

Welcome to *California*



# Using the CDC's NHSN AU Module to Track and Report Antimicrobial Use Data

Presented via Webinar

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**Erin Epson, MD**

Public Health Medical Officer / Assistant Chief

**Sam Horwich-Scholefield, MPH, CIC**

Antimicrobial Use and Resistance Coordinator

Healthcare Associated Infections Program

Center for Healthcare Quality

California Department of Public Health



# Objectives

- Describe how the CDC's National Healthcare Safety Network (NHSN) Antimicrobial Use (AU) Module can be used to track and analyze antimicrobial use
  - Data collected
  - Output options
  - AU metrics
- Review necessary hospital informatics capabilities and the process for submitting data to NHSN AU
- Present results of the CDPH Antimicrobial Use and Informatics Capabilities Survey

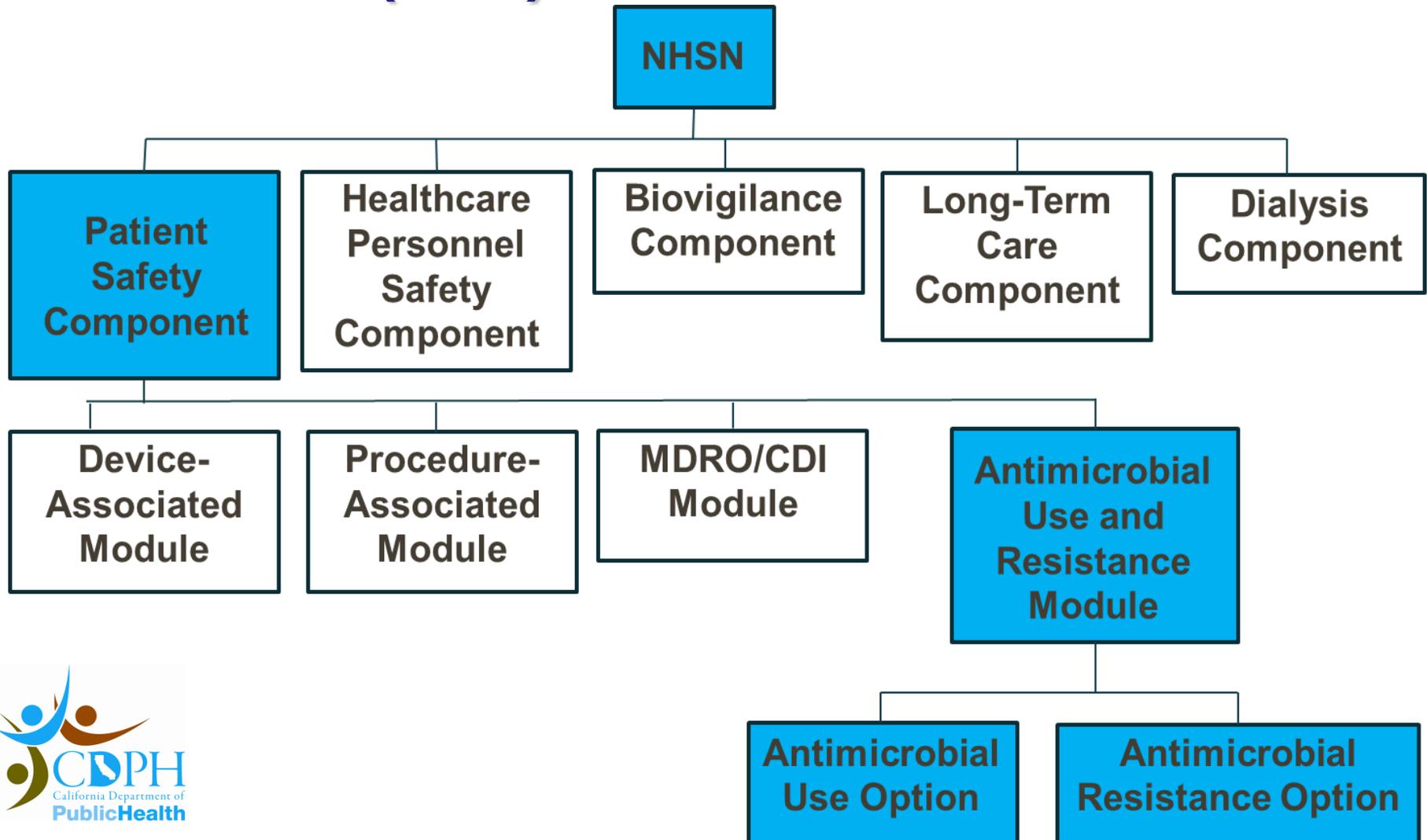
# Importance of Tracking Antimicrobial Use

- Rates of antimicrobial resistance and *Clostridium difficile* infections (CDI) continue to increase in California hospitals
- Antimicrobial exposure drives selection of resistant organisms and predisposes to CDIs
- Feedback to clinicians on antimicrobial use rates improves the appropriateness of antimicrobial usage
- Tracking antimicrobial use is an important process measure of an antimicrobial stewardship program

# CDC's National Healthcare Safety Network

- Secure, internet-based surveillance system managed by the CDC's Division of Healthcare Quality Promotion (DHQP)
- Collect mandated and voluntarily reported data:
  - Healthcare-associated infections (HAIs)
  - Healthcare personnel influenza vaccination
  - Antimicrobial use and resistance
- Provide healthcare facilities a tool for surveillance and analysis:
  - Identify and monitor trends
  - Facilitate inter-facility comparisons and local quality improvement activities

# NHSN and the Antimicrobial Use and Resistance (AUR) Module



# Objectives of the NHSN AU Option

- Primary
  - To facilitate risk-adjusted inter- and intra-facility benchmarking of antimicrobial usage as part of antimicrobial stewardship efforts at a facility
- Secondary
  - To evaluate trends of antimicrobial usage over time at the facility, state/regional and national levels, and provide AU benchmarks.

