Internal Validation of NHSN Patient Safety Component Data by Reporting Facilities: Assuring NHSN Data Quality

Intended audience: Reporting facilities, including acute care facilities, inpatient rehabilitation facilities, and long-term acute care facilities, reporting selected data to NHSN

Included metrics: Central line-associated bloodstream infection (CLABSI), catheter-associated urinary tract infection (CAUTI), surgical site infection (SSI), Clostridium difficile infection laboratory-identified event (CDI LabID Event), and methicillin-resistant Staphylococcus aureus bacteremia laboratory-identified event (MRSA blood labID Event)

INTERNAL VALIDATION	**Active efforts by a reporting facility to assure completeness and accuracy of data reported to NHSN**

Background

Facilities report to the Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN) for several purposes: to monitor healthcare-associated infections (HAIs) and the impact of their own prevention efforts, to benchmark facility performance against risk-adjusted national data, to fulfill state-mandated reporting requirements, and/or to comply with Centers for Medicare and Medicaid (CMS) Quality Reporting Program requirements. Regardless of the reasons for participation, facilities that report to NHSN are required to follow NHSN methods and to use NHSN definitions and criteria. The principal source of information on NHSN methods, definitions, and criteria for reporters is the NHSN Manual. This Guidance and Toolkit describes implementation practices by reporting facilities that support good quality surveillance data when reporting to NHSN.

NHSN Reporter Training and Assessment

Those persons responsible for NHSN reporting must remain up-to-date as the system evolves to meet new purposes and expanded capabilities. Given complex and changing definitions, annual training updates are obligatory for NHSN reporters. CDC provides multiple training resources on the NHSN website (http://www.cdc.gov/nhsn/Training/patient-safety-component/index.html). These include annually updated self-paced interactive multimedia instruction, training webinars, and case studies. The multimedia trainings include imbedded assessments and can generate evidence of successful completion for each component.

Printing out certificates demonstrating successful completion of current NHSN online multimedia trainings provides evidence of up-to-date knowledge of NHSN methods and definitions, and may be useful to NHSN reporters when undergoing external validation audits.

Other opportunities for training include CDC-sponsored training events, NHSN blast emails (delivering updates every January), the quarterly NHSN newsletter, and the NHSN Manual, updated each January with current methods, definitions, and criteria.

Assuring Data Quality

Central Line-associated Bloodstream Infection (CLABSI) and Catheter-associated Urinary Tract Infection (CAUTI)

Business Rules and Edit Checks Providing Intrinsic CLABSI and CAUTI Data Quality

Business rules and edit checks built into NHSN's web interface are designed to reduce keystroke errors and provide a mechanism to assure logical integrity upon data entry. Examples of business rules and edit checks for CLABSI and CAUTI data entries are listed in Table1.

Table 1: Selected NHSN Data Entry Checks for CLABSI and CAUTI (2013)

Topic	Data Entry Check
Dates	Date of birth must be ≥ 01/01/1890 and ≤ current date Date of birth must be ≤ event date Date of birth must be ≤ admission date Event date must be ≥ 3 days after admission date (admission date = day 1); *note: this was new logic for 2013 CLABSI and CAUTI definitions*
Dropdown menus	Location of attribution for CLABSI or CAUTI event Pathogen identity
Events	Logic to populate common commensal vs. recognized pathogen (CLABSI) Logic to populate uropathogen and common commensal lists (CAUTI) Required fields given monthly reporting plan Limit maximum number of feasible events per patient, per date (e.g., only one BSI or UTI can be reported per patient per date)
Summary Denominators	Format of denominator screen is driven by mapped locations Patient days must be ≥ device days for a given location

Internal Validation of CLABSI and CAUTI Data Quality by Reporting Facilities

Although business rules and edit checks that support data quality are built into NHSN, CLABSI and CAUTI data are subject to error in:

- assignment as healthcare-associated infections (HAIs)
- case-ascertainment of bloodstream infection (BSI) or urinary tract infection (UTI)
- case-classification (primary vs. secondary BSI, or type of UTI, e.g. asymptomatic bacteremic urinary tract infection (ABUTI), or types of symptomatic urinary tract infection (SUTI1a, SUTI2a, SUTI3, SUTI4 or other UTIs)
- location of attribution
- denominator reporting
- risk-adjustment variables

High quality CLABSI and CAUTI surveillance requires accurate collection of denominator data (patient days, central line days, urinary catheter days), risk-adjustment variables (patient care location mapping, teaching hospital affiliation), and screening of all potential CLABSI and CAUTI events in surveillance locations, with documentation of decisions regarding case-status and case-classification.

