Statewide MDRO Trends

Louisiana Office of Public Health

Infectious Disease Epidemiology Section

2023 Louisiana Office of Public Health Antimicrobial Stewardship Summit

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The speaker does not have a financial or non-financial relationship with a commercial interest that would create a conflict of interest with this presentation.

Disclosure Statement

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Objectives

I. Describe the significance of antimicrobial resistance
II. Review national multi-drug resistant organism (MDRO) data
III. Understand COVID-19 impacts on antimicrobial resistance
IV. Summarize MDRO trends in Louisiana
V. Apply infection control practices to prevent infections in healthcare settings

Commonly Used Acronyms

- Multi-Drug Resistant Organism **(MDRO)**
- Antimicrobial Resistance **(AR)**
- Antimicrobial Resistance Lab Network **(ARLN)**
- Carbapenem-Resistant Enterobacterales **(CRE)**
- Carbapenem Resistant Acinetobacter **(CRA)**
- Carbapenem Resistant Acinetobacter Baumannii **(CRAB)**
- Carbapenem Resistant Pseudomonas Aeruginosa **(CRPA)**
- Candida Auris **(C. *auris*)**
- Carbapenemase **(CP)**
- Carbapenemase Producing Organisms **(CPO)**
- Klebsiella Pneumoniae Carbapenemase **(KPC)**
- Oxacillinase **(OXA)**
- Verona Integron-Encoded Metallo-β-lactamase **(VIM)**
- New Delhi Metallo-β-lactamase **(NDM)**

The Significance of Antimicrobial Resistance

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Antimicrobial Resistance occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to medicines making infections harder to treat and increasing the risk of disease spread, severe illness, and death.[10]

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Antimicrobial Resistance- A Leading Public Health Threat

Antimicrobial resistance is among the top 10 public health threats worldwide.

Every 11 seconds, someone in the US gets an infection that is resistant to antibiotics, and every 15 minutes, someone dies.

Each year, antibiotic-resistant bacteria and fungi result in more than 2.8 million infections and 35,000 fatalities in the US.

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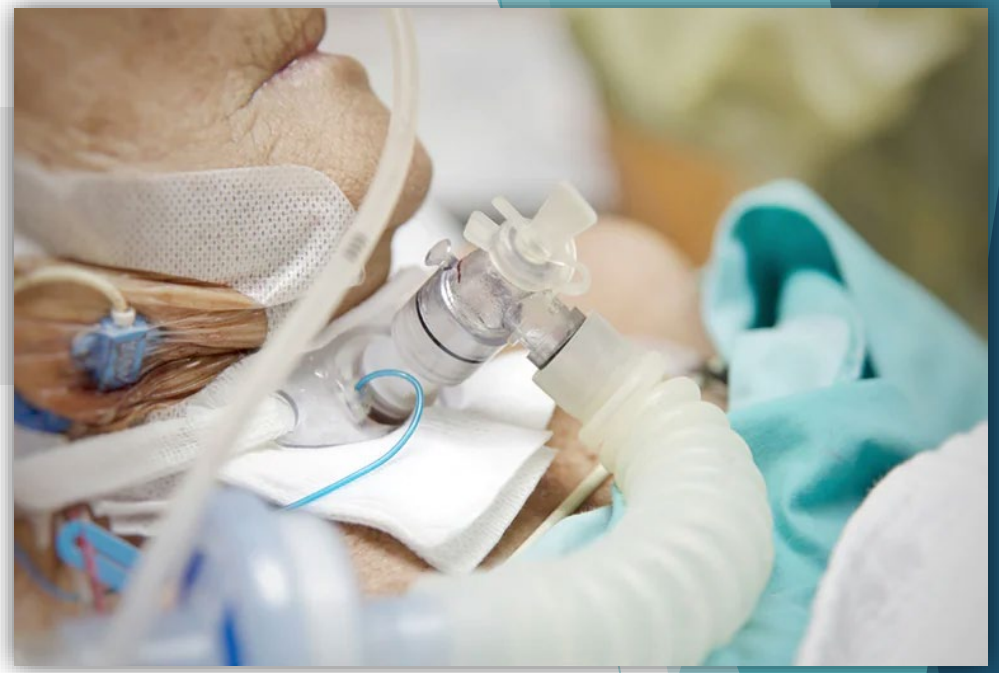
Transmission in Healthcare Settings

- Medical procedures
- Indwelling medical devices
- Contaminated environmental surfaces in healthcare settings
- Contaminated hands of healthcare workers
- Movement of patients between healthcare facilities while infected or colonized with an MDRO

Risk Factors



- Infection and/or colonization with other MDROs
- Underlying medical conditions
- Recent antimicrobial use
- Indwelling medical devices
- Open wounds
- Frequent or prolonged healthcare stays especially at ventilator equipped skilled nursing facilities (vSNFs) and long term acute care hospitals (LTACHs)
- Admission in intensive care unit (ICU)

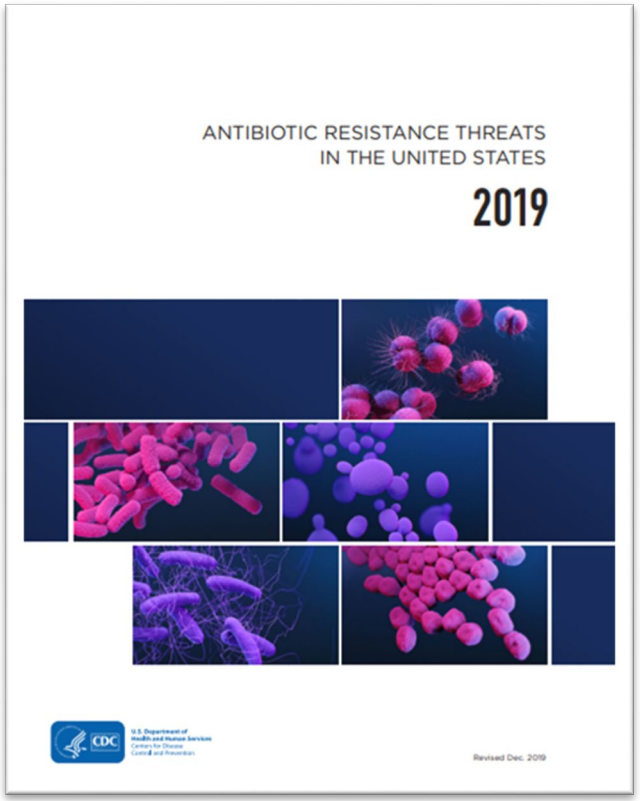
Antimicrobial Resistance Impact

As drug resistance increases internationally, antibiotics are becoming progressively less effective.

Resistant infections add considerable costs to the healthcare system.

Surgery, and other medical procedures become riskier.

Morbidity and mortality will rise in the absence of efficient detection and management of drug-resistant infections.



ARLABnetwork

U.S. MDRO Data

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- CRE, are a family of germs that are difficult to treat because they are resistant to nearly all antibiotics, including carbapenems, some of our most powerful drugs.
- The two most common types of CRE in the United States are carbapenem-resistant Klebsiella species and carbapenem-resistant E. coli.
- Approximately 30% of CRE carry a mobile genetic element that can make a *carbapenemase*, or an enzyme which makes carbapenem antibiotics ineffective. These resistance genes can be passed to other bacteria.

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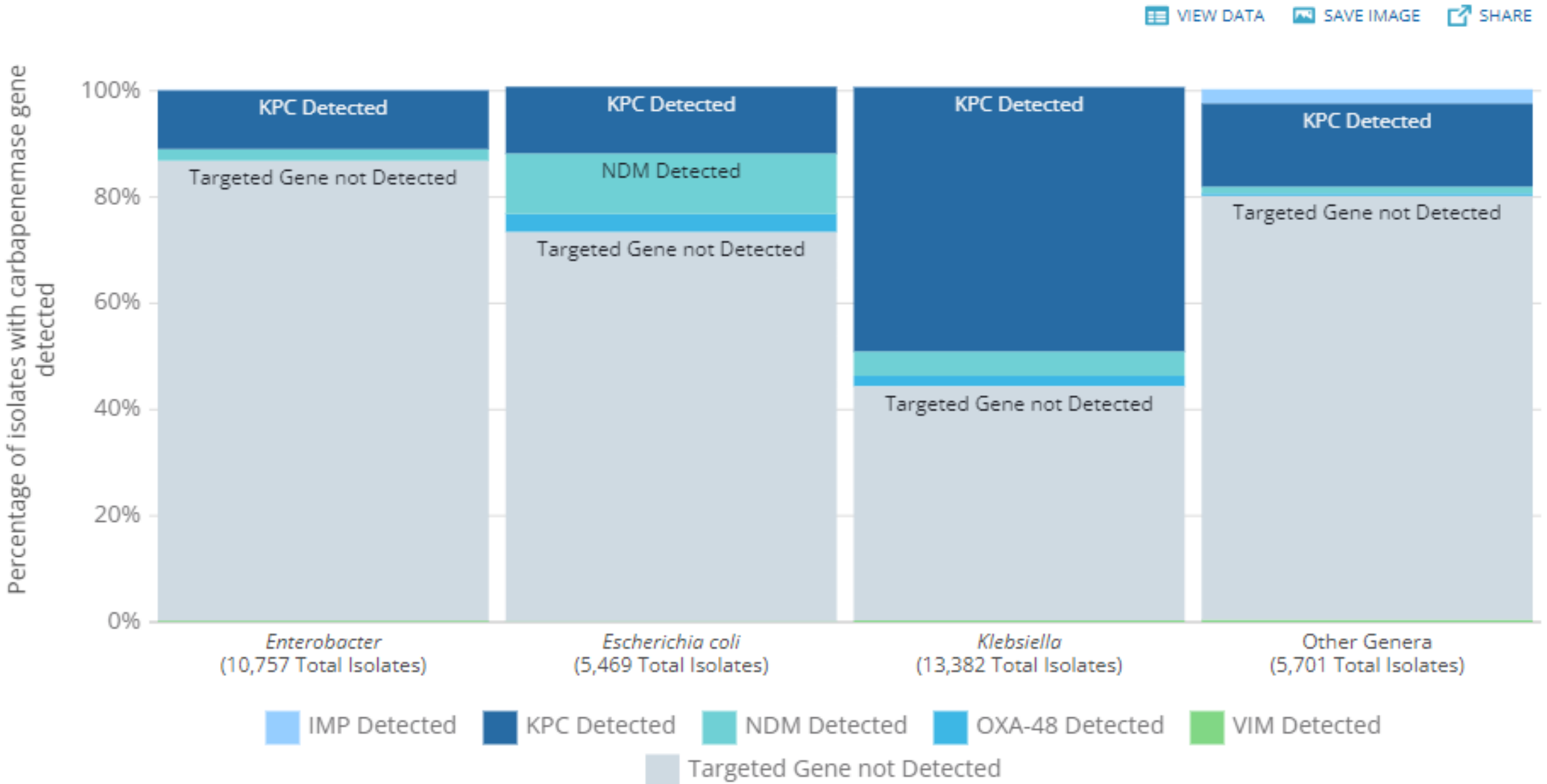
CDC. 2019 AR Threats Report: *Antibiotic Resistance Threats in the United States*, 2019.[2]

Carbapenemases

Carbapenemase	Details	Bacteria Usually Found In
K. pneumoniae carbapenemase (KPC)	Most common carbapenemase identified domestically	Enterobacteriaceae
New Delhi Metallo-beta-lactamase (NDM)	VIM and IMP are less common in the United States; however, cases of NDM are increasing. All are concerning because they can be resistant to even more antibiotics than KPC.	Enterobacteriaceae, Pseudomonas aeruginosa, Acinetobacter spp.
Verona Integron-Enconded Metallo-beta-lactamase (VIM)		
Imipenemase (IMP)		
Oxacillinase-48 (OXA-48)	Less common in the United States	Enterobacteriaceae, Pseudomonas aeruginosa, Acinetobacter spp.
Oxacillinase-23, 24/40, 58, and others (OXA-##)	Common carbapenemases	Acinetobacter spp.

Carbapenemase Genes Detected in CRE, by Genus, 2017-2020 (AR Lab Network)



Centers for Disease Control and Prevention, 2022[4]

Detection of CP-CROs and multi-CP gene CROs, by year-AR Lab Network, 2018-2021

	CRE			CRPA		
Year	Isolates Tested	CP-CRE Isolates Detected (%)	Multi-CP Gene CRE Isolates Detected (%)	Isolates Tested	CP-CRPA Isolates Detected (%)	Multi-CP Gene CRPA Isolates Detected (%)
2018	15,409	5,508 (35.75%)	66 (0.43%)	11,181	252 (2.25%)	4 (0.04%)
2019	19,231	6,371 (33.14)	85 (0.44%)	15,421	353 (2.29%)	14 (0.09%)
2020	15,787	5,156 (32.66%)	98 (0.62%)	12,630	228 (1.81%)	4 (0.03%)
2021	17,683	6,216 (35.15%)	165 (0.93%)	12,996	280 (2.15%)	4 (0.03%)

- The number of multi-CP gene CROs detected in the AR Lab Network has increased each year, from 70 in 2018 to 169 in 2021.
- Multi-CP gene CROs may pose an even greater threat to patients since antibiotic treatment options may be further limited and the risk of resistance transmission may be higher.

Multi-Carbapenemase Genes

TARGETED CARBAPENEMASE GENES DETECTED IN MULTI-CP GENE CRE

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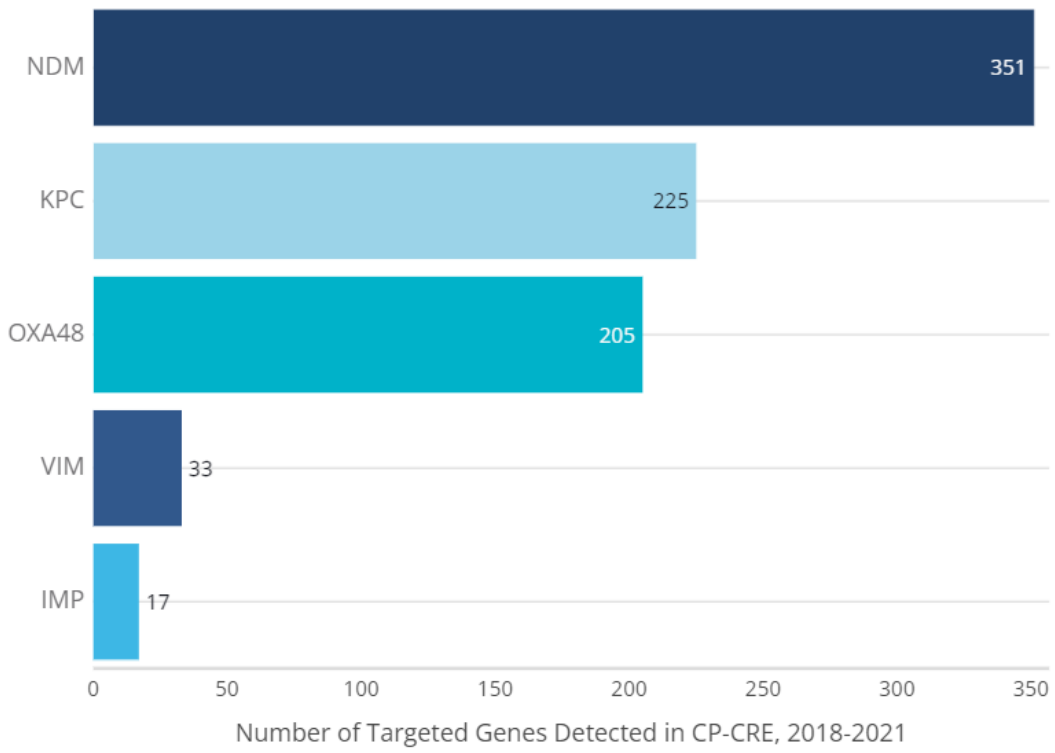

