CDC’s National Healthcare Safety Network (NHSN)

Quality Committee at the Federation of American Hospitals' June Policy Conference: Breakout

June 12, 2024

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NHSN Overview

Mission of CDC's Division of Healthcare Quality Promotion (DHQP)

To protect patients; protect healthcare personnel; and promote safety, quality, and value in both national and international healthcare delivery systems.

Image by David Mark from Pixabay

National Healthcare Safety Network

CDC's domestic tracking and response system to identify emerging and enduring threats across healthcare

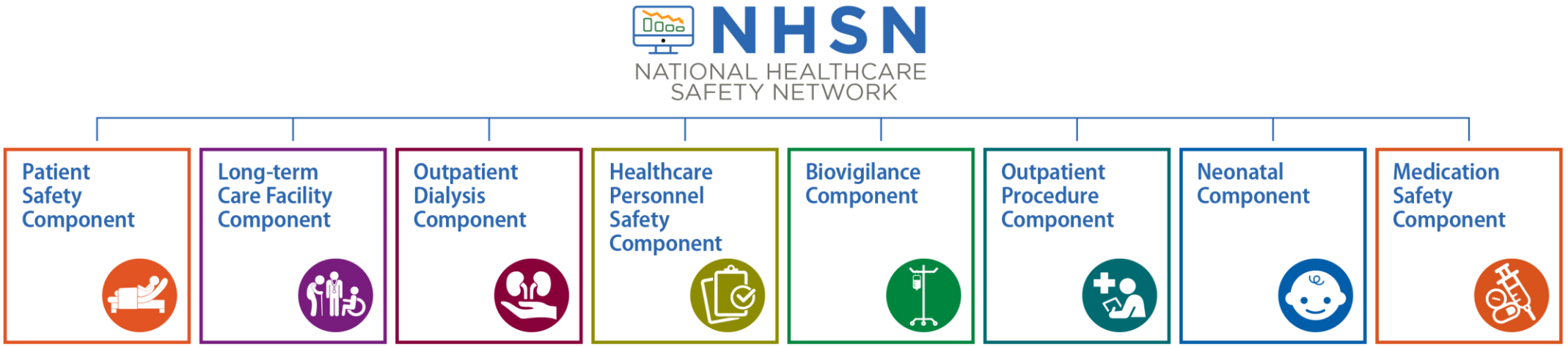
Surveillance Program with risk-adjusted, national benchmarking of:

- Healthcare-associated infections (HAIs) and conditions
- Patient-safety events
- Antimicrobial use and resistance
- Vaccination of healthcare personnel
- Emerging pathogens and diseases
    - E.g., COVID-19, Influenza
- Healthcare bed capacity

NHSN: The Nation's Healthcare Surveillance System

Standards-based, vendor-neutral, surveillance program

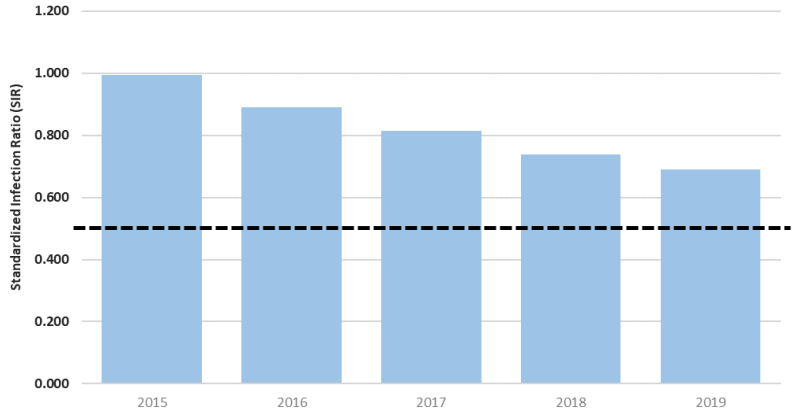
Meaningful, rigorously collected data to support impactful interventions



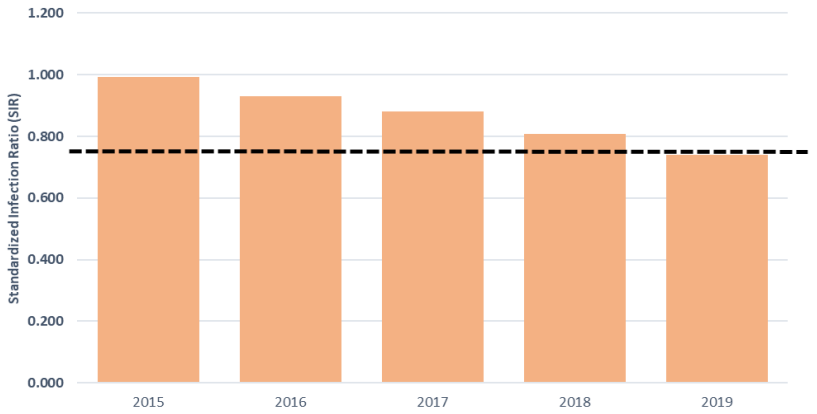
- ~38,000 facilities across the nation send data to NHSN, which includes over 5,500 hospitals currently reporting
- The Patient Safety Component collects some hospital bed capacity data through required COVID-19 reporting
- The NHSN Connectivity Initiative will be a separate, automated data feed into NHSN
- While there are similarities and some overlap in the existing bed capacity data elements currently reported, the NHSN Connectivity Initiative data elements are more granular

2019: Healthcare-Associated Infections Near or Meeting HHS Targets

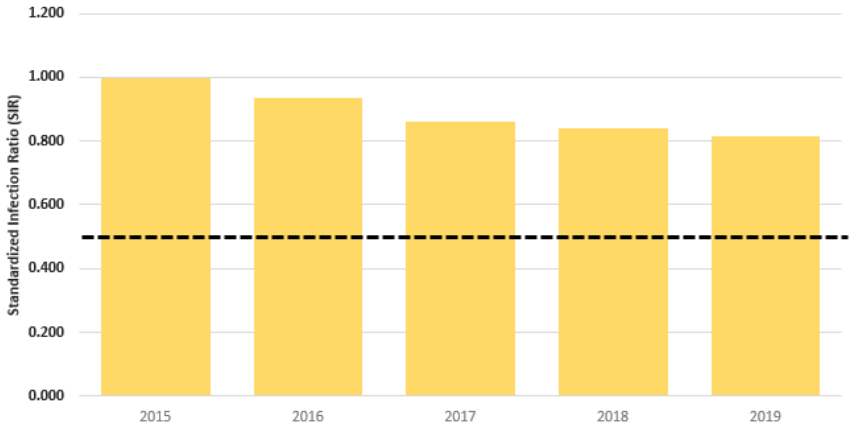
Central line-associated blood stream infection (CLABSI) SIR in acute care hospitals (ACH) by Year, National Healthcare Safety Network (NHSN), 2015-2019



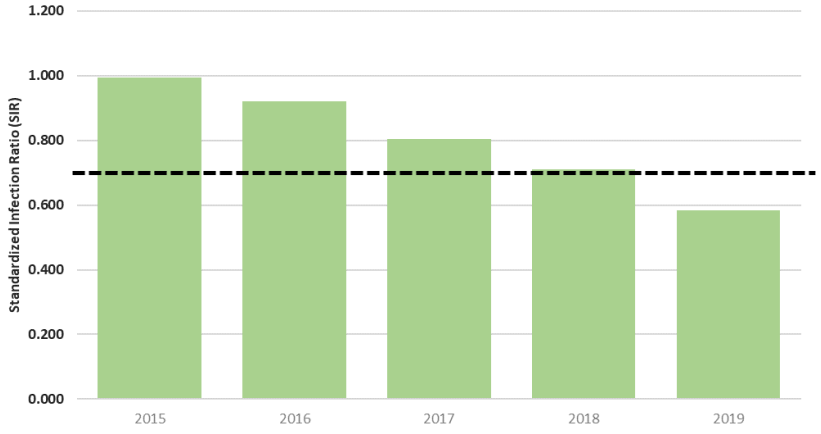
Catheter-associated urinary tract infection (CAUTI) SIR in acute care hospitals (ACH) by Year, National Healthcare Safety Network, 2015-2019



Laboratory-identified Methicillin-resistant *Staphylococcus aureus* (MRSA) SIR in acute care hospitals (ACH) by Year, National Healthcare Safety Network (NHSN), 2015-2019



Laboratory-identified *Clostridioides difficile* (*C. difficile*) SIR in acute care hospitals (ACH) by Year, National Healthcare Safety Network (NHSN), 2015-2019



---- HHS target

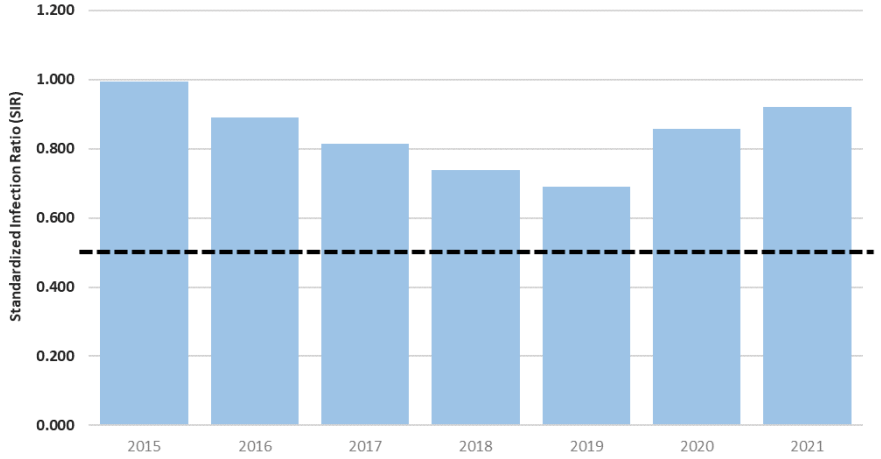
Slide courtesy of Maggie Dudeck, MPH.

