



The Relation Between the Compliance with an Intervention Bundle and the Risk of Central Line Associated Bloodstream Infections

Authors: E.A. Smid¹, S.C. de Greeff¹, S.E. Geerlings², M.C. Vos³ and M.B.G. Koek¹

¹ Centre for Infectious Disease Control, National Institute for Public Health and the Environment, Bilthoven, The Netherlands

² Department of Internal Medicine, Division of Infectious Diseases, Academic Medical Center of the University of Amsterdam, Amsterdam, The Netherlands

³ Department of Medical Microbiology and Infectious Diseases, Erasmus MC, Rotterdam, Netherlands.

Contact: emma.smid@rivm.nl

Background

Central venous catheters (CVC) are an important cause of bloodstream infections leading to additional treatment, increased hospital stay and increased costs. In 2009 a 6-item intervention bundle was implemented to prevent central line associated bloodstream infections (CLABSI) in Dutch hospitals (Box 1). Four items were aimed to optimize hygienic/sterile insertion of the CVC: hand hygiene, precautions during insertion, disinfection of the skin and selection of insertion site. The two other items consisted of daily checks: a daily check on the indication of the CVC, and a daily check of the insertion site on the presence of infection symptoms. Hospitals were asked to report compliance or non-compliance with these 6 items together with the incidence of CLABSI within the Dutch nosocomial surveillance network (PREZIES). The aim of this study was to determine the impact of the compliance with the intervention bundle on the risk of CLABSI in The Netherlands.

Material/methods

This study was performed within the PREZIES-network, the Dutch national network for surveillance of hospital acquired infections (HAI). The goal of the network is to use surveillance to reduce the number of HAI. The PREZIES CLABSI surveillance is a standardized surveillance using strict criteria for assessing CLABSI based on the definitions from the (European) Centre for Disease Control. Hospitals participate voluntarily.

From 2009 to 2013, data from hospitals reporting compliance or non-compliance with the intervention bundle for at least 80% of their CVCs annually were included. CLABSI incidence rates were estimated using multilevel Cox regression, adjusted for age, gender, application, insertion site and year of participation and reported as hazard ratios (HR). We analyzed the effect of compliance with the entire bundle on risk of CLABSI and we separately analyzed the effect of compliance with the 4 items reported during insertion and the 2 daily check items. Compliance was compared to both non-compliance and partial compliance.