MULTI-CP GENE CRE DETECTED AMONG NDM CP-CRE

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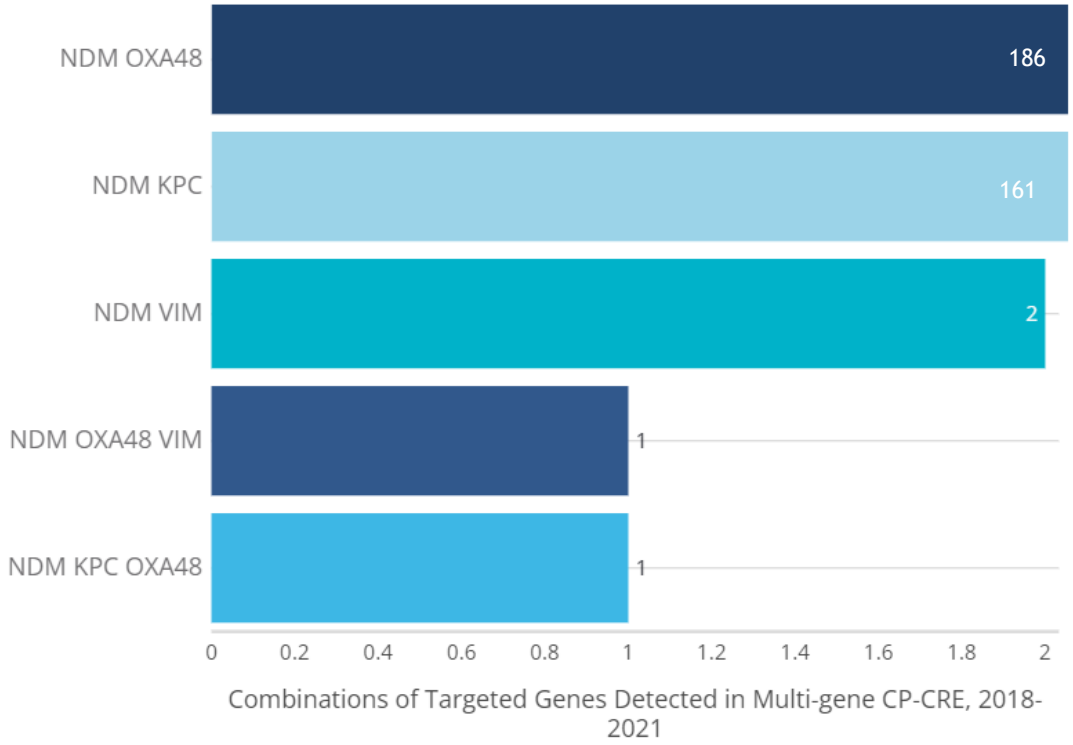

Centers for Disease Control and Prevention, 2022[4]

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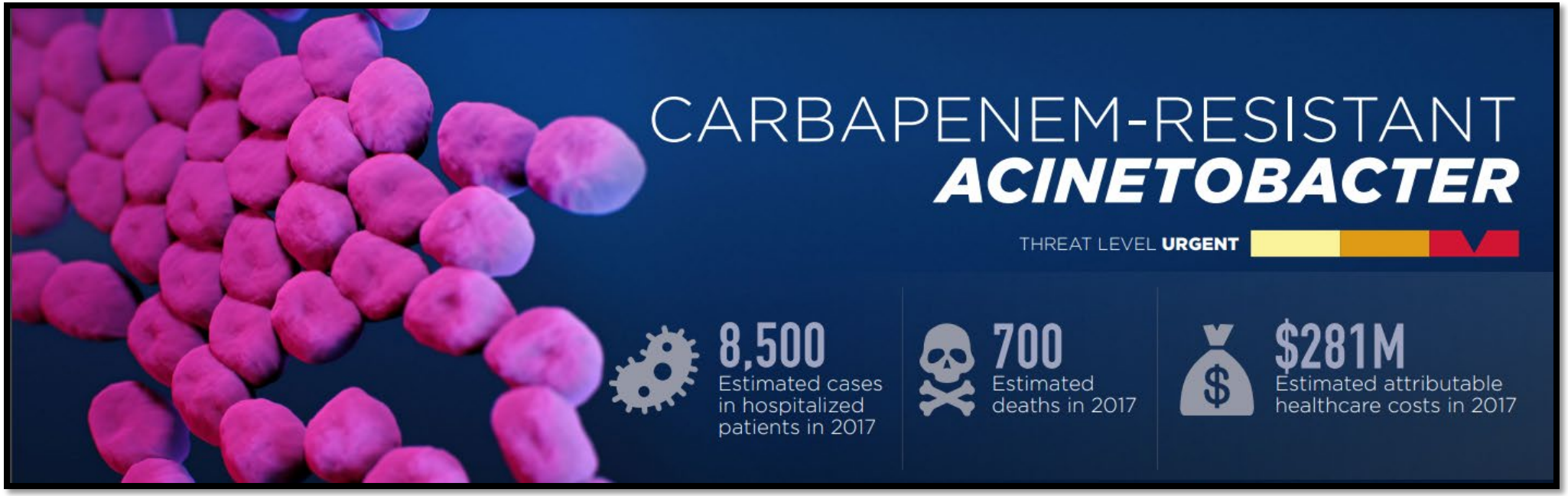

- Commonly found in the environment, such as in soil and water.
- Acinetobacter baumannii is the most commonly identified species associated with healthcare infections.
- Can cause deadly infections and large outbreaks among hospitalized patients and nursing home residents.
- Can survive on environmental surfaces and shared equipment for long periods if not adequately cleaned.
- Can cause infections in the lungs, bloodstream, urinary tract and wounds.
- Can colonize in respiratory secretions or open wounds.

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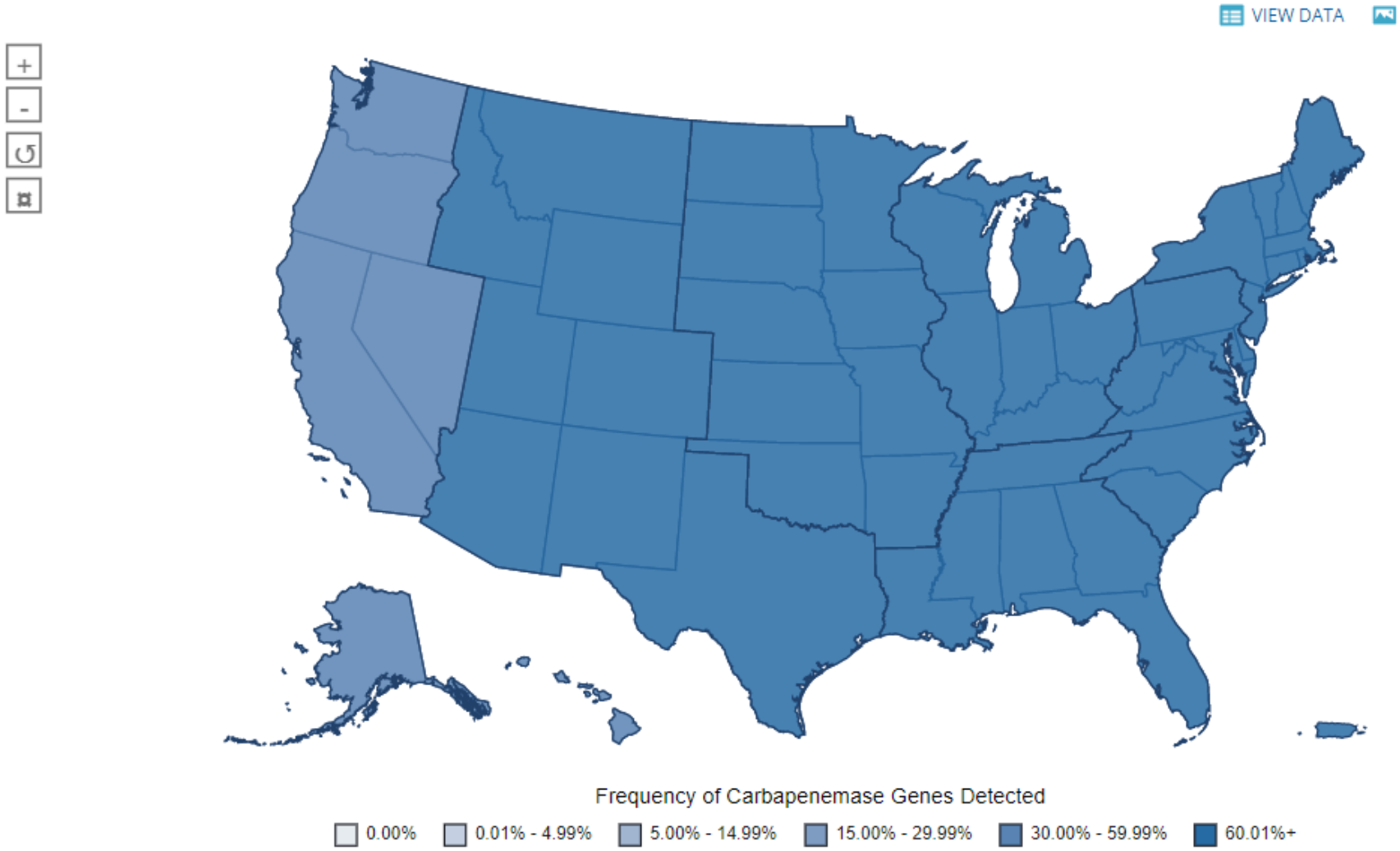
CDC. 2019 AR Threats Report: *Antibiotic Resistance Threats in the United States*, 2019.[2]

Figure 1: Frequency of detecting carbapenemase genes that are more common in CRA, by AR Lab Network Region—2019



Carbapenemase genes that are *more common* in CRA: OXA-23-like, OXA-24/40-like, OXA-58-like

ARLN Region	CP PCR Frequency
Central	84.8
Mid-Atlantic	100.0
Midwest	73.5
Mountain	94.2
Northeast	66.5
Southeast	71.4
West	37.8

Centers for Disease Control and Prevention, 2021[3]

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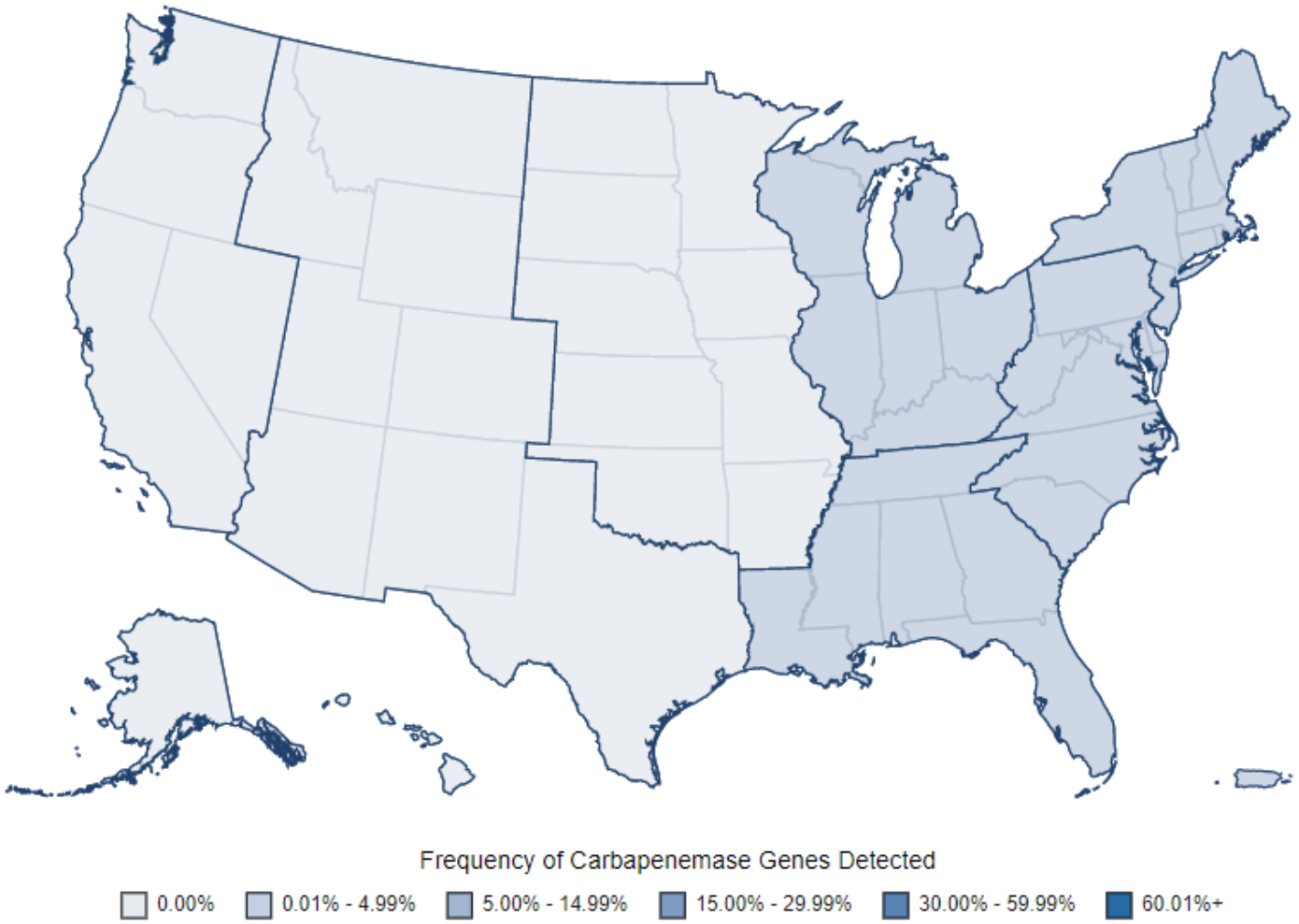
Figure 2: Frequency of detecting carbapenemase genes that are less common in CRA, by AR Lab Network Region—2019



Carbapenemase genes that are *less common* in CRA: KPC, IMP, NDM, VIM, OXA-48-like

ARLN Region	CP PCR Frequency
Central	0.0
Mid-Atlantic	3.4
Midwest	1.6
Mountain	0.0
Northeast	0.6
Southeast	0.8
West	0.0

Centers for Disease Control and Prevention, 2021[3]

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- Drug-resistant fungus first identified in Asia of 2009.
- Some strains are resistant to all three available classes of antifungals.
- Can be carried on patients' skin without causing infection.
- Environmentally resilient and capable of causing outbreaks in healthcare facilities.
- Common hospital-grade disinfectants are not effective.
- Difficult to identify with standard laboratory methods.

CDC. 2019 AR Threats Report: *Antibiotic Resistance Threats in the United States*, 2019.[2]

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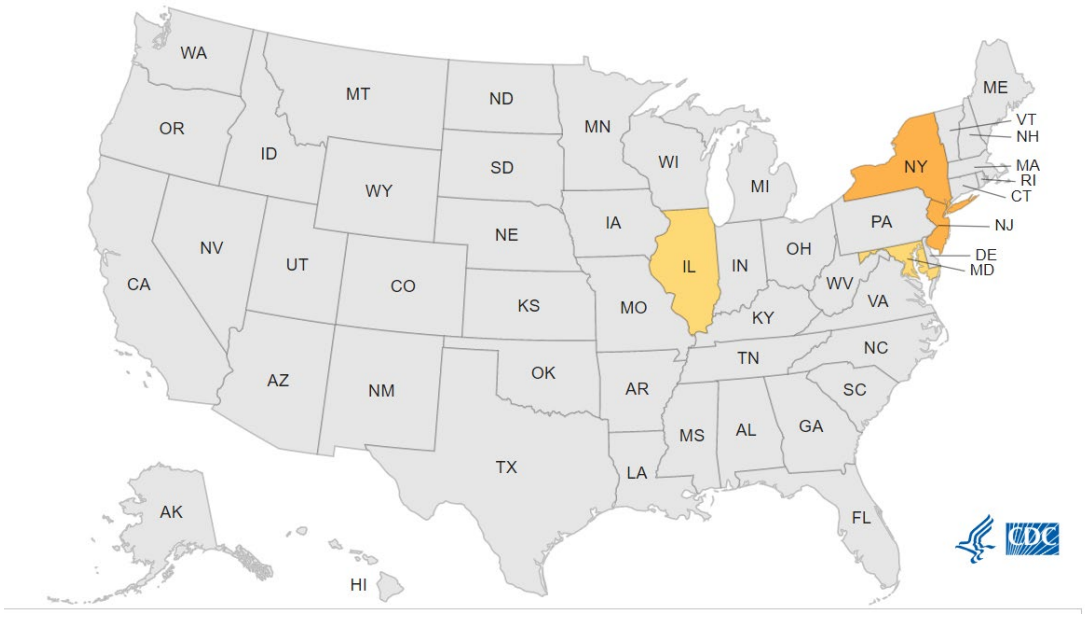
C. *auris* Trends

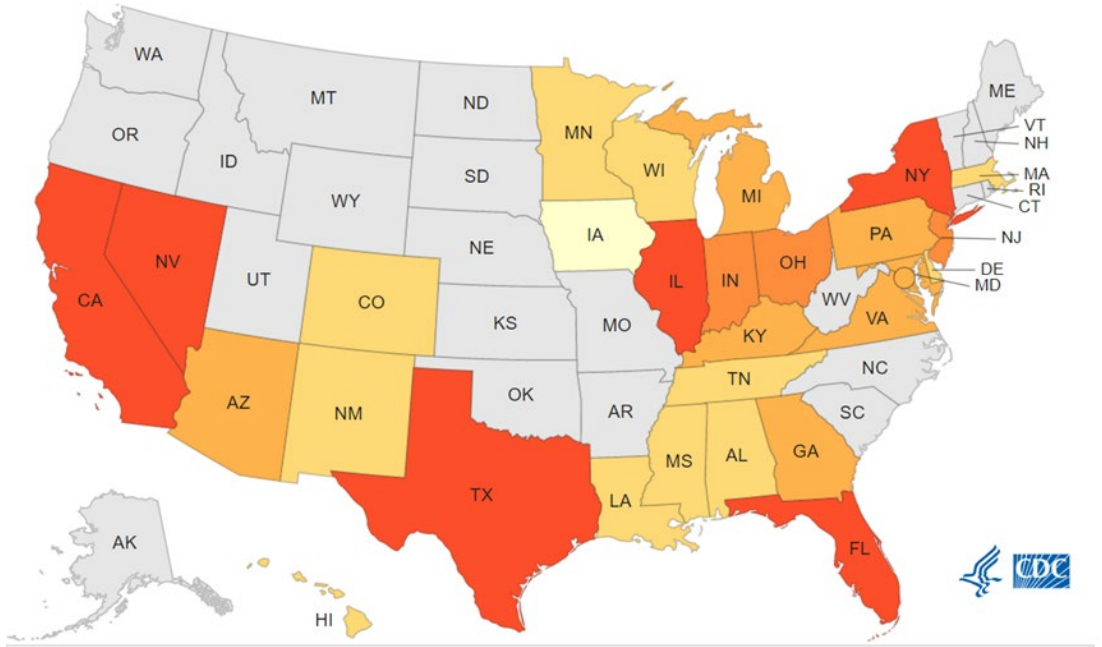
2013-2016

63 clinical cases and 14 screening cases



2022

2,377 clinical cases and 5,754 screening cases



Centers for Disease Control and Prevention. *Tracking Candida auris*, 2019.[5]

