NHSN Antimicrobial Use and Resistance (AUR) Module
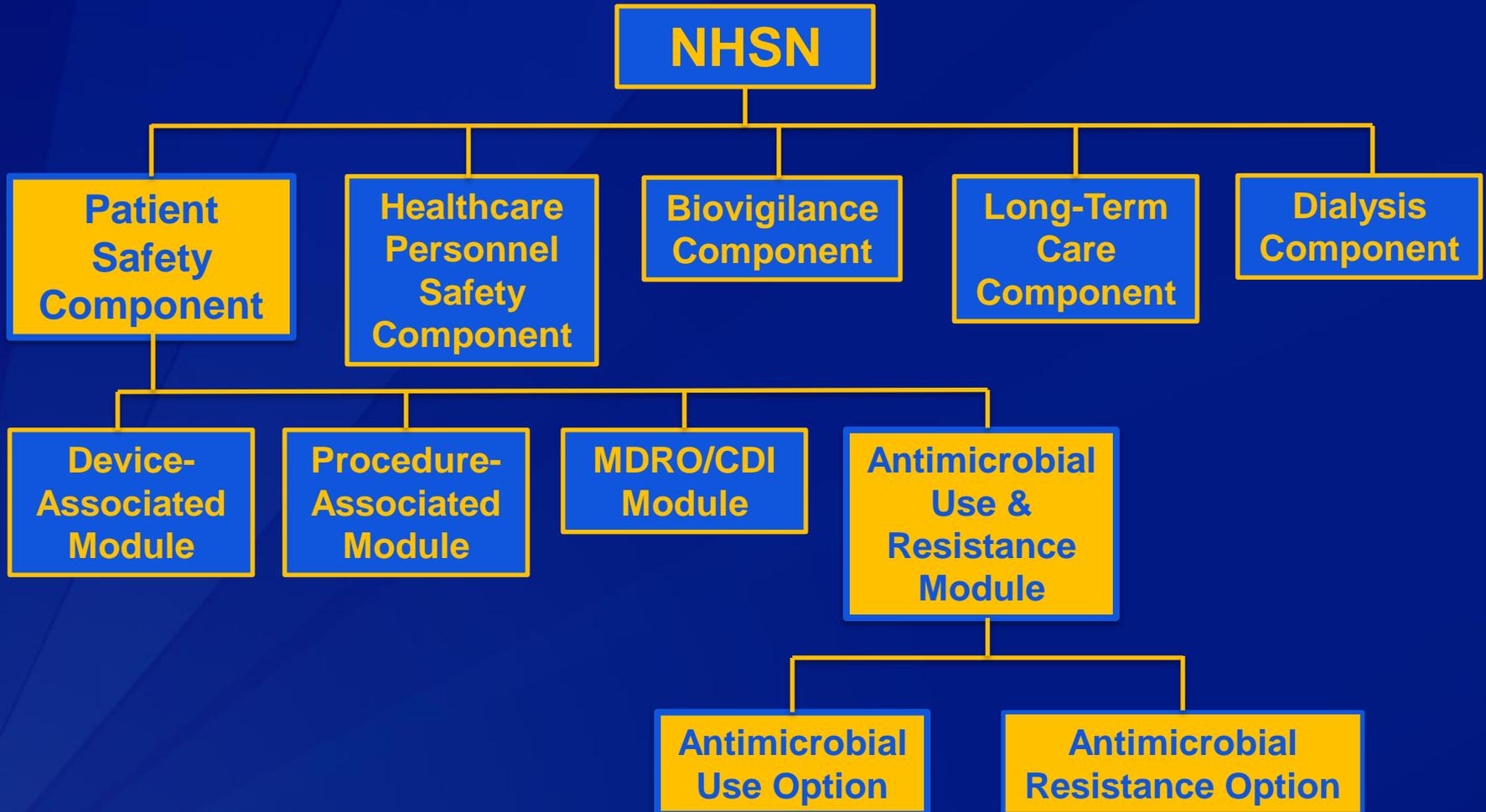
September 2014