HHS National HAI Targets and Metrics. https://www.hhs.gov/oidp/topics/health-care-associated-infections/targets-metrics/index.html

Data source: CDC. National and State HAI Progress Reports. https://www.cdc.gov/nhsn/datastat/progress-report.html

2020–2021: Healthcare-Associated Infections

Central line-associated blood stream infection (CLABSI) SIR in acute care hospitals (ACH) by Year, National Healthcare Safety Network (NHSN), 2015-2021



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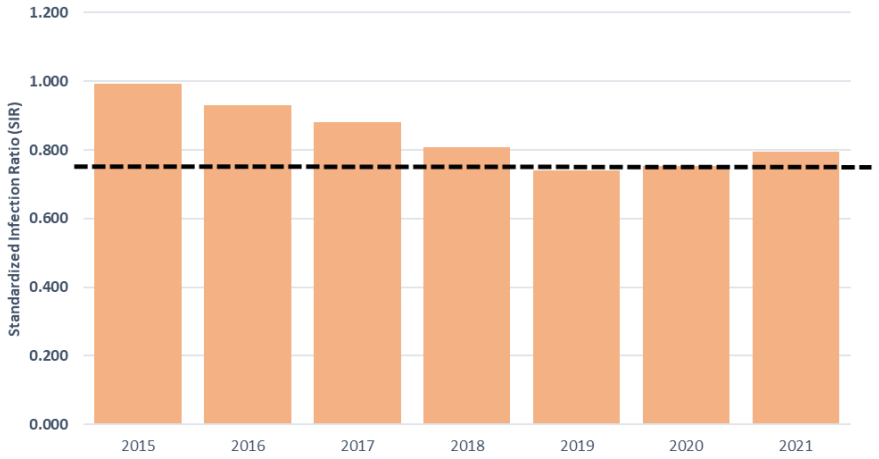

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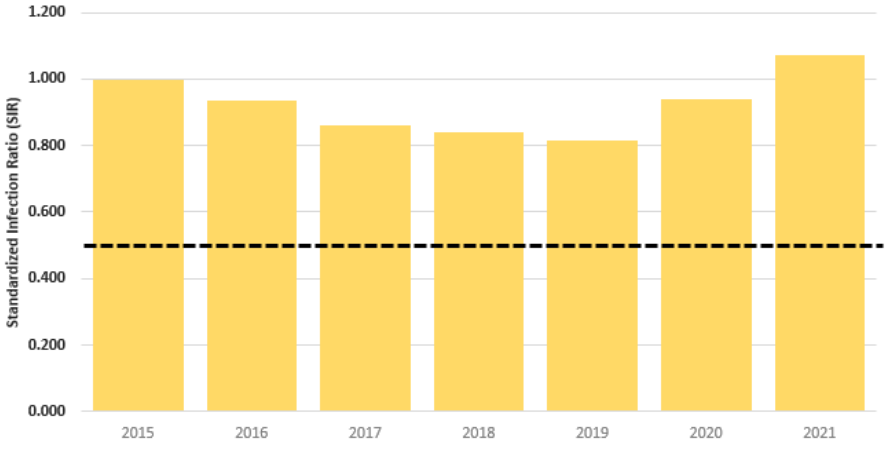

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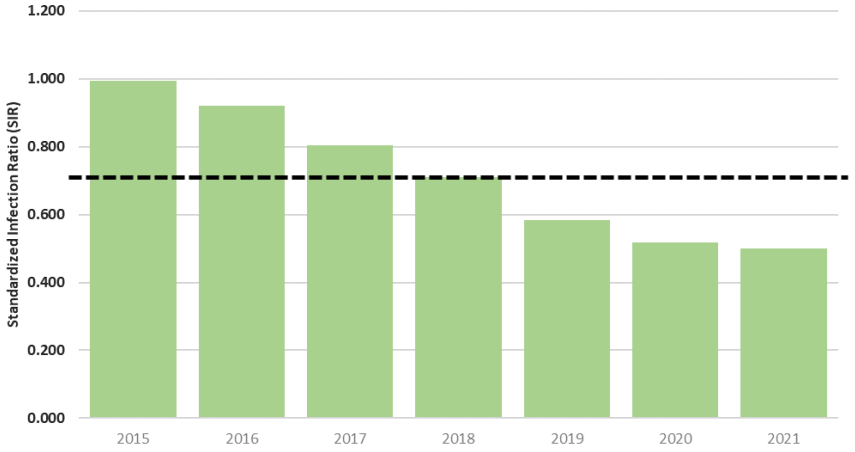


---- HHS target

Slide courtesy of Maggie Dudeck, MPH.

Data source: CDC. National and State HAI Progress Reports. https://www.cdc.gov/nhsn/datastat/progress-report.html

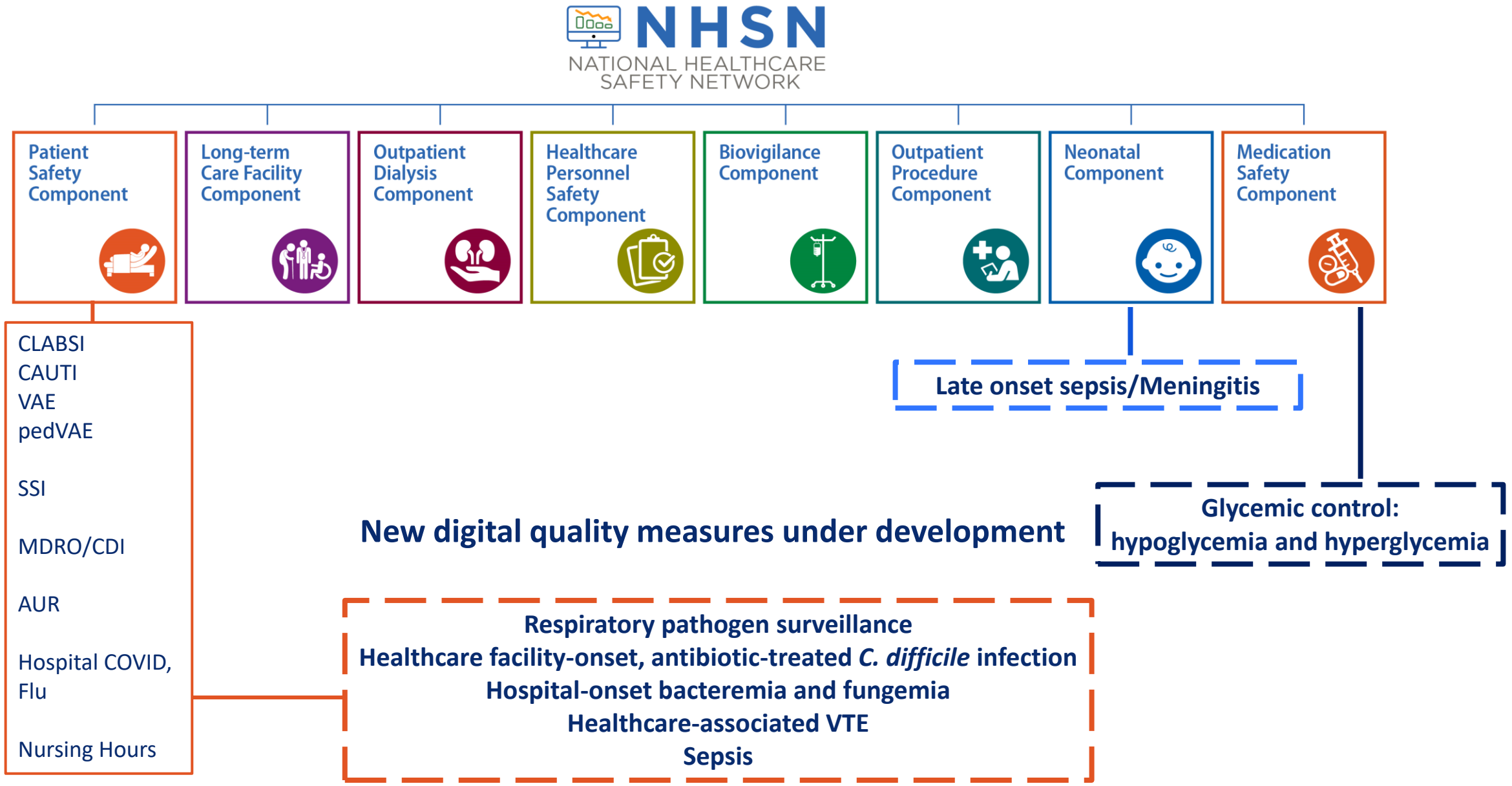
Changes in the 2022 National HAI Standardized Infection Ratios (SIRs) Compared to 2021

	Acute Care Hospitals (ACH)	Inpatient Rehab Facilities (IRF)	Long-term Acute Care Hospitals (LTACH)
CAUTI	↓ 12%	No change[1]	No change[1]
CLABSI	↓ 9%	No change[1]	No change[1]
VAE	↓ 19%		No change[1]
SSI-COLO	No change[1]		
SSI-HYST	No change[1]		
LabID MRSA bacteremia	↓ 16%	No change[1]	No change[1]
LabID CDI	↓ 3%	↓ 9%	No change[1]

Data represent all facilities with at least 1 month of in-plan data, and all location types for device-associated HAIs.
[1]"No change" signifies that the change in SIR was not statistically significant

Slide courtesy of the NHSN Acute Care Analytics Team, including Karen Jones and Maggie Dudeck, Surveillance Branch, DHQP, CDC.
2022 National and State HAI Progress Report. *Publication pending.*

Digital Measures Update

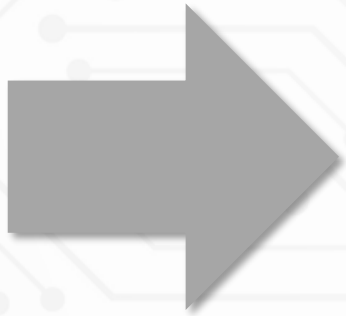


AUR: antimicrobial use and resistance; CDI: *Clostridioides difficile* infection; CAUTI: catheter-associated urinary tract infection; CLABSI: central line-associated bloodstream infection; MDRO: multi-drug resistant organism; SSI: surgical site infection; VAE: ventilator-associated event; pedVAE: pediatric VAE

