



NHSN Antimicrobial Resistance (AR) Option: Facility-Wide Antibigram Report

2021 NHSN Annual Training

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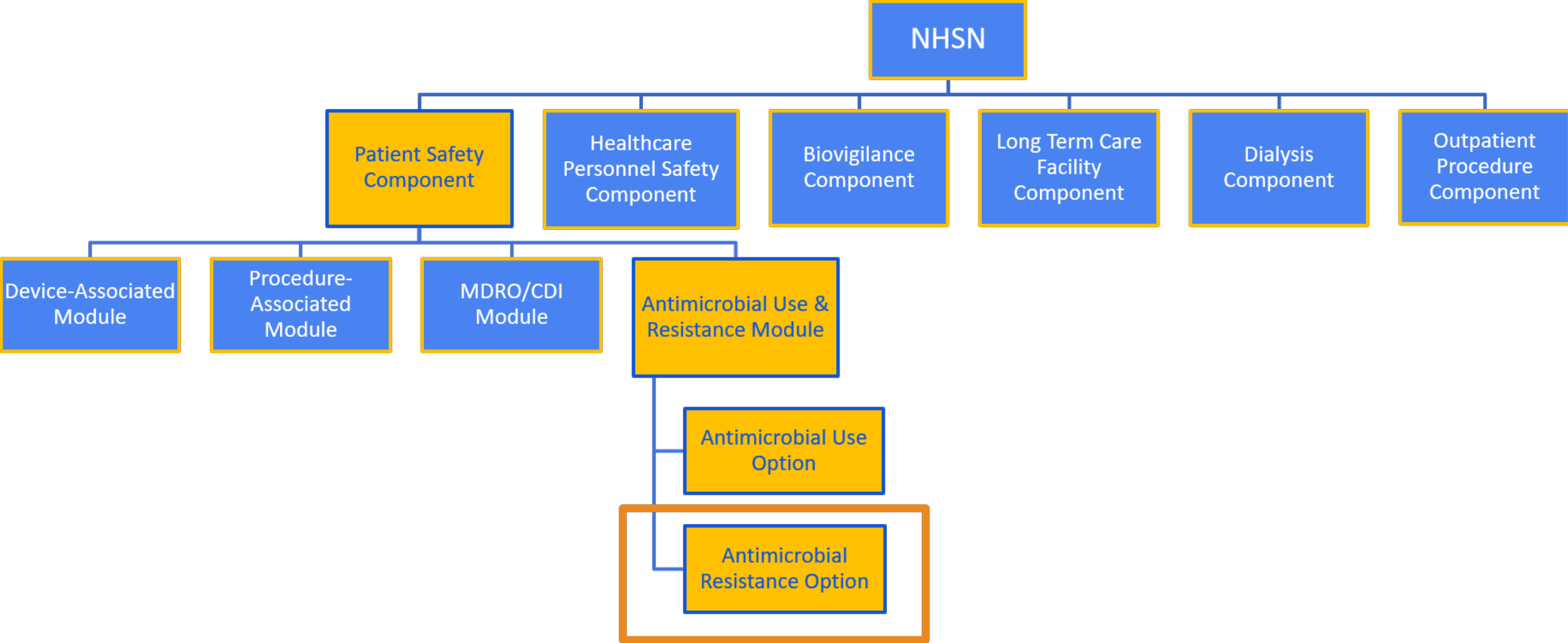
Contractor for the Division of Healthcare Quality Promotion, CDC

Objectives

- Briefly describe the AR Option
- Describe Facility-Wide Antibiogram analysis report, including recent updates
- Provide examples on how to modify, run and interpret the Facility-Wide Antibiogram report

AR Option Brief Overview

NHSN Structure



Antimicrobial Resistance (AR) Option

- Purpose:
 - Facilitate evaluation of AR data using standardized approach & definitions
 - Provide facilities with improved awareness of AR issues to aid in clinical decision making and prioritize transmission prevention efforts
- Voluntary reporting
 - Not part of CMS Quality Reporting Programs
 - *Included as one option for Public Health Registry reporting for Promoting Interoperability (previously Meaningful Use [MU])

