Disclosures

• Advisory board 3M, Astellas, Roche,
• Core member patient safety WHO, Geneva
• Recipient of a Grant to study C. difficile by Swiss National Science Foundation (SNCF)
• Recipient of a federal government grant to study antimicrobial coated surfaces (KTI)
• Recipient of a unrestricted Grant by Pfizer to study prevalence and C. difficile pathogenesis.
Andreas F. Widmer, MD, MS

WHO - SSI

Headquarters
• Novartis
• Roche

New antibiotics
POL7080 / Ceftobiprole
Actelion

University founded 1442
University Hospital Basel: 1400 bed tertiary care center
892 acute beds for adults +130 children, and +352 geriatric/rehabilitation
- 38,000 admissions
- 36,000 surgical interventions
- 134 stem cell transplantation/ 80 kidney transplantation
Remote Infection
Hands of Health Care Workers
Skin Colonization
Fibrin sheath
Hematogenous Seeding

Contaminated Infusate
Contaminated Disinfectants
Hub Colonization

<table>
<thead>
<tr>
<th>Device</th>
<th>prospective mean (CI&lt;sub&gt;95&lt;/sub&gt;) studies per 100 catheters</th>
<th>mean (CI&lt;sub&gt;95&lt;/sub&gt;) per 1000 cath days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peripheral venous catheter</td>
<td>13 0.2 (0.1–0.3)</td>
<td>0.6 (0.3–1.2)</td>
</tr>
<tr>
<td>Arterial catheter</td>
<td>6 1.5 (0.9–2.4)</td>
<td>2.9 (1.8–4.5)</td>
</tr>
<tr>
<td><strong>Short-term, nonmedicated CVC</strong></td>
<td><strong>61 3.3 (3.3–4.0)</strong></td>
<td><strong>2.3 (2.0–2.4)</strong></td>
</tr>
<tr>
<td>Pulmonary-artery catheter</td>
<td>12 1.9 (1.1–2.5)</td>
<td>5.5 (3.2–12.4)</td>
</tr>
<tr>
<td>Hemodialysis catheter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noncuffed</td>
<td>15 16.2 (13.5–18.3)</td>
<td>2.8 (2.3–3.1)</td>
</tr>
<tr>
<td>Cuffed</td>
<td>6 6.3 (4.2–9.2)</td>
<td>1.1 (0.7–1.6)</td>
</tr>
<tr>
<td>PICC</td>
<td>8 1.2 (0.5–2.2)</td>
<td>0.4 (0.2–0.7)</td>
</tr>
<tr>
<td>Long-term tunneled and cuffed CVC</td>
<td>18 20.9 (18.2–21.9)</td>
<td>1.2 (1.0–1.3)</td>
</tr>
<tr>
<td>Port a cath</td>
<td>13 5.1 (4.0–6.3)</td>
<td>0.2 (0.1–0.2)</td>
</tr>
</tbody>
</table>
CLABSI pathogen detection methods

Andreas F. Widmer, MD, MS, FIDSA, FSHEA
SWITZERLAND
Deputy Chief of Div Infectious Disease & Hospital epidemiolog
Core member Patient safety WHO Geneva
President of the Swiss National Reference Center for Infection PreventionSSI Surveillance
www.swissnosso.ch
What is CLABSI?

CA-BSI (CLABSI) vs CR-BSI

Commonly reported as
BSI Events without identifiable source /1000 catheter days

Facts or alternate Facts?
Selection of Data: Alternate Facts

• Strategy to prepare this talk strong influenced by a political approach
  – Use of unbiased selection of information
  – Balanced interpretation of evidence
  – No fiction, just facts

Former President of Italy after paying 5000 € from tax payers money for a party with Ruby, a ± 18y old girl to join his party.
Reading the CLABSI Literature

- A guide for Gameing
- Sources of Data
  - Surveillance
Definitions
Catheter-associated bloodstream infection (CA-BSI): Defined by the following: A CLABSI is a primary BSI in a patient who had a central line within the 48-hour period before development of the BSI and is not bloodstream infection at another site. Bloodstream infection is considered to be associated with a central line if the line was in use during the 48-hour period before development of the bloodstream infection and other sources have been ruled out. Culturing the catheter tip or peripheral blood is not a criterion for CLABSI.

CA-BSI of CVC; Central-line associated BSI

CDC Guidelines for the Prevention of Intravascular Catheter-Related Infections. MMWR 2002;51:# RR-10
Central line-associated BSI (CLABSI):
A laboratory-confirmed bloodstream infection (LCBI) where central line (CL) or umbilical catheter (UC) was in place for >2 calendar days on the date of event, with day of device placement being Day 1,

AND

the line was also in place on the date of event or the day before. If a CL or UC was in place for >2 calendar days and then removed, the date of event of the LCBI must be the day of discontinuation or the next day to be a CLABSI.

https://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf
Blood Culture Specimen Notes

- All blood cultures (regardless of collection method) must be included in surveillance if participating in NHSN CLABSI surveillance
  - Blood collected via venipuncture
  - Blood collected through vascular catheters
  - Cannot be considered a contaminant unless single unmatched common commensal (surveillance vs. clinical determination)
Contamination or Infection?

LCBI- Criterion 2

- Patient has at least one of the following signs or symptoms: fever (>38.0°C), chills, or hypotension
  - And
  - Organisms cultured from blood are not related to an infection at another site
- "And
- the same common commensal (i.e. diptheroids 26 [Corynebacterium spp.], Bacillus [not B. anthracis] spp., Propionibacterium spp., coagulase-negative staphylococci [including S. epidermidis], viridans group streptococci, Aerococcus spp., Micrococcus spp.) is cultured from two or more blood cultures drawn on separate occasions (same or consecutive days) within the 7 day Infection Window Period
## Determining ‘sameness’ of common commensals continued

