



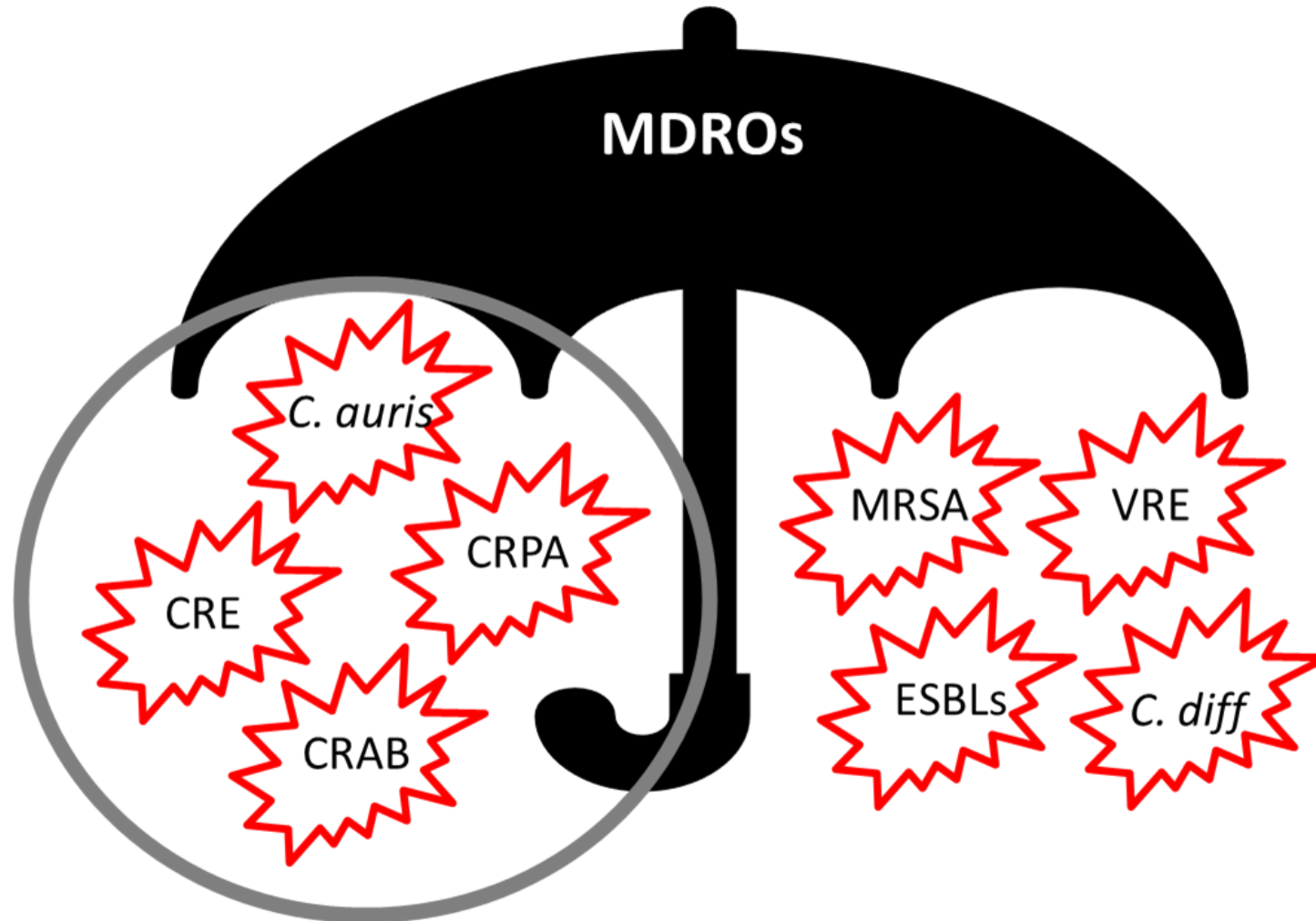
# Multidrug Resistant Organisms in Michigan

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Michigan Department of Health and Human  
Services

