Urinary Tract Infection (Catheter-Associated Urinary Tract Infection [CAUTI] and Non-Catheter-Associated Urinary Tract Infection [UTI]) Events

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Introduction

Urinary tract infections (UTIs) are the fifth most common type of healthcare-associated infection, with an estimated 62,700 UTIs in acute care hospitals in 2015. UTIs additionally account for more than 9.5% of infections reported by acute care hospitals[1]. Virtually, all healthcare-associated UTIs are caused by instrumentation of the urinary tract.

Approximately 12%-16% of adult hospital inpatients will have an indwelling urinary catheter (IUC) at some time during their hospitalization, and each day the indwelling urinary catheter remains, a patient has a 3%-7% increased risk of acquiring a catheter-associated urinary tract infection (CAUTI).[2-3]

CAUTIs can lead to such complications as prostatitis, epididymitis, and orchitis, cystitis, pyelonephritis, gram-negative bacteremia, endocarditis, vertebral osteomyelitis, septic arthritis, endophthalmitis, and meningitis in patients. Complications associated with CAUTIs cause discomfort to the patient, prolonged hospital stays, and increased costs and mortality[4]. It has been estimated that each year, more than 13,000 deaths are associated with UTIs.[5]

Prevention of CAUTIs is discussed in the CDC/HICPAC document, *Guideline for Prevention of Catheter-associated Urinary Tract Infection*.[6]

Settings: CAUTI surveillance may occur in any inpatient location(s) where denominator data can be collected, such as critical intensive care units (ICU), specialty care areas (SCA), step-down units, wards, inpatient rehabilitation locations, and long-term acute care locations. Neonatal ICUs may participate, but only off plan (not as a part of their monthly reporting plan). A complete listing of inpatient locations and instructions for mapping are located in the [CDC Locations and Descriptions](#) chapter.

Note: Post-discharge surveillance for CAUTI is not required. However, if a post-discharge CAUTI is discovered, any CAUTI with a date of event (DOE) on the day of discharge or the next day is attributable to the discharging location and should be included in any CAUTI reported to NHSN for that location (see Transfer Rule [Chapter 2](#)). No additional indwelling urinary catheter (IUC) days are reported.

Refer to the NHSN Patient Safety Manual, [Chapter *2 Identifying Healthcare Associated Infections in NHSN*](#) and [Chapter 16 *NHSN Key Terms*](#) for definitions of the following universal concepts for conducting HAI surveillance.

I.	Date of event (DOE)
II.	Healthcare associated infection (HAI)
III.	Infection window period (IWP)
IV.	Present on admission (POA)
V.	Repeat infection timeframe (RIT)
VI.	Secondary BSI attribution period (SBAP)
VII.	Location of Attribution (LOA)
VIII.	Transfer rule

Definitions:

Urinary tract infections: (UTI) are defined using Symptomatic Urinary Tract Infection (SUTI) criteria and Asymptomatic Bacteremic UTI (ABUTI). (See [Table 1](#)).

Note: A UTI is a primary site of infection; it is never considered secondary to another site of infection.

Indwelling Urinary Catheter (IUC): A drainage tube that is inserted into the urinary bladder through the urethra, is left in place, and is connected to a drainage bag (including leg bags). IUCs are often called Foley catheters. IUCs used for intermittent or continuous irrigation are also included in CAUTI surveillance. Catheters not meeting the IUC definition may include but is not limited to condom or straight in-and-out catheters. Nephrostomy tubes, ileoconduits, or suprapubic catheters do not meet the IUC definition unless an IUC is also present.

Catheter-associated UTI (CAUTI): A UTI where an indwelling urinary catheter (IUC) was in place for more than two consecutive days in an inpatient location on the date of event or the day before, with day of device placement being Day 1*. If an IUC was in place for more than two consecutive days in an inpatient location and then removed, the date of event for the UTI must be the day of device discontinuation or the next day for the UTI to be catheter-associated.

*If the IUC was in place prior to inpatient admission, the catheter day count that determines catheter-association begins with the admission date to the first inpatient location allowing for consistency with device denominator count collection (see Table 2 Denominator Data Collection Methods).

