Battling the Dementors (Fighting Antimicrobial Resistance)

AR Lab Network Activities at the WSLH

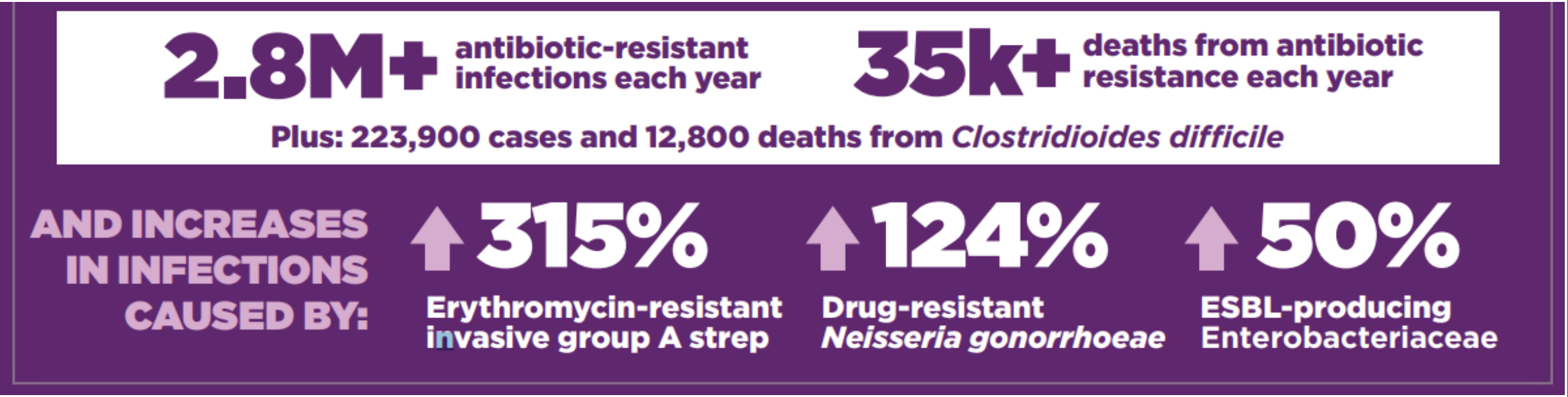
Megan Lasure, MPH
AR Epidemiologist

Outline

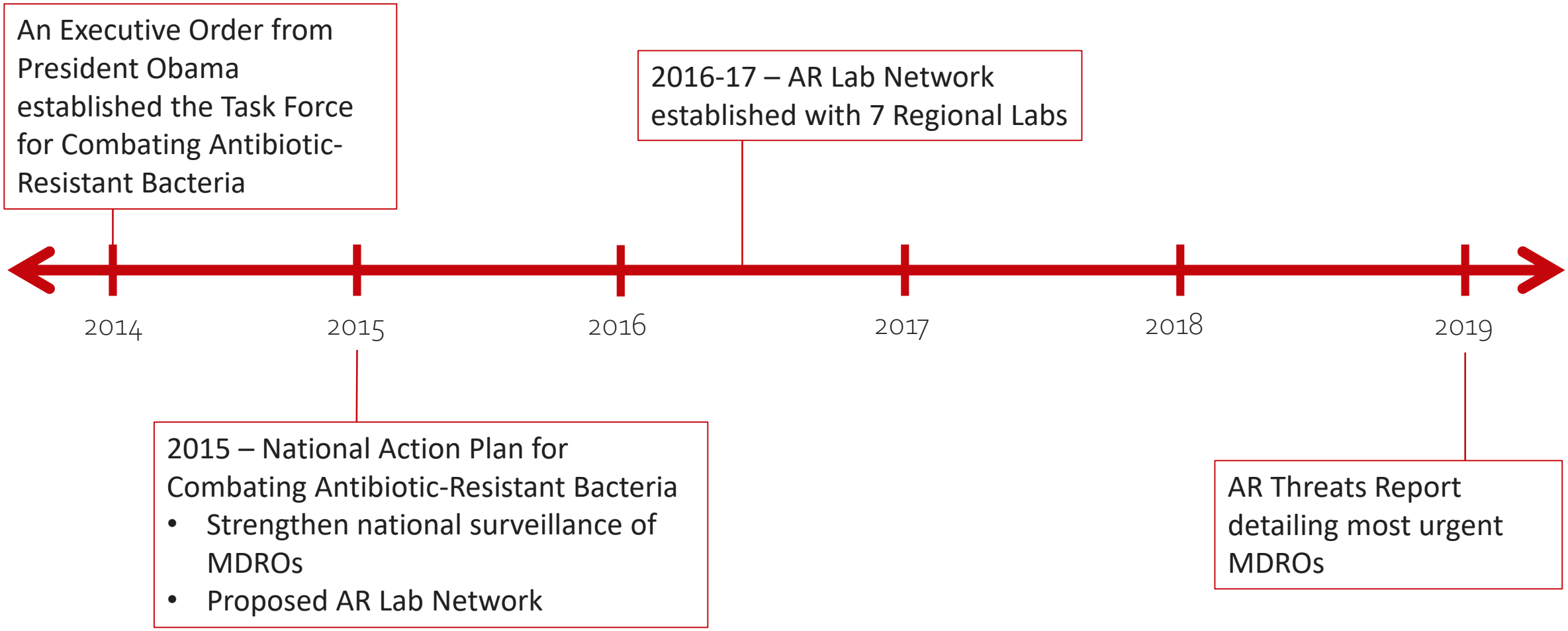
- What's the AR Lab Network?
- What do we test?
- What does antimicrobial resistance look like in Wisconsin?
- What's next?

What's the AR Lab Network?

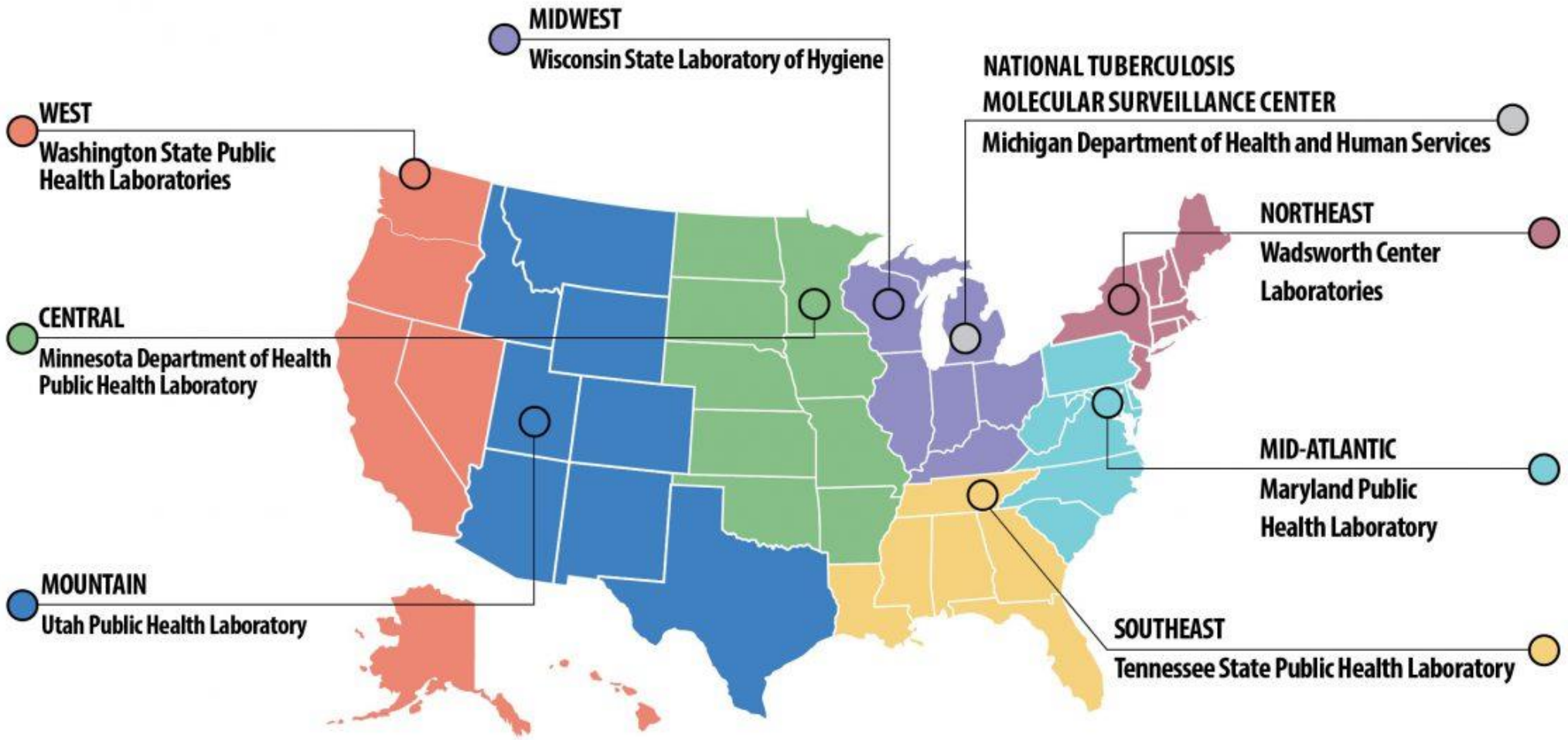
AR Threats Report 2019



A Short History of the AR Lab Network



The AR Lab Network



Pathogens Tested by the AR Lab Network

- Carbapenem-resistant Enterobacterales (CRE)
- Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)
- Carbapenem-resistant *Acinetobacter baumannii* (CRAB)
- *Candida*, including *Candida auris*
- *Streptococcus pneumoniae*
- *Clostridioides difficile*
- *Neisseria gonorrhoeae*
- *Mycobacterium tuberculosis*
- *Aspergillus fumigatus*

Carbapenemase-producing organisms (CPOs)

- **Carbapenemases** are enzymes that confer increased resistant to carbapenem antibiotics
- **Carbapenems** are "drugs of last resort"
- Genes for carbapenemases can be found on **plasmids**
  - Mobile genetic elements
  - Can move between bacteria and confer resistance
- Tracking spread of plasmids is CDC's primary goal for CRE, CRPA, and CRAB surveillance

What do we test?