<table>
<thead>
<tr>
<th>Culture Report</th>
<th>Companion Culture Report</th>
<th>Report as…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulase-positive staphylococci</td>
<td><em>S. aureus</em></td>
<td><em>S. aureus</em></td>
</tr>
<tr>
<td><em>S. epidermidis</em></td>
<td>Coagulase-negative staphylococci</td>
<td><em>S. epidermidis</em></td>
</tr>
<tr>
<td><em>Enterococcus</em> spp.</td>
<td><em>E. faecium</em></td>
<td><em>E. faecium</em></td>
</tr>
<tr>
<td><em>Bacillus</em> spp. (not anthracis)</td>
<td><em>B. cereus</em></td>
<td><em>B. cereus</em></td>
</tr>
<tr>
<td><em>S. salivarius</em></td>
<td>Strep viridans</td>
<td><em>S. salivarius</em></td>
</tr>
</tbody>
</table>

Table found on page 4-13 of the BSI protocol

MALDI-TOF MS applied to indirect carbapenemase detection: a validated procedure to clearly distinguish between carbapenemase-positive and carbapenemase-negative bacterial strains

Lijun Wang · Chao Han · Wenjun Sui · Mei Wang · Xinxin Lu
### Determining ‘sameness’ of common commensals continued

<table>
<thead>
<tr>
<th>Culture Report</th>
<th>Companion Culture Report</th>
<th>Report as...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulase-positive staphylococci</td>
<td><em>S. aureus</em></td>
<td><em>S. aureus</em></td>
</tr>
<tr>
<td><em>S. epidermidis</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Enterococcus</em> spp.</td>
<td><em>E. faecium</em></td>
<td><em>E. faecium</em></td>
</tr>
<tr>
<td><em>Bacillus</em> spp. (not anthracis)</td>
<td><em>B. cereus</em></td>
<td><em>B. cereus</em></td>
</tr>
<tr>
<td><em>S. salivarius</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **S. saprophyticus** contamination
- **S. milleri** contamination


Table found on page 4-13 of the BSI protocol
Reading the CLABSI Literature

- A guide for Gameing
- Sources of Data
  - Surveillance
  - ICD-9 / 10 Codes
Validity of ICD-9-CM codes for the identification of complications related to central venous catheterization.

<table>
<thead>
<tr>
<th>Infection</th>
<th>Method</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. difficile infection</td>
<td>Meta-analysis</td>
<td>76%</td>
<td>100%</td>
</tr>
<tr>
<td>Surgical site infection</td>
<td>Meta-analysis</td>
<td>81%</td>
<td>97%</td>
</tr>
<tr>
<td>VAP</td>
<td>Systematic review</td>
<td>42-72%</td>
<td>82-92%</td>
</tr>
<tr>
<td>CAUTI</td>
<td>Systematic review</td>
<td>50-52%</td>
<td>94-99%</td>
</tr>
<tr>
<td>CLABSI</td>
<td>Systematic review</td>
<td>48%</td>
<td>66%</td>
</tr>
<tr>
<td>MRSA infection</td>
<td>24-59%</td>
<td>99-100%</td>
<td></td>
</tr>
</tbody>
</table>

The ICD-9-CM codes for CLABSI had a sensitivity of 33.3%, specificity of 99.0%, PPV of 28.6%, and NPV of 99.2%.

The low sensitivity and variable PPV of ICD-9-CM codes for detection of complications of CVC raise concerns about their use for research or pay-for-performance purposes.

Reading the CLABSI Literature

• A guide for Gaming

• Sources of Data
  – Surveillance
  – ICD-9 / 10 Codes
  – CLABSI in Neutropenia
### 2013 Targets and Progress Made by 2014

**CMS**

<table>
<thead>
<tr>
<th>Measure (and data source)</th>
<th>Original target for 2013 (from 2009 baseline)</th>
<th>Progress made by 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLABSI (NHSN)</strong></td>
<td>50% reduction</td>
<td>50% reduction</td>
</tr>
<tr>
<td><strong>CAUTI (NHSN)</strong></td>
<td>25% reduction</td>
<td>No change</td>
</tr>
<tr>
<td>Invasive MRSA (NHSN/EIP)</td>
<td>50% reduction</td>
<td>36% reduction</td>
</tr>
<tr>
<td>Facility-onset MRSA (NHSN)</td>
<td>25% reduction</td>
<td>13% reduction</td>
</tr>
<tr>
<td><strong>CDI (NHSN)</strong></td>
<td>30% reduction</td>
<td>8% reduction</td>
</tr>
<tr>
<td><strong>SSI (NHSN)</strong></td>
<td>25% reduction</td>
<td>18% reduction</td>
</tr>
<tr>
<td>Clostridium difficile hospitalizations (HCUP2)</td>
<td>30% reduction</td>
<td>18% increase</td>
</tr>
</tbody>
</table>

---


https://health.gov/hcq/prevent-hai-measures.asp
<table>
<thead>
<tr>
<th>Measure (and data source)</th>
<th>2020 Target (from 2015 baseline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLABSI (NHSN)</td>
<td>50% reduction</td>
</tr>
<tr>
<td>CAUTI (NHSN)</td>
<td>25% reduction</td>
</tr>
<tr>
<td>Invasive MRSA (NHSN/EIP)</td>
<td>50% reduction</td>
</tr>
<tr>
<td>Facility-onset MRSA (NHSN)</td>
<td>50% reduction</td>
</tr>
<tr>
<td>CDI (NHSN)</td>
<td>30% reduction</td>
</tr>
<tr>
<td>SSI (NHSN)</td>
<td>30% reduction</td>
</tr>
<tr>
<td>Clostridium difficile hospitalizations (HCUP)</td>
<td>30% reduction</td>
</tr>
</tbody>
</table>

https://health.gov/hcq/prevent-hai-measures.asp
Your Task: you are staff physician at CDC and want to comply with Centers for Medicare and Medicaid Services (CMS)

- How to ensure that the goal of 50% reduction will be reached in 2020?
Mucosal Barrier Injury Laboratory-Confirmed Bloodstream Infection (MBI-LCBI)

In 2015 when reporting an LCBI, it is required to indicate which of the underlying conditions of the MBI-LCBI criterion was met, if any. All CLABSI, whether LCBI or MBI-LCBI, must be reported if CLABSI is part of the Monthly Reporting Plan.

**MBI-LCBI 1**

Patient of any age meets criterion 1 for LCBI with at least one blood culture growing any of the following intestinal organisms with no other organisms isolated. See *Comment #5*: *Bacteroides spp.*, *Clostridium spp.*, *Enterococcus spp.*, *Fusobacterium spp.*, *Prevotella spp.*, *Veillonella spp.*, or *Enterobacteriaceae*.