# Multidrug-Resistant Organisms



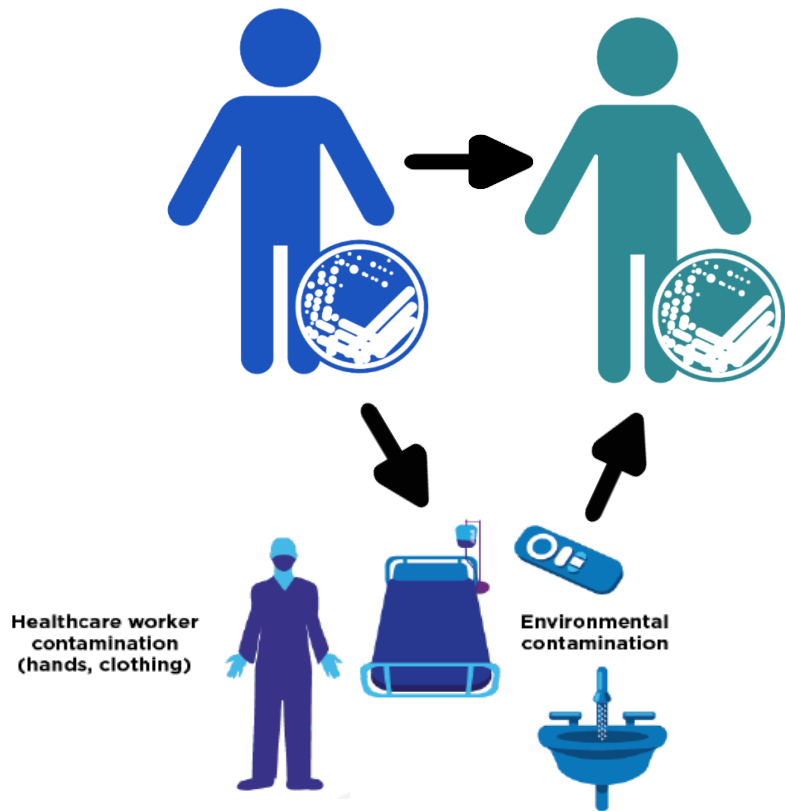
# Targeted Multidrug-Resistant Organisms



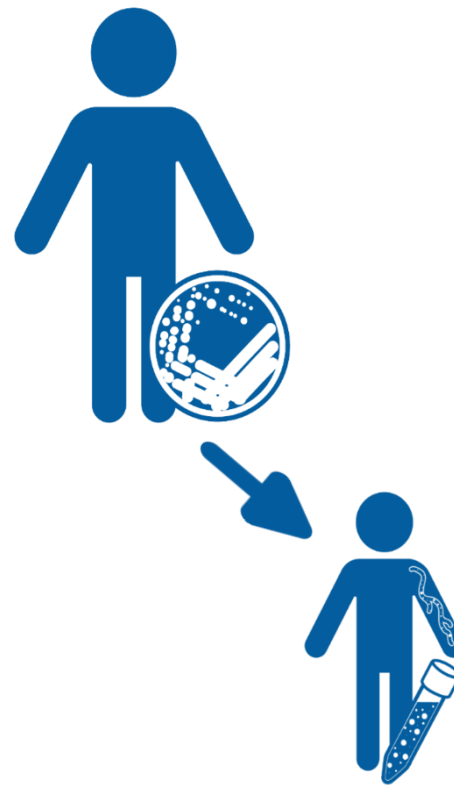
## What do they have in common?

- Opportunistic pathogens that can **colonize** multiple mucosal and/or skin surfaces
- Cause a **variety of infections**, most commonly urinary tract, wound, and bloodstream infections, and pneumonia
- In **healthcare settings**, transmitted via **direct and indirect contact** with infected or colonized individuals or **contaminated healthcare environment**
- Are **emerging in prevalence** in the region