*MU 3 Final Rule: <https://www.federalregister.gov/articles/2015/10/16/2015-25595/medicare-and-medicaid-programs-electronic-health-record-incentive-program-stage-3-and-modifications>

*NHSN MU3 page: <https://www.cdc.gov/nhsn/cdaportal/meaningfuluse.html>

Requirements for AR Data Submission

Who Can Participate?

- Hospitals* that have:
 - Electronic Laboratory Information System (LIS) and
 - Admission Discharge Transfer (ADT) System
 - *Or electronic access to required data elements*

AND

- Ability to collect and package data using HL7 standardized format: Clinical Document Architecture <https://www.cdc.gov/nhsn/cdaportal/index.html>

*Inpatient facilities enrolled in NHSN & participating in the Patient Safety Component

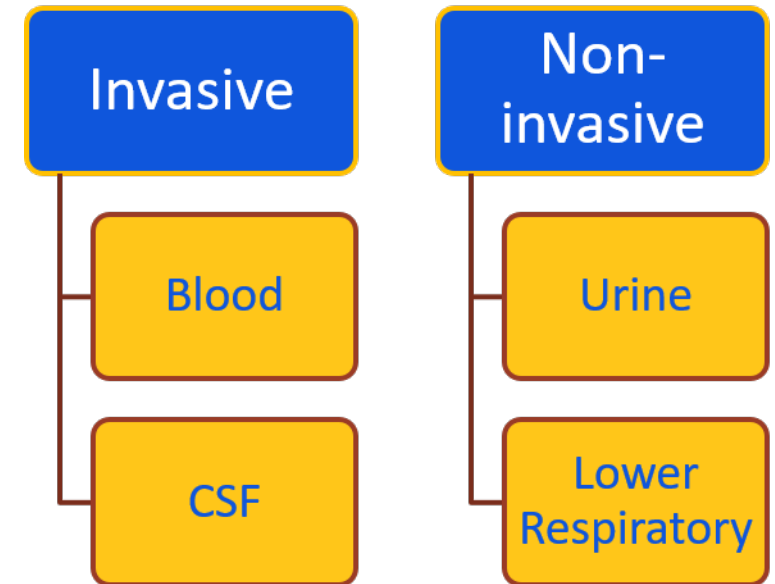
AR Data Elements

What Data Are Collected?

- Two separate file types (similar to MDRO FacWideIN LabID reporting):
 - AR Event files – contain all information associated with the individual isolate
 - Each AR Event is a separate, individual file
 - Reported from:
 - All inpatient locations
 - 3 outpatient location types: ED, pediatric ED & 24-hour observation area
 - AR Summary files – contain summary-level patient day and admission counts
 - Reported for FacWideIN only
 - Not submitted for individual inpatient locations
 - Summary files for outpatient locations will be accepted later in 2021

AR Events – What Qualifies?

- Event data: Isolate-level susceptibility results for specific organisms
- Qualifying isolate criteria for an AR Event:
 1. Collected from one of four specimen types:
 - Blood
 - Cerebral spinal fluid (CSF)
 - Urine
 - Lower respiratory
 2. One of over 20 organisms identified
 - See list on next slide
 3. Antimicrobial susceptibility testing must be completed
 - Qualifies for submission regardless of susceptibility results



