Surveillance for HAIs: Changing Definitions as Accountability for Prevention Increases

Tom Talbot, MD MPH
Associate Professor of Medicine
and Health Policy,
Vanderbilt University School of Medicine
Chief Hospital Epidemiologist,
Vanderbilt University Medical Center

April 24, 2015
Objectives

- Review the history of and the rationale for HAI surveillance
- Review the recent (2013-2015) NHSN HAI definition changes
- Discuss some logistic challenges and issues related to the new definitions
Disclaimer

• Some of these slides are taken from the reports presented at HICPAC meetings between 2011-14 from the following CDC experts:
  - Scott Fridkin
  - Ryan Fagan
  - Shelley Magill
  - Carolyn Gould
Surveillance

• Routine collection of data
  - Should be applicable to all facilities
• Utilize standardized definitions for cases
• Utilize common denominator populations
• Allows for:
  - Assessment of impact of prevention interventions
  - Comparison and benchmarking
• Risk stratification important
Key Moments in Healthcare Epidemiology/HAI Surveillance

- 1958: AHA advisory committee recommends nosocomial infection surveillance/establishment of IC committees
- **1965**: 6 hospital pilot of HAI surveillance programs
- 1970: CDC establishes NNIS system (19 → 300 hospitals)
- 1974-83: SENIC project
- 1975: Half of US hospitals had IC programs/ICPs
- 1992: HICPAC established
- 1990s: Era of guidelines
- 2000s: Era of QI
- 2006: NNIS → NHSN system
- 2008: CMS and nonpayment for HACs
- 2011: CMS-driven public reporting of key HAIs with VBP
Surveillance of Nosocomial Infections in Community Hospitals.
I. Surveillance Methods, Effectiveness, and Initial Results

Theodore C. Eickhoff,* Philip S. Brachman, John V. Bennett, and Jeanette F. Brown

From the Epidemiology Program, National Communicable Disease Center, Health Services and Mental Health Administration, Public Health Service, Department of Health, Education and Welfare, Atlanta, Georgia

Table 2. Methods of surveillance used in participating hospitals

<table>
<thead>
<tr>
<th>Hosp.</th>
<th>Hospital epidemiologist</th>
<th>Surveillance nurse</th>
<th>Reporting person</th>
<th>Individual patient forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Director, Medical Education</td>
<td>Personnel</td>
<td>Head nurses</td>
<td>+</td>
</tr>
<tr>
<td>B</td>
<td>Pathologist</td>
<td>Personnel</td>
<td>Head nurses</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Head nurses</td>
<td>+</td>
</tr>
</tbody>
</table>

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Figure 3

Name of Hospital

MONTHLY INFECTION REPORT

Total Hospital Discharges
Number of Infections Reports Received  Percent
Total Number of Infections
Present on Admission
Developed After Admission
Infections Developed After Admission (By Service)

<table>
<thead>
<tr>
<th>Medical</th>
<th>Discharges</th>
<th>Infections</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O.B.-Newborn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pediatrics</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Infections Developed After Admission (By Type)

<table>
<thead>
<tr>
<th>Wound</th>
<th>Discharges</th>
<th>Infections</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin &amp; Subcutaneous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urinary Tract</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4. Composite monthly rate of nosocomial infection, 6 participating hospitals, July, 1965–December, 1966.
Key Moments in Healthcare Epidemiology/HAI Surveillance

- **1958**: AHA advisory committee recommends nosocomial infection surveillance/establishment of IC committees
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- **2000s**: Era of QI
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- **2011**: CMS-driven public reporting of key HAIs with VBP
Infection surveillance and control programs strongly associated with:

- Reduced UTI, SSI, pneumonia, BSI

HAI with IC programs: ↓ 32%

HAI without HAI programs ↑ 18%

Essential components of program:

- Organized surveillance
- 1 ICP per 250 beds
- Trained MD
- System to report SSI rates to surgeons
Key Moments in Healthcare Epidemiology/HAI Surveillance

- **1958**: AHA advisory committee recommends nosocomial infection surveillance/establishment of IC committees
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- **1975**: Half of US hospitals had IC programs/ICPs
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- **1990s**: Era of guidelines
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- **2011**: CMS-driven public reporting of key HAIs with VBP
NNIS ➔ NHSN

- CDC program
- National nosocomial infection database
- Main purposes:
  - Describe the epidemiology of nosocomial infections
  - Describe antimicrobial resistance trends
  - Produce nosocomial infection rates to use for comparison purposes by hospital type (benchmark)
- NNIS enrollment capped @ 315 hospitals
- Fall 2004: National Health & Safety Network
Table 2
Enrolled National Healthcare Safety Network facilities contributing data used in this report, by facility type and bed size