And patient meets at least one of the following:

- Is an allogeneic hematopoietic stem cell transplant recipient within the past year with one of the following documented during same hospitalization as positive blood culture:
  - Grade III or IV gastrointestinal graft versus host disease (GVHD)
  - ≥2 liter diarrhea in a 24-hour period (or ≥0.20 mL/kg in a 24-hour period for patients <18 years of age) with onset on or within 7 calendar days before the date the positive blood culture was collected.

**MBI-LCBI 3**

Patient ≤1 year of age meets criterion 3 for LCBI when the blood cultures are growing viridans group streptococci with no other organisms isolated.

And patient meets at least one of the following:

- Is an allogeneic hematopoietic stem cell transplant recipient within the past year with one of the following documented during same hospitalization as positive blood culture:
  - Grade III or IV gastrointestinal graft versus host disease (GVHD)
  - ≥20 mL/kg diarrhea in a 24-hour period with onset on or within 7 calendar days before the date the first positive blood culture was collected.

1. Is neutropenic, defined as at least two separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC) <500 cells/μL within a seven-day time period which includes the date the positive blood culture was collected (Day 1), the 3 calendar days before and the 3 calendar days after. (See Table 4 for example.)
Utilizing MBI-LCBI Data

Reporting required in 2015, as it will be a baseline year for future SIR data. Will be removed from 2016 CLABSII metrics shared with CMS.

Your facility may choose to consider MBI-LCBI data separately from LCBI data in your internal QA work as prevention efforts for the two types of BSI may differ.
“...and organism cultured from blood is not related to an infection at another site...”

A BSI that is associated with an infection at another site is referred to as a Secondary BSI and never reported as an LCBI or CLABSI.

A CLABSI may not be secondary to an infection at another site, i.e., it must be a primary BSI.

A Primary BSI is identified by ruling out all non-blood sites as the source of the bloodstream infection.

NEW 2015: more objective criteria in NHSN definitions
Removal of yeast from UTI definitions will no longer be a secondary source for fungemia (SHEA 2015 Carolyn Gould CDC)
Reading the CLABSI Literature

- A guide for Gameing

- Sources of Data
  - Surveillance
  - ICD-9 / 10 Codes
  - CLABSI in Neutropenia
  - Average time of catheterization
The diagram illustrates the percentage of catheter surface covered by biofilm over different duration periods. It shows a gradual increase in the percentage of the internal surface covered by biofilm with longer durations of catheterization, compared to the external surface. The data points for different duration periods (less than 10 days, 10-30 days, and more than 30 days) are represented with error bars, indicating variability in the measurements.
Duration of Catheterization and Risk of Catheter-related bloodstream Infection

Reading the CLABSI Literature

• A guide for Gameing

• Sources of Data
  – Surveillance
  – ICD-9 / 10 Codes
  – CLABSI in Neutropenia
  – Average time of catheterization
  – Counting catheter days
<table>
<thead>
<tr>
<th>Country</th>
<th>Belgium</th>
<th>France (SE)</th>
<th>Netherlands</th>
<th>Spain</th>
<th>Germany</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network</td>
<td>NSIH-ICU</td>
<td>REA-SE</td>
<td>PREZIES-ICU</td>
<td>ENVIN-UCI</td>
<td>KISS-ICU</td>
<td>NNIS (CDC)</td>
</tr>
<tr>
<td>Type of surveillance</td>
<td>Incl. patients</td>
<td>Patient, date of admission; Patient, date of discharge</td>
<td>Patient, date of admission; Patient, date of discharge; Patient, date of admission; Patient, date of admission; Patient, date of admission</td>
<td>Patient, date of admission; Patient, date of admission; Patient, date of admission; Patient, date of admission; Patient, date of admission</td>
<td>Unit based, 5 ICU types</td>
<td>Unit based, 11 ICU types</td>
</tr>
<tr>
<td>Period incl data</td>
<td>Patient, date of admission; Patient, date of discharge</td>
<td>Patient, date of admission; Patient, date of discharge</td>
<td>Patient, date of admission; Patient, date of admission</td>
<td>Patient, date of admission; Patient, date of admission</td>
<td>Patient, date of admission; Patient, date of admission</td>
<td>Patient, date of admission; Patient, date of admission</td>
</tr>
<tr>
<td>n patients</td>
<td>63491</td>
<td>64658</td>
<td>2972</td>
<td>9544</td>
<td>250313</td>
<td>7446512</td>
</tr>
<tr>
<td>patient-days</td>
<td>424028</td>
<td>701026</td>
<td>27922</td>
<td>68915</td>
<td>956807</td>
<td>7446512</td>
</tr>
<tr>
<td>mean LOS (days)</td>
<td>6.7</td>
<td>10.8</td>
<td>9.4</td>
<td>7.2</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>P50 SAPS II</td>
<td>29</td>
<td>34</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P50 APACHE II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definition of device-day</td>
<td>&lt;24 h use</td>
<td>&gt;=24 h use</td>
<td>&lt;24 h use</td>
<td>&lt;24 h use</td>
<td>&lt;24 h use</td>
<td>&lt;24 h use</td>
</tr>
<tr>
<td>Central line days</td>
<td>3 cath=1 day</td>
<td>3 cath=1 day</td>
<td>3 cath=3 days</td>
<td>3 cath=3 days</td>
<td>3 cath=1 day</td>
<td>3 cath=1 day</td>
</tr>
<tr>
<td>ventilation-days/1000 pd</td>
<td>377</td>
<td>571</td>
<td>508</td>
<td>510</td>
<td>430</td>
<td>419</td>
</tr>
<tr>
<td>central line days/1000 pd</td>
<td>709</td>
<td>671</td>
<td>681</td>
<td>1143</td>
<td>721</td>
<td>523</td>
</tr>
<tr>
<td>urinary cath. days/1000 pd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definition of “icu-acquired” infection</td>
<td>infection date &gt; 2 days (48h) after admission</td>
<td>infection date &gt; 2 days (48h) after admission</td>
<td>not present at admission</td>
<td>not in incubation at admission</td>
<td>not in incubation at admission</td>
<td>not in incubation at admission</td>
</tr>
<tr>
<td>Definition of “device-associated” infection</td>
<td>&gt;=1 day device before infection</td>
<td>&gt;=1 day device before infection</td>
<td>clinician decides</td>
<td>&gt;=24h device in 48h bef. inf.</td>
<td>&gt;=24h device in 48h bef. inf.</td>
<td>&gt;=24h device in 48h bef. inf.</td>
</tr>
<tr>
<td>Infection episodes in indicator</td>
<td>first infection only</td>
<td>first infection only</td>
<td>all episodes</td>
<td>all episodes</td>
<td>all episodes</td>
<td>all episodes</td>
</tr>
<tr>
<td>Definition of Pneumonia</td>
<td>large, clinical + bacteriological BAL/PB</td>
<td>bacteriological BAL/PB</td>
<td>CDC + definite BAL/PB</td>
<td>CDC</td>
<td>CDC</td>
<td>CDC</td>
</tr>
<tr>
<td># VAP/100 admissions</td>
<td>5.1%</td>
<td>9.1%</td>
<td>14.0%</td>
<td>6.5%</td>
<td>1.6%</td>
<td></td>
</tr>
<tr>
<td># VAP/1000 ventilation days</td>
<td>20.2</td>
<td>14.8</td>
<td>24.5</td>
<td>17.7</td>
<td>9.9</td>
<td>10.0</td>
</tr>
<tr>
<td># C-BSI/100 admissions</td>
<td>1.3%</td>
<td>0.8%</td>
<td>2.2%</td>
<td>1.1%</td>
<td>0.5%</td>
<td></td>
</tr>
<tr>
<td># C-BSI/1000 central line d</td>
<td>2.7</td>
<td>1.0</td>
<td>3.5</td>
<td>1.3</td>
<td>1.8</td>
<td>5.1</td>
</tr>
<tr>
<td># UTI/100 admissions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UTI rate/1000 ur. catheter d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Diagnosis of Catheter-related Bloodstream Infection

