



3M™ Curoc™ Disinfecting Port Protectors

# Clinical evidence summary

# Table of contents

Outcomes key	
	Infection and/or contaminated blood cultures
	Compliance and/or patient/staff satisfaction
	Staff time and/or length of stay
	Cost

## Peer reviewed

### Effectiveness of disinfecting caps for intravenous access points in reducing central line-associated bloodstream infections, clinical utilisation and cost of care during COVID-19.

Hou Y, Griffin LP, Ertmer K, Bernatchez SF, Kärpänen TJ, Palka-Santini M.  
*Clinicoecon Outcomes Res.* 2023;15:477–486.










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Population: Hospital wide

### Antiseptic barrier caps to prevent central line-associated bloodstream infections: A systematic review and meta-analysis.

Gillis, Veerle ELM, *et al.* *American Journal of Infection Control.* 2023;51.7:827–835.










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Population: Multiple specialties

### Antiseptic barrier caps in central line-associated bloodstream infections: A systematic review and meta-analysis.

Tejada, Sofia, *et al.* *European Journal of Internal Medicine.* 2022;99:70–81.










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Population: Multiple specialties

### Antiseptic barrier cap effective in reducing central line-associated bloodstream infections: A systematic review and meta-analysis.

Voor in 't holt AF, Helder OK, Vos MC, *et al.* *Int J Nurs Stud.* 2017;69:34–40.

10

Population: Multiple specialties

### Disinfection of vascular catheter connectors that are protected by antiseptic caps is unnecessary.

Fillman KM, Ryder JH, Brailita DM, *et al.* *Infect Control Hosp Epidemiol.* Published online 2023:1–5. doi:10.1017/ice.2023.148.




11

Population: Intensive care & acute care

### A bundled approach to decrease the rate of primary bloodstream infections related to peripheral intravenous catheters.

Duncan M, Warden P, Bernatchez S, Morse D. *J Assoc Vasc Access.* 2018;23(1):15–22.







12

Population: Hospital wide

### Strategies for the successful implementation of disinfecting port protectors to reduce CLABSI in a large tertiary care teaching hospital.

Beeler C, Kerley D, Davis C, *et al.* *Am J Infect Control.* 2019;47(12):1505–1507. doi:10.1016/j.ajic.2019.05.016


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Population: Hospital wide

# Table of contents, continued

Outcomes key	
	Infection and/or contaminated blood cultures
	Compliance and/or patient/staff satisfaction
	Staff time and/or length of stay
	Cost

## Peer reviewed

### Educational interventions alone and combined with port protector reduce the rate of central venous catheter infection and colonisation in respiratory semi-intensive care unit.

Inchingolo R, Pasciuto G, Magnini D, et al. *BMC Infect Dis.* 2019;19(1):215.







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Population: Respiratory semi-intensive care

### Impact of universal disinfectant cap implementation on central line-associated bloodstream infections.

Merrill KC, Sumner S, Linford L, Taylor C, Macintosh C. *Am J Infect Control.* 2014;42:1274-1277.

15

Population: Multiple specialties

### Use of alcohol containing caps for preventing bloodstream infections: A randomised controlled trial.

Taşdelen Ögülmen D, Ateş S. *J Vasc Access.* 2021 Nov;22(6):920-925. doi:10.1177/1129729820952961.







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Population: Intensive care

### Port protectors in clinical practice: an audit.

Cameron-Watson C. *Br J Nurs.* 2016;25(8):S25-S31.


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Population: Multiple specialties

### Central venous catheter protective connector caps reduce intraluminal catheter-related infection.

Ramirez C, Lee AM, Welch K. *J Assoc Vasc Access.* 2012;17(4):210-213.







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Population: Intensive care

### Use of a central catheter maintenance bundle in long-term acute care hospitals.

Grigonis AM, Dawson AM, Burkett M, et al. *Am J Crit Care.* 2016;25(2):165-172.

19

Population: Long term acute care

### Impact of alcohol-impregnated port protectors and needleless neutral pressure connectors on central line-associated bloodstream infections and contamination of blood cultures in an inpatient oncology unit.

Sweet MA, Cumpston A, Briggs F, Craig M, Hamadani M. *Am J Infect Control.* 2012;40(10):931-934.




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Population: Hematology & oncology



# Table of contents, continued

Outcomes key	
	Infection and/or contaminated blood cultures
	Compliance and/or patient/staff satisfaction
	Staff time and/or length of stay
	Cost

## Peer reviewed

### Efforts of a unit practice council to implement practice change utilizing alcohol impregnated port protectors in a burn ICU.

Martino A, Thompson L, Mitchell C, *et al. Burns.* 2017;43(5):956–964.




21

Population: Burn intensive care

### Reaching one peripheral intravenous catheter (PIVC) per patient visit with lean multimodal strategy: the PIV5Rights™ Bundle.

Steere L, Ficara C, Davis M, Moureau N. *J Assoc Vasc Access.* 2019;24(3):31–43. doi:10.2309/j.java.2019.003.004.




22

Population: Intensive care

### A quality improvement study on the reduction of central venous catheter-associated bloodstream infections by use of self-disinfecting venous access caps (STERILE).

Cruz-Aguilar R, Carney J, Mondaini V, *et al. Am J Infect Control.* 2021;49(5):586–592. doi:10.1016/j.ajic.2020.09.002.




23

Population: Hematology & oncology

### Reducing central line-associated bloodstream infections on inpatient oncology units using peer review.

Zavotsky KE, Malast T, Festus O, Riskie V. *Clin J Oncol Nurs.* 2015;19(6):655–658. doi:10.1188/15.CJON.655–658.



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Population: Oncology

### Alcohol-impregnated caps and ambulatory central line-associated bloodstream infections (CLABSIs): A randomised clinical trial.

Milstone AM, Rosenberg C, Yenokyan G, Koontz DW, Miller MR, CCLIP Authorship Group. *Infect Control Hosp Epidemiol.* 2021;42(4):431–439. doi:10.1017/ice.2020.467.




25

Population: Pediatric oncology & hematology

### Microbial colonisation of intravascular catheter connectors in hospitalised patients.


Hankins R, Majorant OD, Rupp ME, *et al. Am J Infect Control.* 2019;47(12):1489–1492. doi:10.1016/j.ajic.2019.05.024 .



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Population: Intensive care

# Table of contents, continued

Outcomes key	
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	Staff time and/or length of stay
	Cost

## Abstracts

### Successful decrease of central line-associated bloodstream infections in an urban neonatal intensive care unit using a pediatric-specific interdisciplinary approach.

Karam-Howlin R, Fede A, Gibbs K, Bravo N, Wallach F, Patel G. *Am J Infect Control*. 2015;43(6):S58.



Population: Neonatal intensive care

### Alcohol-impregnated disinfectant caps reduce the rate of central-line associated bloodstream infections and nosocomial bacteremia.

Shelly M, Greene L, Brown L, Romig S, Pettis AM. *Open Forum Infect Dis*. 2014 Dec;1(Suppl 1):S248. doi:10.1093/ofid/ofu052.570.



Population: Multiple specialties

### Decreasing the incidence of central line-associated blood stream infections using alcohol-impregnated port protectors (AIPPS) in a neonatal intensive care unit.

Danielson B, Williamson S, Kaur G, Brooks C, Scholl P, Baker A. *Am J Infect Control*. 2013;41(6):S97–S98.



Population: Neonatal intensive care

### Decreasing CLABSI rates and cost following implementation of a disinfectant cap in a tertiary care hospital.

Sumner S, Merrill KC, Linford L, Taylor C. *Am J Infect Control*. 2013;41(6):S37.



Population: Hospital wide

### Impact of alcohol-impregnated protectors on incidence of catheter-associated blood stream infections.

Mayfield J, Alasmari F, Kittur ND, *et al*. Presented at: IDWeek annual meeting; October 18, 2012; San Diego, CA.



Population: Oncology and stem cell transplant

# Table of contents, continued

Outcomes key	
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	Compliance and/or patient/staff satisfaction
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	Cost

## Abstracts

### PTH-195 Curores™ line caps are effective in reducing catheter related sepsis in inpatients receiving parenteral nutrition.

Wheatley DJ, Rowlands S, Chapman J, *et al.* *Gut*. 2015;64(Suppl 1):A495.1–A495. doi:10.1136/gutjnl-2015-309861.1083



32

Population: Inpatient parenteral nutrition

### 863 reduction in CLABSI with alcohol port protectors.

Russo N, Gupta K, Tibert C, Strymish J. *Open Forum Infect Dis*. 2014;1(Suppl-1):S248. doi:10.1093/ofid/ofu052.571.





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Population: Multiple specialties

## Posters

### Impact of disinfectant cap implementation on peripherally-inserted central catheter (PICC) associated bloodstream infection rates.

Cabahug T, Jie L, Meng QS, Tang M, Wang Y, Foo SY, Wu T. Poster presented at: APSIC Congress. 2019; Vietnam. Abstract available at: [https://www.researchgate.net/publication/333679803\\_Impact\\_of\\_disinfectant\\_cap\\_implementation\\_on\\_peripherally-inserted\\_central\\_catheter\\_PICC\\_associated\\_bloodstream\\_infection\\_rates](https://www.researchgate.net/publication/333679803_Impact_of_disinfectant_cap_implementation_on_peripherally-inserted_central_catheter_PICC_associated_bloodstream_infection_rates)


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Population: General units

## Short communication

### Antiseptic cap protects stopcocks from internal bacterial contamination.

Guyot A, Lorf S, van Stein C, Hüniger F, Schaaf B. *J Hosp Infect*. 2021 Feb;108:212–214. doi:10.1016/j.jhin.2020.11.026.

35

Population: Intensive care

## Additional resources

### Abstracts/Articles/Dissertations

36-37

# The use of 3M™ Curo™ Disinfecting Port Protectors has proven highly effective in mitigating contamination risk, especially where the healthcare system is under significant strain or overloaded

Yuefeng Hou *et al.*, “Effectiveness of Disinfecting Caps for Intravenous Access Points in Reducing Central Line-Associated Bloodstream Infections, Clinical Utilisation and Cost of Care During COVID-19,” *ClinicoEconomics and Outcomes Research* Volume 15 (June 2023): 477–86, <https://doi.org/10.2147/ceor.s404823>.

## Design

This retrospective review of data from Premier Healthcare Database focuses on 200,411 hospitalisations involving central venous catheters between January 2020 and September 2020 – a period characterised by significant strain due to the COVID-19 pandemic.

## Methods

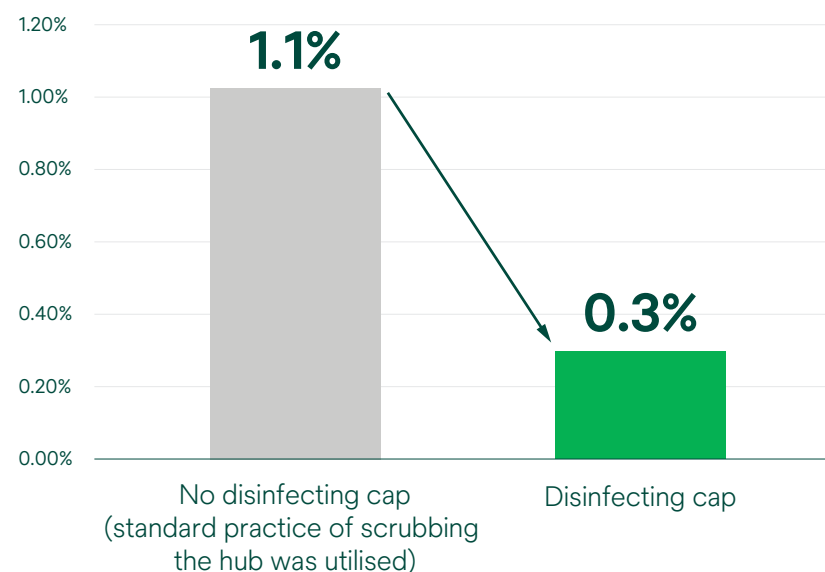
7,423 patients received a 3M™ Curo™ Disinfecting Port Protector, while 192,988 patients did not receive any disinfecting caps and the standard practice of scrubbing the hub was used instead.