<table>
<thead>
<tr>
<th>Facility type</th>
<th>≤50, n (%)</th>
<th>51-200, n (%)</th>
<th>201-500, n (%)</th>
<th>&gt;500, n (%)</th>
<th>Total, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute care hospitals</td>
<td>885 (19.4)</td>
<td>1,581 (34.6)</td>
<td>1,091 (23.9)</td>
<td>258 (5.6)</td>
<td>3,815 (83.5)</td>
</tr>
<tr>
<td>Major teaching</td>
<td>19 (0.4)</td>
<td>102 (2.2)</td>
<td>231 (5.1)</td>
<td>162 (3.5)</td>
<td>514 (11.2)</td>
</tr>
<tr>
<td>Graduate teaching</td>
<td>40 (0.9)</td>
<td>205 (4.5)</td>
<td>253 (5.5)</td>
<td>48 (1.0)</td>
<td>546 (12.0)</td>
</tr>
<tr>
<td>Undergraduate teaching</td>
<td>21 (0.5)</td>
<td>66 (1.4)</td>
<td>36 (0.8)</td>
<td>3 (0.1)</td>
<td>126 (2.8)</td>
</tr>
<tr>
<td>Nonteaching</td>
<td>805 (17.6)</td>
<td>1,208 (26.4)</td>
<td>571 (12.5)</td>
<td>45 (1.0)</td>
<td>2,629 (57.6)</td>
</tr>
<tr>
<td>Long-term acute care hospitals</td>
<td>289 (6.3)</td>
<td>193 (4.2)</td>
<td>11 (2.2)</td>
<td>0 (0.0)</td>
<td>493 (10.8)</td>
</tr>
<tr>
<td>Freestanding</td>
<td>118 (2.6)</td>
<td>171 (3.7)</td>
<td>11 (2.2)</td>
<td>0 (0.0)</td>
<td>300 (6.6)</td>
</tr>
<tr>
<td>Within a hospital</td>
<td>171 (3.7)</td>
<td>22 (0.5)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>193 (4.2)</td>
</tr>
<tr>
<td>Inpatient rehabilitation facilities</td>
<td>120 (2.6)</td>
<td>136 (3.0)</td>
<td>3 (0.1)</td>
<td>0 (0.0)</td>
<td>259 (5.7)</td>
</tr>
<tr>
<td>Freestanding</td>
<td>101 (2.2)</td>
<td>125 (2.7)</td>
<td>3 (0.1)</td>
<td>0 (0.0)</td>
<td>229 (5.0)</td>
</tr>
<tr>
<td>Within a health care facility</td>
<td>19 (0.4)</td>
<td>11 (0.2)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>30 (0.7)</td>
</tr>
<tr>
<td>Total</td>
<td>1,294 (28.3)</td>
<td>1,910 (41.8)</td>
<td>1,105 (24.2)</td>
<td>258 (5.6)</td>
<td>4,567</td>
</tr>
</tbody>
</table>

Freestanding/within a hospital/within a health care facility, physical placement of long-term acute care hospital or inpatient rehabilitation facility and does not define financial or administrative relationships with other health care facility types; Graduate, facility has a program for postgraduate medical training (i.e., residency and fellowships); Major, facility has a program for medical students and postgraduate medical training; Undergraduate, facility has a program for medical students only.

*There were 851 acute care hospitals that also report for locations identified as inpatient rehabilitation facilities.

†Does not include inpatient rehabilitation facilities reporting to the National Healthcare Safety Network as locations within enrolled acute care hospitals.
Central Line Associated Bloodstream Infections (CLABSI)

Lower numbers are better. A score of zero (0) - meaning no CLABSI - is best.

Why is this important?

VANDERBILT UNIVERSITY HOSPITAL

Tennessee

National Benchmark = 1

HAI Reporting Laws and Regulations
States That Have Enacted Laws Relating to Reporting of Healthcare-Associated Infections
Regulatory Requirements: HAI Reporting

- CMS IPPS:
  - ICU CLABSI (Jan ‘11)
  - ICU CAUTI (Jan ‘12)
  - Colon and abdominal hysterectomy SSI (Jan ‘12)
  - Dialysis events (Jan ‘12)
  - MRSA bacteremia Lab ID Event (Jan ‘13)
  - C. diff infection Lab ID Event (Jan ‘13)
  - HCP Influenza vaccination rate (Jan ‘13)
  - CLABSI and CAUTI in adult & pediatric medical, surgical, and medical-surgical non-ICUs (Jan ‘15)
Hospital Infections: Preventable and Unacceptable

Bringing hospital infections down to zero
Zero Tolerance for Infections: A Winning Strategy

APIC launches 'Targeting Zero' initiative to eradicate infections deemed preventable by CMS

Blood infections plague TN hospitals
Even with safety push, state’s rate is still high

BY CHRISTINA E. SANCHEZ • THE TENNESSEAN • JANUARY 17, 2010
“Obviously, Vanderbilt is not where we want to be. We need to get on top of this.”

DR. TOM TALBOT
chief epidemiologist for Vanderbilt University Medical Center

Bloodstream infections trouble two hospitals

Centennial, Vanderbilt have highest numbers

HOW THEY MEASURE UP
Middle Tennessee hospitals seek to score less than 1.0, which shows bloodstream infections are below the National Healthcare Safety Network standard. A standardized infection ratio (SIR) of 1.0 means the number of infections equals the expected number. The figures are for 2009, the most recent report.

BEST IN NASHVILLE
- Baptist Hospital
  Expected: 9.4
  SIR: 0.0
- Saint Thomas Hospital
  Expected: 11
  SIR: 0.2

WORST IN NASHVILLE
- Centennial Medical Center
  Expected: 16
  SIR: 2.5
- Vanderbilt University Medical Center
  Expected: 40
  SIR: 1.9

April 6, 2011
THE GOOD NEWS

BLOODSTREAM INFECTIONS
Tennessee hospitals have made great strides in preventing bloodstream infections. None had an infection rate significantly worse than the national standard, and six scored significantly better:
- Vanderbilt University Medical Center
- Monroe Carell Jr. Children’s Hospital at Vanderbilt
- Le Bonheur Children’s Hospital
- Methodist University Hospital
- Jackson-Madison County General Hospital
- University of Tennessee Medical Center

— Tennessee Department of Health

THE BAD NEWS

CATHERER-RELATED URINARY INFECTIONS
Tennessee hospitals are not doing a good job at preventing catheter-related urinary tract infections. Ten hospitals were red-lined for infection rates significantly higher than the national standard:
- Erlanger Medical Center
- Fort Sanders Regional Medical Center
- Holston Valley Medical Center
- Methodist Healthcare South
- Methodist University Hospital
- Physicians’ Regional Medical Center
- Regional One Health
- Saint Thomas Midtown
- Saint Thomas West
- University of Tennessee Medical Center

COLON SURGERY INFECTIONS
While the overall infection ratio for colon surgery is in line with the national standard, two hospitals had significantly higher cases:
- Jackson-Madison County General Hospital
- University of Tennessee Medical Center

METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA)
MRSA infections at Tennessee hospitals are 12 percent higher than the national standard. Two hospitals had infection rates significantly higher:
- Baptist Memorial Hospital Memphis
- Regional One Health Memphis

CLOSTRIDIUM DIFFICILE INFECTIONS
Clostridium difficile is a serious type of diarrhea that occurs when overuse of antibiotics has killed good bacteria within the digestive system. While the incidence of this diarrhea in Tennessee is 23 percent lower than the national standard, some hospitals have reported cases significantly higher than the baseline:
- Skyline Medical Center
- St. Jude Children’s Research Hospital