Why CLABSI and not CR-BSIs?
## Signs and Symptoms of CR-BSIs

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Noncolonized and CVC-related BSI, n = 35</th>
<th>Colonized CVCs, n = 333</th>
<th>Uninfected CVCs, n = 894</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>25 (2%)</td>
<td>0.0</td>
<td>0.2 ±0.4</td>
</tr>
<tr>
<td>Erythema</td>
<td>25 (2%)</td>
<td>0.0</td>
<td>0.1 ±0.3</td>
</tr>
<tr>
<td>Swelling</td>
<td>126 (10%)</td>
<td>0.2 ±0.4</td>
<td>0.1 ±0.4</td>
</tr>
<tr>
<td>Purulence</td>
<td>10 (0.8%)</td>
<td>0.0</td>
<td>0.0 ±0.1</td>
</tr>
<tr>
<td>Overall</td>
<td>126 (10.0%)</td>
<td>0.2 ±0.4</td>
<td>0.1 ±0.1</td>
</tr>
</tbody>
</table>

Summary CLABSI:

• CLABSI or Catheter-associated BSI: possible / probable case of CR-BSI.

• Central-venous related BSI: positive blood culture AND microbiologically proven source of catheter.
Catheter-related bloodstream infection (CR-BSI):

isolation of the same organism (i.e., identical species, antibiogram) from a semiquantitative or quantitative culture of a catheter segment and from the blood (preferably drawn from a peripheral vein) of a patient with accompanying clinical symptoms of BSI and no other apparent source of infection. In the absence of laboratory confirmation, defervescence after removal of an implicated catheter from a patient with BSI may be considered indirect evidence of CR-BSI.

- positive semiquantitative culture $\geq 15$ CFU) (tip OR sc segment CFU/catheter segment culture (Sonication))
- 2 simultaneous quantitative blood cultures with a $\geq 5:1$ Ratio
- Differential time period to positivity of CVC culture vs peripheral blood culture (automated BC system) $> 2$ hrs
The Semiquantitative Culture Method by MAKI DG

15 CFU applies to >5cm only

Catheters peripheral 217/250 (86.8%)
Catheters central 33/250 (13.2%)
length 5-7cm
segments rolled or smeared

Colonization >15 CFU

Sens 100%
(n=4)
Spec 93%
n=250

Maki DG. NEJM 1977;296:1305-1309
Check if > 5cm of catheter tip in submitted to the laboratory

- **Cut-off: Maki (Evidence)**
  >15 CFU

- **Cut-off Widmer (Eminence)**
  >5 CFU: *S. aureus*
  >10 CFU: Candida ssp
  >15 CFU standard
  >100 CFU: CNS

Maki DG NEJM 1977
Positive predictive value of SQC for central venous lines (SICU) Catheter-related BSI
Culture tip positive for any pathogen >15 CFU


Do not recommend routine culture CVC tips
Vortex Method by Brun-Buisson

Sens 97.5%
Spec 88%
N=331
central venous catheters

16/36 CAB without positive blood culture (clinical Dx)

25% of CAB had prior positive blood cultures (hematogenous seeding)

Brun-Buisson C. Arch Intern Med 1987;147:873-877
Sonication for diagnosis of catheter-related infection is not better than traditional roll-plate culture: a prospective cohort study with 975 central-venous catheters

- 975 CVCs from 2005 until 2009: all 10 cm long

Three year experience with sonicated vascular catheter cultures in a clinical microbiology laboratory.
Sherertz RJ, Raad II, Belani A, Koo LC, Rand KH, Pickett DL, Straub SA, Fauerbach LL.

