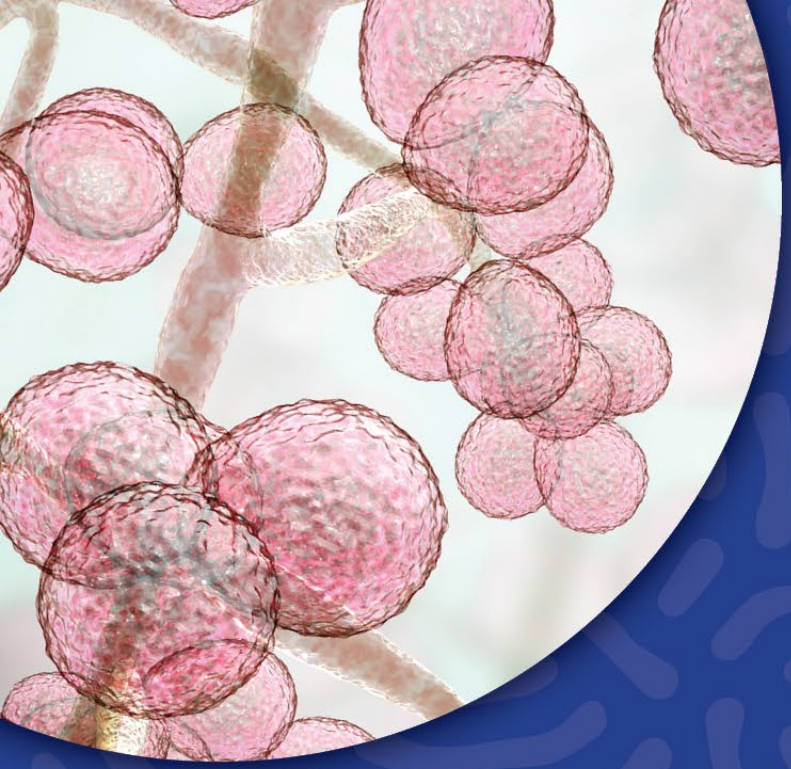

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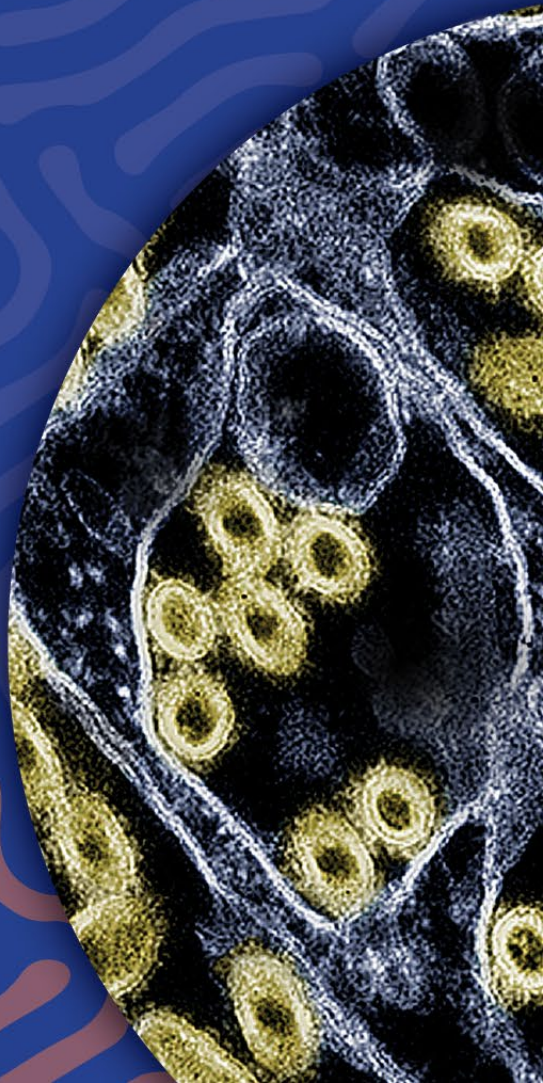

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Carbapenem Resistant *Acinetobacter calcoaceticus-baumannii* complex (CRAB)

A Public Health Perspective

Kim McCullor, PhD MSc
Microbiology Section Manager
Michigan Bureau of Laboratories

CRAB: Who is at Risk?

- Associated with large outbreaks in hospital and nursing home settings
- Spread through contact (infected or colonized patients, medical equipment, healthcare personnel, and environmental surfaces)
  - Shown to persist in the environment for days to weeks
- Risk factors:
  - Patients with complex medical care (i.e. intensive care unit admission)
  - Chronic wounds
  - Recent antibiotic use
  - Occupation of room that was previously occupied by patient with CRAB
  - Patient who has received medical care (inpatient and/or invasive medical procedures outside the U.S. within past 6 months)

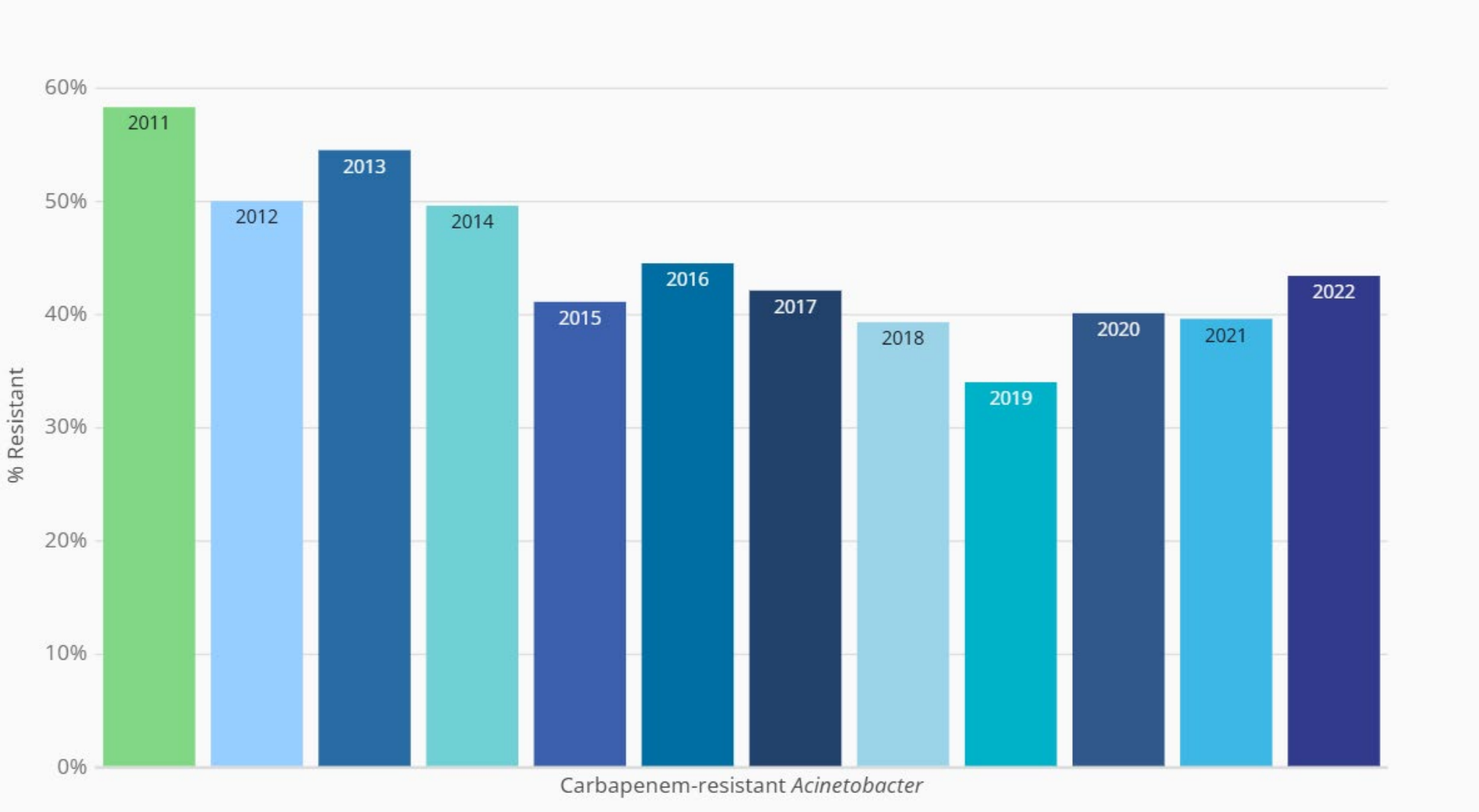
New additions to AR&PSP include: NHSN Antimicrobial Resistance data update for 2022 data and AR Lab Network data update for 2023 data.

Antimicrobial Resistance & Patient Safety Portal

Explore and Visualize Data on Antimicrobial Resistance and Patient Safety

- ANTIMICROBIAL RESISTANCE
- ANTIBIOTIC USE AND STEWARDSHIP
- HEALTHCARE PERSONNEL VACCINATION
- HEALTHCARE- AND COMMUNITY-ASSOCIATED INFECTIONS
- GEOGRAPHIC LOCATION

