# Antimicrobial Use (AU) Option Helpful Hints

## Important URLs

* NHSN AU Option Protocol: <http://www.cdc.gov/nhsn/acute-care-hospital/aur/index.html>
* NHSN CDA Submission Support Portal (CSSP): <http://www.cdc.gov/nhsn/cdaportal/index.html>
* For validation of CDAs without all the business rules of NHSN, use the Lantana CDA validator: <https://www.lantanagroup.com/validator/>
* AU Synthetic Data Set (SDS) Validation: <https://www.cdc.gov/nhsn/cdaportal/sds/index.html>
  + **IMPORTANT NOTE**: SDS validation is required for all AU CDA vendors. Please review the information provided in the [AU SDS Validation](#_AU_Synthetic_Data) section and at the website above.

## Helpful Hints

### Data Import/Deletion

* Facilities cannot enter or modify AU Option Summary data by hand through the web interface. Facilities must enter or modify AU data through the CDA Import Function or import via DIRECT CDA Automation.
* For an AU import to occur for a facility, the facility must have the Patient Safety Component activated.
* NHSN requires you to include AU in the Monthly Reporting Plan for the month in which you are reporting.
  + Facilities cannot enter AU data “off-plan.”
* Application Business Rule for the monthly reporting plan:
  + If an AU location ≠ facility-wide inpatient (FACWIDEIN), then it *may* be the only location followed for a month.
  + If an AU location = FACWIDEIN, then it MUST have at least one other location added to the monthly plan.
* The system will allow CDA import for a month once that month has ended.
  + Example: Upload October data no earlier than November 1
* Enter data into NHSN for a given calendar month by the end of the subsequent calendar month.
* Each CDA represents a specific location and month.
* For manual CDA upload, include multiple CDAs from one facility in ONE zip file.
  + Example:
    - One CDA reporting data for FACWIDEIN for September
      * Include both days present and admissions in this file type
      * Include the data for all inpatient units: 1 North, 1 South, 2 North, 2 South, and 3 North
      * Do not include the data for outpatient units: emergency department
    - One CDA reporting data for 1 North medical ICU for September
    - One CDA reporting data for 1 South surgical ICU for September
    - One CDA reporting data for 2 North medical ward for September
    - One CDA reporting data for 2 South surgical ward for September
    - One CDA reporting data for 3 North the labor and delivery ward for September
    - One CDA reporting data for the emergency department for September
    - One zip file containing all September AU CDAs
* For DIRECT upload, a vendor can include multiple CDAs from multiple facilities in one zip file if the same DIRECT address is used.
* The NHSN User Interface includes a delete capability for AU.
  + Select Summary Data > Delete AUR Data from the left-hand menu in NHSN.
    - Select the Summary Data Type, Location, and the relevant Month and Year. Then click the Delete button.
    - **Note:** Location code = (ALL) includes all individual locations as well as FacWideIN for that month/year.
* Facilities can update an existing record using succession management as defined in the HAI CDA Implementation Guide. Specifics found at <http://www.cdc.gov/nhsn/cdaportal/faqs.html>.

