



NHSN Antimicrobial Use (AU) Option

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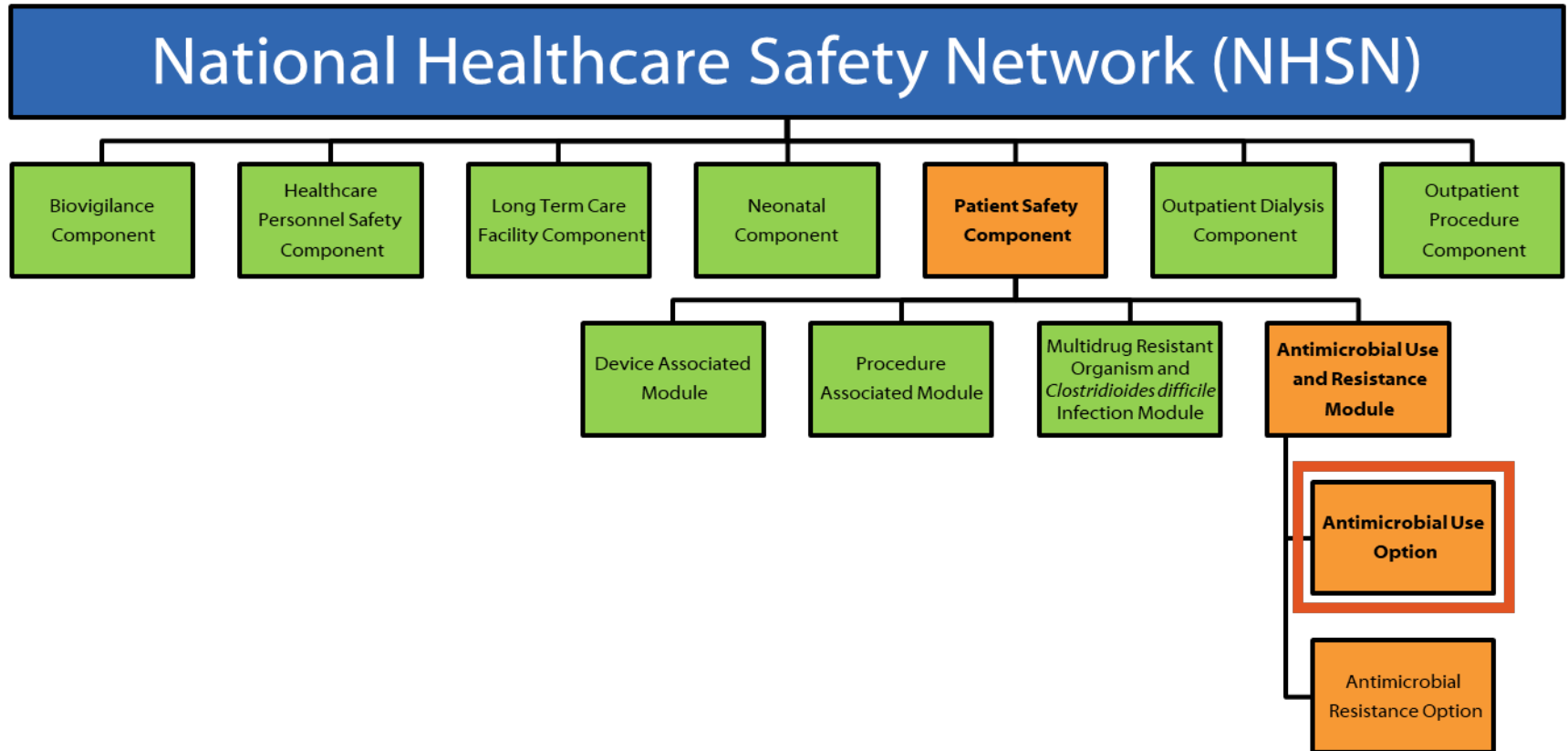
Lantana Consulting Group | Contractor for the Division of Healthcare Quality Promotion, CDC

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Objectives

- Outline the requirements for participation in the AU Option
- Describe the data elements collected by the AU Option
- Illustrate how to submit data to the AU Option