Change of Carbapenem-Resistant *Acinetobacter* Over Time



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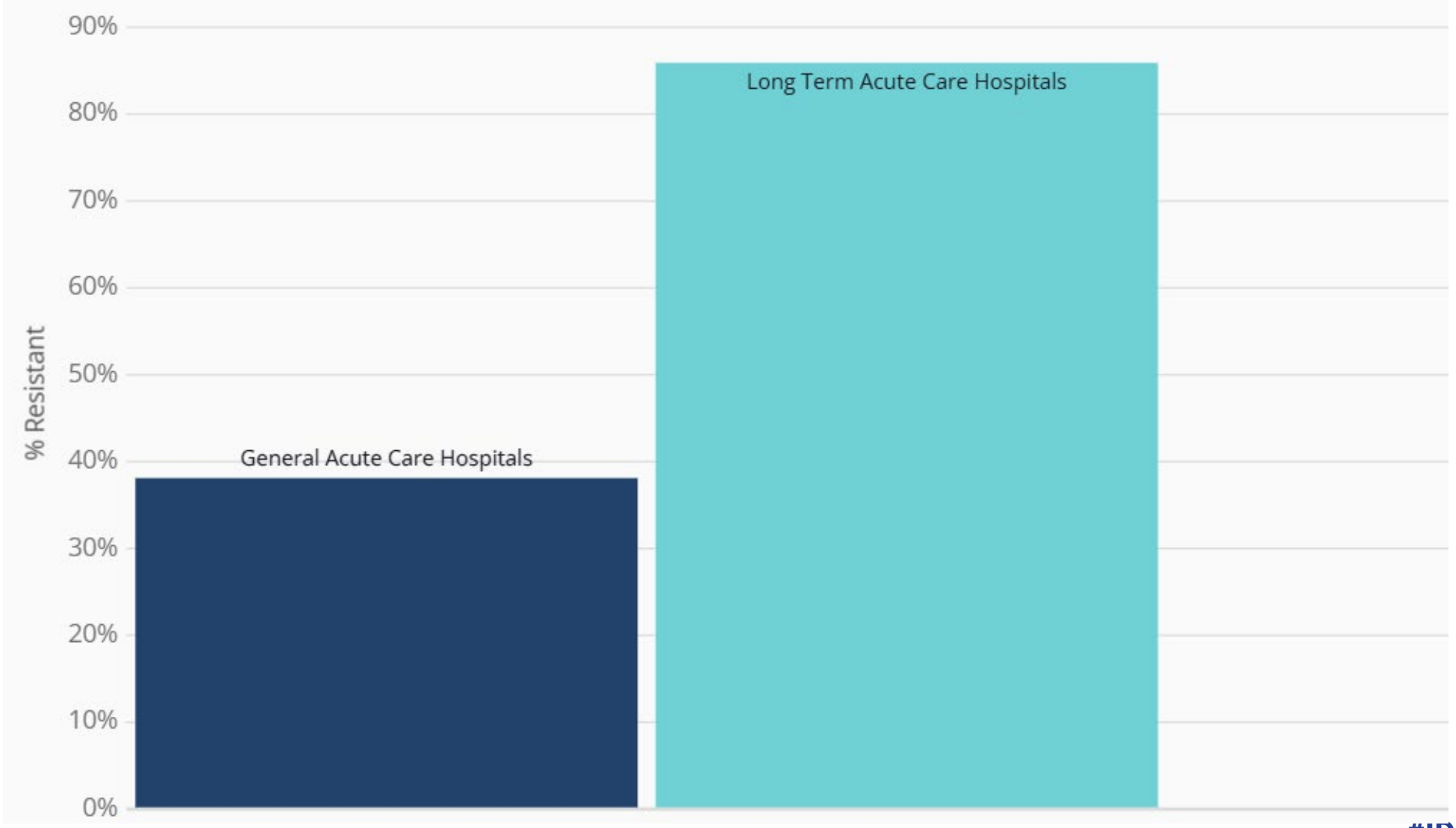
http://arpsp.cdc.gov/profile/antibiotic-resistance/carbapenem-resistant-acinetobacter#changes-over-time-topic accessed 03/15/2025

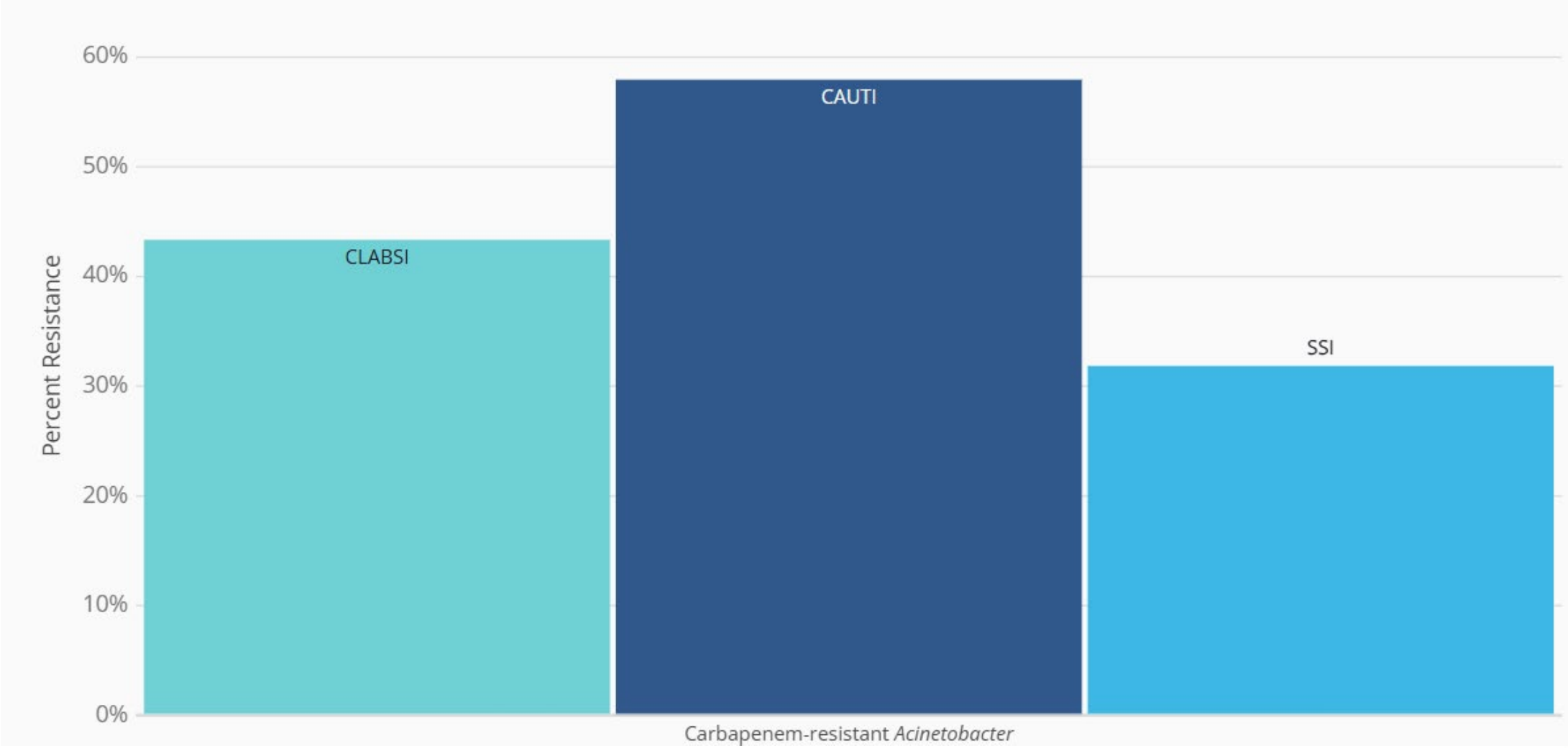
HAI Carbapenem-Resistant *Acinetobacter* by Facility Type (2022)



#IDLabCon

http://arpsp.cdc.gov/profile/antibiotic-resistance/carbapenem-resistant-acinetobacter#changes-over-time-topic accessed 03/15/2025

HAI Carbapenem-Resistant *Acinetobacter* by Site (2022)



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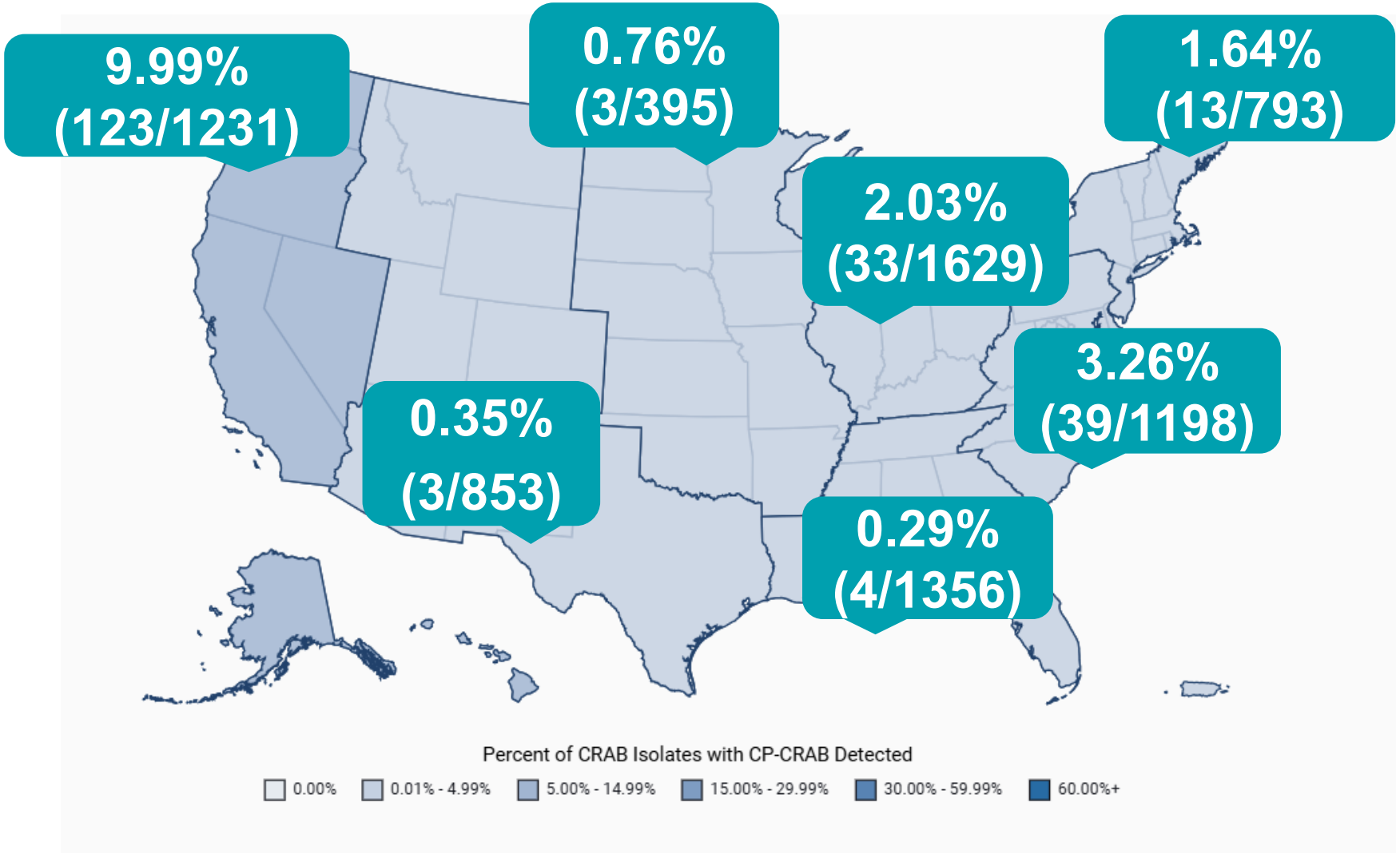
http://arpsp.cdc.gov/profile/antibiotic-resistance/carbapenem-resistant-acinetobacter#changes-over-time-topic accessed 03/15/2025

