

Brookdale Hospital Medical Center
One Brookdale Plaza
Brooklyn, New York 11212

Project Title:

Control of Nosocomial Infections as a Patient Safety Initiative: Three Years Experience in Implementing Recommendations for Reduction of Central Venous Catheter-Related Bloodstream Infections

(Please note this project has been presented at the APIC Conference 2003 and credits and references are in attached reprint)

Submitted by:

Linda Jendresky, MPH, CPHQ, CIC
Director of Infection Control
718.240.5924

Robert Garcia, MT, CIC, BS
Assistant Director Infection Control
718.240.5924

Suzanne Pennacchio, RN
Sr. Vice President for Patient Services
718.240.5966

Brookdale Hospital Medical Center (BHMC) is a voluntary non profit corporation with 530 certified beds. BHMC is located in the borough of Brooklyn, New York serving the residents of central and east Brooklyn, Brownsville, East New York, Canrsie, Starrett City, East Flatbush and Crown Heights. We serve a culturally diverse multilingual community of all age groups and socioeconomic status that represents the diversity that is New York City. Many of our patients are working poor or indigent, with no health insurance, and chronic medical conditions. High-risk health problems characteristic of many inner city urban populations are also prevalent. These include teenage and other high risk pregnancy, lack of prenatal care, violent trauma, child, domestic, and elder abuse, illegal drug abuse, HIV and other communicable diseases. These patients have difficulty initiating lifestyle changes necessary to prevent illness and improve health. The ethnicity of this population is 55% African-American, 17% Hispanic, 18% White, 3% Asian and 8% other groups. The neighborhoods immediately surrounding the hospital are among the poorest in the United States. BHMC services approximately 24,000 inpatients annually, with a total of 340,000 ambulatory care visits and the emergency department treats and releases over 100,000 patients.

Our campus includes The Brookdale Hospital and Medical Center, Brookdale Family Care Network, Schulman and Schachne Institute for Nursing and Rehabilitation, Arlene and David Schlang Pavilion (Assisted Living), and the Brookdale Certified Home Health Agency. BUHMC is one of 3 hospitals within the parent organization of MediSys Health

Network, Inc. (BHMC, Jamaica Hospital Medical Center and Flushing Hospital Medical Center, located in the borough of Queens, NY).

The services provided in these facilities form the core of our integrated delivery system that offers a full range of comprehensive health care throughout the continuum. This includes specialty care services across all settings, emergency services at our Level I Trauma Center, primary care, ambulatory care services, acute inpatient services, ambulatory surgery, hyperbaric services, psychiatric services, rehabilitation services home care, and long term care/sub acute care and pastoral care. The Treatment for Life Center under the oversight of Infectious Diseases provides coordinated acute care and outpatient care for patients with HIV. Comprehensive state of the art diagnostic testing services and information systems support these services.

The BHMC is committed to being the focus of a health community, stressing the organization's values of caring and respect for everyone. We appreciate, and respect the cultural, ethnic, and social diversity of our community. We are committed to continuously improving our performance; ensuring availability and access to our services, and providing a single objective of providing excellent health care for the population we serve.

We envision that the BHMC:

- Provides quality, cost effective health care
 - Assesses the health care needs of our community
 - Provides an integrated health care system to our community
 - Promotes and facilitates preventive care
 - Fosters Education and Research
 - Will become the leader in health care in our area
- And*
- Treats everyone with care, respect and dignity
 - Focuses on customer satisfaction and cultural awareness
 - Increases pride in ourselves and what we do

Analysis of the target area, timeframe for development and implementation of strategies, including barriers to success:

An estimated 250,000 Central Venous Catheter (CVC) Related Bloodstream infections (CR-BSI) occur each year in US hospitals resulting in extensive mortality, excess length of stay and excessive cost to both the patient and hospital.