NHSN Structure



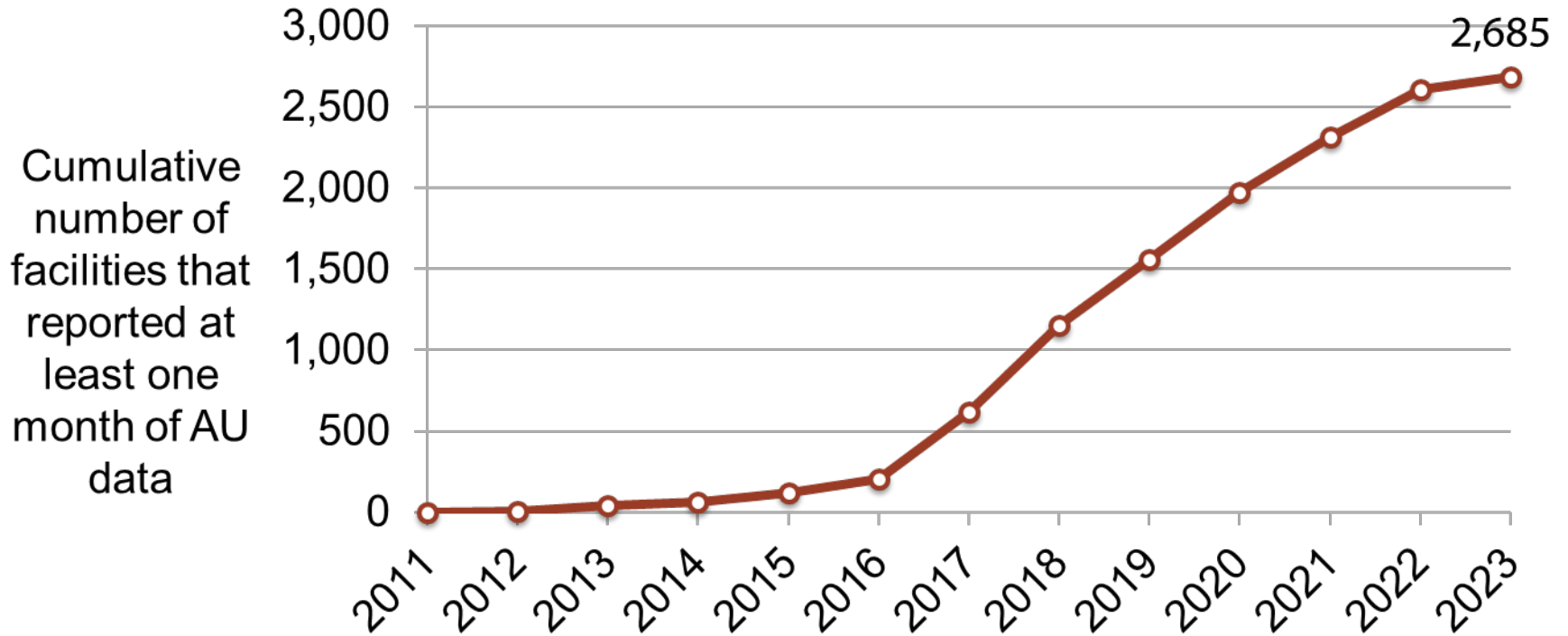
AU Option Background

AU Option

- Released in 2011
- Purpose: Provide a mechanism for facilities to report and analyze antimicrobial usage as part of antimicrobial stewardship efforts at their facility
- Beginning in 2024, AUR Module data are required under the Public Health and Clinical Data Exchange Objective of the CMS Promoting Interoperability Program*

*NHSN Promoting Interoperability Program webpage: <https://www.cdc.gov/nhsn/cdaportal/datainteroperability.html>