NHSN Digital Quality Measures (dQMs) to Drive Patient Safety

Fully-automated, digital quality measures based on standards, measurement science, and clinical science with rigorous benchmarking and appropriate risk-adjustment used to drive patient-safety

Manual and Semi-Automated Measures

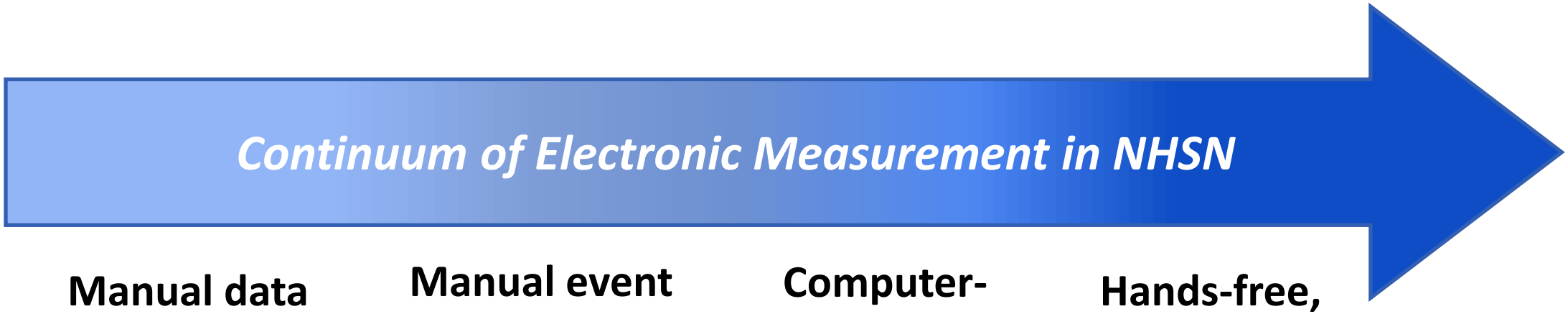


Digital Quality Measures

Benefits of Digital Quality Measures

- ✓ *Reduce time* for data collection
- ✓ Provide *patient-level* data for risk adjustment and stratification
- ✓ *Remove* potential *biases* due to different interpretations
- ✓ *Adjust* measures quickly in response to changes in practices

NHSN: Transforming from current state to future state



Manual data collection & entry

Data manually submitted via NHSN webform

Manual event determination with electronic data transfer

Electronic data submitted using CDA

Computer-assisted

*Electronic data submitted using FHIR; selected data can be user-confirmed**

Hands-free, automated

Electronic data submitted using FHIR; fully automated

*Some measures will have additional format options for submitting data (e.g., CSV)
CDA: Clinical Document Architecture

NHSNCoLab

A formal, funded collaboration between NHSN and selected U.S. healthcare facilities to test, pilot, and validate new NHSN dQMs and data exchange approaches

Site	Site Name	EHR Vendor*	Measures	Site Leads
1	Billings Clinic	Oracle/Cerner	Glycemic Control	Randy Thompson, MD Lisa Ranes, RD, LN, CDCES
2	Geisinger	Epic	CDI/HOB, RPS	Mark Shelly, MD
3	HCA Healthcare	Meditech, Allscripts, Oracle/Cerner	CDI/HOB, Glycemic Control	Kenneth Sands, MD, MPH William Gregg, MD, MS, MPH
4	Mass General Brigham	Epic	Sepsis	Sayon Dutta, MD, MPH Chanu Rhee, MD, MPH
5	Michigan Medicine	Epic	Glycemic Control, CDI/HOB, HA-VTE	Michael Lanham, MD
6	Nebraska Medicine	Epic	Glycemic Control	Andjela Drincic, MD Ron Carson
7	University of California, Davis Medical Center	Epic	Glycemic Control	Greg Maynard, MD, MS, MHM Yauheni Solad, MD, MHS, MBA
8	University of North Carolina Hospitals	Epic	CDI/HOB, RPS	Lisa Stancill, MPH
9	University of Oklahoma Health Sciences Center	Epic	HA-VTE	Aaron Wendelboe, PhD Justin Dvorak, PhD
10	University of Rochester Medical Center	Epic	CDI/HOB	Brenda Tesini, MD
11	Yale New Haven Health	Epic	Glycemic Control	Hyung Paek, MD, MSEE

*Abbreviations: CDI/HOB = Hospital-onset, antibiotic-treated C. difficile infection (CDI) / Hospital–onset bacteremia/fungemia (HOB), HA-VTE= Healthcare-associated venous thromboembolism *Listing of EHR vendors does not imply endorsement by the vendors.*

www.cdc.gov/nhsn/nhsncolab

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

National Healthcare Safety Network (NHSN)

NHSNCoLab

Print

Open All | Close All

Ushering in a new era of NHSN data modernization, innovation, and collaboration for public health surveillance.

About NHSNCoLab

The NHSN Collaborative, or NHSNCoLab, is a collaboration between public and private stakeholders to test, pilot, implement, and validate new National Healthcare Safety Network (NHSN) healthcare surveillance measures and approaches in alignment with CDC's Data Modernization Initiative.

The program established a committed network of CDC's healthcare partners with institutional agreements in place to increase the efficiency and effectiveness of collaboration.

This collaboration will inform new NHSN measures and approaches to healthcare event data collection, assessing the feasibility and validity of new NHSN surveillance concepts that support patient safety, quality reporting, national benchmarking, and public health preparedness and response.

NHSN FHIR dQMs in Development & Implementation

- **Hyperglycemia**
- **Neonatal late-onset sepsis/meningitis**
- **Opioid-related harm**
- **Acute kidney injury**
- **Medication-related bleeding**
- **Antibiotic use**
- **Antibiotic-associated adverse events**

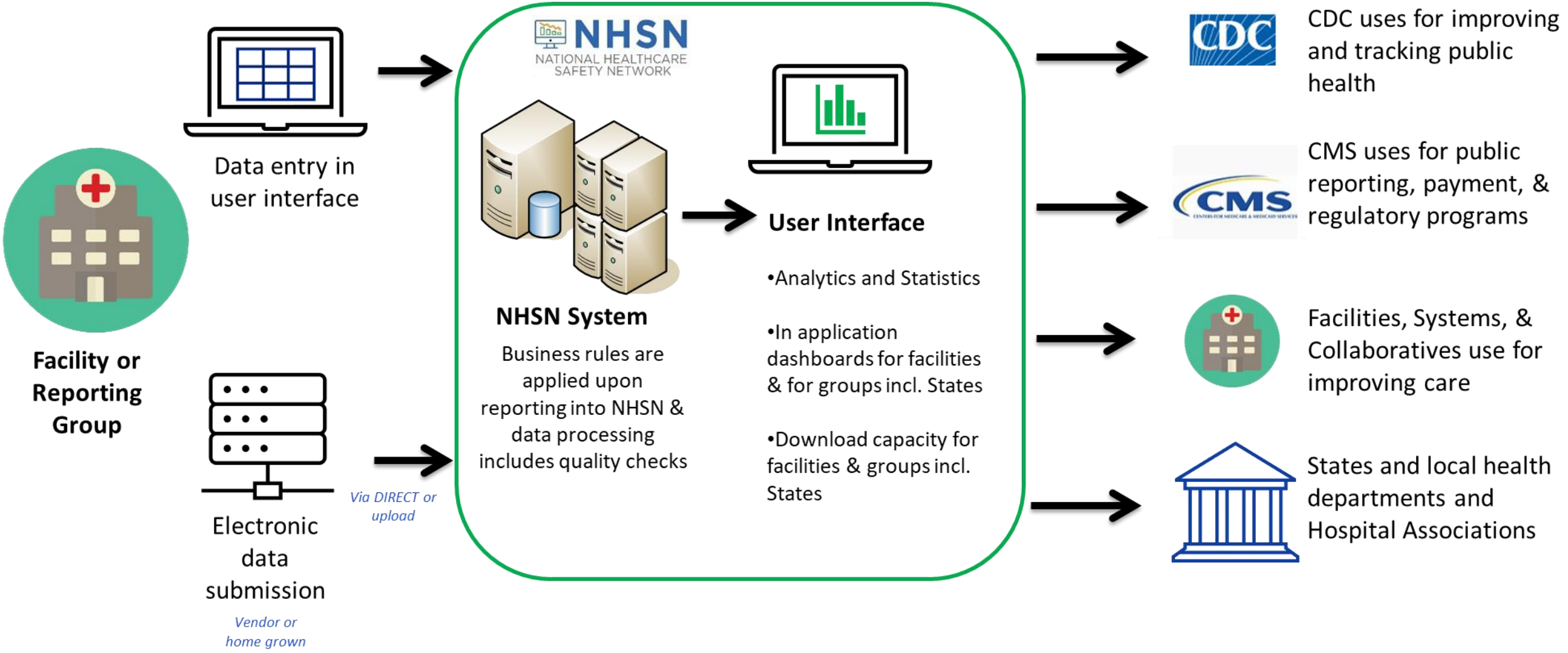
- **Respiratory pathogen surveillance**
- **Adult sepsis**
- **Healthcare-associated VTE**

- **Medication-related hypoglycemia**
- **Healthcare facility-onset, antibiotic-treated *Clostridioides difficile* infection**
- **Hospital-onset bacteremia and fungemia**

- **Medication-related hypoglycemia**
- **Healthcare facility-onset, antibiotic-treated *Clostridioides difficile* infection**
- **Hospital-onset bacteremia and fungemia**