Patients entering hospitals must be provided with the state of the art treatment and best quality the individual practitioner and institution can provide with an assurance of the best possible outcome. On many occasions, patients will require intravascular catheter devices in the provision of their care. It has been estimated that >150 million intravascular devices are purchased and used in healthcare for administration of IV fluids, medications and blood products. One such device, the central venous catheter, has become increasingly common due to the flexibility in allowing simultaneous fluid and medication

administrations as well as hemodynamic monitoring of the critical ill patients. Although there are extensive medical benefits, the use of CVC's may be associated with the development of nosocomial (hospital-acquired) bloodstream infections. The development of CR-BSI may exceed 250,000 per year in US hospitals; up to 35% of patients receiving CVCs may expire as a direct result of a CR-BSI.

The need to reduce the occurrence of CR-BSI has been on the forefront of quality improvement and the patient safety arena for many years. In 1999, the BHMC Infection Control Department spearheaded a quality initiative to determine the effectiveness of implementing various scientifically supported interventions in an attempt to reduce the incidence of CR-BSIs. Although our initial interventions revealed a successful 57% reduction in the mean rate to within national benchmarks of CR-BSI, efforts were continued through 2003 in an attempt to maximize best practice and attain positive patient outcomes.

Review of Infection Control surveillance data collected on nosocomial facility-wide bacteremia identified that CVC lines were the likely source of an increasing number of bloodstream infections. In January, 1999, the Infection Control Department reassigned 1 FTE infection control professional to conduct daily surveillance of all adult patients with CVC inserted. Systems were introduced to identify all such patients. Data was systematically collected (patient name, unit number, location, date of insertion, physician inserting, dressing site and relevant laboratory cultures). Infection Control organized a series of meetings with key representatives from medicine, surgery, nursing, anesthesia, emergency department, and performance improvement in order to stress the need for support, ascertain current practice, identify concerns and needs, and coordinate educational efforts. Information was collected to identify factors that influence occurrences of CR-BSI.

A key component of the information collection process took the form of assessment sessions conducted by Infection Control Practitioners. These included interviews of staff (nurses, anesthesiologist, medical and surgical attending and residents) to ascertain *real* life practices as well as concerns regarding breaks in infection control technique. The initial information gathering process also included observation periods conducted during catheter insertion and maintenance procedures. Such sessions identified key intervention strategies, healthcare worker competency, and product improvement areas. The information gathered from these sessions, along with information published in guidelines and the scientific literature, contributed to an understanding of the root causes of the infection process. A fishbone diagram describing the variables influencing the occurrences of these infections was constructed (See attachment).

Several focused areas were addressed as a result of this analysis:

- 1) A need for staff to understand the nature and severity of the problem
- 2) A need for uniform education program for staff
- 3) A certification process for new physicians
- 4) Selection of the most appropriate insertion site to reduce the risk of infection
- 5) Standardization of sterile attire and compliance with use

- 6) Standards for aseptic practice during insertion and maintenance
- 7) Standardization of skin antiseptics

Prospective data was collected prior to the intervention surveillance period the baseline data; (Jan-Dec 1999) to measure the occurrence of CR-BSI and assess healthcare worker practice. Four key strategies were implemented over the subsequent three-year period and rates of CR-BSI infections measured prior to and following interventions were evaluated:

- 1) **Education and Awareness:** *Implementation January -Dec 2000*
- 2) **Replacement of Silver Chlorhexidine CVC catheters to those composed of a Silver Platinum material:** *Implementation January 2001– Sept 2001*
- 3) **Use of maximal sterile barriers (Universal Line Insertion Kit, custom made kit and education on its use):** *Implementation – September 2001*
- 4) **Use of 2% Chlorhexidine –70% isopropyl alcohol as standard skin prep:** *Implementation January 2002*

As with any new initiative comes with it the struggle of barriers along the road to success. The most challenging being the need to change behaviors of the physicians and nursing staff.

- The need to get “buy in” from the staff so they would prioritize and understand the nature and severity of the issue as it relates to improving patient outcomes.
- The need to standardize the learning curve and credentialing procedures among training physicians.
- The impact of these changes on the increase in cost for more user friendly products to assist the staff with efficient work environment and at the same time promoting safer patient outcomes.
- The need for all staff to conform to revised policies regarding dressing application, dressing replacement, CVC insertion, CVC replacement, and blood culture/CVC tip culturing.

