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2022 Healthcare Associated Infections: Acute Care Hospitals, Non-Acute Care Hospitals

Dialysis

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Healthcare-associated infections (HAIs) are infections that patients acquire during the course of receiving treatment for other conditions within a healthcare setting**.**

* + HAIs are among the leading causes of preventable death in the United States, affecting 1 in 17 hospitalized patients, accounting for an estimated 1.7 million infections and an associated 98,000 deaths.\*

The Massachusetts Department of Public Health (DPH) developed this data update as a component of the Statewide Infection Prevention and Control Program created pursuant to [Chapter 58 of the Acts of 2006](http://www.malegislature.gov/Laws/SessionLaws/Acts/2006/Chapter58).

* + Massachusetts law provides DPH with the legal authority to conduct surveillance, and to investigate and control the spread of communicable and infectious diseases. ([MGL c. 111,sections 6 & 7](http://www.malegislature.gov/Laws/GeneralLaws/PartI/TitleXVI/Chapter111/Section111))
  + DPH implements this responsibility in hospitals through the hospital licensing regulation. (105 CMR 130.000)
  + DPH implements this responsibility in dialysis centers through the out-of-hospital dialysis regulation (105 CMR 145.000)
  + Section 51H of chapter 111 of the Massachusetts General Laws authorizes the Department to collect HAI data and disseminate the information publicly to encourage quality improvement. (<https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXVI/Chapter111/Section51H>)

Haque M, Sartelli M, McKimm J, Abu Bakar M. Healthcare-associated Infections - an Overview. *Infect Drug Resist*. 2018;11:2321–2333.

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Purpose

This HAI presentation is the 14th annual Public Health Council update:

* An important component of larger efforts to reduce preventable infections in healthcare settings
* Presents an analysis of progress in infection prevention within Massachusetts' healthcare facilities
* Provides an overview of infection prevention and control, antibiotic resistance, and stewardship activities.
* Considers the impact of COVID-19 in Massachusetts healthcare settings
* Based upon work supported by funding from both the state and the Centers for Disease Control and Prevention (CDC)

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Methods

The acute care hospital data summary includes the following statewide measures for the 2022 calendar year (January 1, 2022– December 31, 2022) as reported to the CDC’s National Healthcare Safety Network (NHSN).

DPH-required measures are consistent with the Centers for Medicare and Medicaid Services (CMS) quality reporting measures.

* Central line-associated bloodstream infections (CLABSI) in intensive care units and wards
* Catheter-associated urinary tract infections (CAUTI) in intensive care units and wards
* Specific surgical site infections (SSI)
* Specific facility-wide laboratory identified events (LabID)

*National baseline data for each measure are based on a statistical risk model derived from 2015 national data*

*^ All data were extracted from NHSN on August 1, 2023*

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Standardized Infection Ratio (SIR)

Standardized Infection Ratio (SIR) = The actual number of infections divided by the predicted number oof infections.

Standard Utilization Ratio (SUR) = The number of device days divided by the predicted number of device days.

If the SIR/SUR > 1.0, more infections/device days were reported than predicted

If the SIR/SUR = 1.0, the number of infections/number of device days is equal to the predicted number

If the SIR/SUR < 1.0, fewer infections/device days were reported than predicted

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How to Interpret SIRs/SURs and 95% Confidence Intervals (CIs)

The green horizontal bar represents the SIR/SUR, and the blue vertical bar represents the 95% confidence interval (CI). The 95% CI measures the probability that the true SIR/SUR falls between the two parameters.

If the blue vertical bar crosses 1.0 (highlighted in orange), then the actual rate is not statistically significantly different from the predicted rate.

If the blue vertical bar is completely above or below 1.0, then the actual is statistically significantly different from the predicted rate.

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Central Line-Associated Bloodstream Infections (CLABSI):  
Standard Infection Ratio in Adult and Pediatric ICUs and Wards

Key Findings

Four-unit types experienced a significantly lower number of infections than predicted, based on 2015 national aggregate data.

There were no unit types that experienced a significantly higher number of infections than predicted, based on 2015 national aggregate data.