CVC subcutaneous segment
SQC, rsp. sonication

CVC tip segment
Sonication, rsp. SQC

Comparison of detection of catheter colonization in short-term (≤7 days) versus long-term (> 7 days) catheters with SQC and sonication in all 217 catheters

<table>
<thead>
<tr>
<th>Time of catheterization</th>
<th>CVCs ≤7 days n=165</th>
<th></th>
<th>CVCs &gt;7 days n=52</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SQC + Sonication +</td>
<td>157</td>
<td>119 (72,1%)</td>
<td>38 (73,1%)</td>
<td></td>
</tr>
<tr>
<td>SQC</td>
<td>33</td>
<td>27 (16,4%)</td>
<td>6 (11,5%)</td>
<td>p=0.79**</td>
</tr>
<tr>
<td>SQC - Sonication +</td>
<td>27</td>
<td>19 (11,5%)</td>
<td>8 (15,4%)</td>
<td>** OR 1.33 (95% CI 0.46-3.84)</td>
</tr>
</tbody>
</table>

*OR 0.70 (95% CI 0.39-1.27) ** OR 1.33 (95% CI 0.46-3.84)

Erb S & Widmer AF. Clin Infect Dis 2014; 259(4): 541-544
Sonicating multi-lumen sliced catheter tips after the roll-plate technique improves the detection of catheter colonization in adults

N = 52 CVCs
Colonization 14.3% (36/252)  
CR-BSI 5.9% (15/252)
36 colonized CVCs, 21 (58.3%) were detected both by Maki and sonication, 6 (16.7%) only by Maki technique, and 9 (25.0%) only by sonication method.

Differential Time to Positivity (DTP) for the Diagnosis of CR-BSI

- Setting
  - cancer pts
  - long-term IV lines
  - retrospective

- 64 episodes
  - 28 CA-BSI
  - 14 Non-Ca-BSI
  - 22 undetermined

N=32

Cut-off: 2 hours

Gold standard: Brun-Buisson and clinical criteria

Blot F. JCM 1998; 36:105-110
Overall, if 1 lumen-associated culture had been eliminated for both double-lumen and triple-lumen catheters, we would have missed 27.2% and 15.8% of episodes of CRBSI, respectively.

If we had eliminated 2 cultures for triple-lumen catheters, 37.3% of episodes would have been missed.

Personal recommendation:
Septic episode: take 2-3 blood cultures sets, each from a different lumen
Double-lumen: 2 sets Triple lumen: 3 sets
Nonutility of catheter tip cultures for the diagnosis of central line-associated bloodstream infection.

Thus, this test can add little, if anything, to the diagnosis of CLABSI, and direct application of the results could put patients at risk.

A more useful approach for the length of treatment decision appears to be assuring that blood cultures have cleared within 72 hours, as per the 2009 IDSA guideline [4].

At this point, it appears that culture of the central venous catheter tip should be discontinued as a practice and the procedure relegated to the archives of historical medical interest. It also appears appropriate that this test be removed from the IDSA recommendations on the diagnosis and management of CLABSI.

Peterson LR. Clin Infect Dis. 2015 Feb 1;60(3):492-3
Catheter Tip Cultures: Are They Really Relegated to the Archives of Historical Medical Interest?


Note

Potential conflict of interest. Author certifies no potential conflicts of interest.

The author has submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

Leonard A. Mermel

1Division of Infectious Diseases, Rhode Island Hospital, and 2Department of Medicine, Warren Alpert Medical School of Brown University, Providence, Rhode Island

References

CLABSI pathogen detection methods and consequences for management

Impact of pathogen detection in CLABSI and catheter tip culture

- Andreas F. Widmer, MD, MS, FIDSA, FSHEA
- SWITZERLAND
- Deputy Chief of Div Infectious Disease & Hospital epidemiolog
  - Core member Patient safety WHO Geneva
  - President of the Swiss National Reference Center for Infection PreventionSSI Surveillance
  - www.swissnoso.ch
Algorithm for a single pos. blood culture for CoNS

CoNS from 1 of more blood cultures

- Central venous catheter present
  - <2 SIRS criteria: Contamination
  - ≥2 SIRS criteria: True bloodstream infection

- No central venous catheter
  - <3 SIRS criteria: Contamination
  - ≥3 SIRS criteria: True bloodstream infection

---

Elzi L & Widmer AF. Clin Microbiol Infect 2012; 18(9): E355–E361
Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) Quick SOFA

SIRS

Box 4. qSOFA (Quick SOFA) Criteria

- Respiratory rate $\leq 22$/min
- Altered mentation
- Systolic blood pressure $\leq 100$ mm Hg

Singer M. JAMA. 2016;315(8):801-810
Absence of CVC removal is always risky

- **Candida sp:**
  - *N’guen et al - Arch Intern Med*

- **S. aureus:** 50 CRB (retrospective)
  - Persistent BC: 11 vs 56% (p=0.01), Deaths: 5 vs 20%
  - *Malanovski GJ - Arch Intern*

- **S. maltophilia:**
  - % cured: 49/49 vs 32/62 (p<0.0001)
  - *Boktour et al – Cancer2006; 106:1967*

- **Gram negative bacilli**
  - % relapse: 1/67 vs 5/5 (p<0.001)
  - *Hanna et al – ICHE 2004; 25:646*

- **Enterococci (n=61)**
  - % cured: 5/13 vs 40/47 (p<0.01)
  - especially if aminoglycosides are not associated with cell-wall agent
  - *Sandoe JA –JAC 2002; 50:577*

- **CNS:**
  - Deaths: 4/36 vs 4/34, recurrence after 3 months: 1/36 vs 6/34
  - *Raad et al ICHE 1992*
Second Generation Chlorhexidine/Sulodiazin-Coated vs. Uncoated Short-Term Central Venous Catheters

3x higher concentration of chlorhexidine on external surface, and chlorhexidine incorporated onto luminal surface of catheter, hub, and extension lines

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Coated</th>
<th>Control</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter Colonization</td>
<td>32/345 (9%)</td>
<td>59/362 (16%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Catheter-related BSI</td>
<td>1/345 (0.3%)</td>
<td>3/362 (0.8%)</td>
<td>NS</td>
</tr>
<tr>
<td>BSI/1000 catheter-days</td>
<td>0.42</td>
<td>1.24</td>
<td>NS</td>
</tr>
</tbody>
</table>
Cumulative Risk of Catheter-Related Infection and Catheter Colonization

1. Catheter colonization: catheter-tip culture yielding at least 1000 colony-forming units (CFUs)/mL.

2. Catheter-related clinical sepsis without bloodstream infection: a combination of
   1. fever (body temperature ≥38.5°C) or hypothermia (body temperature ≤36.5°C),
   2. a catheter-tip culture yielding at least 10³ CFUs/mL
   3. pus at the insertion site or resolution of clinical sepsis after catheter removal, and
   4. absence of any other infectious focus.

