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Time-series analysis to observe the impact of a centrally organized educational intervention on the prevention of central-line-associated bloodstream infections in 32 German intensive care units

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SUMMARY

Background: Prevention measures reduce central-line-associated bloodstream infections (CLABSIs) but are not always implemented.
Aim: To investigate the effect of a central educational programme in German intensive care units (ICUs) on CLABSI rates.
Methods: Thirty-two German ICUs with CLABSI rates greater than or equal to the national average were compared with two control groups containing 277 and 67 ICUs. Processes and CLABSI rates were surveyed before, during and two years after the implementation of a year-long intervention programme. Segmented regression analysis of interrupted time series using generalized linear models was performed to estimate the association between the number of CLABSIs per month and time, intervention and other confounders, with the clustering effect within an ICU taken into account.
Findings: In total, 508 cases of CLABSI were observed over 266,471 central line (CL)-days. At baseline, the pooled mean CLABSI rate was 2.29 per 1000 CL-days, and this decreased significantly to 1.64 per 1000 CL-days in the follow-up period. Compared with baseline, the relative risk for CLABSI was 0.88 [95% confidence interval (CI) 0.70–1.11] for the intervention period and 0.72 (95% CI 0.58–0.88) for the follow-up period. No changes were observed in either control group. Following successful implementation of the programme, ICUs showed a significant decrease in CLABSI rates. Although rates were already decreasing prior to implementation of the intervention, the invitation to participate in the study, and increased general awareness of CLABSI prevention through use of the comprehensive multi-modal training materials may have had a beneficial effect on practice.
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Introduction

Central-line-associated bloodstream infections (CLABSIs) are a problem in intensive care units (ICUs), and the consequences are a challenge for hospitals.[1] Infection control

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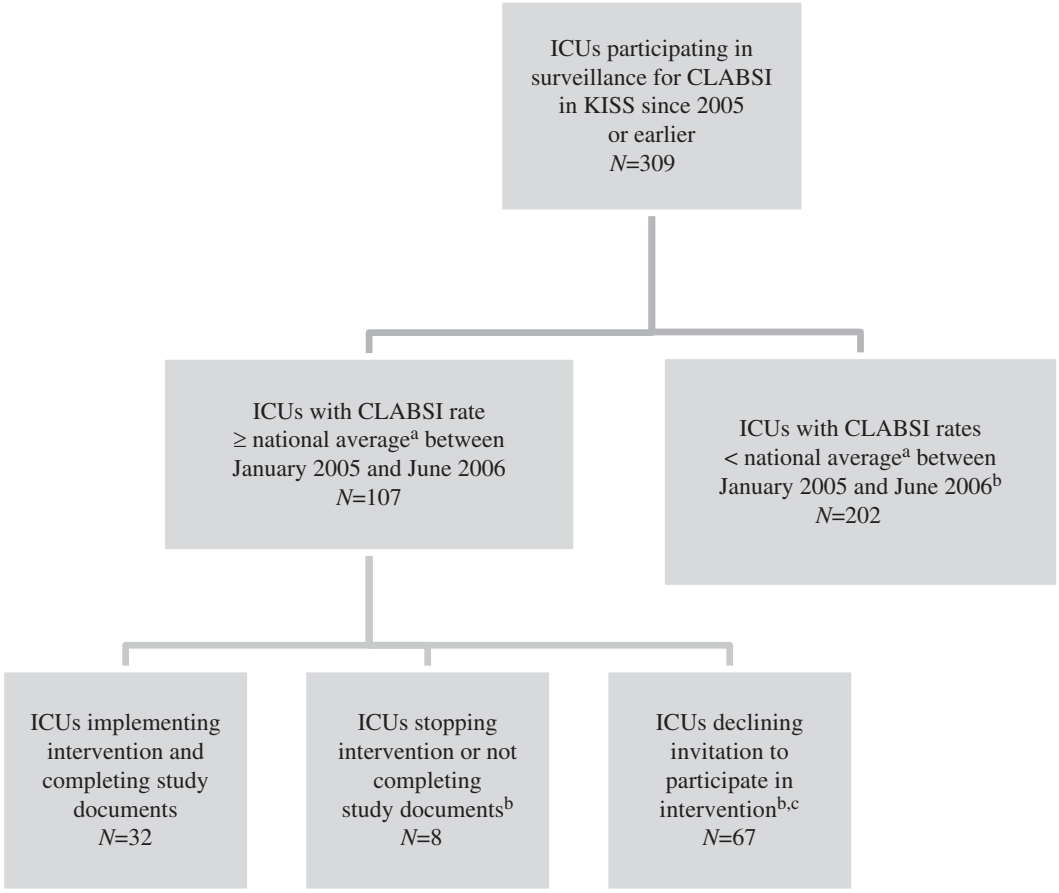

Figure 1. Flow diagram of allocated and analysed intensive care units (ICUs).CLABSI, central-line-associated bloodstream infection; KISS, Krankenhaus Infektions Surveillance System. [a]KISS reference data for 2001–2005. [b]ICUs of Control Group 1 ($N = 277$). [c]ICUs of Control Group 2 ($N = 67$).

measures reduce the incidence of CLABSI but are not always fully implemented.[2] Surveillance decreases healthcare-associated infections by identifying low compliance with infection control measures.[3] Educational training is a valuable method to increase the awareness of healthcare workers, and various educational interventions have been shown to reduce infection rates effectively.[4–6]

An intervention aimed at CLABSI prevention was offered by the Krankenhaus Surveillance System (KISS) to support ICUs in their infection prevention and control activities. All ICUs with CLABSI rates greater than or equal to the national average were invited to implement a centrally organized, multi-modal programme with an intervention period of 12 months. This study describes the impact of the programme on patient care practices and CLABSI rates in the participating ICUs. ICUs were followed-up for two years after the intervention to assess sustainability.

Materials and methods

Study design

This multi-centre interventional study had a before-and-after design. The baseline period (April 2006–March 2007) covered surveillance data 12 months before the intervention. ICU staff received training during the intervention period (April 2007–March 2008). The intervention was followed by collection of surveillance data in a two-year follow-up exercise (April 2008–March 2010).

Two control groups were included to control for secular trends. Control Group 1 consisted of ICUs that had participated in KISS since 2005 or earlier and did not participate in the study ($N = 277$). Control Group 2 consisted of ICUs that had participated in KISS since 2005 and had CLABSI rates greater than or equal to the national average, but declined the invitation to participate in the study ($N = 67$).

Sample size calculation

Sample size estimates were made on the basis of expected differences in outcome results of 30%, with $\alpha = 0.05$ and $\beta = 0.20$. According to the maximum likelihood estimation test, 118 cases of CLABSI were to be analysed in the study. Based on the KISS data from the 110 ICUs that could potentially participate in the study (mean CLABSI rate 2.49, average 2441 CL-days per ICU), 20 ICUs needed to be included in the study for a period of 12 months.

Setting

The intervention programme was offered to 107 ICUs with a CLABSI rate greater than or equal to the national

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