2021 Eligible Organisms

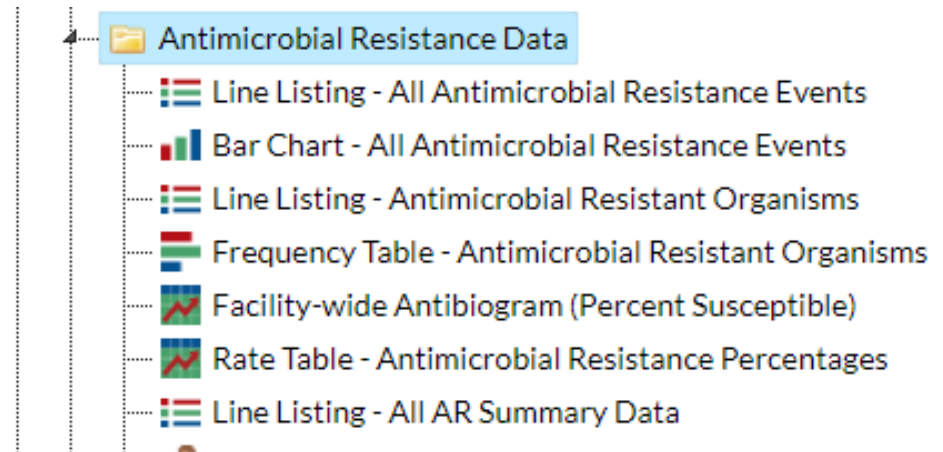
- All *Acinetobacter*
- *Candida albicans; auris; glabrata; parapsilosis; tropicalis*
- *Citrobacter amalonaticus; freundii; koseri*
- All *Enterobacter*
- *Enterococcus faecalis; faecium*
- All *Enterococcus* spp.
- *Escherichia coli*
- *Klebsiella aerogenes; oxytoca; pneumoniae*
- *Morganella morganii*
- *Proteus mirabilis; penneri; vulgaris*
- *Pseudomonas aeruginosa*
- *Serratia marcescens*
- *Staphylococcus aureus*
- *Stenotrophomonas maltophilia*
- *Streptococcus agalactiae (Group B Streptococci)*
- *Streptococcus pneumoniae*

For a complete list of eligible pathogens see the AR Option Pathogen Roll-up Workbook posted within the Antimicrobial Resistance Option CDA Toolkit on this webpage: <https://www.cdc.gov/nhsn/cdaportal/toolkits.html>.

AR Option Facility-Wide Antibigram Report

AR Option Report Types

- AR Event reports
 - Line list, bar chart, antibiogram
- AR Organism reports*
 - Line list, frequency table, rate table
- AR Denominator
 - Line list



*Antimicrobial Resistant Phenotype Definitions for AR Option Data: <https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/aur/ar-phenotype-definitions-508.pdf>

AR Facility-wide Antibiogram:

- Provides a table based on AR events reported in NHSN
- **NEW** Displays the calculated percent susceptible (%S) for each organism-antimicrobial combination reported from all locations (inpatient and outpatient)
 - Prior to the December 2020 9.5 release the antibiogram displayed the calculated percent non-susceptible (% NS)
- Available to both facilities and groups
- Filters allow for customization of the output

Percent Susceptible

- The %S is calculated for each organism-antimicrobial pairing using the following formula:

$$\frac{\textit{Number isolates tested suceptible}}{\textit{Number of isolates tested}} = \%S$$

- %S only calculated if at least 30 isolates are tested for the specific antimicrobial