## Results

### Central line-associated bloodstream infection (CLABSI) rate

73% decrease in CLABSI rates ( $p=0.0013$ )



The use of Curo Disinfecting Port Protectors for reduction in the incidence of CLABSI has not been reviewed by the U.S. FDA.

There were

**73% fewer**

incidences of CLABSI

The disinfecting cap group exhibited a

**0.5 day**

reduction in hospital stay

The disinfecting cap group cost

**\$6,703 USD less**

per hospital stay

# “Antiseptic barrier caps are safe, highly-appreciated by healthcare workers for their ease of use, are timesaving in clinical practice and there are no disadvantages with their use.”

Veerle E.L.M. Gillis *et al.*, “Antiseptic Barrier Caps to Prevent Central Line-associated Bloodstream Infections: A Systematic Review and Meta-analysis,” *American Journal of Infection Control* 51, no. 7 (July 2023): 827–35, <https://doi.org/10.1016/j.ajic.2022.09.005>.

## Design

Systematic review and meta-analysis.

## Methods

The primary outcome of this study was the rate of CLABSI per 1,000 catheter days in patients using 3M™ Curo™ Disinfecting Port Protectors and SwabCap® Disinfecting Caps to manual disinfection. Secondary outcomes included safety, compliance and costs of antiseptic barrier caps.

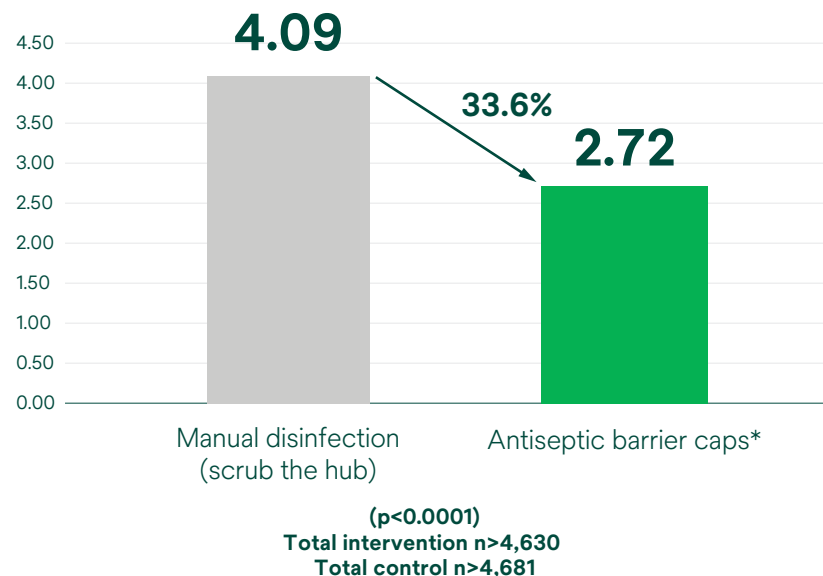
\*\*Calculation was based on data presented in Table 1 and Figure 3 – the relative change between was calculated as:  $(\text{Intervention Rate} - \text{Control Rate}) / (\text{Control Rate})$  where Intervention Rate and Control Rate are the weighted average CLABSI rates.

The use of Curo™ Disinfecting Port Protectors for reduction in the incidence of CLABSI has not been reviewed by the U.S. FDA.



## Results

### Relative CLABSI incidence per 1,000 catheter days\*\*



Sixteen studies were included in the systematic review and fifteen studies were included in the meta-analysis.

\*Curo™ Disinfecting Port Protectors and SwabCap Disinfecting Caps

The risk of a CLABSI was found to be

**41%**

lower with the use of 3M™ Curo™ Disinfecting Port Protectors p<0.0001

There was an **increase in compliance, ease of use and simple monitoring** because of the green-coloured antiseptic barrier caps

The average cost of savings was

**\$41,000 USD**

per 1,000 catheter days



# “Antiseptic barrier cap use appears to be effective and delivers cost savings”

Sofia Tejada *et al.*, “Antiseptic Barrier Caps in Central Line-associated Bloodstream Infections: A Systematic Review and Meta-analysis,” *European Journal of Internal Medicine* 99 (May 2022): 70–81, <https://doi.org/10.1016/j.ejim.2022.01.040>.

## Design

This is a systematic review and meta-analysis.

## Methods

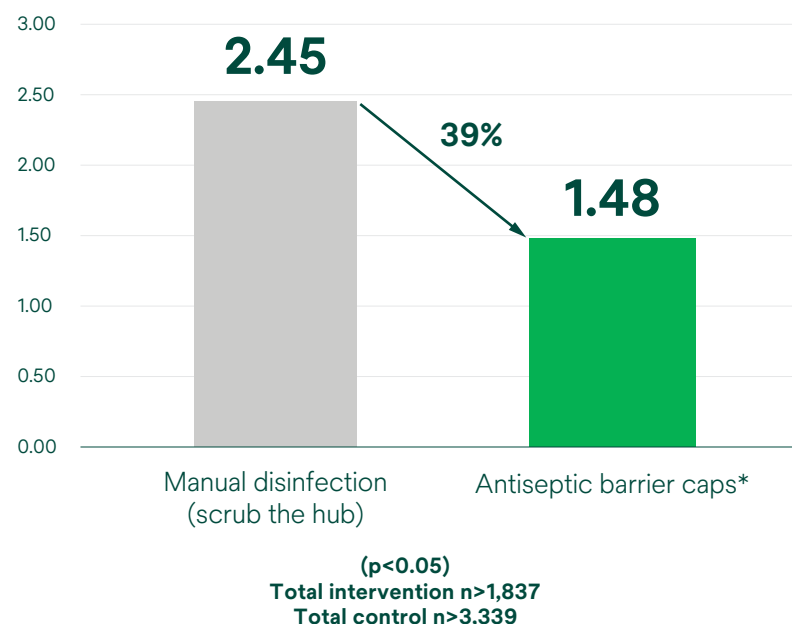
The observational studies and randomised controlled trials (RCTs) on hospitalised patients of any age compared 3M™ Curox™ Disinfecting Cap for Needleless Connectors and SwabCap® Disinfecting Caps to manual disinfection on the incidence of central line associated bloodstream infection (CLABSI) per 1,000 catheter days.

Additional outcomes were compliance with antiseptic cap use, total length of stay and reported economic differences.



## Results

### Central line-associated bloodstream infection (CLABSI) rate per 1,000 catheter days



14 studies were included in the systematic review and 9 within the meta-analysis.

\*Curox Disinfecting Port Protectors and SwabCap Disinfecting Caps

There are

**39% fewer**

incidences of CLABSI per 1,000 catheter days with the use of the antiseptic barrier cap\*\*

The median cost savings were

**\$21,890 USD**

per CLABSI

\*\*Calculation was based on data presented in Figure 3 – the relative change between was calculated as:  $(\text{Intervention Rate} - \text{Control Rate}) / (\text{Control Rate})$  where Intervention Rate and Control Rate are the weighted average CLABSI rates.

The use of Curox Disinfecting Port Protectors for reduction in the incidence of CLABSI has not been reviewed by the U.S. FDA.

# “...use of the antiseptic barrier cap can lower the occurrence of CLABSI and is cost saving”

Anne F. Voor in 't Holt *et al.*, “Antiseptic Barrier Cap Effective in Reducing Central Line-associated Bloodstream Infections: A Systematic Review and Meta-analysis,” *International Journal of Nursing Studies* 69 (April 2017): 34–40, <https://doi.org/10.1016/j.ijnurstu.2017.01.007>.

## Design

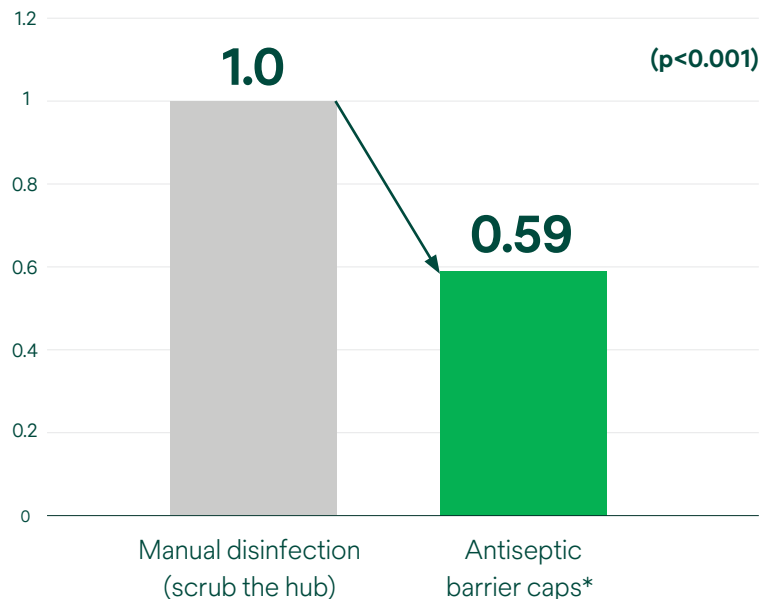
This is a systematic review and meta-analysis.

## Methods

These studies conducted in the hospital setting compared 3M™ Curob™ Disinfecting Cap for Needleless Connectors and SwabCap® Disinfecting Caps to manual disinfection on the incidence of central line associated bloodstream infection (CLABSI) per 1,000 catheter days.

## Results

### Relative pooled CLABSI incidence (per 1,000 catheter days)



Nine studies were included in the systematic review and seven studies were included in the meta-analysis.

\*Curob Disinfecting Cap for Needleless Connectors and SwabCap Disinfecting Caps.

There were

**41% fewer**

CLABSIs associated with use of the antiseptic barrier cap

(IRR = 0.59, 95% CI = 0.45-0.77  
 $p < 0.001$ )

The overall median rate of compliance with barrier =

**82.5%**

The net cost savings ranged from

**\$39,050–  
\$3,268,990**

**USD**

# “Use of an antiseptic-containing cap reduces the risk of catheter connector colonisation independent of an alcohol scrub”

Kelsey M. Fillman *et al.*, “Disinfection of Vascular Catheter Connectors That Are Protected by Antiseptic Caps Is Unnecessary,” *Infection Control and Hospital Epidemiology* 45, no. 1 (January 2024): 35–39, <https://doi.org/10.1017/ice.2023.148>.

## Design

This is a quality improvement study over five days that assesses whether vascular catheter disinfecting antiseptic-containing caps alone are effective at decreasing microbial colonisation compared to antiseptic-containing caps plus a 5-second alcohol manual disinfection.

## Methods

### Standard-of-care group

165 catheter connectors with 3M™ Curox Jet™ Disinfecting Cap for Needleless Connectors cleaned with a 5-second alcohol wipe scrub prior to culture were used.

### Comparison group

165 catheter connectors with 3M™ Curox Jet™ Disinfecting Cap for Needleless Connectors without a 5-second alcohol wipe scrub prior to culture were used.

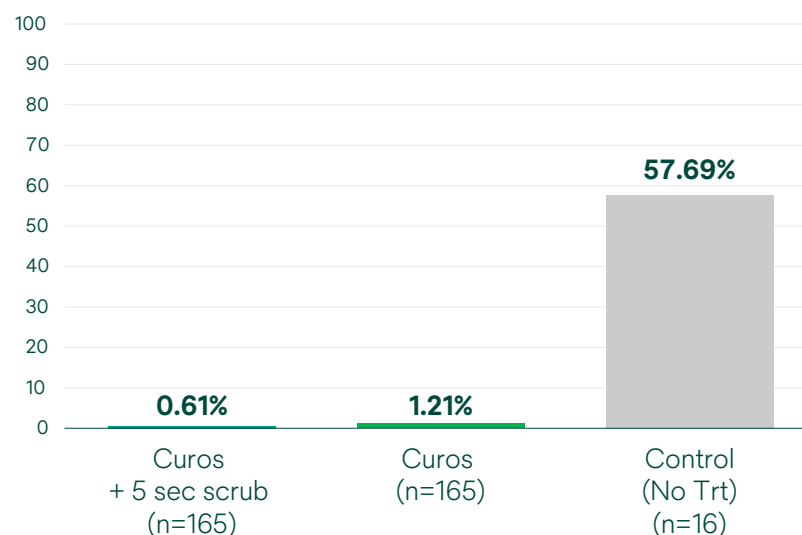
### Control group

26 catheter connectors without an antiseptic-containing cap were used.