Spinal Cord Injury-associated Neurogenic Bladder (SCI-NB): For the purpose of NHSN reporting, neurogenic bladder is a condition in which there is dysfunction or damage to the nerves that control the bladder as a result of a spinal cord injury. In order to answer "Yes" to the 'Neurogenic bladder' field within the NHSN application you must utilize:
- One of the ICD-10-CM diagnosis codes that indicates a diagnosis of spinal cord injury (SCI) **AND**
- One of the ICD-10-CM diagnosis codes that indicates a diagnosis of neurogenic bladder (NB)

In tandem, these diagnostic codes define SCI-NB for NHSN surveillance purposes. For a complete list of eligible ICD-10-CM codes please visit the Urinary Tract Infection (UTI) Events section of the NHSN website under "Supporting Materials".

Example of Associating Catheter Use to UTI:
A patient in an inpatient unit has an indwelling urinary catheter (IUC) inserted, and the following day is the UTI date of event. The IUC on the date of event has not been in place for more than two consecutive days in an inpatient location, therefore the UTI is not a CAUTI. Depending on the date of admission, the UTI may be healthcare-associated. Please refer to SUTI 1b: Non-CAUTI.

Notes:
- SUTI 1b cannot be catheter-associated.

- Indwelling urinary catheters (IUCs) that are removed and reinserted:
  - If, after an IUC removal, the patient is without an IUC for at least 1 full calendar day (NOT to be read as 24 hours), then the IUC day count will start anew.
  - If instead, a new IUC is inserted before a full calendar day has passed, the IUC device day count, to determine eligibility for a CAUTI, will continue uninterrupted.

Figure 1: Associating Catheter Use to UTI

Indwelling Urinary Catheter = IUC	March 29th	March 30th	March 31st	April 1st	April 2nd	April 3rd	April 4th	April 5th	April 6th
Patient A	IUC (Day 1)	IUC (Day 2)	IUC (Day 3)	IUC (Day 4)	IUC removed (Day 5)	IUC inserted (Day 6)	IUC (Day 7)	IUC removed (Day 8)	NO IUC
Patient B	IUC (Day 1)	IUC (Day 2)	IUC (Day 3)	IUC (Day 4)	IUC removed (Day 5)	NO IUC	IUC inserted (Day 1)	IUC (Day 2)	IUC (Day 3)

Rationale: NHSN surveillance for infection is not aimed at a specific device; surveillance is aimed at identifying risk to the patient that is the result of device use in general.

Notes:

- In the examples above, Patient **A** is eligible for a CAUTI March 31st through April 6th, since an IUC was in place for some portion of each calendar day until April 6th through April 5th. A UTI with the date of event on April 6th would be a CAUTI since the IUC had been in place greater than two days and was removed the day before the date of event.
- Patient **B** is eligible for a CAUTI on March 31st (IUC Day 3) through April 3rd. The IUC had been in place for greater than two days and a HAI occurring on the day of device discontinuation, or the following calendar day is considered a device-associated infection.
- If patient **B** did not have a CAUTI by April 3rd, the patient is not eligible for a CAUTI until April 6th, when the second IUC had been in place for greater than two days.

Table 1. Urinary Tract Infection Criteria

Criterion	Urinary Tract Infection
SUTI 1a **Catheter-associated Urinary Tract Infection (CAUTI) in any age patient**	**Symptomatic UTI (SUTI)** Must meet at least **_one_** of the following criteria:
	Patient must meet 1, 2, <u>and</u> 3 below: 1. Patient had an indwelling urinary catheter that had been in place for more than 2 consecutive days in an inpatient location on the date of event AND was either: • Present for any portion of the calendar day on the date of event[†], **OR** • Removed the day before the date of event[‡] 2. Patient has at least **_one_** of the following signs or symptoms: • fever (>38.0°C) • suprapubic tenderness* • costovertebral angle pain or tenderness* • urinary urgency ^ • urinary frequency ^ • dysuria ^ 3. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of ≥10^5 CFU/ml (See Comments). All elements of the SUTI criterion must occur during the IWP (See IWP Definition Chapter 2 Identifying HAIs in NHSN). [†] When entering event into NHSN choose "INPLACE" for Risk Factor for IUC [‡] When entering event into NHSN choose "REMOVE" for Risk Factor for IUC *****See Comments for additional information. **^** These symptoms cannot be used when catheter is in place. An IUC in place could cause patient complaints of "frequency" "urgency" or "dysuria". **Note:** • Fever is a non-specific symptom of infection and cannot be excluded from UTI determination because it is clinically deemed due to another recognized cause.