Additional updates to the Facility-Wide Antibigram Report

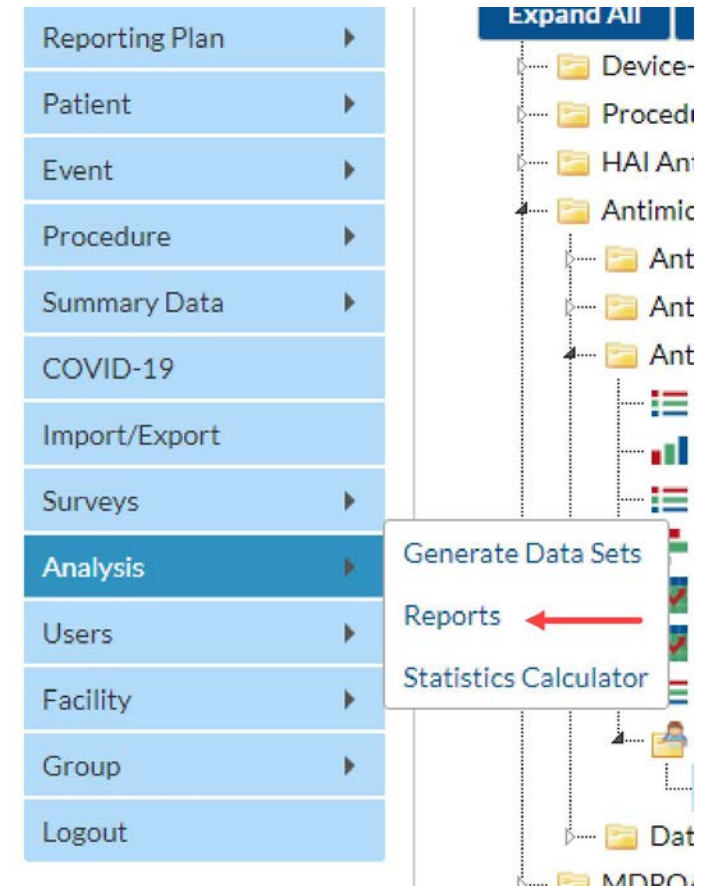
- New filters
 - Organism category
 - Drug class
 - Onset
 - Age group (adult, pediatric, neonatal)
 - Location, CDC location, & location type
- Updated display
 - Columns sorted by organism category
 - Rows sorted by drug class

Default settings

- Tables by month
- Isolates from:
 - all specimen types (blood, cerebrospinal fluid, urine, and lower respiratory)
 - all patient ages
 - all locations
- All isolates regardless of organism category (gram negative, gram positive, or fungal)
- Both healthcare facility and community onset

Run the default report

- Let's review how to access the Facility-Wide Antibigram within the NHSN application
- Suppose you want to run the report with the default settings
- After generating datasets, navigate to Analysis > Reports to get started



Facility-wide Antibigram

Analysis Reports

Expand All Collapse All Search

- Device-Associated (DA) Module
- Procedure-Associated (PA) Module
- HAI Antimicrobial Resistance (DA+PA Modules)
- 1 Antimicrobial Use and Resistance Module
 - Antimicrobial Use Data
 - Antimicrobial Use Data - 2014 Baseline SAARs
 - 2 Antimicrobial Resistance Data
 - Line Listing - All Antimicrobial Resistance Events
 - Bar Chart - All Antimicrobial Resistance Events
 - Line Listing - Antimicrobial Resistant Organisms
 - Frequency Table - Antimicrobial Resistant Organisms
 - 3 Facility-wide Antibigram (Percent Susceptible) Resistance Percentages
 - 4 Run Report
 - Modify Report
 - Export Data Set
- MDR/AAC/Module - ABU/Event Reporting

Facility-wide Antibigram

**National Healthcare Safety Network
Facility-wide Antibigram (Percent Susceptible)
Rate per 100 Isolates**
As of: December 24, 2020 at 10:58 AM
Date Range: All AUR_SUMMARY

orgID=33617 CCN=N/A SpecimenDateYM=2020M01

Gram-Negative				
Drug Class	Drug	Enterobacter ludwigii - ENTELUDW	Escherichia coli - EC	K aer
Aminoglycosides	AMK	.	82.0	
	GENTA	.	82.0	
	STREP			
	TOBRA	.	.	
Azoles	FLUCO			
	ITRA			
	POSAC			
	VORI			
B-lactam/ B- lactamase inhibitor combination	AMOXWC	.	21.0	
	AMPIWS	.	1.0	