## Results

### Colonisation of catheter connectors

(%)



( $p < 0.0001$ )

The authors concluded that the 5-second alcohol-wipe disinfection step is unnecessary when an antiseptic-containing cap is in place. The use of an antiseptic-containing cap helps reduce the risk of catheter connector colonisation independent of an alcohol scrub.

The contamination rates were statistically not different between the Standard-of-care Group and Comparison Group  $P = .0063$

# “Using a PIV maintenance bundle including disinfecting caps and tips can effectively lower the rate of primary bloodstream infections attributable to PIV lines”

Mary Duncan *et al.*, “A Bundled Approach to Decrease the Rate of Primary Bloodstream Infections Related to Peripheral Intravenous Catheters,” *Journal of the Association for Vascular Access* 23, no. 1 (March 2018): 15–22, <https://doi.org/10.1016/j.java.2017.07.004>.

## Design

Before and after intervention study comparing hospital wide peripheral line-associated bloodstream infections (PLABSI) and intervention compliance.

## Methods

**Pre-intervention:** Primary bloodstream infection and IV catheter data was collected.

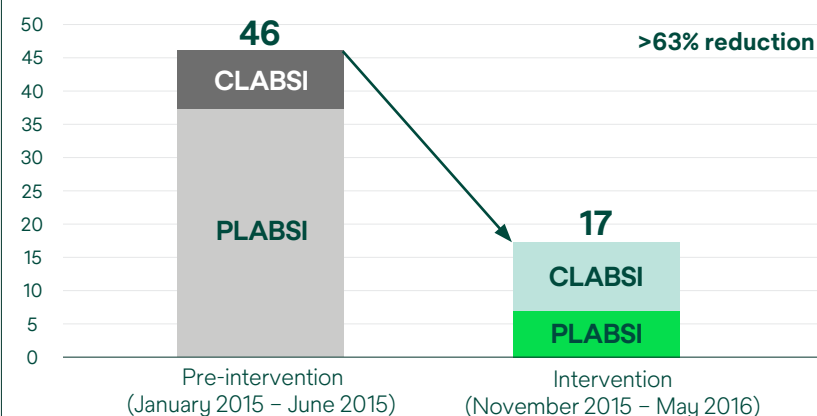
**Intervention:** A PIV bundle was implemented. 3M™ Curoc Tips™ Disinfecting Cap for Male Luers were added to the existing Central Line-Associated Bloodstream Infection (CLABSI) bundle for all disconnected IV tubing. Compliance was monitored for PIV and CLABSI bundles.

### PIV bundle elements:

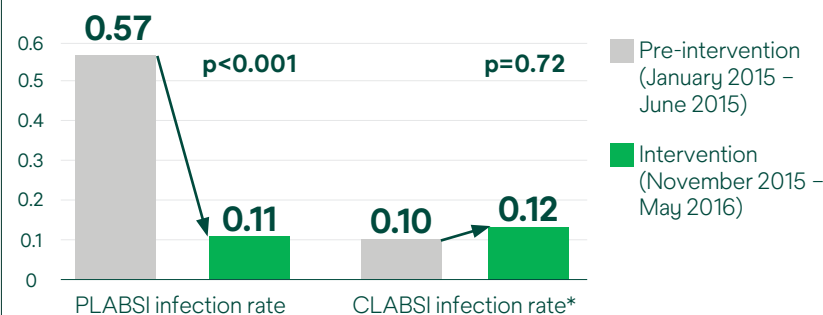
- Prohibit disconnecting IV tubing for convenience
- 3M™ Curoc™ Disinfecting Cap for Needleless Connectors on all ports for all patients
- 3M™ Curoc Tips™ Disinfecting Cap for Male Luers on all disconnected tubing
- Assessment of IV site, removing IV catheters with indication of phlebitis
- Assessment of dressing, changing if nonocclusive or blood is present

## Results

### # of primary bloodstream infections



### Average BSI rate for peripheral and central lines (per 1,000 patient days)



\*Because CLABSI bundle was implemented prior to study, no significant change to CLABSI rate was anticipated or observed during study time period.

Compliance with protecting all needless connectors was near

**90%**

Compliance with protecting male ends of disconnected IV tubing was near

**90%**

# “Inclusion of the alcohol impregnated disinfecting port protectors (AIDPP), as a component of the CLABSI bundle, hardwired adherence by audit accountability”

Cole Beeler *et al.*, “Strategies for the Successful Implementation of Disinfecting Port Protectors to Reduce CLABSI in a Large Tertiary Care Teaching Hospital,” *American Journal of Infection Control* 47, no. 12 (December 2019): 1505–7, <https://doi.org/10.1016/j.ajic.2019.05.016>.

## Design

This is a quasi-experimental study that compares hospital-wide central line-associated bloodstream infection (CLABSI) rates at a 1,009-bed tertiary hospital using an evidence-based, multidisciplinary approach.

## Methods

### Pre-intervention:

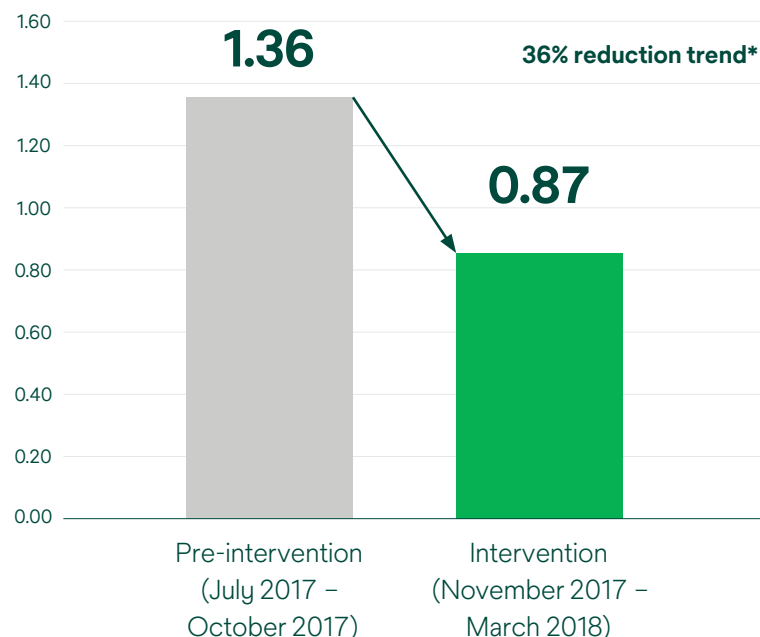
A standard central line bundle of care was used.

### Intervention:

- Standard central line bundle of care
- 3M™ Curo™ Disinfecting Port Protectors implementation plan
- Curo Disinfecting Port Protectors 21-Day Challenge
- 3M™ Curo Jet™ Disinfecting Cap for Needleless Connectors
- 3M™ Curo™ Stopper Disinfecting Cap for Open Female Luers
- 3M™ Curo Tips™ Disinfecting Cap for Male Luers

## Results

### CLABSIs (per 1,000 device days)



\*The authors did not statistically test if the reduction in CLABSI was significant between the periods.

There was a reduction of  
**1.36 to 0.87**

CLABSIs per 1,000 device days

A 21-day challenge was used to increase the adherence rate from

**67% to 94%**

There were potential savings of an adjusted

**\$1.6M USD**

in eight months, including the added cost of port protectors



# 3M™ Curoso™ Disinfecting Cap for Needleless Connectors combined with educational interventions led to zero rate of CLABSI

Riccardo Inchingolo *et al.*, “Educational Interventions Alone and Combined With Port Protector Reduce the Rate of Central Venous Catheter Infection and Colonisation in Respiratory Semi-intensive Care Unit,” *BMC Infectious Diseases* 19, no. 1 (March 2019), <https://doi.org/10.1186/s12879-019-3848-z>.

## Design

A prospective randomised study assessed the rate of CLABSI, central venous catheter (CVC) colonisations and contaminated blood cultures before and after the introduction of educational interventions – alone and combined with Curoso Disinfecting Cap for Needleless Connectors.

## Methods

### Pre-intervention:

Standard central line bundle of care (n=86).

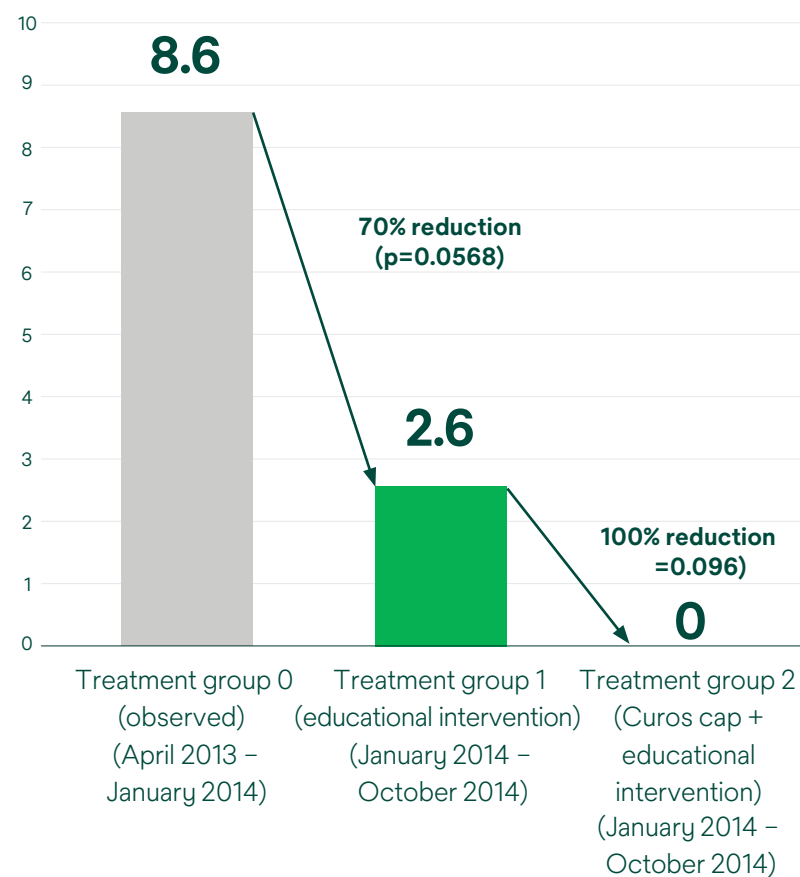
### Intervention:

Patients were randomised into two groups:

- Group 1: Educational intervention (n=25)
- Group 2: Curoso Disinfecting Cap for Needleless Connectors plus educational intervention (n=21)

## Results

### CLABSI rate (per 1,000 central line days)



Contaminated blood cultures decreased to

# ZERO

with Curoso Disinfecting Cap for Needleless Connectors plus educational interventions

There was a

# 67%

reduction of CVC colonisations with Curoso Disinfecting Cap for Needleless Connectors plus educational interventions

# “Disinfectant cap use was associated with an estimated savings of almost \$300,000 per year in the hospital studied”

Katreena Collette Merrill *et al.*, “Impact of Universal Disinfectant Cap Implementation on Central Line–associated Bloodstream Infections,” *American Journal of Infection Control* 42, no. 12 (December 2014): 1274–77, <https://doi.org/10.1016/j.ajic.2014.09.008>.

## Design

This is a before and after intervention study that compares CLABSI rates and estimated costs in patients (newborn to adult) with CVCs and PIVs from 13 units at a level 1 trauma center.