Be aware that important changes in NHSN definitions for healthcare-associated infection, date of event, and required duration of device use were introduced in 2013. These definitions can affect CLABSI and CAUTI case-ascertainment and classification. Reporters need to be familiar with these methods to correctly report NHSN cases.

Recommended facility CLABSI and CAUTI surveillance program competencies

The infection prevention program should assure the following facility-level competencies for NHSN CLABSI and CAUTI surveillance and validation activities:

- Overall:
  - Documentation of up-to-date training in CLABSI and CAUTI surveillance
- Risk-Adjustment:
  - Assurance of appropriate risk-adjustment elements (bed size, mapping, and teaching hospital affiliation)
- Denominators: Ability to generate correct denominator data (CLABSI: central line days and patient days, CAUTI: indwelling urinary catheter days and patient days)
  - Assurance that persons counting patient days, central line days, and/or indwelling urinary catheter days have good knowledge of NHSN methods and definitions pertaining to denominators
  - For manual denominator counting, oversight and maintenance of daily records for inspection during external validation audits
  - Before reporting electronically-counted denominator data, documented validation of accuracy (within 5% of manual counts for at least 3 months)
- Numerators (CLABSI): Ability to correctly and completely identify CLABSI events in real time
  - Awareness and investigation of all positive blood cultures among patients with central lines
  - Capacity to reproduce a complete list of positive blood cultures collected from patients assigned to facility surveillance location(s) to facilitate internal or external audits
  - Documentation of candidate CLABSI events and relevant decisions leading to reporting outcomes
  - Ability to correctly apply CLABSI case-definitions, including ability to differentiate between primary and secondary bloodstream infections in accordance with NHSN protocols. Of note, NHSN definitions for alternative primary infection sites must be met to assign bloodstream infections as secondary. Up-to-date alternative primary site definitions are available in the NHSN Manual Chapter 17 (available at http://www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf). Dated versions of the NHSN Chapter 17 HAI definitions have been transposed into checklist format by the Tennessee (TN) Department of Health, and are available at (http://health.state.tn.us/ceds/hai/). Current rules for assigning a bloodstream isolate to an alternative primary site are detailed in the NHSN Manual, Chapter 4 (CLABSI), Appendix 1 (http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC_CLABScurrent.pdf).
- Numerators (CAUTI): Ability to correctly and completely identify CAUTI events in real time
  - Awareness and investigation of all positive urine cultures[1] among patients with indwelling urinary catheters
  - Capacity to reproduce a complete list of positive urine cultures[1] collected from patients assigned to facility surveillance location(s), to facilitate internal or external audits
  - Documentation of candidate CAUTI events and relevant decisions leading to reporting outcomes
  - Ability to correctly apply CAUTI case-definitions following NHSN protocols.

[1] growth of at least 10^3 organisms and no more than two different species from urine culture

Suggestions for internal validation of NHSN CLABSI and CAUTI data quality

Validation planning

Consider how you will assure/validate data quality as you plan for NHSN surveillance. Ideally, CLABSI and CAUTI validation will have elements that are conducted annually (such as surveillance staff training updates and review of patient care location mapping and bed size), monthly (such as quality of uploaded denominator data), and daily to weekly (such as review of positive blood and urine cultures and spot checks of denominator counting) as you conduct daily surveillance for events. Changes in facility systems (new patient care locations, new or modified electronic medical records systems) should trigger proactive investigation of effects on data quality.

Risk-adjustment: location mapping, bed size, and teaching hospital type in the NHSN annual survey

- Mapping is important because it can affect risk-adjustment, benchmarking, and reporting to CMS. Review location mapping annually and whenever demographic changes in patient populations are anticipated. It is important to map correctly before reporting data, because data linked to mis-mapped locations cannot easily be corrected. Up-to-date information about mapping is available at http://www.cdc.gov/nhsn/PDFs/pscManual/15LocationsDescriptions_current.pdf. For questions, contact NHSN support: NHSN@cdc.gov. Instructions for reporting facility bed size by location type are available at http://www.cdc.gov/nhsn/forms/instr/57_103-TOI.pdf . Updated bed size information is required in the NHSN annual survey.
- Review NHSN definitions for teaching hospital types (under Key Terms, http://www.cdc.gov/nhsn/PDFs/pscManual/16pscKeyTerms_current.pdf), and assure that facility teaching hospital status is accurate in the NHSN annual survey.