A description of the formal process of identifying areas for error reduction and performance improvement initiatives

The Infection Control Department performs surveillance activities on an ongoing basis. There is an active hospital wide infection control surveillance program. The purpose of the Infection Control Surveillance Program is to identify and monitor nosocomial infections in a systematic manner in order to institute the most effective and practical control practices that will prevent infection. Infection Control collects and analyzes surveillance data on an ongoing basis so as to monitor effects of intervention strategies. We identify areas of high risk for infection and assure that appropriate infection control interventions are in place and followed, as well as provide feedback to patient care providers about the nosocomial infection risks of their patients. CR-BSIs are trended, analyzed, and presented as monthly surveillance statistics for presentation at Infection Control Committee meetings for review. The Infection Control Committee is a Medical

Board Committee, therefore, recommendations for further review and actions are made to the Committee and Infection Control will tailor the surveillance program based on these recommendations.

The Patient Safety Program and Infection Control Program integrated through the Performance Improvement Plan and by collaboration between the Directors of Infection Control, Performance Improvement, Safety and Risk Management via the Organization wide Performance Improvement Committee (OPIC), Executive Safety Committee, Infection Control Committee and Risk Management Committee.

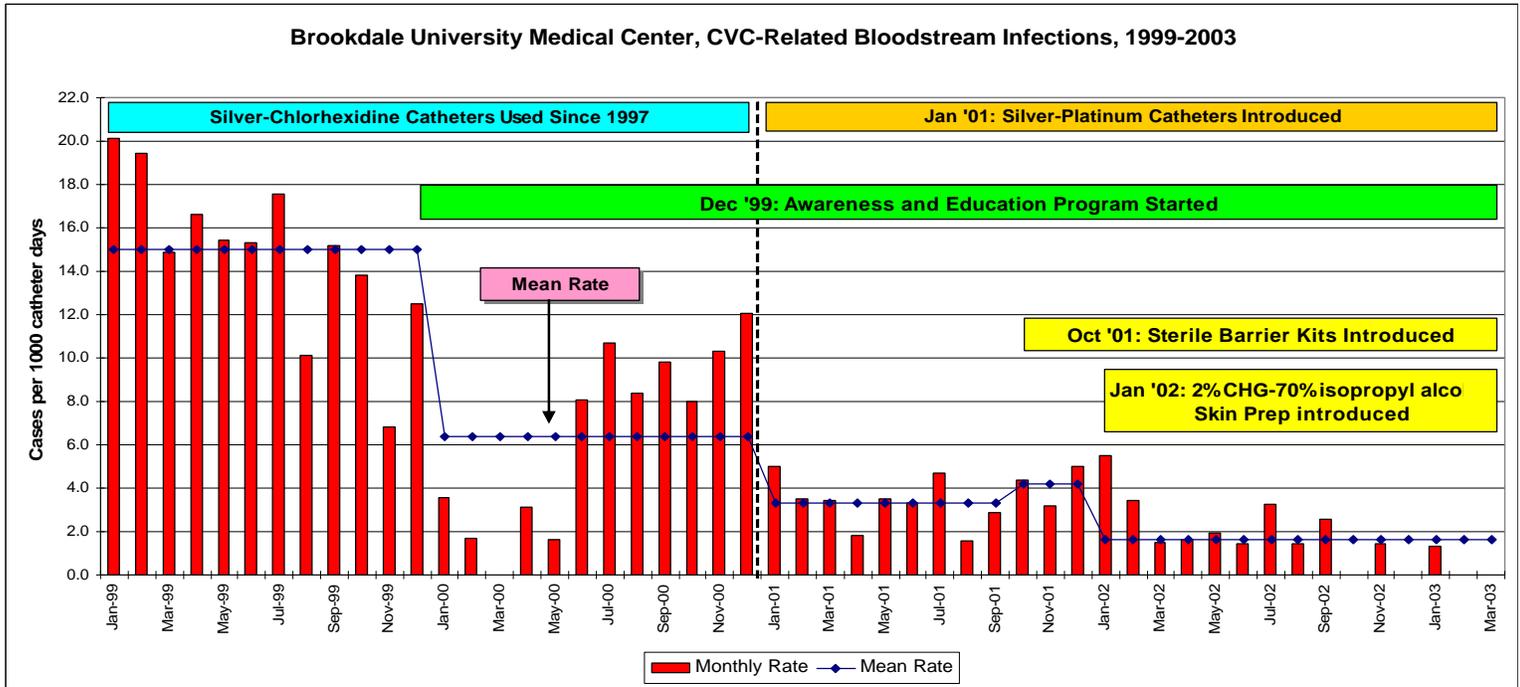
The Patient Safety Program is defined as processes to identify measure and assess medical errors, adverse events and undesirable patient outcomes (including Sentinel Events) and to improve processes for reporting measuring and reducing these events. The Patient Safety Program and Infection Control Program integrated through the Performance Improvement Plan and by collaboration between the Directors of Infection Control, Performance Improvement, Safety and Risk Management via the Organization wide Performance Improvement Committee (OPIC), Executive Safety Committee , Infection Control Committee and Risk Management Committee.