## Methods

### Pre-intervention:

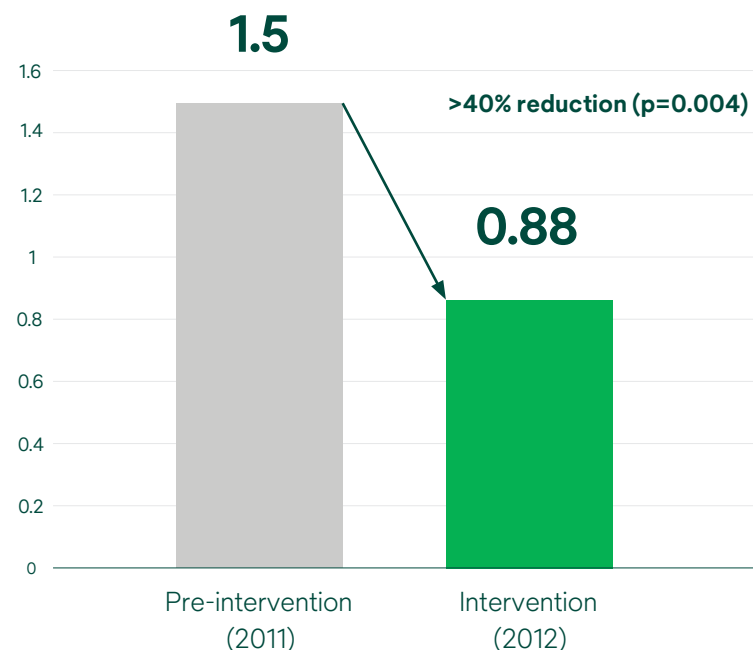
A standard central line bundle of care was used.

### Intervention:

3M™ Curores™ Disinfecting Cap for Needleless Connectors was placed on central, peripheral and IV tubing needleless connectors.

## Results

### Mean CLABSI rate (per 1,000 catheter days)



There was a

**10%**

increase in compliance associated with a

**7%**

drop in infection rates

There was an

estimated decrease of

**68**

patient hospital days after cap implementation

The estimated annual savings was

**\$282,840 USD**

# Alcohol containing caps were found to be a beneficial addition to a bundle helping to prevent CLABSI

Deniz Taşdelen Öğülmen and Sebahat Ateş, "Use of Alcohol Containing Caps for Preventing Bloodstream Infections: A Randomised Controlled Trial," *The Journal of Vascular Access* 22, no. 6 (November 2021): 920–25, <https://doi.org/10.1177/1129729820952961>.

## Design

This is a randomised controlled trial investigating the effect of disinfecting caps on CLABSI in ICU patients with jugular or subclavian catheters.

## Methods

There were 95 patients between July and December 2018 who met inclusion criteria in the study.

### CVC insertion:

2% chlorhexidine in IPA skin prep, gauze and/or chlorhexidine-impregnated dressing was used.

### Pre-intervention:

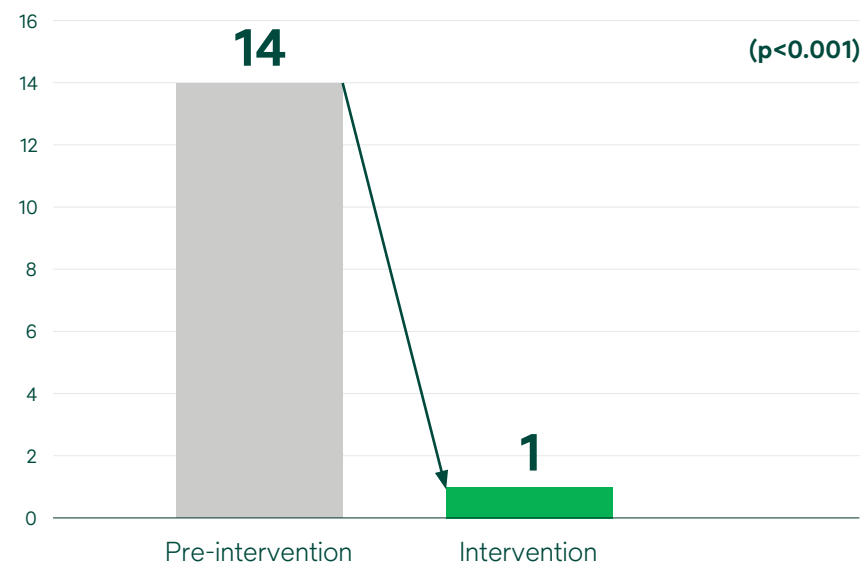
Sterile end caps and active disinfection with 70% IPA wipes were used (not explicitly state in the study, per author clarification).

### Intervention:

An addition of needleless connectors were covered with 3M™ Curosurf™ Disinfecting Cap for Needleless Connectors.

## Results

### Number of CLABSIs



Pre-intervention group (n=48)

Intervention group (n=47)

Infection risk in the pre-intervention group was

**13.7x**

higher than in the intervention group

There was a significant difference between groups regarding **fever (p<0.001)** and **chills distribution (p=0.016)**

# The number of vascular access device (VAD) related bacteraemias was reduced by 69% when compliance with Curoso™ cap placement was 80% or more

Corinne Cameron-Watson, "Port Protectors in Clinical Practice: An Audit," *British Journal of Nursing* 25, no. 8 (April 2016): S25–31, <https://doi.org/10.12968/bjon.2016.25.8.s25>.

## Design

This is a before and after intervention study comparing VAD related bacteraemia for CVCs, PIVs and arterial lines from four wards at two hospital sites.

## Methods

### Pre-intervention:

Scrub the hub using CHG/IPA wipes was used prior to IV access.

### Intervention:

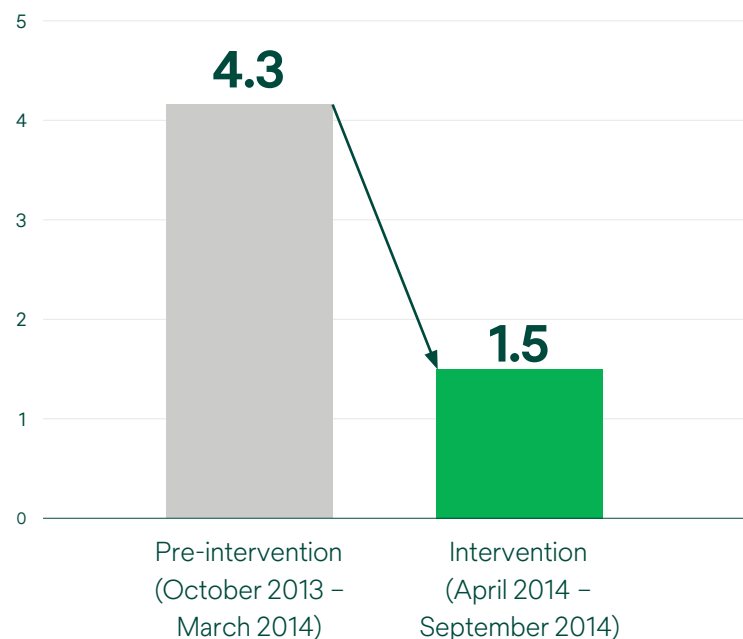
3M™ Curoso™ Disinfecting Cap for Needleless Connectors were placed on all needleless devices.

### Post intervention:

Scrub the hub protocol was resumed.

## Results

### Catheter-related bloodstream infections (per 1,000 line days)



Infection rates began to increase when scrub the hub was resumed in the post-intervention period (October 2014 – March 2015).

Compliance to protocol increased from

**27% to 80%**

during the intervention period. **100%** of staff surveyed preferred disinfecting caps.

**92%** of patients provided positive feedback.



The estimated potential time savings from passive disinfection compared to scrub the hub equated to

**82.4**

working days per year



The estimated cost savings with passive disinfection =

**£387,366.22**



# “The implementation of the port protector cap system resulted in lower infection rates compared with an alcohol swab technique”

Chuck Ramirez, Antonina M. Lee, and Ken Welch, “Central Venous Catheter Protective Connector Caps Reduce Intraluminal Catheter-Related Infection,” *Journal of the Association for Vascular Access* 17, no. 4 (December 2012): 210–13, <https://doi.org/10.1016/j.java.2012.10.002>.

## Design

This is a before and after intervention study comparing CLABSI rates in patients with CVCs from two ICUs.

## Methods

### Pre-intervention:

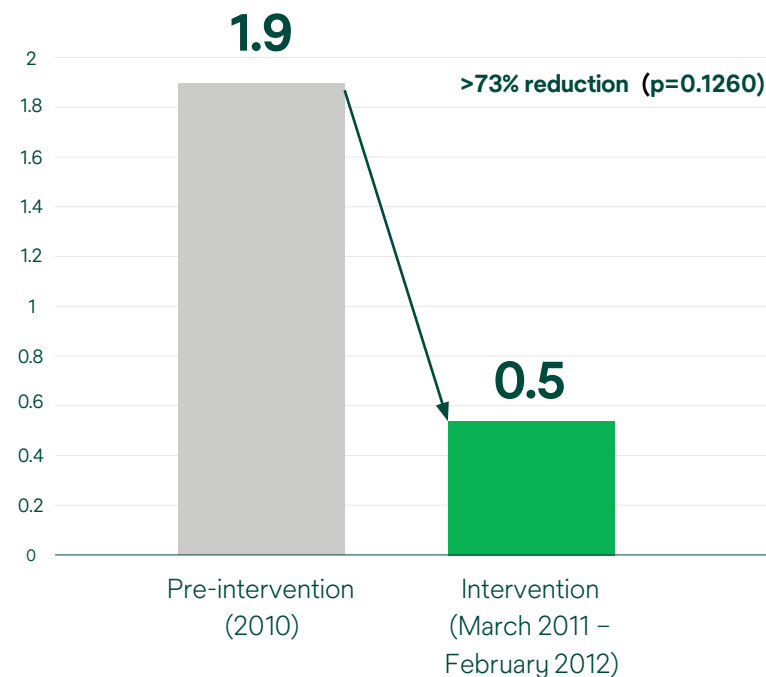
The scrub the hub protocol was used.

### Intervention:

The 3M™ Curox™ Disinfecting Cap for Needleless Connectors was placed on all CVC and IV tubing needleless connectors.

## Results

### CLABSI rate (per 1,000 catheter days)



Compliance increased from  
**63% to 80%**  
after moving from single caps  
to multiple cap strips to hang  
on IV pole for bedside access

The trial resulted in a  
calculated net savings of  
**\$39,050 USD**



# “Application of the bundle resulted in a significant and sustained reduction in CLABSI rates in long-term acute care hospitals (LTACHs) for 14 months”

Antony M. Grigonis *et al.*, “Use of a Central Catheter Maintenance Bundle in Long-Term Acute Care Hospitals,” *American Journal of Critical Care* 25, no. 2 (March 2016): 165–72, <https://doi.org/10.4037/ajcc2016894>.

## Design

This is a before and after intervention study comparing CLABSI in patients with CVCs from 30 LTACHs.

## Methods

### Pre-intervention:

There was no formal standardised CVC maintenance protocol in place.

### Intervention:

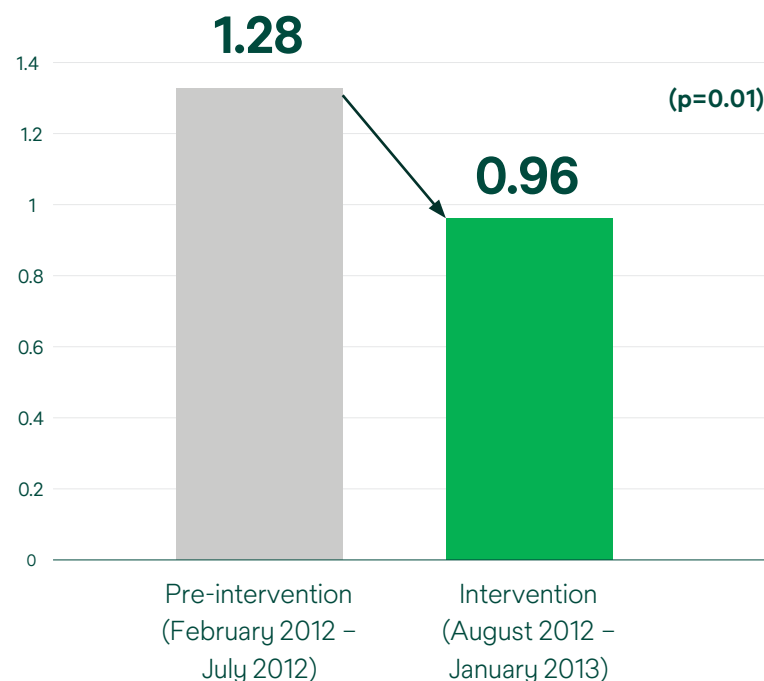
A CVC maintenance bundle and a care team trained on CVC care was implemented.