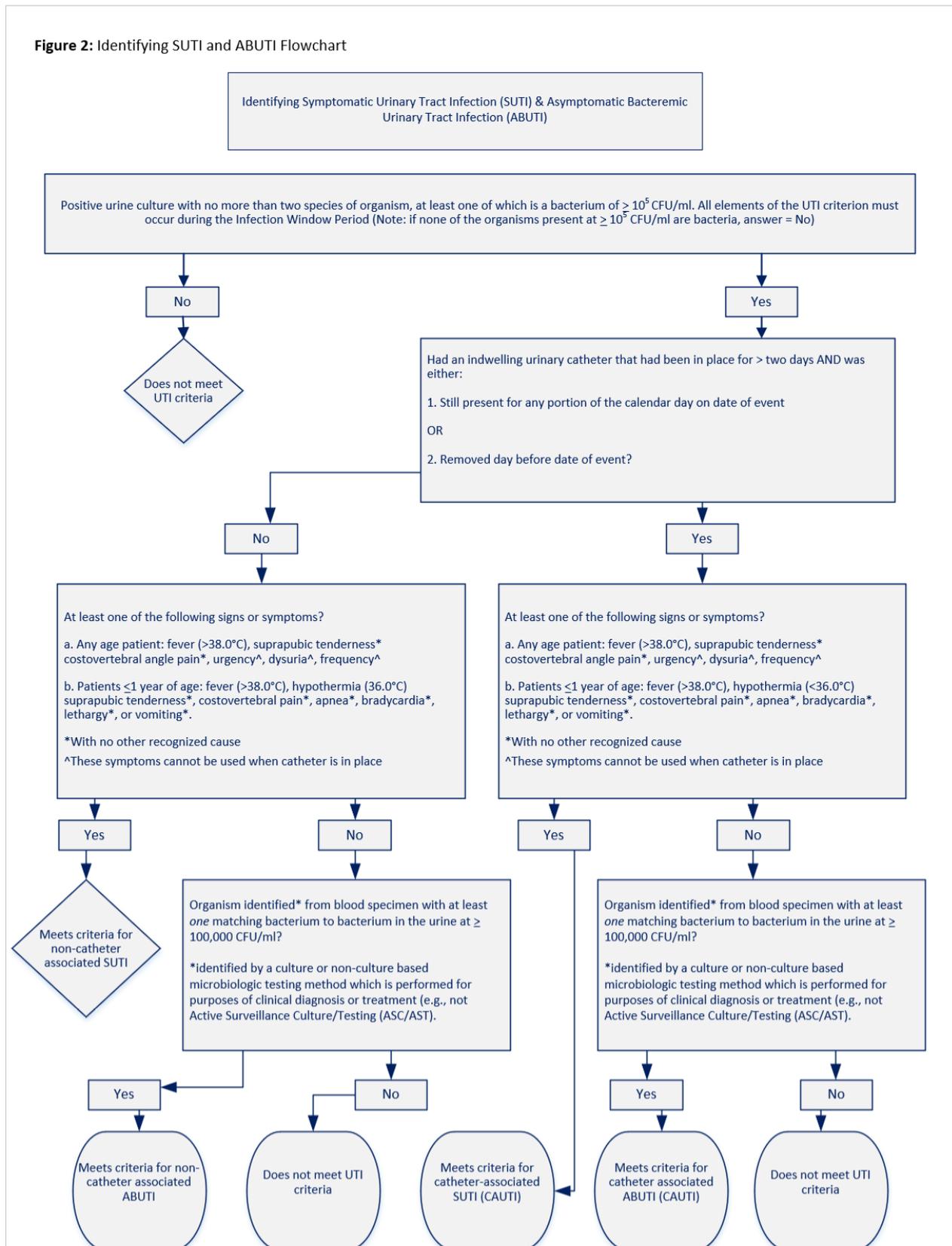| Criterion	Urinary Tract Infection (UTI)