### AU Option CDA Specifications

* Create the AU CDA using the R6 or R1 Normative IG. The CMS Promoting Interoperability Program requires a facility to use the R1 Normative AU CDA import if they wish to satisfy program requirements. The R6 AU CDA version will continue to be a valid CDA import for facilities not participating in the Promoting Interoperability Program.
* In the CDA, code each antimicrobial in a separate summary encounter.
* Example: <encounter classCode="ENC" moodCode="EVN">
* Include all antimicrobials listed in the AU Option protocol in the CDA. Refer to the [Numerator](#Numerator) section for further guidance on how to indicate antimicrobials not used in a given month.
  + Beginning with NHSN R8.8 for 2018 data, NHSN added a new drug, Delafloxacin to the AU Option. The new drug is optional when uploading files dated ≤ 2018. NHSN requires the inclusion of Delafloxacin when uploading files dated ≥ 2019.
  + Beginning with NHSN R9.2 for 2019 data, NHSN added a new drug, Meropenem-Vaborbactam to the AU Option. The drug was optional when uploading files dated ≤ 2019.
  + Beginning with NHSN R9.4 for 2020 data, NHSN will apply the following changes:
    - NHSN added six drugs that vendors can optionally include: Amikacin liposomal, Baloxavir Marboxil, Colistin, Eravacycline, Omadacycline, and Plazomicin
      * NOTE: Remdesivir was added in mid-2020 and is required to be included in files dated July 2020 forward
    - NHSN removed six drugs which vendors must remove from files dated ≥ 2020: Cefditoren, Ceftibuten, Ceftizoxime, Sulfisoxazole, Telithromycin, Ticarcillin/Clavulanate
    - NHSN requires the inclusion of Meropenem-Vaborbactam for files dated ≥ 2020
  + Beginning with NHSN 9.5 for 2021 data, NHSN will apply the following changes:
    - NHSN added four drugs: Amphotericin B lipid complex, Cefiderocol, Lefamulin and Imipenem/cilastatin/relebactam
    - NHSN removed three drugs: Doripenem, Erythromycin/Sulfisoxazole, and Piperacillin
  + Beginning with NHSN 10.1.2 for 2022 data, NHSN will apply the following changes:
    - Molnupiravir and Nirmatrelvir are optional for January and February 2022.
    - Molnupiravir and Nirmatrelvir are required for March 2022 and forward.
  + No new drugs were added and no drugs were removed for 2023 reporting. However, the NHSN application logic was updated to require reporting from all 95 drugs and will no longer accept a range of drugs.
  + Beginning with NHSN 12.0 for 2024 data, NHSN will apply the following changes:
    - NHSN added three new agents: Nirsevimab, Rezafungin, Sulbactam/Durlobactam
    - NHSN removed two agents: Gemifloxacin and Quinupristin with Dalfopristin
  + Beginning with NHSN 13.0 for 2025 data, NHSN will apply the following changes:
    - NHSN added three new agents: Cefepime/Enmetazobactam, Ceftobiprole Medocaril, Pivmecillinam
    - NHSN removed one agent: Chloramphenicol
* As a reminder, NHSN uses the ingredient (IN) level RxNorm codes for AU Option submission. Please review your facilities’ data feeds to ensure use reported with a more granular RxNorm code term type (e.g., SCDC, SCD/GPCK, etc.) is rolled up and reported to NHSN using the ingredient level code.
* Report the total Number of Days Present, Number of Therapy Days, and Number of Admissions as a whole number (not a decimal number).
* Below is a high-level example of data included in the CDA:
  + Month Range
  + Location
  + # of Admissions (only reported for location = FACWIDEIN)
  + Patient present days (aka days present)
    - Note: Days present is not the same as the patient days denominator used in other parts of NHSN. See Denominator section below for more information.
  + Each specific drug
    - Aggregate data for the antimicrobial
    - Stratified data of antimicrobial for 4 Routes of administration:
      * Respiratory tract route
      * Digestive tract route
      * Intravenous (IV) route
      * Intramuscular (IM) route

### AU Option Location Specifications

* NHSN strongly encourages the submission of data from all NHSN-defined inpatient locations, FACWIDEIN, and select outpatient acute-care settings (specifically, outpatient emergency department, pediatric emergency department, and 24-hour observation area) from which the vendor system can accurately capture the numerator and denominator data.
  + If the vendor system is not able to accurately electronically capture data from a given location, the facility should not submit data from that location. Additionally, vendors should not include that location in the FACWIDEIN record.
* Only upload an AU summary record to NHSN for a specific location if both the numerator (antimicrobial days) and denominator (days present & admissions) data are electronically available.
* NHSN accepts the CDC Location Codes for AU Option summary data import as found in the   
  “Location Codes” tab of the IDM. These locations will have a ‘Y’ in the AUR column of the “Location Codes” tab.
  + The only outpatient location types currently accepted are Emergency Department, Pediatric Emergency Department, and 24-hour observation area.
* FACWIDEIN should include reporting of all inpatient location types that fall under one of the definitions of a specific inpatient type in the healthcare service location value set specified by NHSN in the “Location Codes” tab of the IDM.
  + FACWIDEIN represents all inpatient locations for the facility where the vendor system can collect accurate numerator and denominator counts.
    - If a vendor system cannot electronically capture a location’s numerator and/or denominator, the system should exclude the location’s numerator and denominator data from the FACWIDEIN numerator and denominator data.
  + Include all the facility’s inpatient locations with electronically captured numerator (antimicrobial days) and denominator (days present & admissions) data in the FACWIDEIN record for full inpatient facility coverage.
* For inpatient locations, include all patients physically residing in that location in the location specific and FACWIDEIN data regardless of patient status (inpatient, outpatient, observation, etc.).

