NY hospital uses process, product, education to cut bloodstream infections

The Hospital:
Brookdale University Medical Center, Brooklyn, NY

The Problem:
Central venous catheter-related bloodstream infections

The Solution:
Conversion to new skin antiseptic

The Vendor:
Medi-Flex Inc., Overland Park, KS

The central venous catheter is among the most widely used intravascular devices on the market today. In fact, so-called central lines are among the most commonly used of all medical products. Estimates are that more than 150 million intravascular devices are purchased by healthcare facilities each year for the administration of I.V. fluids, medications, blood products and parenteral nutrition. At the same time, while central lines contribute positively to patient care, there is unquestionably a dark side to the equation: As many as a quarter-million central venous catheter-related bloodstream infections are attributed to central lines, leaving a trail of extensive mortality, excess length of stay and rising costs in their wake.

This dichotomy is well-known in the infection control community. So when infection control practitioners at Brookdale University Medical Center, a busy 525-bed teaching facility in Brooklyn, NY, sought a way to stem the tide of patient infections and their associated costs, their detective work led them to eye central lines as a major culprit.

In 1999, reports Robert Garcia, the hospital's lead infection control expert, Brookdale embarked on house-wide surveillance of central line performance at the hospital. It quickly became apparent that compared with established benchmarks, central line infections at Brookdale were both a patient safety hazard and a producer of red ink. Changes had to be made and Garcia and his staff began to chart their intervention strategy.

In January 2000, a yearlong education and awareness program was begun, showing clinicians what central line infections were costing the hospital and harming patients (See Table Two for data on the effect of education on staff). The program consisted of targeting medical residents, surgical residents, anesthesiologists and all nurses involved in the maintenance of the insertion site. Topics covered included the morbidity, mortality, and costs associated with the occurrence of catheter-related bloodstream infections; hospital rates vs. national benchmarks; indications for use of a CVC; risk of infection by insertion site; procedure and timing of handwashing; proper sterile attire to be used during catheter insertion; aseptic techniques during initial catheter insertion and replacement (conducted by an experienced surgical attending); the nature and mechanism of infection prevention when using antimicrobial catheters; proper placement and maintenance of dressings including the recommended regimen for the application of skin antiseptics; review of the revised process for physician certification (first-year residents are required to successfully complete five insertions under supervision prior to solo attempts).

Physician education also was conducted during new resident orientation sessions as well as monthly for residents covering critical care areas. "We achieved nearly a 60 percent infection rate reduction (more precisely 57.3 percent) simply with education," says Garcia. "But soon after that, the improvement reached a plateau."