# National Incentives for NHSN AU Reporting

- Meaningful Use Stage 3 - Proposed Rule
- National Strategy for Combatting Antibiotic-Resistant Bacteria (CARB)
  - Goal: By 2020, at least 95% of eligible hospitals will report AU data to the NHSN.
- CDC's Epidemiology and Laboratory Capacity (ELC) cooperative agreement program provides support for state health departments
- CDC considering additional tools – decision-support web service, vendor validation datasets

# What data are collected in the AU Option

- Numerator: Antimicrobial days (days of therapy)
  - 82 antimicrobial agents collected – including antibacterial, antifungal, and anti-influenza agents
    - Agents are sub-stratified by route of administration
- Denominators:
  - Days Present - number of patients present for any portion of each day of a calendar month in specific unit or in any inpatient location (facility-wide)
  - Admissions - number of patients admitted to the facility (facility-wide calculation only)

# AU Option – 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 20, 2015 at 5:01 PM

Date Range: All SUMMARYAU1MONTH

Location=MICU

Facility Org ID	Summary Year/Month	Antimicrobial Agent Description	Location	Days Present	Antimicrobial Days	Route: IM	Route: IV	Route: Digestive	Route: Respiratory
13860	2015M01	AMAN - Amantadine	MICU	421	0	0	0	0	0
13860	2015M01	AMK - Amikacin	MICU	421	2	0	2	0	1
13860	2015M01	AMOX - Amoxicillin	MICU	421	0	0	0	0	0
13860	2015M01	AMOXWC - Amoxicillin with Clavulanate	MICU	421	0	0	0	0	0
13860	2015M01	AMP - Ampicillin	MICU	421	4	0	4	0	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.



# AU Option – Bar Chart Table by Location

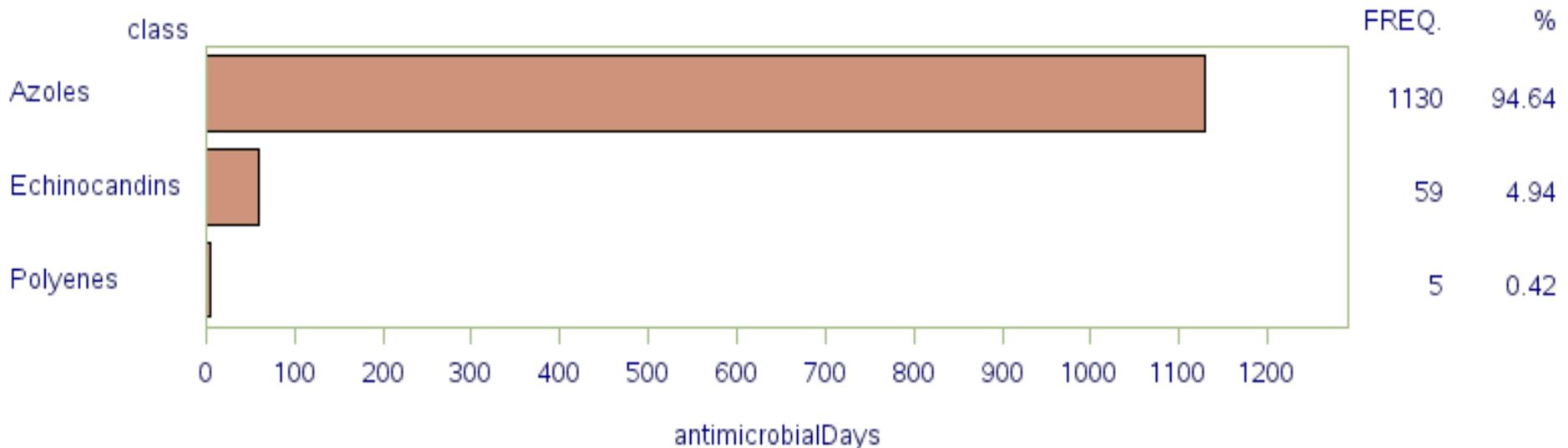
## National Healthcare Safety Network

Bar Chart - All Data - Proportion of Antimicrobial Days per Antifungal Class by Location

As of: February 23, 2015 at 2:07 PM

Date Range: All SUMMARYAU

location=HEM



Sample bar chart by location:

- Shows proportion of antimicrobial days per antifungal class

# AU Option – Pie Chart Table by Location

## National Healthcare Safety Network

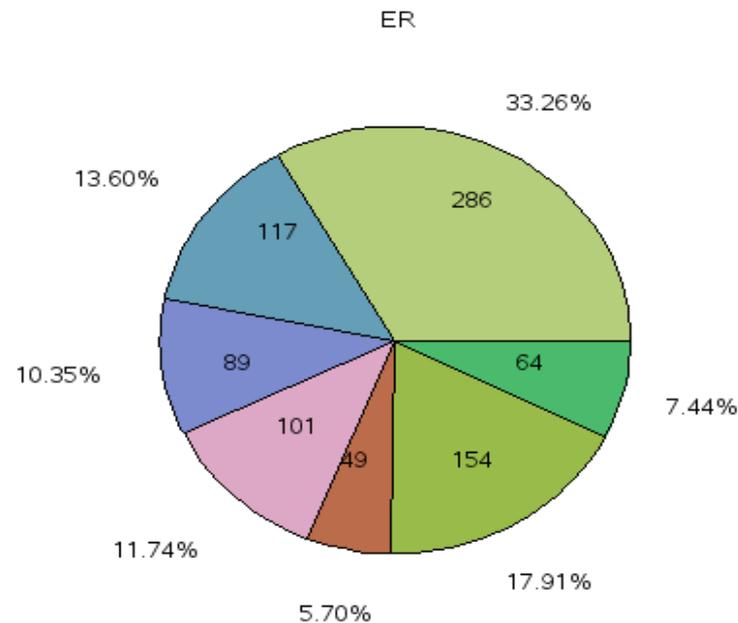
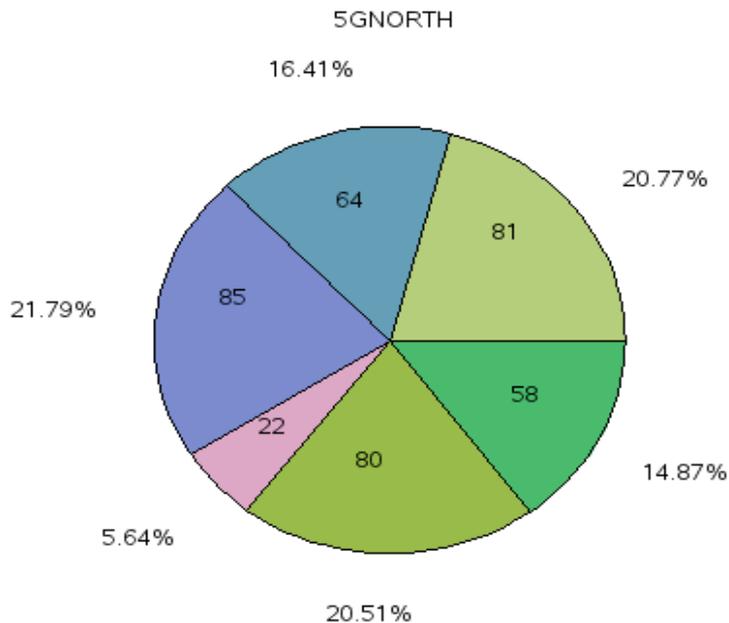
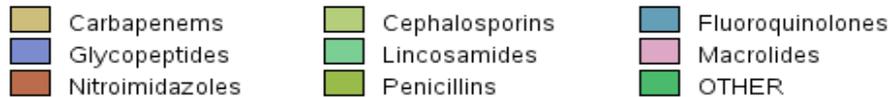
Pie Chart - Current Month - Proportion of Antimicrobial Days per Antibacterial Class by Location