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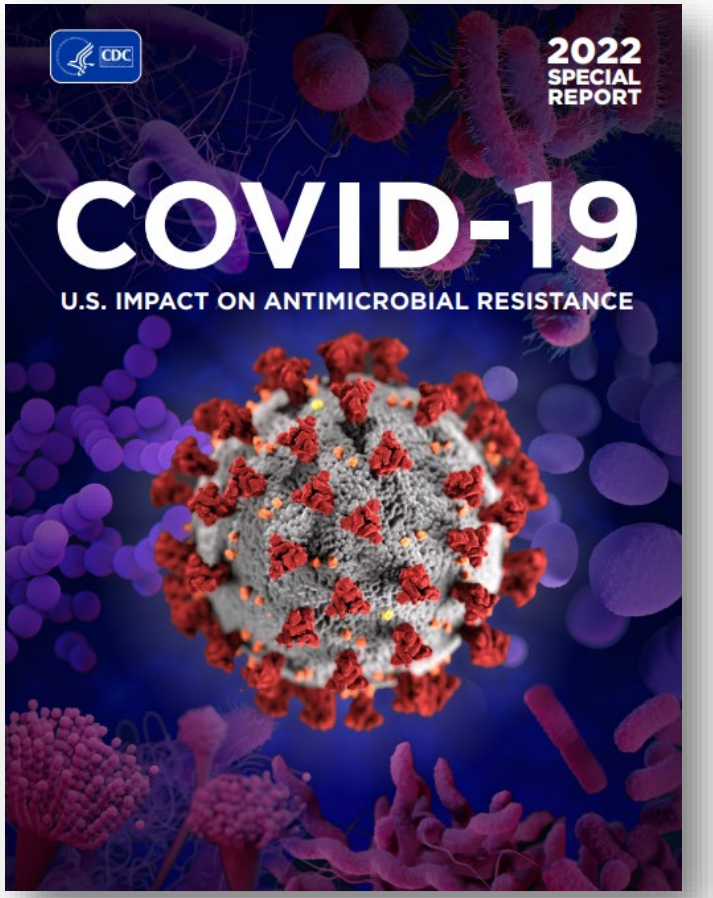

Understand COVID-19 Impacts on Antimicrobial Resistance

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COVID-19 Impact on MDROs

- As of 2017, committed infection prevention and control measures in the United States helped to lower the overall number of deaths from antimicrobial-resistant infections by 18% and the number of deaths in hospitals by nearly 30%.[7]
- However, the pandemic has negatively impacted this progress. Resistant hospital-onset infections and deaths both increased at least 15% during the first year of the pandemic.[7]

COVID-19 Impact on MDROs

Less detection and reporting of antimicrobial resistance data

CDC's AR Lab Network received and tested 23% fewer specimens or isolates in 2020 than in 2019.

Hospitals saw a higher percentage of sicker patients who required longer stays in 2020 compared to the pre-pandemic population.

Limited bandwidth of healthcare facilities and healthcare departments

Lapses in infection prevention and control practices

Prescribing COVID-19 patients with antibiotics, which are ineffective against viruses

CDC. *COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022.*2022.[7]

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Antibiotic Use During COVID-19

Hospitals

- Between March and October of 2020, nearly 80% of hospitalized COVID-19 patients received an antibiotic.
- As of August 2021, antibiotic use was down overall compared to 2019, but up for specific antibiotics like azithromycin and ceftriaxone.

Nursing Homes

- Antibiotic use in nursing homes increased parallel to surges of COVID-19 cases, but remains lower overall.
- Azithromycin use was 150% higher in April 2020 and 82% higher in December 2020 than the same months in 2019.

CDC. *COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022.*2022.[7]

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Hospital-onset Infections Increase

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.

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

CDC. *COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022.*2022.[7]

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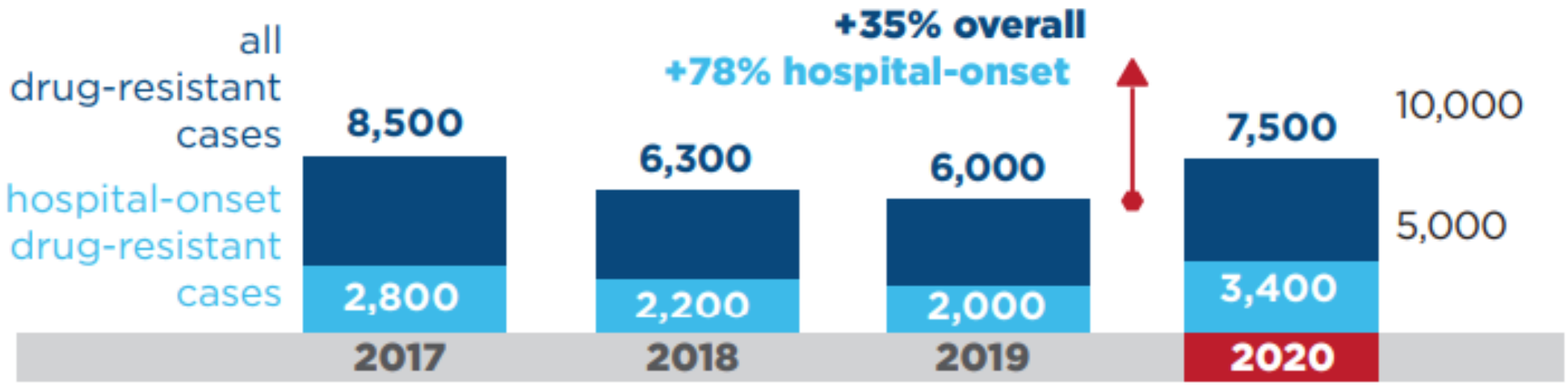
CRAB

The rates of hospital-onset carbapenem-resistant *Acinetobacter* cases decreased 2012-2017, began to plateau, then increased 78% in 2020.



Data from 2018–2020 are preliminary.

CDC. *COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022.*2022.[7]

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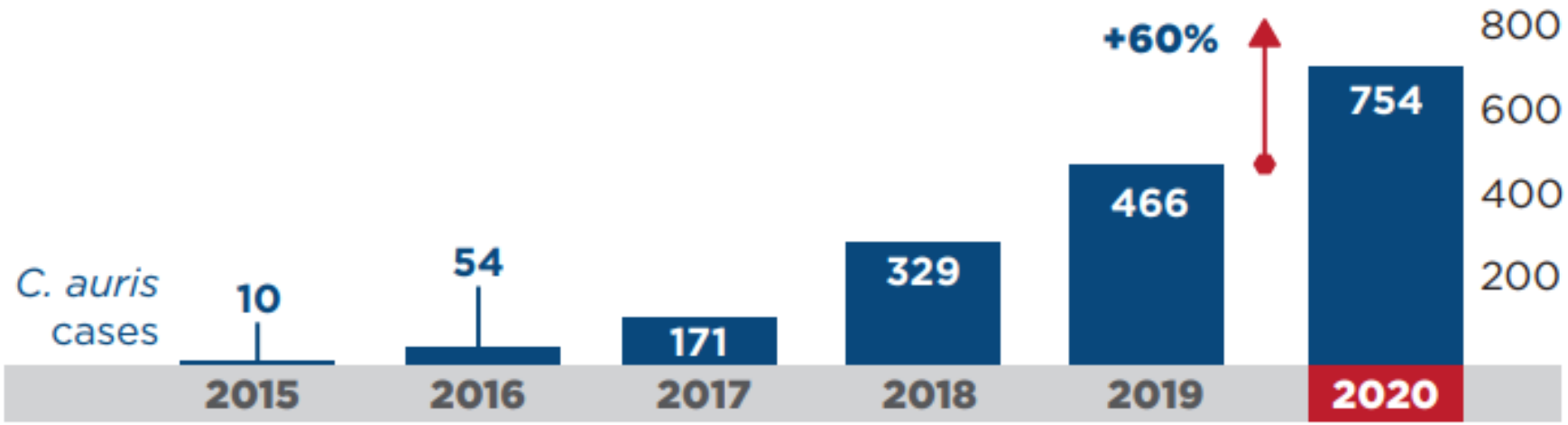
C. *auris*

C. auris clinical cases have steadily increased since 2015 and significantly increased in 2020. The increase in 2020 could be a result of staffing and supply shortages, an increased number of sicker patients, and changes in infection prevention and control practices (e.g., re-use or extended use of gowns and gloves).



CDC. *COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022.*2022.[7]

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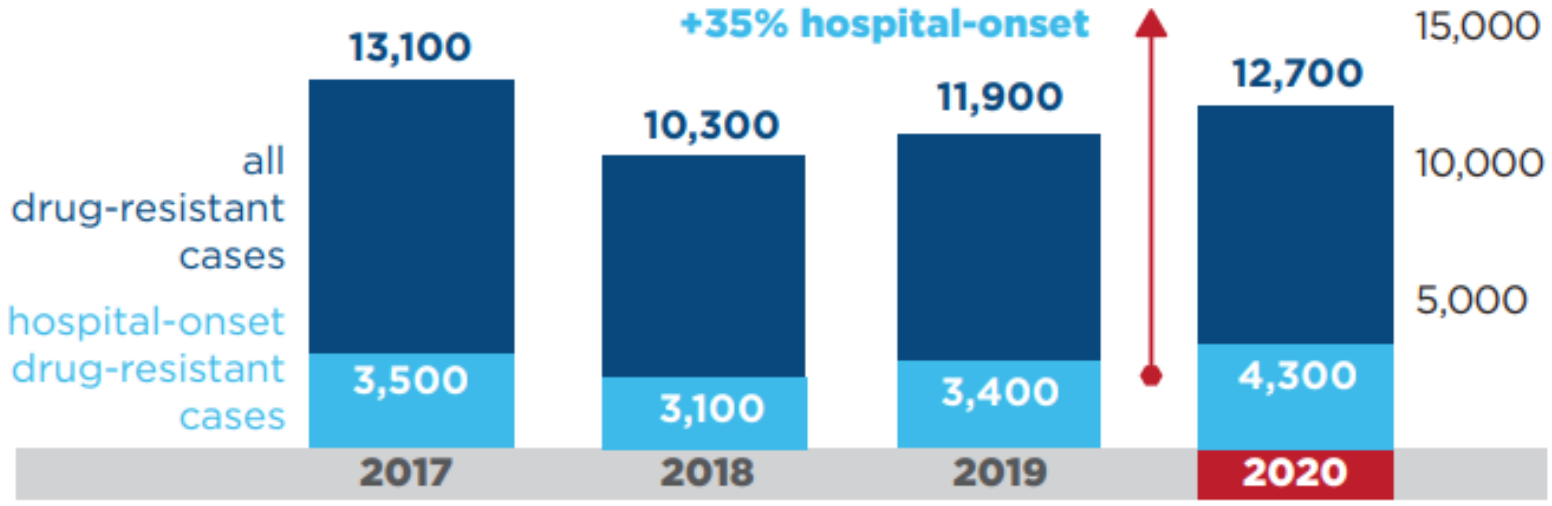
CRE

The rate of CRE cases declined significantly from 2017 to 2018, but began to rise again in 2019 and continued into 2020.



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Statewide MDRO Trends

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Detecting MDROs in Louisiana

Louisiana Office of Public Health Laboratory Antibiotic Resistance Testing Summary

November 10, 2022

Condition	Incident Isolates Identified from These Body Sites	Species	Directly Submit to this Laboratory
Carbapenem-resistant Enterobacteriaceae (CRE)	All	*Enterobacter spp.* *Klebsiella pneumoniae* *Klebsiella oxytoca* *Escherichia coli*	LA-OPHL
		All other Enterobacteriaceae genera (e.g. *Citrobacter spp., Providencia spp., Proteus spp., Serratia spp., Morganella spp.*)	Southeast CDC Antimicrobial Resistance Laboratory
Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)	Sterile Sites Only	*Pseudomonas aeruginosa*	LA-OPHL
Candida auris	All	*Candida auris*, as well as common misidentifications of *C. auris* (e.g., *C. haemolunii, C. duobushaemolunii, C. famata, C. lusitaniae, C. sake, C. parapsilosis, C. catenulata, C. guilliermondii, and Rhodotorula glutinis*)	Southeast CDC Antimicrobial Resistance Laboratory
Pan-Non-Susceptible Organisms	All	CRE (*Enterobacter spp., Klebsiella pneumoniae, Klebsiella oxytoca, Escherichia coli*) or CRPA identified as intermediate or resistant to all antibiotics tested.	LA-OPHL
	All	Any CRE (Not *Enterobacter spp., Klebsiella pneumoniae, Klebsiella oxytoca, Escherichia coli) or* non-CRPA organism identified as intermediate or resistant to all antibiotics tested.	Southeast CDC Antimicrobial Resistance Laboratory
Staphylococcus aureus, Vancomycin Intermediate or Resistant (VISA/VRSA)	All	*Staphylococcus aureus* when vancomycin MIC ≥ 8 µg/ml	LA-OPHL

Protocol for Submitting Isolates to Southeast Antimicrobial Resistance Laboratory in Tennessee:

1. Notify the HAI/AR program as well as the Southeast AR Laboratory by sending an e-mail notification to hai@la.gov and arln.health@tn.gov.
   a. Attach the susceptibility report on the isolate.
   b. Include patient's name, date of birth, and specimen source.
2. The HAI/AR team will respond if the isolate is approved for testing and will send shipment instructions.
   a. A FedEx account number will be shared with facilities that are approved for isolate submissions.
   b. Isolates should only be shipped Monday through Thursday unless special approval is communicated by ARLN.
   c. **Note:** submitter should list the *submitting facility* as the submitter, not LA-OPHL.
3. Results will be sent to submitting facilities by snail mail.

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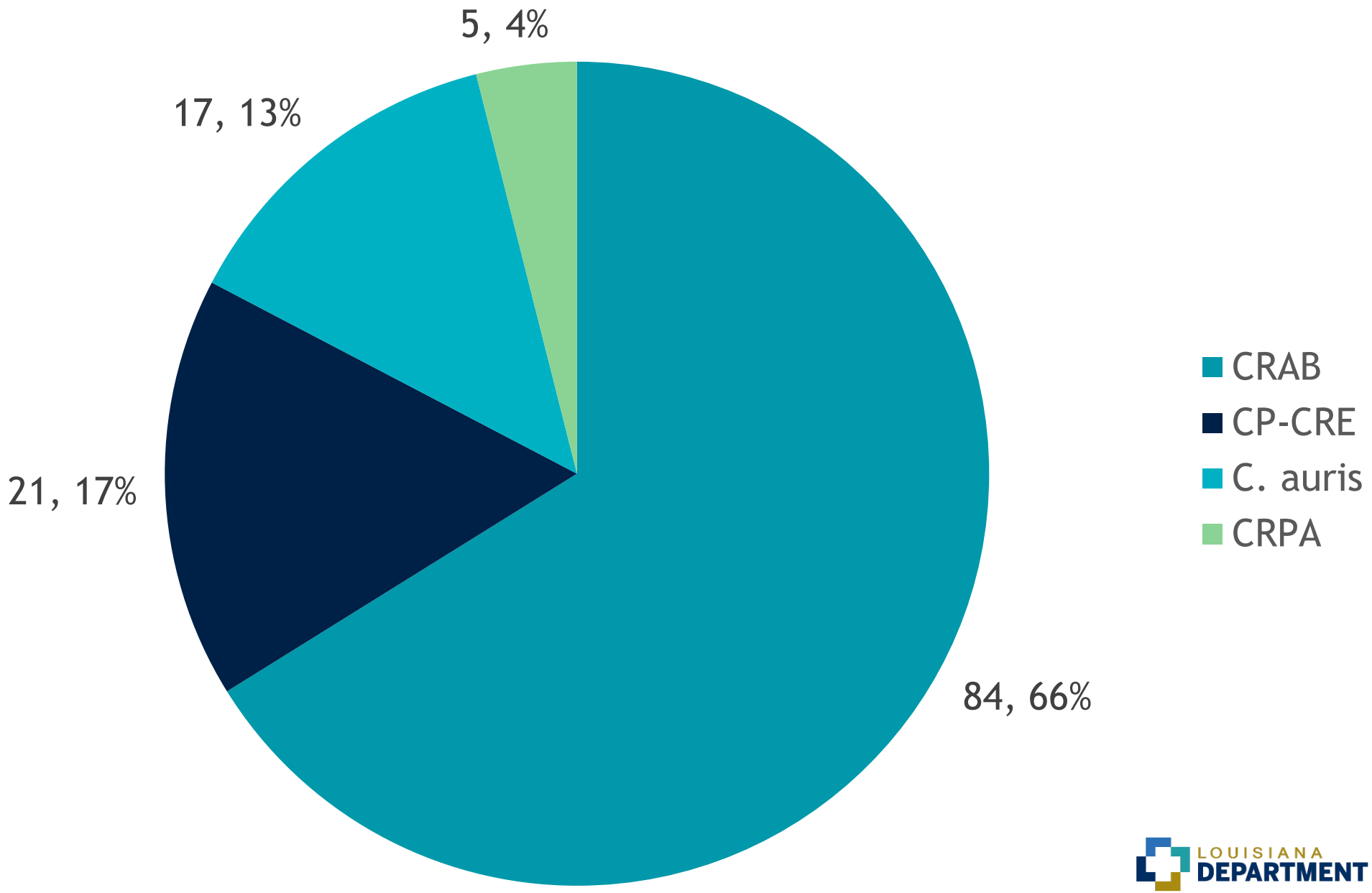
Louisiana Data Overview

- Data includes clinical isolates collected during inpatient admissions that triggered positive alert values received from LA state lab or ARLN.
- Carbapenemase Producing-Carbapenem Resistant Enterobacterales **(CP-CRE)**
- Carbapenem Resistant Acinetobacter Baumannii **(CRAB)**
  - Carbapenemase producer or pan resistant
- Carbapenem Resistant Pseudomonas Aeruginosa **(CRPA)**
  - Carbapenemase producer, pan resistant, or pan non susceptible
- Candida Auris **(C.*auris*)**
  - Only clinical isolates are included in the general overview section.