### CVC bundle:

- CDC guideline recommendations
- Mandatory use of 3M™ Curosur™ Disinfecting Cap for Needleless Connectors on all IV needleless connectors
- Chlorhexidine gluconate dressings

## Results

### CLABSI standardised infection ratio (SIR)



The number of central line days was 120,137 before and 119,412 after bundle implementation.

The study concluded that the mean number of CLABSIs per LTACH decreased by 4.5 in the 14 months after the intervention. The infection reduction could have potentially saved

**20**  
patients' lives.\*

\*assuming a 15% mortality rate

There was an estimated potential savings of approximately

**\$3.7 million USD**  
for the LTACHs studied

# Implementation of port protectors and needleless neutral pressure connectors was associated with a significant reduction in the rate of CLABSI and contaminated blood cultures (CBCs)

Michael A. Sweet *et al.*, "Impact of Alcohol-impregnated Port Protectors and Needleless Neutral Pressure Connectors on Central Line-associated Bloodstream Infections and Contamination of Blood Cultures in an Inpatient Oncology Unit," *American Journal of Infection Control* 40, no. 10 (December 2012): 931–34, <https://doi.org/10.1016/j.ajic.2012.01.025>.

## Design

This is a before and after intervention study comparing CLABSI and CBC rates in adult hematology and oncology patients with CVCs.

## Methods

### Pre-intervention:

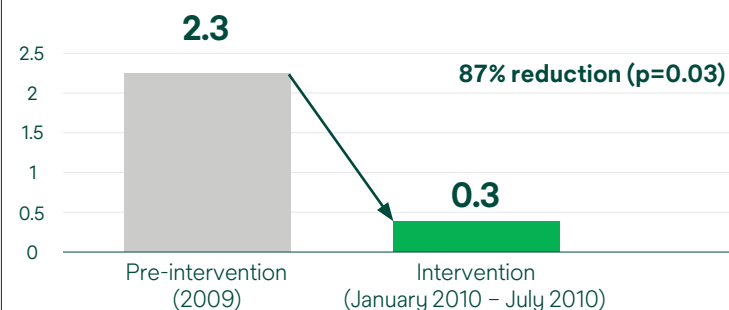
The scrub the hub protocol was used.

### Intervention:

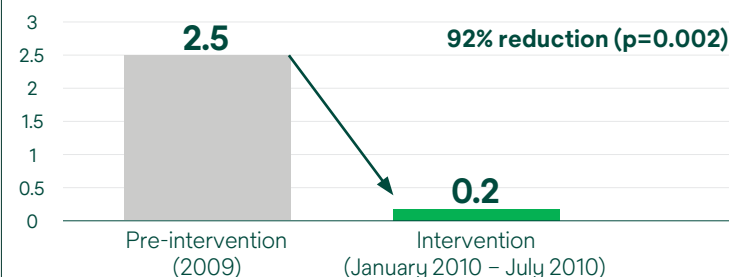
The needleless neutral pressure connectors and 3M™ Curoc™ Disinfecting Cap for Needleless Connectors were used.

## Results

### CLABSI rate (per 1,000 catheter days)



### CBC rate (‰)



The number of central line days was 6,851 in the pre-intervention and 3,005 in the intervention period.

The compliance to the intervention =  
**85.2%**



# “Following implementation of the caps, the rates of CLABSI within the burn ICU were significantly reduced...”

Amy Martino *et al.*, “Efforts of a Unit Practice Council to Implement Practice Change Utilizing Alcohol Impregnated Port Protectors in a Burn ICU,” *Burns* 43, no. 5 (August 2017): 956–64, <https://doi.org/10.1016/j.burns.2017.01.010>.

## Background

Despite > 90% compliance to the CVC bundle, the CLABSI rate in the burn ICU was higher than the benchmark.

## Design

This prospective before and after intervention study compares CLABSI rates in burn patients with CVCs.

## Methods

### Pre-intervention:

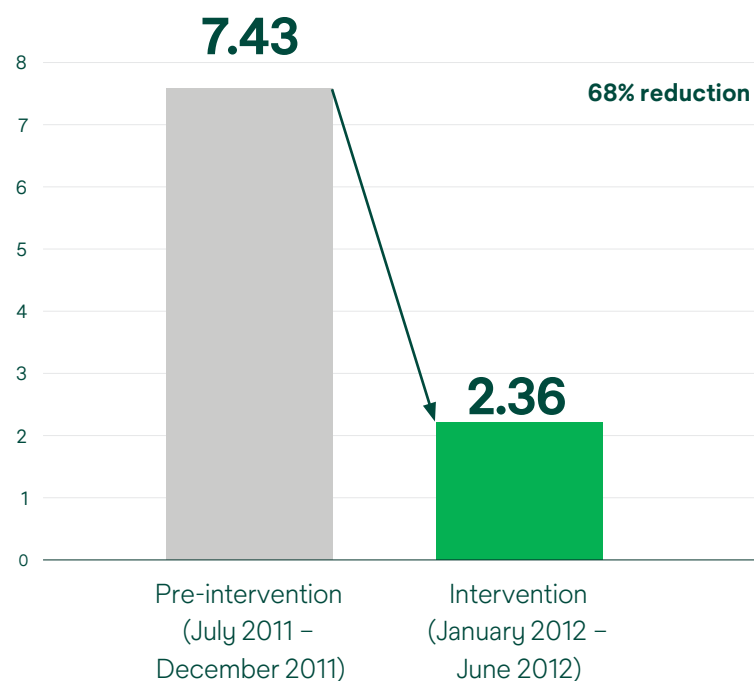
The CDC recommended the CVC bundle and scrub the hub protocol.

### Intervention:

The 3M™ Curosur™ Disinfecting Cap for Needleless Connectors were added to the CVC bundle as a standard of care January 2012.

## Results

### CLABSI rate (per 1,000 central line days)



“... ease of use with the caps simplified daily tasks, leading to higher compliance.”

The number of central line days was 673 in the pre-intervention and 1,272 in the intervention period.

# “Reducing the number of IV attempts and extending the functionality of a PIVC without complications are keys to reducing waste, improving efficiency, and increasing patient satisfaction of services”

Lee Steere et al., “Reaching One Peripheral Intravenous Catheter (PIVC) per Patient Visit With Lean Multimodal Strategy: The PIV5Rights™ Bundle,” *Journal of the Association for Vascular Access* 24, no. 3 (September 2019): 31–43, <https://doi.org/10.2309/j.java.2019.003.004>.

## Design

A prospective comparator single-center study compared peripheral intravenous catheter (PIVC) outcomes and dwell time in adult patients in a medical surgical unit.

## Methods

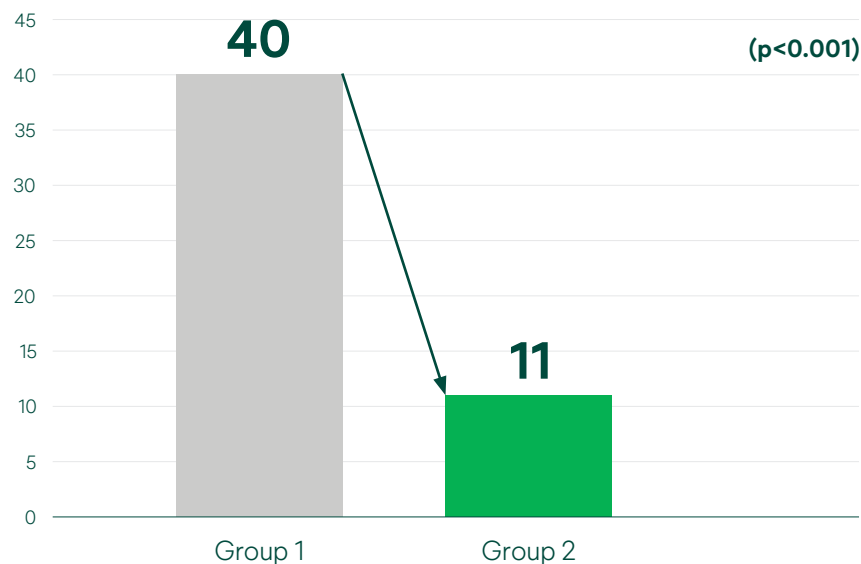
**Control (Group 1):** Staff nurses inserted PIVCs without an ultrasound. There was also variability in placement location and supplies and technology, including neutral needleless connectors.

**Intervention (Group 2):** Infusion team nurses inserted PIVCs using an ultrasound as needed. The preferred insertion site was in forearm, and supplies and technology included:

- IV kit
- CHG/alcohol skin prep
- 22g catheter
- Anti-reflux needleless connector
- Antimicrobial bordered securement dressing
- 3M™ Curores™ Disinfecting Cap for Needleless Connectors and 3M™ Curores Jet™ Disinfecting Cap for Needleless Connectors

## Results

### Complication rate (%)



Group 1: 94 PIVCs  
Group 2: 113 PIVCs

## 89%

of Group 2 PIVCs reached end of treatment, while only

## 15%

reached end of treatment in Group 1 (p<0.001)

Group 2 had an average daily increased dwell time of

## 66.7%

(more than twice as long as Group 1 dwell times) (p<0.001)

Group 2 had a

## 71% reduction in cost

per bed per year, or \$3,376 USD per bed savings

# Introduction of 70% alcohol-impregnated antiseptic barrier catheter caps (ABCs) led to a non-statistically significant decrease in CLABSI incidence rates in a high-risk hematology and oncology population

Rebeca Cruz-Aguilar *et al.*, "A Quality Improvement Study on the Reduction of Central Venous Catheter-associated Bloodstream Infections by Use of Self-disinfecting Venous Access Caps (STERILE)," *American Journal of Infection Control* 49, no. 5 (May 2021): 586–92, <https://doi.org/10.1016/j.ajic.2020.09.002>.

## Design

This is a before and after single center intervention study that compares CLABSI rates in high-risk hematology and oncology patients with jugular, femoral or subclavian central venous catheters (CVCs).

## Methods

### Control:

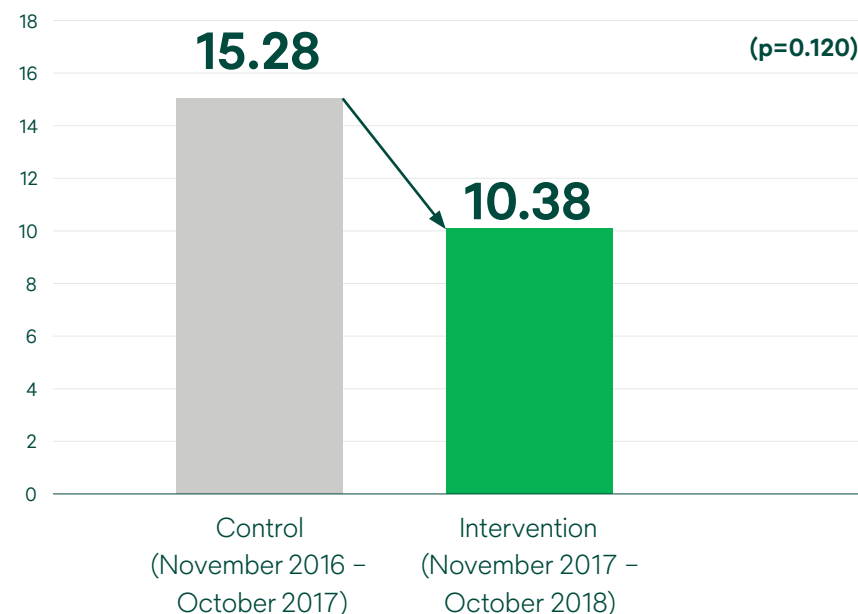
Standard catheter caps were used.

### Intervention:

A 3M™ Curo™ Stopper Disinfecting Cap for Open Female Luers was placed on all CVC catheter hubs.