Data for
example only

Facility-wide Antibigram: Dataset generation

National Healthcare Safety Network
Facility-wide Antibigram (Percent Susceptible)
Rate per 100 Isolates
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Drug Class	Drug	Enterobacter ludwigii - ENTELUDW	Escherichia coli - EC	K aer
Aminoglycosides	AMK	.	82.0	
	GENTA	.	82.0	
	STREP			
	TOBRA	.	.	
Azoles	FLUCO			
	ITRA			
	POSAC			
	VORI			
B-lactam/ B- lactamase inhibitor combination	AMOXWC	.	21.0	
	AMPIWS	.	1.0	

Data for
example only

Facility-wide Antibigram: Table details

National Healthcare Safety Network
Facility-wide Antibigram (Percent Susceptible)
Rate per 100 Isolates
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	ITRA			
	POSAC			
	VORI			
B-lactam/ B- lactamase inhibitor combination	AMOXWC	.	21.0	
	AMPIWS	.	1.0	

Data for
example only

Facility-wide Antibigram: Organism category

National Healthcare Safety Network
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Drug Class	Drug	Enterobacter ludwigii - ENTELUDW	Escherichia coli - EC	K aer
Aminoglycosides	AMK	.	82.0	
	GENTA	.	82.0	
	STREP			
	TOBRA	.	.	
Azoles	FLUCO			
	ITRA			
	POSAC			
	VORI			
B-lactam/ B- lactamase inhibitor combination	AMOXWC	.	21.0	
	AMPIWS	.	1.0	

Data for
example only

Facility-wide Antibigram: Drug class

National Healthcare Safety Network
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Rate per 100 Isolates
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Date Range: All AUR_SUMMARY

orgID=33617 CCN=N/A SpecimenDateYM=2020M01

Gram-Negative				
Drug Class	Drug	Enterobacter ludwigii - ENTELUDW	Escherichia coli - EC	Kaer
Aminoglycosides	AMK	.	82.0	
	GENTA	.	82.0	
	STREP			
	TOBRA	.		
Azoles	FLUCO			
	ITRA			
	POSAC			
	VORI			
B-lactam/ B-lactamase inhibitor combination	AMOXWC	.	21.0	
	AMPIWS	.	1.0	

Data for
example only

Facility-wide Antibigram: Non-valid combinations

- Cells shaded in grey represent non-valid pathogen/drug combinations.
- Refer to the AUR protocol for all valid pathogen/drug combinations.

National Healthcare Safety Network
Facility-wide Antibigram (Percent Susceptible)
Rate per 100 Isolates
As of: December 24, 2020 at 10:58 AM
Date Range: All AUR_SUMMARY

orgID=33617 CCN=N/A SpecimenDateYM=2020M01

Gram-Negative				
Drug Class	Drug	Enterobacter ludwigii - ENTELUDW	Escherichia coli - EC	Kaer
Aminoglycosides	AMK	.	82.0	
	GENTA	.	82.0	
	STREP			
	TOBRA	.	.	
Azoles	FLUCO			
	ITRA			
	POSAC			
	VORI			
B-lactam/ B-lactamase inhibitor combination	AMOXWC	.	21.0	
	AMPIWS	.	1.0	

Customize the report

- Suppose you want to review the resistance patterns for *Candida* spp.
- You want this report to include healthcare facility-onset isolates from critical care locations submitted to the AR Option for the entire calendar year of 2020.

Navigate to the report

The screenshot shows the 'Analysis Reports' interface. At the top, there is a header with a user icon and the title 'Analysis Reports'. Below the header are two buttons: 'Expand All' and 'Collapse All', followed by a search input field. The main content is a tree view of folders and reports. Red circles with numbers 1, 2, 3, and 4 indicate the navigation path. Step 1 points to the 'Antimicrobial Use and Resistance Module' folder. Step 2 points to the 'Antimicrobial Resistance Data' folder. Step 3 points to the 'Facility-wide Antibigram (Percent Susceptible)' report, which is highlighted in blue. Step 4 points to the 'Run Report' option in a context menu that is open over the report.