MDROs in Louisiana, January 2021- April 2023



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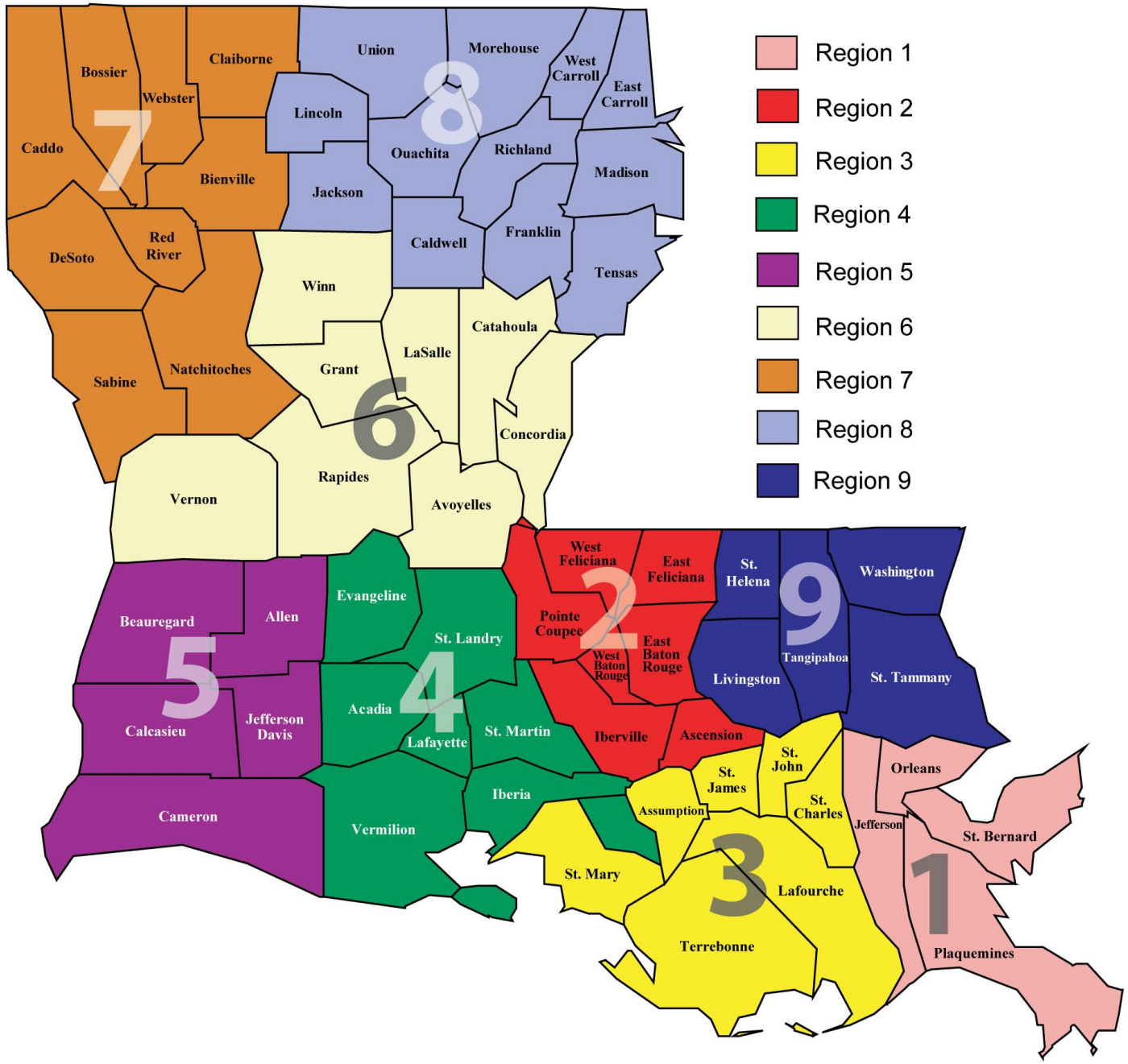

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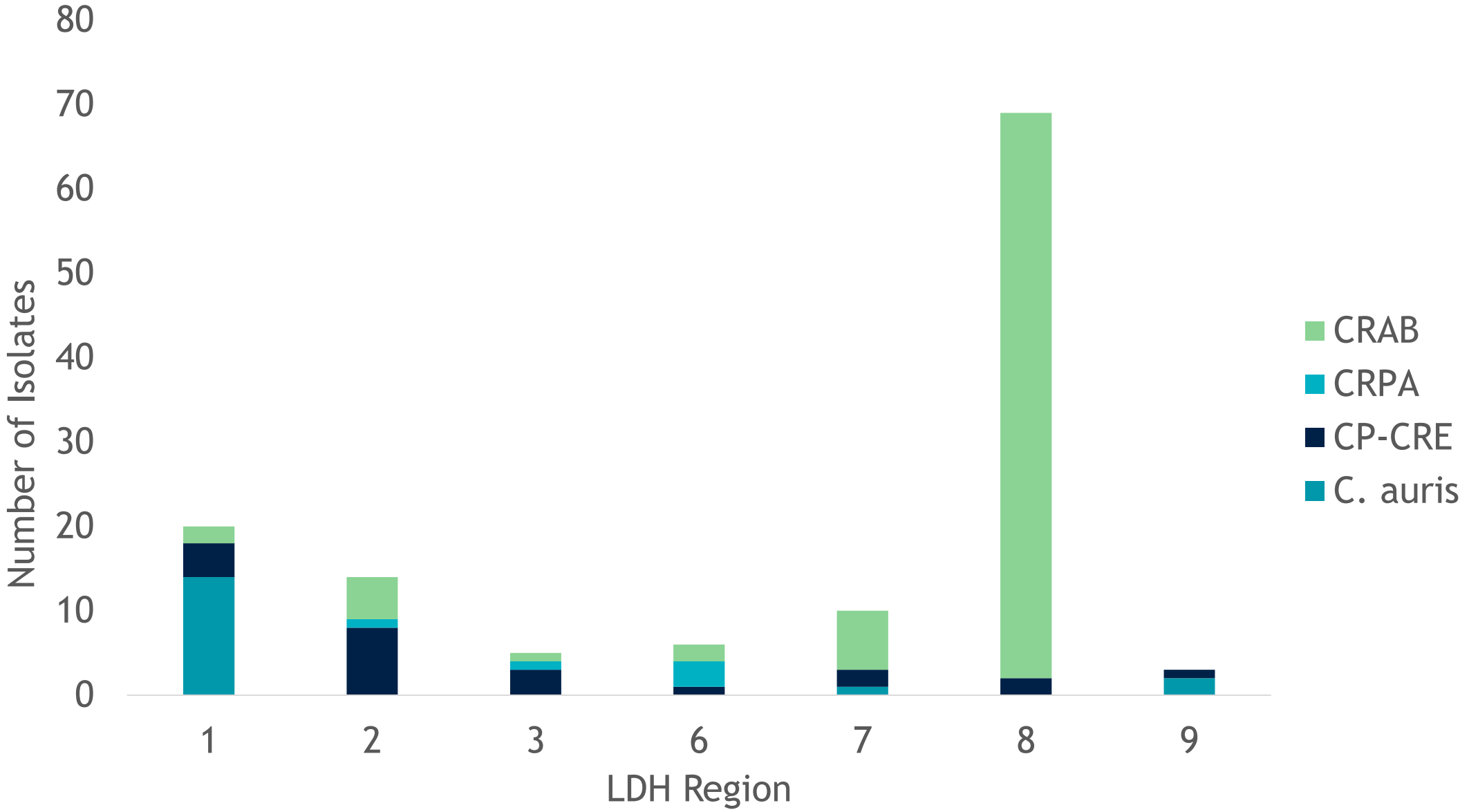
Distribution of MDROs in Louisiana, January 2021-April 2023



No data for regions 4 and 5*

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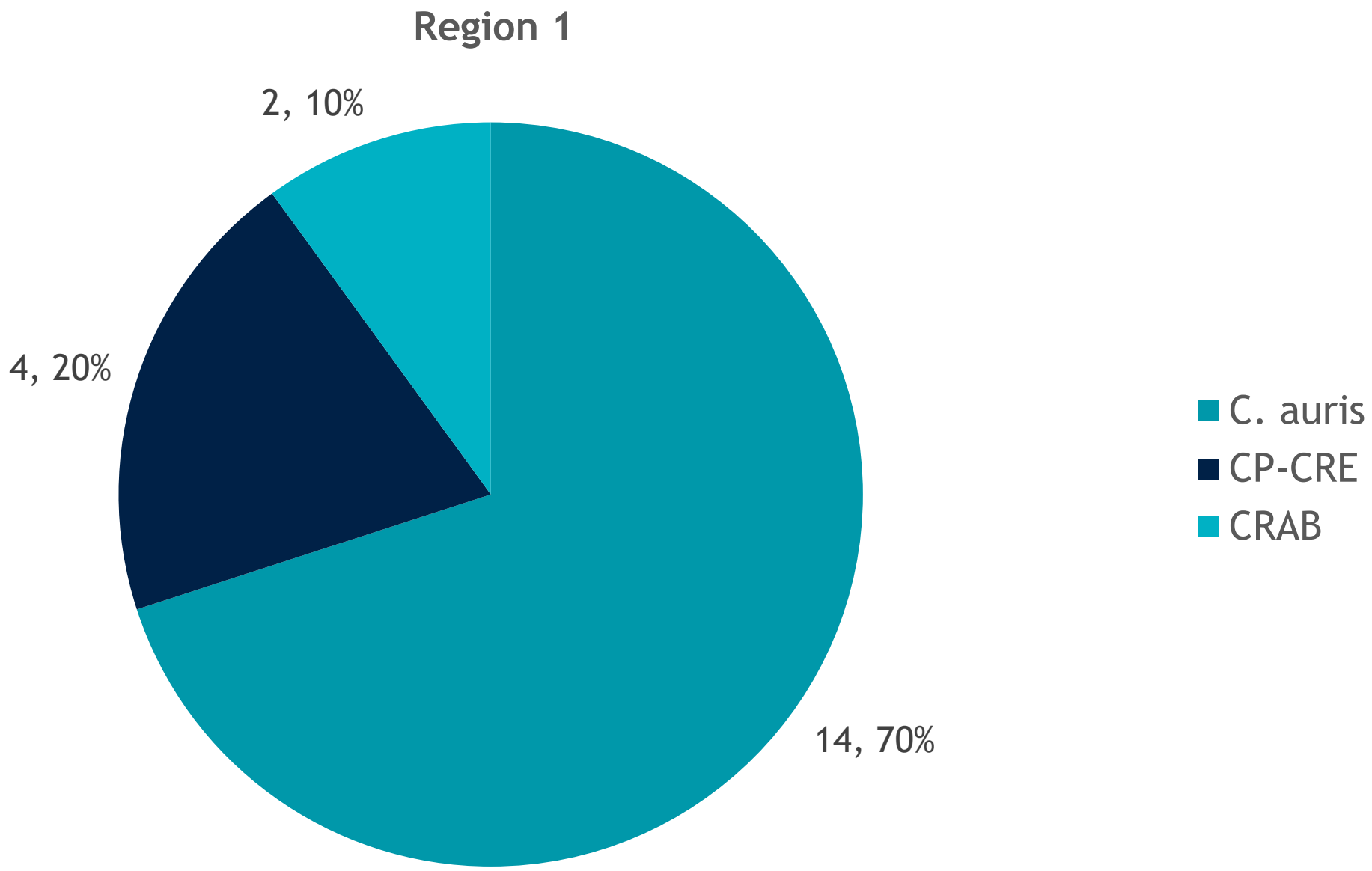
Distribution of MDROs in Louisiana, January 2021-April 2023



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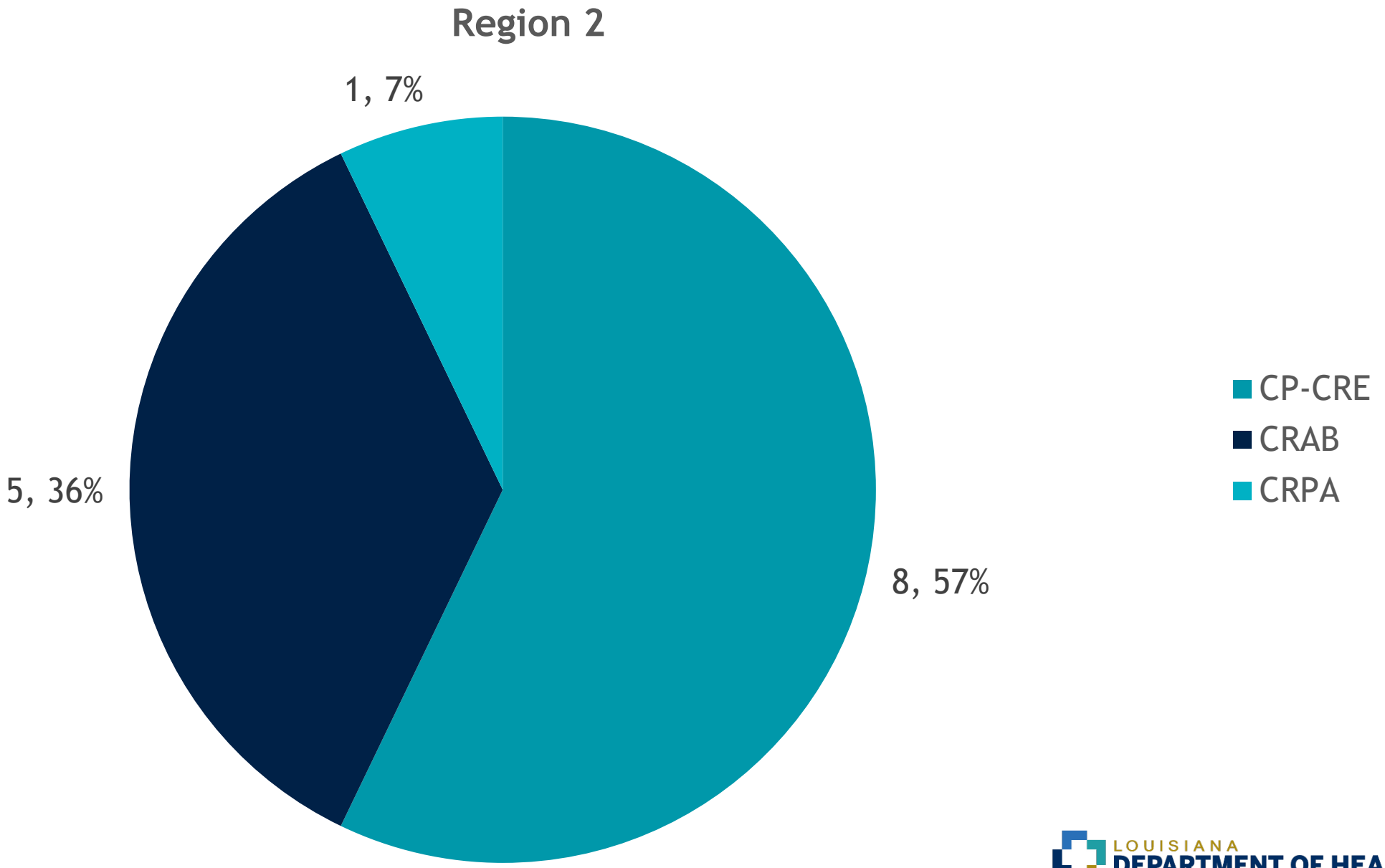