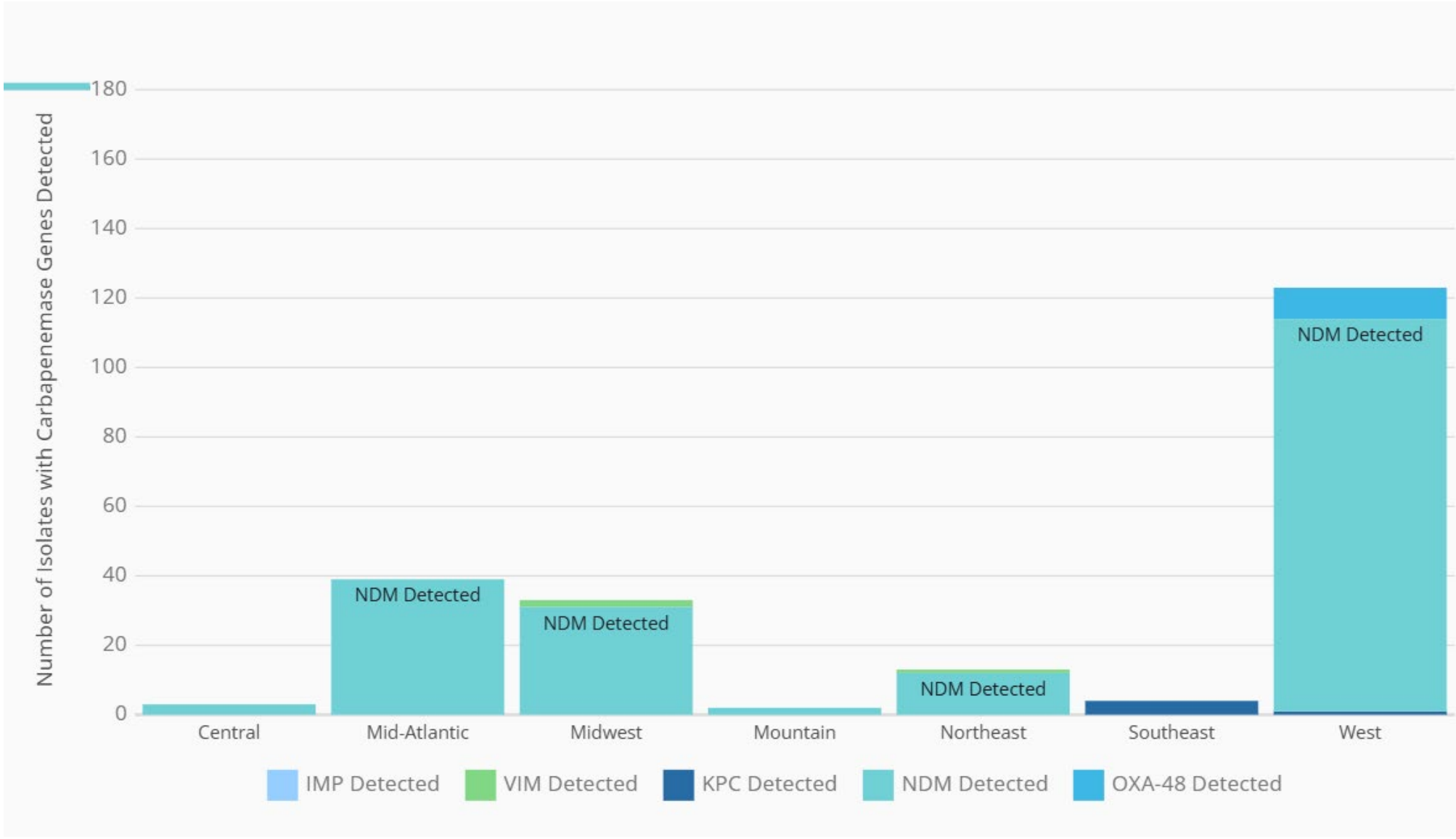
Prevalence of Big 5 (NDM, KPC, VIM, IMP & OXA-48) in Carbapenemase producing CRAB (CP-CRAB; 2023)



#IDLabCon

http://arpsp.cdc.gov/profile/antibiotic-resistance/carbapenem-resistant-acinetobacter#changes-over-time-topic accessed 03/15/2025

Prevalence of Big 5 by Gene CP-CRAB (2023)



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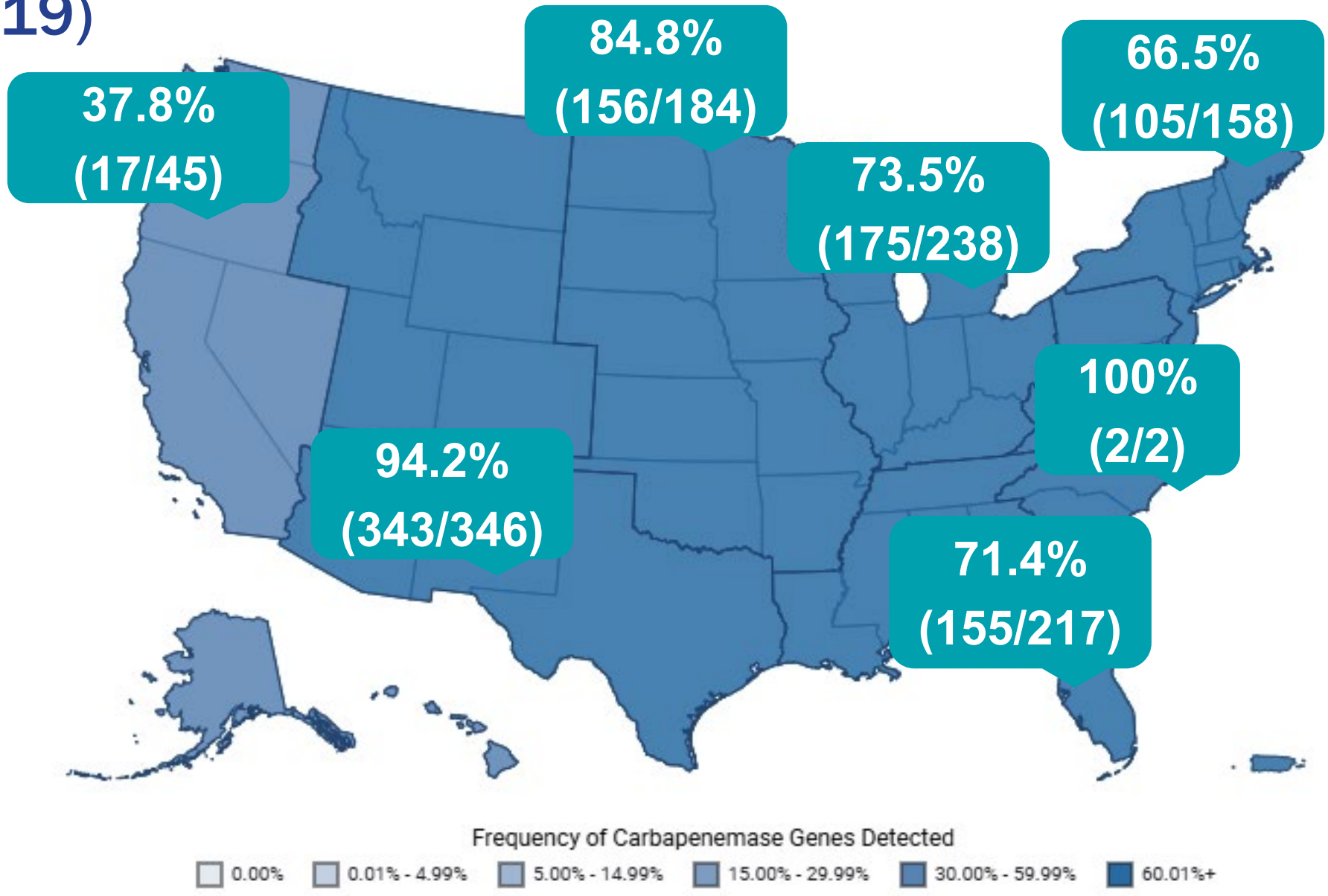
http://arpsp.cdc.gov/profile/antibiotic-resistance/carbapenem-resistant-acinetobacter#changes-over-time-topic accessed 03/15/2025

Majority of CP-CRAB Harbor OXA-23, OXA-24/4, or OXA-58 (2019)



