Targeted Validation of Central Line-Associated Bloodstream Infection Data Reported to the National Healthcare Safety Network

Brynn Berger, MPH, CIC
Epidemiologist, TN Department of Health
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Background

- Reporting central-line associated blood stream infections (CLABSIs) to the National Healthcare Safety Network (NHSN) is the foundation for CLABSI surveillance in many states.
- Ensuring validity of these data is essential:
  - Data guide infection prevention policies and strategies.
  - Providers must believe the data in order to be motivated by the data.
  - Implications for public reporting and value-based purchasing.
CLABSI Reporting in Tennessee

Reporting to NHSN became mandatory in TN in:

- January 2008 – adult/ped intensive care units (ICUs), excluding burn and trauma
- July 2008 – neonatal ICUs
- July 2010 – burn and trauma ICUs, specialty care areas (SCAs), and long-term acute care (LTAC)
  - SCA requirement removed in January 2012

TN publishes facility-specific data for ICUs, excluding burn and trauma

- CMS also publishes facility-specific data
CLABSI Validation in Tennessee

- Time period: Jan. 2009–June 2010 data
- Population: ICUs – adult/pediatric and neonatal
- Goals:
  - Maximize data accuracy using a targeted approach to facility and chart selection
  - Identify reporting problems while using resources efficiently
Why a Targeted Approach?

“Seek and destroy” errors by choosing facilities and charts with greater potential for inaccuracies

- Correct mistakes/misclassifications
- Identify systematic errors within facilities
- Identify errors that are common across facilities
- Feedback to NHSN
- Provide education to all facilities in TN
- Create an environment where accuracy is emphasized
  - Non-punitive unless intentional misclassification is found
Objective: Validate CLABSI data in at least 26 (33%) of the 78 facilities with adult/ped ICUs and 13 (50%) of the 26 facilities with NICUs
  - First time for TN to validate NICU data

Facilities were selected based on ICU CLABSI rates in 2009
  - Adult/ped and neonatal ICUs chosen separately
  - Compared rates with NHSN 2006–2008 data
  - Targeted facilities with high and low CLABSI rates
Facility Selection – Adult/Ped Intensive Care Units (ICUs)

- Adult & Pediatric ICU Facility Selection

**High CLABSI Rates**
- 78 acute care facilities with adult and/or pediatric ICU
  - 10 facilities: CLABSI rate ≥90th percentile in at least 1 ICU
  - 30 facilities: no units with CLABSI rate of 0 or rate ≥90th percentile
  - 6 (20%) of these facilities chosen randomly
  - 3 facilities with facility-wide CLABSI SIR significantly <1

**Low CLABSI Rates**
- 38 facilities: CLABSI rate=0 in at least 1 ICU
  - 35 facilities: CLABSI SIR for facility not significantly <1
  - 7 (20%) of these facilities chosen randomly

**Total 26 (33%) facilities with adult and/or pediatric ICU selected for validation**
Facility Selection - NICUs

- Umbilical catheter-associated BSI (UCABSI) and CLABSI rates calculated for 5 birth weight categories
  - Resulted in up to 10 BSI rates per NICU
Facility Selection – NICUs, cont.

26 acute care facilities with NICU

High CLABSI Rates

- 6 NICUs: CLABSI rate ≥90th percentile in at least 1 line type/birth weight category
- 1 NICU: CLABSI rate of 0 in 6 line type - birth weight categories

Low CLABSI Rates

- 7 NICUs: CLABSI rate = 0 in at least 7 line type – birth weight categories

Total 14 (54%) facilities with NICU selected for validation
Map of 31 TN Facilities Selected for Validation

Red pin = Facility underwent NICU validation only
Green pin = Facility underwent adult/pediatric validation only
Blue pin = Facility underwent both NICU and adult/ped validation
All facilities (not just those chosen for validation) were required to submit all positive blood culture results in ICUs during Jan. 2009–June 2010.