Cumulative annual submission to the AU Option*



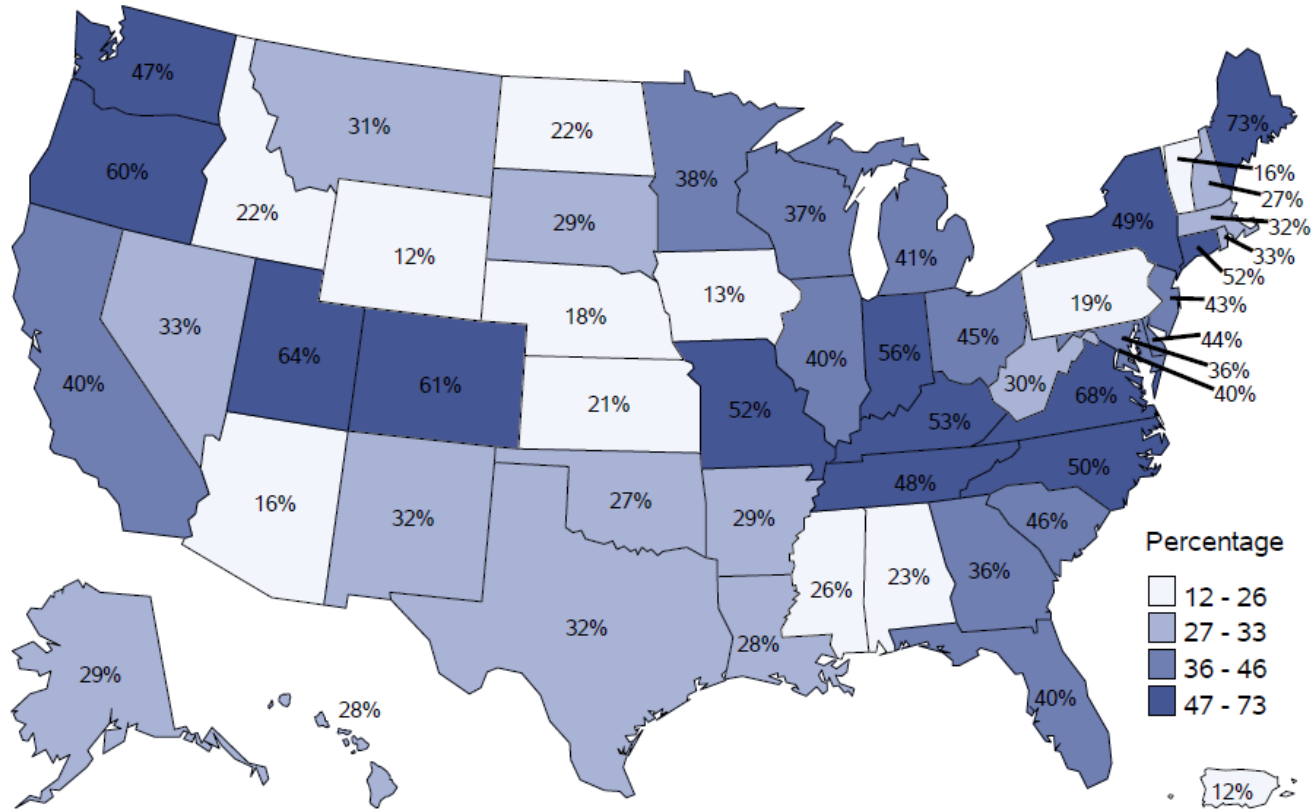
*As of February 1, 2023

Submission Metrics

- 2,685 facilities submitted at least one month of data
 - From all 50 states plus Washington DC, Puerto Rico, and select US military bases located internationally
 - Bed size
 - Average = 200
 - Median = 142
 - Min/Max = 1, 1533
 - Teaching status
 - Teaching hospitals: 71%
 - Major teaching: 41% of all teaching hospitals

*As of February 1, 2023

Cumulative percentage of facilities reporting at least one month of data to the AU Option*



*As of
February 1,
2023

AU Option Reporting

Who can participate in the AU Option?

- Hospitals* that have:
 - Electronic Medication Administration Record (eMAR) or Bar Coding Medication Administration (BCMA) system
 - Admission Discharge Transfer (ADT) system
 - Ability to collect and package data using Clinical Document Architecture (CDA)
 - Commercial software vendor or “homegrown” internal IT/informatics resources that passes AU Option Synthetic Data Set (SDS) validation (<https://www.cdc.gov/nhsn/cdaportal/sds/au-vendor-list.html>)

*General acute care hospitals, critical access hospitals, children’s hospitals, long term acute care hospitals, pediatric long term acute care hospitals, military and veterans’ hospitals, oncology hospitals, orthopedic hospitals, psychiatric hospitals, rehabilitation hospitals, surgical hospitals, women’s hospitals, women’s and children’s hospitals, government and non-government hospitals for public health emergencies enrolled in NHSN and participating in the Patient Safety Component

AU Option Data Elements – Numerator

- **Antimicrobial days (days of therapy):** Sum of days for which any amount of specific agent was administered to a patient
 - 95 antimicrobials (including antibacterial, antifungal, and anti-influenza agents) sub-stratified by route of administration*
 - Intravenous (IV)
 - Intramuscular (IM)
 - Digestive (oral → rectal)
 - Respiratory (inhaled)
 - Only administration data (eMAR/BCMA)

*Please exclude any other routes of administration (for example, topical, antibiotic locks, intracavity, intrapleural, intraperitoneal, intraventricular, ophthalmic, otic, or irrigation) from AU Option reporting

Counting Antimicrobial Days

- 1 antimicrobial day per: 1 patient, 1 drug, 1 location, 1 calendar day
 - Regardless of how many doses patient receives

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- Example: Patient admitted to 1 South (Medical Ward) Monday @ 22:00 & discharged Wednesday @ 12:00

	Monday	Tuesday	Wednesday
Meropenem 1 gram IV every 8 hours			
Amikacin 1000mg IV every 24 hours			
Total Antimicrobial Days			

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Amikacin 1000mg IV every 24 hours	Given @23:00		
Total Antimicrobial Days	Meropenem = 1 Amikacin = 1		

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	Monday	Tuesday	Wednesday
Meropenem 1 gram IV every 8 hours	Given @ 23:00	Given @ 07:00 Given @ 15:00 Given @ 23:00	
Amikacin 1000mg IV every 24 hours	Given @ 23:00	Given @ 23:00	
Total Antimicrobial Days	Meropenem = 1 Amikacin = 1	Meropenem = 1 Amikacin = 1	

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 - Regardless of how many doses patient receives
- Example: Patient admitted to 1 South (Medical Ward) Monday @ 22:00 & discharged Wednesday @ 12:00

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Meropenem 1 gram IV every 8 hours	Given @ 23:00	Given @ 07:00 Given @ 15:00 Given @ 23:00	Given @ 07:00
Amikacin 1000mg IV every 24 hours	Given @ 23:00	Given @ 23:00	
Total Antimicrobial Days	Meropenem = 1 Amikacin = 1	Meropenem = 1 Amikacin = 1	Meropenem = 1 Amikacin = 0

Antimicrobial Days – Total vs. Sub-Stratified Routes

- 1 antimicrobial day per: 1 patient, 1 drug, **1 route**, 1 location, 1 calendar day
 - 1 total antimicrobial day per drug & 1 antimicrobial day for **each** route per drug
 - Antimicrobial day counted on the day of administration only

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	Monday	Tuesday	Wednesday
Ciprofloxacin twice daily	<i>Admitted@12:00</i> Given IV @23:00		
Antimicrobial Day Counts	Cipro Total: 1 Cipro IV: 1 Cipro Digestive: 0		