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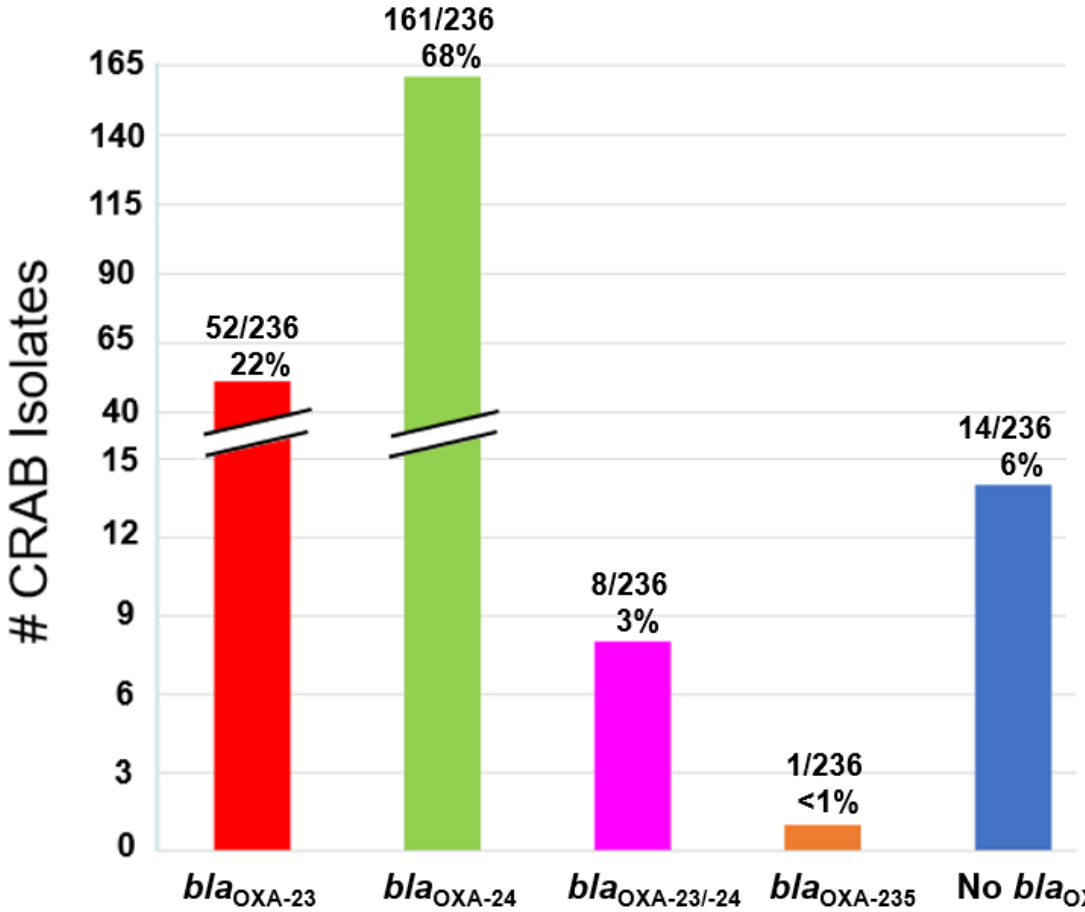
http://arpsp.cdc.gov/story/cra-urgent-public-health-threat#story-topic-4 accessed 03/19/25

CP-CRAB non-OXA-48 Prevalence: an AR Laboratory Network Central Region Perspective

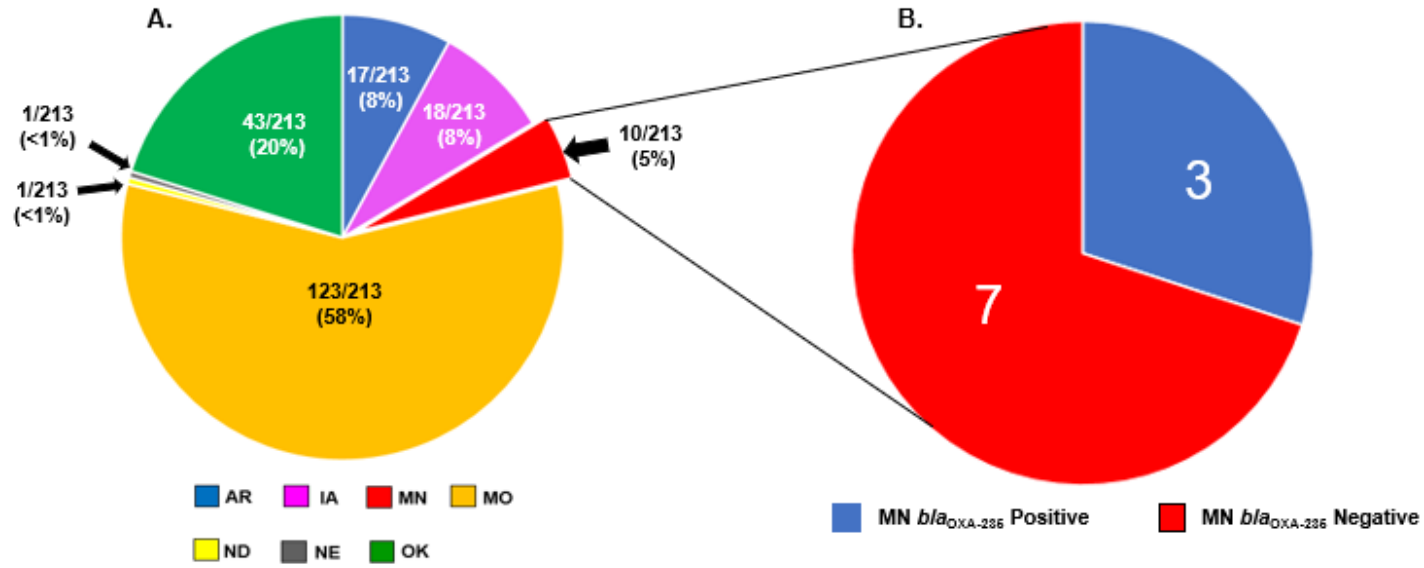
OXA Variants Identified via WGS

2017 - 2023



$bla_{OXA-235}$ Prevalence

Dec. 2022 – Oct 2023



Data provided by the Minnesota Department of Health Public Health Laboratory courtesy of Paula Snippes Vagnone

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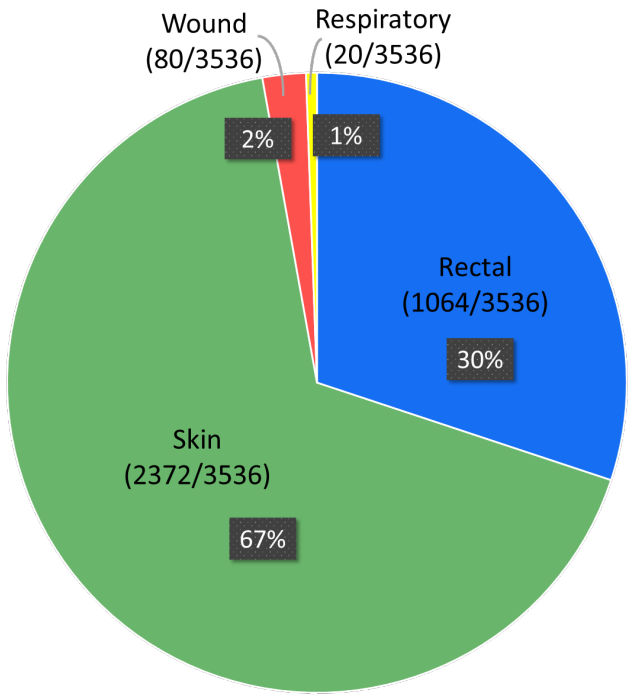
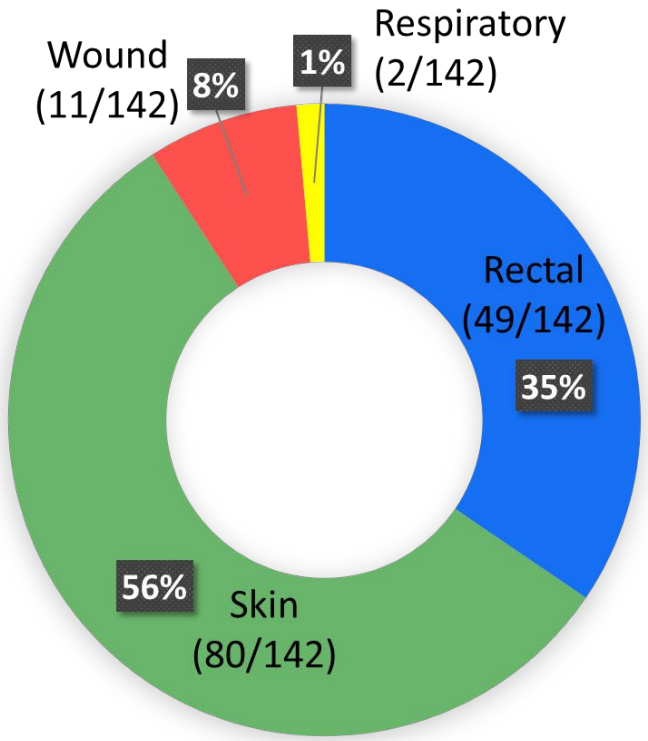
CP-CRAB: Colonization What Specimen Source is Best?

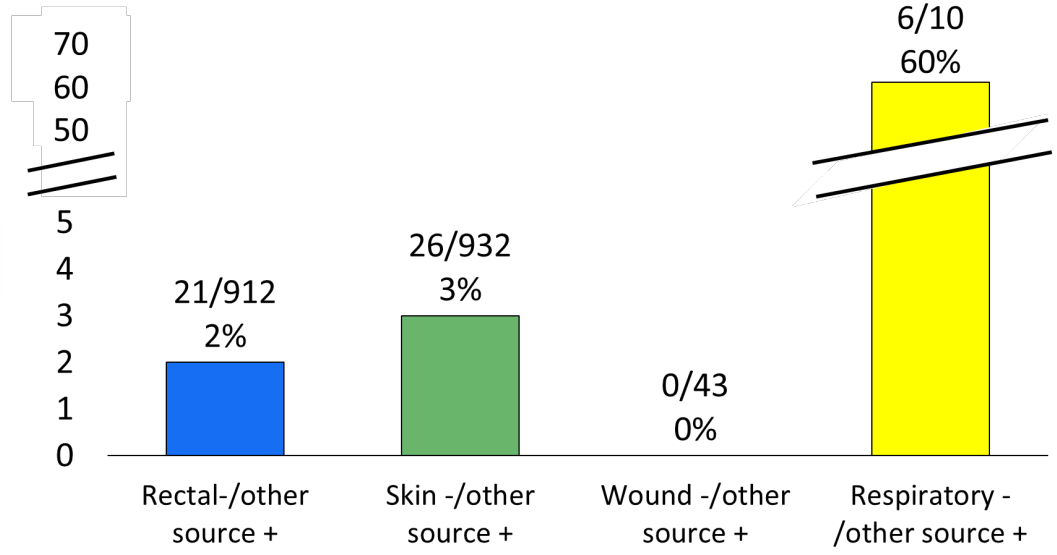
Specimens Tested (n=3536) Jan. 2022 – Nov. 2023



CP Positive Specimens (OXA-23, OXA-24, OXA-23/24)



Percentage Potentially Missed if Single Site Only Screened



Data provided by the Minnesota Department of Health Public Health Laboratory courtesy of Paula Snippes Vagnone

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Carbapenem Resistance Profiles (2019)