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Central Line-Associated Bloodstream Infections (CLABSI):  
Standard Utilization Ratio in Adult and Pediatric ICUs and Wards

CLABSI Standard Utilization Ratio (SUR) by ICU type

Key Findings

Ten unit types experienced a significantly lower number of device days than predicted, based on 2015 national aggregate data.

Eight unit types experienced a significantly higher number of device days than predicted, based on 2015 national aggregate data.

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CLABSI Adult & Pediatric ICU Pathogens for 2021 and 2022

ICU Pathogens

Calendar year 2021: ICU pathogens n =241. staphylococcus aureus (not MRSA), 3%; Methicillin resistant staphylococcus aureus, 2%; Coagulase negative staphylococcus, 19%; Enterococcus sp.,20%; gram positive 5%; gram-negative bacteria 15%; Candida albicans, 11%; yeast fungus, other 13%; multiple organisms, 12%;

Calendar year 2022: ICU pathogens n = 198. staphylococcus aureus (not MRSA), 9%; Methicillin resistant staphylococcus aureus, 9%; Coagulase negative staphylococcus, 12%; Enterococcus sp.,23%; gram positive 5%; gram-negative bacteria 22%; Candida albicans, 11%; yeast fungus, other 14%; multiple organisms, 10%;

Ward Pathogens

Calendar year 2021: Ward pathogens n =123. staphylococcus aureus (not MRSA), 9%; Methicillin resistant staphylococcus aureus, 9%; Enterococcus sp.,17 %; gram positive 5%; gram-negative bacteria 35%; Candida albicans,2%; yeast fungus, other 3%; multiple organisms, 7%;

Calendar year 2022: Ward pathogens n =179. staphylococcus aureus (not MRSA), 17%; Methicillin resistant staphylococcus aureus, 7%; Enterococcus sp.,13 %; gram positive 1%; gram-negative bacteria 23%; Candida albicans,8%; yeast fungus, other 8%; multiple organisms, 12%;

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State CLABSI SIR and SUR in ICU and Wards

Key Findings

In 2022, adult ICUs and wards experienced a significantly lower number of infections than predicted, based on 2015 national aggregate data.

In 2022, adult ICUs, pediatric ICUs, and pediatric Wards experienced a significantly higher number of device days than predicted, based on 2015 national aggregate data.

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Central Line-Associated Bloodstream Infections (CLABSI):  
Neonatal ICUs by Birth Weight Category

Key Findings

There were 17 CLABSIs reported in Neonatal ICUs in 2022.

There were no birthweight categories experiencing a significantly higher or lower number of infections than predicted, based on 2015 national aggregate data.

Four birthweight categories experienced a significantly lower number of device days than predicted, based on 2015 national aggregate data.

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CLABSI NICU Pathogens for 2021 and 2022

Calendar year 2021 n=19%; Staphylococcus aureus not MRSA, 21%; Coagulase-negative staphylococcus 16%; enterococcus sp., 10%.; Escherichia coli, 11%; Gram-negative (other) bacteria 32%; Candida and other yeast/fungus, 5%; multiple organisms, 5%

Calendar year 2021; n=17; Staphylococcus aureus not MRSA, 23%; Coagulase-negative staphylococcus, 23%; Escherichia coli, 18%; Gram-negative bacteria (other)18%; Candida and other yeast/fungus, 6%; multiple organisms, 12%

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Catheter-Associated Urinary Tract Infections (CAUTI):  
Standard Infection Ratio in Adult and Pediatric ICUs and Wards

Key Findings

Four unit types experienced a significantly lower number of infections than predicted, based on 2015 national aggregate data.

One unit type experienced a significantly higher number of infections than predicted, based on 2015 national aggregate data.

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Catheter-Associated Urinary Tract infection (CAUTI) SIR in. Adult and Pediatric ICUs and Wards

CAUTI Standard Infection Ratio (SIR) by IU Type

Key Findings

Ten unit types experienced a significantly lower number of device days than predicted, based on 2015 national aggregate data.