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	Monday	Tuesday	Wednesday
Ciprofloxacin twice daily	<i>Admitted</i> @12:00 Given IV @23:00	Given IV @11:00 Given PO @23:00	
Antimicrobial Day Counts	Cipro Total: 1 Cipro IV: 1 Cipro Digestive: 0	Cipro Total: 1 Cipro IV: 1 Cipro Digestive: 1	

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Ciprofloxacin twice daily	<i>Admitted@12:00</i> Given IV @23:00	Given IV @11:00 Given PO @23:00	Given PO @11:00 <i>Discharged @5:00</i>
Antimicrobial Day Counts	Cipro Total: 1 Cipro IV: 1 Cipro Digestive: 0	Cipro Total: 1 Cipro IV: 1 Cipro Digestive: 1	Cipro Total: 1 Cipro IV: 0 Cipro Digestive: 1

Antimicrobial Days – Sum of the Routes

- 1 patient can contribute 1 antimicrobial day to **multiple** routes in the same calendar day
- Routes **cannot** be summed to calculate the total antimicrobial days because drugs can be given more than once daily via multiple routes
- Total antimicrobial days \leq Sum of the routes**

	Monday	Tuesday	Wednesday
Ciprofloxacin twice daily	<i>Admitted@12:00</i> Given IV @23:00	Given IV @11:00 Given PO @23:00	Given PO @11:00 <i>Discharged @5:00</i>
Antimicrobial Day Counts	Cipro Total: 1 Cipro IV: 1 Cipro Digestive: 0	Cipro Total: 1 Cipro IV: 1 Cipro Digestive: 1	Cipro Total: 1 Cipro IV: 0 Cipro Digestive: 1

AU Option Data Elements – Denominators

- **Days present:** Number of days during which a patient spent any time in a specific location or facility
 - Reported for all individual locations and facility-wide inpatient (FacWideIN)
 - **Days present ≠ Patient days**
 - Days present used for AU Option only
 - Patient days used throughout rest of NHSN (including HAI and AR Option)
- **Admissions:** Number of patients admitted to an inpatient location in the facility (reported for FacWideIN only)

Counting Days Present vs. Patient Days

Patient Movement		Days Present	Patient Days (midnight census)
Patient A	Medical Ward: 00:01-24:00	Medical Ward = 1	Medical Ward = 1
Patient B			
Patient C			
Patient D			
Totals:			

Counting Days Present vs. Patient Days

Patient Movement		Days Present	Patient Days (midnight census)
Patient A	Medical Ward: 00:01-24:00	Medical Ward = 1	Medical Ward = 1
Patient B	Medical ICU: 00:01-24:00	Medical ICU = 1	Medical ICU = 1
Patient C			
Patient D			
Totals:			

Counting Days Present vs. Patient Days

Patient Movement		Days Present	Patient Days (midnight census)
Patient A	Medical Ward: 00:01-24:00	Medical Ward = 1	Medical Ward = 1
Patient B	Medical ICU: 00:01-24:00	Medical ICU = 1	Medical ICU = 1
Patient C	Medical ICU: 00:01-08:30	Medical ICU = 1	Medical ICU = 0
	Medical Ward: 08:31-24:00	Medical Ward = 1	Medical Ward = 1
Patient D			
Totals:			

Counting Days Present vs. Patient Days

Patient Movement		Days Present	Patient Days (midnight census)
Patient A	Medical Ward: 00:01-24:00	Medical Ward = 1	Medical Ward = 1
Patient B	Medical ICU: 00:01-24:00	Medical ICU = 1	Medical ICU = 1
Patient C	Medical ICU: 00:01-08:30 Medical Ward: 08:31-24:00	Medical ICU = 1 Medical Ward = 1	Medical ICU = 0 Medical Ward = 1
Patient D	Medical ICU: 00:01-10:00 Step Down: 10:01-15:00 Medical Ward: 15:01-24:00	Medical ICU = 1 Step Down = 1 Medical Ward = 1	Medical ICU = 0 Step Down = 0 Medical Ward = 1
Totals:			

Counting Days Present vs. Patient Days

Patient Movement		Days Present	Patient Days (midnight census)
Patient A	Medical Ward: 00:01-24:00	Medical Ward = 1	Medical Ward = 1
Patient B	Medical ICU: 00:01-24:00	Medical ICU = 1	Medical ICU = 1
Patient C	Medical ICU: 00:01-08:30	Medical ICU = 1	Medical ICU = 0
	Medical Ward: 08:31-24:00	Medical Ward = 1	Medical Ward = 1
Patient D	Medical ICU: 00:01-10:00	Medical ICU = 1	Medical ICU = 0
	Step Down: 10:01-15:00	Step Down = 1	Step Down = 0
	Medical Ward: 15:01-24:00	Medical Ward = 1	Medical Ward = 1
Totals:		Medical Ward = 3	Medical Ward = 3
		Medical ICU = 3	Medical ICU = 1
		Step Down = 1	Step Down = 0

Days Present – FacWideIN

- If a patient transfers between inpatient locations in one calendar day, how many days present does that patient contribute to FacWideIN?
 - Patient contributes 1 day present to FacWideIN
 - FacWideIN = aggregate data for all inpatient locations
 - AU Option only counts a patient once per calendar day for FacWideIN
- Location days present **cannot** be summed to calculate the FacWideIN days present