Isolate Testing

- Majority of bacterial isolates are from Wisconsin labs
- Some other state labs send bacterial isolates for confirmation and additional susceptibility testing

- Majority of fungal isolates from other states
- Send to WSLH for confirmation of identification of Candida auris
- Also test other species for antifungal resistance

Carbapenem-resistant Enterobacterales (CRE)

- Bacterial identification (MALDI-ToF)
- Antibacterial susceptibility panel (Sensititre GN7F)
- Modified Carbapenemase Inactivation Method (mCIM) phenotypic testing
- PCR testing for carbapenemases
  - KPC / NDM
  - VIM
  - IMP
  - OXA-48

Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)

- Only isolates that also are non-susceptible to cefepime and/or ceftazidime
- Bacterial identification (MALDI-ToF)
- Antibacterial susceptibility panel (Sensititre GN7F)
- Modified Carbapenemase Inactivation Method (mCIM) phenotypic testing
- PCR testing for carbapenemases
  - KPC / NDM
  - VIM
  - IMP
  - OXA-48

Carbapenem-Resistant *Acinetobacter baumannii* (CRAB)

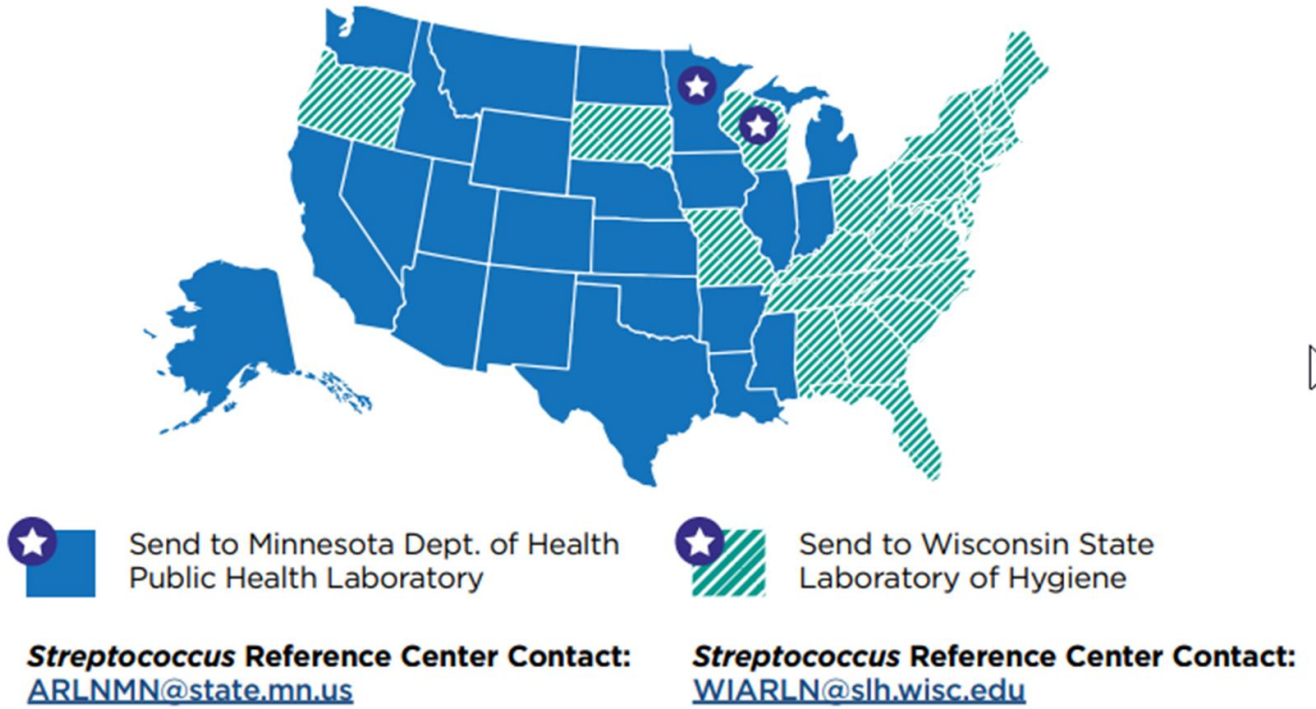
- Bacterial identification (MALDI-ToF)
- Antibacterial susceptibility panel (Sensititre GN7F)
- No mCIM testing
- PCR testing for carbapenemases
  - KPC / NDM
  - VIM
  - IMP
  - OXA-48
  - OXA-23 / OXA-24/40 / OXA-58 (CRAB-specific carbapenemases)

Candida, including *Candida auris*

- Species identification (MALDI-ToF)
- Antifungal resistance panel
  - Triazoles and echinocandins by broth microdilution
    - Custom Sensititre™ panel
  - Amphotericin B by Etest
  - Looking into evaluating ibrexafungerp (new antifungal) for CDC
- Isolate retention for further characterization
  - NGS
  - Additional susceptibility testing
  - Future projects

Streptococcus pneumoniae

- Species identification
- Serotyping/serogrouping (as per request from WI)
- Antimicrobial susceptibility testing (AST)



Special project: non-*baumannii Acinetobacter* and non-*aeruginosa Pseudomonas*

- Special CDC project across the AR Lab Network
- Better understand the prevalence of carbapenemases in other *Acinetobacter* and *Pseudomonas* species
- Asking for clinical labs to submit carbapenem-resistant isolates of:
  - *Acinetobacter* species other than *Acinetobacter baumannii*
  - *Pseudomonas* species other than *Pseudomonas aeruginosa*
- Tentative end point in December 2023

Colonization Testing

- Testing non-clinical swabs for the presence of MDROs
- Free of charge, including supplies and shipping
- Most specimens are sent from other Midwest states
- The majority of the volume of our AR Lab Network testing in the lab
  - Thousands of swabs tested each month
  - We're tired

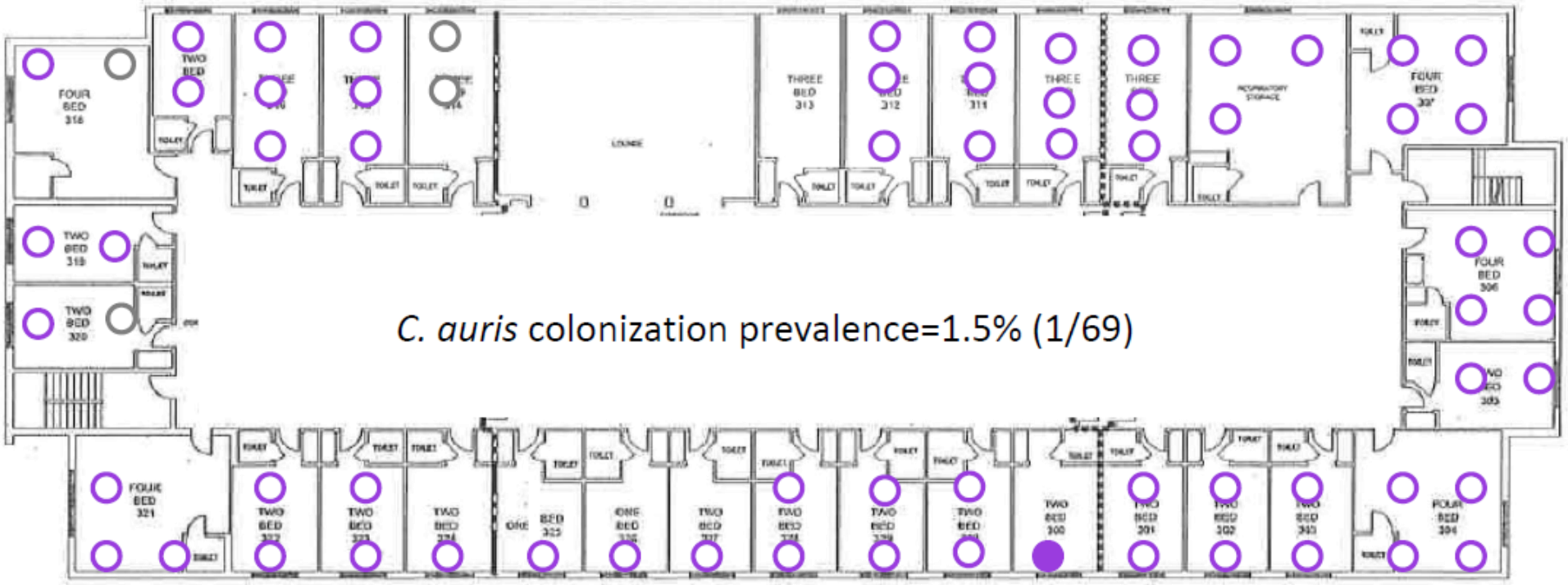
Why colonization testing?

- Colonization: the presence of these organisms without causing clinical illness
- MDROs such as carbapenemase-producing organisms (CPOs) and Candida auris colonize patients
- Patients can be colonized indefinitely
- Colonized patients, even without any symptoms, can transmit MDROs to other patients/residents
- Colonized patients often have risk factors for illness/transmission
  - High acuity
  - Immunocompromised
  - Live in congregate living settings, especially skilled nursing facilities (SNFs)

Types of Colonization Testing

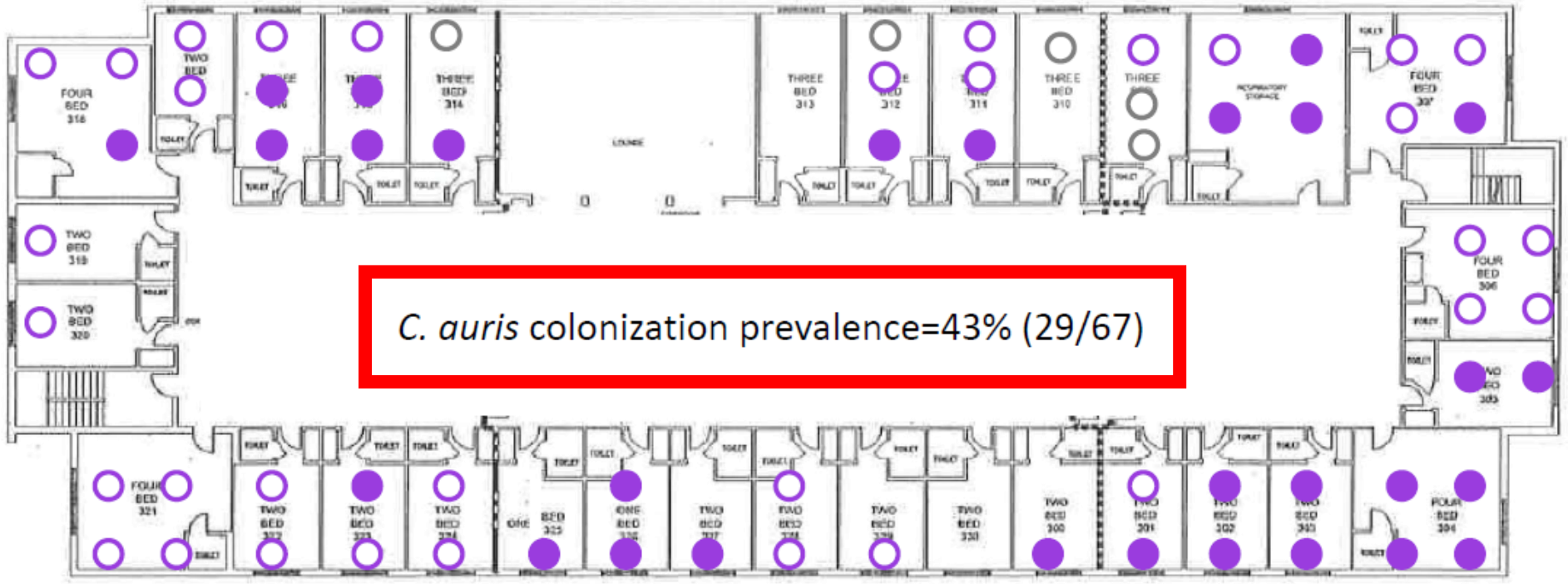
- Point-prevalence screening: testing of entire units or facilities
  - This can be as prevention or response
  - Scope decided via coordination with public health departments and facility
- Admission screening: focus on high-risk patients
  - Healthcare exposure in other countries
  - Contact with known case
  - Admission from facility with known cases
  - Admission from high-risk facility type (LTACH, vSNF)