OVERVIEW OF NHSN

Purposes of NHSN

❑ **NHSN is a secure, Internet-based surveillance system managed by the CDC's Division of Healthcare Quality Promotion (DHQP) that is used to:**

  ▪ Collect mandated and voluntarily reported data on:
    • Healthcare-associated infections (HAIs)
    • Antimicrobial use and resistance
    • Healthcare personnel influenza vaccination
    • Blood safety
  ▪ Analyze and report collected data to permit recognition of trends
  ▪ Provide facilities with data that can be used for inter-facility comparisons and local quality improvement activities

Purposes of NHSN

❑ **Enable healthcare facilities to report healthcare-associated infections (HAI) and prevention practice adherence data via NHSN to fulfill CMS's quality reporting program requirements, state mandate reporting requirements, or collaborative/initiative requirements**

- ▪ **Over 13,000 healthcare facilities enrolled in NHSN**
  - • **Acute care hospitals (Gen, ONC, CAH)**
  - • **Long term acute care hospitals**
  - • **Inpatient rehabilitation facilities**
  - • Dialysis facilities
  - • Ambulatory surgical centers
  - • Long term care facilities (NHs/SNFs)

NHSN Structure

NHSN

- **Patient Safety Component**
- **Healthcare Personnel Safety Component**
- **Biovigilance Component**
- **Long-Term Care Component**
- **Dialysis Component**

Patient Safety Component:
- **Device-Associated Module**
- **Procedure-Associated Module**
- **MDRO/CDI Module**
- **Antimicrobial Use & Resistance Module**
  - **Antimicrobial Use Option**
  - **Antimicrobial Resistance Option**

ANTIMICROBIAL USE OPTION

Antimicrobial Use 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

Antimicrobial Use Option

❑ **Who can participate:**

- General acute care hospitals (ACH), long-term acute care hospitals (LTAC/LTCH), inpatient rehabilitation facilities (IRF), oncology hospitals, critical access hospitals (CAH) enrolled in NHSN with:
  - Electronic Medication Administration Record (eMAR) or Bar Coding Medication Administration (BCMA) systems
    - No manual entry allowed
  - Ability to collect and package data using HL7 standardized format: Clinical Document Architecture
    - Participating 3rd party vendors: http://www.sidp.org/aurvendors
    - "Homegrown" vendors

Antimicrobial Use Option

- **What data are collected:**
  - Monthly summary-level data gathered by location-specific and facility-wide inpatient usage
    - All inpatient locations & 3 outpatient locations (ED, pediatric ED, 24 hour observation)
  - Numerator: Antimicrobial days (days of therapy)
    - 82 antimicrobials collected – includes antibacterial, antifungal, and anti-influenza agents
      - Agents are sub-stratified by route of administration: intravenous (IV), intramuscular (IM), digestive (oral), and respiratory (inhaled)
  - Denominators:
    - Days Present - number of days spent in specific unit or facility
    - Admissions - number of patients admitted to the facility (Facility-wide calculation only)

AU Option – NHSN Analysis Output Options

Antimicrobial Use and Resistance Module
　Antimicrobial Use Data
　　CDC Defined Output