Analysis Reports

Expand All Collapse All Search

- Device-Associated (DA) Module
- Procedure-Associated (PA) Module
- HAI Antimicrobial Resistance (DA+PA Modules)
- 1** Antimicrobial Use and Resistance Module
 - Antimicrobial Use Data
 - Antimicrobial Use Data - 2014 Baseline SAARs
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 - Line Listing - All Antimicrobial Resistance Events
 - Bar Chart - All Antimicrobial Resistance Events
 - Line Listing - Antimicrobial Resistant Organisms
 - Frequency Table - Antimicrobial Resistant Organisms
 - 3** Facility-wide Antibigram (Percent Susceptible) Resistance Percentages
 - Antimicrobial Resistance Percentages
 - Antimicrobial Use Data
 - MDRO/CAUTI Module - CAPD Event Reporting

4 Run Report
Modify Report
Export Data Set

Modifications: Title

Modify "Facility-wide Antibigram (Percent Susceptible)"

Show descriptive variable names ([Print List](#)) Analysis Data Set: AUR_Summary Type: Rate Table Last Generated: December 23, 2020 9:03 AM

Title/Format Time Period Filters Display Options

Title:
Candida Antibigram (Percent Susceptible)

Format:

html pdf xls rtf

▶ Run Save... Export... Close

Modifications: Time period

Modify "Facility-wide Antibigram (Percent Susceptible)"

Show descriptive variable names ([Print List](#)) Analysis Data Set: AUR_Summary Type: Rate Table Last Generated: December 23, 2020 9:03 AM

Title/Format **Time Period** Filters Display Options

Time Period:

Date Variable	Beginning	Ending	
Specimen Date~Year ▼	2020	2020	Clear Time Period

Enter Date variable/Time period at the time you click the Run button

[▶ Run](#) [Save...](#) [Export...](#) [Close](#)

Modifications: Filters

The screenshot displays a software interface for configuring filters. At the top, there are four tabs: 'Title/Format', 'Time Period', 'Filters' (which is selected), and 'Display Options'. Below the tabs, there are two buttons: 'Show' and 'Clear'. The main area contains a filter tree structure. At the top level, there are 'AND' and 'OR' options and an 'Add group' button. Below this, there is another level with 'AND' and 'OR' options and an 'Add rule' button. A dropdown menu is open, showing a list of filterable fields: 'Modify User ID', 'OID of Facility', 'Onset', 'Organism Category', 'OrgID_CL', 'Pathogen', 'Pathogen Desc', 'Patient Age Group', 'Patient Days', and 'Specimen Category'. The 'Pathogen' field is currently selected and highlighted. A tooltip for 'Pathogen' is visible next to it. At the bottom right of the interface, there are four buttons: 'Run', 'Save...', 'Export...', and 'Close'. A red circle with the number '1' is positioned next to the dropdown menu.

Modifications: Filters

The screenshot displays a software interface with a top navigation bar containing four tabs: "Title/Format", "Time Period", "Filters" (which is currently selected), and "Display Options". Below the navigation bar, there is a section labeled "Additional Filters:" with two buttons: "Show" and "Clear".

The main area of the interface is a filter configuration panel. It features a hierarchical structure of filter groups and rules. At the top level, there are two buttons: "AND" and "OR". To the right of these buttons is a green "Add group" button. Below this, there is a nested structure. The innermost level shows a dropdown menu with "Pathogen" selected, followed by a dropdown menu with "equal" selected. A red circle with the number "2" is positioned above the "equal" dropdown. To the right of the "equal" dropdown is an empty text input field with a dropdown arrow on its right side, and a red "Delete" button. Below the "equal" dropdown, a list of filter operators is displayed: "equal", "not equal", "in", and "not in". The "in" operator is highlighted with a grey background and a mouse cursor is pointing at it.

At the bottom right of the interface, there is a row of four buttons: "Run", "Save...", "Export...", and "Close".