vSNF B 3rd Floor
March 2017 *C. auris* PPS Results



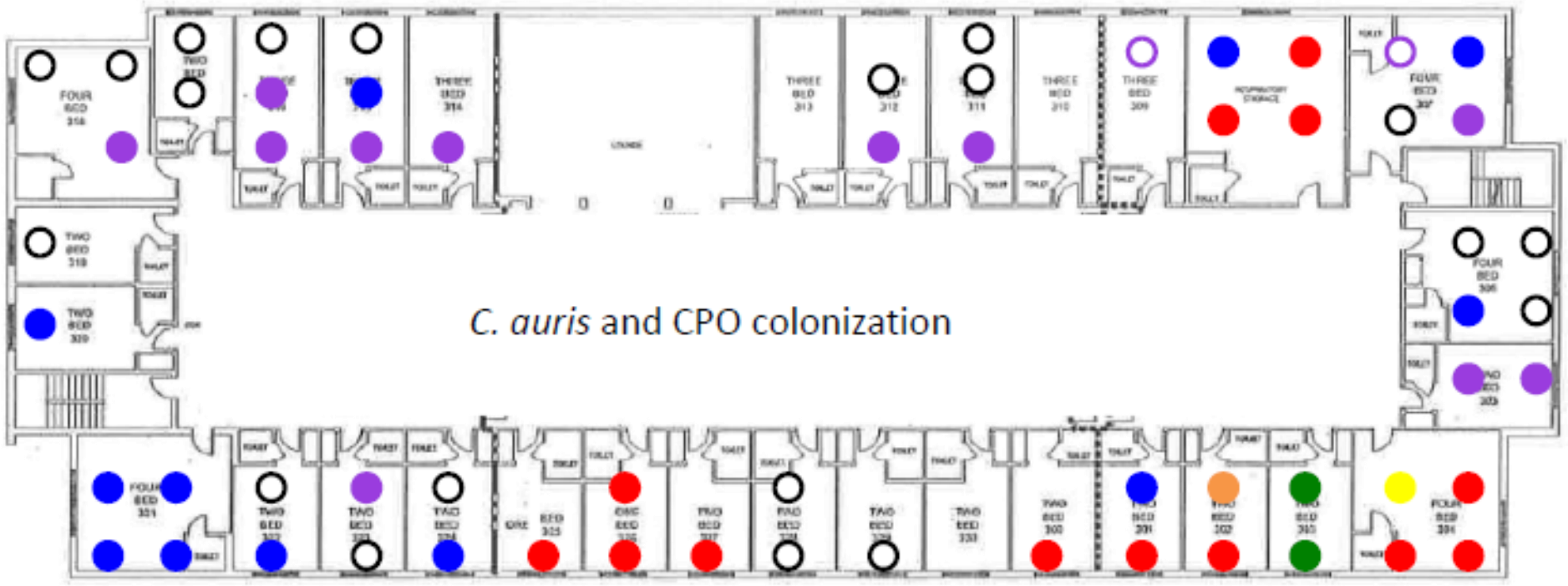
- ● *C. auris* positive
- ○ Screened negative for *C. auris*
- ○ Not tested for C. auris (refused or not in room)

vSNF B 3rd Floor
January 2018 *C. auris* PPS Results



- *C. auris* positive
- Screened negative for *C. auris*
- Not tested for C. auris (refused or not in room)

vSNF B 3rd Floor
January 2018 CPO and *C. auris* PPS Results

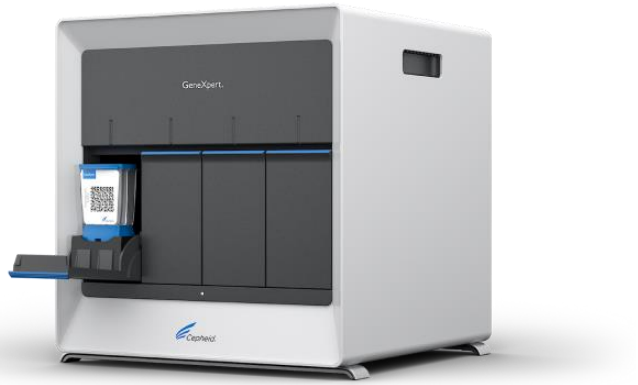


- *C. auris*
- *C. auris* and KPC
- KPC or CRE with unknown mechanism of resistance
- *C . auris*, KPC, and NDM
- *C. auris*, VIM-CRPA, and KPC
- *C. auris* and KPC-CRPA

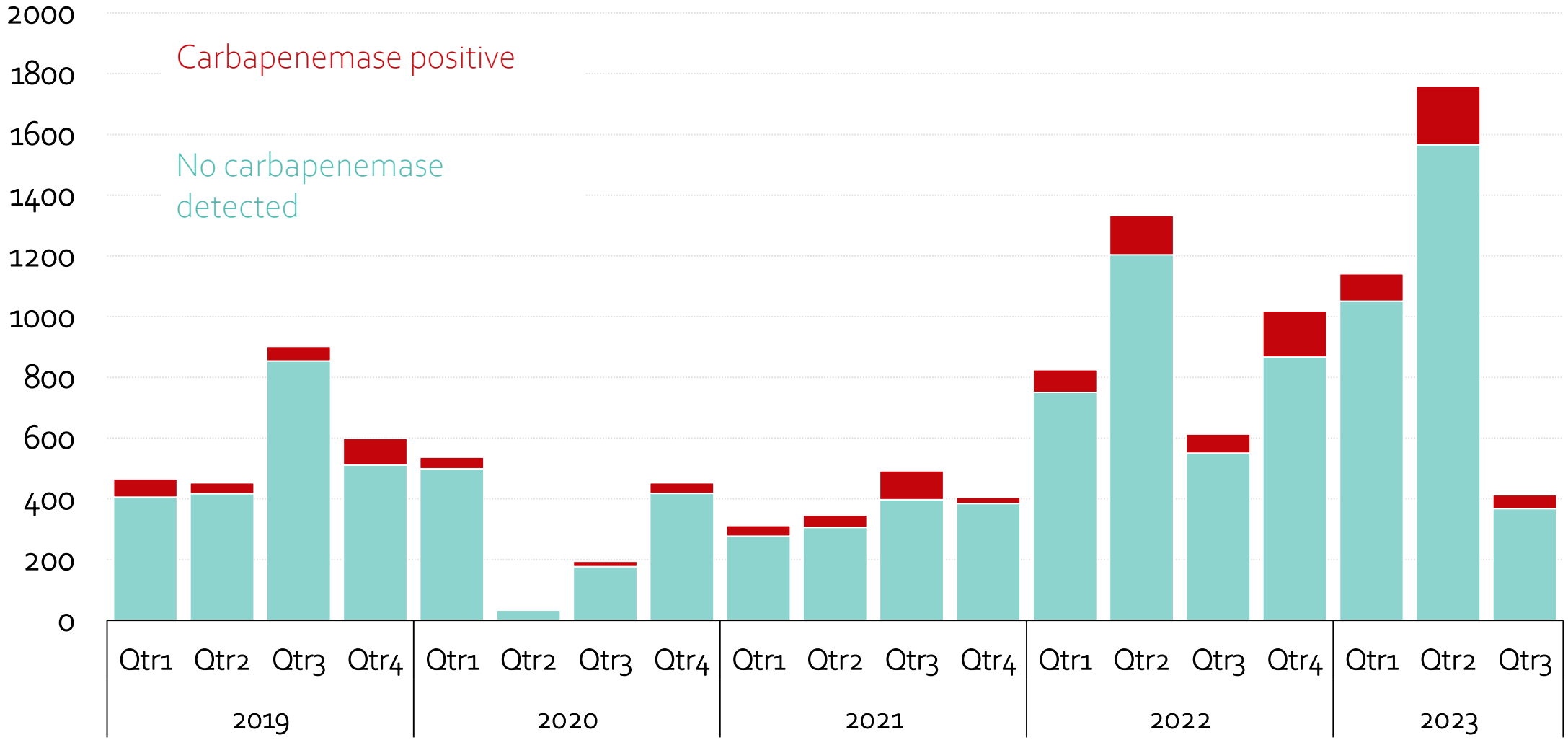
- Screened negative for *C. auris*, but not tested for CRE
- Screened negative for CRE and *C. auris*

CRE/CRPA colonization testing

- Cepheid GeneXpert CARBA-R Assay tests for carbapenemases directly from rectal swab
  - KPC
  - NDM
  - OXA-48
  - VIM
  - IMP*
- Reflex to culture for non-KPC positives
- Also validated to do culture-based testing on other specimen sources
  - Axilla/groin
  - Tracheostomy
  - Stool/colostomy