— Tennessee Department of Health

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August 26, 2014
History of HAI Surveillance

- 1960s: “House-wide” surveillance
- 1970-80s: Moved to “surveillance by objective”
- Current:
  - Target high-risk areas, infections (e.g. MRSA) → “Intensive Infection Units”
  - Periodic special projects
  - PA: Reports “any HAI that occurs in an in-patient location” as part of public reporting law
The Problem: Healthcare Associated Infections

Central Line-Associated Bloodstream Infections

Ventilator-Associated Pneumonia

Catheter-Associated Urinary Tract Infections

MDROs and C. diff

Surgical Site Infections
Pick Your Definition: Surgical Site Infection

- Wound with purulent drainage
- Wound with culture + drainage
- Red, warm, or draining wound requiring opening by an MD
- Physician diagnosis
- Radiologic presence of abscess
SSI-SURGICAL SITE INFECTION

SIP/SIS-Superficial incisional surgical site infection

A superficial incisional SSI (SIP or SIS) must meet the following criterion:
Infection occurs within 30 days after the operative procedure
and
involves only skin and subcutaneous tissue of the incision
and
patient has at least 1 of the following:

a. purulent drainage from the superficial incision

b. organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision

c. at least 1 of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat, and superficial incision is ultimately opened by surgeon and is culture-positive or not cultured. A culture-negative finding does not meet this criterion.

d. diagnosis of superficial incisional SSI by the surgeon or attending physician.

DIP/DIS-Deep incisional surgical site infection

A deep incisional SSI (DIP or DIS) must meet the following criterion:
Infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operative procedure
and
involves deep soft tissues (e.g., fascial and muscle layers) of the incision
and
patient has at least 1 of the following:

a. purulent drainage from the deep incision but not from the organ/space component of the surgical site

b. a deep incision spontaneously dehisces or is deliberately opened by a surgeon and is culture-positive or not cultured when the patient has at least 1 of the following signs or symptoms: fever (>38°C), localized pain or tenderness. A culture-negative finding does not meet this criterion.

c. an abscess or other evidence of infection involving the deep incision is found on direct examination during reoperation, or by histopathologic or radiologic examination

d. diagnosis of a deep incisional SSI by a surgeon or attending physician.

Organ/space-Organ/space surgical site infection

An organ/space SSI involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure. Specific sites are assigned to organ/space SSI to identify further the location of the infection. Listed below in reporting instructions are the specific sites that must be used to differentiate organ/space SSI. An example is appendectomy with subsequent subdiaphragmatic abscess, which would be reported as an organ/space SSI at the intraabdominal specific site (SSI-IAB).

An organ/space SSI must meet the following criterion:
Infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operative procedure
and
infection involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure
and
patient has at least 1 of the following:

a. purulent drainage from a drain that is placed through a stab wound into the organ/space

b. organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space

c. an abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination

d. diagnosis of an organ/space SSI by a surgeon or attending physician.
Surveillance Definitions ≠ Clinical Diagnosis

• Intent of surveillance definitions:
  - Originally used as internal infection prevention measure/quality control
  - Focused on high volume, high morbidity infections as surrogates for infection control/prevention practices throughout a facility

• Ideal requirements:
  • Reproducibility
  • Access to available data components
  • Minimal subjectivity
  • Measure something that can be prevented
Challenges of Utilizing HAI Surveillance Definitions

• **Subjectivity**
  - Ex: Purulent sputum (VAP), physician diagnosis (SSI), Interpretation of BSI due to skin commensal (false positive blood culture vs. meets CLABSI definition)

• **Variability in clinical documentation**
  - Electronic medical records: more likely to capture outcome
  - Reliant on interpretation of clinicians

• **Do not completely align with clinically-diagnosed infections**
Challenges of Utilizing HAI Surveillance Definitions

- Challenges when internal outcome metrics are used for purposes other than quality improvement
- Creates **skewed incentives**
  - Goal: reduce the rate of infection by excluding events vs. true reduction in infection outcomes ("argue away the number")
- More likely to exclude perceived false positives than include clinically-diagnosed infections that fail to meet surveillance definitions
- **Adjudication panels**
  - Where events that meet the surveillance definitions are presented to facility leadership to make a “final” ascertainment as to whether such event is an HAI
2. Are any of the following approaches used at your institution to adjudicate difficult or controversial cases in order to meet reporting requirements?

[Instructions were to check all that apply; numbers add to more than 100%] [243 respondents]

<table>
<thead>
<tr>
<th>Approach</th>
<th>Number (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No adjudication method; original “call” will stand</td>
<td>32 (13%)</td>
</tr>
<tr>
<td>Consensus method</td>
<td>161 (66%)</td>
</tr>
<tr>
<td>Single “decider” makes final call</td>
<td>61 (25%)</td>
</tr>
<tr>
<td>Clinician is allowed a “veto” (clinical judgment)</td>
<td>32 (13%)</td>
</tr>
<tr>
<td>Other</td>
<td>24 (10%)</td>
</tr>
<tr>
<td>Do not know</td>
<td>16 (7%)</td>
</tr>
</tbody>
</table>

- We try to report honestly with the least possible "clinical judgment" intruding into our calls. That is why I favor an automated approach; accuracy is less important than consistency and a level playing field.

- There is often a strong (unvoiced) disincentive to recognize CLABSI. [NH]

- With reporting of nosocomial infections, hospitals are now using the strictest definition to exclude as many cases as possible. Reported rates are bordering on the improbable. [KY]

- Internal and external reporting has sparked a trend toward post-hoc adjudication of HAI cases. We need to ensure that the emperor has (objective) clothes as we pursue the critical goal of limiting HAI, including CLABSI. [OH]
Public Reporting of Health Care–Associated Surveillance Data: Recommendations From the Healthcare Infection Control Practices Advisory Committee

Thomas R. Talbot, MD, MPH; Dale W. Bratzler, DO, MPH; Ruth M. Carrico, PhD, RN; Daniel J. Diekema, MD; Mary K. Hayden, MD; Susan S. Huang, MD, MPH; Deborah S. Yokoe, MD, MPH; and Neil O. Fishman, MD, for the Healthcare Infection Control Practices Advisory Committee

Health care–associated infection (HAI) rates are used as measures of a health care facility’s quality of patient care. Recently, these outcomes have been used to publicly rank quality efforts and determine facility reimbursement. The value of comparing HAI rates among health care facilities is limited by many factors inherent to HAI surveillance, and incentives that reward low HAI rates can lead to unintended consequences that can compromise medical care surveillance efforts, such as the use of clinical adjudication panels to veto events that meet HAI surveillance definitions.