Carbapenemase Gene(s)	Carbapenem	Number of Isolates	Intermediate	Resistant	Not Susceptible
Carbapenemase genes not detected	Doripenem	160			86%
Carbapenemase genes not detected	Imipenem	155	14%	67%	81%
Carbapenemase genes not detected	Meropenem	160	4%	86%	89%
Carbapenemase gene detected	Doripenem	820			100%
Carbapenemase gene detected	Imipenem	814	0%	99%	100%
Carbapenemase gene detected	Meropenem	830	0%	100%	100%

arpsp.cdc.gov/story/cra-urgent-public-health-threat#story-topic-5 accessed 03/19/25

Resistance Profiles by Carbapenemase Gene

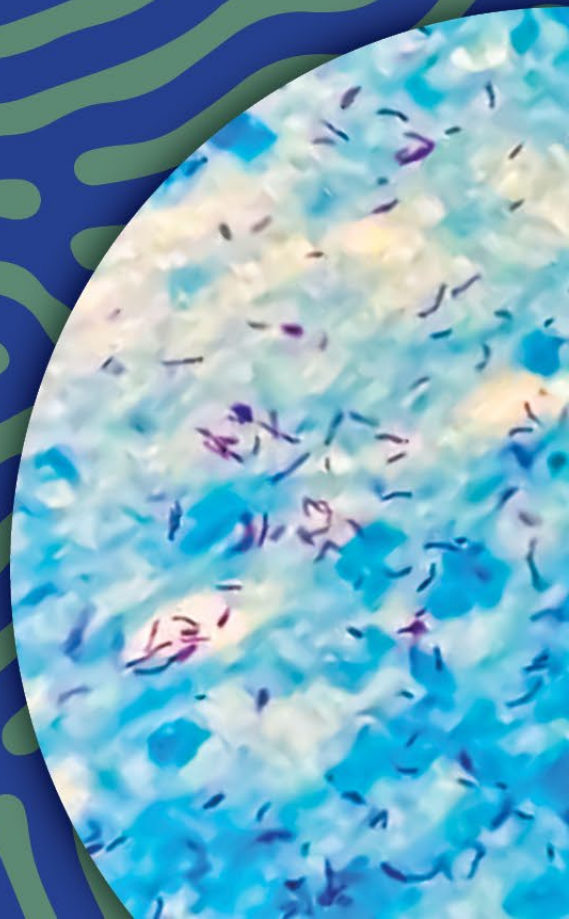
Carbapenemase Gene(s)	Carbapenem	Number of Isolates	Intermediate	Resistant	Not Susceptible
KPC Detected	Doripenem	2			100%
KPC Detected	Imipenem	2	50%	50%	100%
KPC Detected	Meropenem	2	50%	50%	100%
NDM Detected	Doripenem	18			100%
NDM Detected	Imipenem	17	0%	100%	100%
NDM Detected	Meropenem	18	0%	100%	100%
OXA-23, OXA-24/4, or OXA-58 Detected	Doripenem	800			100%
OXA-23, OXA-24/4, or OXA-58 Detected	Imipenem	795	0%	100%	100%
OXA-23, OXA-24/4, or OXA-58 Detected	Meropenem	810	0%	100%	100%

arpsp.cdc.gov/story/cra-urgent-public-health-threat#story-topic-5 accessed 03/19/25

OXA-23, OXA-24/4, and OXA-58 most common carbapenemase genes of CP-CRAB isolates

Consider collection from multiple sources to increase likelihood for CP-CRAB detection

Reach out to HAI Prevention and local public health laboratory for consultation on best sources for screening



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Shigella spp.

A Public Health Perspective

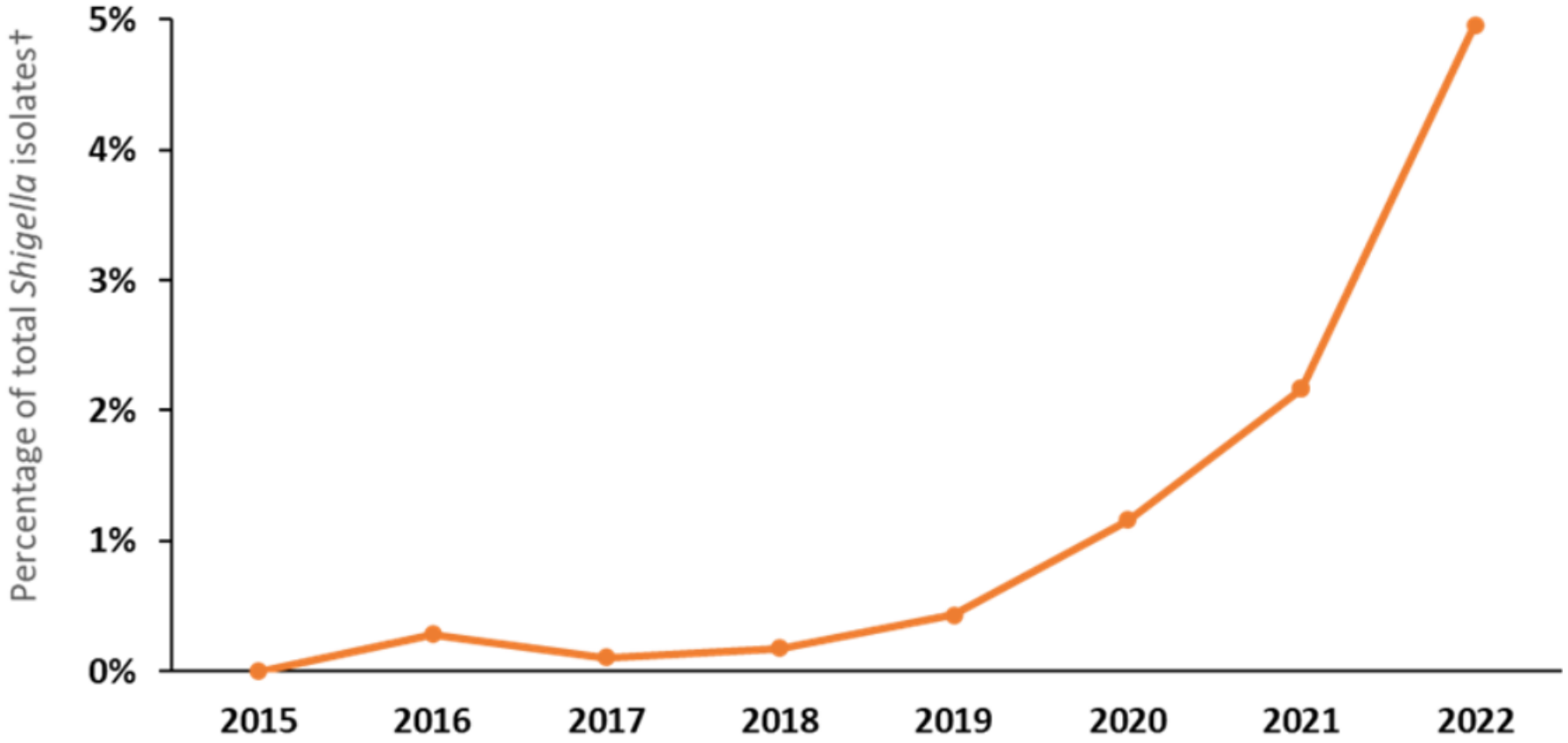
Kim McCullor, PhD MSc
Microbiology Section Manager
Michigan Bureau of Laboratories

Increase in Extensively Drug-Resistant Shigellosis in the United States

Print

Distributed via the CDC Health Alert Network
February 24, 2023, 11:30 AM ET
CDCHAN-00486

Stark Rise in Incidences of XDR-*Shigella* Infections



*XDR *Shigella* bacteria (n=239) are defined as resistant to azithromycin, ciprofloxacin, ceftriaxone, trimethoprim-sulfamethoxazole, and ampicillin.

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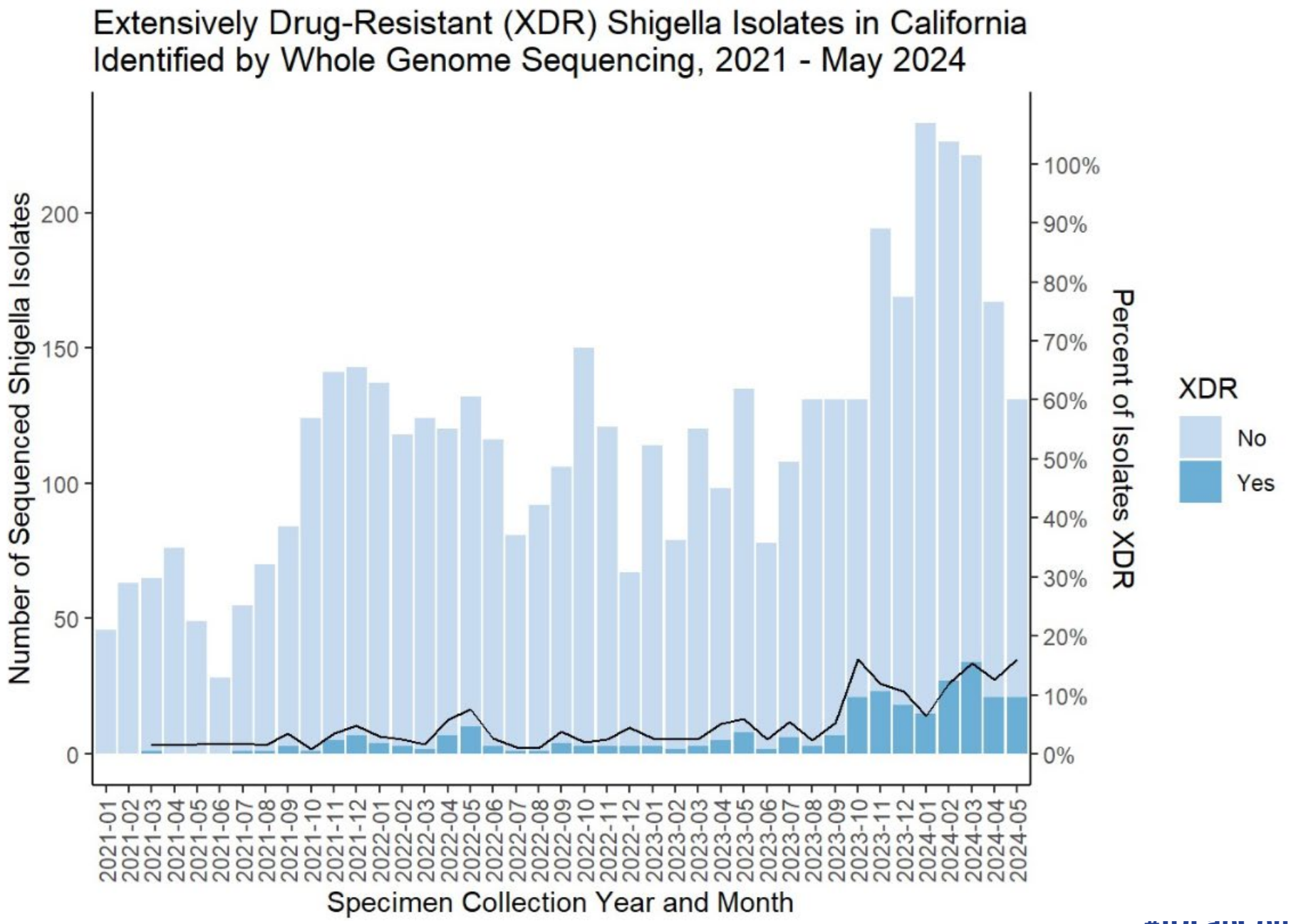


Rise in Extensivehttps://www.cdph.ca.gov/Programs/OPA/Pages/CAHAN/Rise-in-Extensively-Drug-Resistant-Shigella-Strains.aspxly Drug-Resistant Shigella Strains accessed 03/23/2025

Review > J Clin Microbiol. 2021 Nov 18;59(12):e0021321. doi: 10.1128/JCM.00213-21.
Epub 2021 Sep 22.

