



CLINICAL EVIDENCE

# **Central Line Bundles & Vantex Antimicrobial Catheter**

# Table of Contents

<b>Introduction: Central Line Bundles</b>	<b>2</b>
A multicenter, phased, cluster-randomized controlled trial to reduce central line-associated bloodstream infections in intensive care units	3
An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU	4
Reduction in Central Line–Associated Bloodstream Infections among Patients in Intensive Care Units - Pennsylvania, April 2001–March 2005	5
Improving central line maintenance to reduce central line-associated bloodstream infections	6
Prevention of Catheter-Related Blood Stream Infection: Back to Basics?	7
<b>Introduction: Vantex Antimicrobial Catheter</b>	<b>8</b>
A prospective, randomized study in critically ill patients using the Oligon Vantex catheter	9
Impact of central venous catheter type and methods on catheter-related colonization and bacteraemia	10
A prospective, randomized trial of rifampicin-minocycline-coated and silver-platinum-carbon-impregnated central venous catheters	11
Impact of oligon central venous catheters on catheter colonization and catheter-related blood stream infection	12
Three years experience in implementing HICPAC recommendations for the reduction of central venous catheter-related bloodstream infections	13
References	14

---

# Introduction: Central Line Bundles

## Challenges in Vascular Access

It is estimated that at least five million central venous catheters (CVCs) are inserted on an annual basis in the United States.<sup>1</sup> The use of CVCs is linked with central line associated blood stream infections (CLABSI), which are one of the most dangerous and costly nosocomial infections. In this context, CLABSIs are also referred to as catheter related blood stream infections (CRBSI). CLABSIs are estimated to occur in 3 to 7% of venous catheter placements and may cost as much as \$45,000 per occurrence.<sup>1,2</sup> These estimates stress the importance of limiting CVC related infections through comprehensive prevention strategies.

## Medline Central Line Bundle

Many CLABSIs are thought to occur during central line insertion and maintenance, when central line components are at high risk of bacterial contamination. At the frontier of infection prevention strategies are bundles and kits that simplify and standardize care. Bundles and kits promote aseptic technique through many facets, including the use of appropriate barrier precautions, skin antiseptics, and step-by-step checklists; they are clinically proven to reduce infections associated with central line insertion and maintenance.<sup>3-8</sup>

## Clinical Evidence

This is a summary of clinical evidence supporting the use of central line bundles and kits. The following data are from clinical studies published in medical journals.

## A multicenter, phased, cluster-randomized controlled trial to reduce central line-associated bloodstream infections in intensive care units

Marsteller JA, Sexton JB, Hsu Y et al. A multicenter, phased, cluster-randomized controlled trial to reduce central line-associated bloodstream infections in intensive care units. Crit Care Med. 2012; 40(11):2933-2939.

### Intervention

The intervention group underwent a phased implementation of a comprehensive infection prevention bundle:

1. Hand washing prior to line placement
2. Use of appropriate barrier precautions
3. Avoiding unnecessary line placements at the femoral site
4. Use of chlorhexidine skin antiseptic prior to line placement and maintenance

### Methods

A multi-center, randomized, controlled study where 45 ICUs from 35 different hospitals were randomized into two groups. One group implemented the infection prevention bundle and one group did not.

### Results

	Pre-Intervention CLABSI rate (CLABSI/1000 line days)	Post-Intervention CLABSI rate (CLABSI/1000 line days)
Bundle Group	4.48	1.33
Control Group	2.71	2.16

- » CLABSI rate was significantly reduced in the bundle group compared to control
  - o P = 0.003
- » Both groups were eventually transitioned to using the bundle. At 19 months post-bundle, both groups sustained CLABSI rates lower than 1.0 per 1000 line days

### Conclusion

The use of a CLABSI prevention bundle significantly reduced CLABSI rates compared to the group that did not use the bundle. Bundles that emphasize the aspects above may provide clinical benefits to patients.