- Line Listing - Most Recent Month of AU Data for ...more [Run] [Modify]
- Line Listing - Most Recent Month of AU Data by L...more [Run] [Modify]
- Line Listing - All Submitted AU Data for FACWIDEIN [Run] [Modify]
- Line Listing - All Submitted AU Data by Location [Run] [Modify]
- Rate Table - Most Recent Month of AU Data - Anti...more [Run] [Modify]
- Rate Table - All Submitted AU Data - Antimicrobi...more [Run] [Modify]
- Rate Table - Most Recent Month of AU Data - Anti...more [Run] [Modify]
- Rate Table - All Submitted AU Data - Antimicrobi...more [Run] [Modify]
- Pie Chart - Most Recent Month of AU Data by Anti...more [Run] [Modify]
- Pie Chart - All AU Data by Antibacterial Class a...more [Run] [Modify]
- Pie Chart - Most Recent Month of AU Data by Anti...more [Run] [Modify]
- Pie Chart - All AU Data by Antifungal Class and ...more [Run] [Modify]
- Pie Chart - Most Recent Month of AU Data by Anti...more [Run] [Modify]
- Pie Chart - All AU Data by Anti-influenza Class ...more [Run] [Modify]
- Bar Chart - Most Recent Month of AU Data by Anti...more [Run] [Modify]
- Bar Chart - All AU Data by Antibacterial Class a...more [Run] [Modify]
- Bar Chart - Most Recent Month of AU Data by Anti...more [Run] [Modify]
- Bar Chart - All AU Data by Antifungal Class and ...more [Run] [Modify]
- Bar Chart - Most Recent Month of AU Data by Anti...more [Run] [Modify]
- Bar Chart - All AU Data by Anti-influenza Class ...more [Run] [Modify]

❑ **Basic analysis output options available**

- Line lists
- Rate tables
- Pie charts
- Bar charts

AU Option – Line List by Location

National Healthcare Safety Network
Line Listing - Most Recent Month of AU Data by Location
As of: February 3, 2012 at 3:49 PM
Date Range: All SUMMARYAU1MONTH

Location=ICU-A

Org ID	Summary Yr/Mon	Antimicrobial Agent	Location	Antimicrobial Days	Days Present	Admissions	Route: IM	Route: IV	Route: Digestive	Route: Respiratory
10846	2011M03	AMAN	ICU-A	3	10000	.	.	.	.	.
10846	2011M03	AMK	ICU-A	432	10000	.	154	1256	.	1603
10846	2011M03	AMOX	ICU-A	3	10000	.	3	3	.	0
10846	2011M03	AMOXWC	ICU-A	3	10000	.	3	3	.	0

❑ **Sample line list of the most recent month of AU data by location**

- Generates a list of each antimicrobial separated by location
- Shows total antimicrobial days, days present and sub-stratification of routes of administration for each antimicrobial

*Data for example only

AU Option – Rate Table by Location

National Healthcare Safety Network
Rate Table - All Submitted AU Data - Antimicrobial Utilization Rates by Location
Rate per 1,000 Days Present
As of: February 3, 2012 at 3:52 PM
Date Range: All AU_RATESLOCATION

Org ID=10846 CDC Location=IN:ACUTE:CC:M Location=INMEDCC

Summary Yr/Mon	Antimicrobial Category	Antimicrobial Class	Antimicrobial Days	Days Present	Rate per 1000 Days Present
2011M01	Antibacterial	-- All --	90165	10000	9,016.500
2011M01	Antibacterial	Aminoglycosides	438	10000	43.800
2011M01	Antibacterial	Carbapenems	12	10000	1.200
2011M01	Antibacterial	Cephalosporins	57	10000	5.700
2011M01	Antibacterial	Fluoroquinolones	12	10000	1.200
2011M01	Antibacterial	Folate pathway inhibitors	6	10000	0.600

❑ **Sample rate table for all submitted AU data by location**

- Generates a rate of utilization per 1,000 days present for each antimicrobial class separated by location

- Report includes separate rates for each antimicrobial class for each month of data submitted