Seven unit types experienced a significantly higher number of device days than predicted, based on 2015 national aggregate data.

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CAUTI Adult and Pediatric Pathogens for 2021 and 2022

Catheter-Associated Urinary Tract Infections (CAUTI):  
Standard Utilization Ratio in Adult and Pediatric ICUs and Wards

ICU pathogens.

Calendar year 2021: n=276

Coagulase- negative Staphylococcus,4%; Enterococcus sp.,17%; Gram-positive bacteria (other), 4%; Escherichia coli 34%; Pseudomonas aeruginosa, 14%; Klebsiella pneumoniae, 7%; Gram negative bacteria, 13%; multiple organisms, 8%.

Calendar year 2022 n= 200

Coagulase- negative Staphylococcus,1%; Enterococcus sp.,13%; Gram-positive bacteria (other), 2%; Escherichia coli 35%; Pseudomonas aeruginosa, 16%; Klebsiella pneumoniae, 11%; Gram negative bacteria, 17%; multiple organisms, 7%.

Ward pathogens n=230

Calendar year 2021

Coagulase- negative Staphylococcus,4%; Enterococcus sp.,11%; Gram-positive bacteria (other), 2%; Escherichia coli 32%; Pseudomonas aeruginosa, 16%; Klebsiella pneumoniae, 9%; Gram negative bacteria, 16%; multiple organisms, 12%.

Ward pathogens n=269

Calendar year 2022

Coagulase- negative Staphylococcus,2%; Enterococcus sp.,7%; Gram-positive bacteria (other), 2%; Escherichia coli 30%; Pseudomonas aeruginosa, 13%; Klebsiella pneumoniae, 11%; Gram negative bacteria, 18%; multiple organisms, 16%.

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State CAUTI SIR and SUR in ICU and Wards

Key Findings

In 2022, adult ICUs experienced a significantly lower number of infections and adult Wards experience a significantly higher number of infections than predicted, based on 2015 national aggregate data.

In 2022, pediatric ICUs experienced a significantly higher number of device days than predicted, based on 2015 national aggregate data.

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Surgical Site Infections (SSI)  
Coronary Artery Bypass Graft (CABG) SIR and Colon Procedure (COLO) SIR

Key Findings

In 2022, MA acute care hospitals performing coronary artery bypass graft (CABG) and colon (COLO) surgeries experienced the same number of infections as predicted, based on 2015 national aggregate data.

There were 40 CABG SSIs reported in 2022.

There were 195 COLO SSIs reported in 2022.

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Surgical Site Infections (SSI)  
Knee Prosthesis (KPRO) SIR and Hip Prosthesis (HPRO) SIR

State CAUTI SIR in ICU and Wards

Key Findings

In 2022, MA acute care hospitals performing knee (KPRO) and hip (HPRO) prosthesis procedures experienced the same number of infections as predicted, based on 2015 national aggregate data.

There were 45 KPRO SSIs reported in 2022, with one facility accounting for over 20% of the reported events.

There were 65 HPRO SSIs reported in 2022.

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Surgical Site Infections (SSI)  
Abdominal Hysterectomy (HYST) SIR and Vaginal Hysterectomy (VHYS) SIR

Key Findings

In 2022, MA acute care hospitals performing abdominal hysterectomy (HYST) procedures experienced a significantly lower number of infections than predicted, based on 2015 national aggregate data.

There were 14 HYST SSIs reported in 2022.

There was 1 VHYS SSI reported in 2022.