Assuring CLABSI and CAUTI denominator data quality

- For manual denominator data collection and reporting:
    - Surveillance supervisors should assure that those responsible for denominator data collection know required methods and definitions, such as the NHSN definition of a central line, methods for enumerating central line days, definition of an indwelling urinary catheter (Foley catheter), and methods for enumerating indwelling urinary catheter days (http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC_CLABScurrent.pdf, http://www.cdc.gov/nhsn/PDFs/pscManual/7pscCAUTIcurrent.pdf). A survey to assess proficiency of denominator counting is provided in Appendix 2.3.
    - Supervisors should know when (what time) the daily counts routinely take place and conduct periodic spot checks of manual denominator counting accuracy, providing feedback to denominator counters.
    - Before reporting monthly counts to NHSN, supervisors should review daily counting logs to determine frequency of omissions. NHSN guidance is provided for dealing with missing denominator data at http://www.cdc.gov/nhsn/PDFs/NHSNMissingDenomData_Sep2013.pdf.
- For electronic denominator collection and reporting:
    - Before transitioning from manual to electronic denominator data reporting, facilities are required to document that electronic data counts are within 5% of manual data counts for 3 months. Focused efforts with support from IT, changes to nursing documentation, and staff training may be required to adjust electronic counting methods to achieve this standard.
    - Facilities reporting electronic denominator counts should provide documentation that adequate validation was performed or re-validate denominator data by concurrent manual and electronic counting for three months.

Assuring numerator quality (CLABSI)

- Investigate all positive blood cultures for possible CLABSI up to a point where CLABSI is ruled-in or out. Document decisions about CLABSI status for positive blood cultures in surveillance locations and why the blood culture did or did not meet the CLABSI case-definition.
- When attribution of positive blood cultures to an alternative primary infection source is being considered, use of NHSN Chapter 17 definitions is required. Tennessee Audit Checklists, based on Chapter 17 definitions (and available for download at http://health.state.tn.us/ceds/hai/) are useful tools to assure accurate case-classification. These checklists are available in dated versions that follow changes in NHSN definitions; use of the correctly-dated version is necessary. In addition, rules for assigning a bloodstream infection to an alternative primary site are detailed in the NHSN Manual, Chapter 4 (CLABSI) Appendix 1, (http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC_CLABScurrent.pdf).
- To assure complete CLABSI surveillance, request a summary line listing of positive blood cultures for surveillance locations to compare with the list of previously investigated blood cultures. If positive blood cultures are identified by the line listing that were not investigated in real time, reasons for the oversight should be explored and corrected.

Assuring numerator quality (CAUTI)

- Investigate all positive urine cultures[2] for possible CAUTI up to a point where CAUTI is ruled-in or out. Document reasons why positive urine cultures in surveillance locations did or did not meet the CAUTI case-definition.
- To assure complete CAUTI surveillance, request a summary line listing of positive urine cultures for surveillance locations at least annually to compare against the list of previously investigated urine cultures. If positive urine cultures are identified by the line listing but were not investigated in real time, reasons for the oversight should be explored and corrected.

Investigating reported CLABSI and CAUTI data through NHSN analysis

- Explore NHSN CLABSI and CAUTI data by location and pathogen. Begin by running pre-programmed NHSN data quality output programs in NHSN Analysis. These programs are modifiable so that facilities can evaluate data in different ways. Updated guidance for using NHSN analysis programs is available on the NHSN website (http://www.cdc.gov/nhsn/PS-Analysis-resources/index.html), including analysis quick reference guides (http://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html) for how to modify many aspects of analysis. These include methods to generate line listings, frequency tables, rate tables, SIR tables, bar charts, pie charts, longitudinal run charts, and statistical calculations.
- Explore location-specific CLABSI and CAUTI rates, SIRs, and central line / indwelling urinary catheter utilization ratios, using the NHSN Rate Table option. Use this information to plan for prevention activities.
- For any discrete time period, bed days (the number of available beds multiplied by the number of days) should be ≥ patient days, and patient days should be ≥ central line days.
- Review longitudinal reports of central line days, indwelling urinary catheter days, and patient days, longitudinal trends in numerators, denominators and Standardized Infection Ratios (SIRs), and investigate inconsistencies.