3. Major catheter-related infection: catheter-related clinical sepsis without bloodstream infection or CR-BSI

Median duration of catheterization was 6 days (interquartile range, 4-10 days) for all curves.

CHGIS indicates Chlorhexidine gluconate-impregnated sponge. CI, confidence interval; HR, hazard ratio.
Comparision Incidence Catheter-related Infections with CHX Gel Dressing vs Control

Cumulative risk of major-CRI with chlorhexidine-gel dressings and non-antiseptic dressings,

Colonization with highly adhesive non-chlorhexidine dressings vs standard dressing

Comparision Incidence Catheter-related Infections with CHX Gel Dressing vs Control

2054 eligible patients

Not included 156
Exclusion criteria 17
Patients or surrogates refused 2

1879 patients enrolled and randomized

CHlorhexidine-gel impregnated dressings
938 patients

Highly adhesive dressings
467 patients

Standard dressings
476 patients

ITT population
1879 patients 4163 catheters

Hard Endpoint CR-BSI
CHX 9 CR-BSI/2018 Cath
Standard: 12 CR-BSI/1067 Cath

Kaplan–Meier curves of time to catheter-related infection (left) and catheter-related bloodstream infection (right) by CHX-a and PVI-a groups in the quasi-experimental study.

- CVC central venous catheters, HR hazard ratio, CI confidence interval, IPWT inverse probability weighting treatment model, PSM propensity score matched

Kaplan–Meier curves of time to catheter-related infection (left) and catheter-related bloodstream infection (right) by CHX-a and PVI-a groups in the quasi-experimental study.

Positive intravenous line tip cultures as predictors of bacteraemia

- **MSSA**: 70/97
- **MRSA**: 3/13
- **CoNS**: 90/533
- **Streptococcus spp.**: 4/10
- **Enterococcus spp.**: 7/50
- **Enterobacteriaceae**: 15/74
- **Pseudomonas spp.**: 3/22
- **Candida spp.**: 2/8
- **Other spp.**: 0/18

Methods for the diagnosis of acute fever in a patient suspected of having short-term (CVC) infection

**Cath-tip >15 CFU S.aureus**  
Blood cultures negative

**Treat as S.aureus BSI**

For **S. aureus** treat 5-7 days, monitor closely for signs of infection, repeat blood cultures accordingly. If due to other microbes: monitor closely for signs of infection, repeat blood cultures accordingly.

Ekkelenkamp MB & Bonten MJM. Clin Infect Dis 2008

Preventing *S. aureus* Bacteremia and Sepsis in Patients With S.aureus Colonization of Intravascular Catheters: A Retrospective Multicenter Study and Meta-Analysis.

Hetem, David; de Ruiter, Susanne; Buiting, Anton; MD, PhD; Kluytmans, Jan; MD, PhD; Thijsen, Steven; MD, PhD; Vlaminckx, Bart; MD, PhD; Wintermans, Robert; MD, PhD; Bonten, Marc; MD, PhD; Ekkelenkamp, Miquel

Digital Object Identifier: 10.1097/MD.0b013e31822403e9

FIGURE 1. Meta-analysis of studies on the protective effect of prophylactic antibiotic therapy for IV catheters colonized with Staphylococcus aureus to prevent subsequent Staphylococcus aureus bacteremia. Comparison: antibiotic therapy for patients with S. aureus IV catheter colonization; outcome: SAB. Note: in the studies by Ruhe et al and Park et al, antibiotic therapy was initiated within 48 hours; in the studies by Ekkelenkamp et al and Hetem et al, antibiotic therapy was initiated within 24 hours. M-H = Mantel-Haenszel analysis.
Approach to the management of patients with short-term (CVC)-related bloodstream infection

Short-term central venous catheter (CVC)–related bloodstream infection

Complicated

Uncomplicated (bloodstream infection and fever resolves within 72 hours in a patient without an active malignancy or immunosuppression who has no intravascular hardware and no evidence of endocarditis or suppurative thrombophlebitis)

Suppurative thrombophlebitis, endocarditis or osteomyelitis, etc

Coagulase-negative staphylococci

Staphylococcus aureus

Enterococcus

Gram-negative bacilli

Candida spp.

- Remove CVC & treat with systemic antibiotic for 5–7 days
- Alternatively, treat with systemic antibiotics, remove CVC, repeat blood cultures and discontinue antibiotic when the catheter is removed.
- If catheter is retained, treat with systemic antibiotic + antibiotic lock therapy for 10–14 days

- Remove CVC & treat with systemic antibiotic for 14 days

- Remove CVC & treat with systemic antibiotic for 7–10 days

- Remove CVC & treat with systemic antibiotic for 7–10 days

- Remove CVC & treat with antifungal therapy for 14 days after last positive blood culture

Approach to the Management of a patient with a long-term CVC or a port-related bloodstream infection*

*An exit site infection without concomitant bloodstream infection or tunnel/port infection may be initially treated with topical antimicrobials followed by systemic antibiotics if the infection fails to respond to topical therapy.

Final concentrations of antibiotic lock solutions used for the treatment of catheter-related bloodstream infections

<table>
<thead>
<tr>
<th>Antibiotic and dosage</th>
<th>Heparin or saline, IU/mL</th>
<th>Reference(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancomycin, 2.5 mg/mL</td>
<td>2500 or 5000</td>
<td>[100, 275]</td>
</tr>
<tr>
<td>Vancomycin, 2.0 mg/mL</td>
<td>10</td>
<td>[275]</td>
</tr>
<tr>
<td>Vancomycin, 5.0 mg/mL</td>
<td>0 or 5000</td>
<td>[276, 277]</td>
</tr>
<tr>
<td>Ceftazidime, 0.5 mg/mL</td>
<td>100</td>
<td>[123]</td>
</tr>
<tr>
<td>Cefazolin, 5.0 mg/mL</td>
<td>2500 or 5000</td>
<td>[100, 277]</td>
</tr>
<tr>
<td>Ciprofloxacin, 0.2 mg/mL</td>
<td>5000</td>
<td>[130]</td>
</tr>
<tr>
<td>Gentamicin, 1.0 mg/mL</td>
<td>2500</td>
<td>[100]</td>
</tr>
<tr>
<td>Ampicillin, 10.0 mg/mL</td>
<td>10 or 5000</td>
<td>[275]</td>
</tr>
<tr>
<td>Ethanol, 70%</td>
<td>0</td>
<td>[131]</td>
</tr>
</tbody>
</table>

Risk factor for Candidemia with colonized CVC with Candida ssp.