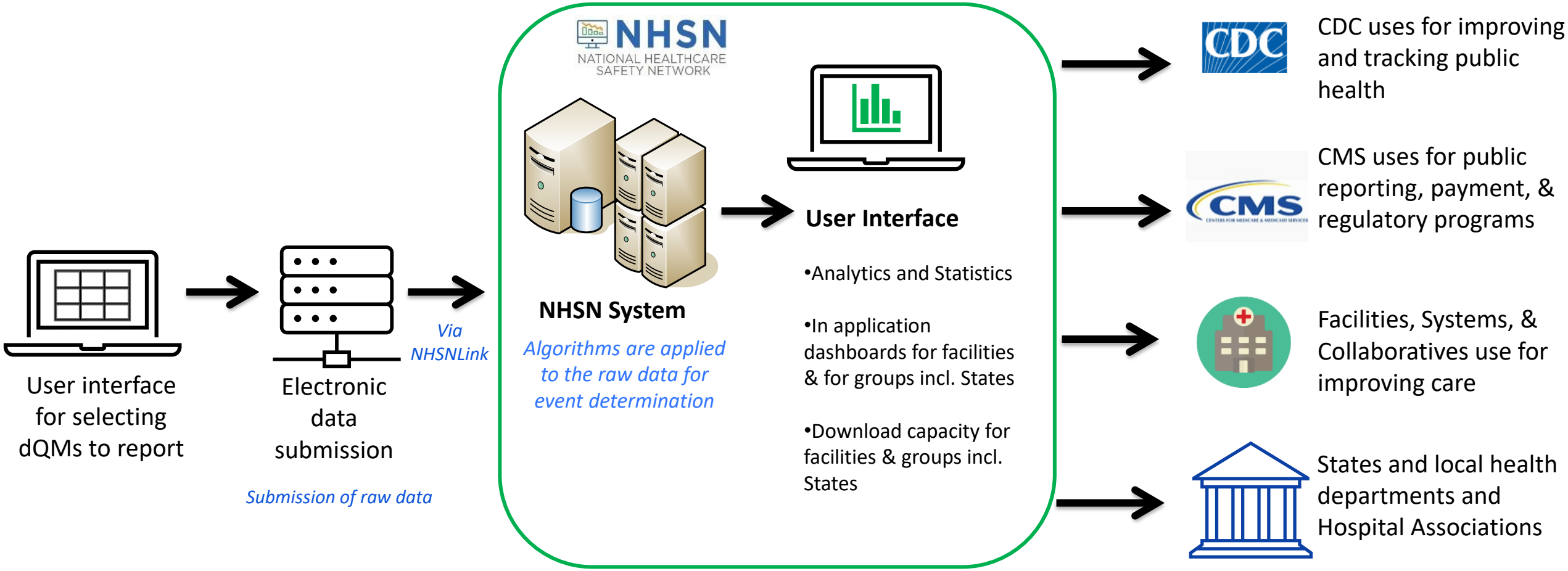
VTE: venous thromboembolism

How NHSN Works: NHSN Data Flow (Current)



How NHSN Digital Measure Reporting Works:

NHSN Data Flow



Patient-Level Data Collection for NHSN dQMs

Process flow from facility EHR to NHSN application

Facility

NHSNLink identifies patients of interest from EHR*

NHSN connects securely to facility via FHIR API

NHSNLink queries EHR to identify data elements required to calculate measures (e.g., medications, labs) for patients of interest

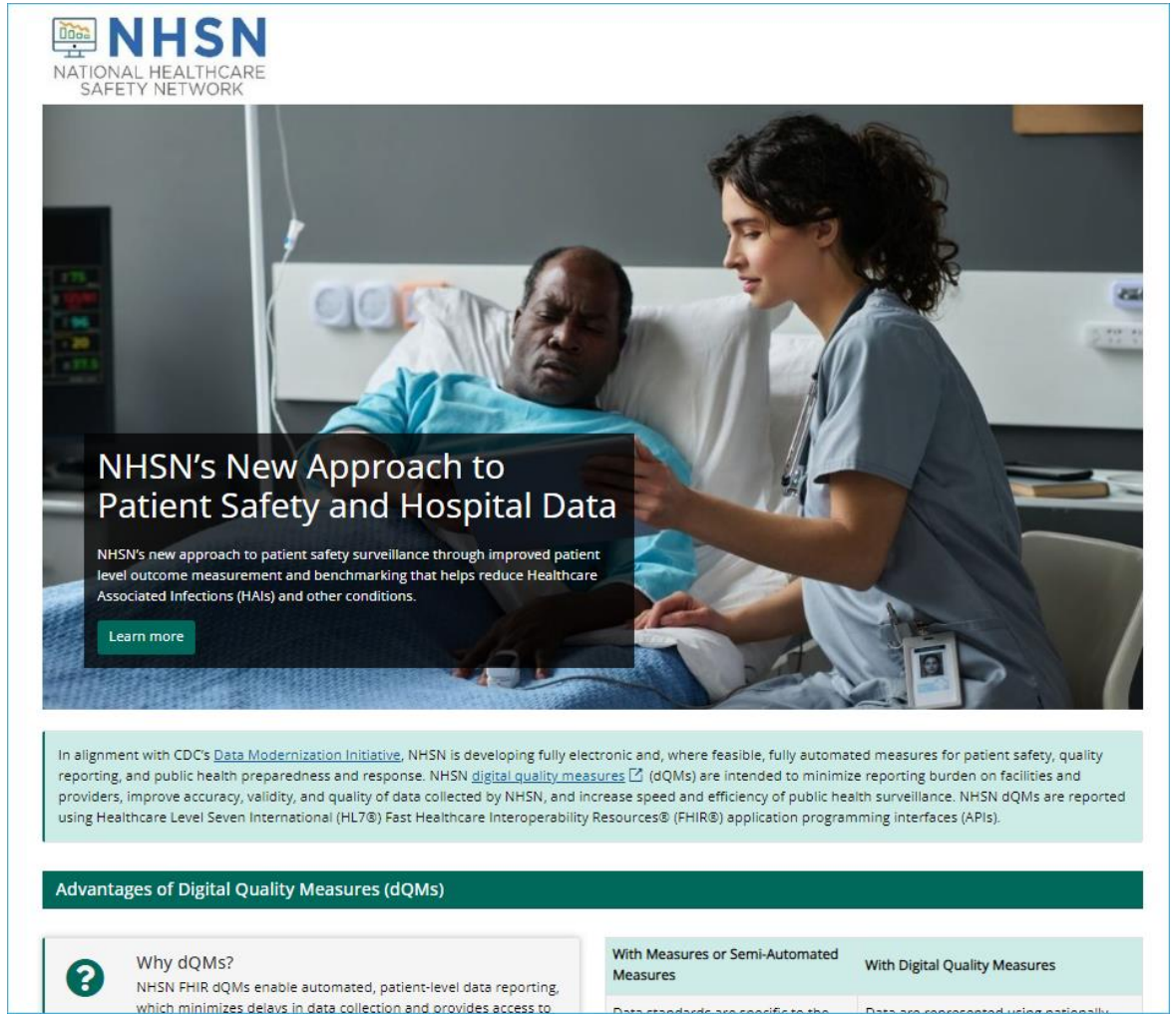
Data further validated and analyzed

NHSN application runs algorithms run to determine if patient meets measure denominator and numerator criteria. Analytics performed and measure reports available for NHSN users.

*Patients in ED, observation, or inpatient *location* or *status* during the measurement period

NHSN dQM Instruction Book

https://www.cdc.gov/nhsn/fhirportal



FHIR Overview

Learn how NHSN FHIR dQMs are reported via NHSNLink, NHSN's FHIR application.

FAQs

Answers on how to connect to NHSNLink, data analysis of dQMs and more!

NHSNCoLab

Collaboration between public and private stakeholders to pilot new NHSN reporting measures.

Respiratory Pathogens Reporting

Respiratory Pathogen Reporting

- Reporting of the of Hospital Respiratory Pathogen, Bed Capacity, and Supply Data (i.e., 'COVID-19 Hospital' data) is voluntary as of May 1, 2024.
- NHSN’s capability to receive COVID-19 data from hospitals has not changed, and the module and reporting modalities (webform, CSV upload, API, etc.) are available for reporting. Current NHSN-based hospital data visualizations are available as a standalone module that visualizes findings from the data voluntarily reported to NHSN after April 30th, including bed occupancy and data completeness summaries.
- The Centers for Medicare & Medicaid Services (CMS) is proposing a new standard requiring hospitals and CAHs to electronically report information about COVID-19, influenza, RSV, and hospital bed capacity in a standardized format and frequency specified by the HHS Secretary. Please contact CMS with questions about the proposed requirements.

NHSN New Automated Respiratory Pathogens Surveillance Module – in Pilot Phase

- **Purpose:** To establish surveillance for acute care and post-acute care healthcare settings that meets the national needs for more comprehensive and timely surveillance of hospitalizations due to respiratory pathogens
- **Definitions:**
  - Respiratory pathogens: COVID-19, Influenza, RSV
  - Combination of laboratory- and medication-confirmed events
- **Key Data Elements: Laboratory, Medications**
- **Facilities will have 2 options for reporting:**
  - FHIR
  - CSV

COVID-19: Coronavirus 2019; RSV: Respiratory Syncytial Virus

Respiratory Pathogens Surveillance Metrics

- Hospitalized patients with respiratory viruses
- Evaluation of admissions and hospital-onset

RSV	COVID-19	Influenza
Percent of all inpatients with RSV	Percent of all inpatients with COVID-19	Percent of all inpatients with influenza
Percent of all ICU patients with RSV	Percent of all ICU patients with COVID-19	Percent of all ICU patients with influenza
Percent of all NICU patients with RSV	Percent of all NICU patients with COVID-19	Percent of all NICU patients with Influenza
Percent of all observation patients with RSV	Percent of all observation patients with COVID-19	Percent of all observation patients with Influenza
Number of RSV admissions	Number of COVID-19 admissions	Number of influenza admissions
Percent of new admissions that are RSV	Percent of new admissions that are COVID-19	Percent of new admissions that are influenza