As of: February 23, 2015 at 1:59 PM

Date Range: All SUMMARYAU1MONTH

Stratified by Location

summaryYM=2015M01



Sample pie chart  
by location:

- Shows proportion of antimicrobial days per antibacterial class

# AU Option – Rate Table by Location

## National Healthcare Safety Network

### Rate Table - Selected Drugs from Most Recent Month of AU Data - Antimicrobial Utilization Rates by Location

#### Rate per 1,000 Days Present

As of: July 22, 2015 at 2:00 PM

Date Range: All AU\_DRUGRATES1MONLOCATION

if (((drugIngredientDesc = "LNZ" ) ) )

orgID=13860 locCDC=IN:ACUTE:CC:M location=MICU

summaryYM	antimicrobialDays	numDaysPresent	RateDaysPresent
2015M01	8	421	19.00

## National Healthcare Safety Network

### Rate Table - Selected Drugs from Most Recent Month of AU Data - Antimicrobial Utilization Rates by Location

#### Rate per 1,000 Days Present

As of: July 22, 2015 at 2:00 PM

Date Range: All AU\_DRUGRATES1MONLOCATION

if (((drugIngredientDesc = "LNZ" ) ) )

orgID=13860 locCDC=IN:ACUTE:CC:MS location=MSICU

summaryYM	antimicrobialDays	numDaysPresent	RateDaysPresent
2015M01	2	279	7.17

Sample rate table for selected antimicrobial(s) by location:

- Generates a rate of utilization per 1,000 days present by location for each antimicrobial, antimicrobial class, or specified subset of antimicrobials that are selected on modification

# Basic AU Metric: SAAR

## Standardized Antimicrobial Administration Ratio

- **SAAR** is an Observed-to-Expected (O-to-E) ratio
- **Observed antibacterial use** – Days of therapy reported for a specified category of antimicrobial agents in a specified patient care location or group of locations
- **Expected antibacterial use** – Days of therapy predicted on the basis of nationally aggregated AU data for use of a specified category of antimicrobial agents in a specified patient care location or group of locations

# SAAR Metric – Patient Care Locations

- **6 groupings of patient care locations:**
  - 1) Adult medical, surgical, and medical/surgical ICUs
  - 2) Adult medical, surgical, and medical/surgical wards
  - 3) Pediatric medical, surgical, and medical/surgical ICUs
  - 4) Pediatric medical, surgical, and medical/surgical wards
  - 5) All adult med, surg, and med/surg ICUs and wards
  - 6) All pediatric med, surg, and med/surg ICUs and wards
- Each of the 6 patient care location groupings is paired with specified categories of antimicrobial agents.
- A separate SAAR is calculated for each patient care location-antimicrobial agent combination.

# SAAR Metric – Five Antibacterial Agent Categories

- 1) Broad spectrum antibacterials predominantly used for hospital-onset/multidrug-resistant infections** – aminoglycosides, some carbapenems, some cephalosporins, some fluoroquinolones, penicillin  $\beta$ -lactam/ $\beta$ -lactamase inhibitor combs, and other agents
- 2) Broad spectrum antibacterials predominantly used for community-acquired infections** – ertapenem, some cephalosporins, and some fluoroquinolones
- 3) Anti-MRSA antibacterials** – ceftaroline, dalbavancin, daptomycin, linezolid, oritavancin, quinupristin/dalfopristin, tedizolid, telavancin, and vancomycin (IV route only)
- 4) Antibacterials predominantly used for surgical site infection prophylaxis** – cefazolin, cefotetan, cefoxitin, cefuroxime (IV route only)

*High level indicators for antimicrobial stewardship programs:*

- 5) All antibacterials** – All agents included in the NHSN AUR protocol

# Interpreting the SAAR

- A **high SAAR** that achieves statistical significance may indicate excessive antibacterial use.
- A **SAAR that is not statistically different from 1.0** indicates antibacterial use is equivalent to the referent population's antibacterial use.
- A **low SAAR** that achieves statistical significance (i.e., different from 1.0) may indicate antibacterial under use.

**Note:** *SAAR alone is not a definitive measure of appropriateness of antimicrobial use, but it gives stewardship programs a way to identify patterns and trends that might warrant investigation.*

# Interpreting the SAAR: Additional Considerations

- Current SAAR risk adjustment is based on facility characteristics (e.g. number of ICU beds)
- CDC is working with experts to examine impact of adding patient-level characteristics to the risk adjustment model

# SAAR: Limited Initial, Intended Uses

- Public health/disease surveillance
- Quality improvement (internal to the specific organization)
- Quality improvement (external benchmarking involving multiple organizations)
- Public reporting
- Payment program
- Regulatory and accreditation programs
- Professional certification or recognition program



The NHSN AU Measure proposal was approved for endorsement by the National Quality Forum (NQF); vote by full NQF membership later this year.

# Reporting AU Data into NHSN

# Monthly Reporting Plan for AU Data into NHSN

## Patient Safety Monthly Reporting Plan

Page 1 of 2

*required for saving					
Facility ID: __CDPH Memorial__			*Month/Year: __July_ / __2015__		
<input type="checkbox"/> No NHSN Patient Safety Modules Followed this Month					
<b>Device-Associated Module</b>					
Locations	CLABSI	VAE	PedVAP	CAUTI	CLIP
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Procedure-Associated Module</b>					
Procedures	SSI				
	IN	OUT			
_____	<input type="checkbox"/>	<input type="checkbox"/>			
<b>Antimicrobial Use and Resistance Module</b>					
Locations	Antimicrobial Use		Antimicrobial Resistance		
_3N-Medical ICU_____	X		<input type="checkbox"/>		
_2E-Surgical ICU_____	X		<input type="checkbox"/>		
_3S-Medical Ward_____	X		<input type="checkbox"/>		
_2W-Surgical Ward_____	X		<input type="checkbox"/>		
_4S-Medical/Surgical Peds Ward_____	X		<input type="checkbox"/>		
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Monthly Reporting Plans must be Updated Manually