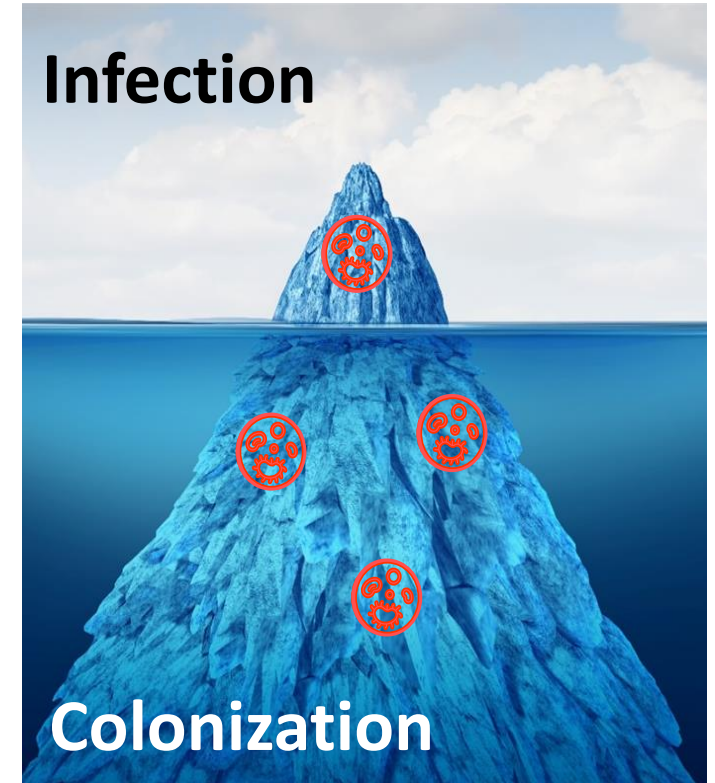
# Colonization Drives Spread and Precedes Infection



Shedding of MDROs from colonized individuals leads to contamination of HCP hands and clothing and the surrounding healthcare environment



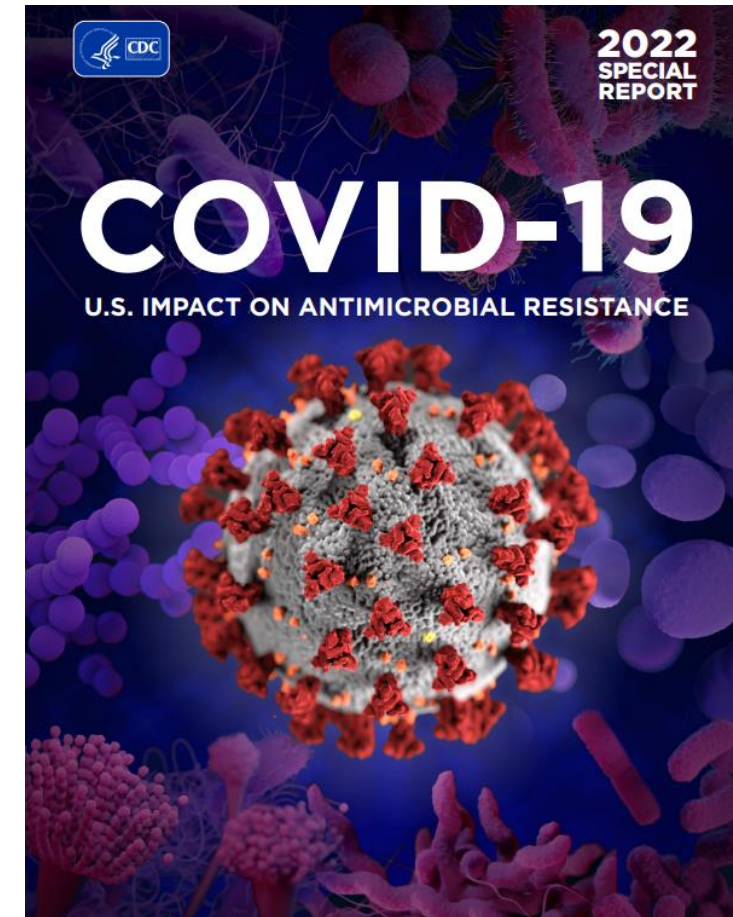
Colonization confers a 2-10 fold higher risk of infection with the colonizing organism than an individual without colonization