The Organization wide Performance Improvement Committee coordinates and integrates environmental safety, patient and employee safety activities including implementing applicable recommendations from Sentinel Events Alerts, Environment of Care, Infection Control plans and Emergency Preparedness initiatives. Organization wide policy and procedures were developed for risk reduction strategies to improve patient safety and decrease medical errors. One of these new strategies was successful implementation of Failure Modes Effects Analysis process in 2002. Continued efforts to change organizational culture related to willingness to report errors in a supportive and blame free environment and improving communication between all caregivers on all levels.

Our PI Method “Plan, Design, Measure, Assess and Improve” are considered when implementing changes in organization wide processes. The team leader sets objectives and timelines for completion of all projects with continuing measures in place to evaluate outcomes.

A detailed description of successful quality improvement efforts previously and currently implemented.

- **The overall reduction in CR-BSI rate over 39 months (Jan 2000-Mar 2003) resulting from the implementation of four interventions was 89.3%.**
- This reduction in rate represents an avoidance of 237 cases over the 39-month intervention period (expected number – actual number of cases). 1st qtr. 2003 data indicates that the number of CR-BSI cases occurring per month has been reduced to 0.3 or approximately one per month



- Standardization of practice and procedure and of patient care supplies through the establishment of a scientifically based policy on the management of intravenous devices.
- We have enhanced the knowledge base of direct care providers, medical and surgical house staff regarding outcomes of CR-BSI, proper insertion technique, site access, site changes and dressing techniques. In addition policy and procedure changes have been made to be in compliance with CDC recommendations as well as our patient outcome data. (See Attachment 2)

Identification of measures used to determine effectiveness, standards and milestones for evaluation and benchmark improvement indicators

- ◆ CR-BSI definition as per published Centers for Disease Control (CDC) Nosocomial Infection Definitions.
- ◆ CR-BSI rate = Number of Nosocomial BSIs per 1000 catheter days (CD).
- ◆ ICU Benchmark: national rates as published by the CDC’s National Nosocomial Infection Study [NNIS].

- ◆ Comparative data on cost of CR-BSI.
- ◆ All adult patients with central venous catheters inserted between 1/1/99 and 3/31/03 were included in this study. A total of 3,079 patients with 31,445 catheter days (average duration 10.2 days) were included in the study.
- ◆ Average CR-BSI rate during the pre-intervention period (1999) was 15.0 cases per 1000 CD.
- ◆ Results of Interventions:
 - Education & Awareness (Jan-Dec 2000): 57.3% reduction in rate to a mean of 6.4 per 1000 CD.
 - Use of silver-platinum antimicrobial catheters (Jan 2001-Sep 2001): 48.4% reduction from the 2000 mean to 3.3 cases per 1000 CD.
 - Use of maximal sterile barriers (Oct 2001-Dec 2001): a small increase in rate to 4.2 cases per 1000 CD.
 - Use of 2% chlorhexidene-70% isopropyl alcohol (Jan 2002-March 2003): The mean rate for this 15 month period was calculated to be 1.6 cases per 1000 CD, an approx. 62% reduction in CR-BSI.
- ◆ ICU Benchmark: Comparison of 1st qtr. 2003 CR-BSI rate [0.9 per 1000 catheter days] to the NNIS data, indicates rate is approximately at the 4th percentile, i.e., the ICUs perform better than 96% of all hospitals in the national study.
- ◆ Reported figures on attributable cost savings per infection have been estimated by the CDC to range from \$34,508 to \$56,000. The cost savings per year in this study are therefore calculated to range from \$2,519,084 to \$4,088,000.