- Specific locations must be listed for AU reporting before any data can be electronically submitted

## Data Collected in the AU Option

Monthly summary-level data (numerators and denominators) required from all of the following 4 locations categories (if applicable to facility):

- 1) Critical care** - All medical, surgical, med/surg, adult and peds critical care units
- 2) Ward** - All medical, surgical, med/surg, adult and peds wards
- 3) Specialty care area** - At least one specialty care area
- 4) Facility-wide** – All inpatient locations

# Data Collected in the AU Option

- **Numerator:** Antimicrobial days (days of therapy)
  - **82 antimicrobial agents** collected – including 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 patients present for any portion of each day of a calendar month in specific unit or in any inpatient location (facility-wide)
  - **Admissions** - number of patients admitted to the facility (facility-wide calculation only)

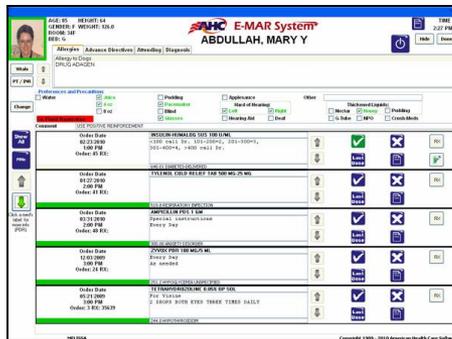
# Patient Days Present

**Table 5. Location-specific and Facility-wide Inpatient Metrics**

Metric Collected	Metric Definition	Comments
<b>Inpatient Care Location-Specific Analyses</b>		
Antimicrobial Days/Days present	Drug-specific antimicrobial days per patient care location per month/Days present per patient care location per month	One patient can contribute only one day present per calendar day for each specific location. Summed total may be higher when compared to facility-wide measure (reflecting transfers between locations).
<b>Facility-wide Inpatient Analyses</b>		
Antimicrobial Days/Days present	Drug-specific antimicrobial days for a facility per month/Days present per facility-wide inpatient per month	One patient can contribute only one day present per calendar day for a facility. Thus, one denominator is obtained for an entire facility. The day present measure for facility-wide inpatient may be lower when compared to sum total from location-specific comparison.
Antimicrobial Days/Admissions	Drug-specific antimicrobial days for a facility per month/Admissions per facility-wide inpatient per month	Only calculated for facility-wide inpatient for AU Option.

# Necessary Informatics Capabilities for Using the AU Option

- **Electronic Medication Administration Record (eMAR) or Bar Coding Medication Administration (BCMA) systems**



- Ability to collect and package data using HL7 standardized format: **Clinical Document Architecture** (no manual data entry)

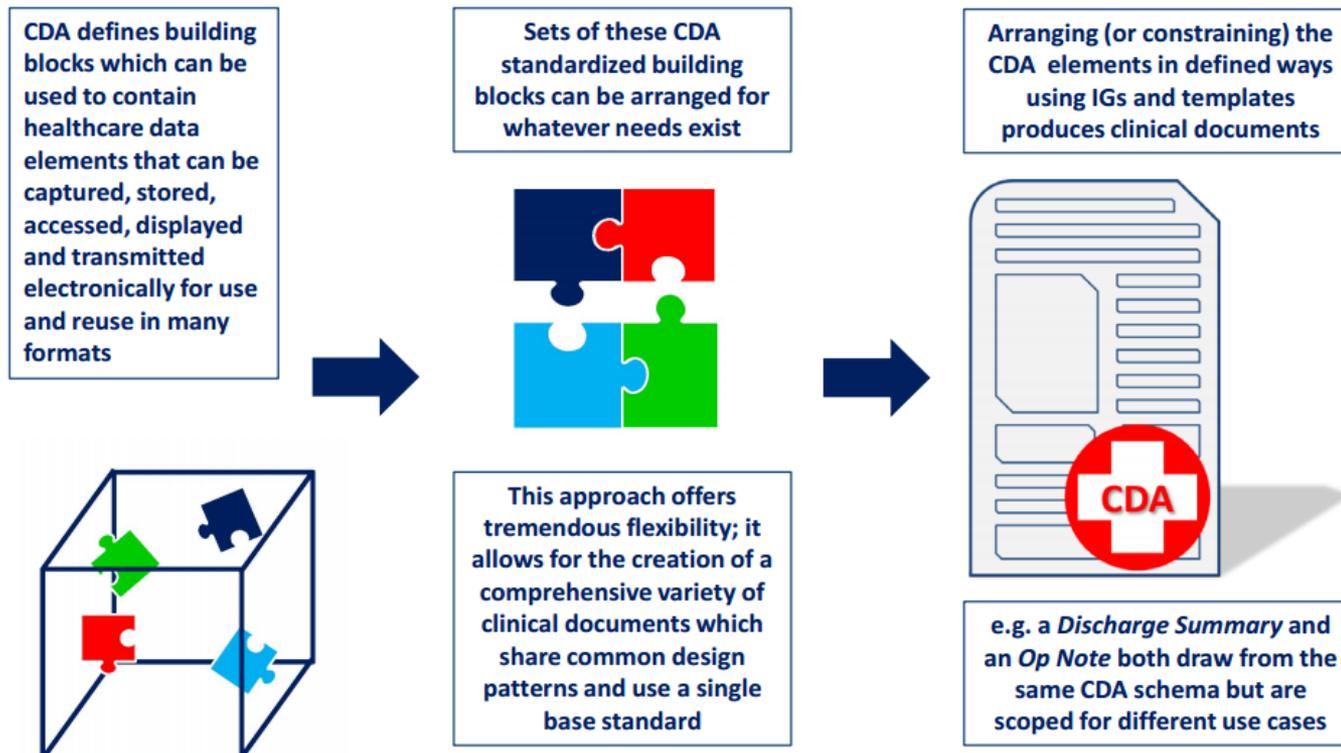
# RxNorm Codes

- Normalized codes for clinical drugs
  - Links to many of the vocabularies commonly used in pharmacy management and drug interaction software
  - By providing links between these vocabularies, RxNorm can mediate messages between systems not using the same software and vocabulary