## An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU

Pronovost P, Needham D, Berenholtz S et al. An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU. The New England Journal of Medicine. 2006; 355(26): 2725-2732.

### Intervention

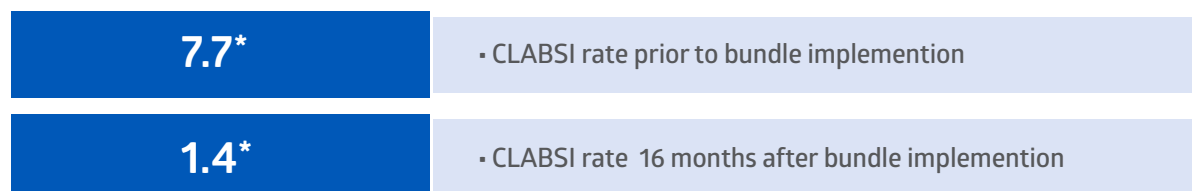
The intervention was a multi-faceted bundle, composed of the following elements:

1. Use of appropriate sterile barrier precautions
2. Emphasis on proper hand hygiene prior to procedures
3. Use of chlorhexidine skin antiseptic prior to line placement
4. Avoiding unnecessary line placements at the femoral site
5. Education on CLABSIs and infection control practices

### Methods

A multi-center, quality improvement project where 103 Intensive Care Units in Michigan implemented a CLABSI prevention bundle. The overall CLABSI rates were recorded and studied; a total of 375,757 catheter-days were included in the final analysis.

### Results



\*CLABSI rate presented as the number of CLABSIs per 1000 central line days

- » CLABSI rate was significantly reduced after bundle implementation
  - o  $P < 0.002$

### Conclusion

This study demonstrates that using a bundle of CLABSI prevention interventions may significantly reduce CLABSI rates over time. Bundles that emphasize the aspects above may provide clinical benefits to patients.

## Reduction in Central Line–Associated Bloodstream Infections among Patients in Intensive Care Units — Pennsylvania, April 2001–March 2005

Center for Disease Control and Prevention. Reduction in Central Line–Associated Bloodstream Infections among Patients in Intensive Care Units — Pennsylvania, April 2001–March 2005. 2005; 54(40): 1013-1016.

### Intervention

The intervention was a multi-faceted bundle, composed of the following elements:

1. Use of appropriate sterile barrier precautions
2. Use of chlorhexidine skin antiseptic prior to line placement
3. Avoiding unnecessary line placements at the femoral site
4. Standardizing the composition of all central line kits
5. Education on CLABSIs and appropriate dressing change practices

### Methods

A multi-center, quality improvement project where 32 hospitals implemented a CLABSI prevention bundle in their intensive care units. The overall CLABSI rates were recorded and studied for four years post-bundle intervention and compared to pre-bundle rates.

### Results

4.31*	• CLABSI rate prior to bundle implementation
1.36*	• CLABSI rate after bundle implementation

\*CLABSI rate presented as the number of CLABSIs per 1000 central line days

- » CLABSI rate was significantly reduced after bundle implementation
  - o  $P < 0.001$

### Conclusion

This study published by the CDC demonstrates that the use of a CLABSI prevention bundle may reduce CLABSI rates. Bundles that emphasize the aspects above may provide clinical benefits to patients.

# Improving central line maintenance to reduce central line-associated bloodstream infections

Drews FA, Bakdash JZ. Improving central line maintenance to reduce central line-associated bloodstream infections. American Journal of Infection Control. 2017;45:1224-1230.