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SSI Pathogens for 2021-2022  
CABG, KPRO, HPRO, HYST, VHYS, COLO

Calendar year 2021 January 1, 2021- December 31, 2021 n=388;

Staphylococcus aureus not MRSA, 13%; Methicillin-resistant Staphylococcus 3%; coagulase negative staphylococcus, 6%; Enterococcus sp., 4%; gram- bacteria (other) 4%; Escherichia coli, 7%; pseudomonas aeruginosa, 0.9%; Klebsiella pnuemoniae, 1%; Gram-negative bacteria 8%; candida and other yeast /fungus, 3%; multiple organisms, 30%;no organism identified, 18%; other, 0.3%

Calendar year 2022 January 1, 2022- December 31, 2022 n=360;

Staphylococcus aureus not MRSA, 14%; Methicillin-resistant Staphylococcus 4%; coagulase negative staphylococcus, 4%; Enterococcus sp., 6%; gram- bacteria (other) 7%; Escherichia coli, 1%; pseudomonas aeruginosa, 0.3%; Klebsiella pnuemoniae, 5%; Gram-negative bacteria 3%; candida and other yeast /fungus, 3%; multiple organisms, 33%;no organism identified, 18%;

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Statewide SSI Trends by Year 2015-2022

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Laboratory Identified Events (LabID)  
Clostridioides difficile (CDI) SIR and Methicillin-resistant Staphylococcus aureus (MRSA) SIR

Key Findings

For the past six years, MA hospitals reporting CDI and MRSA events experienced significantly lower number of infections than predicted, based on 2015 national aggregate data.

There were 1,423 CDI events reported in 2022.

There were 177 MRSA events reported in 2022.

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Statewide LabID Trends by Year  
2015-2022

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Non-Acute Care Hospitals  
State CLABSI and CAUTI SIR and SUR

Key Findings

In 2022, Long-Term Acute Care (LTAC) Hospital ICUs and Wards experienced a significantly lower number of central line days than predicted, based on 2015 national aggregate data.

In 2022, Long-Term Acute Care Hospital ICUs experienced a significantly higher number of catheter-associated infections and Inpatient Rehab Facilities (IRFs) experienced a significantly higher number of catheter days than predicted, based on 2015 national aggregate data.

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Non-Acute Care Hospitals  
Clostridioides difficile (CDI) SIR and Methicillin-resistant Staphylococcus aureus (MRSA) SIR

Laboratory Identified Events (LabID): Clostridium difficile (CDI) SIR

Key Findings

For the past four years, MA non-acute care hospitals reporting CDI and MRSA events experienced significantly lower number of infections than predicted, based on 2015 national aggregate data.

There were 128 CDI events reported in 2022.

There were 10 MRSA events reported in 2022.

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Dialysis Bloodstream Infections (BSI):  
Standard Infection Ratio by Year and Access Type

Key Findings

For the past three years, all access types of access for hemodialysis (central venous catheters (CVC), arteriovenous fistulas and arteriovenous grafts, experienced a significantly lower number of infections than predicted, based on 2014 national aggregate data.

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Dialysis Antibiotic Start Rates by Year and Access Type  
2017-2022

Key Findings

Antibiotic and vancomycin start rates are highest in those with any kind of central venous catheter.

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DPH HAI Prevention and Response Activities

* Comprehensive proactive and responsive on-site Infection Control Assessment and Response (ICAR) visits are conducted at a variety of healthcare facilities.  During these visits, an epidemiologist and public health nurse:
  + Discuss facility infection prevention and control policies and practices;
  + Observe hand hygiene, PPE use, environmental cleaning and disinfection, wound care, point of care blood glucose testing, vaccine storage, and provide feedback and coaching to the facility staff;
  + A comprehensive report is provided to facility leadership with resources and recommendations for improvement.
* Conducted webinars for nursing home staff on topics such as:
  + Enhanced barrier precautions to protect at-risk residents
  + Invasive group A streptococcus due to an increase in cases and clusters
* Promote CDC’s National Training Collaborative, Project Firstline, and develop MA-specific infection control training content and learning programs for frontline healthcare workers.
* Conducted three in-person simulation trainings for dialysis nurses, technicians and infection preventionists on CDC's dialysis evidence-based best practice recommendations.
  + Program content and materials shared with multiple state health departments to promote dialysis training nationwide.

NEW Developed and distributed quarterly dialysis and non-acute hospital data cleaning reports sharing summary statistics using data submitted to NHSN.