- 16 charts chosen from facilities selected for adult/ped ICU validation
  - Charts chosen both from the ICU selected and other ICUs in the same facility
- 16 charts chosen from selected NICUs
- Facilities could be chosen for both NICU and adult/pediatric ICU validation (32 charts total)
2 charts with *Candida*-positive blood cultures

Reason: *Candida* BSIs are often mistakenly reported as secondary infections when *Candida* has been isolated from another body site

- Example: *Candida* colonization of respiratory tract, but NHSN pneumonia definition not met
- Identified as an issue during validation of 2008 data
Targeted Organisms – Coagulase-Negative *Staphylococcus*

- 4 charts with coagulase-negative *Staphylococcus*
  - 2 charts with at least 2 cultures within 48 hours
  - 2 charts without 2 cultures within 48 hours
- Reason: Examine facility’s ability to apply LCBI Criterion 2
Targeted Organisms – MRSA and MSSA

- 2 charts with *Staphylococcus aureus*
  - 1 charts with methicillin-resistant *S. aureus*
  - 1 charts with methicillin-sensitive *S. aureus*

Reason: As with *Candida*, some MRSA BSIs are incorrectly classified as secondary to colonization
Targeted Organisms – Gram-Negatives

- 2 charts with common Gram-negative organisms
  - *Pseudomonas, Acinetobacter, Klebsiella, Enterobacter, or E. coli*
- Reason: Look for issues with applying NHSN definitions to Gram-negative infections
Other Chart Selection Considerations

- 6 additional charts chosen at random, excluding targeted organisms
- 1/16 blood cultures should be drawn <48 hours after admission
  - Examining application of NHSN “transfer rule”
- 1 positive blood culture/patient, unless a facility had a small number of positive cultures
- When possible, ensured that ≥3 of the chosen episodes were reported as CLABSIs to NHSN
Validation Site Visits

- TDH HAI staff notified chosen facilities and provided a list of charts to be reviewed
  - Prior to requesting charts, TDH staff recorded which infections were reported to NHSN

- Validation team filled out a standard chart abstraction form and determined whether the NHSN CLABSI definition was met
  - Used HAI checklists for recording which NHSN criteria were met
  - Validation team was blinded to NHSN results
BONE AND JOINT INFECTION (BJ)

BONE – Osteomyelitis

**DEFINITION:** Osteomyelitis must meet at least **ONE** of the following criteria:

- **Criterion 1:**
  - Patient has organisms cultured from bone

- **Criterion 2:**
  - Patient has evidence of osteomyelitis on direct examination of the bone during **ONE** of the following:
    - surgical operation
    - histopathologic examination

- **Criterion 3:**
  - Patient has at least **TWO** of the following signs or symptoms with no other recognized cause:
    - fever (>38°C)
    - localized swelling
    - tenderness
    - heat
    - drainage at suspected site of bone infection
    - **AND**
      - at least **ONE** of the following:
        - organisms cultured from blood
        - positive blood antigen test (e.g. *H. influenzae*, *S. pneumoniae*)
        - radiographic evidence of infection (e.g. abnormal findings on x-ray, CT scan, MRI, radiolabel scan [gallium, technetium, etc]).

JNT – Joint or Bursa

**DEFINITION:** Joint or bursa infections must meet at least **ONE** of the following criteria:

- **Criterion 1:**
  - Patient has organisms cultured from **ONE** of the following:
    - joint fluid
    - synovial biopsy

- **Criterion 2:**
  - Patient has evidence of **ONE** of the following:
    - joint infection
    - bursa infection
    - seen during **ONE** of the following:
      - surgical operation
      - histopathologic examination

- **Criterion 3:**
  - Patient has at least **TWO** of the following signs or symptoms with no other recognized cause:
    - joint pain
    - swelling
    - tenderness
**BONE AND JOINT INFECTION (BJ)**

- heat
- evidence of effusion
- limitation of motion

**AND**

- at least **ONE** of the following:
  - organisms and white blood cells seen on Gram stain of joint fluid
  - positive antigen test on **ONE** of the following:
    - blood
    - urine
    - joint fluid
  - cellular profile and chemistries of joint fluid compatible with infection and not explained by an underlying rheumatologic disorder
  - radiographic evidence of infection (e.g., abnormal findings on x-ray, CT scan, MRI, radiolabel scan [gallium, technetium, etc]).