## Intervention

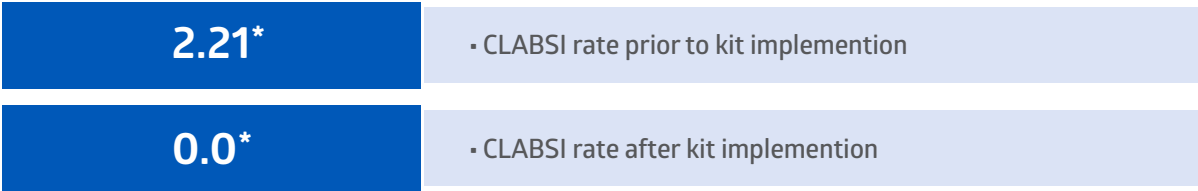
The intervention was a central line maintenance kit, which included supplies laid out to promote ease of use and best practice. Some components of the kit were:

- 1. Hand sanitizer
- 2. Sterile barriers, including exam gloves and mask
- 3. Chlorhexidine skin antiseptic
- 4. Antimicrobial dressing and cap
- 5. Instructions and best practice checklist

## Methods

A 29-month, prospective, observational study where a tertiary hospital implemented the use of central line maintenance kits for all line maintenance procedures. CLABSI rates before and after kit implementation were recorded and compared.

## Results



\*CLABSI rate presented as the number of CLABSIs per 1000 patient line days, sample size: 4,570 line days

- » CLABSI rate was significantly reduced after kit implementation
  - o P = 0.0005

## Conclusion

The use of a central line maintenance kit significantly reduced CLABSI rates compared to the pre-intervention period. Standardized kits that promote best practice may provide clinical benefits to patients.

## Prevention of Catheter-Related Blood Stream Infection: Back to Basics?

Cherry-Bukowiec J, Denchev K, Dickinson S et al. Prevention of Catheter-Related Blood Stream Infection: Back to Basics? Surgical Infections. 2011;12(1):27-32.

### Intervention

Standard Polyurethane CVC and Chlorhexidine coated CVC. Both groups used of a multi-faceted infection prevention bundle, composed of the following elements:

1. Focus on hand hygiene and antisepsis
2. Use of maximum sterile barrier precautions
3. Use of a dedicated CVC cart
4. Chlorhexidine skin antiseptic
5. Line placement instructions and best practice checklist

### Methods

A prospective trial where a surgical ICU implemented use of a chlorhexidine coated CVC. The CLABSI rates of the intervention group were compared to pre-intervention, where standard polyurethane CVCs were utilized. The baseline CLABSI rate was already low due to use of a CLABSI prevention bundle. The author's sought to determine if the antimicrobial CVC provided benefits beyond those attributed to the prevention bundle.

### Results

<b>0.80*</b>	• CLABSI rate with bundle, but without chlorhexidine CVC
<b>0.70*</b>	• CLABSI rate with the bundle and chlorhexidine CVC

\*CLABSI rate presented as the number of CLABSIs per 1000 patient line days, sample size: 4,570 line days

- » CLABSI rate was not significantly changed by the antimicrobial CVC
  - o  $P > 0.05$

### Conclusion

A bundle of infection prevention interventions may be more effective than an antimicrobial CVC. This is especially true in cases where CLABSI rate is already low. Use of a comprehensive infection bundle should be prioritized over use of antimicrobial catheters.



# Introduction: Vantex Antimicrobial Catheter

## Beyond the Bundle

Bundles and kits that standardize care and promote best practice are the first step in reducing infection risk. When these interventions do not reduce CLABSI rates to goal levels, or when a dramatic reduction is desired, healthcare institutions may turn to CVCs that are coated with antimicrobials such as antibiotics, certain metals, or other antiseptics. Clinical evidence suggests that antimicrobial catheters may reduce CLABSI rates.<sup>9-13</sup>

## The Vantex Solution

The Medline Vantex CVC is an infection prevention strategy that does not rely on traditional antibiotics. The catheter utilizes a polymeric silver, carbon, and platinum alloy to prevent colonization of microorganisms through the release of natural silver ions ( $\text{Ag}^+$ ).

