

Antimicrobial Resistance & Patient Safety Portal

Methodology: Antimicrobial Resistance HAI Data

The Antimicrobial Resistance (AR) Healthcare-associated Infection (HAI) dataset of the [AR & Patient Safety Portal](#) includes HAI data reported to CDC's National Healthcare Safety Network (NHSN) by healthcare facilities in the United States. More information about NHSN, including details on the surveillance methodology, can be found at: <http://www.cdc.gov/nhsn/about-nhsn/index.html>. For more information about the AR & Patient Safety Portal AR HAI dataset, visit: <https://arpsp.cdc.gov/about?tab=antibiotic-resistance>.

Data Methodology

Events Represented in the AR HAI Dataset

The AR HAI dataset includes data elements from the following three HAI types that were reported to the Device- and Procedure-associated Modules of the Patient Safety Component of NHSN:

- Central line-associated bloodstream infections (CLABSIs)
- Catheter-associated urinary tract infections (CAUTIs)
- Surgical site infections (SSIs) following inpatient procedures with a primary closure technique

Healthcare Facilities Included and Relationship to CMS Quality Reporting Programs

All facilities that reported at least one eligible HAI to the Patient Safety Component of NHSN are included in the AR HAI dataset. This covers:

- Acute care hospitals
- Long-term acute care hospitals (LTACHs)
- Inpatient rehabilitation facilities (IRFs)
- Critical access hospitals (CAHs)
- Oncology hospitals
- Pediatric hospitals
- Military and VA hospitals
- Surgical and orthopedic hospitals
- Psychiatric hospitals

CLABSIs and CAUTIs captured in the AR HAI dataset occurred in any type of inpatient location in the facility. CLABSIs reported from free-standing IRFs and IRF units within a hospital are excluded. All types of SSIs (superficial, deep, and organ/space) that occurred following any NHSN inpatient procedure performed with a primary closure technique are included. HAIs captured in the AR HAI dataset were included in a facility's NHSN monthly reporting plan and were submitted to NHSN with all required data elements. Data elements related to the pathogen and antimicrobial resistance testing were extracted from each event and aggregated across different strata. More information is provided below about the strata available.



Patient settings related to outpatient care or nursing home/skilled nursing are not included in the AR HAI dataset. The extent of reporting from different facility types varies and is driven largely by the Quality Reporting Programs managed by the Centers for Medicare & Medicaid Services (CMS). More information and a complete list of the requirements for surveillance as part of CMS's Quality Reporting Programs can be found here: <https://www.cdc.gov/nhsn/pdfs/cms/cms-reporting-requirements.pdf>

While both state mandates and federal Quality Reporting Programs influence the types of data submitted to NHSN, data included in the AR HAI dataset are not limited to the specifications of such reporting programs and include facilities that are not participating in these programs.

Pathogen and Antimicrobial Susceptibility Data

Pathogen and antimicrobial susceptibility data reported to NHSN are provided by the facility's designated clinical microbiology laboratory. Laboratories are expected to use Clinical and Laboratory Standards Institute standards for antimicrobial susceptibility testing. Susceptibility results for each pathogen were reported using the category interpretations "susceptible" (S), "intermediate" (I), "resistant" (R), "susceptible-dose dependent" (S-DD, treated as I), "non-susceptible" (NS), or "not tested". Up to three unique pathogens can be reported per CLABSI or CAUTI event; however, SSIs can be reported to NHSN without a pathogen. Any SSI without an associated pathogen is not included in the AR HAI dataset.

For all pathogens included in the AR HAI dataset, there was a select group of antimicrobials for which susceptibility test results were required for NHSN reporting; these pathogen-antimicrobial combinations were then used to define select phenotypes. Because laboratories may test different antimicrobial agents within a class, for some phenotypes, resistance was defined using data from at least one of several agents within the same antimicrobial class. The AR HAI dataset includes 29 antimicrobial resistant phenotypes of epidemiologic importance. Please refer to the "Phenotype Definitions" document on the ["About the Data" page](#) of the Patient Safety Portal for definitions of each phenotype.