NHSN Connectivity Initiative: Hospital Bed Capacity Project Overview

NHSN Connectivity Initiative Background

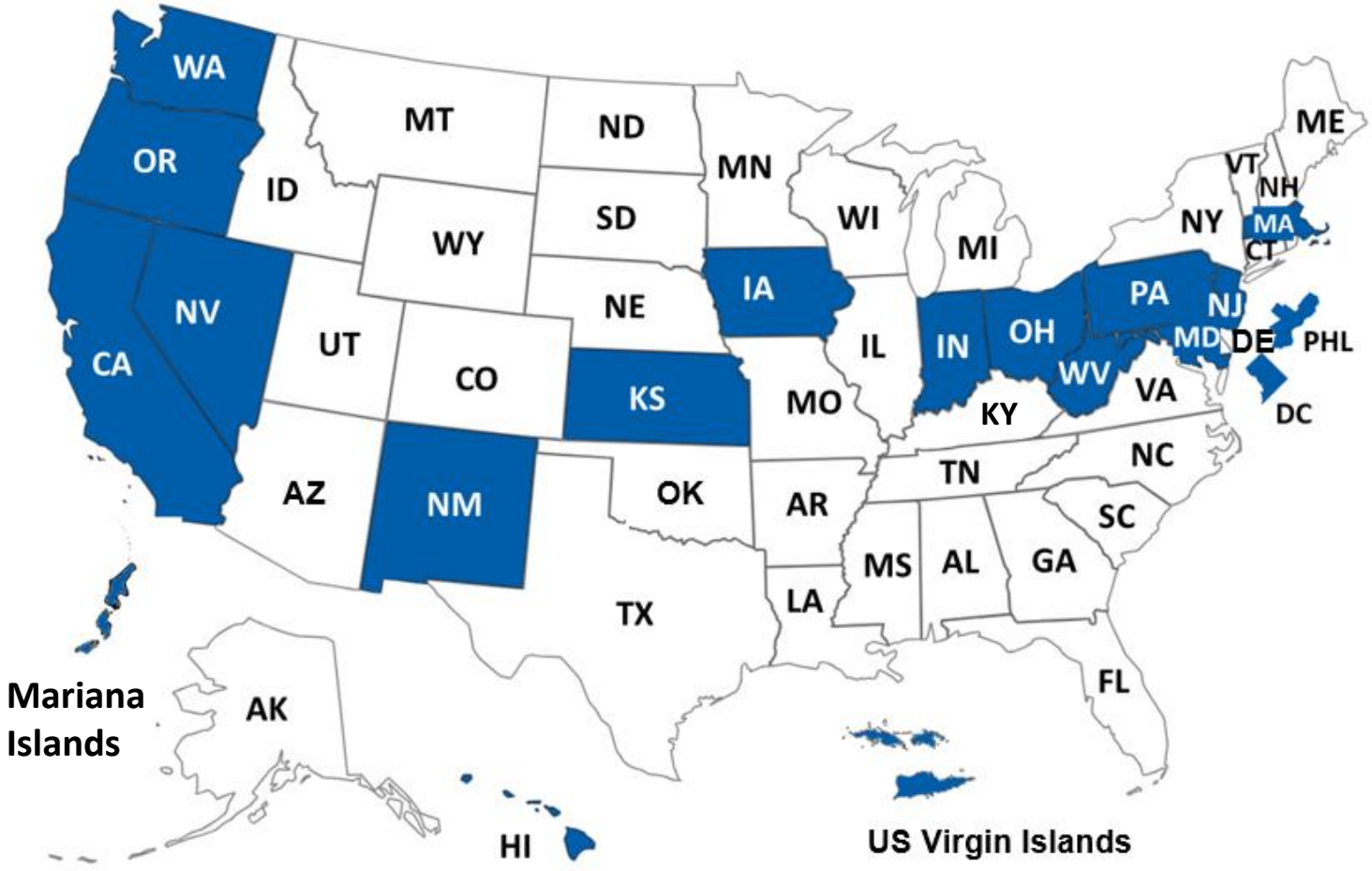
- **Vision**
  - Build infrastructure for the near-time national datastore for healthcare capacity that supports local, state, regional decision-making needs for situational awareness and emergency response as part of the US Government's strategic priorities
  - Combine capacity data with other data sources (pathogen specific, vaccination, PPE, etc.)

- **Next: expand to additional jurisdictions**
  - **Expected Outcomes**
    - Accurate and timely tracking of hospitalizations
    - Improved collaboration among decision-makers to optimize and mitigate resource constraints
    - Better understanding of healthcare system capacity across the nation

- **In 2022/2023, CDC funded Oregon, Massachusetts, and Hawaii for a pilot project to establish a daily automated reporting feed of state hospital bed capacity data to NHSN**
- **Pilot Successes:**
  - Oregon and Hawaii have established data connection to NHSN
  - Massachusetts targets submitting data by the end of Q2 2024

NHSN Connectivity Initiative: Hospital Bed Capacity Project

- ELC Cooperative Agreement SHARP 2 Supplement Special Project
- 19 recipients awarded combined total of $24.9M
- Period of Performance is January 2024 – July 31, 2027
- Oregon Health Authority (OHA) has been designated as the Resource Hub



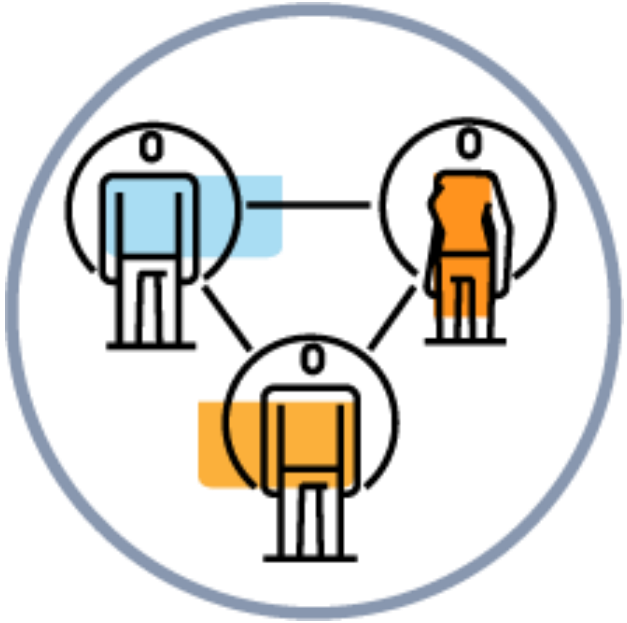
Goals and Objectives of this Phase of Initiative

- **Goals**
  - Establish and sustain ongoing automated bed capacity data collection
  - Standardize core bed capacity data definitions

- **Objectives**
  - Develop and implement secure mechanisms to submit **near real-time hospital bed capacity data** to NHSN
    - *No Personally Identifiable Information (PII) or Protected Health Information (PHI) is collected or transmitted*
  - Achieve a minimum of **90% of acute care hospitals** participation
  - **Optimize jurisdiction capacity system** for daily, surge, and crisis needs
  - Gather feedback for **continuous improvement**

Governance Framework

- Recipients will develop a governance model that meets their unique needs
- Consider how to establish for geographic representation of all hospitals
- Purpose is to centralize discussions and decision making for capacity resources for the state
- Determine how to use real-time data to develop operational standards across providers
- Governance Committee Members incl.
  - Hospitals
  - Hospital Associations
  - Health Departments (state, local)
  - Emergency Responders



Project Timeline

BUDGET/WORKPLAN DEVELOPMENT

Budget and Work Plan development

Engagement with OHA Resource Hub

Attend CDC Office Hours

Engage with Hospital Association

Submit questions to NHSN

Budget workbooks due 02/12/2024

CONTRACTING AND PRE-LAUNCH SUPPORT

Establish contract(s)

Establish governance model

Pre-Launch Kickoff

Pre-Launch Coordination

Q1 2024 - Q4 2024

IT INFRASTRUCTURE AND COORDINATED SCALING

Kick-Off

Data Requirements and Definitions

Collaboration with hospital technical contacts

Deployment of hosting environment and Secure File Transfer Protocol

Q1 -Q2 2025

FINALIZE DATA FEED AND SEND DATA TO NHSN

Establish CDC/NHSN Data Feed

Testing and validation of data feed

Send data daily to CDC/NHSN

Q2-Q4 2025

ONGOING MAINTNENCE AND INNOVATION

Ongoing maintenance

Data quality checks and review

Opportunities for innovation and improvement

Q1 2026 - Q2 2027

Value for Stakeholders

EMS/911

- Real-time data
- In-field decision making
- Reduced dispatch burden
- Time back to 911 call staff
- Comprehensive view
- Maintains ambulances in proximity

Hospitals

- Real-time data
- Dynamic analysis
- Unit load balancing, expedited discharges
- Automated data
- Statewide coordination
- Reduced transfer times

State, Local, & Regional

- Data visualizations
- Dynamic analysis
- Resource coordination
- Capacity planning
- Preparedness integration
- Consistent and reliable data
- Examples incl. support for disaster response across spectrum from no-notice-acute—subacute, respiratory illnesses, burn bed allocation