The Healthcare Infection Control Practices Advisory Committee, a federal advisory committee that provides advice and guidance to the Centers for Disease Control and Prevention (CDC) and the Secretary of the Department of Health and Human Services about strategies for surveillance, prevention, and control of HAIs, assessed the challenges associated with using HAI surveillance data for external quality reporting, including the unintended consequences of clinician veto and clinical adjudication panels. Discussions with stakeholder liaisons and committee members were then used to formulate recommended standards for the use of HAI surveillance data for external facility assessment to ensure valid comparisons and to provide as level a playing field as possible.

The final recommendations advocate for consistent, objective, and independent application of CDC HAI definitions with concomitant validation of HAIs and surveillance processes. The use of clinician veto and adjudication is discouraged.


For author affiliations, see end of text.
Surveillance definitions and clinical definitions are different!

But yeast never causes a UTI!
Current Definitions of Central Line–Associated Bloodstream Infection: Is the Emperor Wearing Clothes?

Daniel J. Sexton, MD; Luke F. Chen, MBBS, MPH, CIC, FRACP; Deverick J. Anderson, MD, MPH

Casablanca Redux: We Are Shocked That Public Reporting of Rates of Central Line–Associated Bloodstream Infections Are Inaccurate

Daniel J. Sexton, MD; Luke F. Chen, MBBS; Rebekah Moehring, MD; Paul A. Thacker,

When Counting Central Line Infections Counts

Mary Dixon-Woods, MSc, DPhil; Eli N. Perencevich, MD, MS

CLABSI Rates in Immunocompromised Patients: A Valuable Patient Centered Outcome?

Thomas G. Fraser and Steven M. Gordon
Department of Infectious Disease, Cleveland Clinic, Cleveland, Ohio

Surveying the Surveillance: Surgical Site Infections Excluded by the January 2013 Updated Surveillance Definitions

Kristen V. Dicks, MD; Sarah S. Lewis, MD; Michael J. Durkin, MD; Arthur W. Baker, MD; Rebekah W. Moehring, MD, MPH; Luke F. Chen, MBBS, MPH, CIC, FRACP; Daniel J. Sexton, MD, FIDSA; Deverick J. Anderson, MD, MPH
NHSN also has to consider Implications of Changes due to Many Interdependent Pieces of NHSN Use and Users

- Scientific (e.g., accuracy)
- Practical (e.g., can it be done given resources in facilities)
- Technical (e.g., software changes)
- Partnership dependent
  - (e.g., changes to CDA guidance)
- Federal Partner expectations/needs
- National Quality Forum
- Relationship with Legacy Data
General Changes: Applicable to All HAI Events
### Previous (Pre-2013) Definitions

<table>
<thead>
<tr>
<th><strong>a. Healthcare facility onset (HO)</strong></th>
<th>Infections that become apparent within the first few days of admission must be carefully reviewed to determine whether they should be considered healthcare associated.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>b. Duration of device use prior to event</strong></td>
<td>There is no minimum period of time that the device must be in place...to be considered device-associated.</td>
</tr>
<tr>
<td><strong>c. Location of attribution/ Transfer Rule</strong></td>
<td>If an HAI develops within 48 hours of transfer from one inpatient location to another ..., the infection is attributed to the transferring location.</td>
</tr>
<tr>
<td><strong>d. Time between events</strong></td>
<td>No NHSN criteria, classification of an HAI event as new or duplicate is determined by NHSN users.</td>
</tr>
</tbody>
</table>
## Increasing Reliability: New NHSN Surveillance Criteria

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>a.</strong> Healthcare facility onset (HO)</td>
<td>&gt;2 calendar days</td>
</tr>
<tr>
<td><strong>b.</strong> Duration of device use prior to event</td>
<td>&gt;2 calendar days</td>
</tr>
<tr>
<td><strong>c.</strong> Location of attribution/Transfer Rule</td>
<td>≤2 calendar days</td>
</tr>
<tr>
<td><strong>d.</strong> Time between events</td>
<td>&gt;14 calendar days</td>
</tr>
</tbody>
</table>

- Changes a-c implemented in January 2013
- Change d implemented in January 2014
- For use with NHSN infection types, where applicable
2015 HAI Definition Changes

• Goal to have all changes in place by Jan 2015
  - Pediatric VAE → in process (but not for 2015)
• 2015 = new baseline year for public reporting
HAI Foundation Definitions*

- **Infection Window Period**
  - 7-day period in which all site-specific infection criterion must be met. The 3 days before and after the first positive diagnostic test.

- **Date of Event**
  - Date of the first element used to meet the site-specific infection criterion within 7-day infection window period.
    - POA Infections – date of event on day of admission or the 2 days before or 1 day after.
    - HAIs – date of event on day 3 of admission or after.

- **Repeat Infection Timeframe (RIT)**
  - 14-day period during which no new infections of the same type will be reported, date of event = day 1.