- Intravascular catheter tip colonization in patients without preceding blood cultures with Candida
- 4% of patients (definite candidemia)
- 12% of patients (definite and possible candidemia combined).

Central venous catheter (CVC) removal for patients of all ages with candidaemia (Review)

- Study characteristics
  no clinical trials with a randomized controlled design

- 73 observational studies that delivered descriptive data on catheter management and survival in people with bloodstream infections caused by Candida.
- Key results
  We identified no randomized controlled trials for statistical analyses and assessments. Therefore, we can present no results on the effect of catheter removal on survival when Candida is found in the bloodstream.

- 73 observational studies with relevant outcomes after the catheter was removed or was kept in place.
  - 40 studies reported a beneficial effect of catheter removal
  - 34 presented results showing no clear differences between groups.
  - No studies reported results in favour of retaining the catheter.
- We found no reports on the harmful effects of removing a catheter and re-inserting a new catheter.
- Quality of evidence
  - No randomized controlled trials met the inclusion criteria. Consequently, we cannot assess the quality of evidence.

Janum S. Cochrane Database Syst Rev. 2016 Jul 11;7:
Final comments on Prevention of CLABSI
Reduction of CVC-BSI rates after Participating in the Surveillance Project „KISS“ over 3 years (150 ICUs)

RR = 0.80
(CI<sub>95</sub> 0.72-0.90)

Gastmeier et al.
J Hosp Infect 2006; 64: 16-22

# Intervention studies to Prevent CLABSIs

<table>
<thead>
<tr>
<th>Autor</th>
<th>Setting</th>
<th>Intervention</th>
<th>Infection rate at the beginning /1000 CVC days</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coppersmith 2002</td>
<td>1 surgical ICU</td>
<td>Educational programme + Feedback</td>
<td>10.8</td>
<td>66 %</td>
</tr>
<tr>
<td>Warren 2003</td>
<td>1 ICU</td>
<td>Educational programme</td>
<td>4.9/</td>
<td>57 %</td>
</tr>
<tr>
<td>Rosenthal 2003</td>
<td>4 ICUs</td>
<td>Educational programme + Feedback</td>
<td>46.6</td>
<td>75 %</td>
</tr>
<tr>
<td>Warren 2004</td>
<td>1 medical ICU</td>
<td>Educational programme</td>
<td>9.4</td>
<td>41 %</td>
</tr>
<tr>
<td>Lobo 2005</td>
<td>1 medical ICU</td>
<td>Multimodal programme</td>
<td>20</td>
<td>40 %</td>
</tr>
<tr>
<td>Eggimann</td>
<td>1 medical ICU</td>
<td>Multimodale programme</td>
<td>24.6</td>
<td>75 %</td>
</tr>
</tbody>
</table>
Healthcare-associated infections (HAI s) are infections patients can get while receiving medical treatment in a healthcare facility. Working toward the elimination of HAI s is a CDC priority. The standardized infection ratio (SIR) is a summary statistic that can be used to track HAI prevention progress over time; lower SIRs are better. The infection data are collected through CDC’s National Healthcare Safety Network (NHSN). HAI data for nearly all U.S. hospitals are published on the Hospital Compare website.

**CLABSIs**

- **CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS**
  - When a tube is placed in a large vein and not put in correctly or kept clean, it can become a way for germs to enter the body and cause deadly infections in the blood.
  - U.S. hospitals reported a significant decrease in CLABSIs between 2012 and 2013.
  - Among the 7,650 U.S. hospitals with enough data to calculate an SIR, 9% had an SIR significantly worse than the national SIR of 0.64.

**CAUTIs**

- **CATHETER-ASSOCIATED URINARY TRACT INFECTIONS**
  - When a urinary catheter is not put in correctly, not kept clean, or left in a patient for too long, germs can travel through the catheter and infect the bladder and kidneys.
  - U.S. hospitals reported a significant increase in CAUTIs between 2012 and 2013.
  - Among the 7,814 U.S. hospitals with enough data to calculate an SIR, 9% had an SIR significantly worse than the national SIR of 1.06.

**MRSA Bacteremia**

- **LABORATORY IDENTIFIED HOSPITAL-ONSET BLOODSTREAM INFECTIONS**
  - Methicillin-resistant Staphylococcus aureus (MRSA) is bacteria usually spread by contaminated hands. In a healthcare setting, such as a hospital, MRSA can cause serious bloodstream infections.
  - U.S. hospitals reported a significant decrease in MRSA Bacteremia between 2012 and 2013.
  - Among the 2,002 U.S. hospitals with enough data to calculate an SIR, 7% had an SIR significantly worse than the national SIR of 0.92.

**SSIs**

- **SURGICAL SITE INFECTIONS**
  - When surgery cuts an area where surgery is or was performed, patients can get a surgical site infection. Sometimes these infections involve only the skin. Other SSIs can involve tissues under the skin, organs, or implanted material.
  - **SSI: Abdominal Hysterectomy**
  - U.S. hospitals reported no significant change in SSIs related to abdominal hysterectomy surgery between 2012 and 2013.
  - Among the 765 U.S. hospitals with enough data to calculate an SIR, 9% had an SIR significantly worse than the national SIR of 0.86.

  - **SSI: Colon Surgery**
  - U.S. hospitals reported a significant increase in SSIs related to colon surgery between 2012 and 2013.
  - Several changes to the NHSN 2013 SSI protocol likely contributed to an increase in the national and some state-specific colon surgery SIRs compared to 2012.
  - Among the 2,030 U.S. hospitals with enough data to calculate an SIR, 7% had an SIR significantly worse than the national SIR of 0.92.