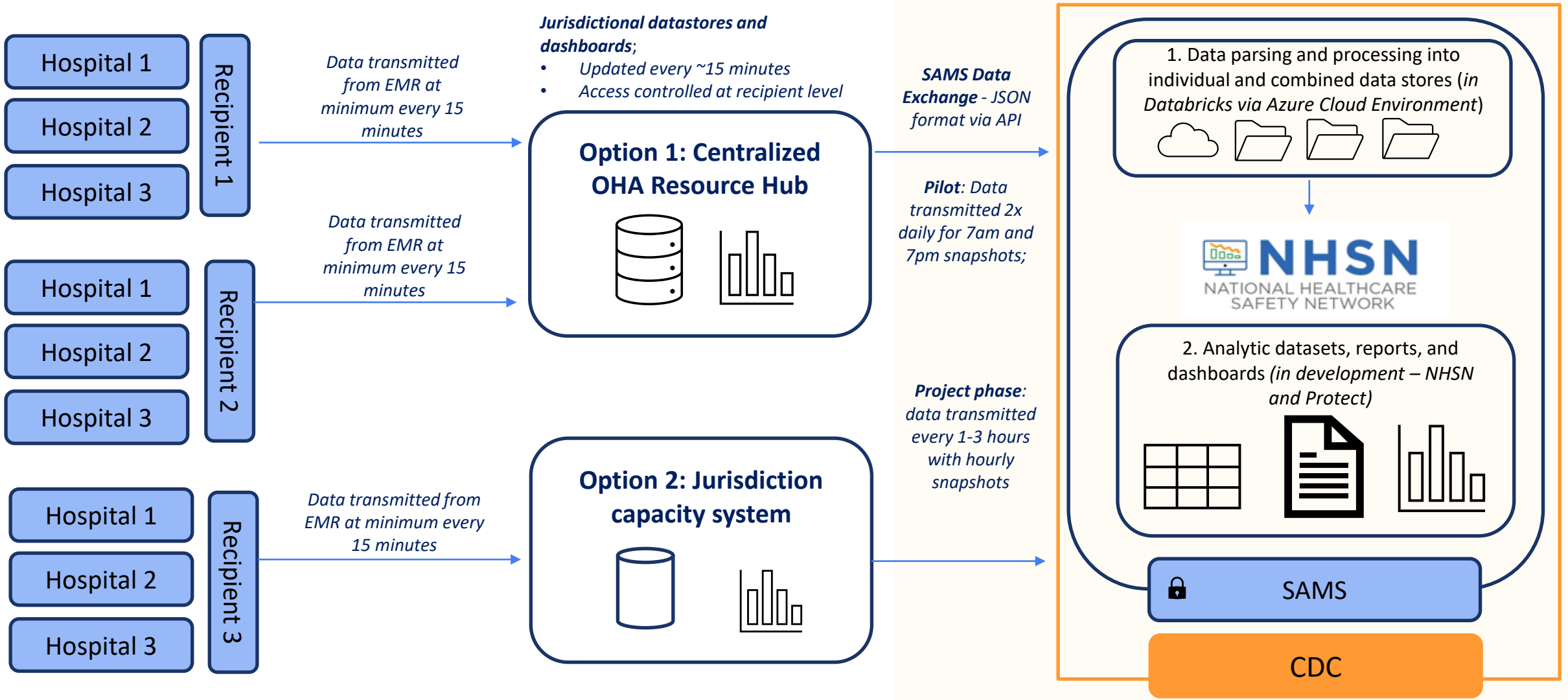
Federal Government

- Standardized national lens for bed capacity
- Inform decisions and policies
- Identify risks to patient safety in healthcare
- Resource allocation
- Coordination of bed allocation for massive disasters

Current Connectivity Options

Connection 1: Hospital-to-jurisdiction capacity system

Connection 2: Jurisdiction-to-NHSN capacity system



Data Elements - Summary

- **77 unique fields across a variety of bed types (occupied and unoccupied counts)**
- **Categories included:**
  - Facility information and datetime
  - Non-specialty adult and pediatric beds
  - Specialty beds
  - Surge beds
  - Emergency department
- **All bed fields represent facility-level aggregates**
- **No pathogen-specific data elements, or anything specific to operational status, supplies, staffing, etc.**

Non-Specialty & Specialty Beds

Non-Specialty Beds	
Non-specialty adult bed census & unoccupied	**Total adult bed census & unoccupied**
	Adult ICU census & unoccupied
	Adult ICU-LOC
	Adult non-ICU census & unoccupied
	Adult progressive care, intermediate care, or step-down
	Adult telemetry, general medicine/surgical/acute care
	Adult observation
Non-specialty pediatric beds & unoccupied	**Total pediatric bed census & unoccupied**
	Pediatric ICU census & unoccupied
	Pediatric ICU-LOC
	Pediatric non-ICU census & unoccupied
	Pediatric progressive care, intermediate care, or step-down
	Pediatric telemetry, general medicine/surgical/acute care
	Pediatric observation

Specialty Beds	
Specialty beds census & unoccupied	**Specialty bed total census & unoccupied**
	Specialty non-crib census & unoccupied
	Obstetrics
	Rehabilitation
	Adult psychiatric
	Pediatric psychiatric
	Specialty crib census & unoccupied
	NICU total census & unoccupied
	NICU 1
	NICU 2
	NICU 3
	NICU 3 Plus
	NICU 4
	Nursery census & unoccupied

Emergency Department

Total emergency department census	**Total ED census**
	Total ED admitted census
Pediatric emergency department census	**Total pediatric ED census**
	Total pediatric ED admitted census
Adult emergency department census	**Total adult ED census**
	Total adult ED admitted census

Surge Beds

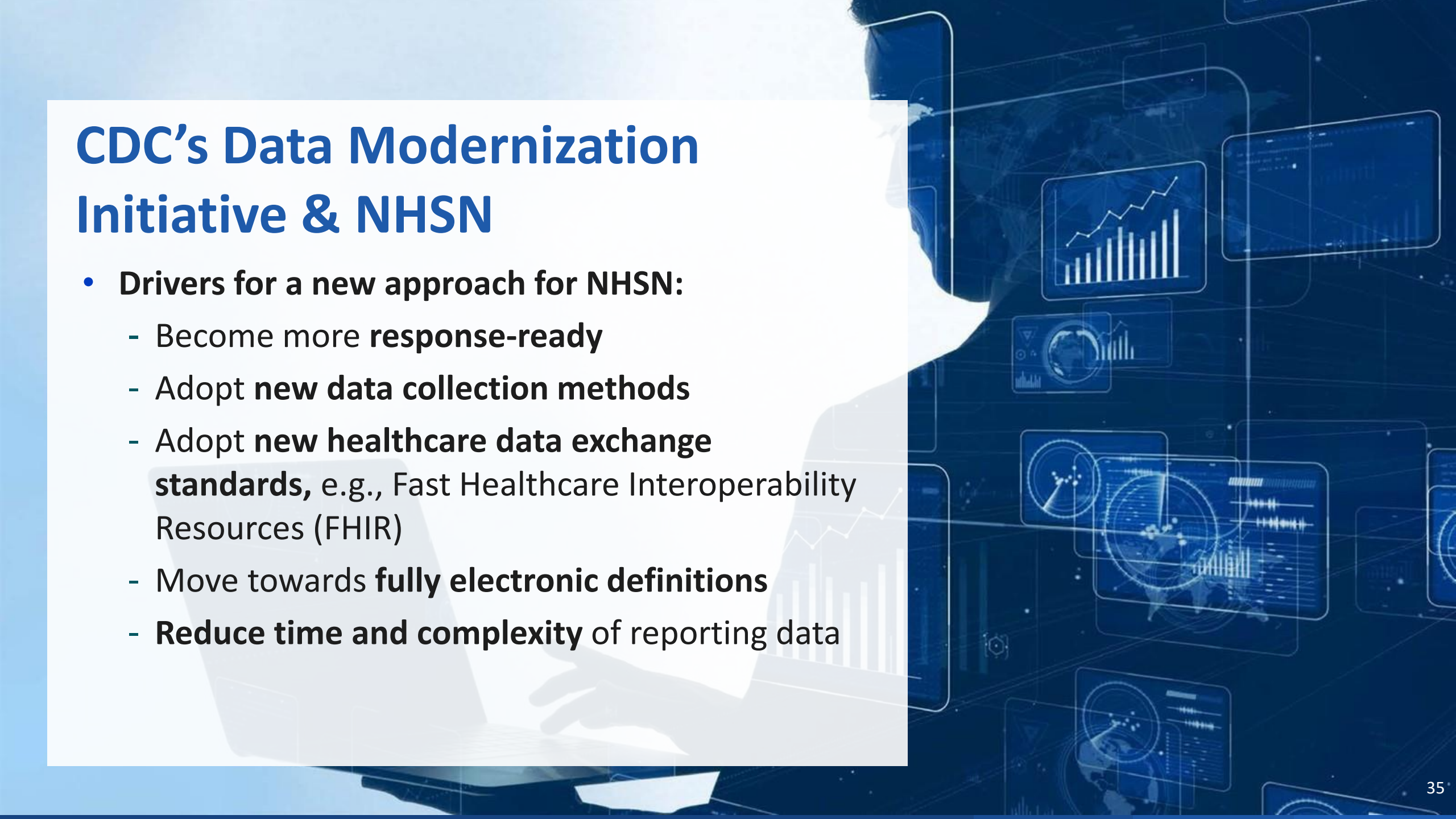
Surge beds census (active only)	**Active surge bed total census**
	Active ICU surge bed census
	Active non-ICU surge bed census
Unoccupied surge beds (active and inactive)	**Unoccupied active surge total beds**
	Unoccupied active surge ICU beds
	Unoccupied active surge non-ICU beds
	Unoccupied inactive surge total beds
	Unoccupied inactive surge ICU beds
	Unoccupied inactive surge non-ICU beds

Thank you!

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

CDC's Data Modernization Initiative & NHSN

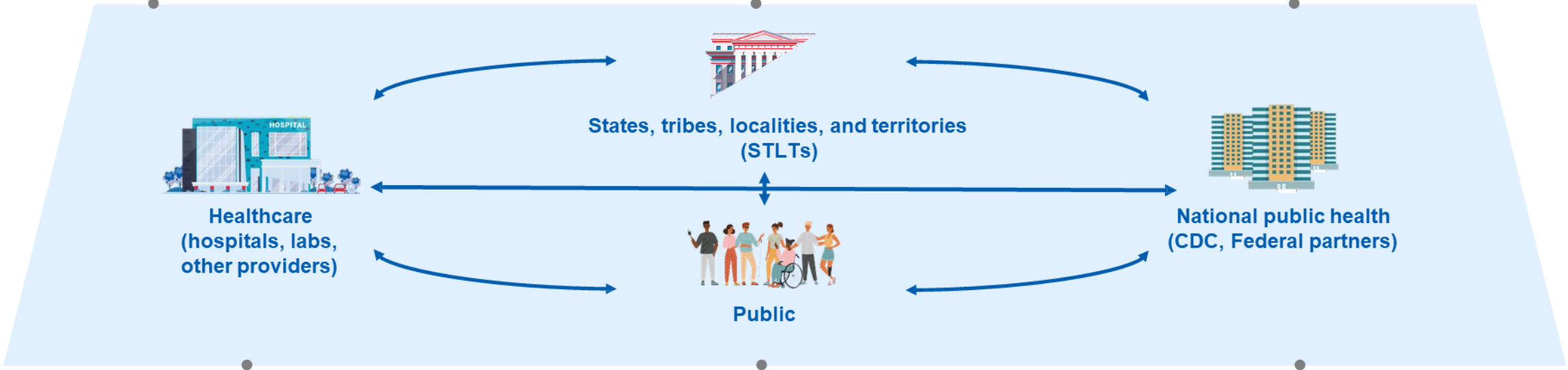
- **Drivers for a new approach for NHSN:**
  - Become more **response-ready**
  - Adopt **new data collection methods**
  - Adopt **new healthcare data exchange standards,** e.g., Fast Healthcare Interoperability Resources (FHIR)
  - Move towards **fully electronic definitions**
  - **Reduce time and complexity** of reporting data



The Public Health Ecosystem & NHSN Connectivity Initiative

CDC's Public Health Data Strategy (PHDS) outlines the data, technology, policy, and administrative actions essential to exchange critical core data efficiently and securely across healthcare and public health. NHSN healthcare capacity data is included in the PHDS Core Data Sources[1].