Explanation of protocol development and steps taken to implement quality improvement strategies.

A master plan was developed by the Infection Control Department and subsequently approved by the Infection Control Committee and Performance Improvement. At the core of the plan were 4 key strategies:

1. **Education.** Targeted medical residents (92% captured), surgical residents (98%), anesthesiologists (100%), and all nurses involved in the maintenance of the insertion site (89%). Topics covered included the morbidity, mortality, and costs associated with the occurrence of CR-BSI; 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 antiseptic; 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 and monthly for residents covering critical care areas. [Implementation: January 2000]

2. **Replacement of Silver-Chlorhexidine CVCs to Catheters Composed of Silver-Platinum Material.** During 1997-1999, all patients requiring CVC access used a silver-chlorhexidine catheter. Significantly high rates observed during 1999 with these catheters resulted in the recommendation of the working group and the ICC to seek alternative antimicrobial devices. A novel antimicrobial catheter combining polyurethane with silver, carbon and platinum was considered. Studies published in the literature appeared to indicate effectiveness in reducing infection. Cost of the insertion kit with a silver-platinum catheter was approximately 20% less expensive than comparable kits using silver-chlorhexidine catheters. Based on the clinical and financial information, a decision was made to convert to silver-platinum catheters for all adult patients requiring CVC devices. [Implementation: January 2001]
3. **Universal Line Insertion Kits.** Observation sessions conducted by ICPs revealed that physicians did not uniformly adhere to a policy of wearing of maximal sterile attire during insertion. Physicians were observed either not wearing any gown, did not wear a sterile gown (due to unavailability on specific units), did not wear a mask, and used various items as patient drapes which were inadequate in size and configuration. A 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. Education was conducted on the use of the kit and the practice of using maximal sterile barriers was incorporated in all subsequent educational sessions. [Implementation: Sept 2001]
4. **Use of 2% Chlorhexidine as the Standard Skin Antiseptic.** Skin organisms, particularly *Staphylococcus aureus* and coagulase-negative *Staphylococci*, have been known for many years as the predominant pathogens causing both wound infections and those related to the use of intravascular catheters. Addressing the issue of adequately degerming the skin prior to catheter insertion becomes a central issue in projects aimed at reducing adverse events such as CR-BSI. Prior to January 2001, the hospital used a 10% tincture of iodine solution as its base antiseptic product. Careful examination of the literature indicated that in trials conducted to compare the efficacy of 2% chlorhexidine (CHG) to 10% povidone iodine (PI), 2% CHG exhibited a much greater ability to reduce colonization and bacteremia. Based on published studies and the approval by the FDA of ChlorPrep® as a skin antiseptic, the Infection Control and the Products Evaluation & Standardization Committees approved the product for use. Bottles, swabs, and other applicators containing povidone-iodine were removed from all patient units and kits and replaced with 2% chlorhexidine. Educational sessions on the use and application of the product were conducted. [Implementation: January 2002]

Data reflecting favorable results directly related to Quality improvement and patient outcome reduction strategies

This PI initiative demonstrates that the implementation of well – supported interventions can have a dramatic effect in reducing the rates of nosocomial CR-BSI and the related mortality and morbidity associated with it.

It should be noted that 3 of the 4 recommendations used during this initiative have moved to a Category A1A ranking in the 2002 CDC guidelines. This is the highest of all categories and indicated that the recommendations are strongly supported by scientific literature and should be practiced by all hospitals. Therefore, the selection of these interventions by BHMC Infection Control and Medical Staff for implementation appears to have been well justified.

