></p> <p>Foreign Bodies (Consider removal of CVL, foley catheter or other invasive devices/lines)</p> <p>Consider Need for Different form of Vascular Access (PICC, Broviac, etc.)</p> <p>Medications - Discontinue or Switch to PO</p> <p>Scheduled Labs/CXR (Minimize CVL access, What tests/procedures/infusions today?)</p> <p>Skin, Dressings, OT/PT ROM</p> <p>Nutrition – Optimize or introduce enteral feeds if NPO</p> <p>Procedure Results Reviewed (CT, ECHO, MRI, etc.)</p>		<p>✓ IF REVIEWED</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p align="center">PICU CORE GOALS REVIEW</p> <p><i>Directions: Each of the following items should be implemented for every PICU patient as appropriate. Circle "Yes" if implemented; "NA" if not applicable to patient status; or "No" if not implemented - Must write a reason in COMMENTS if "No".</i></p> <p>HOB @ 30' if greater than 1 year of age</p> <p>PUD Prophylaxis if NPO</p> <p>PAIN score less than or equal to 3</p>	<p>Yes / No / NA</p> <p>Yes / No / NA</p> <p>Yes / No</p>	<p>(IF "No", COMMENT REQUIRED)</p>

UNFINISHED DAILY GOALS (PREVIOUS 24 HOURS)	COMMENT (IF NOT MOVED TO CURRENT GOALS, COMMENT REQUIRED)

ROUNDS IDENTIFIED	CURRENT DAILY GOALS (GOALS TO BE COMPLETED IN NEXT 24 HOURS UNLESS STATED OTHERWISE)	COMPLETED	COMMENT (IF "No", COMMENT REQUIRED)
AM PM		Yes / No Initials _____	
AM PM		Yes / No Initials _____	
AM PM		Yes / No Initials _____	
AM PM		Yes / No Initials _____	
No Daily Goals For Patient. See Generic/Chronic Care Goal Sheet. Initials _____			

Participants in multidisciplinary rounds/goal setting during this 24 hour period

<input type="checkbox"/> Bedside RN	<input type="checkbox"/> RT	<input type="checkbox"/> Pharmacist	<input type="checkbox"/> Cardiology	AM Round Signature: _____
<input type="checkbox"/> CNC	<input type="checkbox"/> NP	<input type="checkbox"/> Social Work	<input type="checkbox"/> CT Surgery	
<input type="checkbox"/> Intensivist	<input type="checkbox"/> Resident	<input type="checkbox"/> Chaplain	<input type="checkbox"/> Child Life	PM Round Signature: _____
<input type="checkbox"/> Parent	<input type="checkbox"/> Case Manager	<input type="checkbox"/> PT/OT	<input type="checkbox"/> Dietary	

Celebration



Communication

Recognition

