Slide 1

2021 Healthcare Associated Infections: Acute Care Hospitals

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Slide 2

Introduction

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 infections and an associated 98,000 deaths during hospitalization. \*

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.

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)

DPH implements this responsibility in hospitals through the hospital licensing regulation. (105 CMR 130.000)

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. Health care-associated infections - an overview. Infect Drug Resist. 2018;11:2321–2333.

Slide 3

Introduction

This HAI presentation is the 13th annual Public Health Council update:

An important component of larger efforts to reduce preventable infections in health care settings;

Presents an analysis of progress on infection prevention within Massachusetts acute care hospitals

Based upon work supported by state funds and the Centers for Disease Control and Prevention (CDC).

Provides an overview of antibiotic resistance and stewardship activities

Considers the impact of COVID-19 on Massachusetts acute care hospitals

Slide 4

Methods

This data summary includes the following statewide measures for the 2021 calendar year (January 1, 2021 – December 31, 2021) 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 15, 2022*

Slide 5

Measures

The Standardized Infection Ratio (SIR) is calculated by dividing the actual number of infections by the predicted number of infections.

The Standard Utilization Ratio is calculated by dividing the actual number of device days 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

Slide 6

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

The green horizontal bar represents the SIR, and the blue vertical bar represents the 95% confidence interval (CI). The 95% CI measures the probability that the true SIR 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.

Slide 7  
Central Line-Associated Bloodstream Infections (CLABSI): Standard Infection Ratio in Adult and Pediatric ICUs and Wards

Key Findings

Three unit types experienced a significantly lower number of infections than predicted, based on 2015 national aggregate data. Cardiothoracic ICU Medical/Surgical (NT) Ward Surgical Ward

\*SIRs and CIs are currently not calculated when the number of predicted infections is less than 0.5.

Slide 8

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

CLABSI Standard Utilization Ratio (SUR) by ICU type

Key Findings: Seven ICU types experienced a significantly lower number of device days than predicted, based on 2015 national aggregate data:

Medical (NT) ICU

Neurologic ICU

Medical (T and NT) Ward

Medical/Surgical (T and NT) Ward

Surgical Ward

Slide 9

CLABSI Adult & Pediatric ICU Pathogens for 2020 and 2021

ICU Pathogens

Calendar year 2020: ICU pathogens n =241. staphylococcus aureus (not MRSA), 6%; Methicillin resistant staphylococcus aureus, 4%; Coagulase negative staphylococcus, 16%; Enterococcus sp., 17%; gram positive bacteria (other) 3%; gram-negative bacteria 17% ; Candida albicans, 14%; yeast fungus, other 10%; multiple organisms, 14%;

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%;

Ward Pathogens

Calendar year 2020: Ward pathogens n =145. staphylococcus aureus (not MRSA), 9%; Methicillin resistant staphylococcus aureus, 8%; Coagulase negative staphylococcus, 13%; Enterococcus sp., 14%; gram positive bacteria (other) 3%; gram-negative bacteria 21% ; Candida albicans, 10%; yeast fungus, other 7%; multiple organisms, 16%;

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%;

Slide 10

Central Line-Associated Bloodstream Infection (CLABSI) Standard Infection Ratio in Neonatal ICUs

NICU CLABSI Standard Infection Ratio (SIR) by Birthweight Category (grams)

Key Findings

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

There were 19 CLABSIs reported in Neonatal ICUs.

Slide 11

Central Line-Associated Bloodstream Infection (CLABSI) Standard Utilization Ratio in Neonatal ICUs

CLABSI Standard Utilization Ratio (SUR) by Birth Weight Category

Key Findings

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

Less than or equal to 750 grams; 751 – 1,000 grams; 1,001 – 1,500 grams; 1,501 – 2,500 grams

Slide 12

CLABSI NICU Pathogens for 2020 and 2021

Calendar year 2020 n=15; Staphylococcus aureus not MRSA, 33%; Methicillin-resistant Staphylococcus, 6%; enterococcus sp., 6%. Escherichia coli, 7%; Gram-negative bacteria 7%; Candida and other yeast/fungus, 7%; multiple organisms, 33%

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

Slide 13

State CLABSI SIR in ICU and Wards

Key Findings

In 2021, adult, pediatric, and Neonatal ICUs experienced the same number of infections than predicted, based on 2015 national aggregate data.