Vantex technology uses the natural thermodynamic properties of silver and platinum to facilitate the release of silver ions. The addition of carbon to the polymer creates long-lasting antimicrobial effects by permitting slow and consistent silver dispersal. Silver in its ionic form is a proven bactericidal and fungicidal element that has been in medical use for decades.<sup>14</sup>

## Multidrug-Resistant Organisms

Ionic silver is experimentally proven to fight off resistant bacteria such as methicillin resistant *Staphylococcus aureus*, methicillin resistant *Staphylococcus epidermis*, multidrug-resistant *Pseudomonas* species, and *Escherichia coli*.<sup>15-17</sup> Multi-drug resistant organisms plague healthcare systems and are estimated by the Center for Disease Control and Prevention to cost as much as 3.5 billion dollars annually to treat.<sup>18</sup> Silver ions have the potential to eliminate these organisms prophylactically, reducing bacterial proliferation before an infection occurs.

## Clinical Evidence

This is a summary of clinical evidence supporting the use of Vantex central venous catheters. The following data are from clinical studies published in medical journals.

## A prospective, randomized study in critically ill patients using the Oligon Vantex catheter

Corral L, Ibanez-Nolla J, Leon M et al. A prospective, randomized study in critically ill patients using the Oligon Vantex catheter. J of Hosp Infection. 2003;55:212-219.

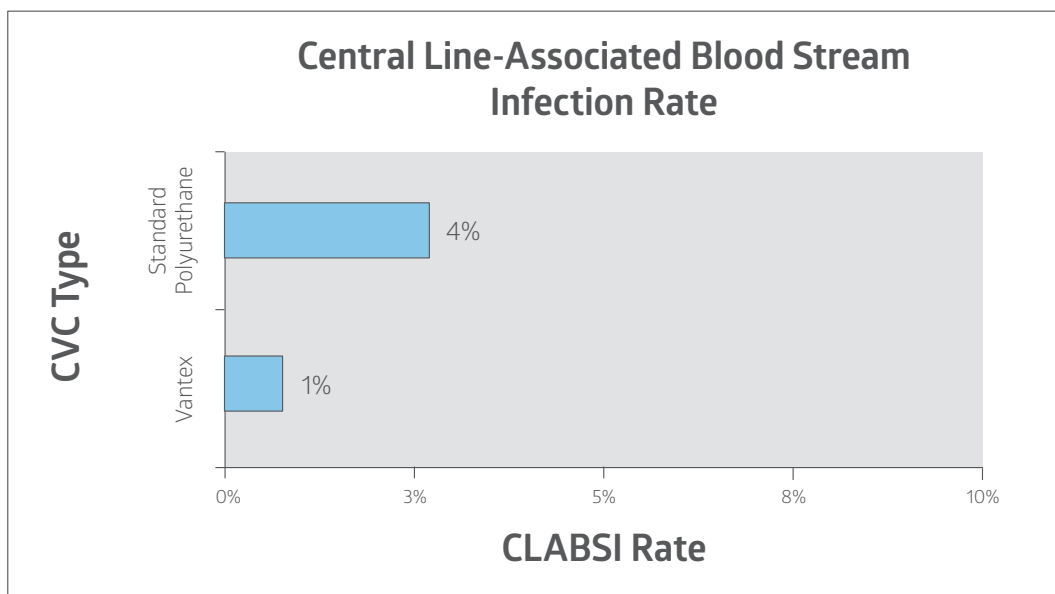
### Intervention

Standard Polyurethane CVC & Vantex CVC

### Methods

A prospective, randomized, controlled study where 206 patients in the ICU received one of the two catheters, each catheter remained in place for at least four full days.

### Results



### Catheter Colonization Rates

- o Polyurethane CVC: colonized in 44% of cases
- o Vantex CVC: colonized in 29% of cases
  - $P = 0.04$

### CLABSI Rates

- o Polyurethane CVC: CLABSI in 4% of cases
- o Vantex CVC: CLABSI in 1% of cases
  - $P < 0.001$

### Conclusion

Vantex CVCs were more effective at preventing bacterial colonization and CLABSIs than polyurethane CVCs

# Impact of central venous catheter type and methods on catheter-related colonization and bacteraemia

Moretti E, Ofstead C. Impact of central venous catheter type and methods on catheter-related colonization and bacteraemia. J of Hosp Infection. 2005; 61: 139-145.