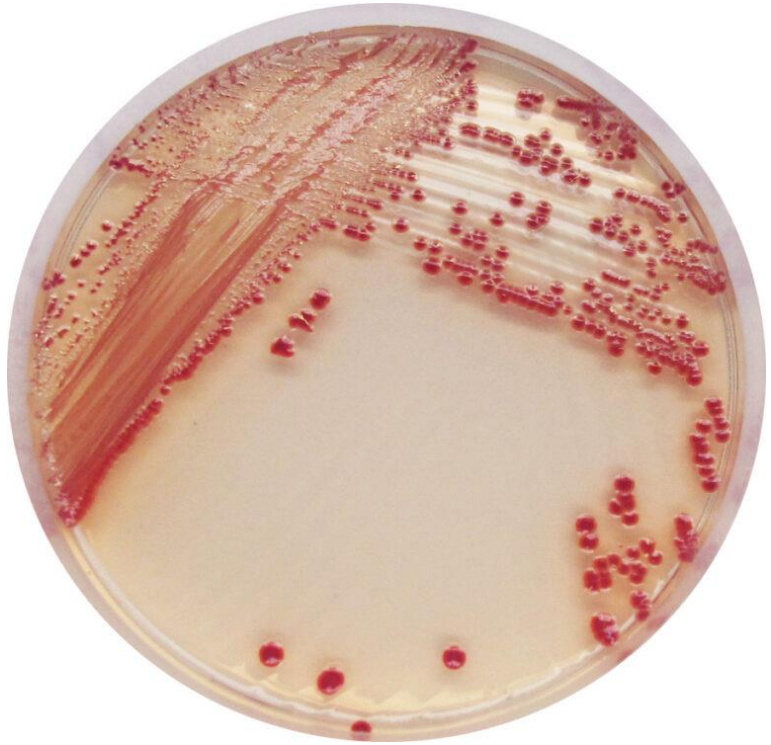


CRE/CRPA Colonization Testing, 2019-2023

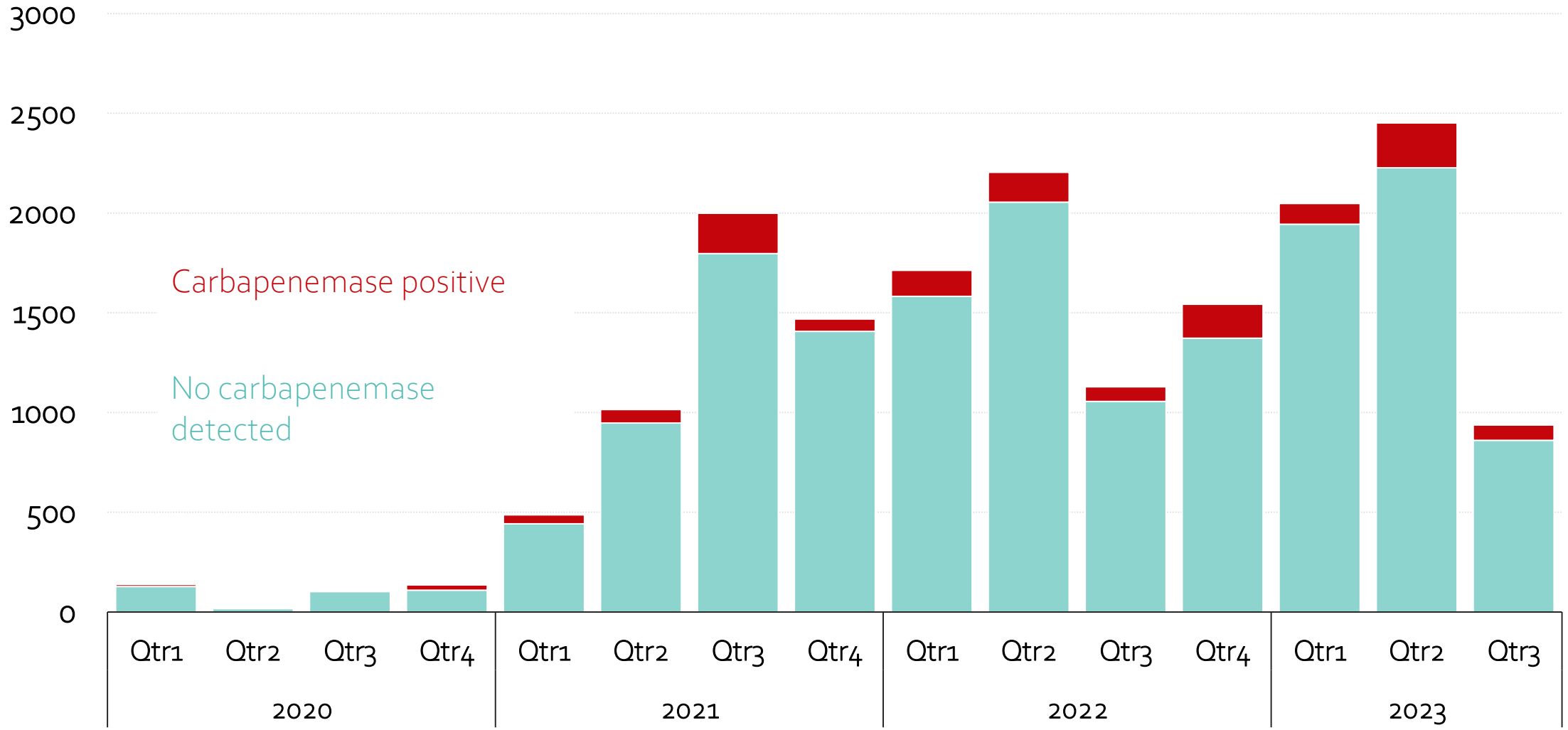


CRAB Colonization Testing

- Culture based testing, primarily from axilla/groin swabs
  - Growth in broth w/ meropenem discs
  - Subculture to Acinetobacter Chromagar with antibiotics
  - Identification confirmed by MALDI-ToF
- Carbapenemase PCRs performed on isolates
- Also validated to test rectal and tracheostomy swabs



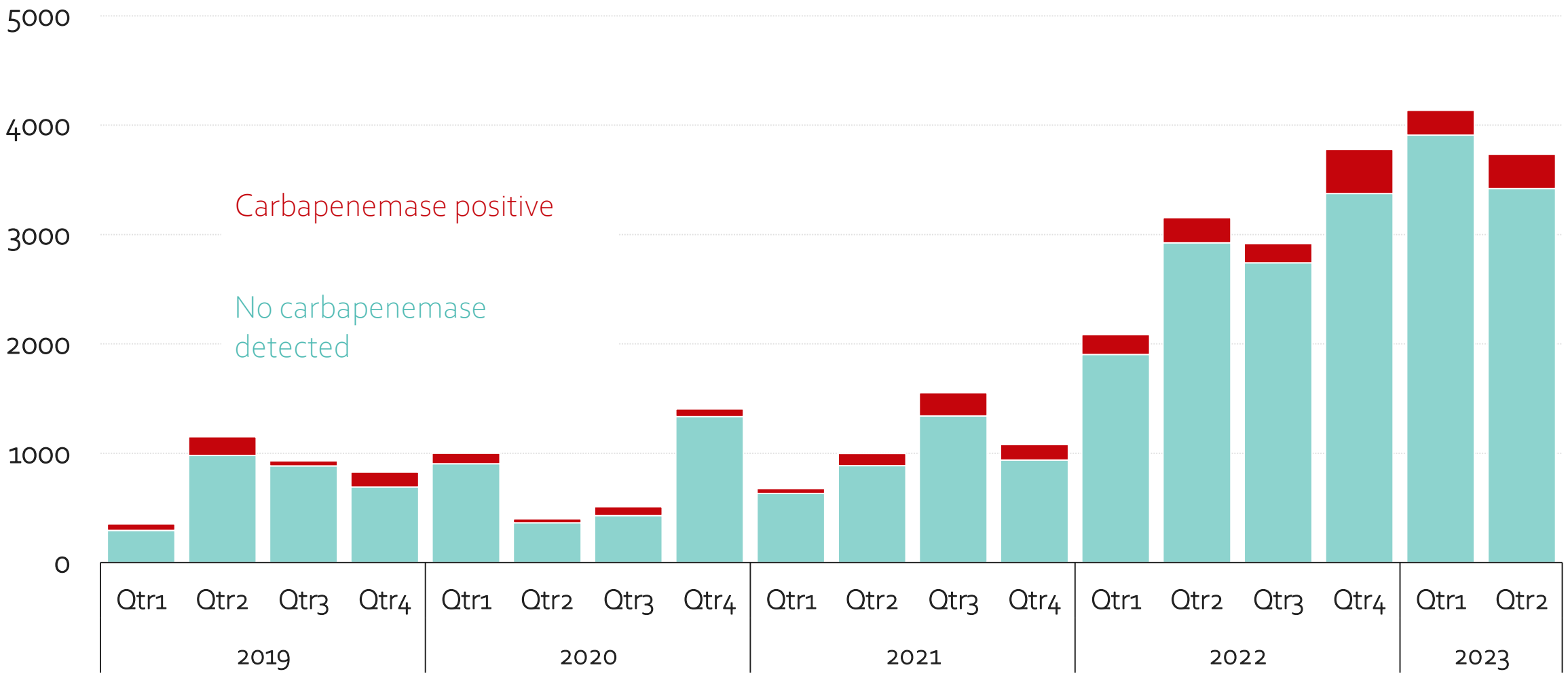
CRAB colonization testing, 2020-2023



Candida auris colonization testing

- PCR detection of positives directly from axilla/groin swab
- Method 1: Kingfisher Flex Extraction / ABI 7500 Fast PCR testing
  - Versatile
  - Kingfisher has 96 samples per run, good for high volume days
- Method 2: BD Max
  - Less hands on time
  - Extraction, amplification, and detection all on same instrument
- Evaluating the use of the Panther Fusion

Candida auris colonization testing, 2019-2023



What does antimicrobial resistance look like in Wisconsin?