*Data for example only
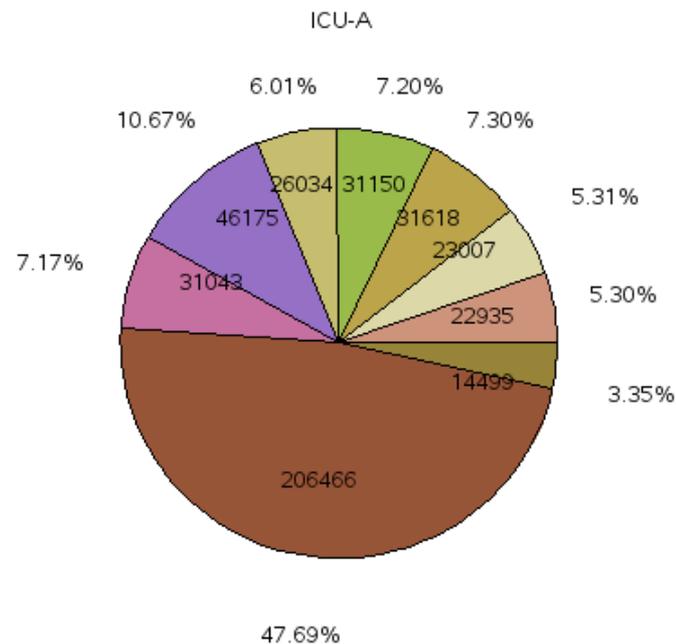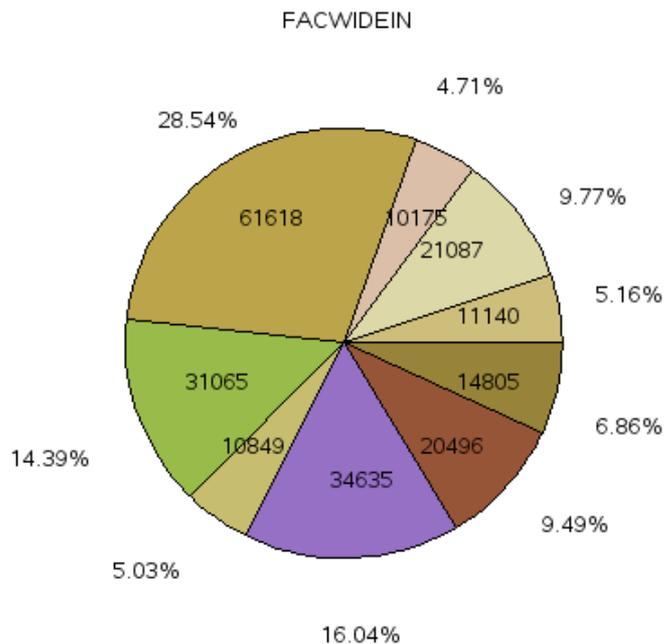
AU Option – Pie Chart by Location