## Results

### CLABSI rate (per 1,000 catheter days)



The pre-intervention group had 309 patients with 443 catheters (4,189 catheter days) and the intervention group had 289 patients with 431 catheter placements (4,818 catheter days)

A decrease in CLABSI rate was demonstrated; however, in the Cox proportional hazard model the effect of ABCs on the CLABSI incidence was not statistically significant



# “The data show overall reduction in CLABSI, improvements in patient outcomes, and increased staff satisfaction”

Kathleen Evanovich Zavotsky *et al.*, “Reducing Central Line–Associated Bloodstream Infections on Inpatient Oncology Units Using Peer Review,” *Clinical Journal of Oncology Nursing* 19, no. 6 (December 2015): 655–58, <https://doi.org/10.1188/15.cjon.655-658>.

## Background

The CLABSI rate in the Oncology Service was rising and prompted a performance improvement strategy and interventions.

## Methods

### Pre-intervention:

A standard central line bundle of care was used.

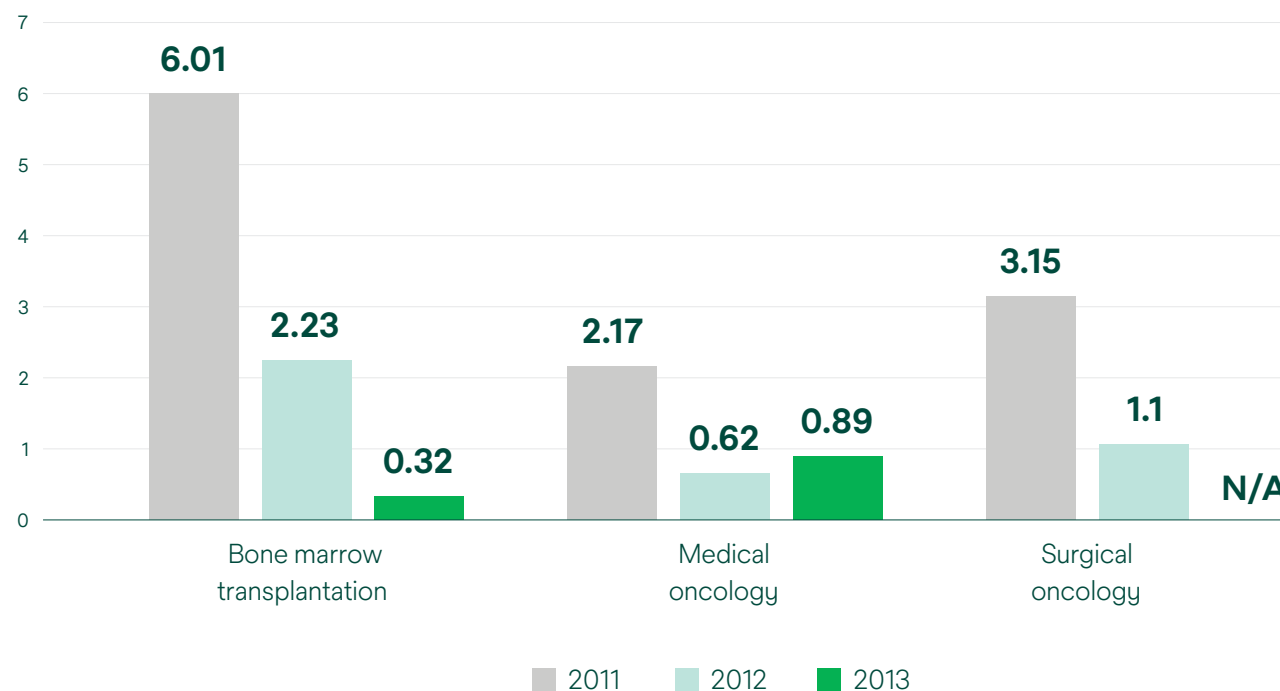
### Intervention:

- Staff education related to standards of insertion, dressing changes and maintenance
- Use of 3M™ Curosur™ Disinfecting Cap for Needleless Connectors on all CVC needleless connectors
- Oncology central line management checklist
- Peer-to-peer program



## Results

### CLABSI rate (per 1,000 patient days)



# Use of isopropyl alcohol-impregnated caps, as part of a care bundle, led to a statistically significant reduction in positive blood cultures in a per protocol analysis

Aaron M. Milstone *et al.*, "Alcohol-impregnated Caps and Ambulatory Central-line-associated Bloodstream Infections (CLABSI): A Randomised Clinical Trial," *Infection Control and Hospital Epidemiology* 42, no. 4 (April 2021): 431–39, <https://doi.org/10.1017/ice.2020.467>.

## Design

This was a 24-month, cluster-randomised, two period, crossover trial that compared ambulatory CLABSI rates at 16 pediatric hematology-oncology clinics.

## Methods

### Control:

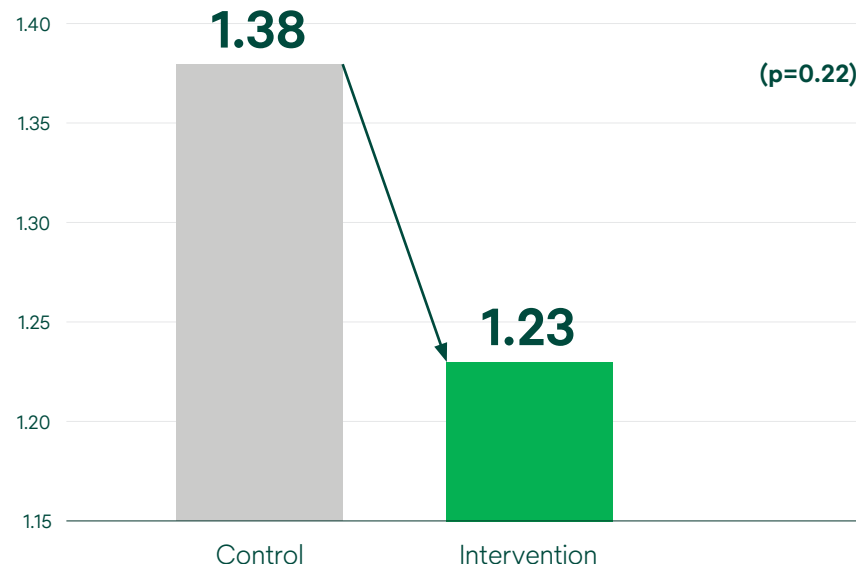
A standard central-line maintenance care bundle per institutional policy was used.

### Intervention:

A 3M™ Curosurf™ Disinfecting Cap for Needleless Connectors was placed on all external central line needleless connectors (Hickman, Broviac, central PICC, or non tunneled central lines).

## Results

### CLABSI rate (per 1,000 at-risk days)



123 CLABSI events occurred in control clinics.

109 CLABSI events occurred in intervention clinics.

In the per protocol analysis, the incidence of positive blood cultures decreased by

**28%**

(p=0.045)

# Switching from a split septum IV connector to a luer lock connector and passive alcohol disinfecting cap reduced colonisation rates

Richard Hankins *et al.*, "Microbial Colonisation of Intravascular Catheter Connectors in Hospitalised Patients," *American Journal of Infection Control* 47, no. 12 (December 2019): 1489–92, <https://doi.org/10.1016/j.ajic.2019.05.024>.

## Design

This is a prospective, two phase, quality improvement study to assess colonisation of catheter connector systems in adult patients receiving active infusions through peripheral or central catheters.

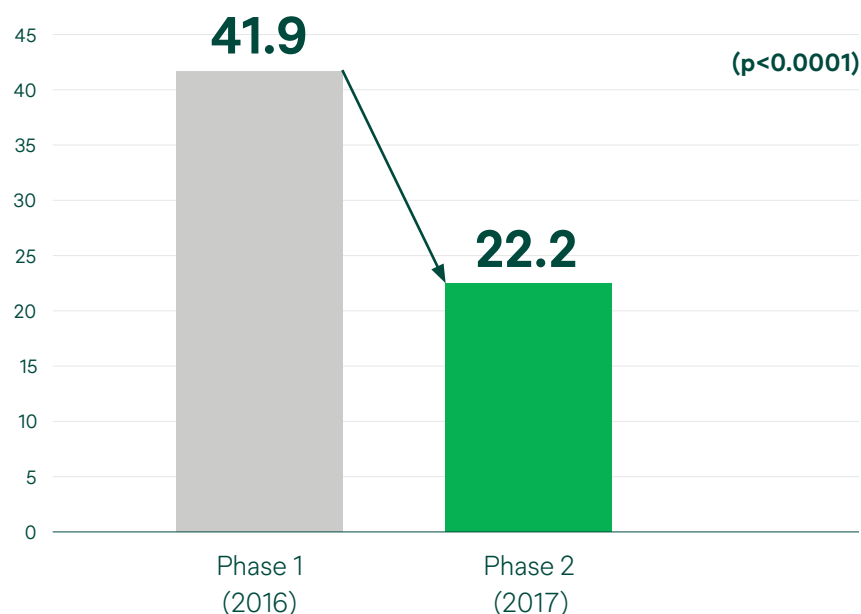
## Methods

### Intervention:

- Phase 1: Split septum IV connector
- Phase 2: Luer lock needleless connector with 3M™ Curoc™ Disinfecting Cap for Needleless Connectors

## Results

### Catheter colonization (%)



Phase 1: There was a total of 234 catheter connectors cultured, of which 98 were colonised.

Phase 2: There were a total of 243 catheter connectors cultured, of which 54 were colonised.

# Post intervention CLABSI rate improved from 5.2 to 0.4 per 1,000 line days in 2014 ( $p<0.05$ )

Ramona Karam-Howlin et al., "Successful Decrease of Central Line Associated Bloodstream Infections in an Urban Neonatal Intensive Care Unit Using a Pediatric-specific Interdisciplinary Approach," *American Journal of Infection Control* 43, no. 6 (June 2015): S58, <https://doi.org/10.1016/j.ajic.2015.04.143>.

## Design

This is a before and after intervention study that compares CLABSI in NICU patients.

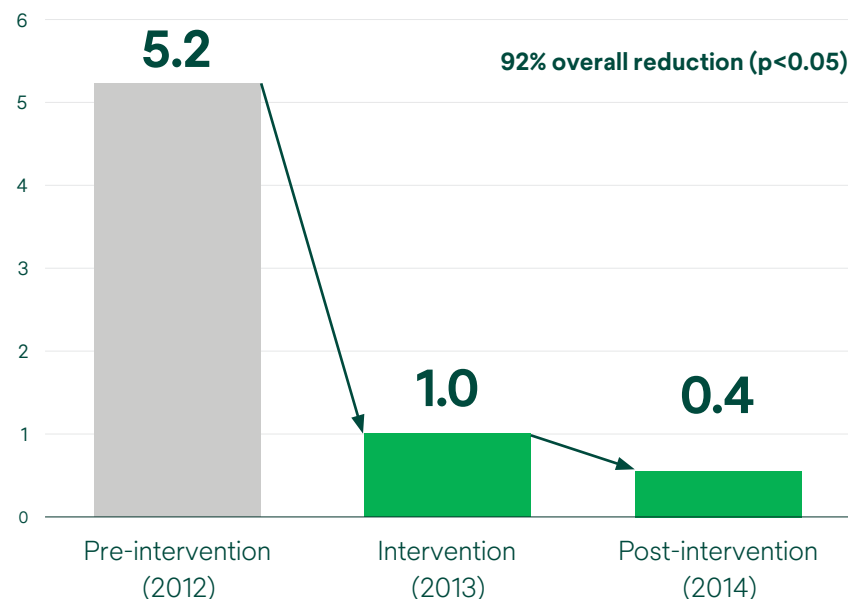
## Intervention

An interdisciplinary pediatric CLABSI committee was implemented along with multiple interventions including:

- Insertion checklist, placement of non-emergent lines in dedicated procedure room
- Daily assessment of line necessity
- Daily assessment of dressing, exit site and presence of 3M™ Curosur™ Disinfecting Cap for Needleless Connectors

## Results

### CLABSI infections (per 1,000 line days)



# “When disinfectant caps were used on all IV ports, the rate of both CLABSI and nosocomial BSI fell significantly”

Mark Shelly *et al.*, “Alcohol-Impregnated Disinfectant Caps Reduce the Rate of Central-Line Associated Bloodstream Infections and Nosocomial Bacteremia,” *Open Forum Infectious Diseases* 1, no. Suppl 1 (December 2014): S248, <https://doi.org/10.1093/ofid/ofu052.570>.