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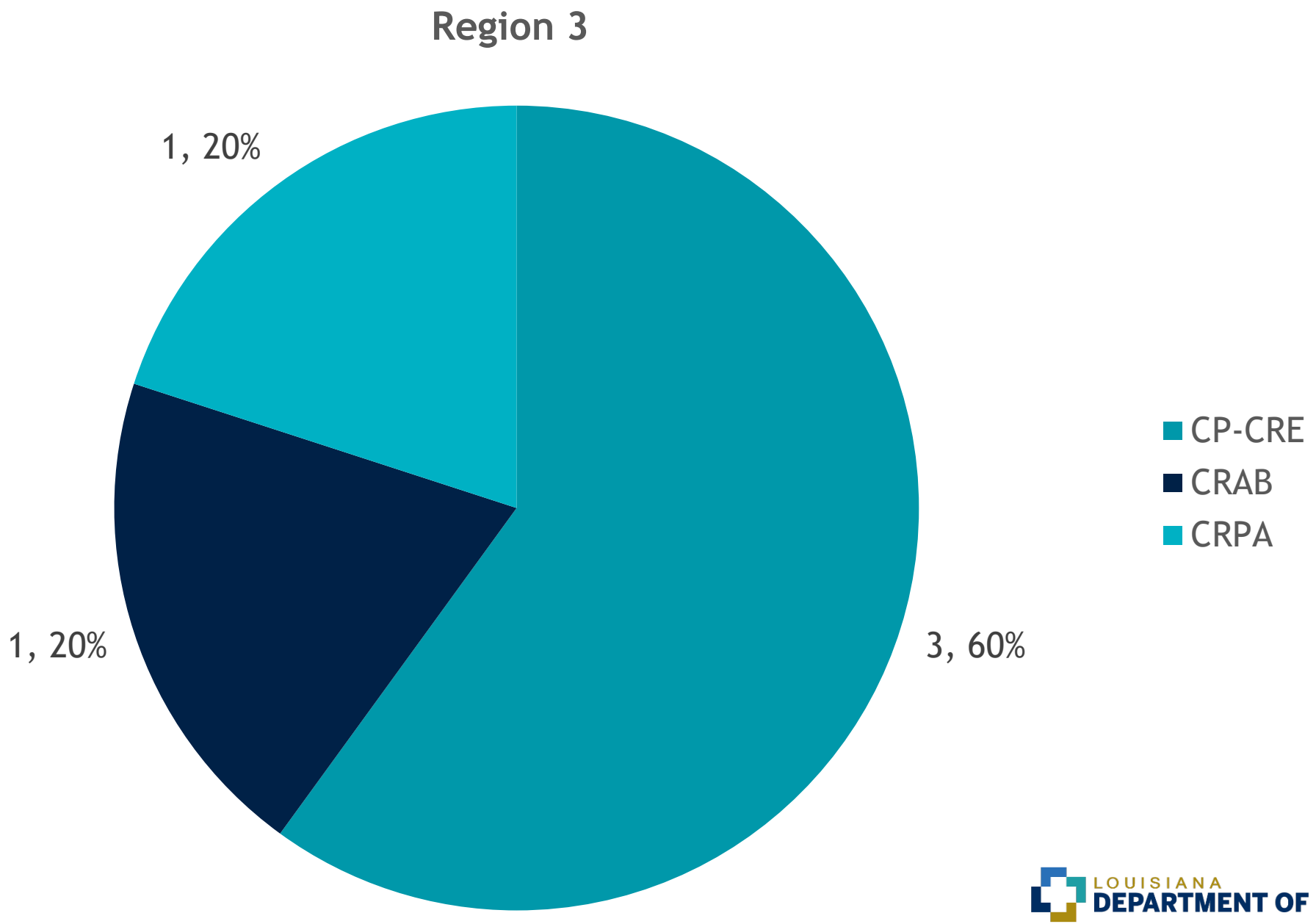
Distribution of MDROs in Louisiana, January 2021- April 2023



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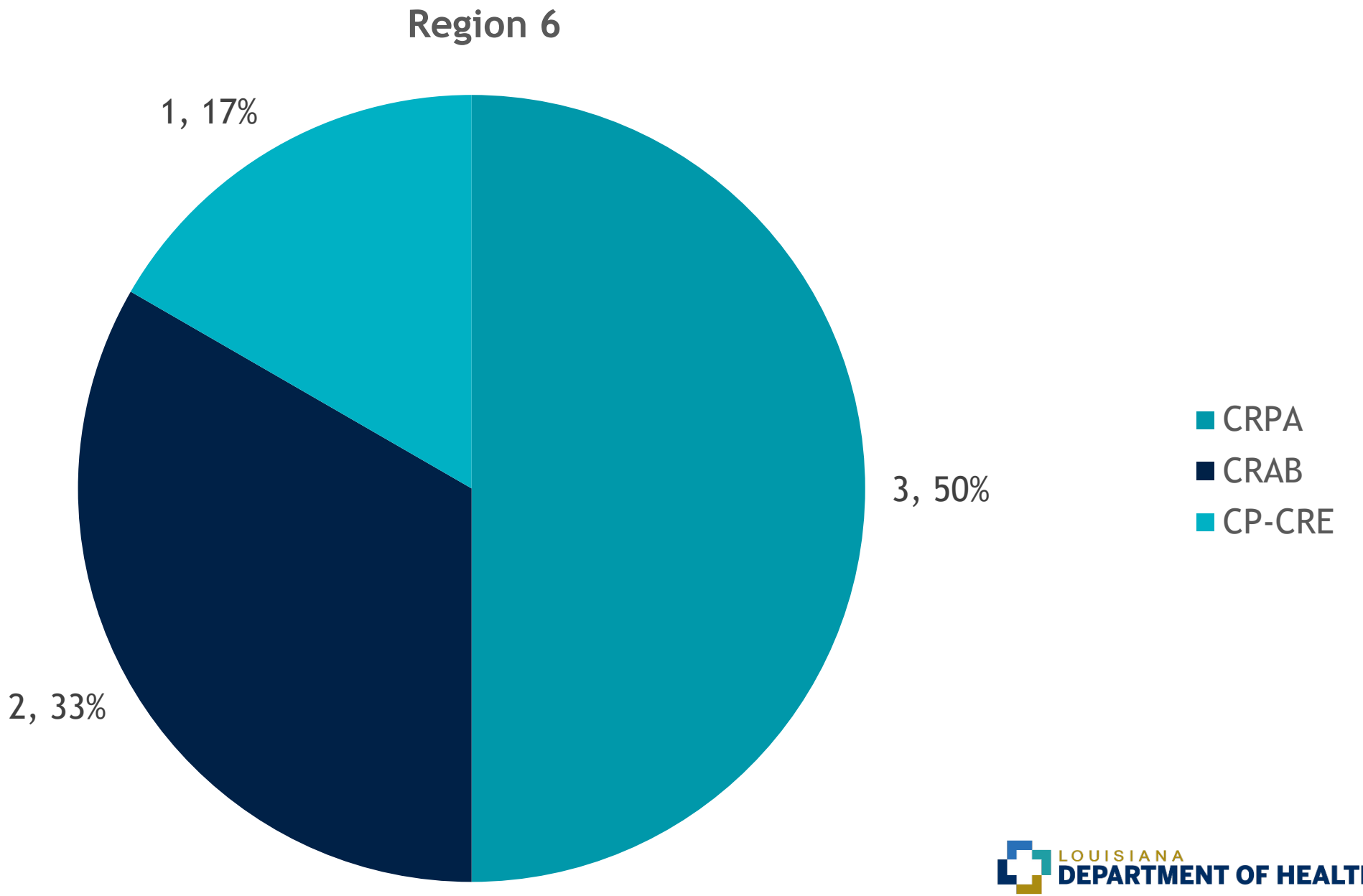
Distribution of MDROs in Louisiana, January 2021- April 2023



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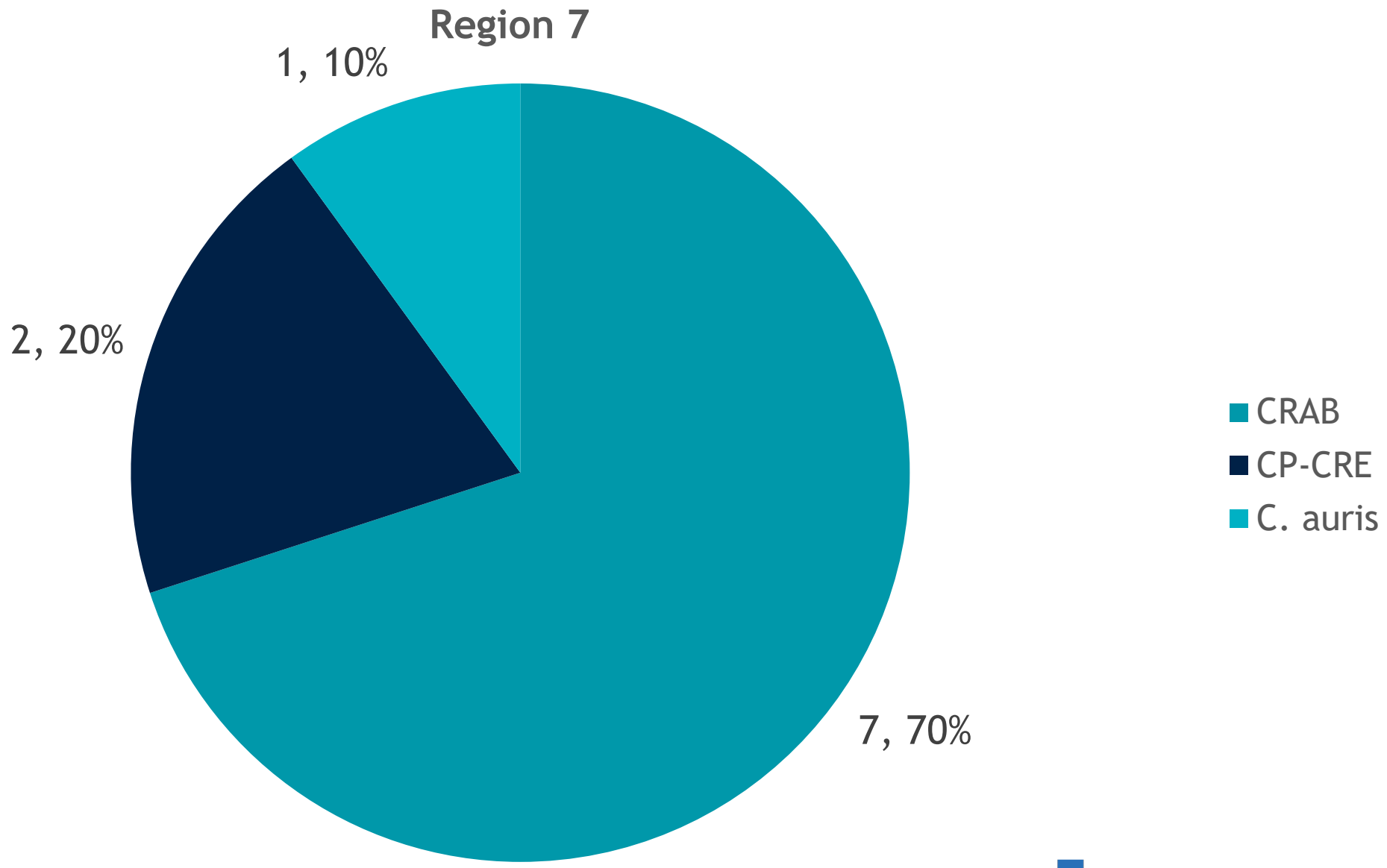

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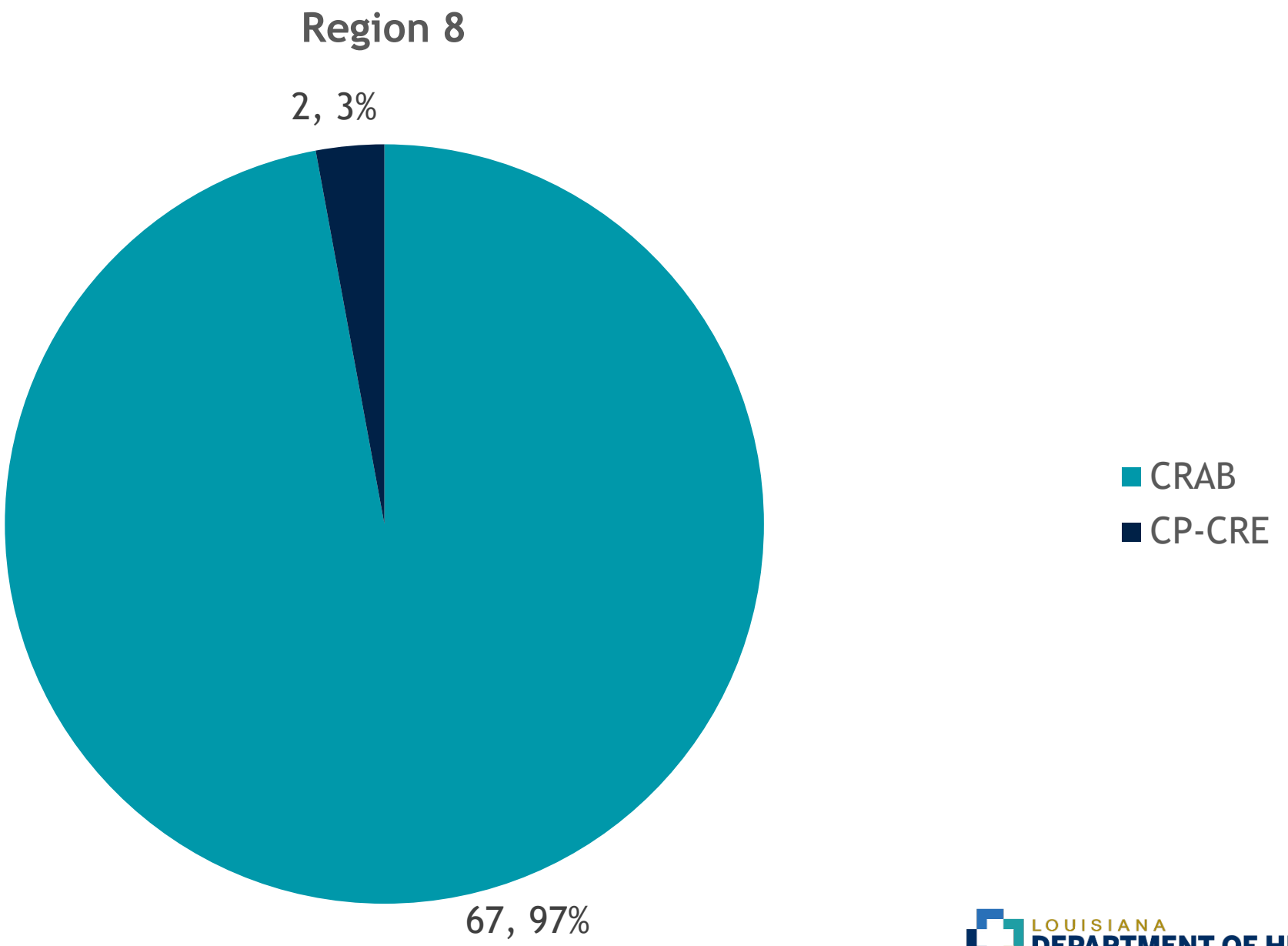
Distribution of MDROs in Louisiana, January 2021- April 2023