National Healthcare Safety Network
Pie Chart - All Data - Proportion of Antimicrobial Days per Antibacterial Class by Location
As of: August 14, 2014 at 5:26 PM
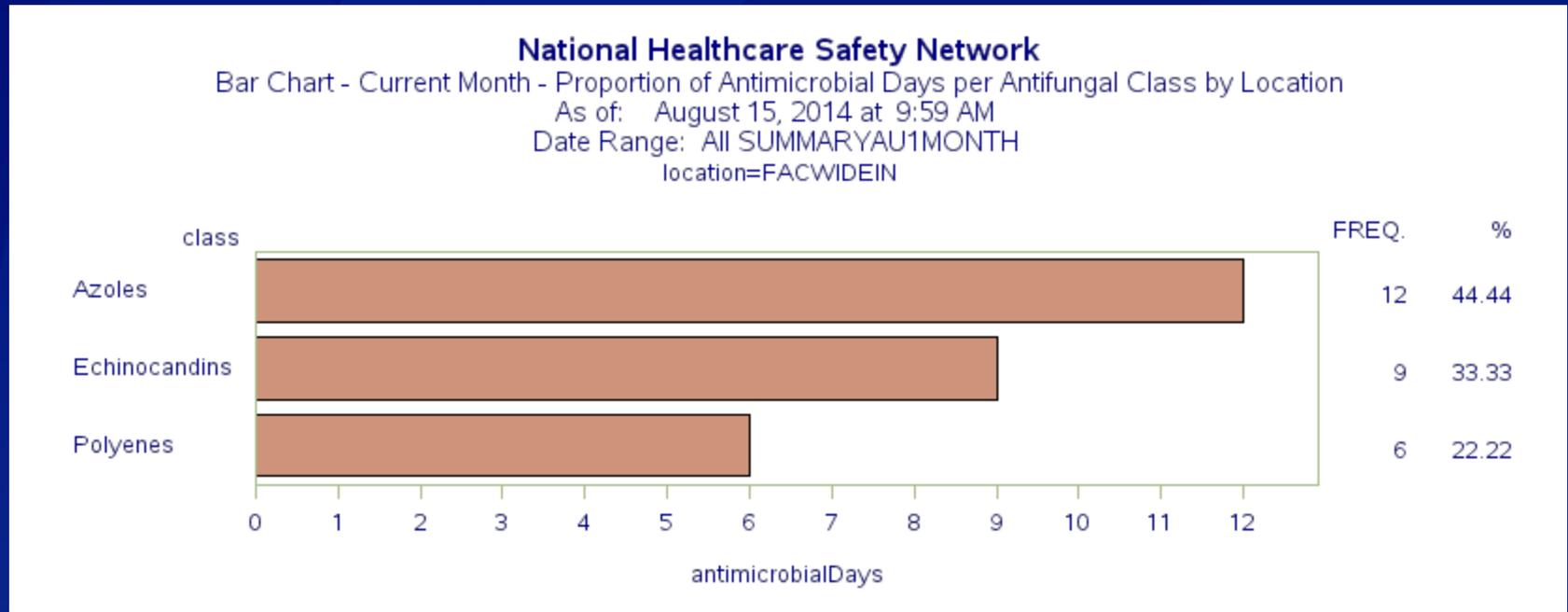Date Range: All SUMMARYAU
Stratified by Location

Legend:
- Aminoglycosides
- Carbapenems
- Glycopeptides
- Lincosamides
- Macrocyclic
- Macrolides
- Penicillins
- Phenicols
- Polymyxins
- Tetracyclines
- OTHER

FACWIDEIN
- 4.71%
- 28.54% — 61618
- 9.77% — 10175 / 21087
- 5.16% — 11140
- 6.86% — 14805
- 9.49% — 20496
- 16.04% — 34635
- 5.03% — 10849
- 14.39% — 31065

ICU-A
- 6.01% — 26034
- 7.20% — 31150
- 7.30% — 31618
- 10.67% — 46175
- 5.31% — 23007
- 7.17% — 31043
- 5.30% — 22935
- 3.35% — 14499
- 47.69% — 206466

- **Sample pie chart by location**
  - Shows proportion of antimicrobial days per antibacterial class

*Data for example only

AU Option – Bar Chart by Location

National Healthcare Safety Network
Bar Chart - Current Month - Proportion of Antimicrobial Days per Antifungal Class by Location
As of: August 15, 2014 at 9:59 AM
Date Range: All SUMMARYAU1MONTH
location=FACWIDEIN

class		FREQ.	%
Azoles		12	44.44
Echinocandins		9	33.33
Polyenes		6	22.22

antimicrobialDays

❑ **Sample bar chart by location**
  ▪ Shows proportion of antimicrobial days per antifungal class

*Data for example only

ANTIMICROBIAL RESISTANCE (AR) OPTION

Antimicrobial Resistance Option

- **Released in July 2014**

- **Purpose:**
  - Facilitate evaluation of antimicrobial resistance data using standardized approach
  - Provide facilities with improved awareness of a variety of AR issues to aid in clinical decision making and prioritize transmission preventions efforts