## Intervention

Standard Polyurethane CVC & Vantex CVC

## Methods

A prospective, randomized, multi-center, controlled study where 539 patients in the ICU received one of the two CVCs, totaling 3,355 catheter days.

## Results

0%	• CLABSI rate with Vantex CVC
0.4%	• CLABSI rate with Polyurethane CVC

## Catheter Colonization Rates

- o Polyurethane CVC: colonized in 24.4% of cases
- o Vantex CVC: colonized in 24.5% of cases
  - P > 0.05

## CLABSI Rates

- o Polyurethane CVC: CLABSI in 0.4% of cases
- o Vantex CVC: CLABSI in 0% of cases
  - P > 0.05

## Conclusion

Vantex CVCs displayed similar colonization rates as polyurethane CVCs. There was no significant difference in CLABSI rates, though rates were exceptionally low for both groups.

It is possible that better adherence to best practice guidelines in both groups explains the low CLABSI rates; these results are consistent with those of other studies, where reduction of CLABSI rates was attributed to a CLABSI prevention bundle even though an antimicrobial catheter was utilized.<sup>7,19</sup>

## A prospective, randomized trial of rifampicin-minocycline-coated and silver-platinum-carbon-impregnated central venous catheters

Fraenkel D, Rickard C, Thomas P et al. A prospective, randomized trial of rifampicin-minocycline-coated and silver-platinum-carbon-impregnated central venous catheters. Crit Care Med. Article in Press. 2006; 34(3): 668-675.

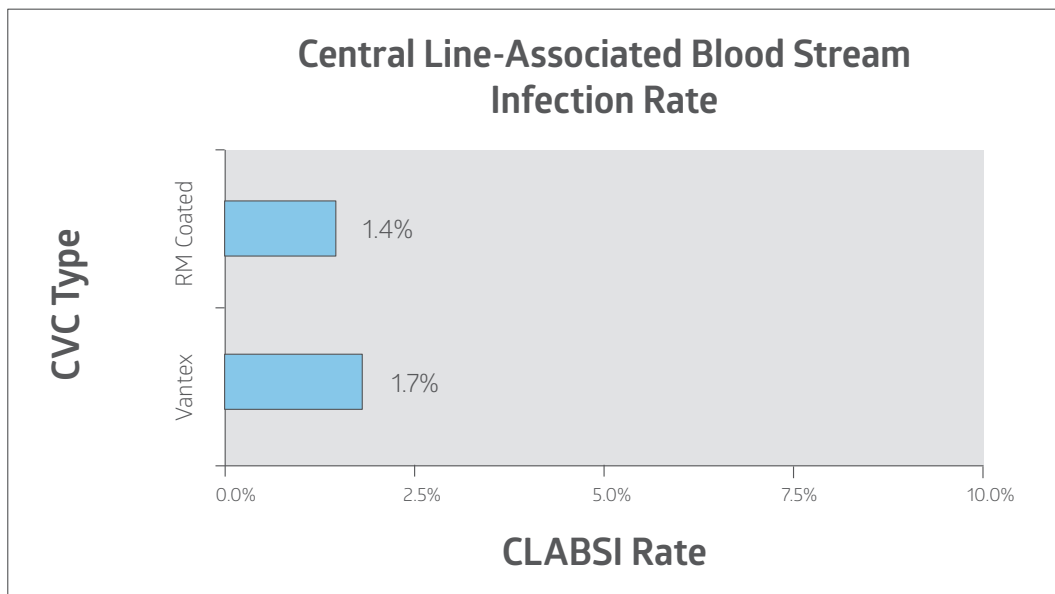
### Intervention

Rifampicin-minocycline (RM) coated CVC & Vantex CVC

### Methods

A prospective, randomized, single-center, controlled study where 780 patients in the ICU received one of the two CVCs, totaling 4,293 catheter days.