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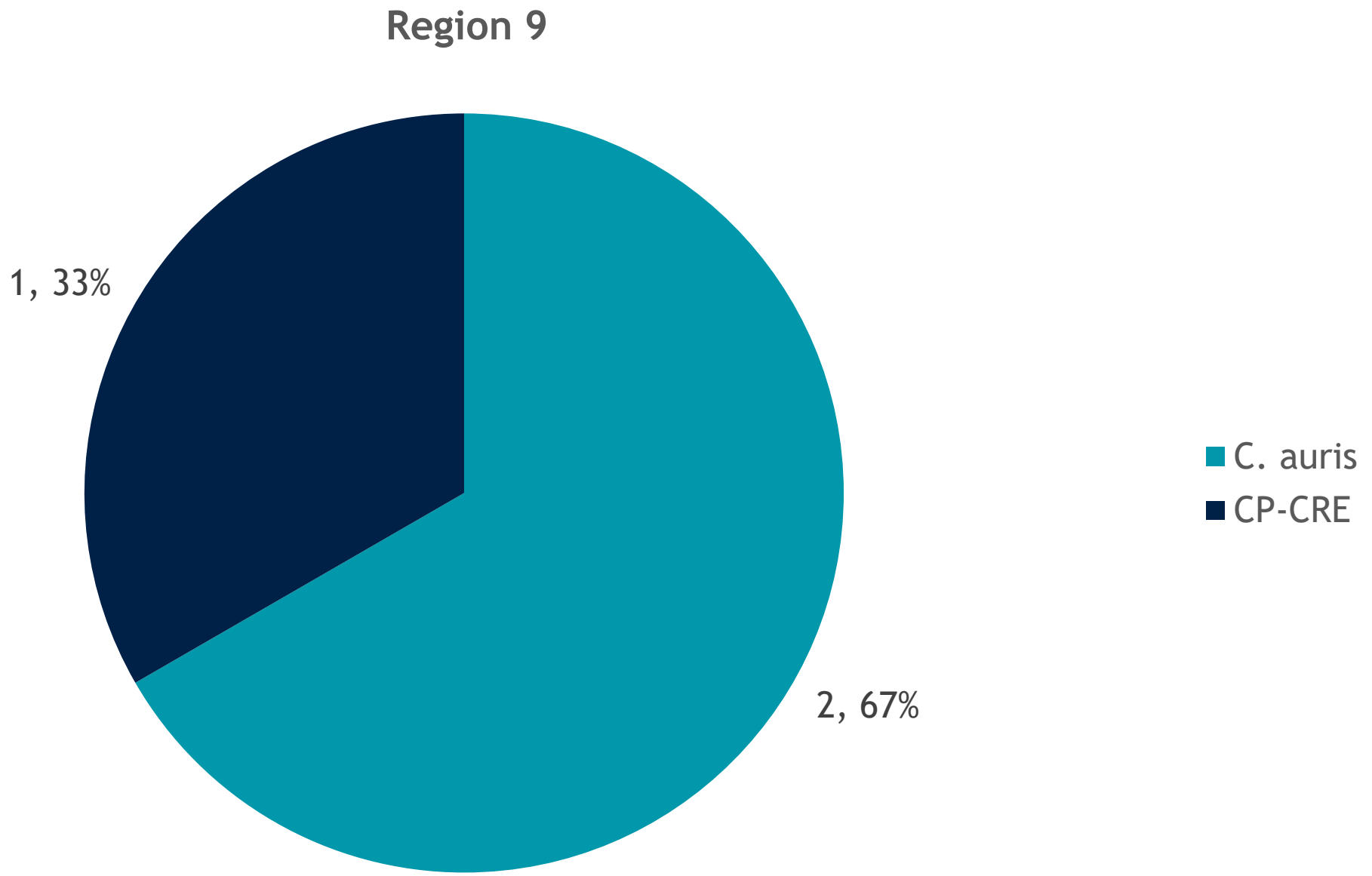
Distribution of MDROs in Louisiana, January 2021- April 2023



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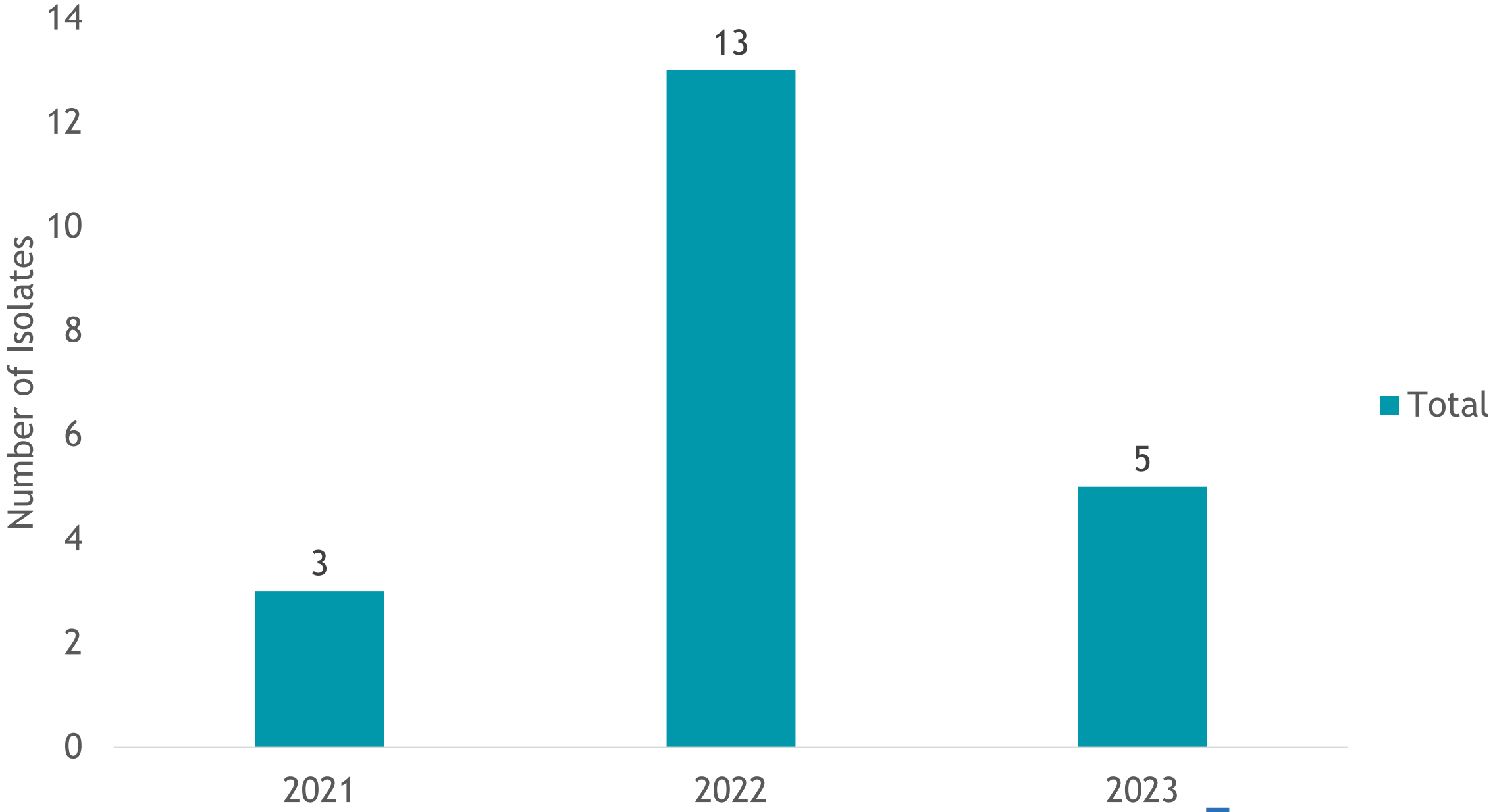
Louisiana: CP-CRE Isolates, January 2021-April 2023



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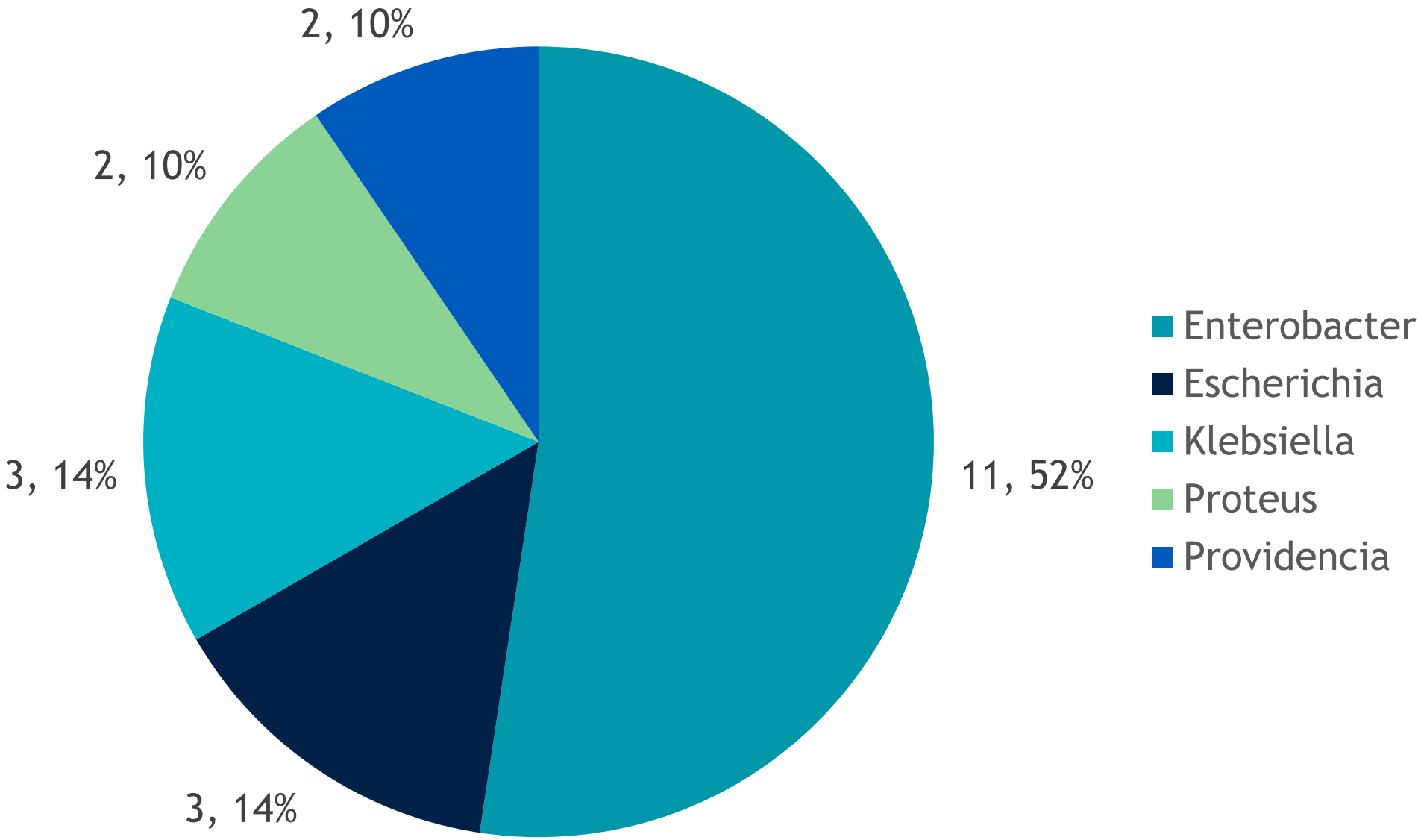
Louisiana: CP-CRE Genus Type, January 2021-April 2023



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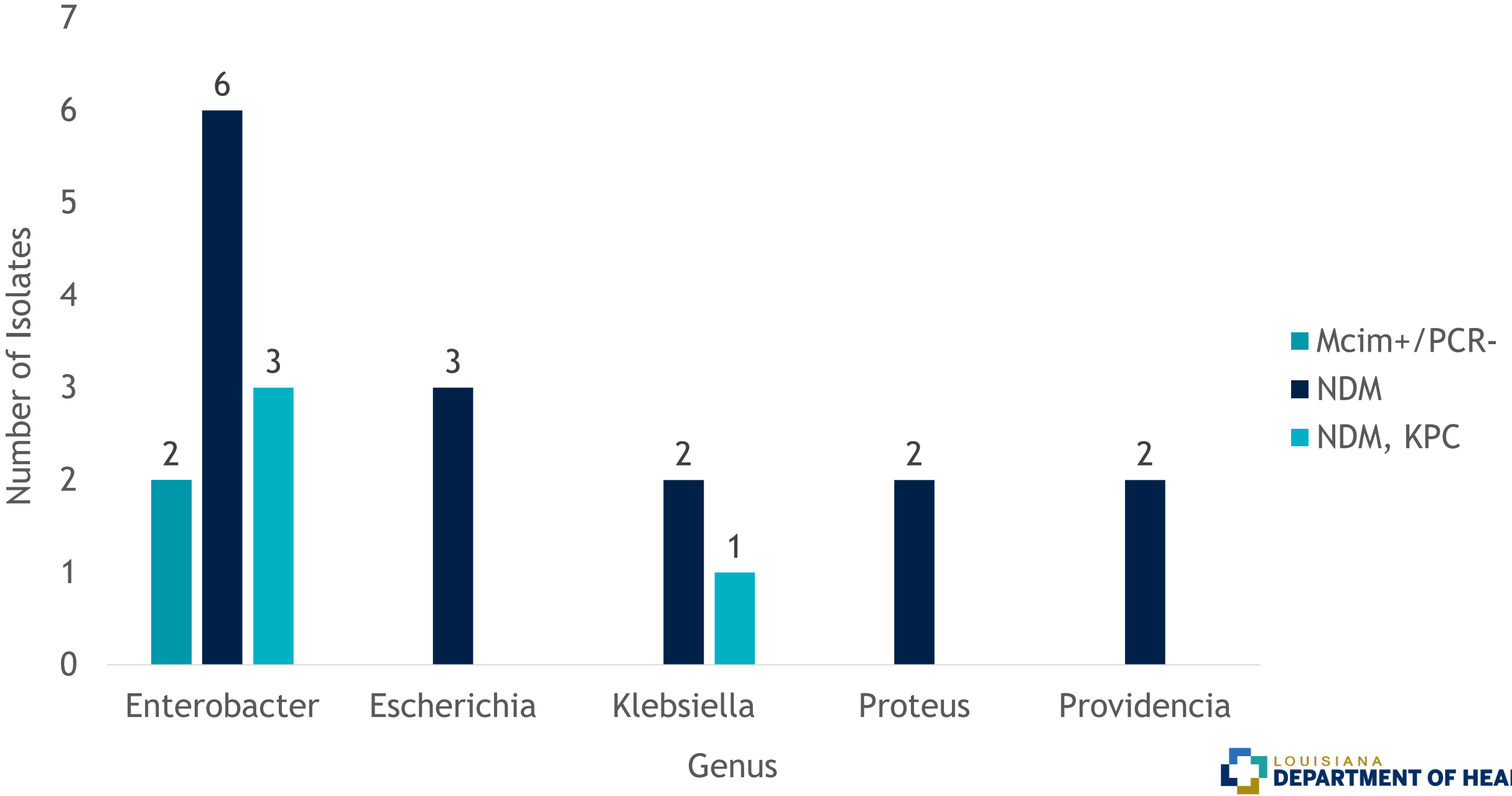
Identified CP-CRE Species

Species	Isolates N(%)
Enterobacter Cloacae	10(48%)
Escherichia Coli	3(14%)
Klebsiella Pneumoniae	3(14%)
Proteus Mirabilis	2(9%)
Enterobacter Bugandensis	1(5%)
Providencia Rettgeri	1(5%)
Providencia Stuartii	1(5%)
Grand Total	21(100%)

Louisiana: CP-CRE Resistance Mechanisms, January 2021-April 2023



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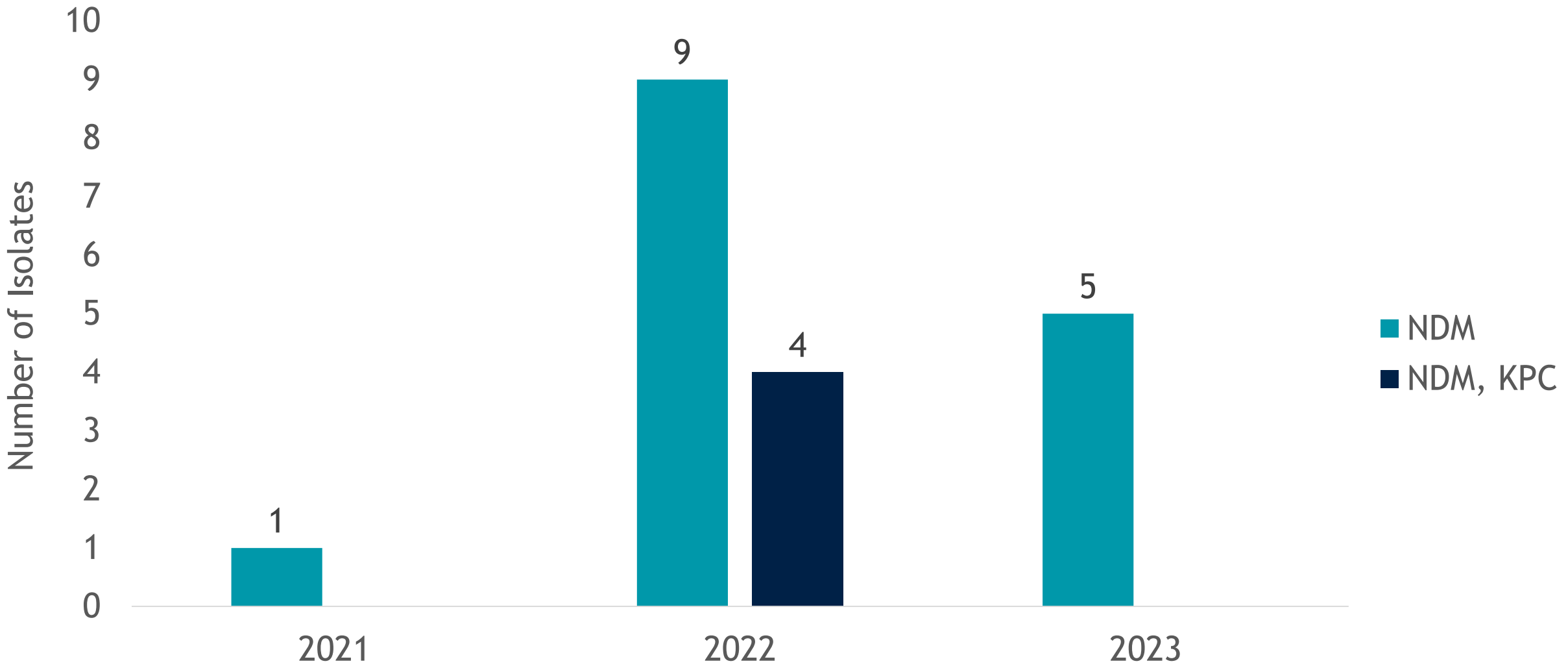
NDM in Louisiana, January 2021- April 2023