SUTI 1b
 	
Non-Catheter-associated Urinary Tract Infection (Non-CAUTI) in any age patient
	Patient must meet 1, 2, <u>and</u> 3 below:
	
	1. One of the following is true:
	   • Patient has/had an indwelling urinary catheter, but it has/had not been in place for more than two consecutive days in an inpatient location on the date of event[†]
	   OR
	   • Patient did not have an indwelling urinary catheter in place on the date of event nor the day before the date of event [†]
	
	2. Patient has at least **_one_** of the following signs or symptoms:
	   • fever (>38°C)
	   • suprapubic tenderness*****
	   • costovertebral angle pain or tenderness*****
	   • urinary frequency ^
	   • urinary urgency ^
	   • dysuria ^
	
	3. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of ≥10^5 CFU/ml. (See [Comments](#)) All elements of the SUTI criterion must occur during the IWP (See IWP Definition [Chapter 2 Identifying HAIs in NHSN](#)).
	
	[†] When entering event into NHSN choose "NEITHER" for Risk Factor for IUC
	*See [Comments](#) for additional information.
	^These symptoms cannot be used when an indwelling urinary catheter (IUC) is in place. An IUC in place could cause patient complaints of "frequency" "urgency" or "dysuria".
	
	Note:
	   • Fever is a non-specific symptom of infection and cannot be excluded from UTI determination because it is clinically deemed due to another recognized cause.

Criterion	Urinary Tract Infection (UTI)
SUTI 2 **CAUTI or Non-CAUTI in patients 1 year of age or less**	Patient must meet 1, 2, <u>and</u> 3 below: 1. Patient is < 1 year of age (with‡ or without an indwelling urinary catheter) 2. Patient has at least ___one___ of the following signs or symptoms: • fever (>38.0°C) • hypothermia (<36.0°C) • apnea^ • bradycardia^ • lethargy^ • vomiting^ • suprapubic tenderness*^ 3. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of ≥10^5 CFU/ml. (See Comments) All elements of the SUTI criterion must occur during the IWP (See IWP Definition Chapter 2 Identifying HAIs in NHSN). ‡ If patient had an indwelling urinary catheter (IUC) in place for more than two consecutive days in an inpatient location and the IUC was in place on the date of event or the previous day, the CAUTI criterion is met. If no such IUC was in place, UTI (non-catheter associated) criterion is met. ***See** Comments for additional information. ^With no other recognized cause **Note:** Fever and hypothermia are non-specific symptoms of infection and cannot be excluded from UTI determination because they are clinically deemed due to another recognized cause.
Comments	"Mixed flora" cannot be reported as a pathogen for a UTI event. Additionally, "mixed flora" represents at least two species of organisms and cannot be used to meet the NHSN UTI criteria. Any additional organisms recovered from the same culture would be in addition to the mixed flora, meaning there are at least three organisms present making the culture ineligible for use to meet NHSN UTI criteria. The following excluded organisms cannot be used to meet the UTI definition: ➢ Any yeast or yeast species yeast ➢ mold ➢ dimorphic fungi or ➢ parasites

Comments	An acceptable urine specimen may include the above organisms if no more than one bacterium with $\geq$ 100,000 CFU/ml is also present. Additionally, these non-bacterial organisms identified from a blood culture cannot be deemed secondary to a UTI since the above non-bacterial organisms are excluded as organisms in the UTI definition.
	➢ Suprapubic tenderness documentation - whether elicited by palpation (tenderness-sign) or provided as a subjective complaint of suprapubic pain (pain-symptom) - found in the medical record is acceptable to meet SUTI criterion if documented in the medical record during the Infection Window Period.
	➢ Lower abdominal pain or bladder or pelvic discomfort are examples of symptoms that can be used as suprapubic tenderness. Generalized "abdominal pain" in the medical record is too general and not to be interpreted as suprapubic tenderness as there are many causes of abdominal pain.
	➢ Lower back pain (left, right, or bilateral) or flank pain (left, right, or bilateral) are examples of symptoms that can be used as costovertebral angle pain or tenderness. Generalized "low back pain" is not to be interpreted as costovertebral angle pain or tenderness.