Cases of MDROs in Wisconsin

- Wisconsin is a low-incidence state compared to many others
- CRAB is the most common MDRO
- Stable levels of transmission for most MDROs

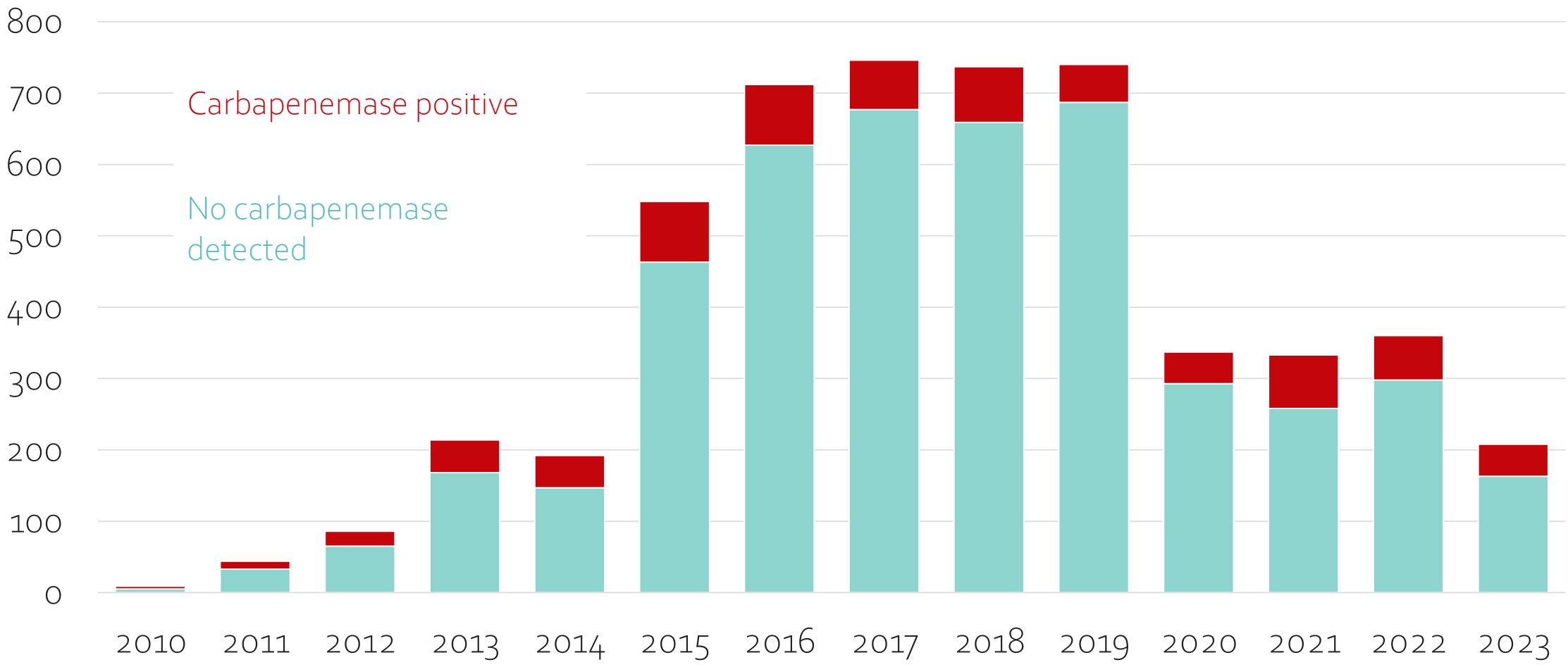
New Cases of MDROs in Wisconsin

	2019	2020	2021	2022
CP-CRE	45	30	42	45
CP-CRPA	0	2	2	4
CP-CRAB	46	41	153	112
C. auris	0	0	1	6

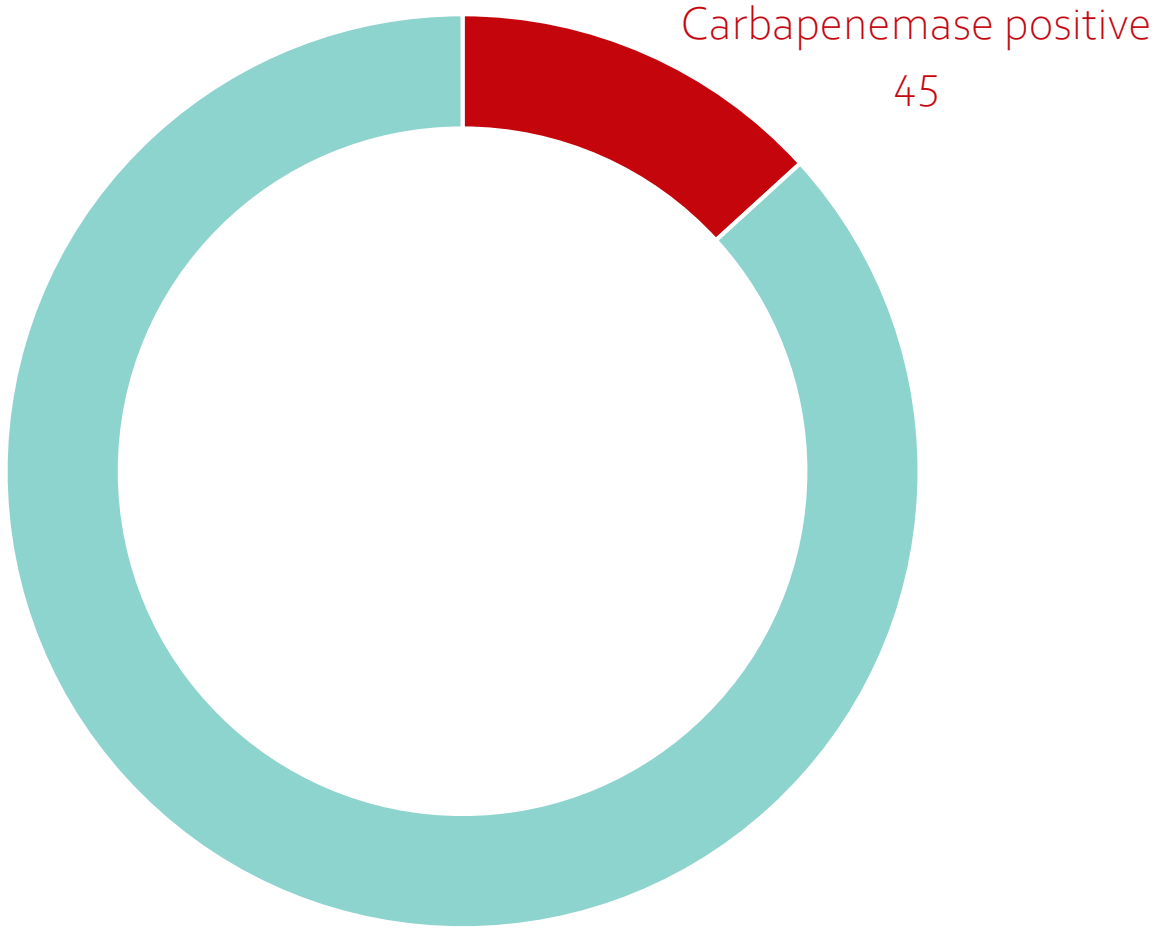
Carbapenem-resistant Enterobacterales (CRE)

- WSLH has been testing CRE since 2010
  - Began with only KPC
  - 2013: added NDM
  - 2014: added OXA-48
  - 2017-18: added IMP, VIM

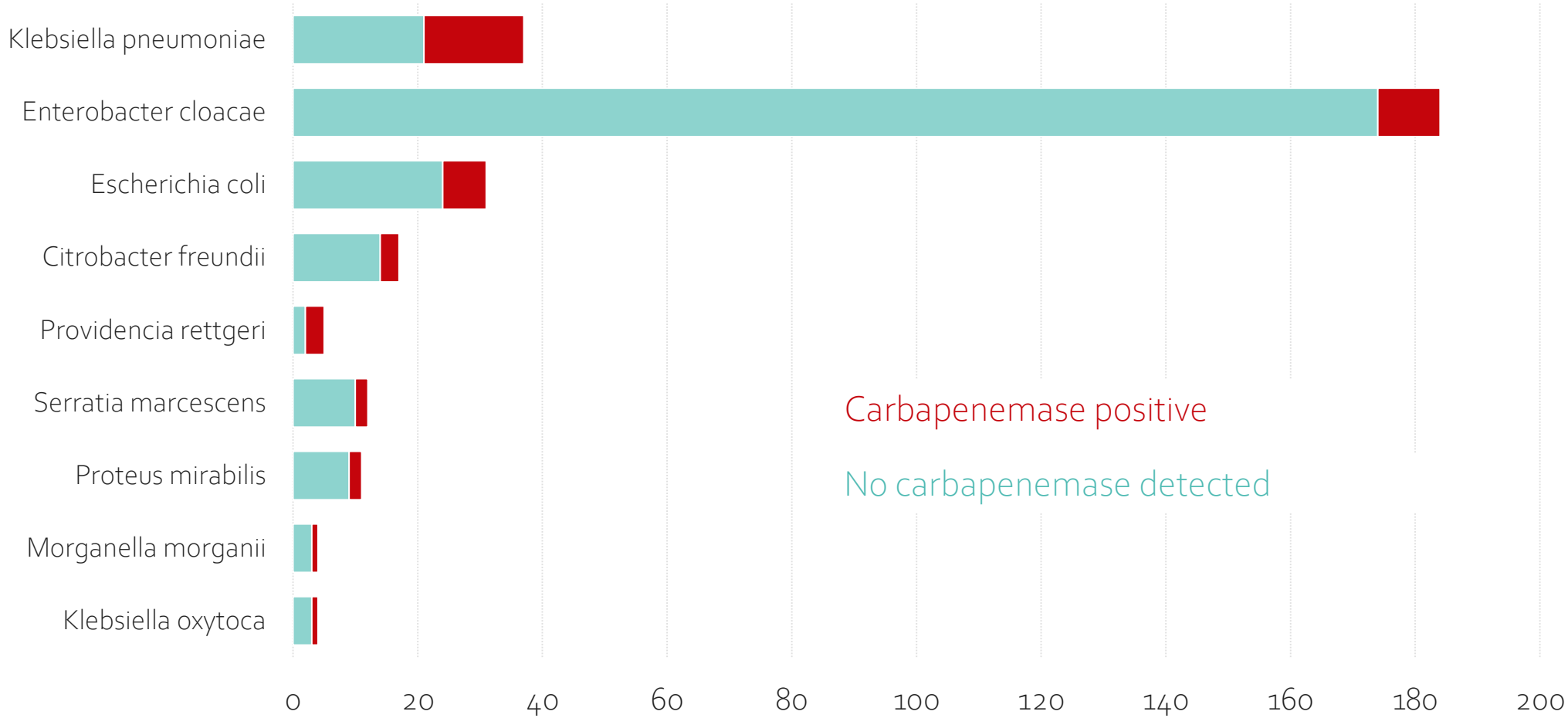
Carbapenem-resistant Enterobacterales (CRE)