Between 2015-2021, adult Wards experienced a significantly lower number of infections than predicted, based on 2015 national aggregate data.

Slide 14S

State CLABSI SUR in ICU and Wards

Key Findings

In 2021, adult ICUs and pediatric Wards experienced a significantly higher number of device days than predicted, based on 2015 national aggregate data.

Between 2015-2021, Neonatal ICUs and adult Wards experienced a significantly lower number of device days than predicted, based on 2015 national aggregate data

Slide 15

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

CAUTI Standard Infection Ratio (SIR) by IU Type

January 1, 2017-December 31, 2017

Key Findings

Two ICU types experienced a significantly lower number of infections than predicted, based on 2015 national aggregate data:

Cardiothoracic ICU

Neurologic ICU

Surgical ICU

Trauma ICU

Slide 16

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

Key Findings

Eight unit types experienced a significantly lower number of device days

than predicted, based on 2015 national aggregate data.

Medical (NT) ICU

Medical/Surgical (T) ICU

Neurologic ICU

Medical (T and NT) Ward

Medical/Surgical (T and NT) Ward

Surgical Ward

Slide 17

CAUTI Adult & Pediatric ICU Pathogens for 2017 and 2018

Calendar Year 2020 n=229

Coagulase- negative Staphylococcus,1%; Enterococcus sp.,10%; Gram-positive bacteria (other), 5%; Escherichia coli 34%; Pseudomonas aeruginosa, 14%; Klebsiella pneumoniae, 7%; Gram negative bacteria, 15%; multiple organisms, 10%;

Calendar Year 2021- n=274

Coagulase- negative Staphylococcus,4%; Enterococcus sp.,16%; Gram-positive bacteria (other), 4%; Escherichia coli 34%; Pseudomonas aeruginosa, 14%; Klebsiella pneumoniae, 7%; Gram negative bacteria, 13%; multiple organisms, 8%;

Ward Pathogens

Calendar Year 2020 n=198

Coagulase- negative Staphylococcus,3%; Enterococcus sp.,9%; Gram-positive bacteria (other), 3%; Escherichia coli 37%; Pseudomonas aeruginosa, 15%; Klebsiella pneumoniae, 5%; Gram negative bacteria, 17%; multiple organisms, 11%;

Calendar Year 2021- n=230

Coagulase- negative Staphylococcus,3%; Enterococcus sp.,11%; Gram-positive bacteria (other), 2%; Escherichia coli 32%; Pseudomonas aeruginosa, 16%; Klebsiella pneumoniae, 9%; Gram negative bacteria, 16%; multiple organisms, 12%;

Slide 18

State CAUTI SIR in ICU and Wards

Key Findings

In 2021, adult ICUs experienced a significantly lower number of infections than predicted, based on 2015 national aggregate data.

In 2021, adult and pediatric wards experienced the same number of infections than predicted, based on 2015 national aggregate

Slide 19

State CAUTI SUR

Key Findings: In 2021, pediatric ICUs and Wards experienced a significantly higher number of device days than predicted, based on 2015 national aggregate data.

For the past seven years, adult Wards experienced a significantly lower number of device days than predicted, based on 2015 national aggregate data.

Slide 20

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

Key Findings

In 2021, 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 36 CABG SSIs reported in 2021.

There were 193 COLO SSIs reported in 2021

Slide 21

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

Key Findings

In 2021, 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 41 KPRO SSIs reported in 2021, with one facility accounting for 20% of the reported events.

There were 71 HPRO SSIs reported in 2021.

Slide 22

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

Key Findings

In 2021, Massachusetts acute care hospitals performing abdominal hysterectomy (HYST) procedures experienced significantly higher number of infections than predicted, based on 2015 national aggregate data.

There were 45 HYST SSIs reported in 2021.

There were 3 VHYS SSIs reported in 2021.