Modifications: Filters

The screenshot displays a software interface for configuring filters. At the top, there are four tabs: "Title/Format", "Time Period", "Filters" (which is the active tab), and "Display Options". Below the tabs, there are two buttons: "Show" and "Clear".

The main area of the interface is a filter configuration panel. It features a hierarchical structure of filter groups and rules. At the top of this panel, there are two buttons: "AND" and "OR". To the right of these buttons is a green "Add group" button. Below this, there is another "AND" and "OR" button pair, with a green "Add rule" button to its right. The main configuration area contains a rule for the field "Pathogen" with the operator "in". The values for this rule are "Candida albicans - CA" and "Candida auris - CAAUR". A red "Delete" button is located to the right of the rule. A red circle with the number "3" is positioned to the left of the "Pathogen" field, and a red circle with the number "4" is positioned to the left of the rule's values. A mouse cursor is pointing at a plus sign icon at the bottom left of the rule's value field.

At the bottom of the interface, there are four buttons: "Run", "Save...", "Export...", and "Close".

Modifications: Filters

The screenshot shows a software interface for configuring filters. The interface has tabs for **Title/Format**, **Time Period**, **Filters** (selected), and **Display Options**. Below the tabs are **Additional Filters: Show** and **Clear** buttons.

The main area shows a nested filter structure with **AND** and **OR** options. A red circle with the number **5** highlights the **Add rule** button. The filter rule is **Pathogen in** with a list of *Candida* species: *Candida albicans - CA*, *Candida glabrata - CG*, *Candida tropicalis - CT*, *Candida auris - CAAUR*, and *Candida parapsilosis - CP*. Each item has a dropdown arrow and a delete **X** button.

At the bottom right are **Run**, **Save...**, **Export...**, and **Close** buttons.

Modifications: Filters

Title/Format **Time Period** **Filters** **Display Options**

Additional Filters:

AND OR

AND OR

Pathogen

Escherichia coli - EC

Candida glabrata - CG

Candida tropicalis - CT

+

6 Location Type

Modifications: Filters

The screenshot shows a web-based filter configuration interface. At the top, there are four tabs: "Title/Format", "Time Period", "Filters" (which is active and highlighted in green), and "Display Options". Below the tabs, there are two buttons: "Show" and "Clear".

The main area is titled "Additional Filters:" and contains a hierarchical structure of filter rules. At the top level, there are two options: "AND" and "OR". A green "Add group" button is located to the right. Below this, there is a nested structure with "AND" and "OR" options and a green "Add rule" button. The first rule is a "Pathogen" filter with an "in" operator. It contains three entries: "Escherichia coli - EC", "Candida glabrata - CG", and "Candida tropicalis - CT". The second rule is a "Location Type" filter with an "equal" operator, set to "CC". The third rule is an "Onset" filter with an "equal" operator, set to "HO - Healthcare Facility-Onset". A red circle with the number "7" is next to the "Onset" filter. Each rule has a red "Delete" button to its right.

At the bottom of the interface, there are four buttons: "Run", "Save...", "Export...", and "Close".

Modifications: Display

Modify "Facility-wide Antibigram (Percent Susceptible)"

Show descriptive variable names ([Print List](#)) Analysis Data Set: AUR_Summary Type: Rate Table Last Generated: December 23, 2020 9:03 AM

Title/Format Time Period Filters **Display Options**

Rate Table Options:

Group by: Specimen Date~Year ▼

[▶ Run](#) [Save...](#) [Export...](#) [Close](#)

Facility-wide Antibigram: Example output



National Healthcare Safety Network

Candida Antibigram (Percent Susceptible)