Counting FacWideIN Days Present

	Patient Movement	Days Present
Patient A	Medical Ward: 00:01-24:00	FacWideIN = 1
Patient B	Medical ICU: 00:01-24:00	FacWideIN = 1
Patient C	Medical ICU: 00:01-08:30 Medical Ward: 08:31-24:00	FacWideIN = 1
Patient D	Medical ICU: 00:01-10:00 Step Down: 10:01-15:00 Medical Ward: 15:01-24:00	FacWideIN = 1
Total:		FacWideIN = 4

AU Option Summary Data

- Monthly aggregate, summary-level data by location
 - All inpatient locations individually
 - All inpatient locations combined (FacWideIN)
 - 3 outpatient locations (ED, pediatric ED, 24-hour observation)
 - Use same mapped locations throughout all of NHSN
- Data are aggregated prior to sending to NHSN
- No patient-level data shared with NHSN for AU Option
- Requires accurate/complete electronic capture of both the numerator and denominator for the given location

Submitting AU Data into NHSN

Clinical Document Architecture (CDA)

- AU Option Data must be uploaded via CDA
 - Too much data to enter by hand!
- Health Level 7 (HL7) standard
- Provides facilities with standardized way to package and upload data
 - AU, AR, and some HAI
- CDA ≠ CSV (Excel format)
 - CDA uses Extensible Markup Language (XML)

```
</participant>
<!-- Number of Patient-present Days -->
<entryRelationship typeCode="COMP">
  <observation classCode="OBS" moodCode="EVN">
    <templateId root="2.16.840.1.113883.10.20.5.6.69"/>
    <code codeSystem="2.16.840.1.113883.6.277"
          codeSystemName="cdcNHSN"
          code="2525-4"
          displayName="Number of Patient-present Days"/>
    <statusCode code="completed"/>
    <value xsi:type="PQ" unit="d" value="700"/>
  </observation>
</entryRelationship>
<!-- the Drug, aggregate data, no specified route of administration -->
<entryRelationship typeCode="COMP">
  <observation classCode="OBS" moodCode="EVN">
    <templateId root="2.16.840.1.113883.10.20.5.6.69"/>
    <code codeSystem="2.16.840.1.113883.6.277"
          codeSystemName="cdcNHSN"
          code="2524-7"
          displayName="Number of Therapy Days"/>
    <statusCode code="completed"/>
    <value xsi:type="PQ" unit="d" value="3"/>
    <participant typeCode="CSM" <!-- antimicrobial Drug -->
      <participantRole classCode="MANU">
        <code codeSystem="2.16.840.1.113883.6.88"
              codeSystemName="RxNorm"
              code="620"
              displayName="Amantadine"/>
      </participantRole>
    </participant>
  </observation>
</entryRelationship>
<!-- stratified data: Drug + route -->
```


From eMAR/BCMA to CDA

1. eMAR/BCMA captures drug administration
2. Vendor or “homegrown” system extracts and aggregates data elements
 - a) Numerator from eMAR/BCMA
 - b) Denominator from ADT system
3. Vendor or “homegrown” system packages AU data into CDA file(s)
 - a) 1 file per month per patient care location (unit)

Monthly AU Data Submission

- Recommend uploading within 30 days following the completion of the month
- Zip file containing 1 CDA file per location and 1 CDA file for FacWideIN
 - Each CDA file contains numerator and denominator(s) for given location
 - All CDA files can be uploaded in 1 zip file
 - Maximum: 1000 CDAs or file size of 2 MB per zip file
- Encourage reporting data from all applicable inpatient and select outpatient locations