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Antibiotic Resistance:   
Targeting Carbapenemase-producing Organisms (CPO) in MA

* Carbapenems are a class of antibiotics often considered a “last resort” to treat infections caused by Enterobacterales, *Pseudomonas*, and *Acinetobacter*
* One way these organisms are resistant to carbapenems is by   
  producing carbapenemases
* A carbapenemase is an enzyme that can break down (and thus resist)   
  many classes of antibiotics, including carbapenems, making infections   
  with these organisms harder to treat
* Genes that program the organism to produce a carbapenemase   
  can be shared between bacteria
* Carbapenemase gene targets: KPC, NDM, VIM, OXA and IMP
* CDC’s July 2022 [COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report](https://urldefense.com/v3/__https:/www.cdc.gov/drugresistance/pdf/covid19-impact-report-508.pdf__;!!CUhgQOZqV7M!jQVhxvhxJhTbVNdbSa2gcmOpkDiYlcnee9MpHyAdCks4jHB-wkY27p-WuN6gxj308F1K20SQZlF_7EUDm-7A$),   
  concluded that the threat of antimicrobial-resistant infections worsened—with resistant   
  hospital-onset infections and deaths both increasing at least 15% during the first year of   
  the COVID-19 pandemic.

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Antibiotic Resistance Surveillance:   
Reporting and Laboratory Testing Methods

Electronic laboratory reporting (ELR) of multidrug-resistant organisms (MDROs) of concern into the Massachusetts Virtual Epidemiologic Network (MAVEN) is mandatory for clinical laboratories

Mandatory submission of selected MDRO isolates to the Massachusetts State Public Health Laboratory (MA SPHL) for advanced testing at MA SPHL and at our regional Antimicrobial Resistant Laboratory Network (ARLN), the Wadsworth Center in New York:

Identify novel resistance mechanisms such as genes that code for carbapenemase production or   
colistin resistance

Identify Candida auris

Test swabs to identify colonization with target organisms to detect transmission within a healthcare facility

Conduct whole-genome sequencing to determine relatedness of organisms to identify transmission pathways within and across healthcare facilities

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Antibiotic Resistance Surveillance: Increasing Candida auris and Carbapenemase-producing Organism (CPO) Cases in MA

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Antibiotic Resistance Surveillance:

Carbapenemase-producing Organisms (CPOs) in MA

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Antibiotic Stewardship

Studies indicate that between 30-50% of antibiotics prescribed in hospitals and between 40-75% of antibiotics prescribed in nursing homes are unnecessary\*

Improved prescribing practices can help reduce rates of Clostridioides difficile and   
antibiotic resistance

Appropriate antibiotic prescribing can improve patient outcomes and reduce healthcare costs.

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Antibiotic Stewardship: Prevention and Educational Activities

This year, DPH is host health department to one of four IDSA/SHEA Leadership in Epidemiology, Antimicrobial Stewardship, and Public Health Fellows.

In addition to collaborating with the health department, Dr. Kap Sum Foong of Tufts Medical Center will pilot a program to remove unnecessary antibiotic allergy labels in long term care facilities.

Continued collection and analysis of facility-level antibiotic use data voluntarily submitted by long-term care facilities.

76 facilities reported at least one month of data in 2022, on average 43 facilities reported each month.

Updated AS Honor Roll highlighting facilities with consistent participation: https://mainfectioncontrol.populationhealthexchange.org/ltcf-as/antibiotic-stewardship-honor-roll/

Ongoing collaboration with antibiotic stewardship (AS) experts from Tufts Medical Center to enhance AS support and activities in long-term care facilities, including monthly office hours.

Re-established the Antimicrobial Use (AU) Subcommittee of the statewide HAI/AR Technical Advisory Group to provide guidance on how to best leverage NHSN AU module data for understanding trends in antibiotic use, monitoring stewardship activities, and obtaining a comprehensive, statewide picture of antibiotic use in the acute care setting.

Currently, DPH has access to NHSN AU data for 34 acute care hospitals.

Hospitals participating in the CMS Promoting Interoperability (PI) Program must begin reporting AUR Surveillance data in calendar year 2024.

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Thank you for the opportunity to present this information today.

Please direct any questions to:

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