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### Numerator (Antimicrobial Days)

* Aggregate antimicrobial days by month for each patient care location and overall for inpatient areas (FACWIDEIN) as documented in the eMAR and/or BCMA.
* Report a value – a specific number, 0, or NA for every antimicrobial listed in [Appendix B of the NHSN AUR Protocol](http://www.cdc.gov/nhsn/pdfs/pscmanual/11pscaurcurrent.pdf), regardless of whether the antimicrobial was used in the location/facility for a given month.
  + Zero (0) – Use when the facility can electronically capture that antimicrobial (in the eMAR/BCMA) but did not administer it to any patients during the given month.
    - Example: If a facility generally uses amoxicillin but the facility did not administer it to any patients during the month, the amoxicillin count would be 0
    - Expressed in CDA as value="0"
  + Not applicable (NA) – Use when the vendor system cannot electronically capture the antimicrobial at the facility
    - Example: If the facility administers meropenem to patients throughout the month, but the vendor system cannot capture those administrations within eMAR/BCMA, the meropenem count would be ‘NA’
    - Expressed in CDA as nullFlavor="NA"
* The total antimicrobial days for a given antimicrobial should include only the counts administered using one of the four routes accepted into the AU Option (IV, IM, digestive, respiratory). Exclude administrations via any route other than the four accepted routes from all AU Option data.
  + Total antimicrobial days for a given drug should not simply be the sum of the routes of administration for that drug. Drug-specific antimicrobial days (total) attributes one antimicrobial day for any route of administration so the sum of the four routes of administration for a given antimicrobial should always be greater than or equal to the antimicrobial’s total antimicrobial days. For example, if a provider administered tobramycin to a patient intravenously and via a respiratory route on the same day, this patient attributes “one tobramycin Day (Total)”; the stratification by route of administration would be “one tobramycin Day (IV)” and “one tobramycin Day (Respiratory)”.
* Facilities cannot aggregate all locations to equal FACWIDEIN – this must be a separate summation.
  + The sum of antimicrobial days for location-specific analyses would be higher than antimicrobial days for the facility because multiple administrations of an antimicrobial would account for multiple “antimicrobial days” for a given patient.

### Denominator (days present [aka patient-present days])

* **NOTE: Days present ≠ patient days**
  + Only the AU Option uses the days present denominator.
  + All other NHSN Patient Safety Component modules use patient days as the denominator.
  + For a given location or FACWIDEIN, the days present count should almost always be higher than the patient day count since days present take into account patient transfers and discharges.
* Summary records for all location types require the “Patient-Present Days” value.
  + Value must be >= 0.
  + If location = ‘FACWIDEIN' then Total Number of days must be <= 99999; Otherwise, must be <= 50000.
  + The R1 Normative AU CDA lists the “Patient-Present Days” only once per file.
  + The R6 AU CDA lists the “Patient-Present Days” in every drug entry and requires its value to be the same number throughout the file.
* NHSN defines one day as the time between 12:00am and 11:59pm, or one calendar day.
* The patient should begin attributing to the days present count in an outpatient location such as an Emergency Department as soon as they have had an initial interaction with a medical professional (for example, the beginning of triage), regardless of when the patient is placed in a bed.
* For patient-care location-specific analyses
  + Days present – number of patients who were present for any portion of each day in a specific patient care location, regardless of status
    - Example: Patient X starts the day in the Medical ICU and then the hospital transfers him to the Medical Ward at 11:00am. The vendor system would count Patient X once in the Medical ICU and once in the Medical Ward for that day.
  + Patients cannot count for more than one day in a specific patient-care location
    - Example: Patient X starts the day in the Medical ICU, the hospital transfers him to the Medical Ward at 11:00am, and then back to the Medical ICU at 9:00pm. The vendor system would count Patient X only once in the Medical ICU and once in the Medical Ward for that day.
    - This is also true if the hospital admitted, discharged, and admitted a patient to the same location in one calendar day. The patient can only count for 1-day present in a given location per calendar day.
* For FACWIDEIN analyses
  + Days present – number of patients who were present for any portion of each day somewhere within the facility in any inpatient location regardless of status (\*\*This is not the same as patient-days used in the rest of NHSN therefore you cannot use the MDRO Summary Record FACWIDEIN total patient day count. \*\*)
    - Example: The hospital admits Patient Y to the Medical Ward on Monday at 10:00pm and discharges her on Thursday at 8:30am. Patient Y would count for 4 days present in an inpatient location.
    - Example: The hospital admits Patient Z to the Medical Ward on Monday at 10:00pm. On Tuesday at 1:00pm the hospital transfers him to the Surgical ICU and at 11:30pm the hospital transfers him to the Surgical Ward. The hospital discharges him on Thursday at 8:30am. Patient Z would count for 4 days present in an inpatient location.
  + Throughout the entire inpatient facility, count a patient only once per day.
    - This is also true if the hospital admits, discharges, and admits the patient to the same location in one calendar day. The patient can only count for 1 day present for FACWIDEIN per calendar day.
  + Facilities cannot sum days present for location-specific analysis to get FACWIDEIN. This must be a separate summation.
    - Sum of days present for location-specific analyses would be higher than days present for the facility because transfers between wards would account for multiple “days present” for a given patient
  + Do not include outpatient locations (emergency department, pediatric emergency department and 24-hour observation area) in the FACWIDEIN days present counts.