### Results



### Catheter Colonization Rates

- o RM coated CVC: colonized in 8.9% of cases
- o Vantex CVC: colonized in 14.6% of cases
  - $P = 0.04$

### CLABSI Rates

- o RM Coated CVC: CLABSI in 1.4% of cases
- o Vantex CVC: CLABSI in 1.7% of cases
  - $P > 0.05$

### Conclusion

Patients with Vantex CVCs presented with similar CLABSI rates as those treated with rifampicin-minocycline coated CVCs. The RM group displayed a lower colonization rate than the Vantex group.

## Impact of oligon central venous catheters on catheter colonization and catheter-related blood stream infection

Ranucci M, Isgro G, Giomarelli P et al. Impact of oligon central venous catheters on catheter colonization and catheter-related blood stream infection. Crit Care Med. 2003;31(1):52-59.

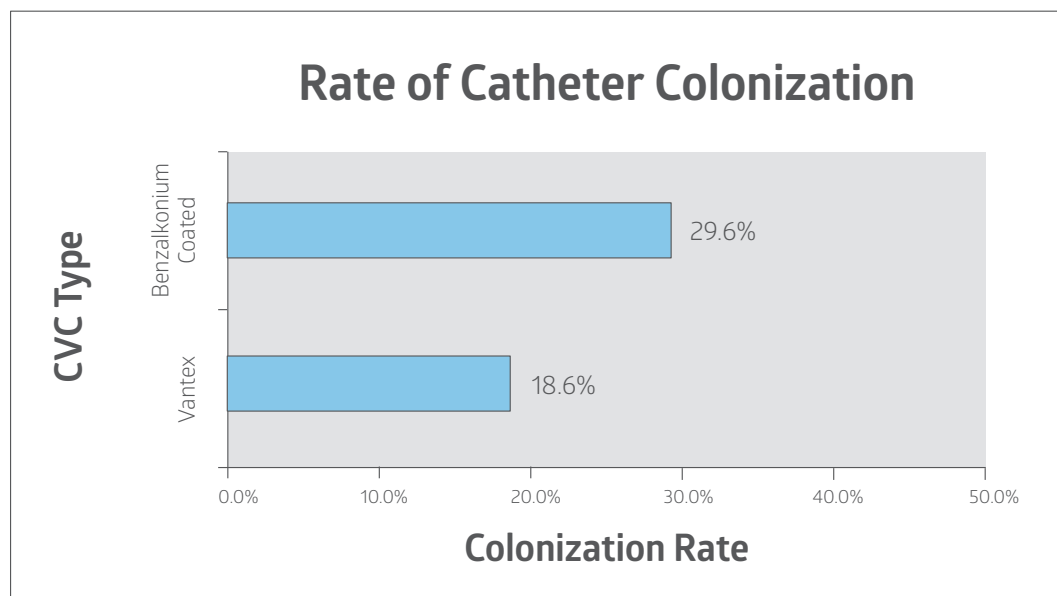
### Intervention

Benzalkonium coated CVC & Vantex CVC

### Methods

A multi-center, prospective, randomized, controlled study where 545 patients in the medical or surgical units received one of the two CVCs

### Results



### Catheter Colonization Rates

- o Benzalkonium CVC: colonized in 29.6% of cases
- o Vantex CVC: colonized in 18.6% of cases
  - $P = 0.003$

### CLABSI Rates

- o Benzalkonium CVC: CLABSI in 4.3% of cases
- o Vantex CVC: CLABSI in 3.3% of cases
  - $P > 0.05$

### Conclusion

Vantex CVCs were more effective at reducing bacterial colonization than Benzalkonium CVCs, but there was no significant difference in CLABSI rates between the two patient groups.

## Three years experience in implementing HICPAC recommendations for the reduction of central venous catheter-related bloodstream infections

Garcia R, Jendresky L, Landesman S et al. Three years experience in implementing HICPAC recommendations for the reduction of central venous catheter-related bloodstream infections. *Management of Infection Control*. 2003;10:42-49.