- **Increased ability for hospitals and STLTs to automatically exchange data with CDC** creates a reliable common operating picture
- **Time saved on data entry, cleaning and analytics,** enables workforce to focus on core public health missions
- **Data on demand enables health disparities analysis** across geographies, conditions, and settings



- **Faster sharing of data** through secure platforms
- **Near real-time awareness of healthcare capacity** through a centralized data platform
- **Faster decision-making and better resource management** during crisis, disasters, and public health emergencies

1. Case (including Electronic Case Reporting eCR), Lab (including Electronic Lab Reporting ELR, Electronic Test Orders and Results ETOR), Emergency department (including National Syndromic Surveillance Program NSSP emergency department data), Vital statistics, Immunization, Healthcare capacity (including National Healthcare Safety Network NHSN data)

Data Definitions – Operational Needs

- Worked with pilot sites to refine definitions for initial roll-out
- Aligned with NHSN Respiratory Virus, Hospital Capacity, and Supply Reporting (“*Covid-19 Hospital Data*”) capacity and occupancy definitions, where overlap exists
- Definitions of units and specialty beds were aligned with other NHSN Protocols
- Locations aligned with NHSN location codes
- Flexibility in what is collected (can modify definitions or add elements over time)

General criteria for inclusion/exclusion

- **For all bed data elements, the staffed beds should be <u>included</u>:**
  - All inpatient **staffed** and **unblocked** beds
  - **Staffed beds:**
    - Represent # of physically available beds with staff on-hand to attend to patients that could occupy the bed.
    - Licensed beds should not be used in place of staffed beds; likely do not represent the facility's actual capacity at any point in time.
- **For all bed data elements, the following types should be <u>excluded</u>:**
  - **Virtual beds** in the EMR that are not physical spaces (i.e., beds used for interoperative phase of care, in certain operative settings, or virtual staging areas for admissions)
  - **Beds no longer in use**, even in case of surge
  - **Blocked beds** (i.e., beds blocked due to logistical or maintenance challenges, staffing restrictions, etc.)

Additional clarifications on criteria

- **Unit vs bed-level data collection:**
  - All bed censuses and counts should not be limited to specific units or locations within the hospital.
  - Therefore, censuses and counts should represent totals across any/all units where a given bed type may be present at the point of data collection.

Balloted Implementation Guide

HL7 Ballot Plans

- NHSN is initiating steps to ballot implementation guide through HL7
- Part of the NHSN ACH dQM IG
- Aiming for September 2024 ballot cycle
- Format will be FHIR compliant JSON bundle

Implementer Engagement Opportunities

- Join us to test at the May 2024 FHIR Connectathon and potentially additional virtual testing opportunities
- Ballot comment period will be open from August 16 – September 16, 2024

Balloted Bed Connectivity Implementation Guide

HL7 Ballot Plans

- Goal of alignment to national standards
- Developing a FHIR compliant implementation guide to bring through HL7 ballot
- NHSN's dQM IG is going to ballot in the September Ballot Cycle
  - IG includes Bed Connectivity examples
- Leveraged existing Data Dictionary that is developed
- Format is FHIR compliant JSON bundle for transmission

Benefits to an HL7 Ballot for Bed Connectivity

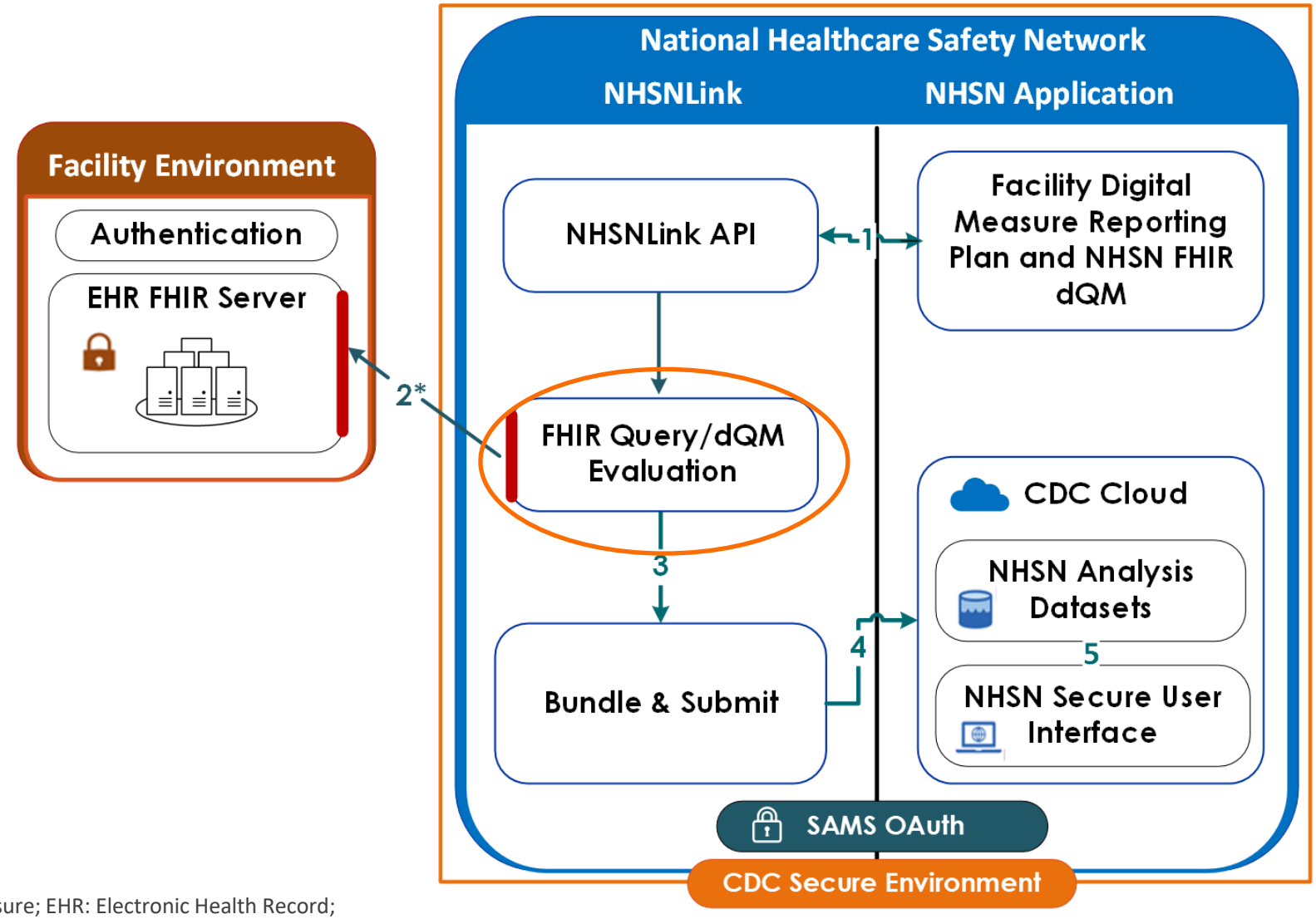
- Allows for NHSN to have one all inclusive, comprehensive IG for automated data submission
  - dQMs and Bed Connectivity would be in the same package
  - Reduction in burden for implementors
  - Reduction in burden to NHSN for updates
- Opportunity for streamlined and more targeted engagement for stakeholders
- Standards and interoperability initiative alignment consistent across NHSN projects

Virtual Testing Event Plans

- Asynchronous testing event for jurisdictions in July/August
- Aiming to have at least three jurisdictions participate
- Goal will be to mimic how data will flow via the FHIR compliant JSON
- Process flow:
  - Oregon/Apprise will develop test files for different scenarios
  - Post to FHIR endpoint
  - NHSN will test transforms and validate