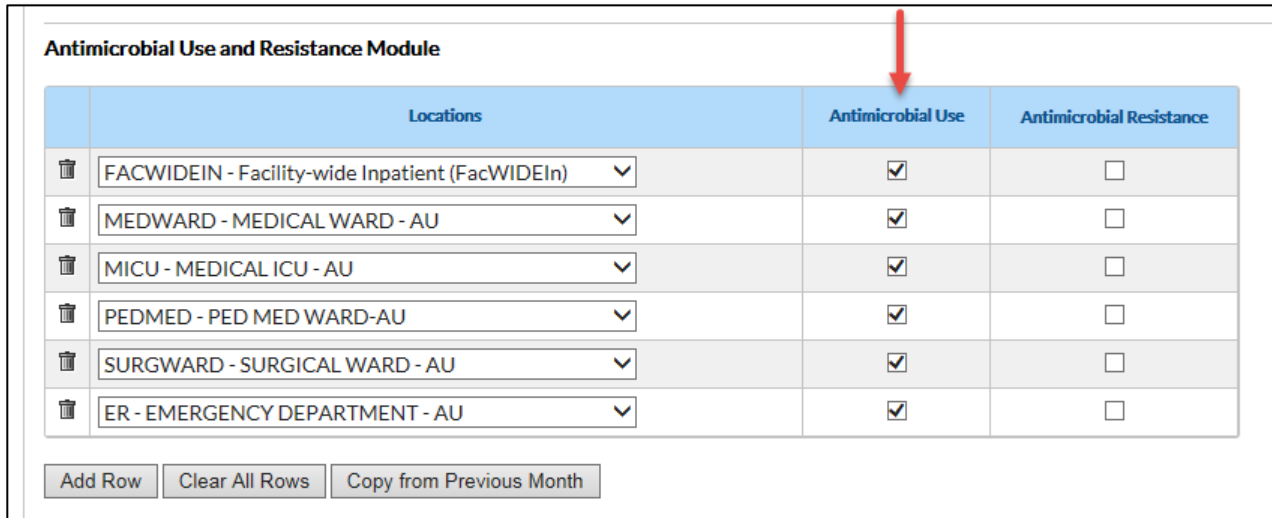
Example Monthly AU Data Submission

- Example for a facility with 4 patient care locations
 - 1 CDA for 1 North - Adult Medical/Surgical ICU
 - 1 CDA for 1 South - Adult Medical/Surgical Ward
 - 1 CDA for 2 North - Pediatric Medical/Surgical Ward
 - 1 CDA for Emergency Department
 - 1 CDA for FacWideIN (combination of all 3 NHSN-defined inpatient locations above)
- **Remember:** 1 CDA file per location and 1 CDA file for FacWideIN

Monthly Reporting Plans

- Add locations to monthly reporting plan prior to uploading data
 - Along with FacWideIN, each inpatient and outpatient location is listed separately
- AUR section in same monthly reporting plan used for HAI reporting

Antimicrobial Use and Resistance Module

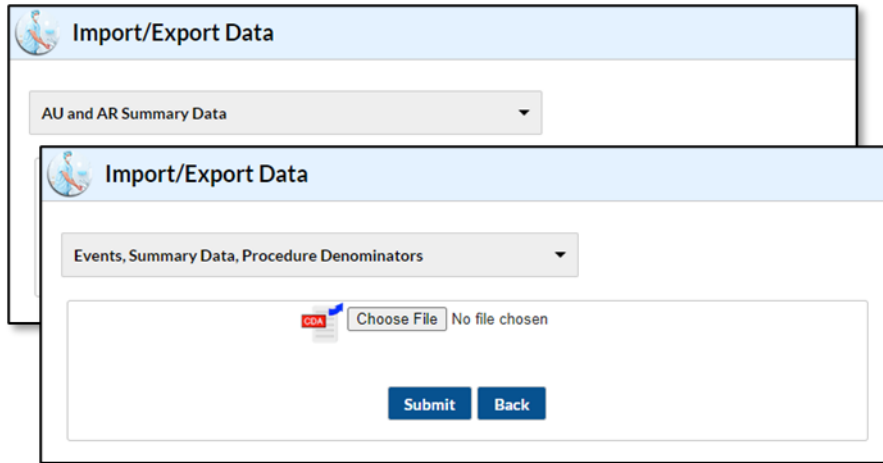


	Locations	Antimicrobial Use	Antimicrobial Resistance
🗑️	FACWIDEIN - Facility-wide Inpatient (FacWIDEIn) ▼	<input checked="" type="checkbox"/>	<input type="checkbox"/>
🗑️	MEDWARD - MEDICAL WARD - AU ▼	<input checked="" type="checkbox"/>	<input type="checkbox"/>
🗑️	MICU - MEDICAL ICU - AU ▼	<input checked="" type="checkbox"/>	<input type="checkbox"/>
🗑️	PEDMED - PED MED WARD-AU ▼	<input checked="" type="checkbox"/>	<input type="checkbox"/>
🗑️	SURGWARD - SURGICAL WARD - AU ▼	<input checked="" type="checkbox"/>	<input type="checkbox"/>
🗑️	ER - EMERGENCY DEPARTMENT - AU ▼	<input checked="" type="checkbox"/>	<input type="checkbox"/>

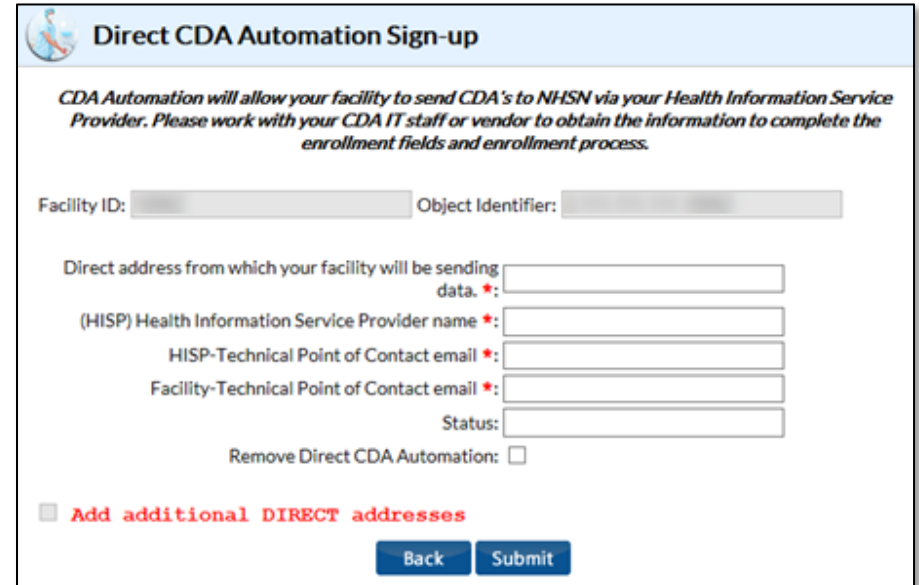
Add Row Clear All Rows Copy from Previous Month

Importing CDA Files into NHSN

- Manual upload
- Automatic upload from vendor/IT solution using DIRECT CDA Automation



The screenshot shows two overlapping windows of the NHSN 'Import/Export Data' interface. The top window has a dropdown menu set to 'AU and AR Summary Data'. The bottom window has a dropdown menu set to 'Events, Summary Data, Procedure Denominators'. Below the dropdown in the bottom window is a file upload area with a 'Choose File' button and the text 'No file chosen'. At the bottom of the bottom window are 'Submit' and 'Back' buttons.