Criterion	Urinary Tract Infection (UTI)
Asymptomatic Bacteremic Urinary Tract Infection (ABUTI) (Any age patient)	
	Patient must meet 1, 2, <u>and</u> 3 below: 1. Patient with***** or without an indwelling urinary catheter has <u>no</u> signs or symptoms of SUTI 1 or 2 regardless of age. 2. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of ≥10^5 CFU/ml (see Comment section below). 3. Patient has organism identified** from blood specimen with at least ***<u>one</u>*** matching bacterium to the $\geq 10^5$ CFU/ml bacterium identified in the urine specimen, or is eligible LCBI criterion 2 (without fever) and matching common commensal(s) in the urine. All elements of the ABUTI criterion must occur during the Infection Window Period (See Definition Chapter 2 Identifying HAIs in NHSN). *****Patient had an IUC in place for more than two consecutive days in an inpatient location on the date of event, and an IUC was in place on the date of event or the day before. *Catheter - associated ABUTI is reportable if CAUTI is in the facility's reporting plan for the location.* ** Organisms identified by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (e.g., not Active Surveillance Culture/Testing (ASC/AST).
Comments	Mixed flora cannot be reported as a pathogen for a UTI event. Additionally, "mixed flora" represents at least two species of organisms and cannot be used to meet the NHSN UTI criteria. Any additional organisms recovered from the same culture would be in addition to the mixed flora, meaning there are at least three organisms present making the culture ineligible for use to meet NHSN UTI criteria. Additionally, the following excluded organisms cannot be used to meet the UTI definition: • Any yeast or yeast species • mold • dimorphic fungi or • parasites An acceptable urine specimen may include these excluded organisms if no more than one bacterium with ≥100,000 CFU/ml is also present. Additionally, these non-bacterial organisms identified from blood cannot be deemed secondary to a UTI since they are excluded as organisms in the UTI definition.

Figure 2: Identifying SUTI and ABUTI Flowchart

Identifying Symptomatic Urinary Tract Infection (SUTI) & Asymptomatic Bacteremic Urinary Tract Infection (ABUTI)

Positive urine culture with no more than two species of organism, at least one of which is a bacterium of $\geq 10^5$ CFU/ml. All elements of the UTI criterion must occur during the Infection Window Period (Note: if none of the organisms present at $\geq 10^5$ CFU/ml are bacteria, answer = No)

No

Does not meet UTI criteria

Yes

Had an indwelling urinary catheter that had been in place for > two days AND was either:

1. Still present for any portion of the calendar day on date of event

OR

2. Removed day before date of event?

No

Yes

At least one of the following signs or symptoms?

a. Any age patient: fever (>38.0°C), suprapubic tenderness* costovertebral angle pain*, urgency^, dysuria^, frequency^

b. Patients <1 year of age: fever (>38.0°C), hypothermia (36.0°C) suprapubic tenderness*, costovertebral pain*, apnea*, bradycardia*, lethargy*, or vomiting*.

*With no other recognized cause
^These symptoms cannot be used when catheter is in place

At least one of the following signs or symptoms?

a. Any age patient: fever (>38.0°C), suprapubic tenderness* costovertebral angle pain*, urgency^, dysuria^, frequency^

b. Patients <1 year of age: fever (>38.0°C), hypothermia (<36.0°C) suprapubic tenderness*, costovertebral pain*, apnea*, bradycardia*, lethargy*, or vomiting*.

*With no other recognized cause
^These symptoms cannot be used when catheter is in place

Yes

No

Yes

No

Meets criteria for non-catheter associated SUTI

Organism identified* from blood specimen with at least *one* matching bacterium to bacterium in the urine at $\geq$ 100,000 CFU/ml?

*identified by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (e.g., not Active Surveillance Culture/Testing (ASC/AST).

Organism identified* from blood specimen with at least *one* matching bacterium to bacterium in the urine at $\geq$ 100,000 CFU/ml?

*identified by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (e.g., not Active Surveillance Culture/Testing (ASC/AST).