<b>RxNorm Code</b>	<b>Antimicrobial Agent</b>	<b>NHSN Drug Code</b>	<b>Antimicrobial Category</b>	<b>Antimicrobial Class</b>
2176	CEFACLOR	CEFAC	Antibacterial	Cephalosporins
2177	CEFADROXIL	CEFAD	Antibacterial	Cephalosporins
2180	CEFAZOLIN	CEFAZ	Antibacterial	Cephalosporins
25037	CEFDINIR	CEFDIN	Antibacterial	Cephalosporins
83682	CEFDITOREN	CEFDIT	Antibacterial	Cephalosporins

# Clinical Document Architecture

- Base standard which provides a common architecture, coding, semantic framework, and markup language for the creation of electronic clinical documents



# NHSN AU CDA Sample

```

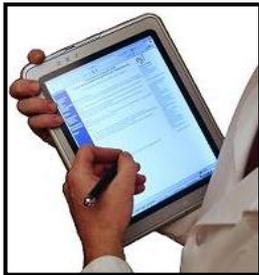
<!-- 33 drug: Ciprofloxacin -->
- <entry typeCode="DRIV">
  <!-- Template for Entry - Summary Data -->
  - <encounter classCode="ENC" moodCode="EVN">
    <templateId root="2.16.840.1.113883.10.20.5.6.70"/>
    <!-- the location ID and type -->
  - <participant typeCode="LOC">
    - <participantRole classCode="SDLOC">
      <id extension="ICU-A" root="2.111.111.111.10009"/>
      <code code="1030-6" displayName="A Location" codeSystemName="HL7 Healthcare Service Location Code" codeSystem="2.16.840.1.113883.6.259"/>
    </participantRole>
  </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 code="2525-4" displayName="Number of Patient-present Days" codeSystemName="cdcNHSN" codeSystem="2.16.840.1.113883.6.277"/>
      <statusCode code="completed"/>
      <value value="3" unit="d" xsi:type="PQ"/>
    </observation>
  </entryRelationship>
  <!-- stratified data: Drug + route -->
- <entryRelationship typeCode="COMP">
  - <observation classCode="OBS" moodCode="EVN">
    <templateId root="2.16.840.1.113883.10.20.5.6.69"/>
    <code code="2524-7" displayName="Number of Therapy Days" codeSystemName="cdcNHSN" codeSystem="2.16.840.1.113883.6.277"/>
    <statusCode code="completed"/>
    <value value="3" unit="d" xsi:type="PQ"/>
    <methodCode code="47625008" displayName="Intravenous route" codeSystemName="SNOMED" codeSystem="2.16.840.1.113883.6.96"/>
    <!-- how actually administered -->
  - <participant typeCode="CSM">
    <!-- antimicrobial Drug -->
    - <participantRole classCode="MANU">
      <code code="2551" displayName="Ciprofloxacin" codeSystemName="RxNorm" codeSystem="2.16.840.1.113883.6.88"/>
    </participantRole>
  </participant>
</observation>
</entryRelationship>

```

ADT data



Automated process:  
EHRs, 3rd party vendor,  
or homegrown system  
pulls appropriate data



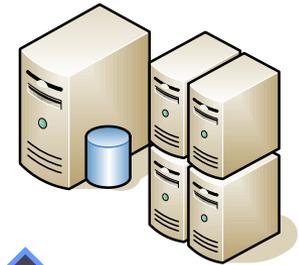
eMAR/BCMA data

# Reporting of AU Data to NHSN

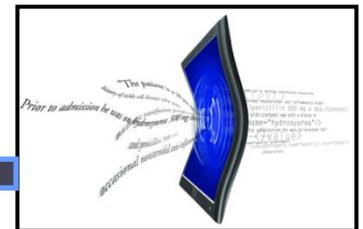


CDA report  
developed in  
standard format

Uploaded  
to NHSN



NHSN  
Servers



Local access of data:  
NHSN web interface –  
view, analyze, run  
reports, share data

-Risk-adjusted usage or resistance  
patterns, by location or hospital-wide

-Stewardship programs compare and  
target for education and interventions

# Electronic Reporting to NHSN

- Clinical Document Architecture (CDA)
  - **CDA Implementation Guide (IG)** – uses CDA templates to define the basic structure that an implementer must follow while providing the data
  - Sample files – show example data in the templates
  - **Schematron** – provides ability to easily verify that data are correct

# Reporting AUR Data

- 2 ways to electronically report AUR data to NHSN:
  - **Manual CDA import**
    - NHSN Login and data submission for one facility at a time
  - Automated send using **NwHIN Direct** (“batch submission”)
    - Import CDA files from one or more facilities in a single zip file
- Both reporting options require a facility be manually enrolled and set-up in NHSN
  - Mapped locations
  - Monthly reporting plan (add AU and/or AR to existing Plan)
  - Annual survey

# Antimicrobial Use and Informatics Survey: Results

# Survey Respondents

- Survey sent to 236 recipients, representing 271 hospitals
  - 9/84 (11%) are Long Term Acute Care
- 84/271 (31%) hospitals submitted complete responses
- 46/84 (55%) are ASP Collaborative Participants

# Current EMR/EHR and eMAR/BCMA Vendors (N=84)

## EMR/EHR

	No.	(%)
<u>Cerner</u>	25	(30)
<u>Epic</u>	16	(19)
McKesson	10	(12)
Allscripts	7	(8)
Pro Touch	6	(7)
CPSI Inc	3	(4)
<u>Vigilanz</u>	1	(1)

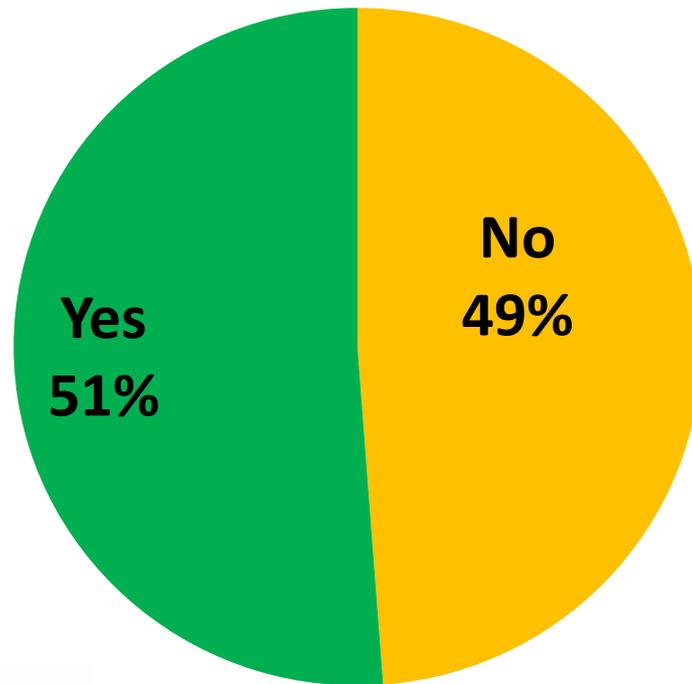
## eMAR/BCMA

	No.	(%)
<u>Cerner</u>	22	(26)
Meditech	20	(24)
<u>Epic</u>	18	(21)
McKesson/Paragon	8	(10)
Allscripts	5	(6)
Pro Touch	4	(5)
Siemens	3	(4)
<u>Sentri 7</u>	2	(2)