Patient Safety not only has evolved to include the occurrence of nosocomial infections, but also errors of omission. Interventional epidemiology, a national performance improvement process originally drafted at BUHMC, advocates extensive assessment of processes in order to clarify “real world” practice. In addition focus evidence-based interventions and implement those interventions with a heightened attention to detail. The results presented here, a significant overall reduction in the rate of nearly 90%, demonstrates the need to combine focused education with the use of novel technology in order to achieve maximum patient safety outcomes.

Evaluation of outcomes and discussion of collaborative efforts and future goal for continued improvement activities.

In the past three years organization wide policy and procedures were developed for risk reduction strategies to improve patient safety and decrease medical errors. One of these new strategies was successful implementation of Failure Modes Effects Analysis process in 2002. Performance Improvement activities focused heavily on improving medical error and adverse event reporting (reporting to the New York State Patient Occurrence and Tracking System (NYPORTS), conduction of effective and credible multidisciplinary root cause analyses which was supported by medical staff leaders and practitioners, implementation of JCAHO Patient Safety Goals, and implementation of new pharmacy electronic dispensing systems to improve pharmacy control and oversight in ordering, dispensing, administering and monitoring medication use.

During the last JCAHO site survey conducted in December 2003, the Infection Control Department’s performance improvement activities were recognized and contributed to the organizations overall score of 99%. The JCAHO survey team was particularly impressed with the organizations PI processes in place as well as our proposed plans of readiness as we enter the arena of the Infection Control Patient Safety goals regarding infections for 2004. **(See Attached letter of request for presentation at JCAHO National Conference in Chicago, Nov, 2003)**

In 2004 , the JCAHO's National Patient Safety goals regarding Infection Control is to manage as sentinel event all identified cases of death or major permanent loss of function attributed to a nosocomial infection. The following processes are in the initial stages and will continue to be implemented to assure the capturing of all unanticipated deaths due to nosocomial infections. The organization-wide Sentinel event and Root Cause Analysis policy has been revised to incorporate the following procedure for investigation of potential Sentinel Events caused by a nosocomial Infections: (Attached policy and Flowchart)

- a. Once it has been determined that an unexpected death and/or permanent injury may be related to a nosocomial infection by the Infection Control Department an investigation will be initiated.
- b. The Infection Control Director / Asst Director will notify the Chief of Infectious Diseases and the attending Physician regarding the potential sentinel event.
- c. The Infection Control Department will use the initial screening tool to determine causation by risk category.
- d. A Multidisciplinary Intensive Analysis Team will be selected with the Director of Infection Control and Director of Performance Improvement and other leaders and staff involved in the event, and an intensive analysis review will be conducted within 30 days of the occurrence.
- e. The team will make recommendations and/or implement immediate actions to be taken to prevent similar occurrences in the future. If the team is not authorized to implement actions or recommendations, applicable team members will refer these recommendations to senior leaders.
- f. Periodic summary reports of intensive analysis events, conclusions, actions and recommendations will be presented to the Infection Control Committee and reported to the Organization-wide PI Committee twice per year.
- g. Disciplines involved will review on an ongoing basis the effectiveness of the changes in policies and procedures to ensure that there are no further incidences. All medication occurrences/events should be discussed as part of departmental staff and/or M&M meetings.

Looking forward to 2004, the performance improvement priorities identified from outcomes of patient safety initiatives and national performance measures will be to continue efforts to change organizational culture related to willingness to report errors in a supportive and blame free environment and improving communication between all caregivers on all levels. The focus on hand hygiene and prevention of hospital acquired device related infections will continue to be a focus. More emphasis on the implementation of strategies to manage patients flow throughout the hospital (formerly referred to as "emergency department overcrowding") and reduce the risk of acquisition of and transmission of nosocomial infections as well as the role of Infection Control in identifying timely potential Emerging Pathogens and or Biological Agents (i.e. SARS) that pose a threat to health care employees and patients at large.

In spite of 9/11 and financial constraints imposed by our external environment, BHMC has focused on measuring and improving quality. In 2004 we continue to be a viable, state of the art Medical Center, thanks to our leaders' initiatives and the expert, experienced and dedicated professional and support staff that is committed to creating and being the focus of, a healthy community.