Overview of Changes to the Clinical and Laboratory Standards Institute *Performance Standards for Antimicrobial Susceptibility Testing*, M100, 31st Edition

Romney Humphries [1], April M Bobenchik [2], Janet A Hindler [3], Audrey N Schuetz [4]

Affiliations + expand

PMID: 34550809 PMCID: PMC8601225 DOI: 10.1128/JCM.00213-21

- AZT breakpoints added to M100 in 2021 (no prior breakpoints)
- In CLSI M100-35th Ed, 2025 *Salmonella/Shigella* own table see (broken out from rest of Enterobacterales)
- AST recommended for all *Shigella* isolates
  - Isolates should have azithromycin, ciprofloxacin, ceftriaxone, trimethoprim-sulfamethoxazole [TMP-SMX], and ampicillin

Culture Independent Testing-Reflex Testing

- Culture independent testing affords a rapid sample to answer service to patients but presents limitations for additional characterization

- Limited to detection of molecular material from the organism which may not be viable

- Isolate still required for further characterization (such as AST) which is especially important when there is concern of possible XDR or need for antibiotic treatment
  - This may include patients who are food handlers; treatment has been demonstrated to shorten the duration of shedding (allowing more rapid return to work)

National Antimicrobial Resistance Monitoring System

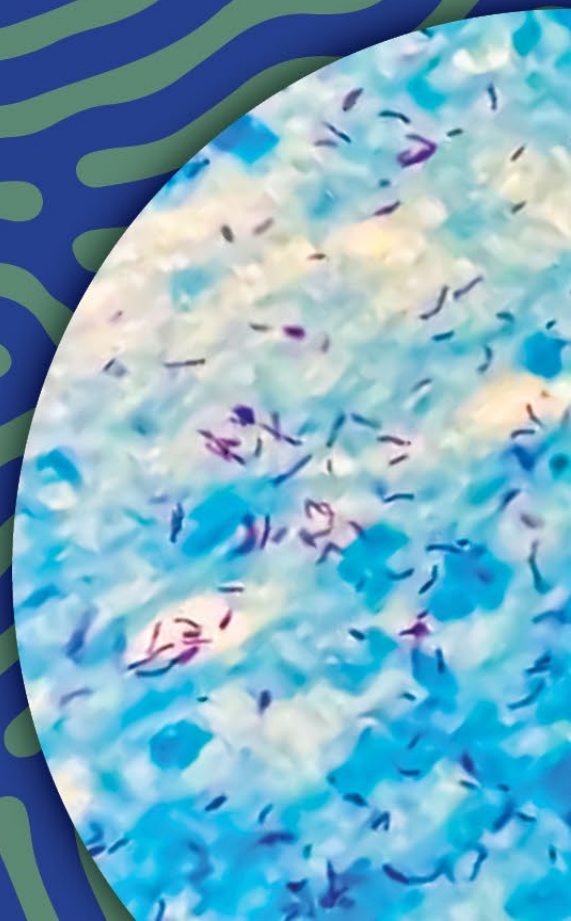
- Multi agency (CDC, FDA, and USDA) enteric surveillance program
  - Collection of data from enteric bacteria isolates from clinical human, meats, and food animals

- Data provides diverse collection of characterized antimicrobial resistance to better understand transmission and spread of multi-drug resistant enteric bacteria

- Data on transmission allows for creating initiatives to slow/stop transmission

NARMS
National Antimicrobial Resistance Monitoring System

- **Culture Independent Testing (CIDT) may not be enough**
  - **Reflex testing for culture and AST when treatment needed (i.e. persistent and/or severe symptoms)**
  - **Higher risk for XDR**
- **Ensure utilization of current *Shigella* specific breakpoints**
- **Contact local public health when XDR identified (or suspected).**
  - **Ensure isolate is retained for shipment to public health laboratory for further characterizations (i.e. WGS)**



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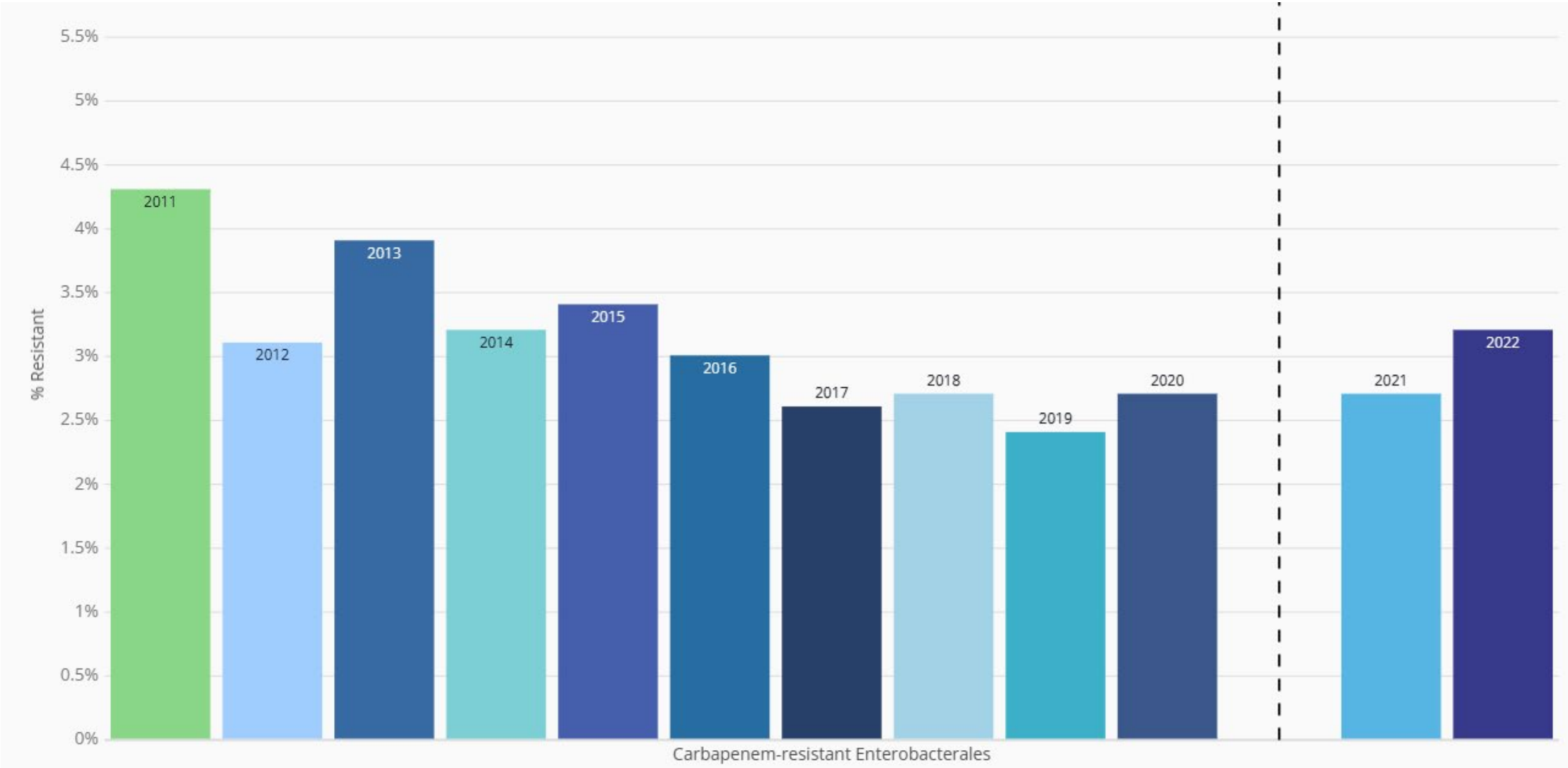
Carbapenemase Producing Enterobacterales

A Public Health Perspective

Kim McCullor, PhD MSc
Microbiology Section Manager
Michigan Bureau of Laboratories