Antimicrobial Resistance Option

❑ **Who can participate:**

- General acute care hospitals (ACH), long-term acute care hospitals (LTAC/LTCH), inpatient rehabilitation facilities (IRF), oncology hospitals, critical access hospitals (CAH) enrolled in NHSN with:
  - Electronic Laboratory Information System (LIS) and Admission Discharge Transfer (ADT) System
    - No manual entry allowed
  - Ability to collect and package data using HL7 standardized format: Clinical Document Architecture

Antimicrobial Resistance Option

❑ **What data are collected:**

- ▪ Numerator: Patient-level susceptibility results for 19 specific organisms
  - • DOB, gender, date admitted to facility, location
  - • Specimen collection date, specimen source
    - ○ Blood, cerebral spinal fluid (CSF), urine, lower respiratory
  - • Organism & antimicrobial susceptibility data for each antimicrobial required for the isolated organism/specimen type
    - ○ Values for E-test, MIC, or Zone
    - ○ Final lab interpretation
      - • S, S-DD, I, R, NS, N
- ▪ Denominator: patient days & admissions (facility-wide only)

AR Option – Eligible Organisms

- *Acinetobacter*
- *Candida albicans*
- *Candida glabrata*
- *Citrobacter freundii*
- *Enterobacter*
- *Enterococcus faecalis*
- *Enterococcus faecium*
- *Enterococcus* spp. (when not specified to the species level)
- *Escherichia coli*
- Group B *Streptococcus*

- *Klebsiella oxytoca*
- *Klebsiella pneumoniae*
- *Morganella morganii*
- *Proteus mirabilis*
- *Pseudomonas aeruginosa*
- *Serratia marcescens*
- *Staphylococcus aureus*
- *Stenotrophomonas maltophilia*
- *Streptococcus pneumoniae*

AR Option – Organism/Agent Combinations

Organism	Specimen Type	Antimicrobial Agents
Acinetobacter	Blood, Urine, Lower Respiratory, CSF	Amikacin Ampicillin-sulbactam Cefepime Cefotaxime Ceftazidime Ceftriaxone Ciprofloxacin Doxycycline Gentamicin Imipenem with Cilastatin Levofloxacin Meropenem Minocycline Piperacillin Piperacillin-tazobactam Tetracycline Ticarcillin-clavulanate Tobramycin Trimethoprim-sulfamethoxazole
	Additional Agents for Urine	None

❑ Selected antimicrobial agents are required to be reported for each of the 19 organisms per specimen type
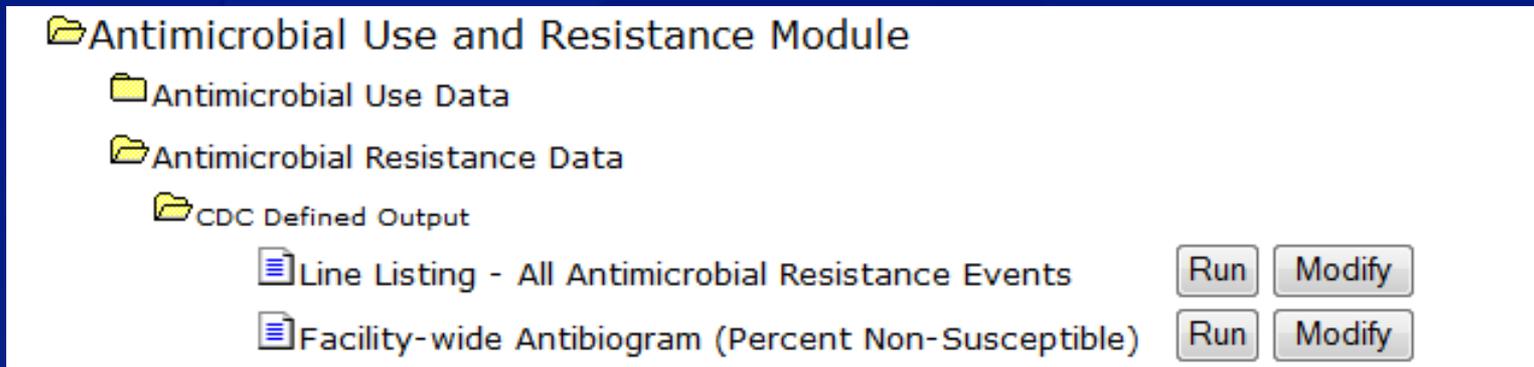   ▪ Full list can be found in the NHSN AUR Module Protocol:
   http://www.cdc.gov/nhsn/PDFs/pscManual/11pscAURcurrent.pdf