Tools for assurance of CLABSI and CAUTI data quality

1. Appendix 1 Appendix 1: Facility Self-validation Guidance
2. Appendices 2.1, 2.2, 2.3 Surveillance Methods Surveys (includes denominator counting surveys for CLABSI and CAUTI)

[2] growth of at least 10^3 organisms and no more than two different species from urine culture

3. Current NHSN Manual, Chapter 4 (CLABSI), with attention to Appendix 1 for attribution of positive blood cultures to alternative infection sources, http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC_CLABScurrent.pdf
4. Tennessee Checklists (downloadable from http://health.state.tn.us/ceds/hai/) for NHSN Manual Chapter 17 criteria (http://www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf)
5. Current NHSN Manual Chapter 7 (CAUTI), http://www.cdc.gov/nhsn/PDFs/pscManual/7pscCAUTIcurrent.pdf

Surgical Site Infection (SSI)

Business rules and edit checks providing intrinsic SSI data quality

Businesses rules and edit checks built into NHSN's web interface are designed to reduce keystroke errors and provide a mechanism to assure logical integrity upon data entry. Examples of business rules and edit checks for SSI data entries are listed in Table 2.

Table 2: Selected NHSN Data Entry Checks for SSI (2013)

Topic	Data Entry Check
Procedure	Patient ID, procedure date, procedure code, inpatient/outpatient are verified for consistency between the SSI event and surgical procedure record already present in NHSN Procedure-specific variables Outpatient/Inpatient logic based on procedure
Drop-down menu	Specific events available for selection are procedure-specific Pathogen identity
Events	Criteria selected correctly meet the specific event definition Wound class selection limited by procedure Required fields given monthly reporting plan
Dates	Logic to verify when event was detected Date of birth must be ≥ 01/01/1890 and ≤ current date Date of birth must be ≤ event date Date of birth must be ≤ admission date Event date must be ≥ admission date

Internal validation of SSI data quality by reporting facilities

Although business rules and edit checks are built into NHSN, SSI data remain subject to error in completeness and accuracy of procedure denominator reporting, quality of risk-adjustment variables, and particularly in completeness of case-ascertainment (due to challenges and variation in post-discharge surveillance) and correct case-classification. High quality SSI surveillance requires that facilities assure accurate collection of denominator data (NHSN procedures and associated risk-adjustment variables such as American Society of Anesthesiologists (ASA) score, procedure duration, and use of general anesthesia), facility risk-adjustment variables (e.g., teaching hospital affiliation, bed size), and recognize and correctly classify potential SSI events following procedures using re-admission and post-discharge surveillance.

Notification of SSIs originating from surgical procedures performed at another facility to the originating surgical facility is an important inter-facility communication that facilitates accurate post-discharge surveillance. This is appropriate and permissible under HIPAA (See Appendix 3).

Be aware of important changes to definitions and methods for SSI surveillance introduced in 2013. These include definitions for "NHSN procedures" and "primary closure," as well as changes to the duration of required surveillance following different procedure types. These changes can impact procedure number (denominator) and case-ascertainment (numerator). Reporters need to be familiar with these changes to correctly report to NHSN for 2013.

Recommended facility SSI surveillance program competencies

The infection prevention program should assure the following facility-level competencies for NHSN SSI surveillance and validation activities:

- Overall: Documentation of up-to-date training in SSI surveillance

- Risk-Adjustment: Ability to correctly report SSI risk-adjustment variables for all surgical procedures entered in NHSN SSI procedure denominator
- Denominators: Ability to generate and report monthly procedure denominators completely and correctly for procedures under surveillance
- Numerators: Evaluation of all potential admission and readmission infections in real time during the prescribed surveillance window (30- or 90-days, based on the procedure); post-discharge surveillance tracking outpatient SSI events and reports of re-admissions to other facilities during the SSI surveillance window
    - Ability to identify all readmissions among patients undergoing surveillance procedures during the SSI surveillance window (30- or 90- days, based on the procedure; for COLO and HYST the window is 30 days)
    - Ability to correctly classify SSI cases using NHSN definitions as either Superficial Incisional, Deep Incisional, or Organ/Space infections
    - Ability to correctly use the NHSN Principal Operative Procedure Category Selection List when attributing Organ/Space Infections in the context of multiple concurrent NHSN procedures

Note that NHSN requires reporting of all SSIs, including superficial incisional infections, whereas only deep incisional and organ/space infections are shared by NHSN with CMS per CMS Quality Reporting Program (QRP) requirements. Facilities that participate in NHSN for compliance with CMS QRPs are required to follow NHSN methods, including superficial SSI reporting.

Suggestions for internal validation of NHSN SSI data quality

Validation planning

Consider how you will assure/validate surgical procedures and SSI event data quality as you plan for NHSN surveillance. Ideally, SSI validation will have elements that are conducted annually (such as surveillance staff training updates, review of bed size, optimal source(s) of procedures and re-operations), monthly (such as quality of uploaded or entered denominator data and completeness of risk-adjustment variables), and daily to weekly (such as surveillance for events). Changes to facility systems (e.g., modifications to operating room or electronic medical records systems) should trigger proactive investigation of effects on data quality.