In January 2001, the decision was made to start evaluating new products, leading

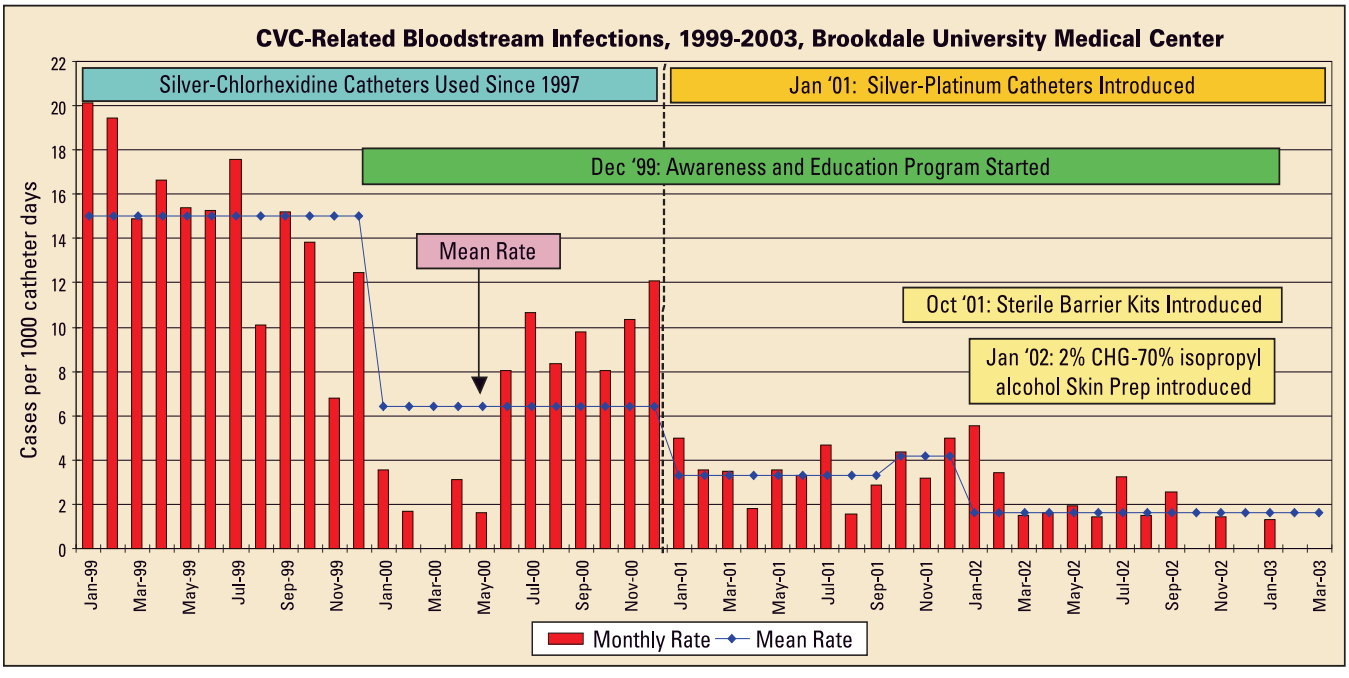

Table 1. Results of Four Interventions to Reduce Central Venous Catheter-Related Bloodstream Infections

Intervention	Period	Months between interventions	# Patients	# CD	# BSI	Mean Rate	Percent Change from Prior Mean	Percent Change from Baseline
(Baseline or pre-intervention period)	Jan 99-Dec 99	12	642	6,457	97	15.0	—-	—-
Education	Jan 00-Dec 00	12	668	7,305	47	6.4	-57.3	-57.3
Silver-platinum catheters	Jan 01-Sep 01	9	628	5,438	6	3.3	-48.4	-78.0
Maximal sterile barriers	Oct 01-Dec 01	3	197	1,915	8	4.2	21.4	-72.0
2% chlorhexidine skin antiseptic	Jan 02-Mar 03	15	944	10,330	17	1.6	-61.9	-89.3
Totals:			**3,079**	**31,445**				

CD = catheter days; BSI = bloodstream infection

Brookdale to bring in silver-platinum catheters for all adult patients requiring CVCs, items that are about 20 percent less costly and deemed "very promising and very cost-effective" by Garcia and a working infection control group, to replace the older silver-chlorhexidine catheter in use at the hospital for years. Through the next nine months, that change dropped the infection rate another 48.4 percent or approximately 78 percent below the January 1999 baseline. But at the same time a disturbing trend was also uncovered: Observation sessions conducted by ICPs at Brookdale revealed that physicians failed to uniformly adhere to a policy of wearing of maximal sterile attire during central line insertion. Physicians were observed either not wearing any gown, not wearing a sterile gown (due to unavailability on specific units), not wearing a mask, as well as using various items such as patient drapes, which were inadequate in size and configuration (obtained from the catheter kit or from other supply). In fact, under the older 1996 CDC guidelines using maximal sterile barriers, between October and December 2001 the number of blood stream infections at Brookdale actually increased by 21.4 percent, proving that there was more work to be done.