Change of Carbapenem-Resistant Enterobacterales (CRE) Over Time



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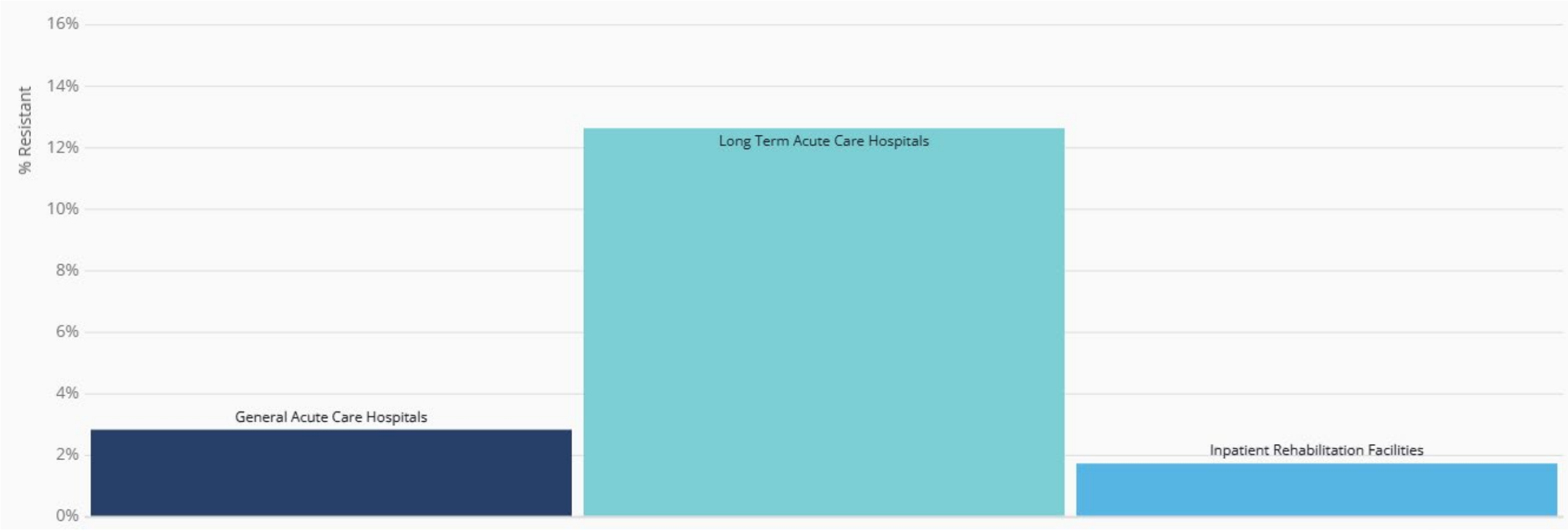
arpsp.cdc.gov/profile/antibiotic-resistance/carbapenem-resistant-enterobacterales#changes-over-time-topic accessed 03/20/2025

Change of Carbapenem-Resistant Enterobacterales (CRE) Over Time (2022)



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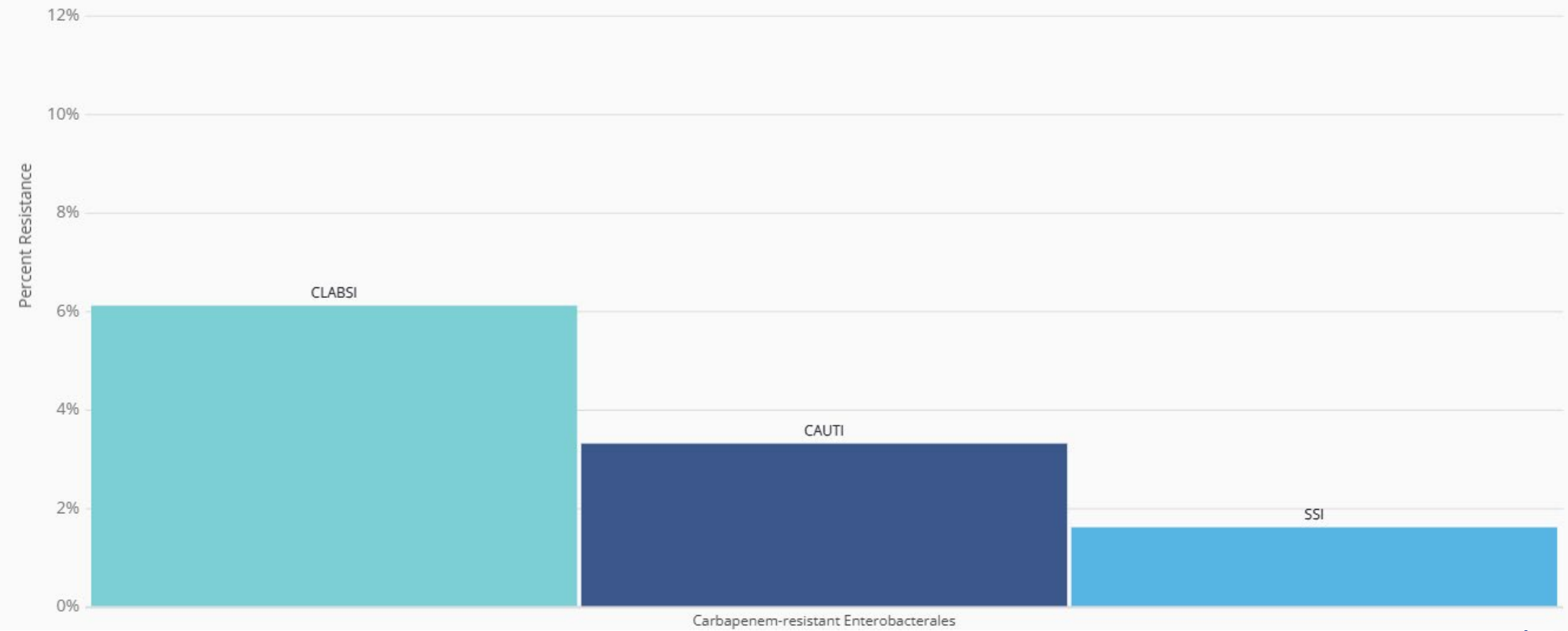
arpsp.cdc.gov/profile/antibiotic-resistance/carbapenem-resistant-enterobacterales#changes-over-time-topic accessed 03/20/2025

HAI Carbapenem-Resistant Enterobacterales (CRE) by Site (2022)



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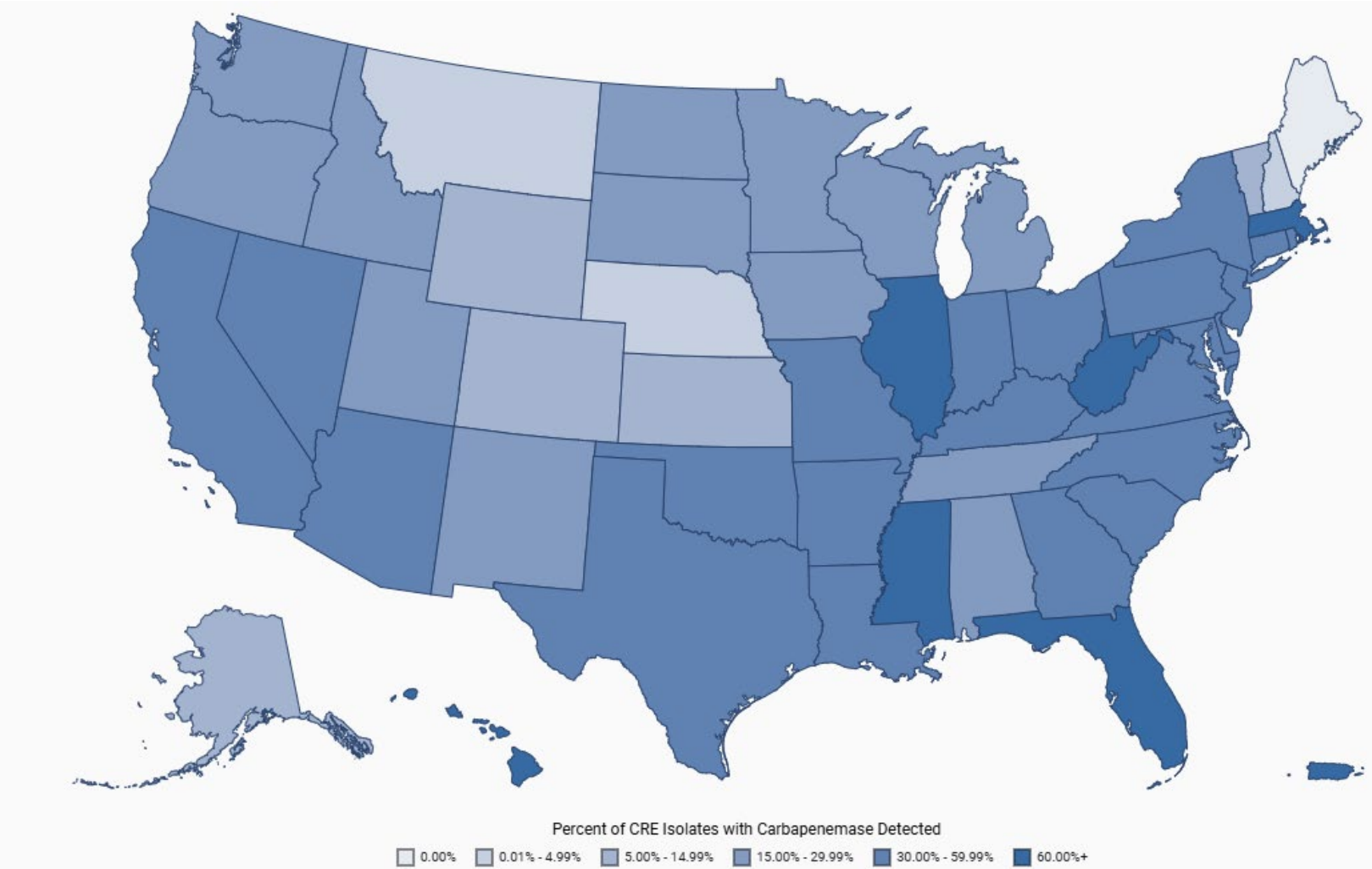
arpsp.cdc.gov/profile/antibiotic-resistance/carbapenem-resistant-enterobacterales#changes-over-time-topic accessed 03/20/2025

Prevalence of Big 5 (NDM, KPC, VIM, IMP & OXA-48) in Carbapenemase producing CRE (CP-CRE; 2023)