Risk-adjustment variables, including bed size and teaching hospital status

Risk index models using data elements collected along with other surgical procedure denominator data have been developed for NHSN surgical procedures and are detailed in a report referenced below.[3] Accurate risk-adjustment requires complete and accurate collection of these variables at the individual procedure level.

- For procedures under surveillance, know which variables are required for risk-adjustment. Assure completeness (using NHSN analysis) and accuracy (by spot-checking quality) of these variables at the time they are reported or uploaded to NHSN. Failure to assure completeness and accuracy of these variables will prevent appropriate benchmarking, and may cause difficulties during external audits.
    - For COLO, 2013 risk-adjustment variables include anesthesia, endoscope, gender, ASA score, wound class, bed size, age, and duration.
    - For HYST, 2013 risk-adjustment variables include anesthesia, endoscope, ASA score, wound class, and duration.
- Review your facility annual survey to assure correct reporting of bed size and teaching hospital category. Up to date instructions for reporting facility bed size by location type is available at http://www.cdc.gov/nhsn/forms/instr/57_103-TOI.pdf.

[3] Mu Y, Edwards JR, Horan TC, et al. Improving risk-adjusted measures of surgical site infection for the National Healthcare Safety Network. *Infect Control Hosp Epidemiol* 2011; 32(10):970-986.

Review NHSN definitions for teaching hospital types (under Key Terms, http://www.cdc.gov/nhsn/PDFs/pscManual/16pscKeyTerms_current.pdf), and assure that facility teaching hospital status is accurate in the NHSN annual survey.

Denominators (surgical procedures)

- Completeness of inpatient surgical procedure reporting is determined by consideration of all surgical procedures under surveillance and performed on an inpatient (admission date is different from discharge date) in a single trip to a hospital inpatient operating room (OR), (this may include cesarean section room, interventional radiology room, or cardiac catheterization lab), where a surgeon (as defined by NHSN) makes ≥ 1 incision through skin/mucous membrane, and closes the incision primarily* before the patient leaves the OR. Procedures designated by the facility as under NHSN surveillance are identified based on assignment of an appropriate ICD-9-CM procedure code (See NHSN Manual Chapter 9). Note that the available NHSN crosswalk to Current Procedural Terminology (CPT) codes applies only to procedures in ambulatory surgical centers, and that CPT codes are not fully interchangeable with ICD-9-CM codes.

Procedures are to be removed from the 2013 NHSN surgical procedure denominator if they fail to meet the 2013 NHSN definition of primary closure*. Procedures are NOT to be removed from the denominator based on pre-existing infection or fecal spillage at the time of surgery.

- Assure optimal source(s) of information to identify all in-plan surgical procedures. This may come directly from operating room records, from coding data, from a vendor system using these sources, or perhaps ideally from a combination of these and other sources to assure completeness and accuracy. Note changes to the definition of an NHSN operative procedure for 2013, particularly the 2013 definition of primary closure*:

*Note: 2013 definition of **Primary Closure**: "Closure of all tissue levels during the original surgery, regardless of the presence of wires, wicks, drains, or other devices or objects extruding through the incision. This category includes surgeries where the skin is closed by some means; including incisions that are described as being "loosely closed" at the skin level. Thus, if any portion of the incision is closed at the skin level, by any manner, a designation of primary closure should be assigned to the surgery."

Non-primary closure: Closure that is other than primary (non-primary closure) includes surgeries in which the superficial layers are left completely open during the original surgery and therefore cannot be classified as having primary closure. For surgeries with non-primary closure, the deep tissue layers may be closed by some means (with the superficial layers left open), or the deep and superficial layers may both be left completely open. An example of a surgery with non-primary closure would be a laparotomy in which the incision was closed to the level of the deep tissue layers, sometimes called "fascial layers" or "deep fascia," but the superficial layers are left open. Another example would be an "open abdomen" case in which the abdomen is left completely open after the surgery. Wounds that are "closed secondarily" at some later date, or described as "healing by secondary intention" should also be classified as having non-primary closure. Wounds with non-primary closure may or may not be described as "packed" with gauze or other material, and may or may not be covered with plastic, "wound vacs," or other synthetic devices or materials.

NOTE: Assign the surgical wound closure that applies when the patient leaves the OR from the principal operative procedure. This instruction should be followed in scenarios where a patient leaves the OR with non-primary closure, but returns to the OR for a subsequent procedure that results in primary closure of the procedure.