Slide 23

SSI Pathogens for 2017-2018 CABG, KPRO, HPRO, HYST, VHYS, COLO

Calendar year 2020 January 1, 2020- December 31, 2020 n=347;

Staphylococcus aureus not MRSA, 13% ; Methicillin-resistant Staphylococcus 2%; coagulase negative staphylococcus, 4%; Enterococcus sp., 4%; gram-positive bacteria (other) 10%; Escherichia coli, 7%; pseudomonas aeruginosa, 0.9%; Klebsiella pnuemoniae, 1%; Gram-negative bacteria 9%; candida and other yeast /fungus, 2%; multiple organisms, 26%;;no organism identified, 20%;

Calendar year 2021 January 1, 2020- December 31, 2021 n=389;

Staphylococcus aureus not MRSA, 13% ; Methicillin-resistant Staphylococcus 3%; coagulase negative staphylococcus, 6%; Enterococcus sp., 4%; gram-positive bacteria (other) 4%; Escherichia coli, 7%; pseudomonas aeruginosa, 3%; Klebsiella pnuemoniae, 1%; Gram-negative bacteria ; candida and other yeast /fungus, 3%; multiple organisms, 30%;no organism identified, 19%;

Slide 24

Statewide SSI Trends by Year 2015-2021

Summary of SSI Results

CABG HPRO COLO KPRO VHYS: Same as predicted

HYST, : Higher than predicted

Slide 25

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

Key Findings

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

There were 1,904 CDI events reported in 2018.

Slide 26

Laboratory Identified Events (LabID): Methicillin-resistant Staphylococcus aureus (MRSA) SIR

Key Findings

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

There were 1,444 CDI events reported in 2021.

Slide 27

Statewide LabID Trends by Year 2015-2021

Slide 28

DPH HAI COVID-19 Activities

* In 2021, DPH Epidemiologists were assigned to each long-term care facility (LTCF) with a COVID-positive resident and/or staff to effectively manage outbreak responses and control measures. Other high risk patient settings including hospitals, assisted living residences (ALR), dialysis centers, inpatient psychiatric units, substance use disorder facilities, prisons, jails and homeless shelters also had assigned epidemiologists.
* Comprehensive on-site Infection Control Assessment and Response (ICAR) visits are conducted at licensed nursing homes, ALRs, rest homes and other healthcare facilities. During these visits an epidemiologist and public health nurse:
  + Discuss facility infection prevention and control policies and practices;
  + Observe screening areas, hand hygiene, PPE use, environmental cleaning and disinfection, testing, vaccine storage, etc. and provide feedback and coaching to the facility staff.
* Daily statewide LTCF and weekly facility-level case counts continued to be published on the COVID-19 Interactive   
  Data Dashboard.
* Weekly analysis of nursing home data submitted to the LTCF COVID-19 Module in NHSN to monitor trends over time and to identify facilities with outbreaks, staffing or PPE shortages and those with lower resident and/or staff vaccination rates.
* Promote CDC’s National Training Collaborative, Project Firstline, and developed MA-specific infection control training content and learning programs for frontline healthcare workers in partnership with the Population Health Exchange (PHX) at Boston University.

Slide 29

New Activities

* Collaboration with Boston University Public Health Exchange (BU PHX) to promote infection prevention and control (IPC) training and education for all healthcare personnel (<https://mainfectioncontrol.populationhealthexchange.org/>)
  + Promote CDC’s Project Firstline: <https://www.cdc.gov/infectioncontrol/projectfirstline/index.html>
  + Provide additional IPC education and training
    - Cleaning and disinfection in healthcare settings
    - Ventilation tips and strategies
    - Developing resilience in challenging times
    - Water management including sinks and drains
  + Promote antimicrobial stewardship/combat   
    antibiotic resistance
* Developing data cleaning reports to share summary statistics with dialysis providers and non-acute hospitals on a quarterly basis before the end of 2022

Slide 30

U.S. Impact on Antibiotic Resistance: CDC 2022 Special Report

In July 2022, CDC released a [new report](https://urldefense.com/v3/__https:/www.cdc.gov/drugresistance/covid19.html__;!!CUhgQOZqV7M!jQVhxvhxJhTbVNdbSa2gcmOpkDiYlcnee9MpHyAdCks4jHB-wkY27p-WuN6gxj308F1K20SQZlF_7ADcTmoS$) finding that much of the progress made in the United States in previous years combating antimicrobial resistance (AR) was lost, in large part, due to the effects of the COVID-19 pandemic.

[COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022](https://urldefense.com/v3/__https:/www.cdc.gov/drugresistance/pdf/covid19-impact-report-508.pdf__;!!CUhgQOZqV7M!jQVhxvhxJhTbVNdbSa2gcmOpkDiYlcnee9MpHyAdCks4jHB-wkY27p-WuN6gxj308F1K20SQZlF_7EUDm-7A$), concludes that the threat of antimicrobial-resistant infections has worsened—with resistant hospital-onset infections and deaths both increasing at least 15% during the first year of the pandemic.

Slide 31

U.S. Impact on Antibiotic Resistance: CDC 2022 Special Report

* Resistant hospital-onset infections and deaths both increased at least 15% during the first year of the pandemic. In a 2021 analysis, CDC also reported that, after years of steady reductions in healthcare-associated infections (HAIs), U.S. hospitals saw significantly higher rates for four out of six types of HAIs in 2020. Many of these HAIs are resistant to antibiotics or antifungals.
* There were more and sicker patients during the pandemic who required more frequent and longer use of catheters and ventilators. This may have increased risk of HAIs and spread of pathogens, especially when combined with personal protective equipment and lab supply challenges, reduced staff, and longer lengths of stay.
* Acute care hospitals also saw more *Candida auris* cases, including in COVID-19 units. *C. auris* has previously been a threat in post-acute care facilities (e.g., long-term care). The increased spread in hospitals could be a result of staffing and supply shortages and changes in infection prevention and control practices.

Slide 32

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 carbapanemase 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

Slide 33

Antibiotic Resistance Surveillance: Reporting and Laboratory Testing Methods

* Electronic laboratory reporting (ELR) of mandatory MDROs of concern into the Massachusetts Virtual Epidemiologic Network (MAVEN)
* 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

Slide 34

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

CPO cases in Massachusetts: 2017, 48; 2018,92; 2019, 122; 2020, 116; 2021, 220

C. auris cases in Massachusetts: 2017, 10; 2018, 0; 2019, 2; 2020, 1; 2021, 22.

Slide 35

Antibiotic Resistance Surveillance: Carbapenemase-producing Organisms (CPOs) in MA

Carbapenemase Gene Targets Identified in Massachusetts 2017-2021

IMP: 2017, 0; 2018, 0; 2019, 2; 2020, 3;

KPC: 2017, 37; 2018, 43; 2019, 55; 2020, 58; 2021, 106

NDM: 2017, 7; 2018, 35; 2019 57; 2020, 43; 2021, 81

OXA-Like: 2017, 5; 2018, 13; 2019, 8; 2020, 12; 2021, 30

VIM: 2017, 1; 2018, 1; 2019, 0; 2020, 0; 2021, 1.

Slide 36

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

[*https://www.cdc.gov/antibiotic-use/healthcare/*](https://www.cdc.gov/antibiotic-use/healthcare/)

[*https://www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html*](https://www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html)

Slide 37

Antibiotic Stewardship: Prevention and Educational Activities

* Collection, monitoring, and benchmarking of facility-level antibiotic use data in long-term care facilities (86 facilities reported at least one month of data in 2021, averaging of 46 participating facilities each month) with continued expansion of this program
* Ongoing collaboration with antibiotic stewardship (AS) experts from Tufts Medical Center to enhance AS support and activities in our long-term care facilities including monthly office hours for long term care facilities (LTCF) and a new AS Honor Roll to highlight facilities with consistent participation: <https://mainfectioncontrol.populationhealthexchange.org/ltcf-as/antibiotic-stewardship-honor-roll/>
* Collaboration with CDC and several mid-Atlantic states on a six-part webinar series (CEUs offered) covering prevention and control of MDROs, Enhanced Barrier Precautions, cleaning and disinfection, hand hygiene, and water management including sink hygiene. Several hundred MA healthcare providers have participated in this series.
* Thirty-four acute care hospitals currently participate in the NHSN antibiotic use (AU) module to better understand trends in antibiotic use and to monitor stewardship activities- we continue to leverage this data and engage remaining acute care hospitals in reporting to have a comprehensive, statewide picture of antibiotic use in the acute care setting.

Slide 38

Thank you for the opportunity to present this information today.

Please direct any questions to:

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