AR Option Reporting Rules

□ **Same organism from invasive specimen source (blood & CSF) reported once per patient per 14 day period**

□ **Same organism from non-invasive source (urine & lower respiratory) reported once per patient per month**

Please see NHSN AUR Module Protocol for further details:
http://www.cdc.gov/nhsn/PDFs/pscManual/11pscAURcurrent.pdf

AR Option – Output Options

Antimicrobial Use and Resistance Module
- Antimicrobial Use Data
- Antimicrobial Resistance Data
  - CDC Defined Output
    - Line Listing - All Antimicrobial Resistance Events [Run] [Modify]
    - Facility-wide Antibiogram (Percent Non-Susceptible) [Run] [Modify]

❑ **Basic analysis output options available**
- ▪ Line listing
- ▪ Facility-wide antibiogram

AR Option – Line List

National Healthcare Safety Network
Line Listing - Antimicrobial Resistance Events by Pathogen
As of: August 15, 2014 at 10:05 AM
Date Range: All AUR_DETAIL

Pathogen=CA

orgID	patID	dob	gender	eventID	admitDate	location	specimenDate	isolateID	SpecimenGroup	Pathogen
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA

❑ **Sample line list of AR events by pathogen**

▪ Lists each patient, specimen collection date, specimen source, and pathogen

*Data for example only

AR Option – Line List

National Healthcare Safety Network
Line Listing - Antimicrobial Resistance Events by Pathogen
As of: August 15, 2014 at 10:05 AM
Date Range: All AUR_DETAIL

Pathogen=CA

orgID	patID	dob	gender	eventID	admitDate	location	specimenDate	isolateID	SpecimenGroup	Pathogen
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Urine	11/25/1954	M	43733	01/15/2013	1029-8	01/21/2013	123456-7u	Urine	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_Bld	11/25/1954	M	43734	01/15/2013	1029-8	01/21/2013	123456-7	Blood	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA
10846	Candida_csf	11/25/1954	M	43735	01/15/2013	1029-8	01/21/2013	123456-7	CSF	CA

❑ **Reading the line list**

- ▪ Patient ID 'Candida_Urine' had a urine specimen taken on Jan 21, 2013 while he was in the location '1029-8.' Candida albicans was identified in the specimen.

*Data for example only

AR Option – Line List

orgID	patID	isolateID	SpecimenGroup	Pathogen	arDrugDesc	eTestValue	eTestSign	eTestInterp	MICValue	MICSign	MICInterp	ZoneValue	ZoneSign	ZoneInterp	FinalInterpDesc
10846	Candida_Urine	123456-7u	Urine	CA	ANID - Anidulafungin	0.100	<	S	0.100	<=	S	2.500	=	I	NS - Non-Susceptible
10846	Candida_Urine	123456-7u	Urine	CA	CASPO - Caspofungin	0.100	<	S	0.100	<=	S	2.500	=	I	S - Susceptible
10846	Candida_Urine	123456-7u	Urine	CA	FLUCO - Fluconazole	0.100	<	S	0.100	<=	S	2.500	=	I	S - Susceptible
10846	Candida_Urine	123456-7u	Urine	CA	FLUCY - Flucytosine	0.100	<	S	0.100	<=	S	2.500	=	I	S - Susceptible
10846	Candida_Urine	123456-7u	Urine	CA	ITRA - Itraconazole	0.100	<	S	0.100	<=	S	2.500	=	I	S - Susceptible
10846	Candida_Urine	123456-7u	Urine	CA	MICA - Micafungin	0.100	<	S	0.100	<=	S	2.500	=	I	S - Susceptible
10846	Candida_Urine	123456-7u	Urine	CA	POSAC - Posaconazole	0.100	<	S	0.100	<=	S	2.500	=	I	S - Susceptible
10846	Candida_Urine	123456-7u	Urine	CA	VORI - Voriconazole	.		N	.		N	.		N	N - Not Tested