### Denominator (Admissions)

* The “Number of Admissions” value is valid for summary records reporting for a FACWIDEIN file only.
  + Value must be >= 0 and <= 99999
* How to count patient admissions for AU calculations when a patient’s stay extends from one month to another:
  + The time at which a patient enters the door to a facility or a location is the time of their admission to that facility or specific location. If they do not leave, then that stay is all part of that same admission, no matter how long. So, a stay that continues across multiple months is still only one admission.
    - For example, if the patient is admitted to the Medical Ward on January 29 and remains in that unit until being discharged on February 2, the patient attributes 1 admission to January and 0 admissions to February.
* A patient admitted to an inpatient unit would be counted as an admission even if they were discharged that same calendar day.
* If the hospital discharges or transfers a patient to a different facility and then that patient returns later, then the vendor system should count that patient as a new admission.
* A patient transfer from an inpatient to an outpatient ED, pediatric ED or 24hr observation location then back to an inpatient location is counted as two separate admissions.
* Do not include outpatient locations (emergency department, pediatric emergency department and 24-hour observation area) in the FACWIDEIN admission counts.

### AU SDS Validation

* NHSN requires SDS validation for all AU CDA vendors. Any AU Summary CDA file that does not contain the SDS validation information will fail to import into NHSN.
* The AU SDS is test data that NHSN AU Option implementers can use to validate their AU data aggregation methods comply with the NHSN AU Option protocol’s requirements.
* The AU SDS is intended for use in testing antimicrobial day numerator and days present denominator data aggregation, not conformance to the AU CDA file structure.
* Be sure to review the AU SDS Validation website: <https://www.cdc.gov/nhsn/cdaportal/sds/index.html> .

### AU Option Analysis Reports

* Review AU Option data using the NHSN Analysis function. Specific details on AU Option analysis can be found in the [protocol](http://www.cdc.gov/nhsn/pdfs/pscmanual/11pscaurcurrent.pdf) or in the Analysis Resources section of the NHSN AUR Module [webpage](http://www.cdc.gov/nhsn/acute-care-hospital/aur/index.html).

## Change Log

* January 2025
  + NHSN added three new agents: Cefepime/Enmetazobactam, Ceftobiprole Medocaril, Pivmecillinam
  + NHSN removed one agent: Chloramphenicol
  + Clarified encounter definition
* January 2024
  + NHSN now validates that all 96 drugs are included in the AUR file for summary records January 2024 and forward.
  + Removal of Gemifloxacin and Quinupristin with Dalfopristin for January 2024 and forward
  + Reporting of Nirsevimab, Rezafungin and Sulbactam/Durlobactam for January 2024 and forward
  + Added clarifications for days present and admission counting.
* January 2023
  + NHSN now validates that all 95 drugs are included in the AU file for summary records January 2023 and forward.
  + Added clarification for admission counting.
* February 2022
  + AU Option CDA Specifications
    - Included information on the changes that will be applied for 2022 data beginning with NHSN 10.1.2.
      * Reporting of two COVID drugs, Molnupiravir and Nirmatrelvir, are optional for January and February 2022 and required for March 2022 and forward.
    - Included a reminder that NHSN uses the ingredient (IN) level RxNorm codes for AU Option submission.