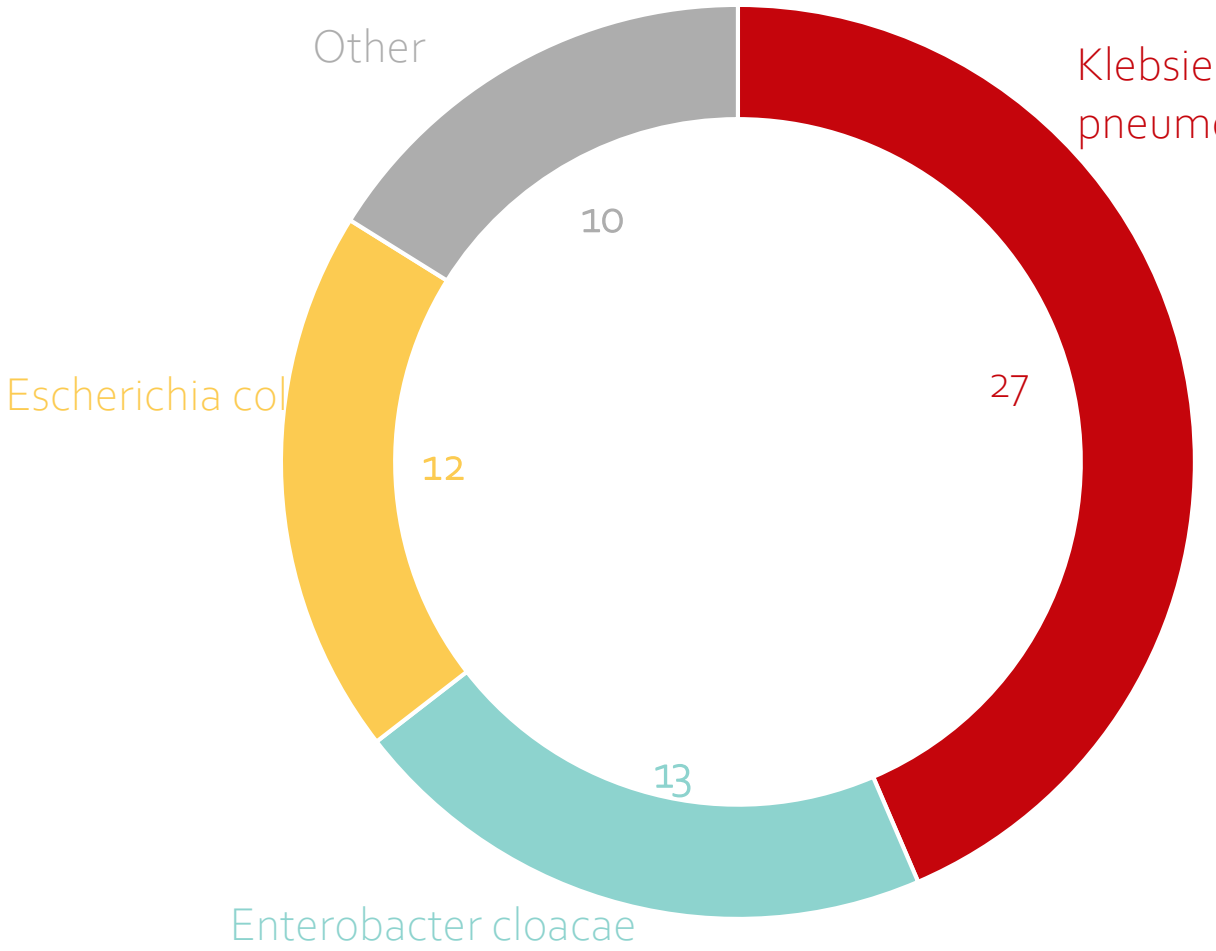
Carbapenem-resistant Enterobacterales (CRE), 2022



Carbapenem-resistant Enterobacterales (CRE), 2022

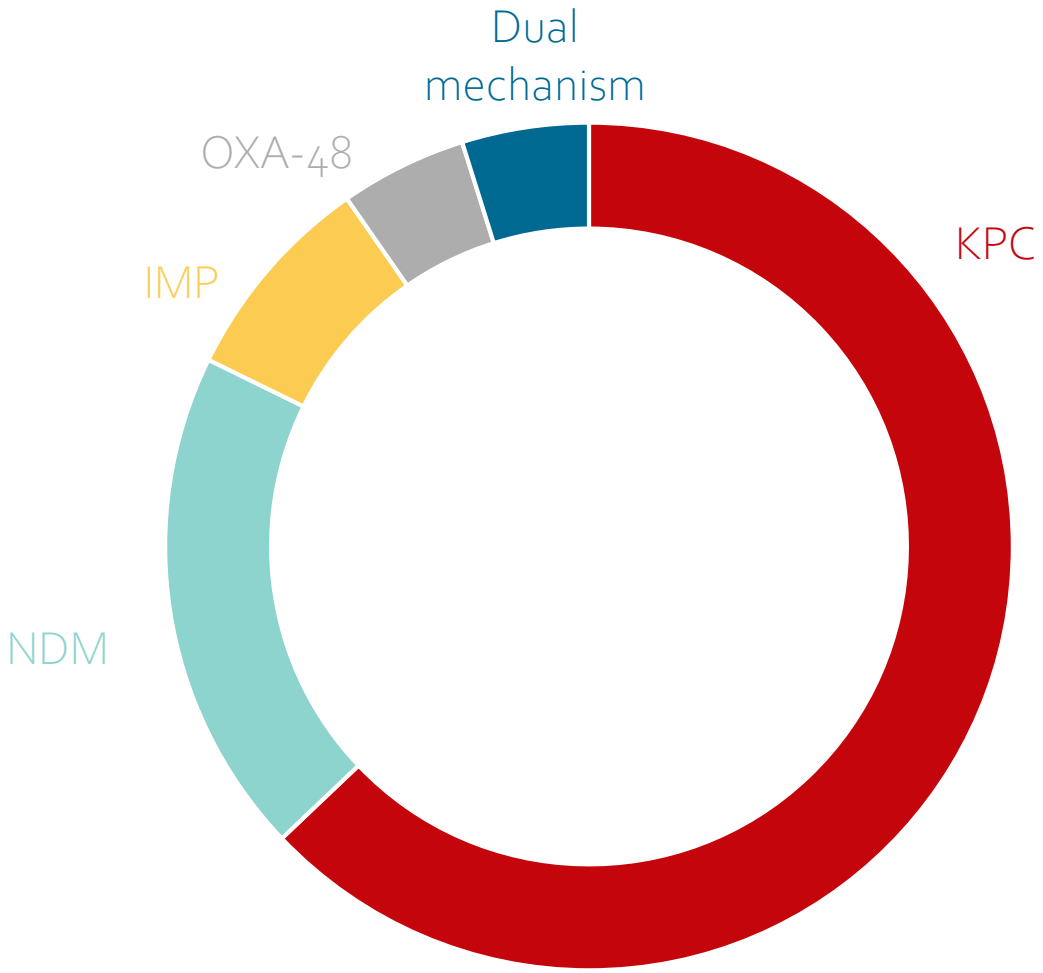


Carbapenemase-producing CRE, 2022



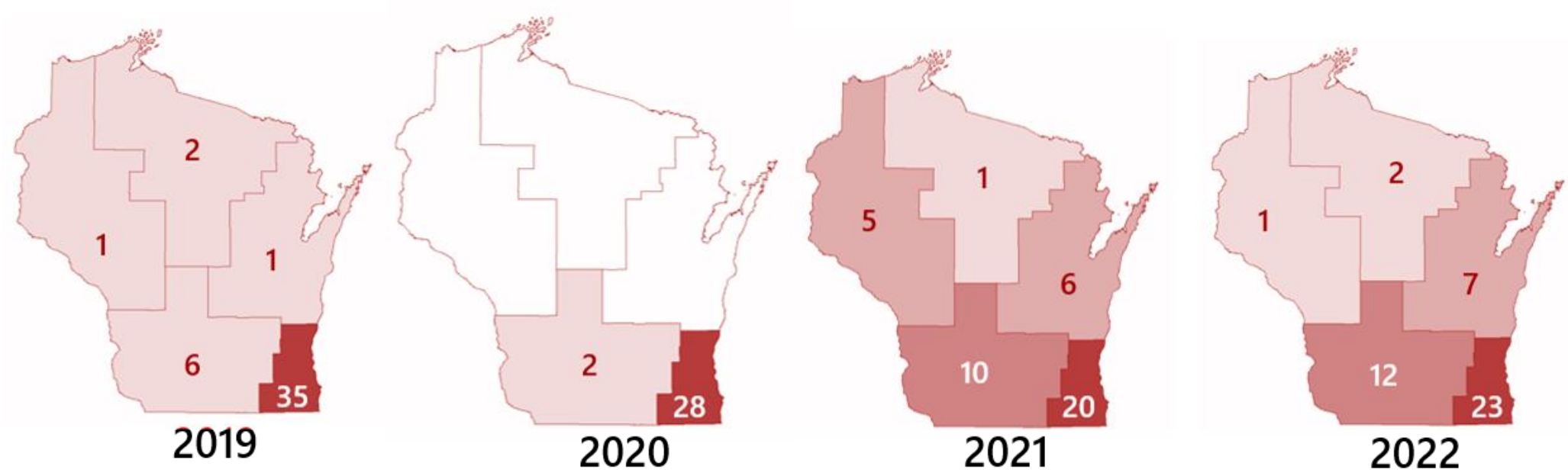
Other species	
Citrobacter freundii	3
Providencia rettgeri	3
Proteus mirabilis	2
Klebsiella oxytoca	1
Morganella morganii	1