- If procedure data are electronically uploaded to NHSN, assure completeness, accuracy, and quality of uploaded procedures and risk-adjustment variables. Work with OR and IT staff to improve data quality, accuracy, and completeness as needed.

Numerators (SSIs)

- Be aware of and investigate all suspected SSIs following surveillance procedures. Several approaches will typically be necessary. Although wound culture surveillance is often helpful, most SSIs are not identified by wound culture. Frequent rounding on surgical floors, reviewing charts, reviewing discharge summaries for surgical patients, and relationships with surgical staff members can improve case finding.
- Although NHSN does not recommend specific methods, documentation of post-discharge surveillance methods and findings may be useful when undergoing external audit and review. Records should be kept regarding reports of SSIs made to other facilities and receipt of reports from other facilities.
- Correct case-classification of COLO and HYST SSIs may be facilitated by use of relevant TN Checklists (http://health.state.tn.us/ceds/hai/) which may be useful to document site-specific organ/space infection criteria. These checklists, which derive from NHSN manual definitions, provide a format that some reviewers may prefer.

> - **Note:** Facilities reporting SSIs into NHSN are required to report Superficial Incisional Infections and secondary infections, as well as Deep Incisional Primary and Organ Space Primary infections for in-plan procedures, despite the more limited CMS requirements.
> - CMS will receive only in-plan Deep Incisional Primary and Organ/Space Primary infection data within 30 days of the procedure for adult inpatients following COLO or HYST procedures, and only these events will be correlated by CMS between reporters and CMS validators.

Investigating reported SSI data through NHSN analysis

- Explore NHSN SSI data by procedure, surgeon, and pathogen. As a start, run pre-programmed NHSN data quality output programs in NHSN Analysis. These programs are modifiable so that facilities can evaluate data in different ways. Updated guidance for using NHSN analysis programs is available on the NHSN website (http://www.cdc.gov/nhsn/PS-Analysis-resources/index.html), including analysis quick reference guides (http://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html) for how to modify many aspects of analysis. These include methods to generate line listings, frequency tables, rate tables, SIR tables, bar charts, pie charts, longitudinal run charts, and statistical calculations. A Webinar delivered in October 2012 ("Advanced Analysis: Focus on SSI", available at http://www.cdc.gov/nhsn/Training/analysis/index.html), contains advice for troubleshooting issues with NHSN data reporting to CMS.

> - **Note:** Results of your analyses of facility data may differ from other analyses. For example, when reporting facilities conduct NHSN analysis for CMS data, aggregate CMS results will differ from overall facility-level results because the NHSN data shared with CMS are a subset of what is required of facilities by NHSN.
> - Certain procedures may also be excluded from calculations generating the standardized infection ratio (SIR), as detailed in the NHSN Newsletter, October 2010, Special Edition, Appendix C.

Tools for assurance of SSI data quality

1. Appendix 1 Facility Self-validation Guide for CLABSI, CAUTI, and SSI Surveillance
2. Appendix 2.4 Surveillance Methods Surveys
3. Tennessee Checklists (downloadable from http://health.state.tn.us/ceds/hai/)
4. Appendix 3: Facility/Provider to Facility/Provider Communications under HIPAA: Questions and Answers
5. Current NHSN Manual, Chapter 9 (SSI)

LabID Event

Business rules and edit checks providing intrinsic LabID Event data quality

Business rules and edit checks built into NHSN's web interface are designed to reduce keystroke errors and provide a mechanism to assure logical integrity upon data entry. Examples of business rules and edit checks for LabID Event data entries are listed in Table 3.

Table 3: Selected NHSN data entry checks for LabID Event (2013)

Topic	Data Entry Check
Dates	-Date of birth must be ≥ 01/01/1890 and ≤ current date -Date of birth must be ≤ specimen collection date -Date of birth must be ≤ admission date -Specimen collection date and location admission date must be ≥ facility admission date -Specimen collection date must be ≥ and location admission date
Dropdown menus	-Specimen source limited by body site -Specimen source and body site choices limited by organism -Location of attribution driven by mapped locations
Events	-Previous event verified -Required fields given monthly reporting plan
Summary Denominators	-Facility-wide patient days ≥ any single location-specific patient days -*C.difficile* patient days ≤ total facility-wide patient days

Internal validation of facility-wide inpatient (FacWideIN) LabID Event data quality by reporting facilities