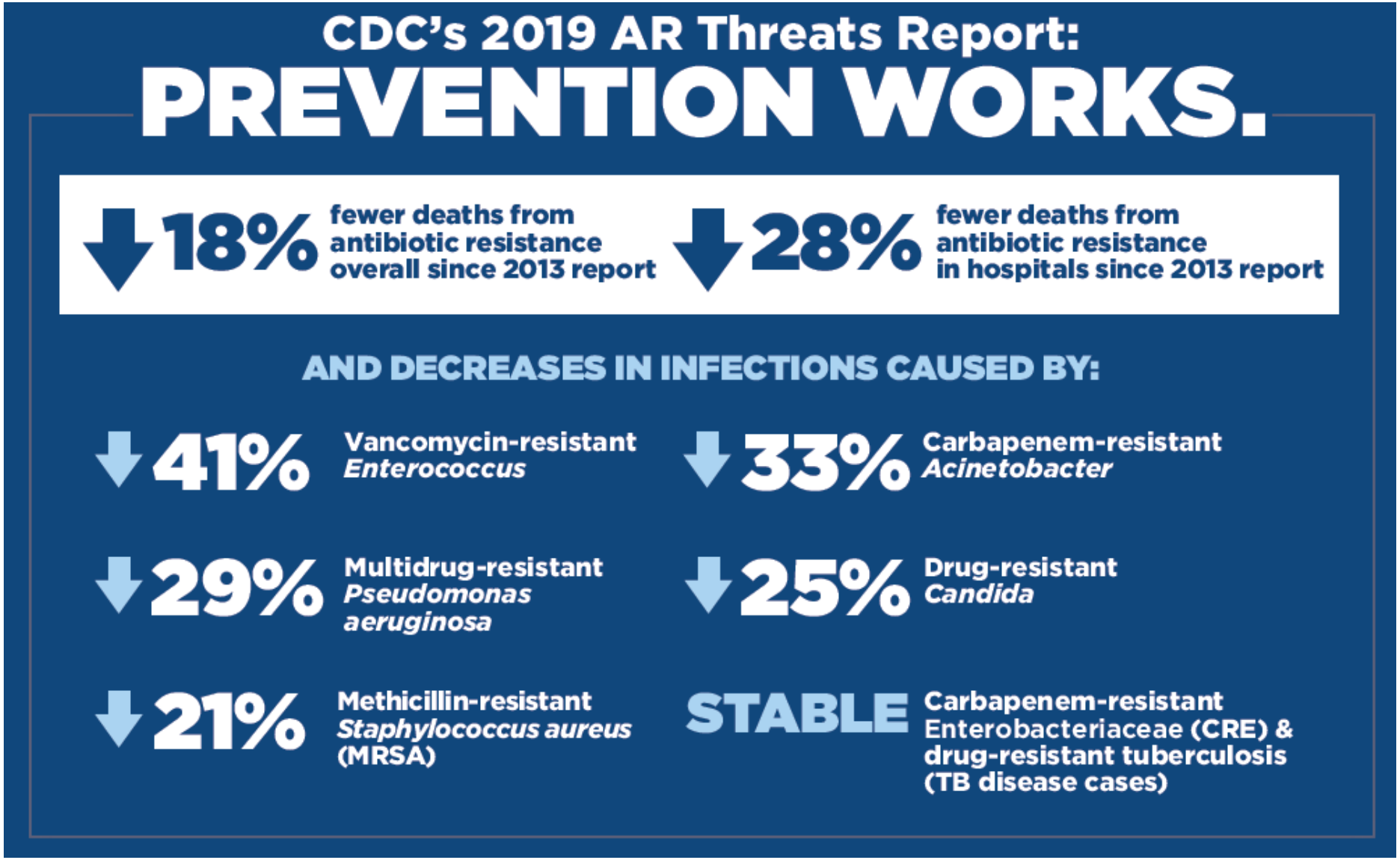
NHSNLink: How it Works

1. Confirm facility enrollment; request and receive NHSN FHIR dQM
2. Request and receive Patients of Interest, then query for required data
3. Evaluate and filter data using dQM criteria
4. Submit data for patients meeting dQM definition
5. NHSN ingests and analyzes submission and makes reports available via secure NHSN user interface



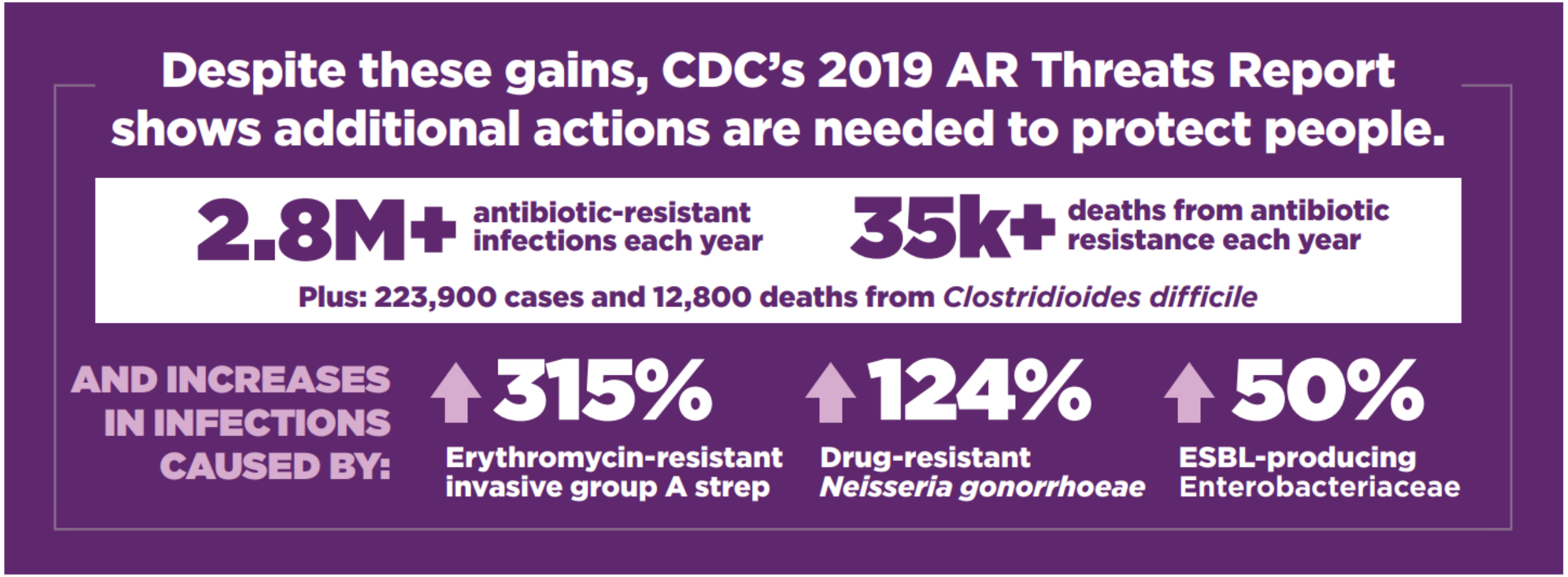
API: Application Programing Interface; dQM: digital quality measure; EHR: Electronic Health Record; FHIR: Fast Healthcare Interoperability Resources; SAMS: Secure Access Management Services

2019: Data Show Prevention Success for Antimicrobial Resistance



https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf

2019: Despite Progress, High Burden of AR

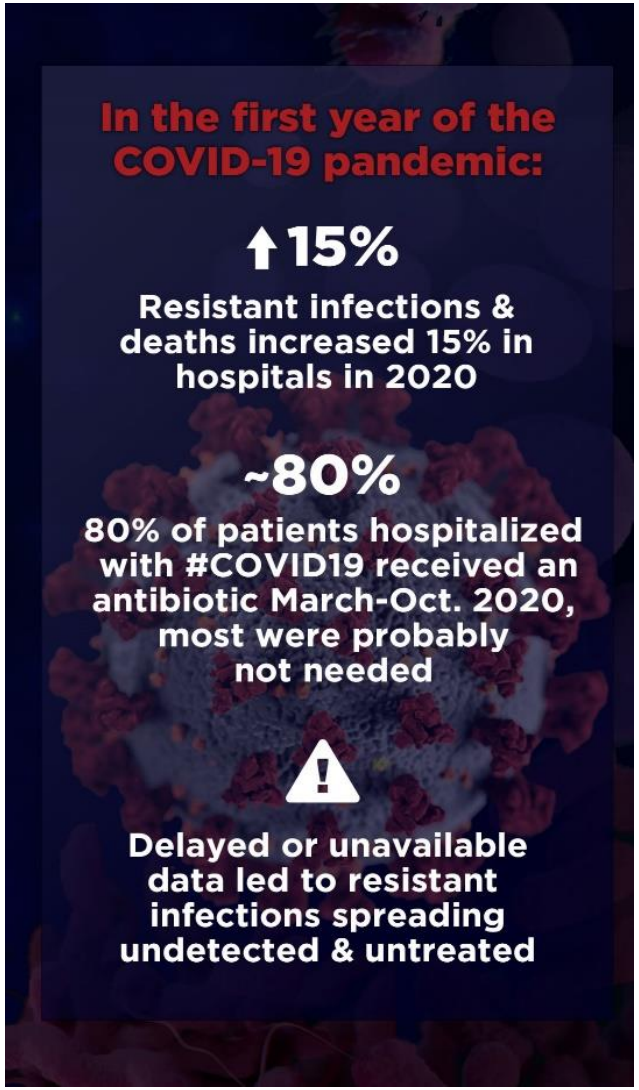


https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf

Impact of COVID-19 Pandemic on AR

Recent prevention successes in hospitals **were reversed by the pandemic:**

- **Resistant hospital-onset infections and deaths both increased at least 15%** during the first year of the pandemic.
- **More than 29,400 people died from AR infections** commonly associated with healthcare during the first year of the pandemic.
  - Of these, **nearly 40% of the people** got the infection while they were in the hospital.
- The burden of resistance is likely much higher, but the pandemic caused **data gaps**.



CDC. COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022. Atlanta, GA: U.S. Department of Health and Human Services, CDC; 2022. https://www.cdc.gov/drugresistance/covid19.html

AR Pathogens During the COVID-19 Pandemic

Because of pandemic impacts, 2020 data are delayed or unavailable for 9 of the 18 antimicrobial resistance threats.

- *Clostridioides difficile (C. diff)*
- Drug-resistant *Neisseria gonorrhoeae*
- Drug-resistant *Campylobacter*
- Drug-resistant nontyphoidal *Salmonella*
- Drug-resistant *Salmonella* serotype Typhi
- Drug-resistant *Shigella*
- Drug-resistant *Streptococcus pneumoniae*
- Erythromycin-resistant group A *Streptococcus*
- Clindamycin-resistant group B *Streptococcus*

Available data show an alarming increase in resistant infections starting during hospitalization, growing at least 15% from 2019 to 2020.

- Carbapenem-resistant *Acinetobacter* (↑78%)
- Antifungal-resistant *Candida auris* (↑60%)*
- Carbapenem-resistant Enterobacterales (↑35%)
- Antifungal-resistant *Candida* (↑26%)
- ESBL-producing Enterobacterales (↑32%)
- Vancomycin-resistant Enterococcus (↑14%)
- Multidrug-resistant *P. aeruginosa* (↑32%)
- Methicillin-resistant *Staphylococcus aureus* (↑13%)

**Candida auris* was not included in the hospital-onset rate calculation of 15%. See Data Table and Methods for more information on this pathogen.

CDC. COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022. Atlanta, GA: U.S. Department of Health and Human Services, CDC; 2022. https://www.cdc.gov/drugresistance/covid19.html