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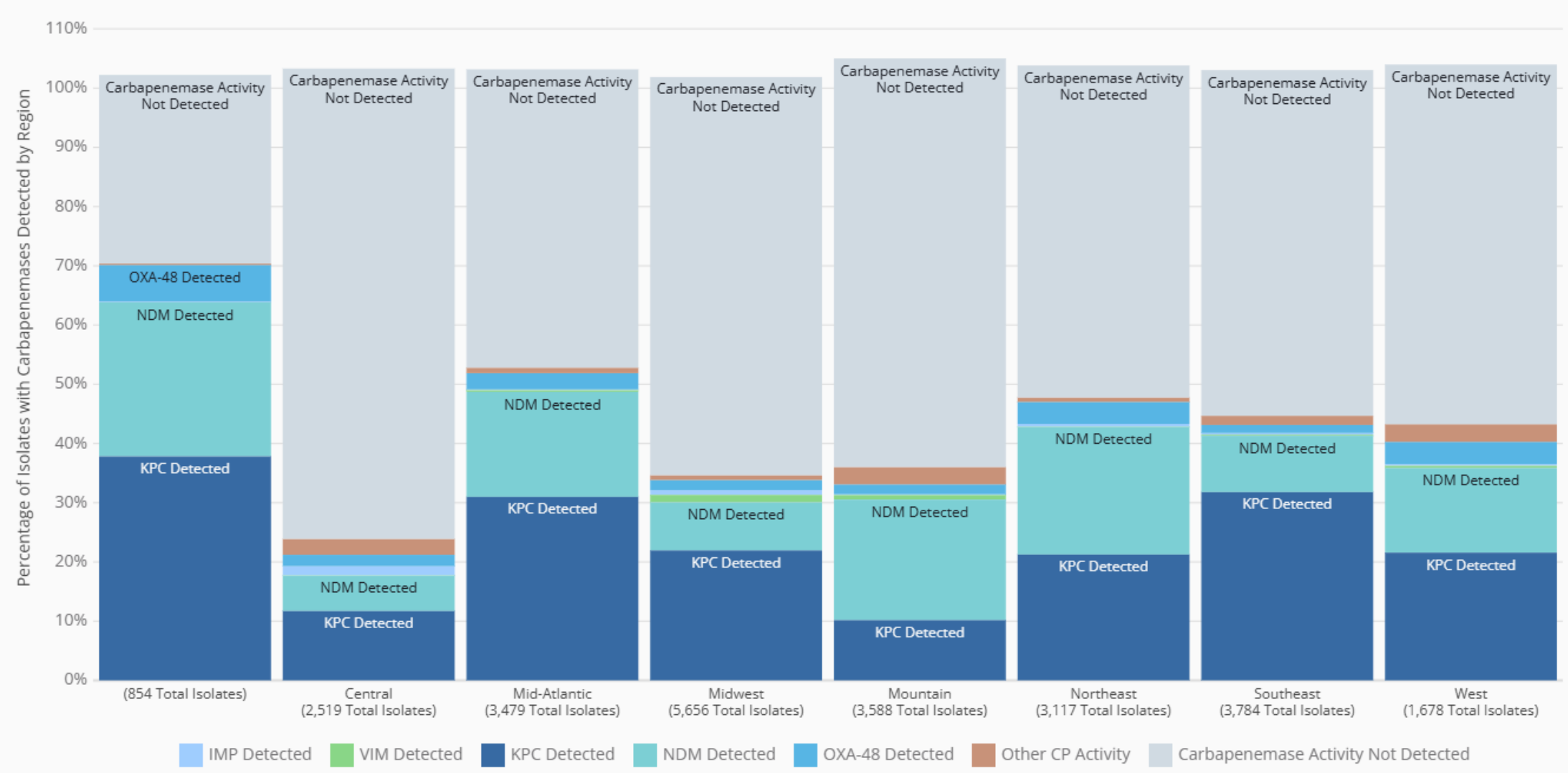
http://arpsp.cdc.gov/profile/arln/cre#arln-state-map accessed 03/20/2025

Prevalence of Big 5 by Gene CP-CRE (2023)



http://arpsp.cdc.gov/profile/arln/cre#arln-state-map accessed 03/20/2025

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Resistance Profiles CP vs non-CP Enterobacterales

Carbapenemase Gene*	Carbapenem	Number of Isolates	Intermediate	Resistant	Not Susceptible
Targeted genes not detected	Doripenem	19,470	8%	10%	18%
Targeted genes not detected	Ertapenem	20,580	18%	58%	76%
Targeted genes not detected	Imipenem	23,735	7%	15%	23%
Targeted genes not detected	Meropenem	26,786	5%	18%	23%
Carbapenemase gene detected	Doripenem	28,495	17%	66%	83%
Carbapenemase gene detected	Ertapenem	40,852	5%	92%	97%
Carbapenemase gene detected	Imipenem	36,161	9%	85%	94%
Carbapenemase gene detected	Meropenem	39,328	6%	83%	89%

http://arpsp.cdc.gov/profile/arln/cre#ast-table accessed 03/20/25

Resistance Profiles in CP-CRE by Big 5

Carbapenemase Gene*	Carbapenem	Number of Isolates	Intermediate	Resistant	Not Susceptible
KPC detected	Doripenem	11,031	26%	60%	81%
KPC detected	Ertapenem	30,550	5%	91%	96%
KPC detected	Imipenem	26,419	10%	83%	93%
KPC detected	Meropenem	29,440	7%	81%	88%
NDM detected	Doripenem	4,176	3%	96%	99%
NDM detected	Ertapenem	7,869	1%	99%	100%
NDM detected	Imipenem	7,536	1%	98%	99%
NDM detected	Meropenem	7,624	2%	97%	99%
VIM detected	Doripenem	207	10%	79%	89%
VIM detected	Ertapenem	377	15%	73%	88%
VIM detected	Imipenem	377	4%	91%	95%
VIM detected	Meropenem	380	7%	79%	86%

http://arpsp.cdc.gov/profile/arln/cre#ast-table accessed 03/20/25

Resistance Profiles in CP-CRE by Big 5

Carbapenemase Gene*	Carbapenem	Number of Isolates	Intermediate	Resistant	Not Susceptible
IMP detected	Doripenem	208	16%	72%	88%
IMP detected	Ertapenem	472	6%	85%	91%
IMP detected	Imipenem	387	26%	57%	83%
IMP detected	Meropenem	416	11%	77%	88%
OXA-48 detected	Doripenem	1,196	9%	51%	60%
OXA-48 detected	Ertapenem	1,584	8%	88%	96%
OXA-48 detected	Imipenem	1,442	16%	51%	67%
OXA-48 detected	Meropenem	1,468	7%	51%	58%

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APHL ID LAB CON 2025

http://arpsp.cdc.gov/profile/arln/cre#ast-table accessed 03/20/25

Detection of CPOs Know Your Platform: Impacts on Variant Detection

- MN sequenced total of 134 isolates
  - Majority *Proteus/ Providencia* & *P. aeruginosa*
- 93% IMP-27
- 3% IMP-14
- 1.5% IMP-13
- 1.5% IMP-26
- 0.7%% IMP-1

Table 19. Summary of Variants Detected by Wet Testing or Predicted to be Detected Based on *In Silico* Analysis

Marker (or Traditional Subgroup)	Wet Testing			Not Tested but Predicted to be Detected Based on *in silico* Analysis
	No. of Samples	Type(s) Detected	Type(s) not Detected	
KPC	12	KPC-2,3,4	--	KPC-5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
NDM	18	NDM-1,2,4,5	--	NDM-3, 6, 7, 8, 9
VIM	12	VIM-1,2,4,10,19	--	VIM-5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 20, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38
OXA-48	18	OXA-48, 181 (OXA-48 variant)	--	OXA-162, 163, 204, 232, 244, 245, 247
IMP	17	IMP-1 (9 strains), IMP-2, 4, 6, 10, 11	IMP-7[a], 13[b], 14[a]	IMP-3, 8, 9, 13[b], 19, 20, 21, 22, 24, 25, 27, 28, 30, 31, 33, 37, 40, 42

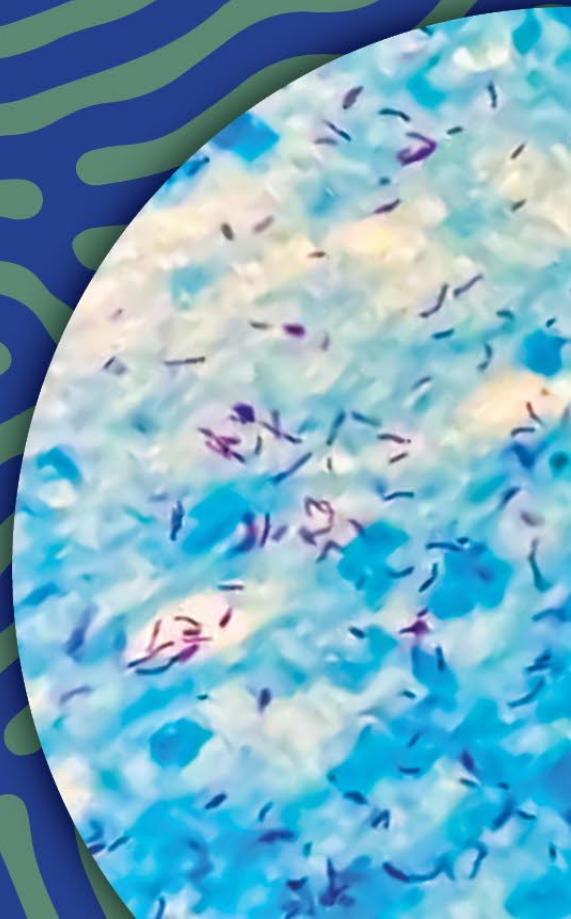
a. IMP-7 and IMP-14 genes (*Pseudomonas aeruginosa*) were not detected by the assay and were not predicted to be detected by *in silico analysis* (see Section 15, Limitations).
b. IMP-13 gene (*Klebsiella pneumoniae*) was tested: although predicted to be detected by *in silico analysis*, the IMP-13 gene was not detected by the assay (see Section 15, Limitations).

Slide provided by the Minnesota Department of Health Public Health Laboratory courtesy of Paula Snippes Vagnone

Detection of CPOs via mCIM: Hyper-producing AmpC vs. CPO

- Modified carbapenem inactivation method (mCIM) is a highly sensitive and specific method with some caveats:
  - Hyper-producing AmpC ESBL can produce false mCIM positive or indeterminates
- Clues that may help to delineate hyperexpression of ampC:
  - Predominantly found in *Enterobacter cloacae* complex
  - Typically non-susceptible to ceftriaxone, cefotaxime, and/or ceftazidime
  - Susceptible 4th generation cephalosporin
  - May be resistant to ertapenem but susceptible to other carbapenems

- **Culture Independent Testing (CIDT) may not be enough**
  - Consider reflex testing for culture and AST when treatment needed (i.e. persistent and/or severe symptoms)
  - Higher risk for XDR
- **Ensure utilization of current breakpoints**
- **Contact local public health when XDR identified (or suspected).**
  - Retain isolate for shipment to public health laboratory for further characterizations (i.e. WGS)



Questions