A select group of senior medical and surgical residents were gathered in order to solicit information on an ideal kit for use when inserting not only CVCs, but peripherally inserted central catheters (PICCs), arterial, and swan-ganz lines. It was decided that a custom kit to include a 36" x 60" sterile drape, sterile gown (folded in a manner to avoid contamination when donning), a mask, sterile gloves, and enclosed wound dressing kit (Sorbaview transparent dressing, tape strips, 70% isopropyl alcohol-2% chlorhexidine antiseptic applicator, gauze, small drape) would be needed. Central supply ensured distribution to all patient care units, including the operating and emergency departments. The vendor, Tri-State Hospital Supply, Howell, MI, conducted in-service on the use of the kit and by September 2001 the practice of using maximal sterile barriers was incorporated in all subsequent educational sessions.

However, still unsatisfied and sensing further cost savings and patient safety ahead, Garcia and his infection control group plowed further. The Centers for Disease Control and Prevention had just recommended use of 2% chlorhexidine and by January 2002 that product, manufactured by Medi-Flex Inc., Overland, KS, was brought in as the standard skin antiseptic at Brookdale. "Part of the good news for us was that we didn't have to reinvent the wheel," says Garcia, who delivered a poster presentation at this year's APIC annual meeting on the experience. "We found that the 2% chlorhexidine was superior over povodine iodine, the studies were already done and it wasn't a hard sell to the institution at that point."

The Medi-Flex product, known commercially as ChloraPrep, was packaged in dressing kits and the hospital ceased ordering the old kits, checking the older stock for the 2% chlorhexidine. "We used the 2% chlorhexidine product for all kinds of central lines," he says.

The ChloraPrep antiseptic cost $1.00 per application, a full 75 percent more than the hospital was spending on the previous product. But despite that, Garcia says that the institution recaptured much of the costs thanks to lower waste and reductions in possible contamination. "There was some debate over the 75 percent increase in costs, but our mindset is that the product offers better patient care," he says. Prior to that, Brookdale used a 10% tincture of iodine solution as its base antiseptic product. Garcia says that careful examination of the literature indicated that in trials conducted to compare the efficacy of 2% chlorhexidine to 10% povidone iodine, the 2% chlorhexidine "exhibited a much greater ability to reduce colonization and bacteremia."

The result? An estimated 73 cases of blood stream infection were avoided each year during the 39-month period of intervention. Reported figures on attributable cost per infection are estimated at $34,508 to $56,000. Consequently, the cost savings per year were calculated to range between $2,519,084 and $4,088,000.

Garcia, in his poster presentation, said that "patient safety not only has evolved to include the occurrence of nosocomial infection, but also errors of omission. Interventional epidemiology advocates extensive assessment of processes in order to clarify 'real world' practice, focus evidence-based interventions and implement those interventions with a heightened attention to detail." In all, the study results show an overall reduction in the blood stream infection rate of nearly 90 percent, demonstrating the need to combine focused education with the use of novel technology in order to achieve maximum outcomes.

"There is no one magic bullet here," says Garcia. "Some hospitals educate, some change products. Lots of physicians didn't know what 2% chlorhexidine was, even though it really has been on the market for 30 years. We instituted a real project with about 20 core people that has been very successful, and we implemented a variety of things and each must sustain itself over time. Now, everyone benefits and we have very good outcomes." **HPN**

Table 2. Estimate of the Number of Central Venous Catheter-Related Bloodstream Infections Avoided After Institution of Interventions

Intervention	Period	Months between interventions	Expected # of BSIs	Actual # of BSIs	# of BSIs Avoided
(Baseline)	Jan 99-Dec 99	12	—	97	—
Education	Jan 00-Dec 00	12	97	47	50
Silver-platinum catheters	Jan 01-Sep 01	9	72	6	66
Maximal sterile barriers	Oct 01-Dec 01	3	24	8	18
2% chlorhexidine skin antiseptic	Jan 02-Mar 03	15	120	17	103
Totals:					**237**

 # BSIs Avoided = Expected # BSIs - Actual # BSIs