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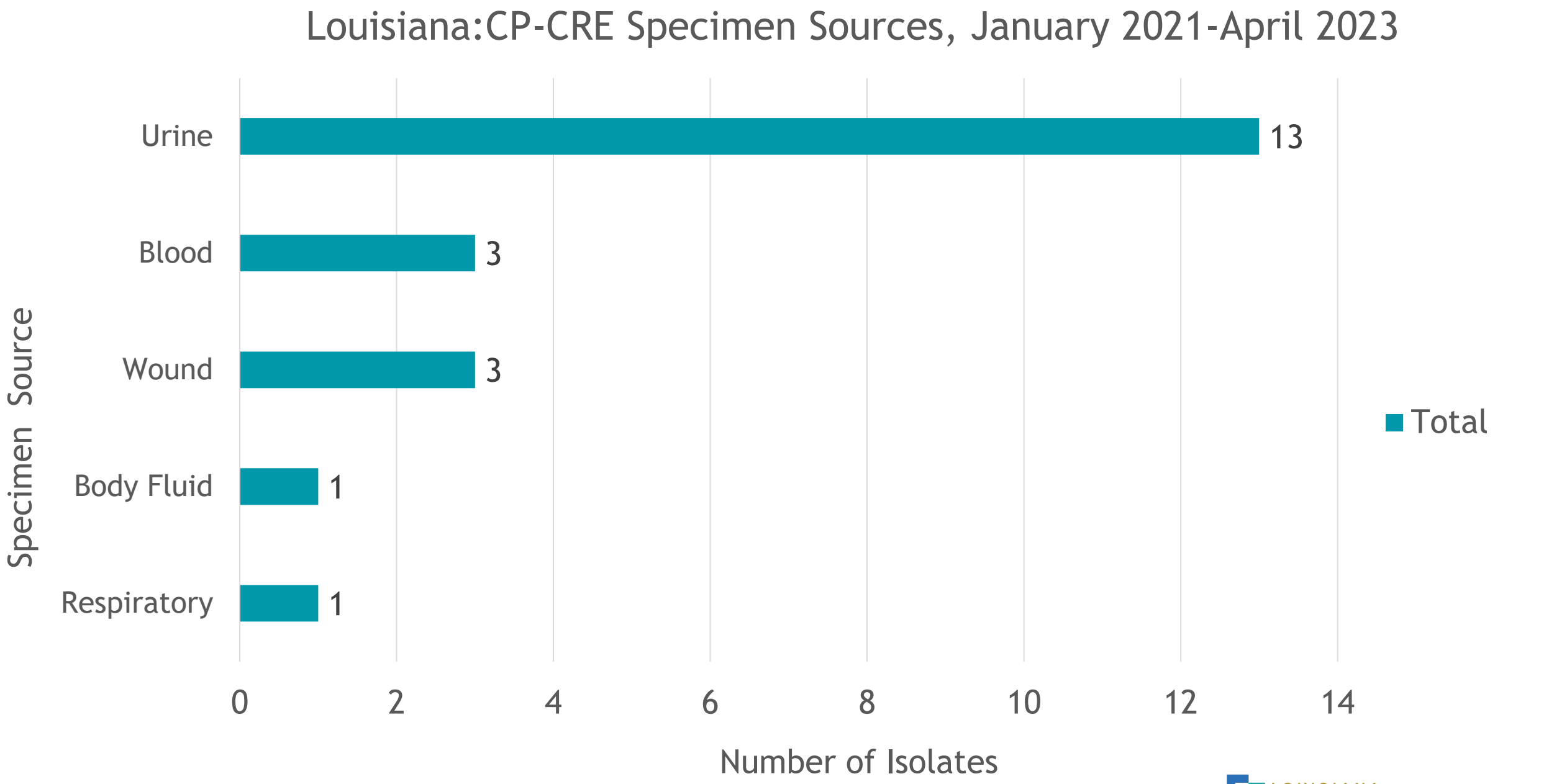

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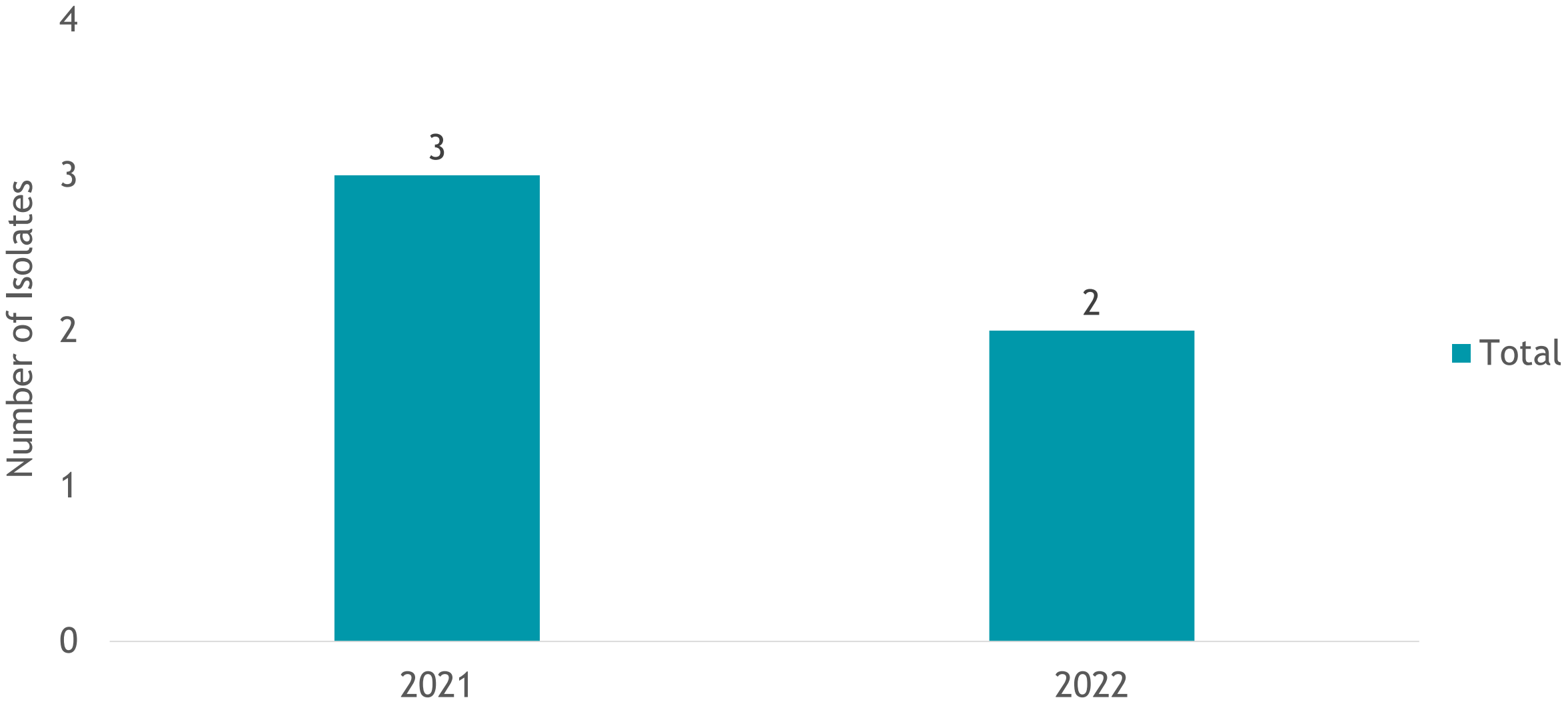
Louisiana: CRPA Cases by Year



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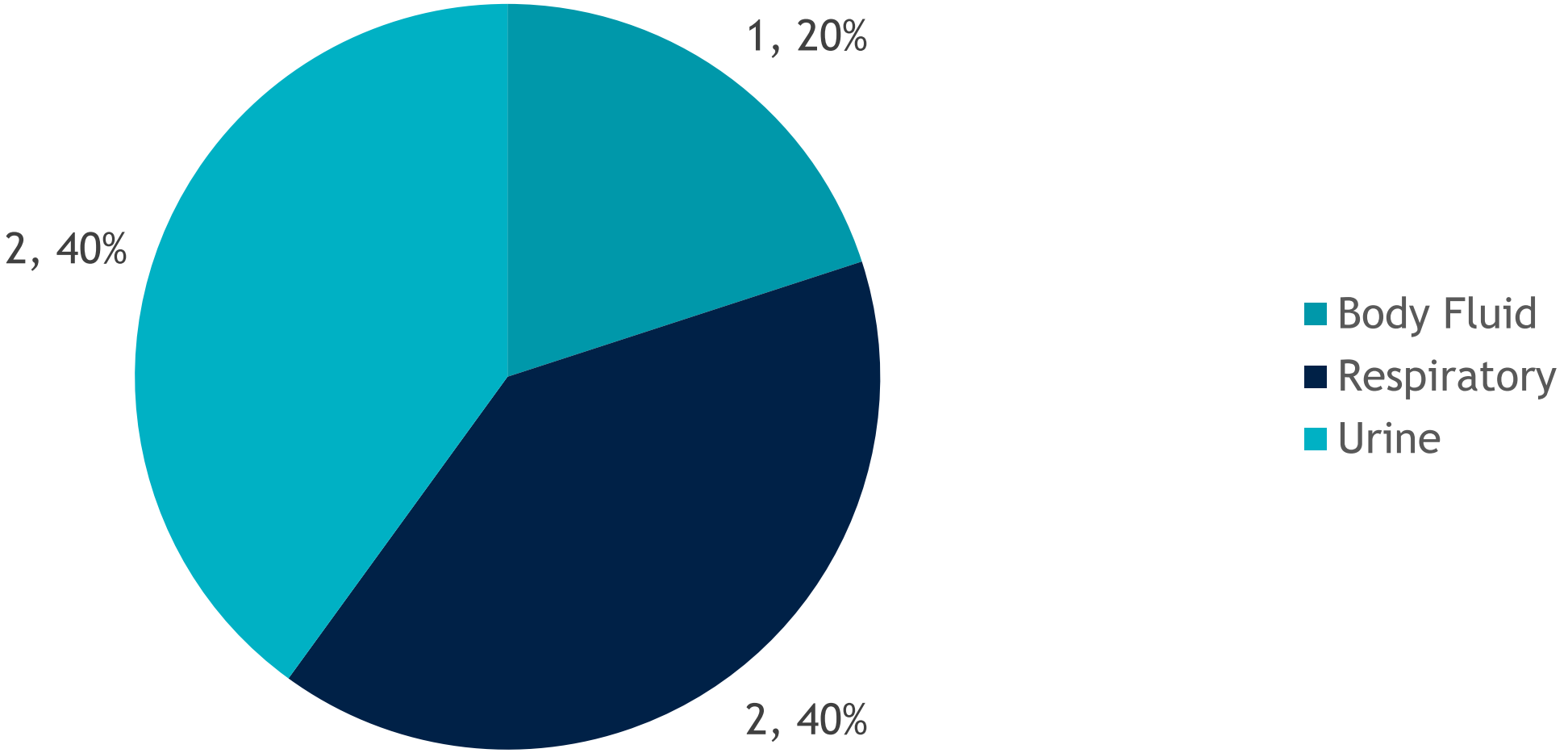
CRPA

CRPA	N(%)
Verona Integron-Enconded Metallo-beta-lactamase (VIM)	2(40%)
Pan Non-Susceptible	2(40%)
Pan-Resistant	1(20%)
Total	5(100%)

CRPA Specimen Sources, 2021-2022



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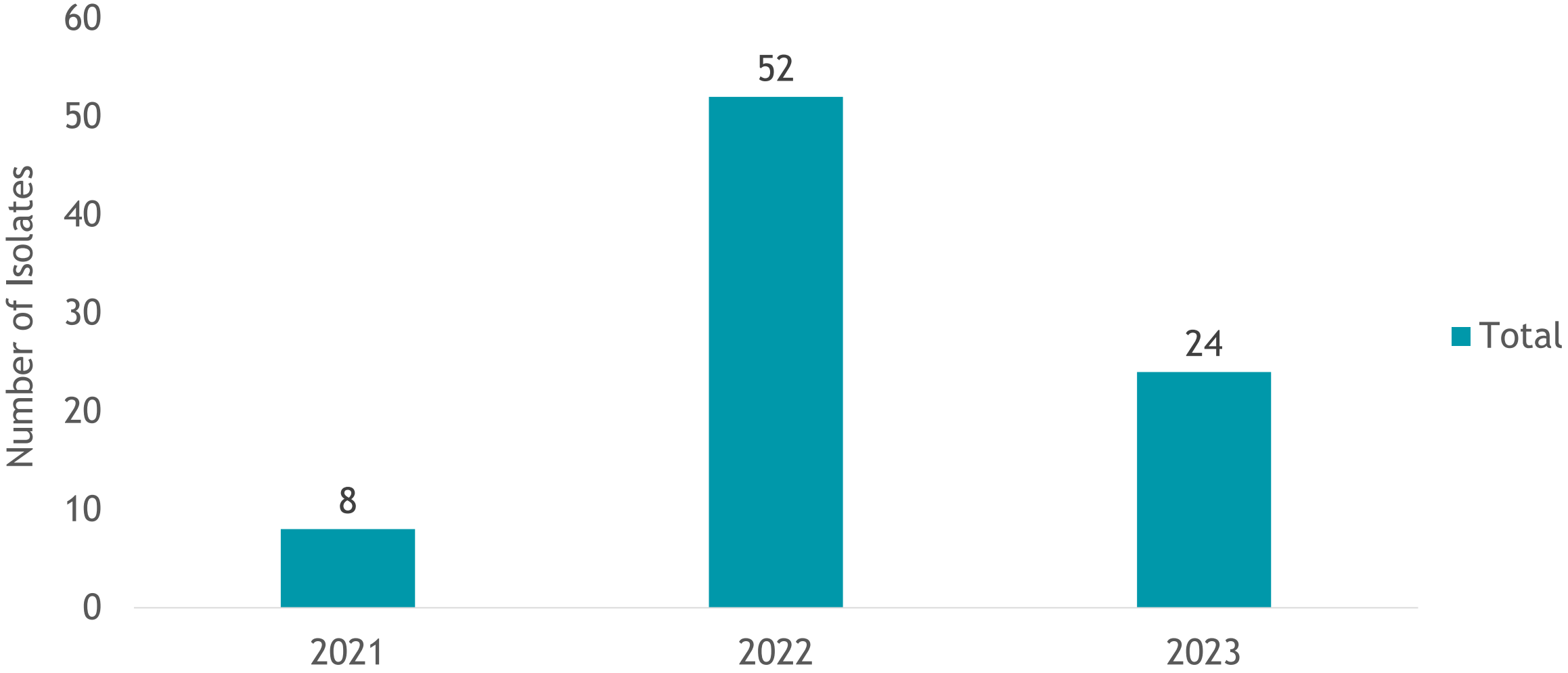
Louisiana: CRAB Isolates, January 2021-April 2023