Rate per 100 Isolates

As of: January 8, 2021 at 9:35 AM

Date Range: AUR_SUMMARY SpecimenDateYr 2020 to 2020

if (((Pathogen IN (CA, CAAUR, CG, CP, CT)) AND (onset = HO) AND (locationType = CC)))

orgID=33617 CCN=N/A SpecimenDateYr=2020

		Pathogen				
		Fungal				
Drug Class	Drug	Candida auris - CAAUR	Candida albicans - CA	Candida glabrata - CG	Candida parapsilosis - CP	Candida tropicalis - CT
Azoles	FLUCO	-	87.0	91.0	-	-
	ITRA	-	100	100	-	-
	POSAC	-	100	100	-	-
	VORI	-	-	-	-	-
Echinocandins	ANID	-	97.0	100	-	-
	CASPO	-	97.0	100	-	-
	MICA	-	100	100	-	-
Pyrimidine analog	FLUCY	-	100	99.0	-	-

1. Percent susceptible is calculated as the sum of the number of isolates that tested susceptible divided by the number of total isolates tested for that pathogen-drug combination.
2. Percent susceptible is only calculated when at least 30 isolates have been tested for a particular drug. Cells with a missing value "-" represent pathogen-drug combinations for which there were less than 30 isolates tested.
3. Cells shaded in grey represent non-valid pathogen/drug combinations. Refer to the AUR protocol for all valid pathogen/drug combinations.

Data contained in this report were last generated on December 24, 2020 at 12:34 PM to include data beginning January 2019 through December 2020.

Data for
example only

Facility-wide Antibiogram: Example output

National Healthcare Safety Network Candida Antibiogram (Percent Susceptible) Rate per 100 Isolates

As of: January 8, 2021 at 9:15 AM

Date Range: AUR_SUMMARY SpecimenDateYr 2020 to 2020
if (((Pathogen IN (CA, CAAUR, CG, CP, CT)) AND (onset = HO) AND (locationType = CC)))

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		Pathogen				
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	VORI
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	CASPO	.	97.0	100	.	.
	MICA	.	100	100	.	.
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Facility-wide Antibigram: Example output

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Pyrimidine analog	FLUCY	.	100	99.0	.	.

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	CASPO	.	97.0	100	.	.
	MICA	.	100	100	.	.
Pyrimidine analog	FLUCY	.	100	99.0	.	.

In 2020, among events in critical care locations, 87% of healthcare facility-onset *Candida albicans* and 91% of healthcare facility-onset *Candida glabrata* tested were susceptible to fluconazole.

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Data for
example only

Quick Reference Guide

- Provides:
 - Details on how to run and modify this analysis report
 - Example modifications and outputs
- Available for your reference on the AUR Module webpage.

AR Option Facility-Wide Antibigram

Description

The Antimicrobial Resistance (AR) Option facility-wide antibiogram is a table displaying the calculated percent susceptible (%S) for each organism-antimicrobial combination reported from all locations (inpatient and outpatient) to the AR Option. Each organism reported to the AR Option has a specific antimicrobial panel for which antimicrobial susceptibility testing values are required to be reported. The specific panel requirements for each organism are in Appendix F of the AUR Module protocol: <https://www.cdc.gov/nhsn/pdfs/pscmanual/11pscaurcurrent.pdf>.

The %S is calculated for each organism-antimicrobial pairing using the following formula*:

$$\frac{\text{Number isolates tested susceptible}}{\text{Number of isolates tested}} = \%S$$

*note: prior to NHSN 9.5 in December of 2020 this report displayed percent Non-Susceptible.

Resources for running AR Option reports

- AUR Module Protocol:
<https://www.cdc.gov/nhsn/PDFs/pscManual/11pscAURcurrent.pdf>
- AR Option: Reporting and Analysis – May 2019:
https://www.cdc.gov/nhsn/training/patient-safety-component/index.html#anchor_1557767426817
- AR Phenotype Definitions:
<https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/aur/ar-phenotype-definitions-508.pdf>
- NHSN Analysis Quick Reference Guides:
<http://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html>

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Additional NHSN training resources:

<https://www.cdc.gov/nhsn/training/>

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