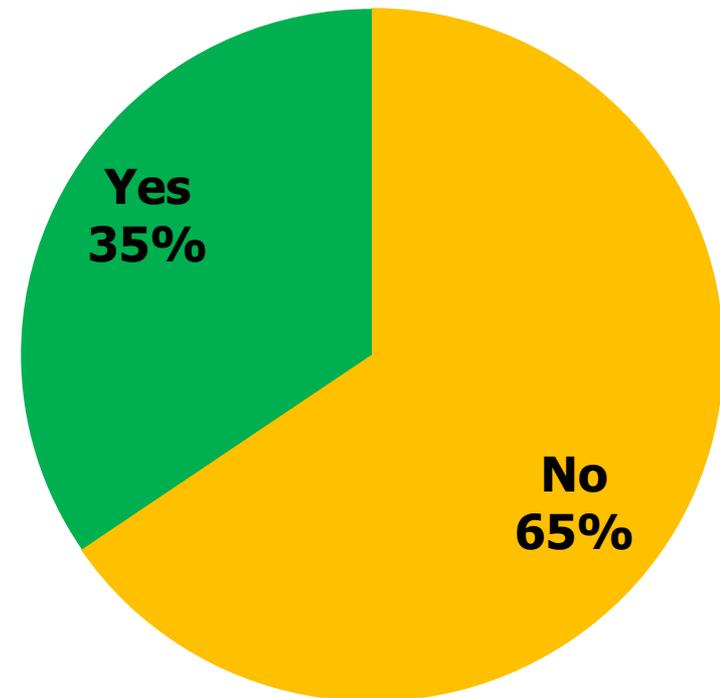
Note: Some hospitals have more than 1 system,  
percentages may add to more than 100%

# Clinical Document Architecture Experience

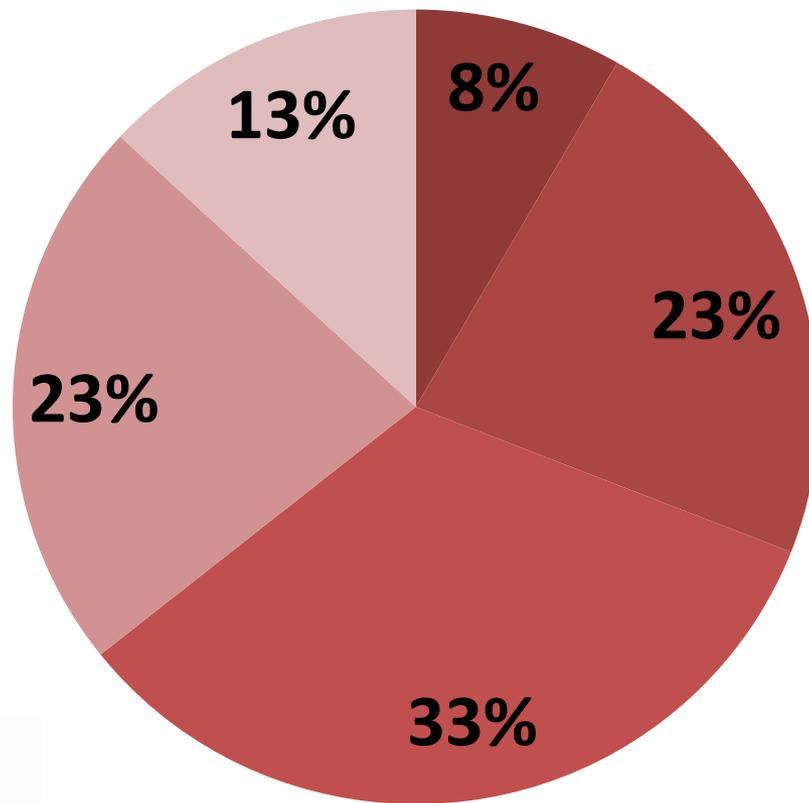
**Experience with CDA  
(N=84)**



**Experience Reporting  
CDA to NHSN (N=84)**

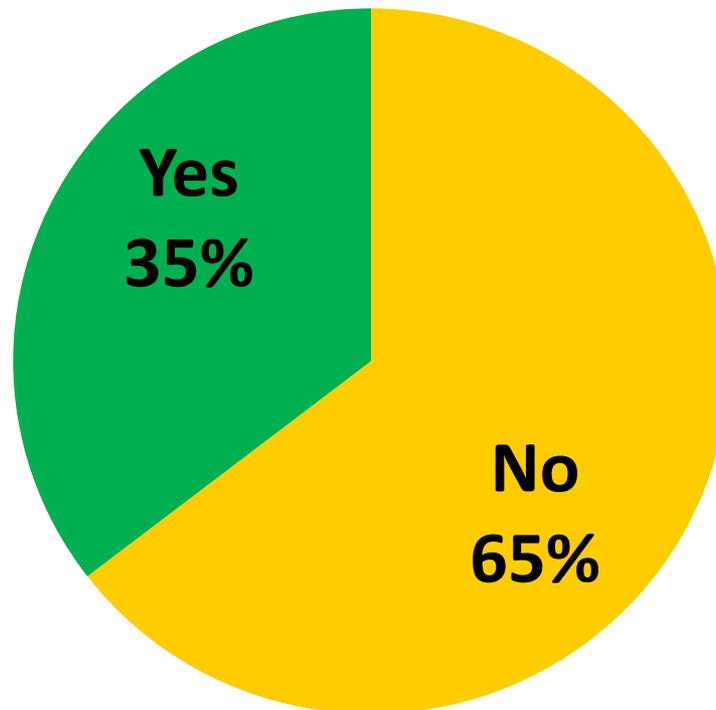


# Does your hospital track summary counts reported as Days of Therapy for each specific antimicrobial administered to patients? (N=84)