Although business rules and edit checks that support data quality are built into NHSN, LabID Event data are subject to several types of error. First, if a positive specimen collected in the emergency department or a hospital outpatient clinic on the day of admission is overlooked, initial assignment as hospital-onset (HO) can be incorrect. Initial assignment as community-onset (CO) may be incorrect when formal facility admission is preceded by overnight stays on an inpatient location as an observation patient (these patients count toward admissions and days toward patient days). Second, unassisted determination of duplicate vs. reportable test results are subject to error, and use of the online calculator (http://www.cdc.gov/nhsn/labid-calculator/index.html) is highly recommended to improve accuracy. Third, denominator data are subject to error if observation patients located in inpatient locations are incorrectly excluded from denominator counts. Finally, because events are linked through patient location and time, one error in classification can cause a series of downstream errors in case-classification.

Recommended LabID Event surveillance program competencies

The infection prevention program should assure the following facility-level competencies for facility-wide inpatient (FacWideIN) LabID Event surveillance and validation activities:

- Overall: Documentation of up-to-date training in LabID Event surveillance
- Risk-adjustment: Assurance of accurate risk-adjustment elements
- Denominators: Internally validated ability to generate correct monthly summary denominator data (FacWideIN patient days, admissions to inpatient locations)
- Numerators: Ability to comprehensively identify and correctly assign positive laboratory tests as reportable vs. duplicate
    - Understanding of and ability to correctly apply LabID Event following NHSN protocols
    - Awareness of MRSA-positive blood cultures and toxin-positive CDI test results among inpatients

- Ability to identify MRSA-positive blood cultures and toxin-positive CDI test results obtained in the hospital ED or facility-affiliated outpatient clinics or observation area on the day of admission
- Tracking relevant decisions for positive laboratory tests leading to reporting outcomes
- Capacity to produce a complete list of MRSA-positive blood cultures and/or toxin-positive CDI test results from stool specimens by location for all NHSN inpatients to facilitate internal (or external) audits

Suggestions for internal validation of NHSN LabID Event data quality

Validation planning

Consider how you will assure LabID Event data quality as you plan for NHSN surveillance. Ideally, LabID Event validation will have elements that are conducted annually (such as surveillance staff training updates, and review of patient care location mapping with patient demographics and location bed size during the NHSN annual survey), monthly (such as quality of uploaded denominator data; patient days and admissions), and daily to weekly (such as review of laboratory reports and data entry decisions for LabID Events). Changes to facility systems (new or removed patient care locations, new or modified electronic medical records systems) should trigger proactive investigation of effects on data quality.

Risk-adjustment: location mapping, bed size, and teaching hospital status

- For MRSA Bacteremia LabID Event, risk-adjustment variables are teaching hospital affiliation, facility bed size, and CO MRSA bacteremia prevalence rate (automatically generated by NHSN); for CDI LabID Event, risk-adjustment variables are teaching hospital affiliation, facility bed size, CDI test type, and CO CDI prevalence rate (automatically generated by NHSN; see http://www.cdc.gov/nhsn/PDFs/mrsa-cdi/RiskAdjustment-MRSA-CDI.pdf).
- Expanded mapping information was included in the NHSN Manual for 2013 (Chapter 15). Review and update your facility inpatient care location demographics and bed size with regard to current NHSN location descriptions (see http://www.cdc.gov/nhsn/PDFs/pscManual/15LocationsDescriptions_current.pdf). Use this information to validate location-mapping information in NHSN. Mapping is important because it can affect benchmarks, risk-adjustment, and reporting to CMS. It is important to map correctly before reporting data, because data linked to mis-mapped locations cannot easily be corrected. If you have questions, contact NHSN support: NHSN@cdc.gov.
- Once mapping is assured, review facility bed size (stratified by location type) as documented on the NHSN annual survey
- Review current NHSN definitions for teaching hospital types (under Key Terms, http://www.cdc.gov/nhsn/PDFs/pscManual/16pscKeyTerms_current.pdf, and assure that facility teaching hospital status is accurate in the NHSN annual survey.

Assuring LabID Event denominator quality

- "FacWideIN" includes all patient days counted at the same time each day for all inpatient locations, including any patients housed in inpatient locations, whether or not the facility considers them admitted patients or observation patients but excluding any patients housed for the day in outpatient observation locations. This information is typically collected electronically.

> Note: Observation unit locations are considered outpatient locations by NHSN, but observation patients (a billing distinction) may be located in inpatient locations (where they are counted in the FacWideIN denominator) or in outpatient locations (where they are not to be counted).