*Most do not apply to VAE, LabID Event, or SSI Surveillance*
Central Line-Associated Bloodstream Infections (CLABSI)
MBI-LCBI: Eligible Organisms

At least one blood culture growing at least one of the following pathogens:

- Bacteroides spp.
- Candida spp.
- Clostridium spp.
- Enterococcus spp.
- Fusobacterium spp.
- Peptostreptococcus spp.
- Prevotella spp.
- Veillonella spp.
- Enterobacteriaceae

OR

Signs/symptoms and two or more blood cultures growing:

- Viridans group streptococci

AND

No other pathogens are identified (i.e., patient does not have additional organisms isolated that would meet LCBI definition)
# MBI-LCBI: Eligible patients

<table>
<thead>
<tr>
<th>Patient population</th>
<th>Criteria for eligibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allogeneic hematopoietic stem cell transplant (SCT) recipients</td>
<td>Allo-SCT within the past 1 year <strong>AND</strong> one of the following documented during same hospitalization as positive blood culture:</td>
</tr>
<tr>
<td></td>
<td>1) Grade III or IV GI GVHD</td>
</tr>
<tr>
<td></td>
<td><strong>OR</strong></td>
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<tr>
<td></td>
<td>2) ≥1 liter diarrhea in a 24 hour period (or ≥20 mL/kg in a 24 hour period for patients &lt;18 years of age) with onset on or within 7 calendar days before the date the positive blood culture is collected</td>
</tr>
<tr>
<td>Patients with neutropenia</td>
<td>At least 2 separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC)</td>
</tr>
</tbody>
</table>

The neutropenia definition used for 2014 will be: 2 days of absolute neutrophil count (ANC) or white blood cell (WBC) count less than 500 cells/mm³ within the following time period surrounding the positive blood culture - the 3 calendar days before, the day of, and the 3 calendar days after. In 2013, the time period was limited to the 3 calendar days before and the day of positive blood culture.
CLABSI: Unresolved Issues

• Will (and if so, when) CLAMBI be excluded from CLABSI for public reporting?
  - Anticipate removal from public reported data with resetting of baseline (2015)

• Other surrogates?
  - Healthcare-onset all-cause bacteremia?
Surgical Site Infections (SSI)
SSI-SURGICAL SITE INFECTION
SIP/SIS-Superficial incisional surgical site infection

A superficial incisional SSI (SIP or SIS) must meet the following criterion:
Infection occurs within 30 days after the operative procedure and involves only skin and subcutaneous tissue of the incision and patient has at least 1 of the following:

a. purulent drainage from the superficial incision
b. organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision
c. at least 1 of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat, and superficial incision is separately opened by surgeon and is culture positive or not cultured. A culture-negative finding does not meet this criterion.
d. diagnosis of superficial incisional SSI by the surgeon or attending physician.

DIP/DIS-Deep incisional surgical site infection

A deep incisional SSI (DIP or DIS) must meet the following criterion:
Infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operative procedure and involves deep soft tissues (e.g., fascial and muscle layers) of the incision and patient has at least 1 of the following:

a. purulent drainage from the deep incision but not from the organ/spaces component of the surgical site
b. a deep incision spontaneously dehisces or is deliberately opened by a surgeon and is culture-positive or not cultured when the patient has at least 1 of the following signs or symptoms: fever (>38°C), or localized pain or tenderness. A culture-negative finding does not meet this criterion.
c. an abscess or other evidence of infection involving the deep incision is found on direct examination during reoperation, or by histopathologic or radiologic examination
d. diagnosis of a deep incisional SSI by a surgeon or attending physician.

Organ/Space-Organ/space surgical site infection

An organ/space SSI involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure. Specific sites are assigned to organ/space SSI to identify further the location of the infection. Listed below are instructions on how to classify organ/space SSI.

An organ/space SSI must meet the following criterion:
Infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operative procedure and infection involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure and patient has at least 1 of the following:

a. purulent drainage from a drain that is placed through a stab wound into the organ/space
b. organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space
c. an abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination
d. diagnosis of an organ/space SSI by a surgeon or attending physician.
NHSN SSI Surveillance Changes for 2013

- Primary incisional closure: definition changed to include all incisions with some closure to the level of the skin, regardless of extruding wicks, wires, etc.
- Implant variable: no longer used to determine length of followup and removed from data collection requirements
Changes for 2013, Continued: Surveillance Period Redefined by NHSN Procedure Category

- **90 days**: deep incisional and organ / space SSI for
  - BRST
  - CARD, CBGB, CBGC
  - CRAN, VSHN
  - FUSN, RFUSN, FX, HPRO, KPRO
  - HER
  - PACE, PVBY

- **30 days**
  - Superficial SSIs of any procedure type
  - Secondary incisional SSIs of any procedure type
  - Deep Incisional and Organ / Space SSI for all procedure types not listed in the 90 day group
Changes for 2014-2015

- **New definition of operative procedure removes the requirement that incisions be primarily closed**
  - NHSN will also collect information about type of closure (primary vs. other than primary)

- **Add new required fields for all procedures**
  - Height, weight *(To calculate BMI)*
  - Diabetes:
  - Transoral to approach for FUSN and RFUSN procedures
Infection present at time of surgery (PATOS): PATOS denotes that there is evidence of an infection or abscess at the start of or during the index surgical procedure (in other words, it is present preoperatively). PATOS is a YES/NO field on the SSI Event form. PATOS does not apply if there is a period of wellness between the time of a preoperative condition and surgery. The evidence of infection or abscess must be noted/document preoperatively or found intraoperatively in a pre-operative or intraoperative note. Only select PATOS = YES if it applies to the depth of SSI that is being attributed to the procedures (e.g., if a patient had evidence of an intraabdominal infection at the time of surgery and then later return with an organ space SSI the PATOS field would be selected as a YES. If the patient returned with a superficial or deep incisional SSI the PATOS field would be selected as a NO). The patient does not have to meet the NHSN definition of an SSI at the time of the primary procedure but there must be notation that there is evidence of an infection or abscess present at the time of surgery.