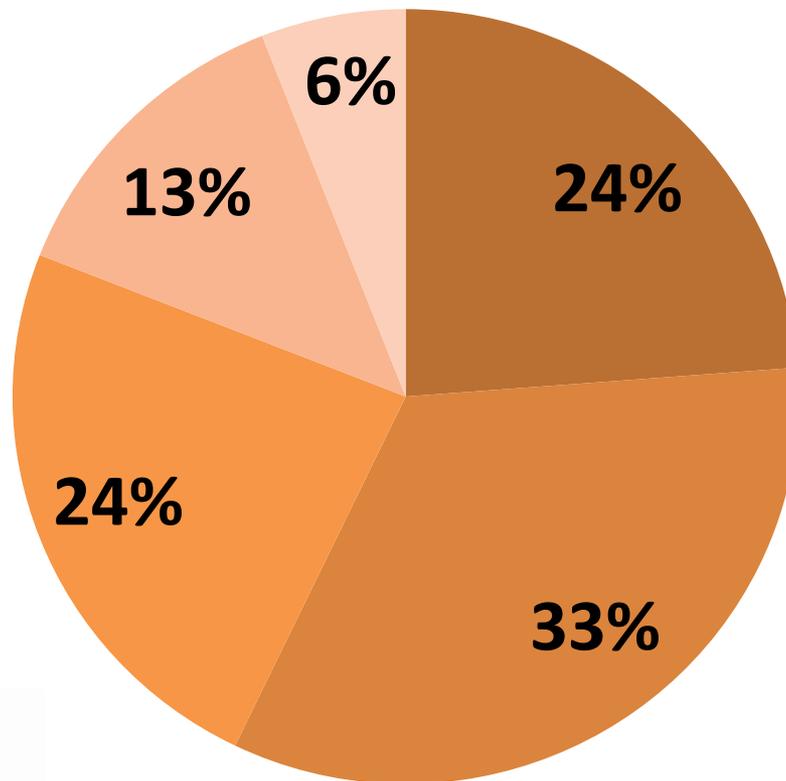


- Already exchanged electronically
- Fairly easy to extract and use this data
- Some effort required
- Difficult
- Not possible at this time

## Use of Rx Norm Codes (N=79)

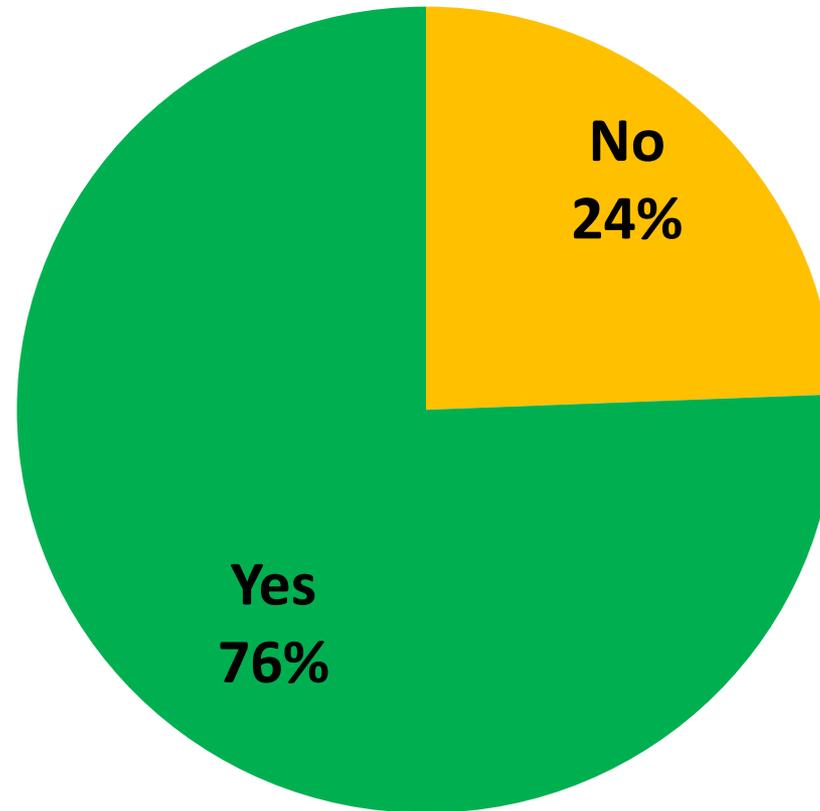


# Does Your Hospital Currently Track Routes of Administration using your Electronical Health Information System? (N=84)



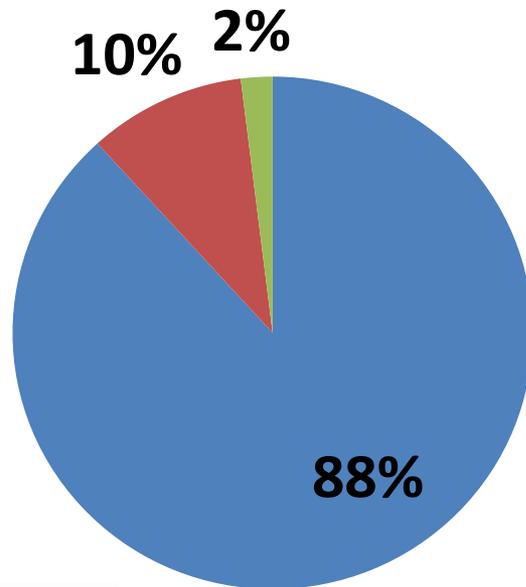
- Already exchanged electronically
- Fairly easy to extract and use this data
- Some effort required
- Difficult
- Not possible at this time

Does your hospital use patient admit/discharge/transfer (ADT) data for surveillance, monitoring, or reporting purposes?  
(N=82)