Carbapenemases detected in CRE, 2022

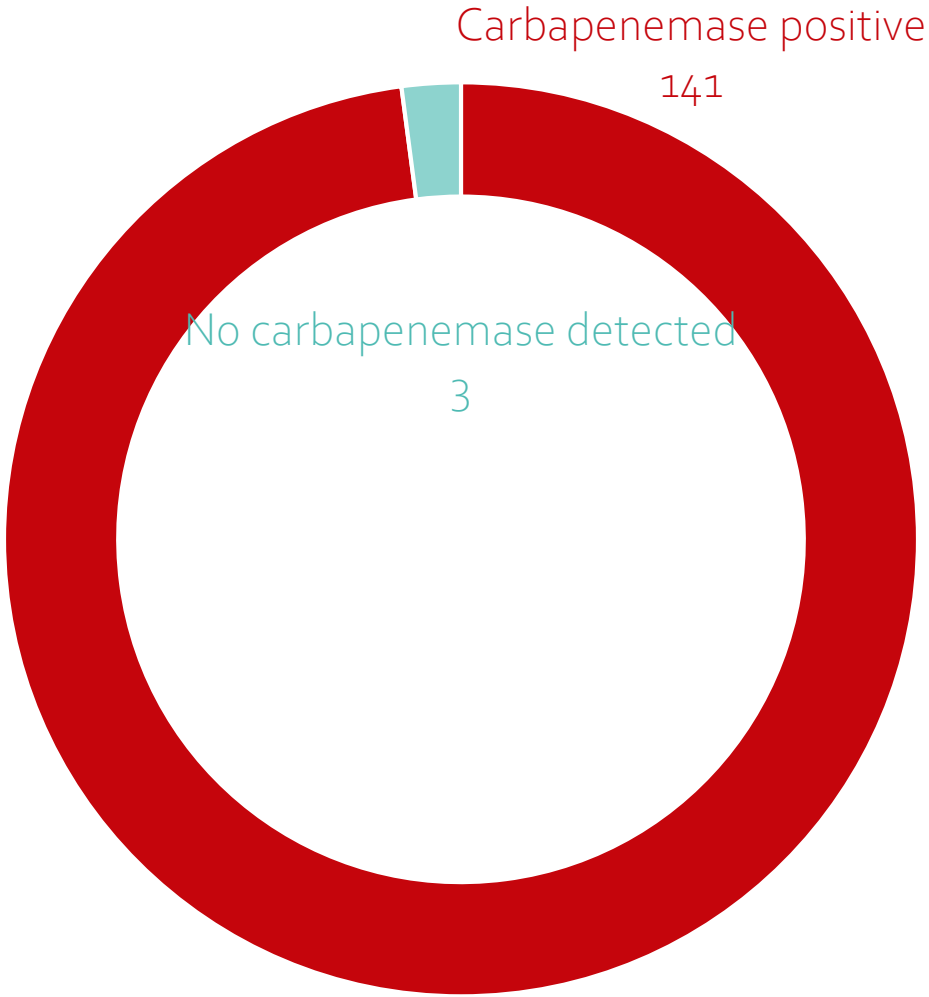


- Dual mechanisms – KPC/NDM

Carbapenemase-producing CRE

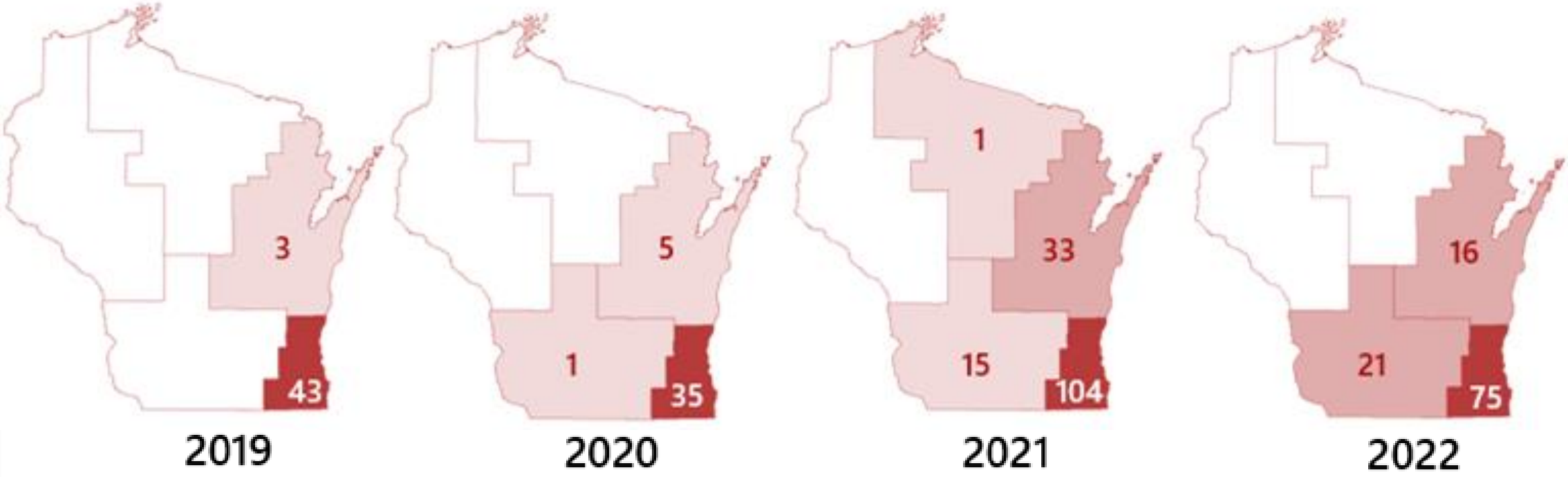


Carbapenem-resistant *Acinetobacter baumannii* (CRAB), 2022

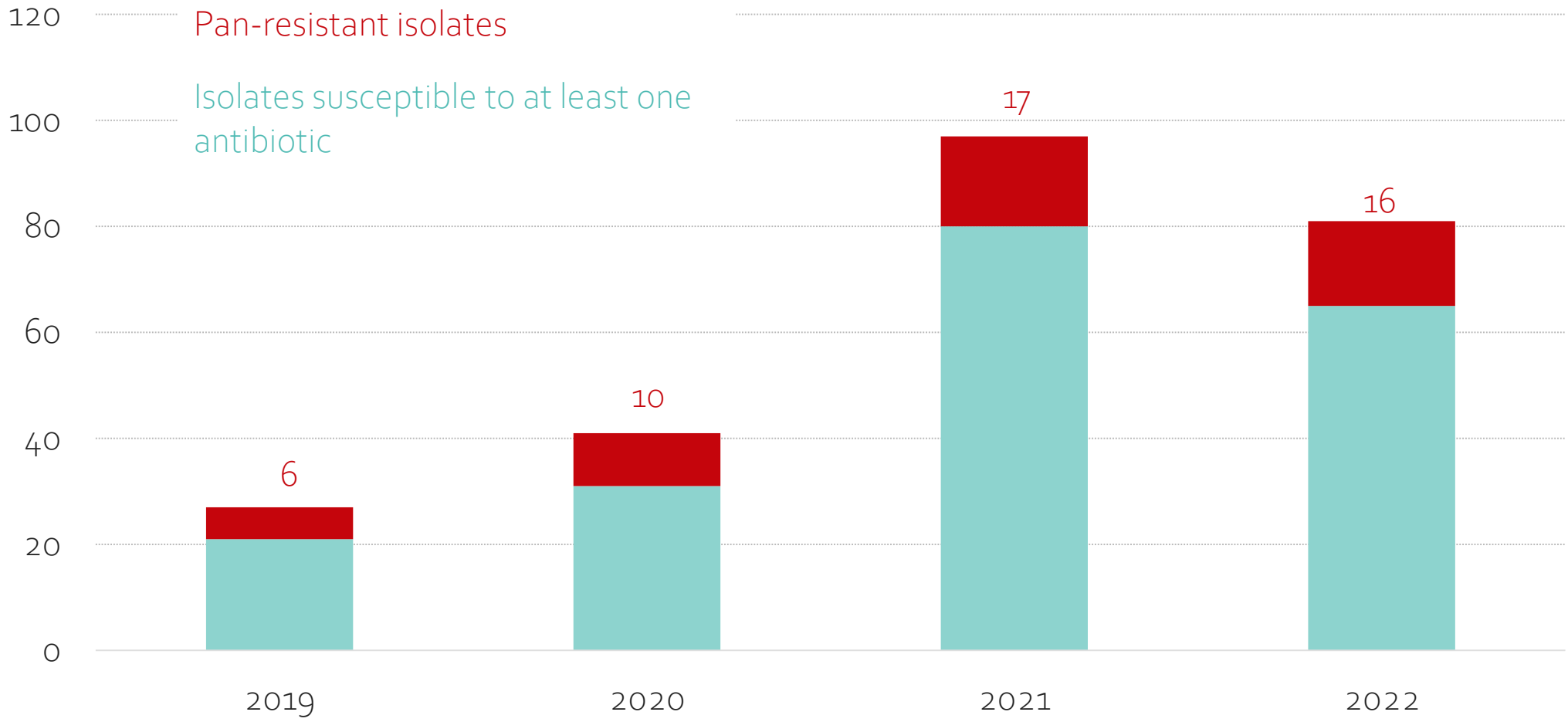


Carbapenemase	No.
OXA-24/40	128
OXA-23	13

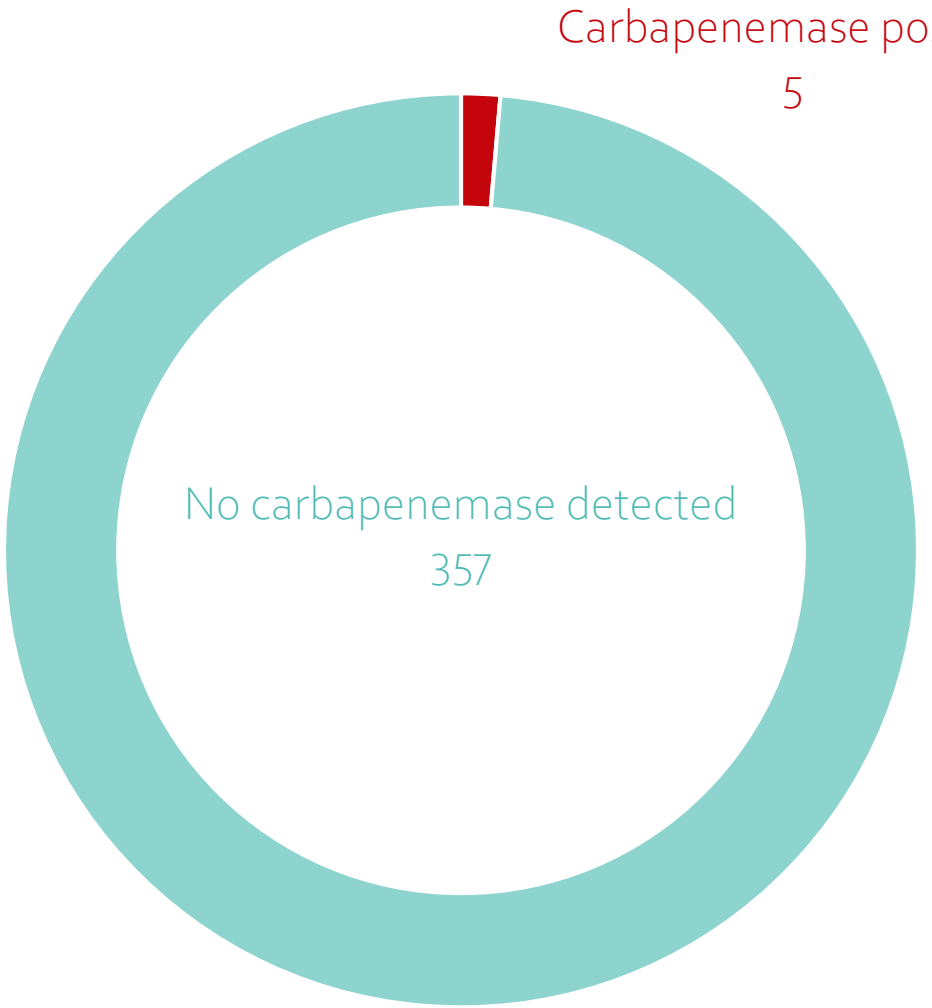
Carbapenemase-producing CRAB



Pan-resistant CRAB

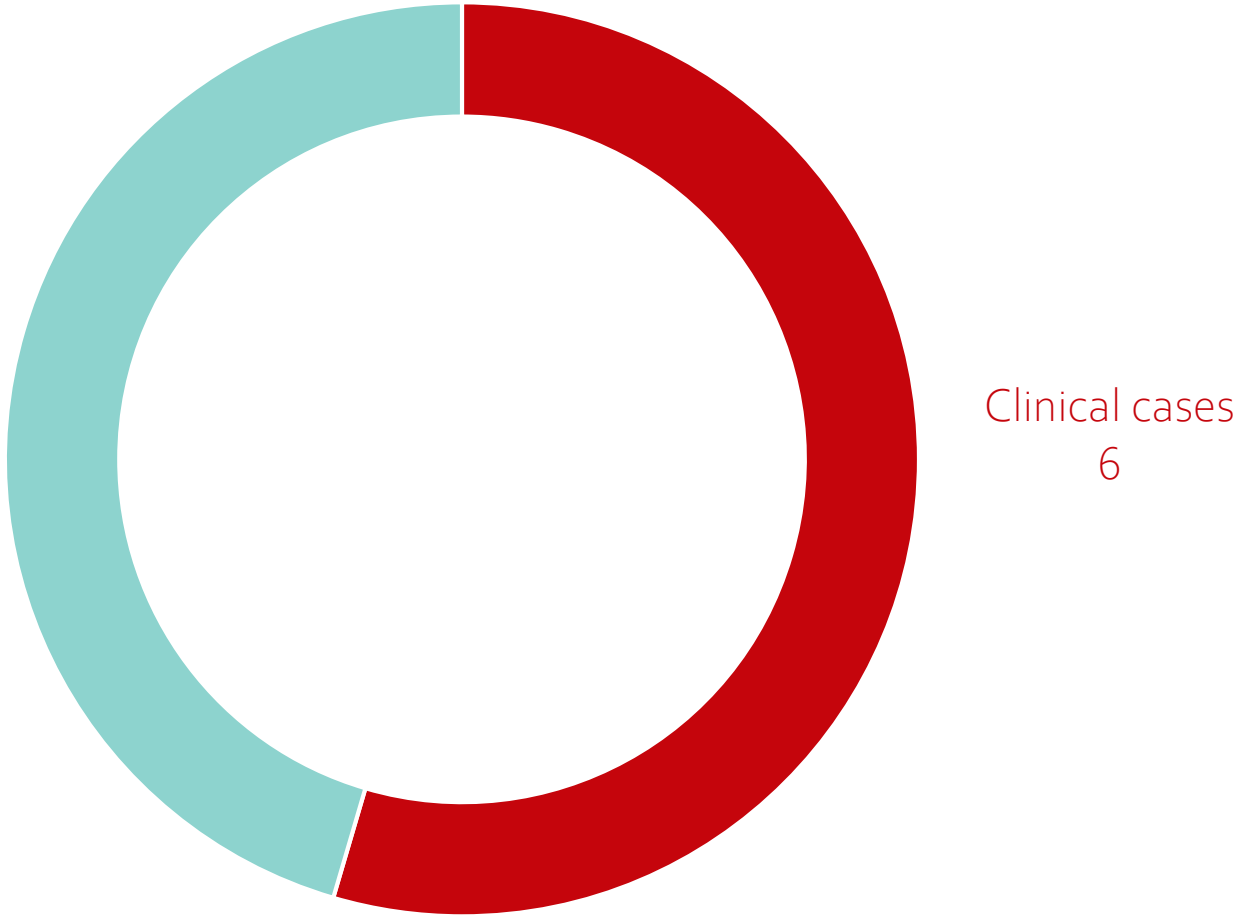


Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA), 2022

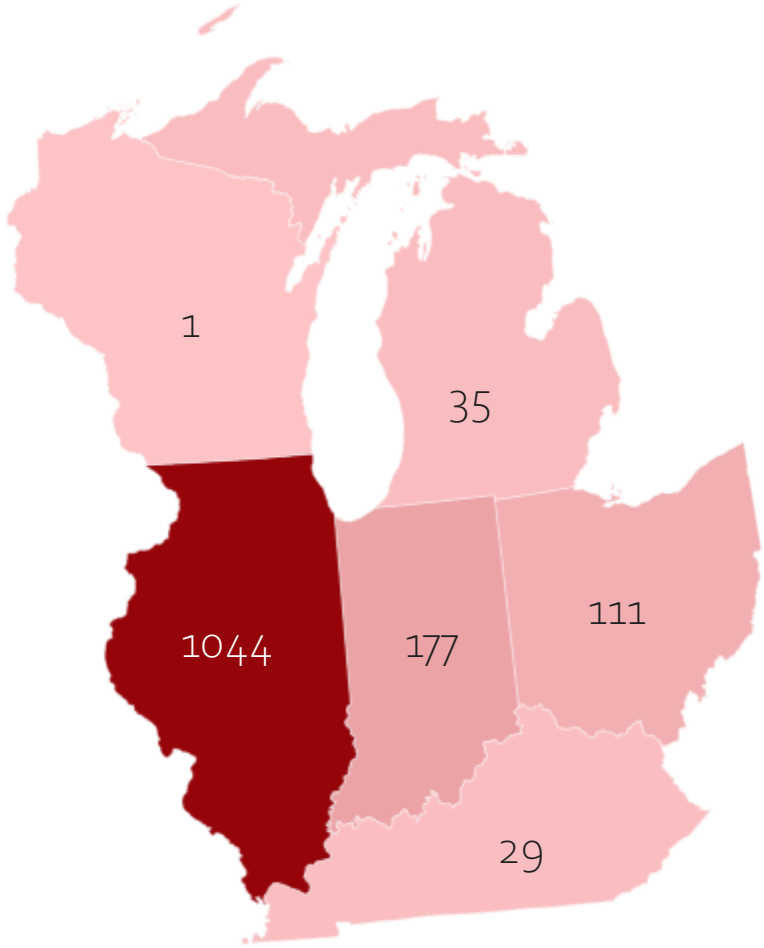


Carbapenemase	No.
KPC	3
VIM	1
OXA-848, OXA-10	1

Candida auris, through August 2023



Midwest Region *Candida auris* (as of Dec 2022)



What's next?

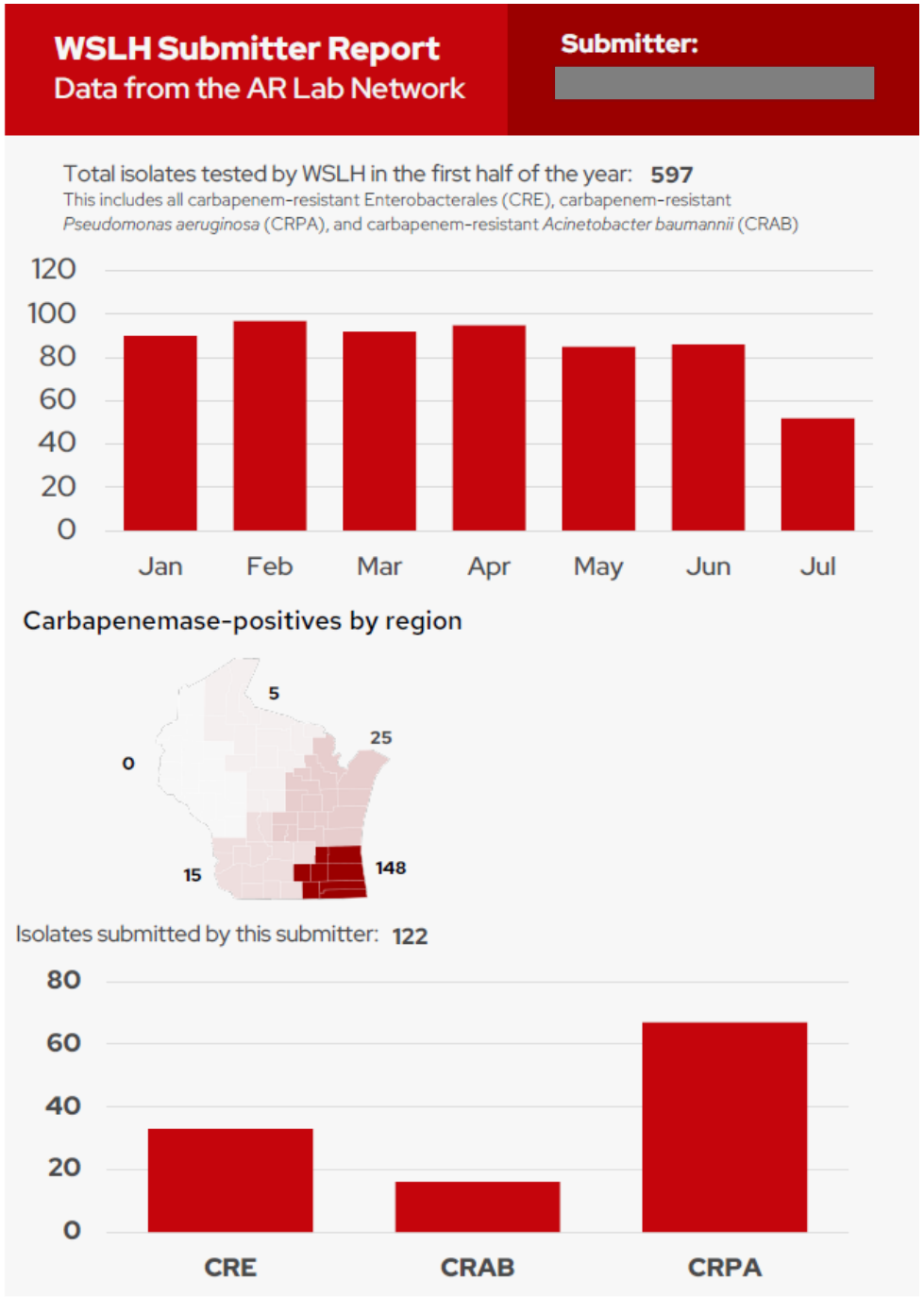
Always looking to improve

- Candida auris NGS
  - Will provide clade information
  - Cluster analysis
- Candida auris PCR on the Panther Fusion
  - Increase testing capacity
- Ideas for improving carbapenemase detection process
  - Evaluate CARBA-5 lateral flow test
  - Multiplex PCR assays
  - Evaluate Streck kits
- Add OXA-235 PCR for CRAB
- Evaluating testing for CRAB colonization directly from swab

How to get more data back to submitters…

- Considering a quarterly report to submitters
- Examples of data to include:
  - How many isolates submitted
  - What species were submitted
  - What carbapenemases were detected
  - Overview of Wisconsin as a whole and by Public Health Region
- What would you find most useful or interesting?

Template Report Example



Thank you!

My contact info:
megan.lasure@dhs.wisconsin.gov
608-266-0915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