❑ Modifications can be made to the output option to show the antimicrobial tested, susceptibility test values, and final susceptibility interpretation

*Data for example only

AR Option – Facility-wide Antibiogram

National Healthcare Safety Network
Facility-wide Antibiogram (Percent Non-Susceptible)
Rate per 100 Isolates
As of: August 15, 2014 at 4:32 PM
Date Range: All AUR_SUMMARY

orgID=13860 CCN=N/A SpecimenDateYM=2014M01

Drug	Pathogen	
	Acinetobacter spp. - ACS	Staphylococcus aureus - SA
AMK	0	
AMPIWS	100	
AZITH		100
CEFEP	0	
CEFOT	0	
CEFOX		49.0
CEFTAZ	0	
CEFTRX	0	
CHLOR		0
CIPRO	33.0	0
CLARTH		0
CLIND		0
DAPTO		0
DOXY	33.0	0
ERYTH		0
GENTA	33.0	0
IMIPWC	33.0	
LEVO	33.0	0
LNZ		0
LOM		.
MERO	33.0	
MINO	33.0	0
MOXI		0

- ❑ **Sample facility-wide antibiogram**
  - Shows the pathogens from the specimens reported into the AR Option for a given month
  - Lists all antimicrobials and the percent of isolates that were non-susceptible to the pathogen
  - Percent non-susceptible only calculated when ≥ 30 isolates have been tested for a particular drug. Cells with "." represent pathogen-drug combinations for which there were less than 30 isolates tested.
  - Cells shaded in grey represent non-valid pathogen/drug combinations

*Data for example only

AR Option – Facility-wide Antibiogram

National Healthcare Safety Network
Facility-wide Antibiogram (Percent Non-Susceptible)
Rate per 100 Isolates
As of: August 15, 2014 at 4:32 PM
Date Range: All AUR_SUMMARY

orgID=13860 CCN=N/A SpecimenDateYM=2014M01

	Pathogen	
Drug	**Acinetobacter spp. - ACS**	**Staphylococcus aureus - SA**
AMK	0	
AMPIWS	100	
AZITH		100
CEFEP	0	
CEFOT	0	
CEFOX		49.0
CEFTAZ	0	
CEFTRX	0	
CHLOR		0
CIPRO	33.0	0
CLARTH		0
CLIND		0
DAPTO		0
DOXY	33.0	0
ERYTH		0
GENTA	33.0	0
IMIPWC	33.0	
LEVO	33.0	0
LNZ		0
LOM		.
MERO	33.0	
MINO	33.0	0
MOXI		0

❑ **Reading the antibiogram:**

- ▪ In January 2014, 33.0% of *Acinetobacter* spp. isolates tested were non-susceptible to Ciprofloxacin
- ▪ In January 2014, 0% of *Staphylococcus aureus isolates* were non-susceptible to Ciprofloxacin

*Data for example only

AUR Resources

- **NHSN AUR Protocol:**
  http://www.cdc.gov/nhsn/PDFs/pscManual/11pscAURcurrent.pdf

- **NHSN Helpdesk:**
  - NHSN@cdc.gov

Thank you!

Division of Healthcare Quality Promotion
National Center for Emerging and Zoonotic Infectious Diseases

CDC