Yes

No

Yes

No

Meets criteria for non-catheter associated ABUTI

Does not meet UTI criteria

Meets criteria for catheter-associated SUTI (CAUTI)

Meets criteria for catheter associated ABUTI (CAUTI)

Does not meet UTI criteria

Monthly Summary Data

Numerator Data: The _Urinary Tract Infection (UTI) form (CDC 57.114)_ is used to collect and report each CAUTI that is identified during the month selected for surveillance. The Instructions for Completion of Urinary Tract Infection form include brief instructions for collection and entry of each data element on the form. The UTI form includes patient demographic information and information on whether an indwelling urinary catheter was present. Additional data include the specific criteria met for identifying the UTI, whether the patient developed a secondary bloodstream infection, whether the patient died, and the organisms isolated from cultures and their antimicrobial susceptibilities.

Reporting Instructions:
If no CAUTIs are identified during the month of surveillance, the "Report No Events" box must be checked on the appropriate denominator summary screen, (for example, _Denominators for Intensive Care Unit (ICU)/Other Locations (Not NICU or SCA/ONC)_).

Denominator Data: Device days and patient days are used for denominators (See Key Terms chapter).The method of collecting device-day denominator data may differ depending on the location of patients being monitored. The following methods may be used:

Table 2: Denominator Data Collection Methods

Denominator Data Collection Method	Details
Manual, Daily (specifically, collected at the same time **every day** of the month)	Denominator data (patient days and device days) should be collected at the same time, every day, for each location performing surveillance to ensure that differing collection methods don't inadvertently result in device days being greater than patient days.
	The Instructions for Completion of Denominators for Intensive Care Unit (ICU)/Other Locations (Not NICU and SCA/ONC) and Instructions for Completion of Denominators for Specialty Care Areas (SCA)/Oncology (ONC) contain brief instructions for collection and entry of each data element on the form.
	Indwelling urinary catheter days, which are the number of patients with an indwelling urinary catheter device, are collected daily, at the same time each day, according to the chosen location using the appropriate form (CDC 57.117 and 57.118). These daily counts are summed and only the total for the month is entered into NHSN. Indwelling urinary catheter days and patient days are collected separately for each of the locations monitored.

Denominator Data Collection Method	Details
Manual, sampled once/week (collected at the same time on the same designated day, **once per week**)	To maximize staff resources on time spent collecting surveillance data, once/week sampling of denominator data to generate estimated urinary catheter days may be used as an alternative to daily collection in non-oncology ICUs and wards (see Notes below). Sampling may not be used in SCA/ONC locations or NICUs. During the month, the number of patients in the location (patient-days) and the number of patients with an indwelling urinary catheter (urinary catheter-days) is collected on a designated day each week (for example, every Tuesday), at the same time each day. Evaluations of this method have repeatedly shown that collecting weekly denominator data on Saturday or Sunday generates the least accurate estimates of denominator data, therefore, Saturday and Sunday should not be selected.[7-9] If the designated sampling collection day is missed, collect the data the next available day instead. The following must be collected and entered NHSN: 1. The monthly total for patient-days, collected daily 2. The sampled total patient-days 3. The sampled total urinary catheter-days When these data are entered, the NHSN application will calculate an estimate of urinary catheter-days. **Notes:** • To ensure the accuracy of estimated denominator data obtained by sampling, only ICUs and ward locations with an average of 75 or more urinary catheter-days per month are eligible to use the sampling method. A review of each location's urinary catheter denominator data for the past 12 months in NHSN will help determine which locations are eligible to use the sampling method. • The accuracy of estimated denominator data generated by sampling can be heavily influenced by incorrect or missing data. Using the guidance in this protocol is essential to avoid erroneous fluctuations in rates or Standardized Infection Ratios (SIRs) when implementing data collection by sampling.

Denominator Data Collection Method	Details
Electronic	For **_any_** location, denominator data from electronic sources (for example, urinary catheter days from electronic charting), may be used after validation of a minimum three consecutive months proves the electronic data to be within 5% (+/-) of the manually-collected, once a day counts. Perform the validation of electronic counts separately for each location conducting CAUTI surveillance. When converting from one electronic counting system to another electronic counting system, the new electronic system should be validated against manual counts as above. If electronic counts for the new electronic system are not within 5% of manual counts, resume manual counting and continue working with IT staff to improve design of electronic denominator data extraction (while reporting manual counts) until concurrent counts are within 5% for 3 consecutive months. **Note:** This guideline is important because validating a new electronic counting system against an existing electronic system can magnify errors and result in inaccurate denominator counts. • Perform the validation of electronic counts separately for each location conducting CLABSI surveillance.