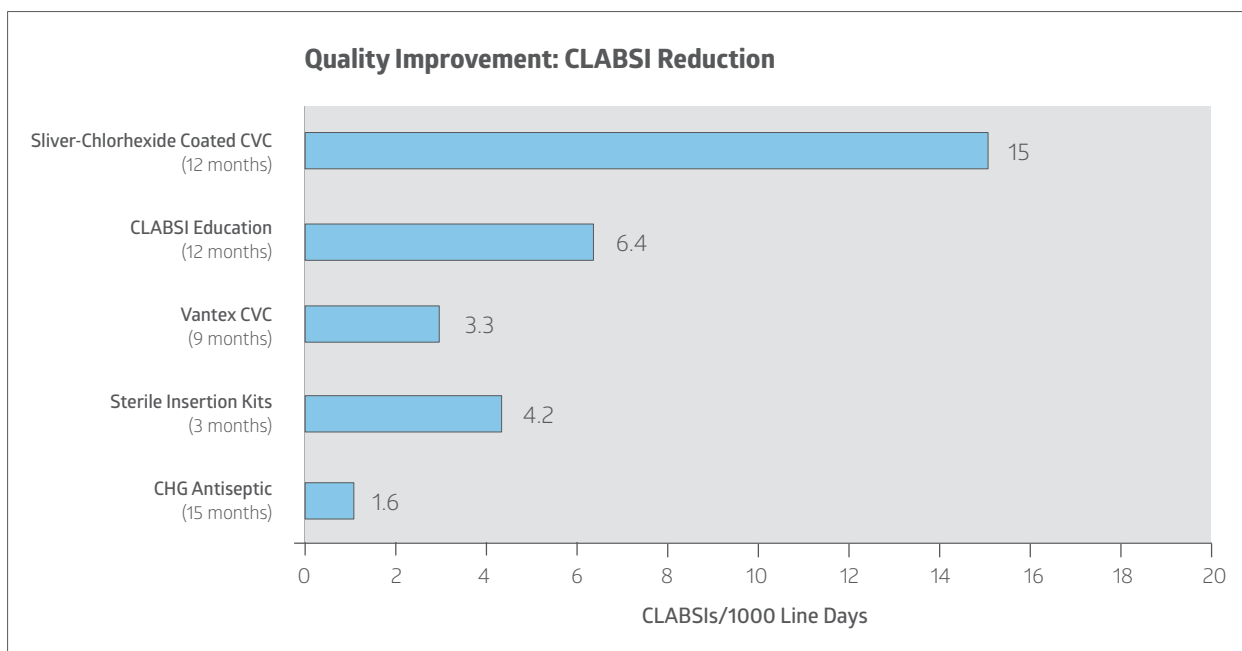
### Intervention

CLABSI education program, Vantex CVC, central line insertion kit, and chlorhexidine skin prep

### Methods

A quality improvement project, where CLABSI rates were followed as different infection prevention strategies were implemented over the course of four years. At baseline, a silver-chlorhexidine catheter was used with povidone-iodine skin antiseptic. The first intervention was CLABSI education, then Vantex catheters, then a central line insertion kit, and finally 2% chlorhexidine skin antiseptic used prior to line insertion. Each of these interventions built upon one another, except for the Vantex CVC which completely replaced the silver-chlorhexidine CVC.

### Results



### Conclusion

Vantex CVCs, among other interventions, were integral in the effort to reduce CLABSI rates in this institution.

