

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

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

Children's Hospital 8200 Dodge Street Omaha, Nebraska 68114

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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 200	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).





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
5	Area Action Council, in addition to infection rate
August 2006	Direct observation monitoring of line insertion "bundle" compliance
e	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 200	06 Research project evaluating the influence of line cap types (valve versus
1	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
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Figure	4
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	2004	2005	2005	2006 Actual	
Key Measure	Actual	Goal	Actual	through July	
Outcome: CVL BSI rate per	12.4	6.2	4.2	5.8	
1000 device days		(50% reduction		(Figure 5)	
		from 2004 rate)			
Outcome: # days between	13	26	46	16	
CVL BSI occurrence		(double average #			
		days from 2004)			
Process: Maintenance	NA	> 80%	30%	50%	
"bundle" compliance		(CHCA "best			
Ĩ		practice")			
Process: Insertion "bundle"	Insertion obs	servation delayed; on	ly one infection	in 2004/2005	
compliance	occurred	occurred within 7 days of insertion, indicating that these			
-	infections are most likely related to line maintenand		enance, not		
		insertion techni	que/practice		
Process: Daily Goal	NA	100%	100%	100%	
prevalence (consideration of					
line necessity)					
Balance: Central venous	0.76	0.72 to 0.8	0.8	0.78	
line prevalence (line days per		( <u>&lt;</u> 5% change)			
PICU patient day)					

Figure 5	Results in green indicate goal met; results in red indicate goal not met
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### 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       Sterile gown
<ul> <li>Barrier Protection for Assistant at Bedside</li> <li>Mask for all who are in the room</li> <li>Sterile gloves for all who are involved in holding, crossing over, or touching the child or the sterile field</li> <li>Cap for all who are involved in holding, crossing over, or touching the child or the sterile field</li> <li>Sterile gown for all who are involved in holding, crossing over, or touching the child or the sterile field</li> </ul>
Catheter Type (long or short catheter)         UAC       Skin Sutures       Broviac         UVC       PICC       Femoral         Sutureless       Subclavian       Jugular
Catheter Material       Polyurethane         Antibiotic impregnated       Silicone
<ul> <li>Skin Prep</li> <li>CHG, utilizing back and forth motion and allow to dry – if child is &lt; 2 months old follow CHG wash with saline swab in a circular motion from inside to outside</li> </ul>
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 o	r Inje	ection	n Cap
Clean Site with ChloraPrep □ Back and for the motion large enough to cover outside borders of dressing □ Completely wet the area for 30 sec.				Patient Name Date Unit	yes	no	Comments
□ Allow to dry, minimum of 1 minute				Wash hands with soap or hand sanitize			
☐ If < 2 months of age, remove Chlora Prep from skin with sterile saline pad, wiping from center to outside in a circular motion and not re contaminating prepped field.				Don non-sterile gloves and mask			
Apply transparent dressing, forming stress loop and leaving 1-1.5 inch border on all sides				Cleanse outside connection separating with alcohol and allow to air dry			
Remove gloves and wash hands or use hand sanitize				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			

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Appendix C





Patient Label

DATE:

PICU MULTIDISCIPLINARY DAILY GOALS

CARE MANAGEMENT REVIEW <u>Directions</u> : Each of the following items should be "reviewed" during AM Rounds as app Check the items reviewed.	✓ IF REVIEWED	
Foreign Bodies (Consider removal of CVL, foley catheter or other invasive devices/lines)		
Consider Need for Different form of Vascular Access (PICC, Broviac, etc.)		
Medications - Discontinue or Switch to PO		
Scheduled Labs/CXR (Minimize CVL access, What tests/procedures/infusions today?)		
Skin, Dressings, OT/PT ROM		· · · · · · · · · · · · · · · · · · ·
Nutrition – Optimize or introduce enteral feeds if NPO		
Procedure Results Reviewed (CT, ECHO, MRI, etc.)		
PICU CORE GOALS REVIEW <u>Directions</u> : 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".		(IF "NO", COMMENT REQUIRED)
HOB @ 30' if greater than 1 year of age	Yes / No / NA	
PUD Prophylaxis if NPO	Yes / No / NA	
PAIN score less than or equal to 3	Yes / No	
UNFINISHED DAILY GOALS (PREVIOUS 24 HOURS)	(IF NOT MOVED ]	COMMENT TO CURRENT GOALS, COMMENT REQUIRED)

ROUNDS	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 G	oal Sheet. Initials	_

Participants in mu	ultidisciplinary rounds	s/goal setting during	g this 24 hour period		
Bedside RN	🗌 RT	Pharmacist	Cardiology	AM Round Signature:	
CNC	□ NP	Social Work	CT Surgery		
Intensivist	Resident	Chaplain	Child Life	PM Round Signature:	
Parent	Case Manager		Dietary		

## Appendix D

## **Celebration**