**DISC – Disc Space Infection**

**DEFINITION:** Vertebral disc space infection must meet at least **ONE** of the following criteria:

- **Criterion 1.**
  - Patient has organisms cultured from vertebral disc space tissue obtained during **ONE** of the following:
    - surgical operation
    - needle aspiration

- **Criterion 2.**
  - Patient has evidence of vertebral disc space infection seen during **ONE** of the following:
    - surgical operation
    - histopathologic examination

- **Criterion 3.**
  - Patient has **BOTH**
    - fever (>38°C) with no other recognized cause
    - pain at the involved vertebral disc space

- **Criterion 4.**
  - Patient has **BOTH**
    - fever (>38°C) with no other recognized cause
    - pain at the involved vertebral disc space

  **AND**
  - radiographic evidence of infection, (e.g., abnormal findings on x-ray, CT scan, MRI, radiolabel scan [gallium, technetium, etc]).

  **AND**
  - positive antigen test (e.g., *H. influenzae*, *S. pneumoniae*, *N. meningitidis*, or Group B Streptococcus) on **ONE** of the following:
    - blood
    - urine
Chart Review Follow-Up

- A TDH epidemiologist reviewed determinations and kept a list of discrepancies with NHSN results.
- HAI Team discussed discrepancies at meetings:
  - Validation team contacted IP if further information was needed to resolve discrepancy.
  - Contacted NHSN help desk as needed.
- Final determination made:
  - IP notified of required changes to NHSN data, if any.
  - Validation team provided education.
390 positive blood culture episodes reviewed

Overall results:
- Sensitivity = 73%
- Specificity = 96%
- PPV = 79%
## Results – Neonatal ICUs

174 positive blood culture episodes reviewed

**Overall results:**
- Sensitivity = 84%
- Specificity = 98%
- PPV = 92%

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<tr>
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<td>7</td>
<td>128</td>
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Common Reporting Errors

“Infection at another site” – pneumonia was the “other site” with the most problems

Lessons:

- A positive culture or clinical diagnosis may not be sufficient to meet the definition of “infection at another site” – use the NHSN definitions.
- Often, a positive blood culture can count toward a definition of “infection at another site” (e.g., PNU2). If the other site definition is met using the positive blood culture, a CLABSI should not be called.
CLABSI definition issues

Lessons:
- Know the concept of “event onset” in relation to central line presence.
- There is no minimum time (e.g., 48 hrs) for a central line to be in place before a CLABSI can be called.
- Be familiar with the list of common commensals.
- Don’t allow a physician or other staff person to dictate what should be called a CLABSI.
- The transfer rule does not apply if no line was in place during or prior to the transfer.
Blood culture issues

Lessons:
- Have a system in place to handle + blood culture results, including those returned postmortem.
- Don’t ignore a + blood culture just because the patient has concurrent bowel problems or a complicated clinical history.
- A single + blood culture among several negative blood cultures doesn’t necessarily indicate “contamination” – apply NHSN definitions.
Conclusions

A targeted approach to validation allowed Tennessee to focus resources on:
- Identifying common reporting errors
- Ensuring that facilities with high or low CLABSI rates were not systematically misclassifying CLABSI events

Targeted validation is not representative of all facilities
- Quantitative results from TN should not be compared to results from other approaches
- If anything, TN results should underestimate true sensitivity and specificity
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Questions?

- Brynn.E.Berger@tn.gov; 615-741-2005