Because the task of validating "FacWideIN" patient days and admissions facility-wide is daunting, accurate denominator counting can be internally validated using manual counting of patient days and admissions in a sample of three specified location types for one month each: one ICU, one Labor/Delivery/Recovery/Post-Partum (LDRP) location (if available), and one or more inpatient wards where observation patients are frequently located. Validated counts should be within 5% of the referent (usual) electronic counts, or an evaluation of why they differ

should be conducted. One consideration is the facility's ability to capture observation patients electronically. Note that counts will likely differ for MRSA Bacteremia LabID Event denominators and for CDI LabID Event denominators because CDI excludes counts from neonatal units when counting. A tool for internally validating "FacWideIN" LabID Event denominators is found in Appendix 2.6.

- Inpatient days and admissions may be derived from a number of hospital systems such as admission/discharge/transfer (ADT) data, the billing system, or from vendor systems using hospital data. Feedback to NHSN indicates that ADT data are often the most accurate. **If using billing data, it is important to ensure that observation patients housed in inpatient locations are included in counts, because these patients are often billed separately from inpatients.**
    - The monthly facility-wide inpatient days denominator required for MRSA bacteremia LabID Event includes all inpatient days, on all inpatient locations, counted at a consistent time concurrently in all locations, and including observation patients who are located in inpatient locations.
    - The monthly facility-wide inpatient days denominator required for CDI LabID Event includes the factors above but excludes counts from baby locations and excludes infants located in labor/delivery/recovery/post-partum (LDRP) locations.
    - The monthly facility-wide inpatient admissions denominator required for MRSA bacteremia LabID Event includes all inpatient admissions to the first inpatient location as well as observation patients who are located in inpatient locations.
    - The monthly facility-wide inpatient admissions denominator required for CDI LabID Event includes all inpatient admissions to the first inpatient location as above, excluding baby locations and infants in LDRP locations.
    - Note: facilities using the billing system to determine facility admissions or patient days may have difficulty in accurately reporting inpatient days and inpatient admissions for this module, which requires the inclusion of observation patients housed in inpatient locations for these counts. Other data sources (admission/discharge/transfer [ADT] data or vendor software systems using ADT data) may be more accurate than use of billing data.
    - The denominator for many facilities will differ when reporting MRSA Bacteremia LabID Event, which counts denominator data for all inpatient locations, and reporting CDI LabID Event, which counts denominator data for all non-neonatal inpatient locations (excluding counts from locations where the population is expected to be at least 80% infants, such as NICU, special care nursery, and well-baby nurseries, and excluding babies in LDRP locations).

Assuring LabID Event numerator quality

- A survey tool assessing knowledge of 2013 LabID Event reporting is provided in Appendix 2.5.
- For LabID Event, inpatient status includes all patients present at the time of the daily count (not requiring an overnight stay), and includes observation patients located in inpatient locations even if not formally admitted. In addition, laboratory specimens collected from facility-related outpatient locations such as the emergency department (ED) on the date of admission should be included. During surveillance, IPs should be aware of and investigate ALL MRSA-positive blood cultures and/or toxin-positive CDI tests from stool specimens for inpatients and patients being admitted the same day. Particular attention should be paid to additional laboratory testing done on the day of admission in related outpatient settings. This initial data can change the status of subsequent positive laboratory tests. To assure that LabID Events are not overlooked, IPs should periodically request a summary line listing of MRSA-positive blood cultures and/or toxin-positive CDI tests for inpatients and for outpatients on the day of admission.

Investigating reported LabID Event data through NHSN analysis

- Explore NHSN LabID Event data by location and pathogen. As a start, run pre-programmed NHSN data quality output programs in NHSN Analysis. These programs are modifiable so that you can look at data in different ways. Updated guidance for using NHSN analysis programs is available on the NHSN website (http://www.cdc.gov/nhsn/PS-Analysis-resources/index.html), including analysis quick reference guides (http://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html) for how to modify many aspects of analysis. These include methods to generate line listings, frequency tables, rate tables, SIR tables, bar charts, pie charts, longitudinal run charts, and statistical calculations.
- Explore location-specific LabID Event rates and SIRs, using the NHSN Rate Table option. Use this information to plan for prevention activities.
- Review longitudinal denominator data by location and HO LabID Events by location, and investigate inconsistencies.

Tools for assurance of LabID Event data quality

- Appendices 2.5, 2.6 Surveillance Methods Surveys
- Current NHSN Manual Chapter 12 (MDRO/CDI Module), Option 1: LabID Event Reporting (http://www.cdc.gov/nhsn/PDFs/pscManual/12pscMDRO_CDADcurrent.pdf)