Data Analyses

All data that is entered into NHSN can be analyzed at event or summary level. The data in NHSN can be visualized and analyzed in various ways, for example, descriptive analysis reports for both the denominator and numerator data.

Types of CAUTI Analysis Reports

Standardized Infection Ratio

The Standardized Infection Ratio ([SIR](#)) is a summary measure used to track HAIs at a national, state, or local level over time. The SIR adjusts for various facility and/or patient-level factors that contribute to HAI risk within each facility. In HAI data analysis, the SIR compares the actual number of HAIs reported to the number that would be predicted, given the standard population (i.e., NHSN baseline), adjusting for several risk factors that have been found to be significantly associated with differences in infection incidence. The number of predicted infections is calculated using probabilities from negative binomial regression models constructed from 2015 NHSN data. For more information on SIR and the CAUTI parameter estimates, please the 2015 baseline SIR guide: [https: //www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf](https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf)

$$ SIR = \frac{Observed\ (O)HAIs}{Predicted\ (P)HAIs} $$

An SIR greater than 1.0 indicates that more HAIs were observed than predicted; conversely, an SIR less than 1.0 indicates that fewer HAIs were observed than predicted.

While the CAUTI SIR can be calculated for single locations, the measure also allows you to summarize your data by multiple locations, adjusting for differences in the incidence of infection among the location types. For example, you will be able to obtain one CAUTI SIR adjusting for all locations reported. Similarly, you can obtain one CAUTI SIR for all ICUs in your facility.

For more information on using the CAUTI SIR reports, please see the troubleshooting guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/clabsicauti_sirtroubleshooting.pdf.

For further information regarding the p-value and 95% confidence interval, please the following guide: https://www.cdc.gov/nhsn/ps-analysis-resources/keys-to-success.html

Note: The SIR will be calculated only if the number of predicted CAUTIs (numPred) is ≥1 to help enforce a minimum precision criterion.

The Standardized Utilization Ratio (SUR)

The SUR, or Standardized Utilization Ratio is a summary measure used to track device use at a national, state, local, or facility level over time. The SUR adjusts for various facility and/or location-level factors that contribute to device use. The method of calculating an SUR is similar to the method used to calculate the Standardized Infection Ratio (SIR), a summary statistic used in NHSN to track healthcare-associated infections (HAIs). In device-associated HAI data analysis, the SUR compares the actual number of device days reported to what would be predicted, given the standard population (specifically, the NHSN baseline), adjusting for several factors that have been found to be significantly associated with differences in device utilization.

$$SUR = \frac{Observed\ (O)\ Catheter\ Days}{Predicted\ (P)\ Catheter\ Days}$$

In other words, an SUR greater than 1.0 indicates that more device days were observed than predicted; conversely, an SUR less than 1.0 indicates that fewer device days were observed than predicted. SURs are currently calculated in NHSN for the following device types: central lines, urinary catheters, and ventilators.

More information regarding the CAUTI 2015 baseline SUR model and the parameter estimates can be found at:
https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sur-guide-508.pdf
https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/run-interpret-sur-reports.pdf

Rates and Ratios

The CAUTI rate per 1000 urinary catheter days is calculated by dividing the number of CAUTIs by the number of catheter days and multiplying the result by 1000.

$$CAUTI\ Rate = \frac{No.\ of\ CAUTIs}{No.\ of\ Catheter\ Days} * 1000$$

Device Utilization Ratio

The Urinary Catheter Utilization Ratio is calculated by dividing the number of urinary catheter days by the number of patient days.

$$DUR = \frac{No.\ of\ Urinary\ Catheter\ Days}{No.\ of\ Patient\ Days}$$

These calculations will be performed separately for the different types of ICUs, specialty care areas, and other locations in the institution, except for neonatal locations. DURs are useful for the purposes of tracking device use over shorter periods of time and for internal trend analyses.