**C. difficle Infections**

- **LABORATORY IDENTIFIED HOSPITAL-ONSET C. difficile INFECTIONS**
  - When a person takes antibiotics, good bacteria that protect against infection are destroyed for several months. During this time, patients can get sick from Clostridium difficile (C. difficile), bacteria that cause potentially deadly diarrhea, which can be spread in healthcare settings.
  - U.S. hospitals reported a significant decrease in C. difficile infections between 2012 and 2013.
  - Among the 3,557 U.S. hospitals with enough data to calculate an SIR, 13% had an SIR significantly worse than the national SIR of 0.90.

*Statistically significant.

This report is based on 2013 data, published January 2015.
HEALTHCARE-ASSOCIATED INFECTION (HAI) DATA give healthcare facilities and public health agencies knowledge to design, implement, and evaluate HAI prevention efforts.

<table>
<thead>
<tr>
<th>HAI TYPE</th>
<th># OF U.S. HOSPITALS THAT REPORTED DATA TO CDC'S NHSN, 2013†</th>
<th>2013 NAT'L SIR vs. 2012 Nat'l SIR‡</th>
<th>2013 NAT'L SIR vs. Nat'l Baseline§</th>
<th>2013 NAT'L SIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLABS†</td>
<td>3,578</td>
<td>↓ 4%</td>
<td>↓ 46%</td>
<td>0.54</td>
</tr>
<tr>
<td>CAUTI</td>
<td>3,640</td>
<td>↑ 3%</td>
<td>↓ 6%</td>
<td>1.06</td>
</tr>
<tr>
<td>SSI, Abdominal Hysterectomy</td>
<td>3,152</td>
<td>↓ 4%</td>
<td>↓ 14%</td>
<td>0.86</td>
</tr>
<tr>
<td>SSI, Colon Surgery</td>
<td>3,348</td>
<td>↑ 14%</td>
<td>↓ 8%</td>
<td>0.92</td>
</tr>
<tr>
<td>MRSA Bacteremia</td>
<td>3,827</td>
<td>↓ 5%</td>
<td>↓ 8%</td>
<td>0.92</td>
</tr>
<tr>
<td><em>C. difficile</em> Infections</td>
<td>3,924</td>
<td>↓ 6%</td>
<td>↑ 10%</td>
<td>0.90</td>
</tr>
</tbody>
</table>

*The number of hospitals reporting for each HAI type may differ because some hospitals do not use central lines or urinary catheters, or do not perform colon or abdominal hysterectomy surgeries.
†The 2012 Nat'l SIRs can be found in the data tables of this report.
§Nat'l baseline time period varies by infection type. See first column of this table for specifics.
• Definitions allow ample space for interpretation
• Dropping MBI-LCBI from CLABSI will reduce CLABSI rates in hemato-oncology wards
• MALDI-TOF will almost always provide specific species, not coag-neg-staph or strep ssp and therefore, reduce rate of CR-BSI
• Know difference between CLABSI vs CR-BSIs
CONCLUSIONS -2-

Suggested Flow-chart: CLINICAL

• Setting: ICU Patient with septic fever, but stable
  – DTP: if positive, replace catheter, culture tip, and treat according to pathogen
  – DTP neg: check other source

• Setting: ICU Patient with septic fever, unstable:
  – Take CVC out, culture tip, start treatment

• SURVEILLANCE
  – Low CLABSI rates with CVC is feasible at low cost
    Goal: < 1 CLABSI/1000 patient days)
  – Check Surveillance definitions of CLABSI (DEFINITIONS?)

Catheter tip cultures: clinically still important, but abandoned in the US
Basel Walk of Fame
Garden of University of Basel Hospitals

Thank you for your attention
My Apologies to leave early
Fig. 4. Dissemination of innovations over time. Adapted from Berwick D.M. Disseminating innovations in health care. JAMA 2003; 289:1969–1975.

Vincent de Jonge, Jerome Sint Nicolaas, Monique E. van Leerdam, Ernst J. Kuipers

Overview of the quality assurance movement in health care


http://dx.doi.org/10.1016/j.bpg.2011.05.001
Transmissibility of *Clostridium difficile* Without Contact Isolation: Results From a Prospective Observational Study With 451 Patients

Andreas F. Widmer,1 René Frei,2 Stefan Erb,1 Anne Stranden,1 Ed J. Kuijper,3 Cornelis W. Kuijper,3 and Sarah Tschudin-Sutter4

Divisions of 1Infectious Diseases and Hospital Epidemiology and 2Clinical Microbiology, University Hospital Basel, University of Basel, Switzerland; and 3Section of Experimental Microbiology, Department of Medical Microbiology, Center of Infectious Diseases, Leiden University Medical Center, The Netherlands

**Background.** Contact precautions are recommended by health authorities in Europe and the United States for patients with *Clostridium difficile* infection (CDI). Recently, the significance of nosocomial transmission has been challenged by screening on admission studies and whole-genome sequencing, providing evidence for an endogenous source of *C. difficile*. We discontinued contact precautions for patients with CDI, except for patients infected with hypervirulent ribotypes or with stool incontinence, to determine the rate of transmission.

**Methods.** From January 2014 to December 2015, contacts of each index case with CDI were screened for toxigenic *C. difficile* by culturing rectal swabs. Transmission was defined as possible if toxigenic *C. difficile* was detected in contacts, as probable if the identical polymerase chain reaction ribotype was identified in index–contact pairs, and as confirmed if next-generation sequencing (NGS) revealed clonality of strains.

**Results.** Four hundred fifty-one contacts were exposed to 279 index patients nursed in 2- to 4-bed rooms. Toxigenic *C. difficile* was detected in 6.0% (27/451) after a median contact time of 5 days. Identical ribotypes were identified in 6 index–contact pairs, accounting for probable transmission in 1.3% (6/451). NGS was performed for 4 of 6 pairs with identical strains, and confirmed transmission in 2 contact patients.

**Conclusions.** The rate of transmission of toxigenic, predominantly nonhypervirulent *C. difficile*, was low and no outbreaks were recorded over a 10-year period after discontinuing contact precautions for patients with CDI who were not severely incontinent and who used dedicated toilets. As contact precautions may lead to lower levels of care, their implementation needs to be balanced against the risk of nosocomial transmission.

**Keywords.** *C. difficile*; transmission; contact precautions; screening; acute care hospital.