Transition to ICD-10-CM/PCS and CPT Codes

- Updated ICD-10-CM/PCS and CPT mappings to all NHSN operative procedure categories for SSI surveillance planned for March 2015, for use beginning Oct. 1, 2015. NHSN procedure codes to be reported until system is able to accept new codes with Jan 2016 release.
# Understand the Different SSI SIRs in NHSN

| All SSI SIR Model | • Includes Superficial, Deep & Organ/Space SSIs  
|                  | • Superficial & Deep incisional SSIs limited to primary incisional SSIs only  
|                  | • Includes SSIs identified on admission, readmission & via post-discharge surveillance |
| Complex A/R SSI Model | • Includes only Deep incisional primary SSIs & Organ/Space SSIs  
|                    | • Includes only SSIs identified on Admission/Readmission to facility where procedure was performed  
|                    | • Includes only inpatient procedures  
|                    | • Used for the HAI Progress Report, published annually by CDC |
| Complex 30-day SSI model (used for CMS IPPS) | • Includes only in-plan, inpatient COLO and HYST procedures in adult patients (i.e., ≥ 18 years of age)  
|                                     | • Includes only deep incisional primary SSIs and organ/space SSIs with an event date within 30 days of the procedure  
|                                     | • Uses only age and ASA to determine risk  
|                                     | • Used only for CMS IPPS reporting and for public reporting on Hospital Compare |
Catheter-Associated Urinary Tract Infection (CAUTI)
CAUTI Definitional Review

- Began in February 2013
- Internal core working group
- External experts
  - Infection preventionists, hospital epidemiologists, microbiologists, infectious diseases physicians, state HAI program staff, facility representatives, CAUTI subject matter experts
- Targeted literature reviews
- Analysis of NHSN data
- Survey of clinical laboratories
- Feedback from HICPAC (June 2013)
Major questions addressed (not all-inclusive)

1. Should inclusion of yeasts as urinary pathogens continue?
2. Should quantitative culture categories be modified?
3. Should clinical criteria be modified for special populations?
4. Should a UTI be reported on the basis of fever, even if another cause of fever is identified?
5. Should urinalysis continue to be included in UTI definitions?
Should inclusion of yeasts as urinary pathogens continue?

- Rare cause of UTI, but urinary catheter colonization common in some ICU populations
- Treatment of candiduria not associated with clinical benefit
- Inclusion may encourage inappropriate antifungal prescribing
- Lack of clinical credibility leads to adjudication

Should Quantitative Culture Categories be Modified?

- Current categorizations:
  - $\geq 100,000$ CFU/ml (SUTI 1)
  - $\geq 1000$ and $< 100,000$ CFU/ml (SUTI 2)

- Problems:
  - Laboratory variation in quantitative reporting
  - Concern that lower colony counts less likely to represent true infection; however,
    - Low level bacteriuria progresses to $\geq 100K$ within 3 days\(^1\)
    - Similar percentages of SUTI 1 (6.1%) vs. SUTI 2 (5.2%) reported to have secondary bacteremia in NHSN

1. Stark, Maki NEJM 1984;311:560-4
Laboratory Survey:

Which quantitative threshold does your laboratory use to determine whether organisms are definitively identified in a urine specimen with ≤ 2 organisms collected from an indwelling urinary catheter?

- $\geq 1,000$ CFU/ml: 49 (14%)
- $\geq 10,000$ CFU/ml: 166 (49%)
- $\geq 50,000$ CFU/ml: 39 (12%)
- $\geq 100,000$ CFU/ml: 49 (14%)
- N/A: 42 (12%)
Should Urinalysis Continue to be Included in UTI Definitions?

- Up to 70% of catheterized patients with bacteriuria have accompanying pyuria
- Variability in laboratory reporting methods of pyuria
  - No standardized criteria for “positive”
- 2009 IDSA guideline indicates lack of utility of pyuria for differentiating CA-bacteriuria from CAUTI
  - However, absence of pyuria suggests another diagnosis (if not neutropenic)

Urinary Tract Infections

- 100,000 CFU/ml will be the threshold for NHSN UTI criteria.
- Non-bacteria/Yeasts no longer eligible pathogens for SUTI / ABUTI.
- ABUTI pathogen list no longer used.
- Urinalysis will not be used for any NHSN UTI criteria.
- Dysuria will not be used for UTI definition in patients ≤1 year of age.
- Fever will now be allowed for non-catheterized ABUTI in patients over the age of 65 years.
- Core temperatures no longer required. Temps reported as documented in medical record. (Applies to all infections)

### Combined Counts (Either CFU < 10^5 or Yeast)

<table>
<thead>
<tr>
<th>Year of event</th>
<th>Date</th>
<th>Distinct count of events</th>
<th>Total Cases</th>
<th>Percent of Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2015</td>
<td></td>
<td>20</td>
<td>53</td>
<td>37.74%</td>
</tr>
<tr>
<td>FY 2014</td>
<td></td>
<td>42</td>
<td>124</td>
<td>33.87%</td>
</tr>
</tbody>
</table>
Ventilator-Associated Events (VAE)
Evolution of Pneumonia (PNEU) Definitions

Early National Nosocomial Infection Surveillance system (NNIS) definitions, algorithms for the Study on Nosocomial Infection Control (SE NIC)

- New NNIS surveillance definitions published—2 pneumonia criteria for adults, 1 did not require chest x-ray evidence
- New NNIS pneumonia (PNEU) definitions implemented: CXR evidence required
- NHSN HAI surveillance definitions* published: no changes in PNEU definitions

Definition review and modification process


NNIS ~320 hospitals
NHSN 5000+ healthcare facilities

NHSN PNEU flow diagram
Commentary

Eight initiatives that misleadingly lower ventilator-associated pneumonia rates

Michael Klompas MD, MPH

\[a, b, *\]

\[a\] Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute, Boston, MA.  
\[b\] Infection Control Department, Brigham and Women's Hospital, Boston, MA.