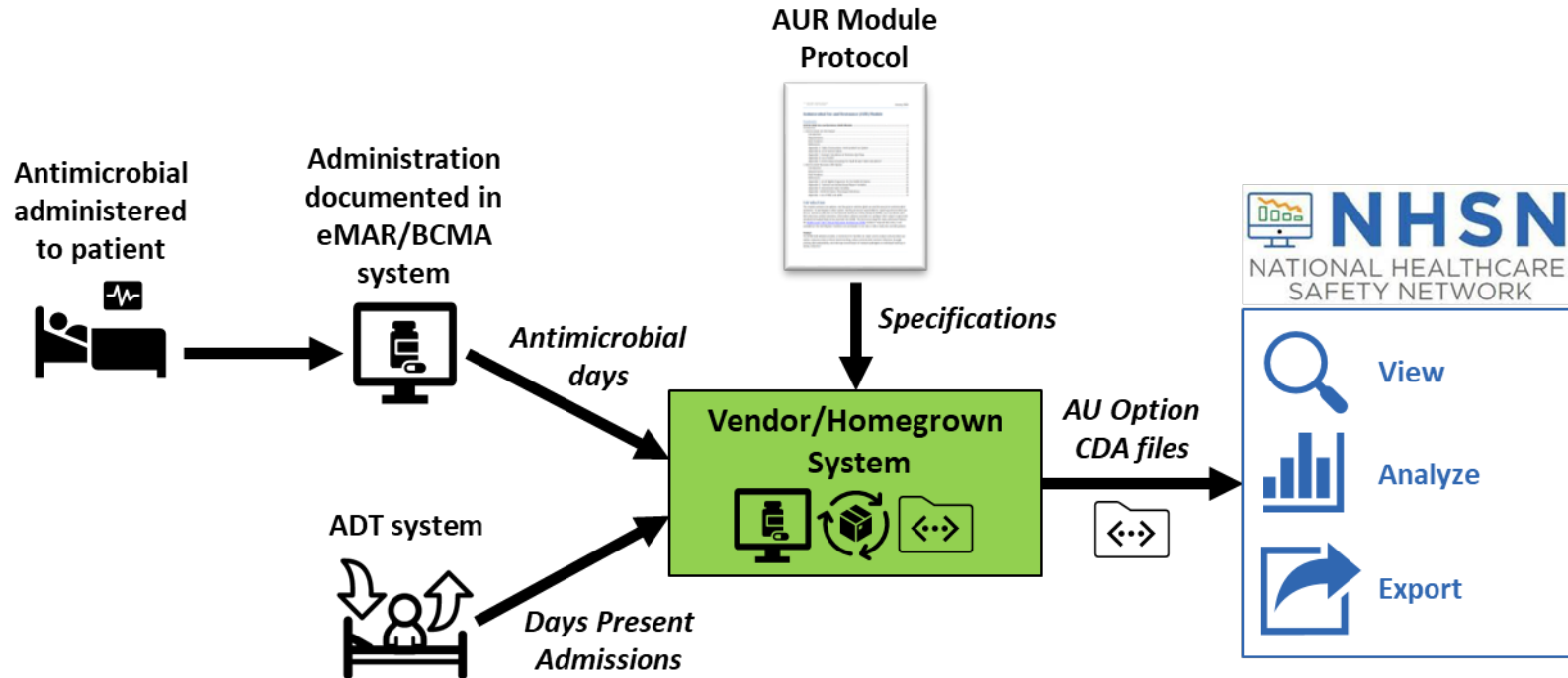


The screenshot shows the 'Direct CDA Automation Sign-up' interface. It includes a header with a globe icon and the title 'Direct CDA Automation Sign-up'. Below the header is a paragraph of text: 'CDA Automation will allow your facility to send CDA's to NHSN via your Health Information Service Provider. Please work with your CDA IT staff or vendor to obtain the information to complete the enrollment fields and enrollment process.' The form contains several input fields: 'Facility ID:' and 'Object Identifier:' (both with greyed-out text), 'Direct address from which your facility will be sending data. *:', '(HISP) Health Information Service Provider name *:', 'HISP-Technical Point of Contact email *:', 'Facility-Technical Point of Contact email *:', and 'Status:'. There is also a checkbox for 'Remove Direct CDA Automation:'. At the bottom, there is a checkbox for 'Add additional DIRECT addresses' and 'Back' and 'Submit' buttons.