Descriptive Analysis

Descriptive analysis output options of numerator and denominator data, such as line listings, frequency tables, and bar and pie charts are available in the NHSN application. SIRs, SURs and CAUTI rates and run charts are also available. Guides on using NHSN analysis features are available at: www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html.

NHSN Group Analysis

NHSN Group Users can perform the same analysis as facility level users in NHSN. A few helpful tools in NHSN for groups are listed in the resources below. These tools are guides on how to start and join a Group; how to create a template to request data from facilities; how to determine the level of access granted by the facility following the previous steps, and how to analyze the facilities data.

Group Analysis Resources

NHSN Group Users Page: https://www.cdc.gov/nhsn/group-users/index.html

Group User's Guide to the Membership Rights Report: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/GroupAnalysisWebinar.pdf

Group User's Guide to the Line Listing- Participation Alerts: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/group-alerts.pdf

Data Quality Resources

Data Quality Website: https://www.cdc.gov/nhsn/ps-analysis-resources/data-quality/index.html

Data Quality Manual: https://www.cdc.gov/nhsn/pdfs/pscmanual/Instructions_DQ.pdf

Data Quality Training: https://www.cdc.gov/nhsn/training/analysis/index.html

Additional Resources

Analysis Resources: https://www.cdc.gov/nhsn/ps-analysis-resources/index.html

Analysis Reference Guides: https://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html

NHSN Training: https://www.cdc.gov/nhsn/training/index.html

Data Quality Website: https://www.cdc.gov/nhsn/ps-analysis-resources/data-quality/index.html

Table 3. CAUTI Measures Available in NHSN

Measure	Calculation	Application
CAUTI SIR	$$\frac{\text{Number of Observed CAUTIs}}{\text{Number of Predicted CAUTIs}}$$	Both location specific and summarized measure
CAUTI Rates	$$\frac{\text{Number of CAUTIs per locaiton}}{\text{Number of Urinary Catheter Days per location}} * 1000$$	Location specific measure only
Urinary Catheter SUR	$$\frac{\text{Number of Observed Catheter Days}}{\text{Number of Predicted Catheter Days}}$$	Both location specific and summarized measure
DUR	$$\frac{\text{Number of Catheter Days for a location}}{\text{Number of Patient Days for a location}}$$	Location specific measure only

References

[1]Magill S., O'Leary S. Janelle D., et al. Changes in Prevalence of Health Care Associated Infection in the U.S. Hospitals. *New England Journal of Medicine*. 2018;379: 1732-1744.

[2]McGuckin M. *The patient survival guide: 8 simple solutions to prevent hospital and healthcare-associated infections.* New York, NY: Demos Medical Publishing; 2012.

[3]Lo E, Nicolle LE, Coffin SE, Gould C, Maragakis LL, Meddings J, et al. Strategies to prevent catheter-associated urinary tract infections in acute care hospitals: 2014 update. *Infection Control and Hospital Epidemiology* 2014; 35:464-79.

[4]Scott R. The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention, 2009. Division of Healthcare Quality Promotion, National Center for Preparedness, Detection, and Control of Infectious Diseases, Coordinating Center for Infectious Diseases, Centers for Disease Control and Prevention, February 2009.

[5]Klevens, R., Edward, J., et al. Estimating Healthcare-associated Infections and Deaths in U.S. Hospitals. *Public Health Reports.* 2007;122: 160-166.

[6]Gould, CV., Umscheid, CA.,Agarwal, RK., Kuntz, G., Pegues, DA. "Guideline for Prevention of Catheter-associated Urinary Tract Infections". *Infection Control and Hospital Epidemiology*. 2010;31: 319-26.

[7]Klevens, R., et al. Sampling for Collection of Central Line Day Denominators in Surveillance for Healthcare-associated Bloodstream Infections. *Infection Control and Hospital Epidemiology*. 2006;27: 338-42.

[8]Thompson, N., et al. Evaluating the Accuracy of Sampling to Estimate Central Line–Days: Simplification of NHSN Surveillance Methods*. Infection Control and Hospital Epidemiology*. 2013;34(3): 221-228.

[9]See, I., et al. ID Week 2012 (Abstract #1284): Evaluation of Sampling Denominator Data to Estimate Urinary Catheter and Ventilator Days for the NHSN. San Diego, California. October 19, 2012.