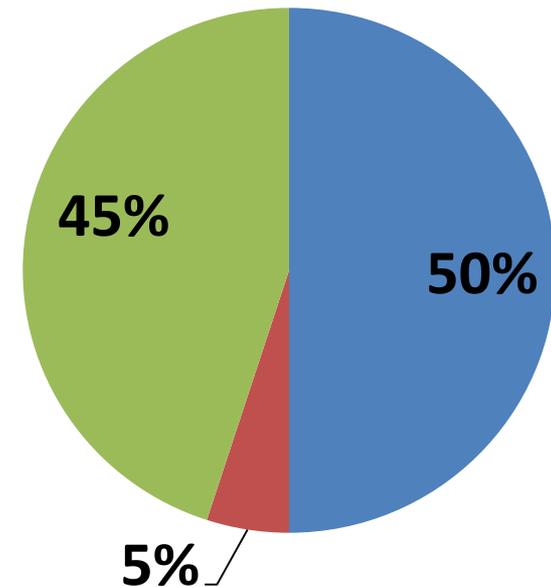


# Does your hospital use ADT Data to Count Admissions & Patient Days Present?

## Admissions (N=51)

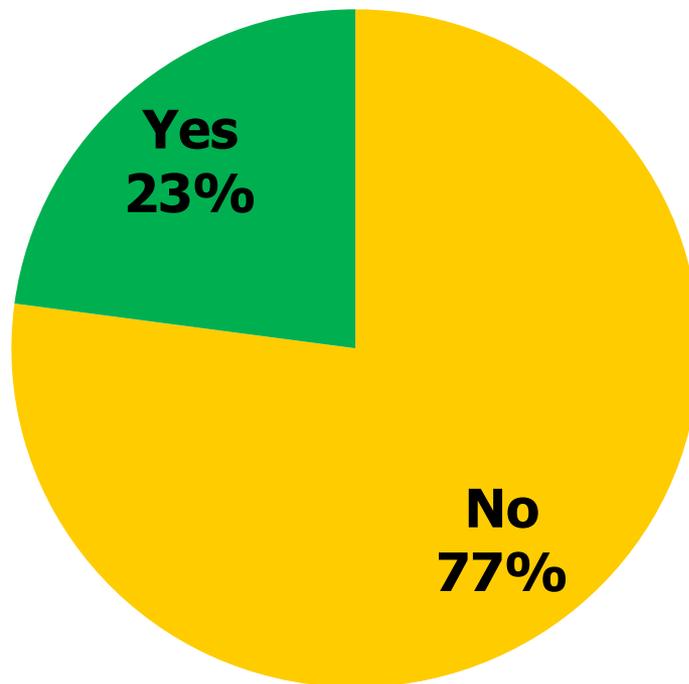


## Patient Days Present (N=40)



- Counts by specific patient care location
- Counts but only at the facility-wide level
- No counts for this item

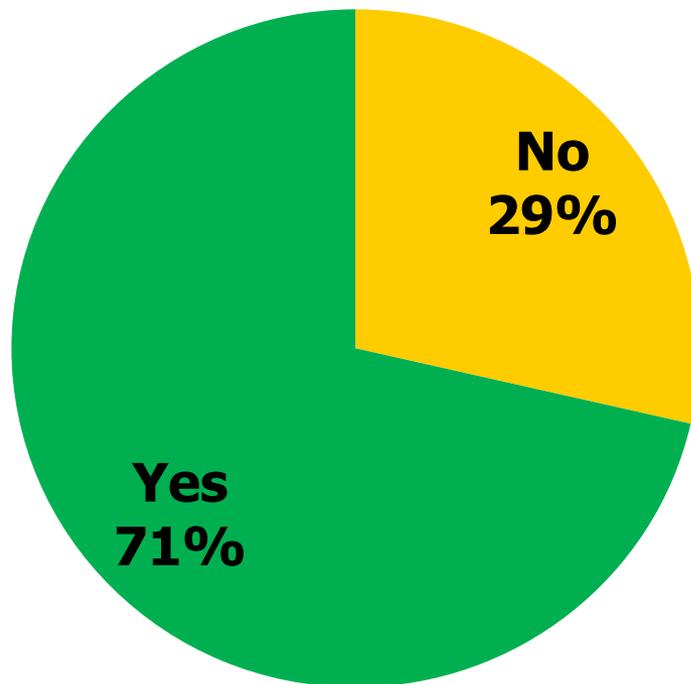
# Does your hospital currently benchmark antimicrobial use with other hospitals (N=83)



## Selected Comments

- Interregional reports
- So far with purchase data. Actual doses delivered hard to get- labor intensive. working on it
- Some assessment vs old NHSN data and selected published articles on antibiotic use.
- Very basic (purchase data), retrospective quarterly reports for all hospitals
- We compare antibiotic usage compared to similar sized hospitals and compare to the average of all hospitals in system

# Is your hospital interested in using the NHSN AU option? (N=77)



## Selected Comments

- eMAR is implemented, we have started an antimicrobial workgroup
- Would be interested in understanding first steps of the process
- Very interested. We have barcoding and our infection preventionists submit data to NHSN
- Need to start at phase 1
- We would need help with the coding and making sure what info is being pulled from the system is what NHSN wants

# CDPH HAI Program Approach to the NHSN AU Option

- Administer and analyze an Antimicrobial Use and Informatics Survey
- Informational visits with current reporters
  - Understand the process to report to NHSN AU
  - Recognize how reporters use the data
  - Learn more about how hospitals work with vendors
    - List of self-identified vendors available at <http://www.sidp.org/aurvendors>
- Identify and support hospitals that may be well positioned to use the NSHN AU Option

# HAI Program Identification of 1st Round of “AU-Ready” Hospitals (N=8)

- Hospital criteria:
  - Submit CDA Data to NHSN
  - Have eMAR/BCMA
  - Use RxNorm Codes
  - Already exchange, fairly easy, or some effort required to extract and use:
    - DOB and Gender
    - Patient care location of patient
    - Routes of administration
  - Summary counts reported as Antimicrobial Days or Days of Therapy



Interested in AU Module

# Learn More about the AU Option

- Please reach out if interested in:
  - Learning more about AU option (even if not currently in a position to begin using it);
  - Understanding the role monitoring of AU can play in stewardship;
  - Inviting HAI Program representatives to speak with pharmacists, IT, administration, or any others about AU

For more information, please contact  
Sam Horwich-Scholefield at:

[sam.horwich-scholefield@cdph.ca.gov](mailto:sam.horwich-scholefield@cdph.ca.gov)  
**510.412.3720**



# References

## CDPH

- To Volunteer or for Questions: [HAIProgram@cdph.ca.gov](mailto:HAIProgram@cdph.ca.gov)

## CDC NHSN

- Acute Care Hospital AUR Web Page:  
<http://www.cdc.gov/nhsn/acute-care-hospital/aur/index.html>
- AUR Protocol:  
<http://www.cdc.gov/nhsn/pdfs/pscmanual/11pscaurcurrent.pdf>
- AUR Slides: <http://www.cdc.gov/nhsn/pdfs/training/aur/aur-training.pdf>
- NHSN CDA Help Desk: [nhsncda@cdc.gov](mailto:nhsncda@cdc.gov)

## Lantana

- NHSN Presentations:  
<http://www.lantanagroup.com/resources/nhsn-presentations/>
- Import and Analysis of NHSN Antimicrobial Use Data
- Direct CDA Automation Vendor Webinar