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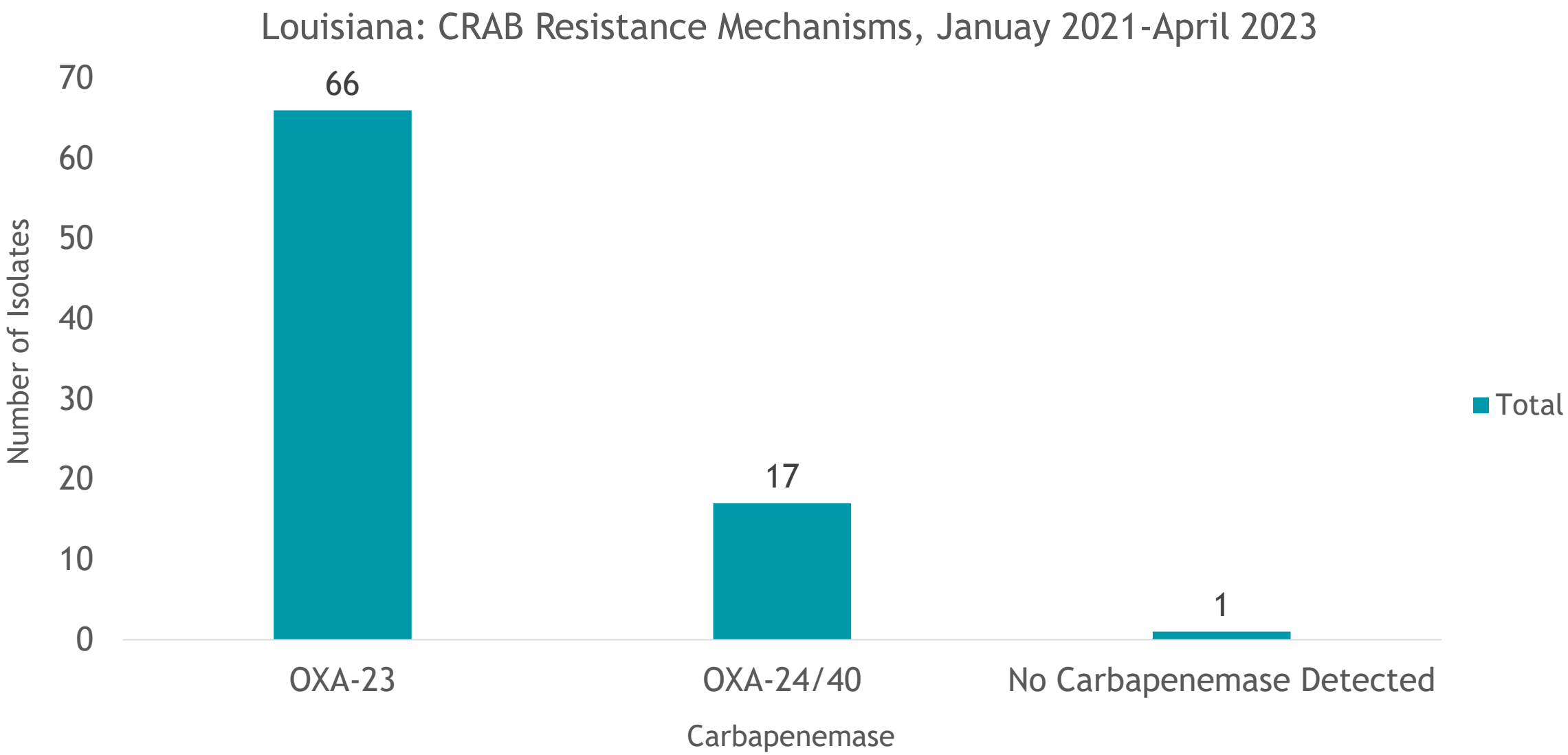

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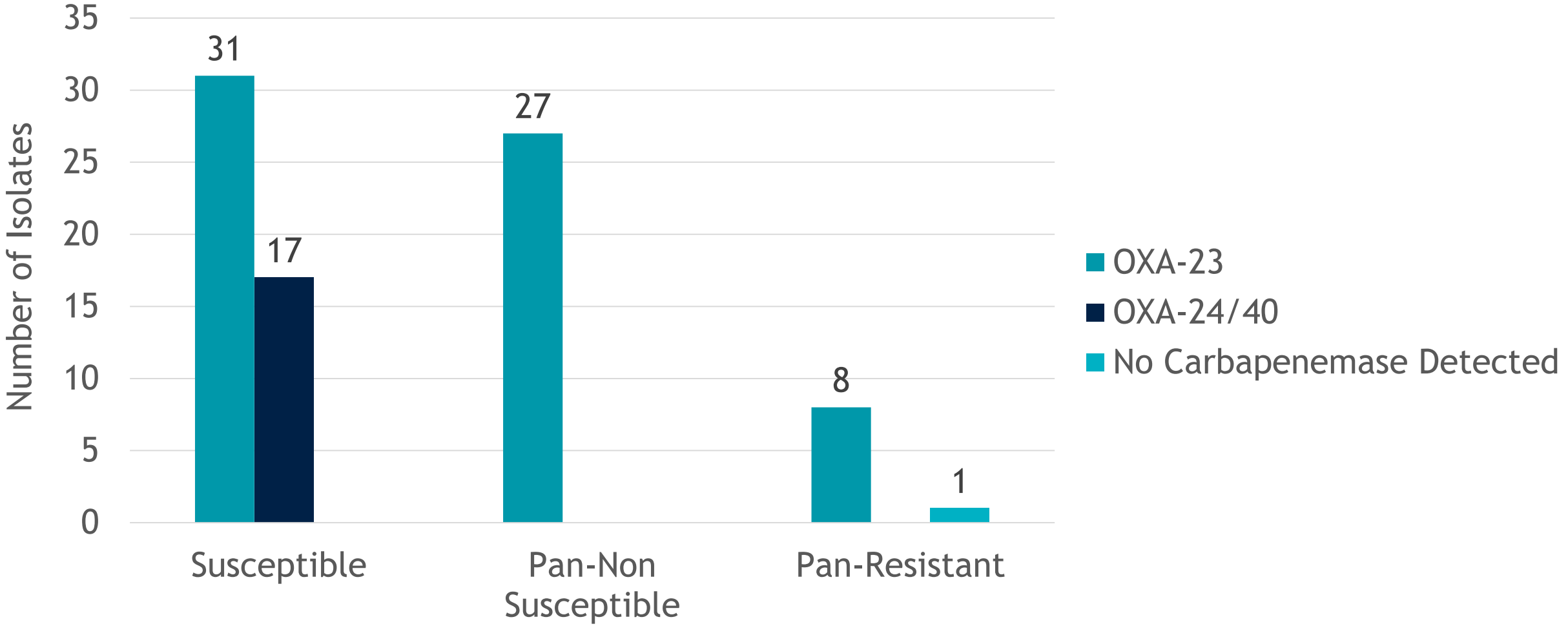
Louisiana: CRAB Susceptibility, January 2021-April 2023



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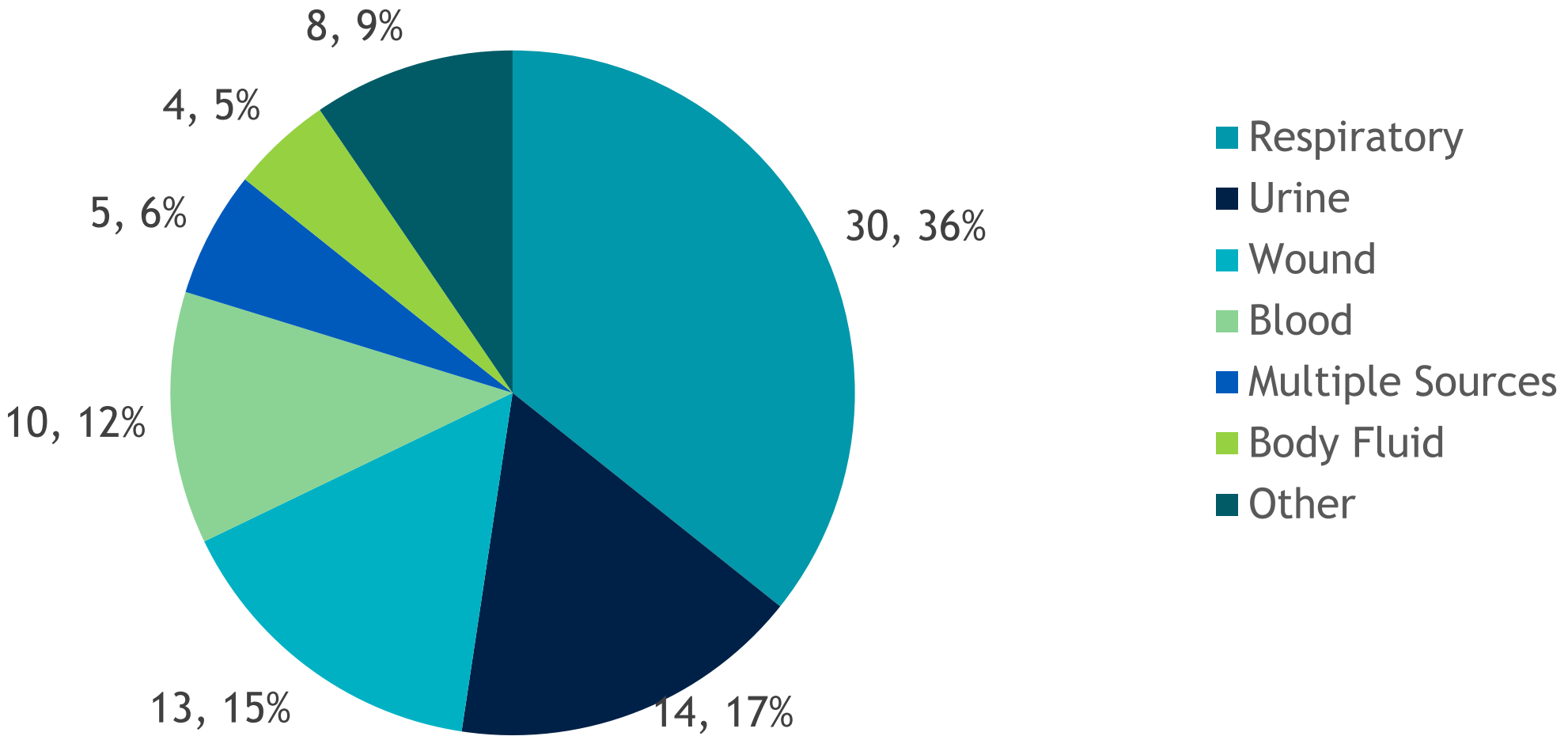
Louisiana: CRAB Specimen Sources, January 2021-April 2023



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C. *auris* in Louisiana (data as of 5/31/2023)

- First LA case detected in 2022
- 63 Confirmed Cases*
  - 19 clinical (includes one initially identified as a colonized case)
  - 44 colonized
- 26% of clinical cases were invasive infections

Source	Count (%)
Tracheal aspirate	1 (5%)
Blood	5 (26%)
Urine	8 (42%)
Wound	5 (26%)

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C. *auris*: Health Conditions and Risk Factors*

- Chronic ulcer/wound: 58% (11)
- Significantly impaired mobility (paraplegia, quadriplegia, Class 3 morbid obesity, TBI): 32% (6)
- Significantly immune-compromised (AIDS, Lymphoma): 12% (2)
- Medical devices: 74% (14)
- Multiple/Prolonged Hospitalizations: 82% (16)
- Broad-spectrum Antibiotic/ Anti-fungal use: 74% (14)
- Diabetes Mellitus: 32% (6)
- Recent surgery: 32% (6)

Based on 19 clinical cases as of 5/31/23*

Apply Infection Control Practices to Prevent Infections in Healthcare Settings

“Stop relying only on new antibiotics that are slow getting to market and that, sadly, these germs will one day render ineffective. We need to adopt aggressive strategies that keep the germs away and infections from occurring in the first place. ” Robert R. Redfield, M.D. |2019 AR Report

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Antibiotic Development

World Health Organization's priority pathogens list for research and development of new antibiotics[11]

Priority 1: CRITICAL

- *Acinetobacter baumannii*, carbapenem-resistant
- *Pseudomonas aeruginosa*, carbapenem-resistant
- *Enterobacteriaceae*, carbapenem-resistant, ESBL-producing

We Can't Rely on Antibiotics Alone to Fix this Problem

As a result of difficult scientific obstacles and challenging business incentives, many pharmaceutical companies are getting out of the antibiotic business altogether.

- Between 1962 and 2000, **no new major classes** of antibiotics were approved to treat common and deadly Gram-negative infections.[6]
- Since 1990, **78% of major drug companies** have scaled back or cut antibiotic research due to development challenges.[7]
- Historical data show that, generally, only **1 out of 5** infectious disease drugs that reach the initial phase of testing in humans will receive approval from the FDA.[8]

CDC. 2019 AR Threats Report: *Antibiotic Resistance Threats in the United States*, 2019.[2]

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Infection Prevention

- **Hand Hygiene**
  - Routinely monitor and audit for hand hygiene compliance
- **Transmission-based Precautions**
  - Contact Precautions- Acute Care
  - Enhanced Barrier Precautions- Nursing Homes
- **Environmental Cleaning**
  - Use EPA-registered disinfectants for daily and terminal cleaning
- **MDRO detection and Surveillance**
  - Monitor trends in MDRO incidence and report HAI conditions according to Louisiana Sanitary Code

Centers for Disease Control and Prevention. *MDRO Prevention and Control*, 2019.[9]

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Infection Prevention

- **Interfacilty communication**
  - Communicate to receiving facilities when transferring a patient infected or colonized with an MDRO
- **Antimicrobial Stewardship**
  - Implement processes to review and improve antimicrobial use
- **Education**
  - Provide competency-based trainings on hand-hygiene, PPE selection and use, and environmental cleaning

Centers for Disease Control and Prevention. *MDRO Prevention and Control*, 2019.[9]

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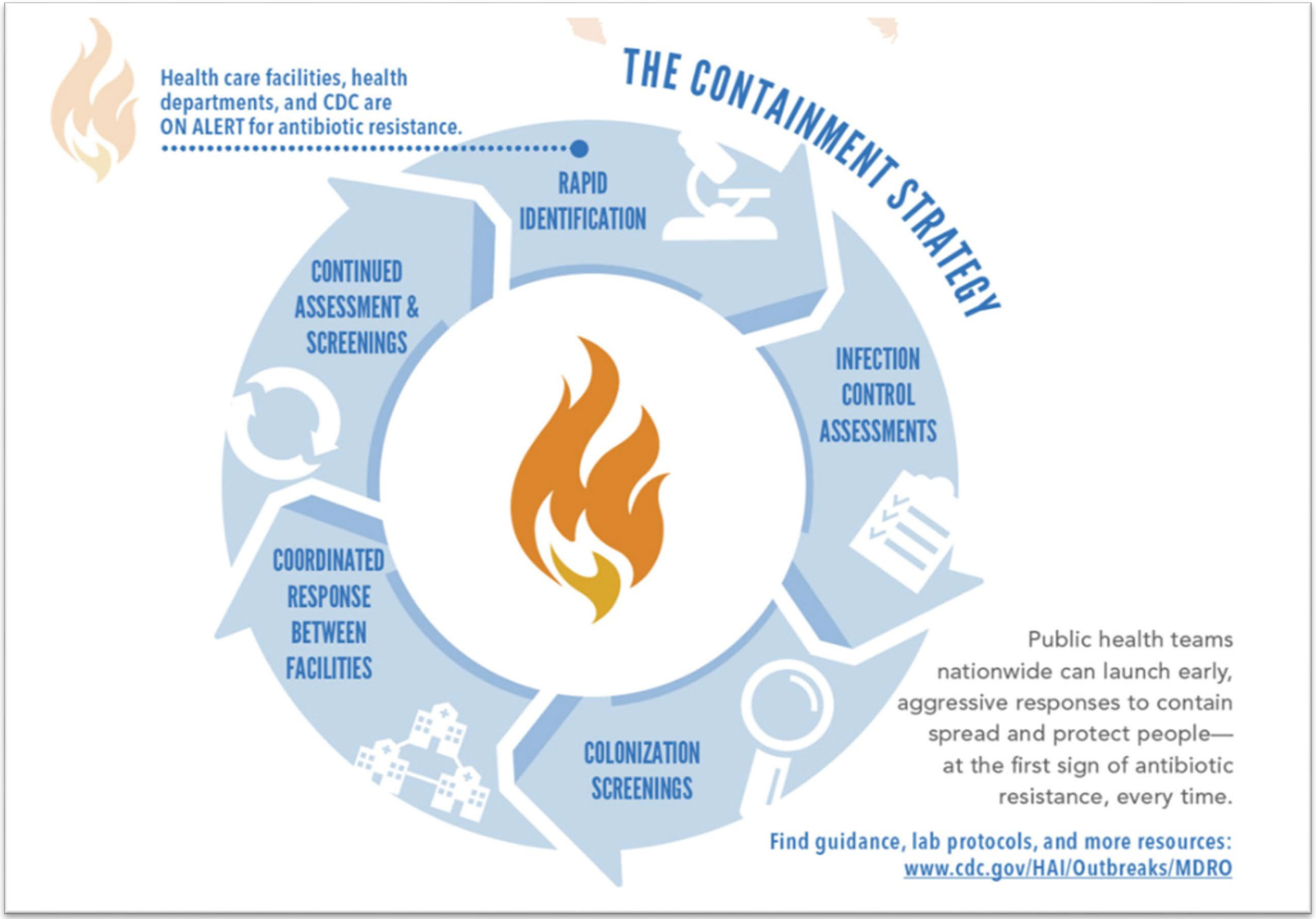
Key Concepts

- Antibiotic resistance has been increasing globally and locally.
- In some parts of Louisiana, resistance mechanisms that were previously uncommon are suddenly being found.
- The epidemiology of MDROs may differ across regions.
- To stop the transmission of MDROs, prompt detection and implementation of infection control practices are needed.
- A key element of the containment strategy is participation in point prevalence surveys.



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Questions?

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504-568-2967

For antimicrobial susceptibility testing and isolate submission inquiries, email HAI@LA.GOV.

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Evaluation Reminder

Evaluation reminder for the 2023 Louisiana Office of Public Health Antimicrobial Stewardship Summit

Please use this QR code or log-on/type in the following URL: https://bit.ly/AMR2023

To use QR code:

- Open your phone Camera app from the Home screen, Control Center, or Lock screen.
- Select the rear-facing camera. Hold your device so that the QR code appears in the viewfinder in the Camera app.
- Tap the notification to open the link associated with the QR code.

Healthcare-associated Infections
HAI Elimination
Louisiana

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