# References

1. Darouiche RO. Device- Associated Infections: A Macroproblem that Starts with Microadherence. *Clinical Infectious Disease*. 2001;33:1567-1572.
2. Zimlichman E, Henderson D, Tamir O et al. Health care- associated infections: A meta-analysis of costs and financial impact on the US health care system. *JAMA Intern Med*. 2013;173(22):2039-2046.
3. Marsteller JA, Sexton JB, Hsu Y et al. A multicenter, phased, cluster-randomized controlled trial to reduce central line-associated bloodstream infections in intensive care units. *Crit Care Med*. 2012;40(11):2933-2939.
4. Pronovost P, Needham D, Berenholtz S et al. An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU. *The New England Journal of Medicine*. 2006;355(26):2725-2732.
5. Center for Disease Control and Prevention. Reduction in Central Line–Associated Bloodstream Infections among Patients in Intensive Care Units — Pennsylvania, April 2001–March 2005. 2005;54(40):1013-1016.
6. Drews FA, Bakdash JZ. Improving central line maintenance to reduce central line-associated bloodstream infections. *American Journal of Infection Control*. 2017;45:1224-1230.
7. Cherry-Bukowiec J, Denchev K, Dickinson S et al. Prevention of Catheter-Related Blood Stream Infection: Back to Basics? *Surgical Infections*. 2011;12(1):27-32.
8. Sacks GD, Diggs BS. Reducing the rate of catheter-associated infections in a surgical intensive care unit using the institute for healthcare improvement central line bundle. *The American Journal of Surgery*. 2014;207:817-823.
9. Corral L, Ibanez-Nolla J, Leon M et al. A prospective, randomized study in critically ill patients using the Oligon Vantex catheter. *J of Hosp Infection*. 2003;55:212-219.
10. Moretti E, Ofstead C. Impact of central venous catheter type and methods on catheter-related colonization and bacteraemia. *J of Hosp Infection*. 2005;61:139-145.
11. Fraenkel D, Rickard C, Thomas P et al. A prospective, randomized trial of rifampicin-minocycline-coated and silver-platinum-carbon-impregnated central venous catheters. *Crit Care Med*. Article in Press. 2006;34(3):668-675.
12. Ranucci M, Isgro G, Giomarelli P et al. Impact of oligon central venous catheters on catheter colonization and catheter-related blood stream infection. *Crit Care Med*. 2003;31(1):52-59.
13. Garcia R, Jendresky L, Landesman S et al. Three years experience in implementing HICPAC recommendations for the reduction of central venous catheter-related bloodstream infections. *Management of Infection Control*. 2003;10:42-49.
14. Russel AD, Path FR. Antimicrobial Activity and Action of Silver. In: *Progress in Medicinal Chemistry*. Volume 31. Elsevier Science B.V. 1994:351-365.
15. Ansari MA, Khan AA. Anti-biofilm efficacy of silver nanoparticles against MRSA and MRSE isolated from wounds in a tertiary care hospital. *Indian Journal of Medical Microbiology*. 2015;33(1):101-109.
16. Nanda A, Saravan M. Biosynthesis of silver nanoparticles from *Staphylococcus aureus* and its antimicrobial activity against MRSA and MRSE. *Nanomed Journal*. 2009;5:452-456.
17. Saravanan M, Nanda A. Extracellular synthesis of silver bionanoparticles from *Aspergillus clavatus* and its antimicrobial activity against MRSA and MRSE. *Colloids and Surfaces*. 2010;77:214-218.
18. Zell B, Goldmann D. Healthcare-Associated Infection and Antimicrobial Resistance: Moving Beyond Description to Prevention. *Infect Control Hosp Epidemiol*. 2007;28:261-264.
19. Rupp M, Lisco S, Lipsett P et al. Effect of a Second-Generation Venous Catheter Impregnated with Chlorhexidine and Silver Sulfadiazine on Central Catheter–Related Infections. *Annals of Internal Medicine*. 2005;143:570-580.



**Medline Industries, Inc.** Three Lakes Drive, Northfield, IL 60093

**Medline United States**  
**1-800-MEDLINE (633-5463)**  
medline.com | info@medline.com

**Medline Canada**  
**1-800-396-6996**  
medline.ca | canada@medline.com

**Medline México**  
**01-800-831-0898**  
medlinemexico.com | mexico@medline.com

FOLLOW US    