## Design

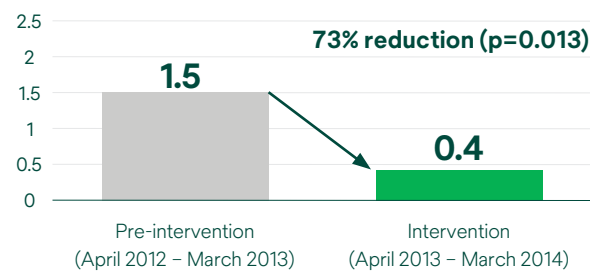
This is a before and after intervention study that compares CLABSI and nosocomia bloodstream infections (BSI) in four hospital units (ICU, step down, two med/surg united).

## Intervention

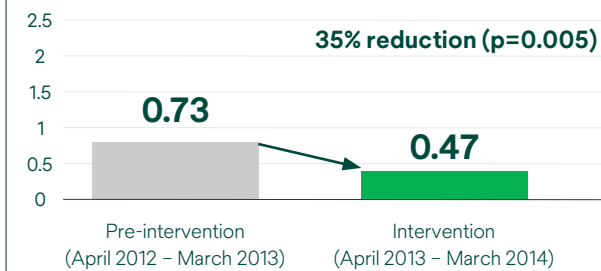
3M™ Curoc™ Disinfecting Cap for Needleless Connectors or Swabcap® Disinfecting Caps were placed on all needleless IV access ports of peripheral and central lines.

## Results

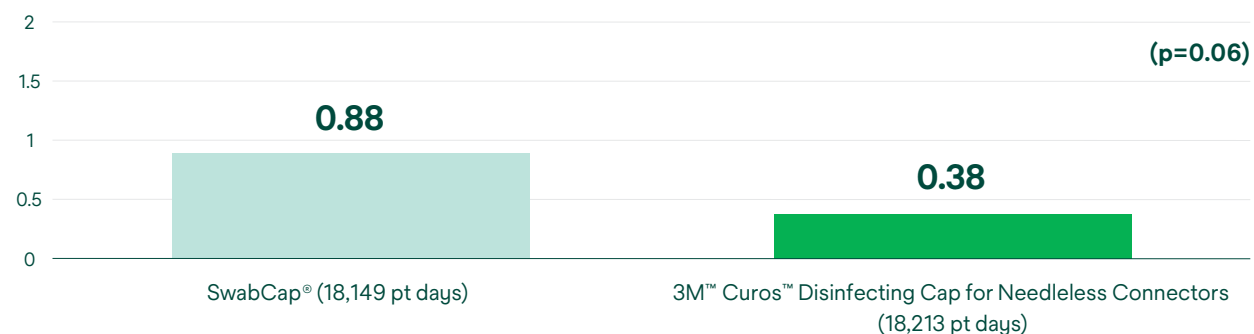
### CLABSI rate (per 1,000 line days)



### Nosocomial BSI rate (per 1,000 patient days)



### Nosocomial BSI rate (per 1,000 patient days)



The number of line days was 10,441 in the baseline and 9,536 in the intervention period.

In units that did not implement disinfectant caps, there was no significant difference in CLABSI or nosocomial BSI rates.



# A significant decline in the incidence of CLABSI was observed after the addition of Curoso<sup>™</sup> disinfecting caps to an existing central line bundle

Barbara Danielson *et al.*, "Decreasing the Incidence of Central Line-associated Blood Stream Infections Using Alcohol-impregnated Port Protectors in a Neonatal Intensive Care Unit," *American Journal of Infection Control* 41, no. 6 (June 2013): S97-98, <https://doi.org/10.1016/j.ajic.2013.03.203>.

## Design

This is a before and after intervention study that compares CLABSI standardised infection ratios (SIR) in level 3 NICU patients.

## Methods

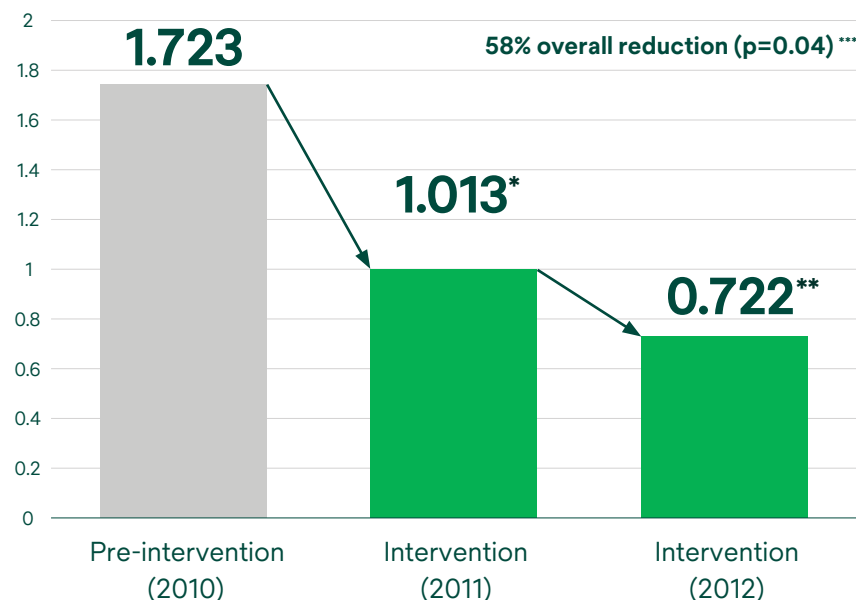
**Pre-intervention:** An evidence-based central line bundle including 15 second scrub the hub protocol was used.

**Intervention:** 3M<sup>™</sup> Curoso<sup>™</sup> Disinfecting Cap for Needleless Connectors on IV access ports were implemented.



## Results

### CLABSI SIR



\*The intervention began in Q1 of 2011. The results included Q4 of 2011 when the Curoso disinfecting cap was not in use.

\*\*The use of the Curoso disinfecting cap resumed in January 2012.

\*\*\*The comparison is between 2010 and 2012.

# “The use of a disinfectant cap is effective in reducing the rate of CLABSI and contaminated blood cultures and provides a substantial cost savings”

Sharon Sumner *et al.*, “Decreasing CLABSI Rates and Cost Following Implementation of a Disinfectant Cap in a Tertiary Care Hospital,” *American Journal of Infection Control* 41, no. 6 (June 2013): S37, <https://doi.org/10.1016/j.ajic.2013.03.077>.

## Design

This is a before and after intervention study that compares CLABSI and nursing compliance in a Level I Trauma Center.

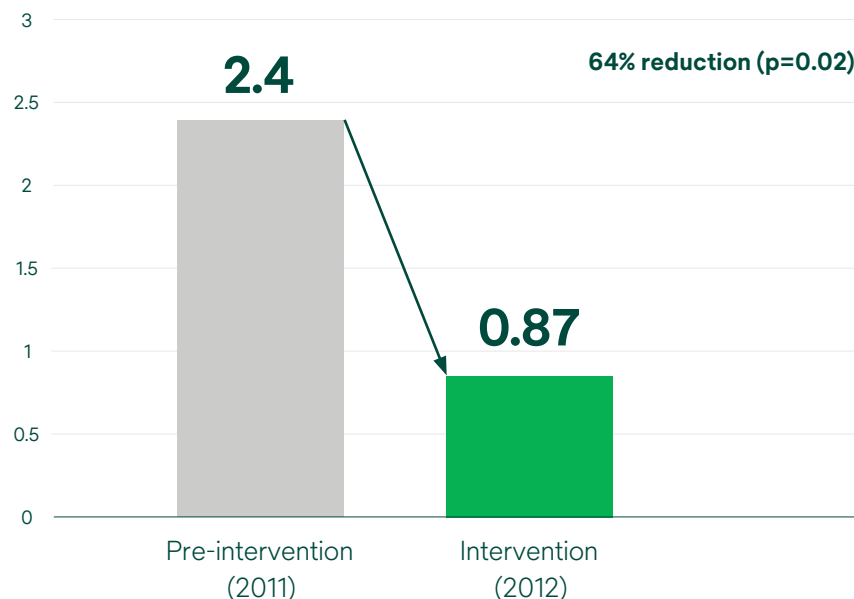
## Methods

**Pre-intervention:** The baseline data found that 55% of nurses scrub the needleless connector for less than five seconds.

**Intervention:** A 3M™ Curoc™ Disinfecting Cap for Needleless Connectors was implemented on all central and peripheral needleless connectors in all inpatient departments (excluding women’s services).

## Results

### CLABSI rate (per 1,000 line days)



There was a non-significant decrease in contaminated blood cultures from **2.5%** before to **1.4%** after intervention

Nursing compliance to the disinfecting cap increased significantly from **73% to 88%** during the study (p=0.01)

The total estimated cost savings per month was **\$95,000 USD**

# Following discontinuation of disinfecting caps, the CABSIs rate returned to the pre-intervention rate

Jennie Mayfield *et al.*, "Impact of Alcohol Impregnated Protectors on Incidence of Catheter- Associated Blood Stream Infections," *IDWeek 2012* (October 2012): [https://www.researchgate.net/publication/267913409\\_Impact\\_of\\_Alcohol\\_Impregnated\\_Protectors\\_on\\_Incidence\\_of\\_Catheter-\\_Associated\\_Blood\\_Stream\\_Infections](https://www.researchgate.net/publication/267913409_Impact_of_Alcohol_Impregnated_Protectors_on_Incidence_of_Catheter-_Associated_Blood_Stream_Infections).

## Design

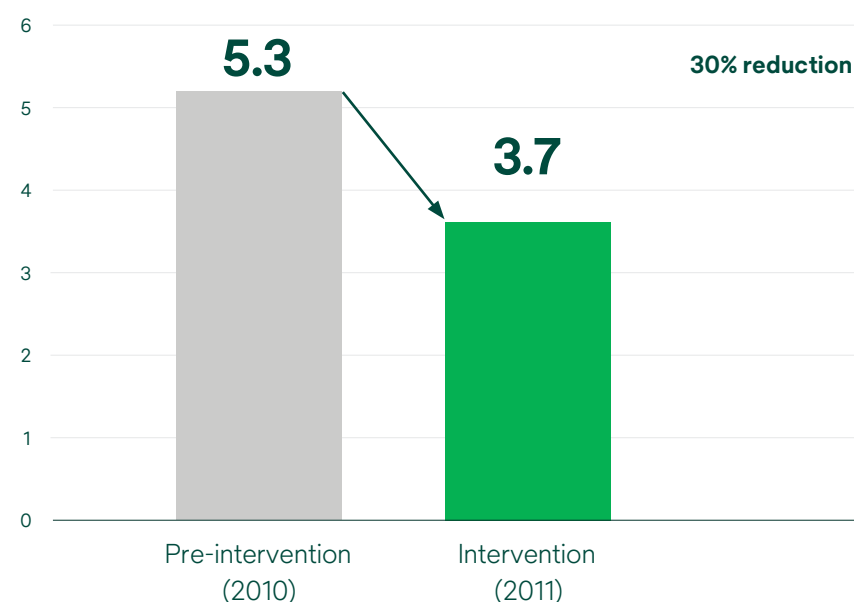
This is a before and after intervention study that compares catheter-associated bloodstream infection (CABSI) between a control and intervention unit caring for acute leukemia and stem cell transplants patients.

## Intervention

3M™ Curo™ Disinfecting Cap for Needleless Connectors on CVC needleless connectors were implemented.

## Results

### Median CABSI rate (per 1,000 central line days)



The number of central line days was 20,126 in the pre-intervention and 20,206 in the intervention period.

Analysis of CABSI rates in a control unit during the same time periods were 5.6 (2010) and 5.4 (2011) per 1,000 central line days.

# Clinically significant fall in catheter related sepsis (CRS) rates related to parenteral nutrition (PN) following introduction of a disinfecting cap

DJ Wheatley *et al.*, "PTH-195 Curoso™ Line Caps Are Effective in Reducing Catheter Related Sepsis in Inpatients Receiving Parenteral Nutrition,"

*Gut* 64, no. Suppl 1 (June 2015): A495.1-A495, <https://doi.org/10.1136/gutjnl-2015-309861.1083>.

## Design

This is a before and after intervention study that compares CRS rates in inpatients receiving PN through either a PICC or dedicated port of a CVC.