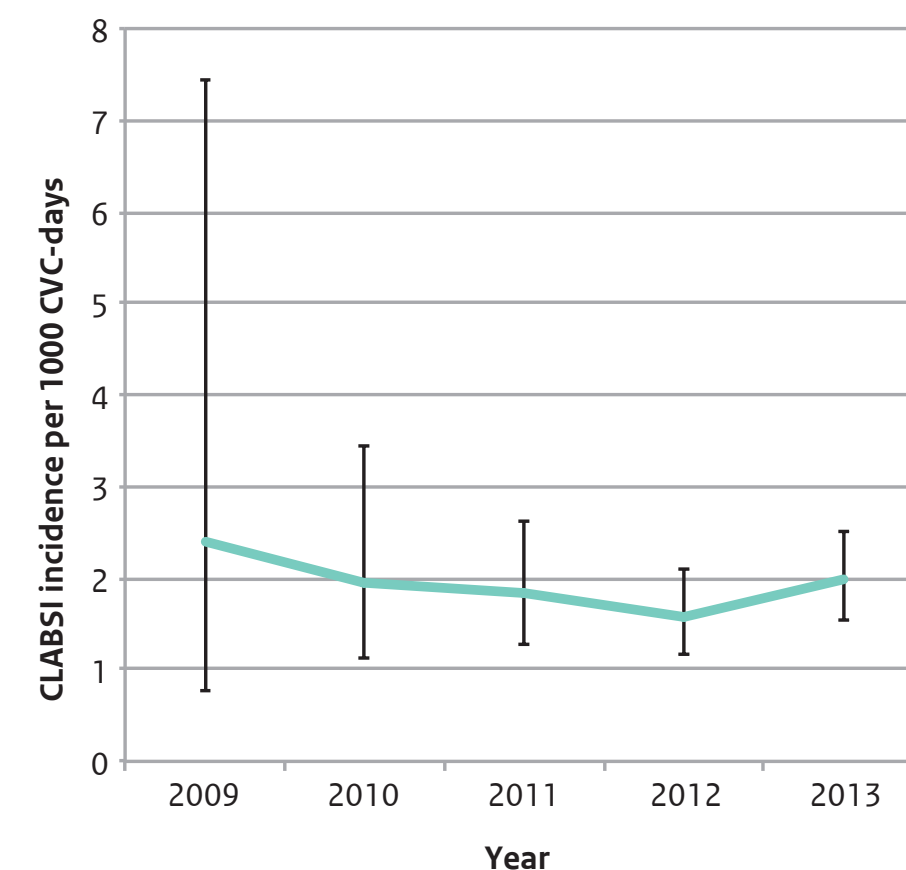


Figure 1: Incidence of infection per 1000 CVC-days from 2009 until 2013

Results

From 2009 to 2013 we obtained data from 33 hospitals reporting (non-)compliance with the intervention bundle for at least 80% of the CVCs annually, resulting in data of 12,139 CVCs and 83,629 catheter-days of 9,105 patients. The annual CLABSI incidence per 1000 CVC-days significantly decreased from 2.4 in 2009 to 2.0 in 2013 ($p=0.02$, figure 1). The CLABSI incidence per year that hospitals participated in the intervention program decreased over time from 2.5 to 0.5 ($p=0.04$, Figure 2). Compliance with the 4 bundle-items measured during insertion of the CVC was associated with a lower risk of a CLABSI, although this effect was not statistically significant (HR=0.94, 95% CI 0.88 - 1.00, table 1). Similar analyses for the two daily check bundle items and for the total bundle revealed a positive association with the risk for CLABSI (HR= 1.19, 95% CI 1.14 - 1.25 and HR=1.13, 95% CI 1.08 - 1.18 respectively, table 1).

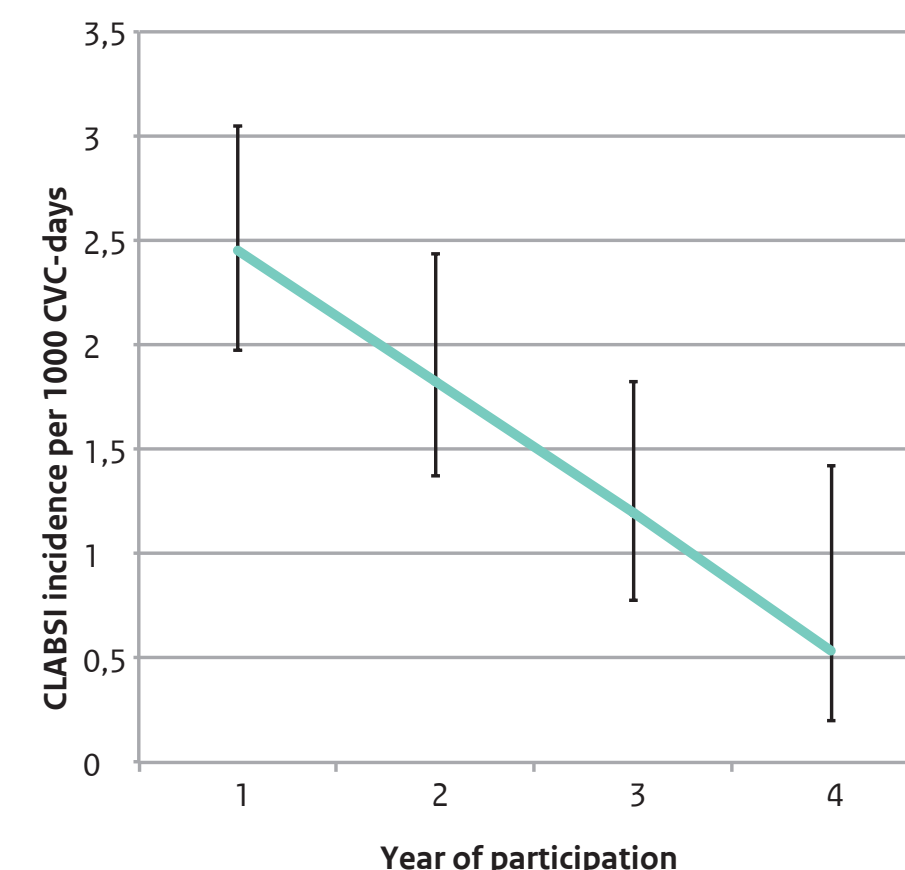


Figure 2: Incidence of infection per 1000 CVC-days adjusted for year of participation

Box 1: Definitions of bundle items

During insertion:

- Hand hygiene:** All hospital personal who took actively part in inserting the CVC have disinfected their hands.
- Precautions during insertion:** the patient is 80% covered with a sterile drape and the clinician and assistants wear surgical mask.
- Disinfection of the skin:** The skin is cleaned with 0.5% chlorhexidine in 70% alcohol.
- Selection of insertion site:** the most optimal insertion site is chosen; 1) v. subclavian, 2) v. jugular, 3) v. femoral.

Daily checks:

- Daily check on indication:** Every day it is checked that the indication for the CVC is still valid, if it is not valid the CVC should be removed
- Daily check on insertion site:** Every day the insertion site is checked for infection symptoms, when there are symptoms of an infection the CVC is removed.

Table 1: Effect of compliance with the bundle on CLABSI risk

	HR*	95% CI
Optimize hygienic/sterile insertion	0.94	0.88 - 1.00
Daily checks	1.19	1.14 - 1.25
Total intervention	1.13	1.08 - 1.18

*HR: Hazard ratio

Conclusions

After implementation of the intervention bundle, a significant reduction in CLABSI was observed. Compliance with the bundle items measured during insertion of the CVC was non-significantly associated with a reduction in the risk of CLABSI. Reported compliance with the entire bundle however was positively associated with the risk for CLABSI. Presumably the daily check items were better reported for patients with an increased risk of infection.