Quick Learn Video - Uploading CDA Files into NHSN:

<https://youtu.be/T4DLtimpB5M>

Flow of AU Data: From Bedside to AU Option



ADT: Admission Discharge Transfer system
eMAR: Electronic Medication Administration Record
BCMA: Bar Coding Medication Administration system
CDA: Clinical Document Architecture

Steps for AU Option Participation

- Meet prerequisites
- Identify facility lead(s)/champion(s) and gain support
- Gather information on CDA submission capabilities
 - Activate, obtain, or develop SDS validated system for aggregating and packaging data into CDA files
(<https://www.cdc.gov/nhsn/cdaportal/sds/au-vendor-list.html>)
- Implementation validation (<https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/aur/AU-Option-Implementation-Data-Validation-P.pdf>)
- Monthly submission
- Annual validation (<https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/aur/annual-au-data-validation-508.pdf>)

AUR Module Reporting Resources

AUR Module Resources

- AUR Module webpage:
<https://www.cdc.gov/nhsn/psc/aur/index.html>
 - Protocol
 - FAQs
 - Quick Reference Guides
 - Training resources
 - Validation resources

The screenshot shows the CDC National Healthcare Safety Network (NHSN) website. The header includes the CDC logo and the text "Centers for Disease Control and Prevention CDC 24/7: Saving Lives. Protecting People™". A search bar is located in the top right corner. Below the header, the page title is "National Healthcare Safety Network (NHSN)". The breadcrumb trail reads "CDC > NHSN Home > Patient Safety Component".

The main content area is titled "Antimicrobial Use and Resistance (AUR) Options". It features a left-hand navigation menu with the following items: NHSN Home, NHSN Login, About NHSN (+), Enroll Facility Here (+), CMS Requirements (+), Change NHSN Facility Admin, Resources by Facility (+), Patient Safety Component (-), Annual Surveys, Locations & Monthly Reporting Plans, Analysis Resources (+), Antimicrobial Use & Resistance (-), AU Option Case Examples, BSI (CLABSI), CLIP, MDRO & CDI, PedVAE, and PNEU.

The main content area is divided into several sections:

- Antimicrobial Use and Resistance (AUR) Options**: Includes a "Print" link.
- Protocols**: Lists "Chapter 14: Antimicrobial Use and Resistance (AUR) Module - January 2023" [PDF - 3 MB] and "2023 Summary of Updates" [PDF - 199 KB].
- Supporting Chapters**: Lists "Chapter 1: NHSN Overview - January 2023" [PDF - 350 KB], "Chapter 3: Patient Safety Monthly Reporting Plan - January 2023" [PDF - 300 KB], and "Chapter 15: CDC Location Labels and Location Descriptions - January 2023" [PDF - 1 MB].
- Data Collection Forms & Instructions**: Includes a link to "Annual Facility Survey Forms".

On the right side, there are several buttons and links:

- AUR Training
- Educational Roadmap
- AU Case Examples
- AUR Synthetic Data Set
- CDA Toolkits
- Quick Reference Guides: How to run, modify and interpret all AUR Module reports.
- FAQs: Includes links for "Antimicrobial Use (AU) Option" and "Antimicrobial Resistance (AR) Option".

There are "Top of Page" links at the bottom of the main content area and the FAQs section.










CDA Resources

- NHSN CDA Submission Support Portal:

<https://www.cdc.gov/nhsn/cdaportal/index.html>

- Toolkits
- FAQs
- Trainings
- Promoting Interoperability Program
- SDS

The screenshot shows the NHSN CDA Submission Support Portal (CSSP) website. At the top, there is the CDC logo and the text "Centers for Disease Control and Prevention" and "CDC 24/7. Saving Lives. Protecting People™". A search bar is located in the top right corner with the text "Search NHSN" and a magnifying glass icon. Below the search bar is a green header with the text "NHSN CDA Submission Support Portal (CSSP)". Underneath the header, there is a section titled "NHSN Home" with a paragraph of text: "Clinical Document Architecture (CDA) is a Health Level 7 (HL7) standard that provides a framework for the encoding, formatting and semantics of electronic documents. CDC's National Healthcare Safety Network (NHSN) supports CDA import of certain healthcare-associated infection (HAI) data. To assist programmers in creating standards for reporting via CDA import, NHSN offers an Implementation Guide and associated materials based fully on HL7-balloted CDA document specifications. Types of data that can be reported include event reports, denominator data, and process-of-care measures." Below this text is a grid of nine cards, each with an icon and a title and description:

 About CDA What is Clinical Document Architecture?	 Getting Started How to implement CDA for HAI reporting.	 FAQs Common questions asked by CDA implementers.
 Implementation Toolkits & Resources NHSN HAI Implementation Guides, IDMs and toolkits.	 Data Validation & Testing Tools to validate and test your CDA data as per NHSN specifications.	 Webinars & Training Videos Webinars on NHSN releases and CDA training.
 Importing Data How to import your data into NHSN using CDA, CSV or Direct.	 Innovation Tools Data sets and algorithmic web services.	 Promoting Interoperability Overview of NHSN AUR Module reporting for the Promoting Interoperability Program.

Thank you!

NHSN Helpdesk
(protocol & submission questions)
NHSN@cdc.gov

NHSN CDA Helpdesk
(technical CDA related questions)
NHSNCDA@cdc.gov

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