- Strict interpretation of clinical signs
- Strict interpretation of chest imaging criteria
- Consensus approach to VAP determinations
- Require critical care approval of cases
- Transfer patients needing prolonged mechanical ventilation
- Admit uncomplicated vented post-op patients to the ICU
Summary of NHSN PNEU Definition Limitations

- Multiple definition pathways increase complexity and data collection burden
- Signs and symptoms are subjective, may not be well documented in medical records
- Chest radiographs are required – and outside scope of infection preventionist expertise
  - Reliance on radiologists, critical care or other MD input varies among facilities
- Diagnostic practice variations influence whether PNEU events are detected and reported
Ventilator-Associated Events

VAC
Ventilator-Associated Conditions
≥2 calendar days of stable or decreasing daily minimum PEEP or FiO2 followed by rise in PEEP ≥3cm H₂O or rise in FiO2 ≥ 20 points sustained for ≥2 days

IVAC
Infection-related Ventilator-Associated Complications
VAC plus temp <36 or >38°C OR leukocyte count ≤4 or ≥12 x 10³ cells/mm³ AND one or more new antibiotics continued for ≥4 days WITHIN 2 days before or after VAC onset EXCLUDING the first 2 days of mechanical ventilation

Possible Pneumonia
IVAC plus sputum/BAL with ≥25 neutrophils/field OR positive culture for pathogenic organism

Probable Pneumonia
IVAC plus sputum/BAL with ≥25 neutrophils/field AND positive quantitative/semi-quantitative culture for pathogenic organism

Now Combined as Single Outcome

Potential Publically-Reported Metric

Internal Metric ONLY
Ventilator-Associated Events:

Ventilator-Associated Condition (VAC)

Infection-Related Ventilator-Associated Complication (IVAC)

Possible or Probable Ventilator-Associated Pneumonia (Poss Vap/Prob VAP)
<table>
<thead>
<tr>
<th>Outcome</th>
<th>Referent</th>
<th>Days to extubation</th>
<th>Days to hospital discharge</th>
<th>Hospital mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>OR (95% CI)</td>
<td>P</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>All VAE tiers vs no VAEs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAC-plus</td>
<td>No VAE</td>
<td>3.12 (2.96–3.29)</td>
<td>&lt;.0001</td>
<td>1.46 (1.37–1.55)</td>
</tr>
<tr>
<td>VAC-alone</td>
<td>No VAE</td>
<td>2.32 (2.19–2.45)</td>
<td>&lt;.0001</td>
<td>1.29 (1.21–1.37)</td>
</tr>
<tr>
<td>IVAC-plus</td>
<td>No VAE</td>
<td>3.45 (3.23–3.68)</td>
<td>&lt;.0001</td>
<td>1.52 (1.41–1.63)</td>
</tr>
<tr>
<td>IVAC-alone</td>
<td>No VAE</td>
<td>3.71 (3.35–4.10)</td>
<td>&lt;.0001</td>
<td>1.69 (1.51–1.90)</td>
</tr>
<tr>
<td>Possible pneumonia</td>
<td>No VAE</td>
<td>3.16 (2.84–3.52)</td>
<td>&lt;.0001</td>
<td>1.38 (1.22–1.56)</td>
</tr>
<tr>
<td>Probable pneumonia</td>
<td>No VAE</td>
<td>3.50 (3.10–3.95)</td>
<td>&lt;.0001</td>
<td>1.50 (1.31–1.70)</td>
</tr>
<tr>
<td>IVAC and subsets vs VAC-alone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVAC-plus</td>
<td>VAC-alone</td>
<td>1.49 (1.37–1.61)</td>
<td>&lt;.0001</td>
<td>1.18 (1.08–1.29)</td>
</tr>
<tr>
<td>IVAC-alone</td>
<td>VAC-alone</td>
<td>1.60 (1.43–1.79)</td>
<td>&lt;.0001</td>
<td>1.32 (1.16–1.49)</td>
</tr>
<tr>
<td>Possible pneumonia</td>
<td>VAC-alone</td>
<td>1.36 (1.21–1.53)</td>
<td>&lt;.0001</td>
<td>1.07 (0.93–1.22)</td>
</tr>
<tr>
<td>Probable pneumonia</td>
<td>VAC-alone</td>
<td>1.51 (1.33–1.72)</td>
<td>&lt;.0001</td>
<td>1.16 (1.01–1.34)</td>
</tr>
<tr>
<td>Pneumonias vs IVAC-alone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possible pneumonia</td>
<td>IVAC-alone</td>
<td>0.85 (0.74–0.98)</td>
<td>.03</td>
<td>0.81 (0.69–0.96)</td>
</tr>
<tr>
<td>Probable pneumonia</td>
<td>IVAC-alone</td>
<td>0.94 (0.81–1.11)</td>
<td>NS</td>
<td>0.88 (0.74–1.05)</td>
</tr>
<tr>
<td>Possible or probable pneumonia</td>
<td>IVAC-alone</td>
<td>0.90 (0.79–1.02)</td>
<td>NS</td>
<td>0.84 (0.73–0.98)</td>
</tr>
<tr>
<td>Probable vs possible pneumonia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probable pneumonia</td>
<td>Possible pneumonia</td>
<td>1.11 (0.94–1.30)</td>
<td>NS</td>
<td>1.09 (0.91–1.30)</td>
</tr>
</tbody>
</table>

NOTE. CI, confidence interval; NS, not significant; OR, odds ratio.
VAE Challenges

- Change in settings with change in managing physician
  - E.g. Likes higher PEEP $\rightarrow$ Min PEEP increases $\rightarrow$ VAC
- Preventability with the current “vent bundle”
- How to present and message the data?
  - Go from single outcome (VAP) to multiple outcomes
- Benchmarks lacking
MRSA and *C. difficile*
Lab ID Events
Lab ID Event

• Uses laboratory testing data without need for clinical chart review
• **Pro:** Less intensive, more standardized, more objective
• **Con:** Prior colonization not considered
• Includes inpatient specimens; can include ED and outpt specimens if collected on DOA
• *C. diff* not reported for NICU, nurseries
Lab ID Event

Events broken out into categories:

- **Community-onset (CO):** collected as an outpatient or an inpatient ≤3 days after admission to the facility (i.e., days 1, 2, or 3 of admission)

- **Community-Onset Healthcare Facility-Associated (CO-HCFA):** CO Lab ID Event collected from a patient who was discharged from the facility ≤4 weeks prior to current date of specimen collection (C. diff only)

- **Healthcare facility-onset (HO):** collected >3 days after admission to the facility (i.e., on or after day 4)
Lab ID Event SIR

• Ratio of observed/expected # events
• Expected # determined “using LabID probabilities estimated from multivariate logistic regression models constructed from NHSN data during a baseline time period, which represents standard populations”
• MRSA bacteremia and C. difficile Lab ID Events reported to CMS as of January 2013
C. difficile Lab ID Event

CDI-positive laboratory assay:

• A positive laboratory test result for C. difficile toxin A and/or B, (includes molecular assays [PCR] and/or toxin assays)

OR

• A toxin-producing C. difficile organism detected by culture or other laboratory means performed on a stool sample
Figure 3. *C. difficile* Test Result Algorithm for Laboratory Identified (LabID) Events

1. **(+) *C. difficile*** test result per patient and location

2. Prior (+) in ≤2 weeks from same patient and location (including across calendar months)

   - **No** → LabID Event
   - **Yes** → Duplicate *C. difficile test*

3. Not a LabID Event
MRSA Bacteremia Lab ID Event

MDRO isolate from blood per patient and location

Prior (+) same MDRO from blood in ≤2 weeks from same patient and location (including across calendar months)

No → LabID Event

Yes → Duplicate MDRO test → Not a LabID Event
Lab ID Event Issues

• Known prior infection/colonization identified at other healthcare facility
• Failure to order, collect and test community-onset disease within first 3 days of hospitalization
• CO-HCFA only captures prior healthcare exposure if prior admission to your facility
  - If *C diff* + at other facility, not captured
Logistic Issues with Implementing the New Definitions
• How to trend data with each change?
  - No break in reporting but note def change
  - e.g. Report from January 2013 onward
  - ??????
Ways Data Could Be Impacted

- Lower rates
  - Exclude events in first days of device placement

Line placed 11:59pm

Culture Collected 12:15am; All def elements now present together

Day 1

Day 2

CLABS with old definition, not with new definition
Ways Data Could Be Impacted

- Lower rates
  - SSI in THA patient occurring on Day 91 post-procedure now excluded
Ways Data Could Be Impacted

• No change, but may help in the future & when assessing preventability
  - CLAMBI
    • Still counted as CLABSI
  - SSI & PATOS
    • Excluded or factored in risk model
Ways Data Could Be Impacted

• Higher rates
  - Events that occur on calendar day 3 but <48hrs now count

Line placed 11:59pm

24 hrs, 2 mins

Culture Collected 12:01am;
All def elements now present together

Day 1  Day 2  Day 3
Ways Data Could Be Impacted

• Higher rates (maybe)
  - SSI in procedure with delayed closure now counted (but also will impact denominator)
  - Such instances NOT included in CMS-reported data for SIR
Ways Data Could Be Impacted

- I have no clue (2015?)
  - Move to CPT coding to determine procedure eligibility
Ways Data Could Be Impacted

• Better risk stratification
  - SSI (e.g. DM, BMI, PATOS, etc.)
  - More to follow?
    • Delayed closure
    • Orthopedic specific variables (e.g. resurfacing)
Beyond the “Big 5”

Multistate Point-Prevalence Survey of Health Care–Associated Infections

In this survey, 4.0% of inpatients in U.S. acute care hospitals had at least 1 health care–associated infection, yielding an estimate of 648,000 inpatients with a total of approximately 721,800 such infections in 2011.

Device-associated infections, which have been a major focus of infection prevention in recent decades, accounted for only 25.6% of all health care–associated infections detected in the current survey.

Table 2. Distribution of 504 Health Care–Associated Infections.*

<table>
<thead>
<tr>
<th>Type of Infection</th>
<th>Rank</th>
<th>No. of Infections</th>
<th>Percentage of All Health Care–Associated Infections (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia†</td>
<td>1 (tie)</td>
<td>110</td>
<td>21.8 (18.4–25.6)</td>
</tr>
<tr>
<td>Surgical-site infection</td>
<td>1 (tie)</td>
<td>110</td>
<td>21.8 (18.4–25.6)</td>
</tr>
<tr>
<td>Gastrointestinal infection</td>
<td>3</td>
<td>86</td>
<td>17.1 (14.0–20.5)</td>
</tr>
<tr>
<td>Urinary tract infection‡</td>
<td>4</td>
<td>65</td>
<td>12.9 (10.2–16.0)</td>
</tr>
<tr>
<td>Primary bloodstream infection§</td>
<td>5</td>
<td>50</td>
<td>9.9 (7.5–12.8)</td>
</tr>
<tr>
<td>Eye, ear, nose, throat, or mouth infection</td>
<td>6</td>
<td>28</td>
<td>5.6 (3.8–7.8)</td>
</tr>
<tr>
<td>Lower respiratory tract infection</td>
<td>7</td>
<td>20</td>
<td>4.0 (2.5–6.0)</td>
</tr>
<tr>
<td>Skin and soft-tissue infection</td>
<td>8</td>
<td>16</td>
<td>3.2 (1.9–5.0)</td>
</tr>
<tr>
<td>Cardiovascular system infection</td>
<td>9</td>
<td>6</td>
<td>1.2 (0.5–2.5)</td>
</tr>
<tr>
<td>Bone and joint infection</td>
<td>10</td>
<td>5</td>
<td>1.0 (0.4–2.2)</td>
</tr>
<tr>
<td>Central nervous system infection</td>
<td>11</td>
<td>4</td>
<td>0.8 (0.3–1.9)</td>
</tr>
<tr>
<td>Reproductive tract infection</td>
<td>12</td>
<td>3</td>
<td>0.6 (0.2–1.6)</td>
</tr>
<tr>
<td>Systemic infection</td>
<td>13</td>
<td>1</td>
<td>0.2 (0.01–1.0)</td>
</tr>
</tbody>
</table>

* Infections were defined with the use of National Healthcare Safety Network criteria. CI denotes confidence interval.

† A total of 43 pneumonia events (39.1%) were associated with a mechanical ventilator.
‡ A total of 44 urinary tract infections (67.7%) were associated with a catheter.
§ A total of 42 primary bloodstream infections (84.0%) were associated with a central catheter.
http://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html
Measure Antibiotic Use in US Hospitals

- Current efforts to measure overall and appropriate antibiotic use will inform our development a metric to submit to the National Quality Forum.
  - Seeking a metric based on the measure in the AU option- antibiotic days per 1000 patient days present.
Lady Macbeth got one thing right: Keep your hands clean.

The CDC says that keeping your hands clean is one of the most effective things you can do to prevent the spread of diseases like the H1N1 flu.