## Methods

### Pre-intervention:

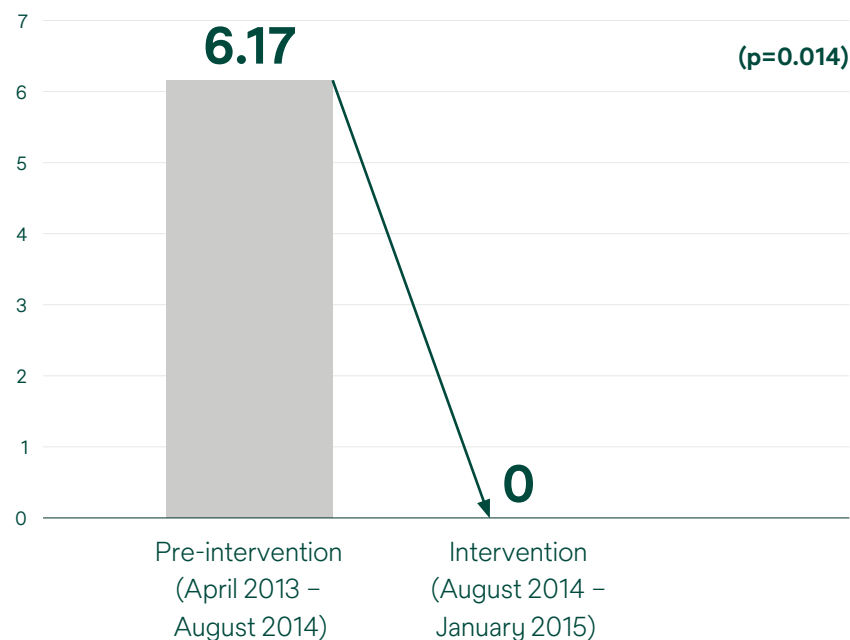
The standard aseptic non-touch technique was used.

### Intervention:

3M™ Curoso™ Disinfecting Cap for Needleless Connectors was added (implemented on Aug. 9, 2014).

## Results

### Catheter related sepsis (events per 1,000 catheter days)



The pre-intervention (no Curoso Disinfecting Cap for Needleless Connectors) total PN days was 1,617.

The intervention group (Curoso Disinfecting Cap for Needleless Connectors) total PN days was 521.

# The introduction of 3M™ Curoc™ Disinfecting Cap for Needleless Connectors, in a care bundle with CHG bathing, was associated with a significant reduction in CLABSI

Nicole Russo *et al.*, "863 Reduction in CLABSIs With Alcohol Port Protectors," *Open Forum Infectious Diseases* 1, no. Suppl 1 (January 2014): S248, <https://doi.org/10.1093/ofid/ofu052.571>.

## Design

This is a before and after intervention study that compares infection rates in multiple levels of care (acute care, ICU and community living center) for patients with peripheral and central catheters.

## Methods

### Pre-intervention:

The CVC best practice bundle was used.

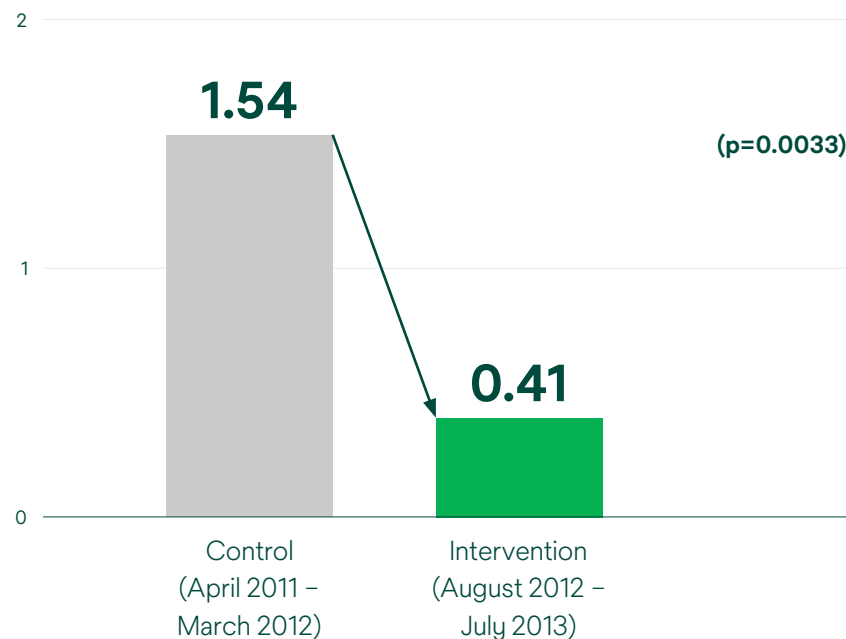
### Intervention:

- Use of Curoc Disinfecting Cap for Needleless Connectors on central and peripheral line needleless connectors
- Added chlorhexidine bathing in ICUs in November 2012



## Results

### CLABSI rates (per 1,000 line days)



The pre-intervention method had 22 infections and 14,308 line days.

The intervention group had 5 infections and 12,263 line days.

# Sustained compliance with disinfecting protocol seen with intervention implementation

Theresa Cabahug *et al.*, "Impact of Disinfectant Cap Implementation on Peripherally-inserted Central Catheter (PICC) Associated Bloodstream Infection Rates," APSIC Congress (June 2019): [https://www.researchgate.net/publication/333679803\\_Impact\\_of\\_disinfectant\\_cap\\_implementation\\_on\\_peripherally-inserted\\_central\\_catheter\\_PICC\\_associated\\_bloodstream\\_infection\\_rates](https://www.researchgate.net/publication/333679803_Impact_of_disinfectant_cap_implementation_on_peripherally-inserted_central_catheter_PICC_associated_bloodstream_infection_rates).

## Design

This is a prospective study assessing the impact of implementing disinfecting caps on CLABSI rates for PICC lines in four inpatient wards.

## Methods

### PICC maintenance bundle education:

- Insertion site care
- Dressing recommendations
- Application of CHG disk (BIOPATCH®)

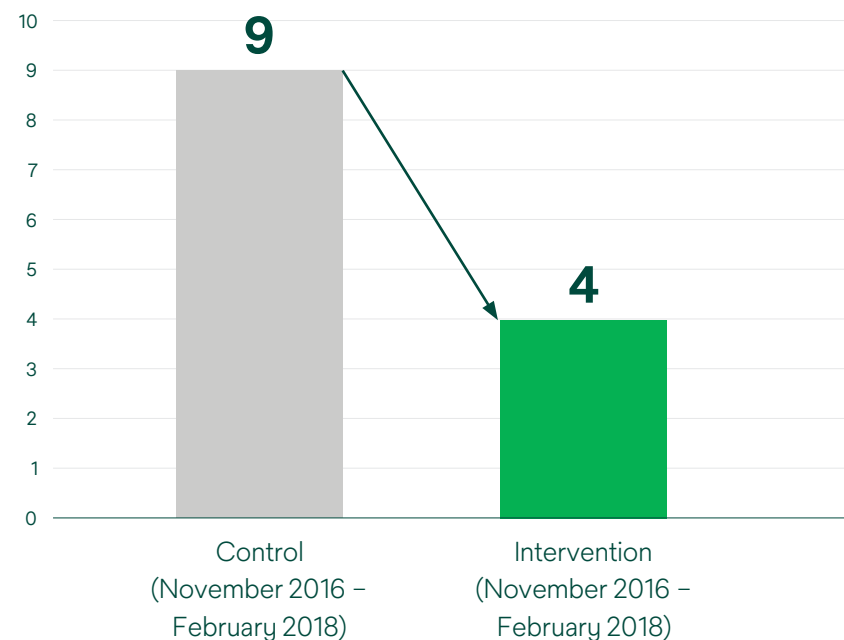
### Intervention:

- PICC maintenance bundle education
- Addition of 3M™ Curosur™ Disinfecting Cap for Needleless Connectors to PICC line needleless connectors



## Results

### Number of CLABSIs\*



The control group had an infection rate of 1.11/1,000 catheter days.

The intervention group had an infection rate of 0.74/1,000 catheter days.

\*Not statistically significant

Compliance with the use of disinfecting caps was

**≥95%**

for 15 out of the 16 months tracked



# Use of antiseptic caps on CVC main stopcocks demonstrated protection from contamination and increased compliance over standard practice

A. Guyot *et al.*, "Antiseptic Caps Protect Stopcocks from Internal Bacterial Contamination," *Journal of Hospital Infection* 108 (February 2021): 212–14, <https://doi.org/10.1016/j.jhin.2020.11.026>.

## Design

A cluster randomised trial assessed the contamination rates of stopcocks and incidence of CLABSI in an ICU.

## Methods

### Pre-intervention:

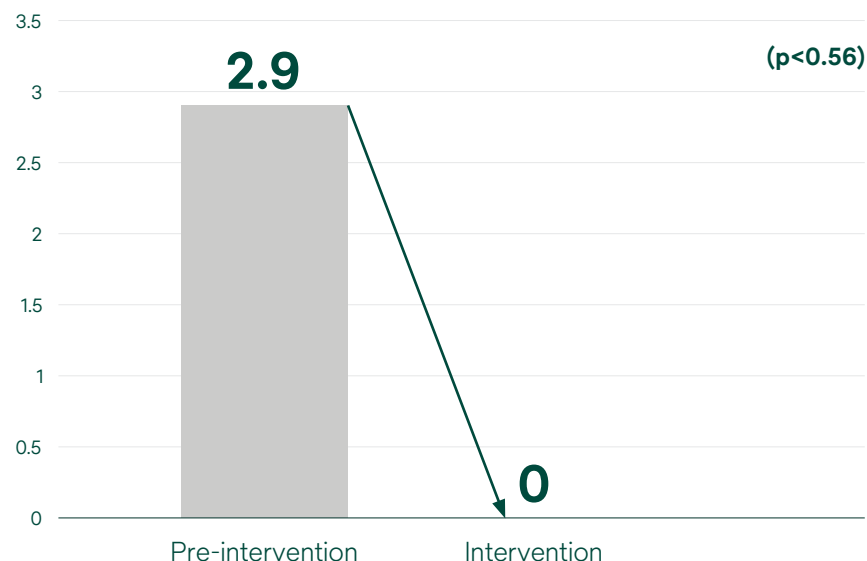
A manual disinfection of stopcock hubs was used, which included the use of Octeniderm® spray and use of Combi-Stopper caps.

### Intervention:

3M™ Curoc™ Stopper Disinfecting Cap for Open Female Luers were placed on all primary IV infusion stopcocks.

## Results

### CLABSI rate (per 1,000 CVC days)



The mean dwell time in the pre-intervention was 10.6 days and 12.7 days in the intervention.

The contamination rates of stopcocks dropped from

**15.9% to 5.6%**

during the study (p<0.03)

Compliance rates to disinfecting caps was

**98%**

compared to

**60%**

for standard disinfection



# Additional resources

## Abstracts

P. Hignell, "Improving Customer Quality Experience and Outcomes with Use of Alcohol-impregnated Disinfection Caps" (presentation, Fraser Health Canada Patient Experience Conference, Surrey, British Columbia, November 2017).

Zachary D. Levy *et al.*, "Rates of Iatrogenic Ventriculitis Before and After the Use of an Alcohol-impregnated External Ventricular Drain Port Cap," *American Journal of Infection Control* 45, no. 1 (January 2017): 92–93, <https://doi.org/10.1016/j.ajic.2016.06.042>.

Gurminder Kaur, "An Interdisciplinary Approach to Reduce Intensive Care Unit (ICU) Central Line Associated Bloodstream Infections (CLABSI) Using LEAN Six Sigma," *American Journal of Infection Control* 43, no. 6 (June 2015): S64, <https://doi.org/10.1016/j.ajic.2015.04.157>.

J. Shiber, G. Jolicoeur, T. Crouchet, "Reducing Central Line-associated Bloodstream Infections Through the Addition of Disinfecting Port Protectors" (presentation, Ochsner Research Day, New Orleans, LA, May 2014).

M. Miskill, E. Ballard, "Implementing Alcohol-impregnated Port Protectors as a Means to Decrease CLABSI" (Carolinas HealthCare System, Charlotte, NC, 2014).

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