Summary Measure of Antimicrobial Resistance

For each available stratum (e.g., HAI type, year, age group, facility type, etc.), a pooled mean percent resistant (%R) was calculated for each pathogen-antimicrobial agent combination by pooling data from all NHSN hospitals for the specified year. This percentage (%R) is calculated as the sum of pathogens that tested resistant ("number resistant"), divided by the sum of pathogens tested for susceptibility ("number tested"), multiplied by 100. Refer to the "Phenotype Definitions" document on the ["About the Data" page](#) of the Patient Safety Portal for more information. The pooled mean percent resistant was not calculated for any pathogen-antimicrobial agent combination for which less than 20 isolates were tested. The national, regional, and state-level data included in the AR HAI dataset are displayed with 95% confidence intervals around the percent resistant, which were calculated using a mid-P exact test and are an indication of precision.



Variables Available for Stratification of All Data

State: Includes 50 U.S. states, District of Columbia, and Puerto Rico. Small islands and territories (e.g., Virgin Islands, Guam) are not shown at the state level, but are included in the national measures.

Region: Defined by the nine U.S. Census Divisions (http://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf). Small islands and territories, including Puerto Rico, are not included in the regional display, but are included in the national measures.

Age: Adults (≥ 18), Pediatrics (< 18). For CLABSI and CAUTI events, patient age is determined based on the patient's age on the date of event. For SSIs, this reflects the patient's age on the date of procedure.

Year: Number resistant, number tested, and pooled mean %R are calculated for each year.

HAI Type: CLABSI, CAUTI, SSI.

Additional Variables Available for Stratification of National Data

Hospital teaching status: whether the hospital has an educational program for undergraduate medical students and post-graduate medical training. This stratification is only available for general acute care hospitals.

Facility size: large facility (≥ 200 beds) or small facility (< 200 beds). This stratification is only available for general acute care hospitals.

Location type: intensive care units, neonatal intensive care units, oncology units (i.e., oncology ICUs and oncology wards), or other unit types (e.g., wards, mixed acuity units, step-down units).

Facility type: acute care hospital, inpatient rehabilitation facility, or long-term acute care hospital.

Surgery type: any of the NHSN inpatient procedure types.

Sex: male or female.

Limitations of the Data

Raw and unadjusted antimicrobial resistance data are presented in the AR HAI dataset. The dataset does not include statistical trend analyses nor other statistical comparative tests; this should be considered when interpreting data presented on this site. Due to changes in NHSN definitions and surveillance protocols, caution should be used when comparing resistance data between years. The AR HAI dataset should not be used to make definitive conclusions about the changes in antimicrobial resistance over time, nor conclusions surrounding the comparison of a state's resistance to the national resistance.



Differences may exist in testing and reporting methods between individual laboratories that could cause inconsistencies in the reported data. NHSN captures only the interpretation (S, I, or R) and not the measured minimum inhibitory concentration, and the interpretations of breakpoints may vary slightly between laboratories depending on the version of CLSI standards in use. When reviewing state-level data, it is important to note that the amount and types of data reported may vary by state due to different state legislation and reporting mandates. Furthermore, the HAI data reported from facilities may not be validated, or validated to the same extent, from every state. States with more intensive data validation programs may have more HAI events reported to NHSN. While the data shown in the AR HAI dataset represent HAIs reported from almost all acute care hospitals, LTACHs, and IRFs in the U.S., they do not include all types of HAIs and are not representative of the entire U.S. population.

It should be noted that the HAI events reported to NHSN represent a subset of all HAIs occurring in various patient settings in the U.S. In addition, these data do not account for any antimicrobial resistance that occurs outside of an inpatient healthcare facility.

For more information about the methods used for these data, their interpretation, and a discussion of select results, visit: <https://www.cdc.gov/nhsn/datastat/index.html>.