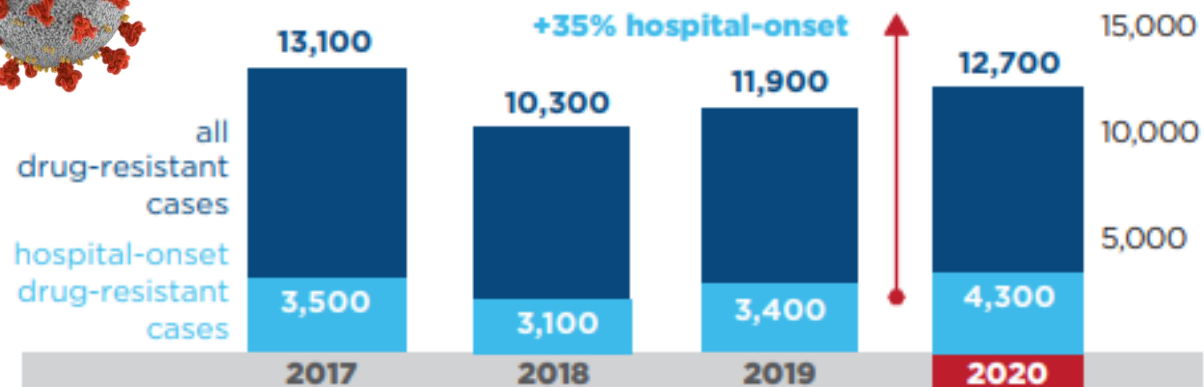
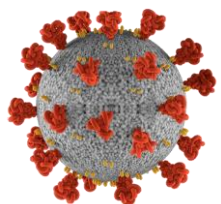


For every individual identified with an MDRO infection, there are some multiplier more who are colonized

# COVID-19 Impact on Antimicrobial Resistance

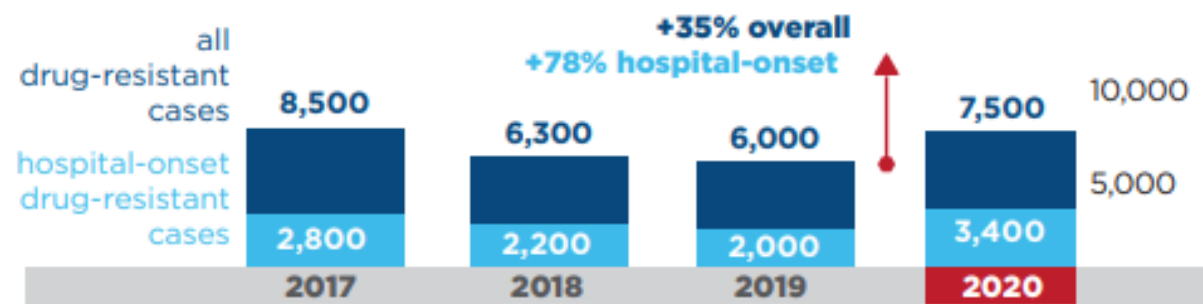
- Resistant hospital-onset infections and deaths both increased at least 15% during the first year of the pandemic
- More than 29,400 people died from AR infections
  - Nearly 40% of the people got the infection while they were in the hospital
- Gaps in surveillance data and isolate submission





Data from 2018-2020 are preliminary.

### Carbapenem-resistant Enterobacterales

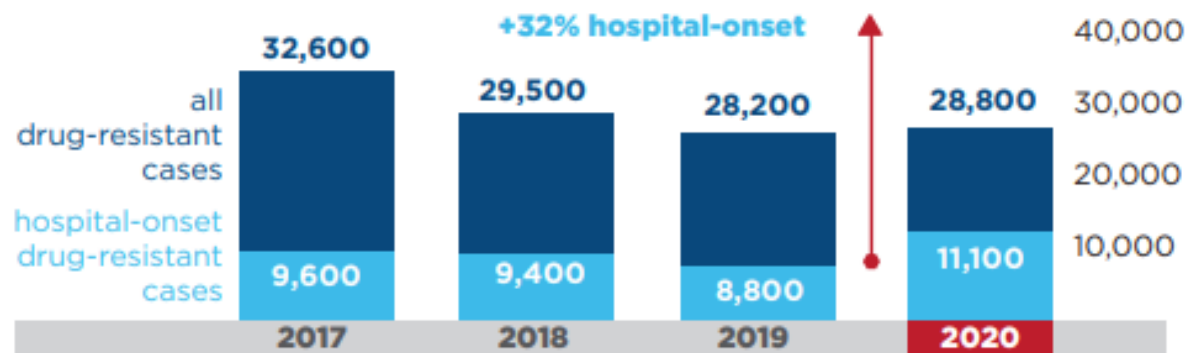


Data from 2018-2020 are preliminary.

### Carbapenem-resistant *Acinetobacter*



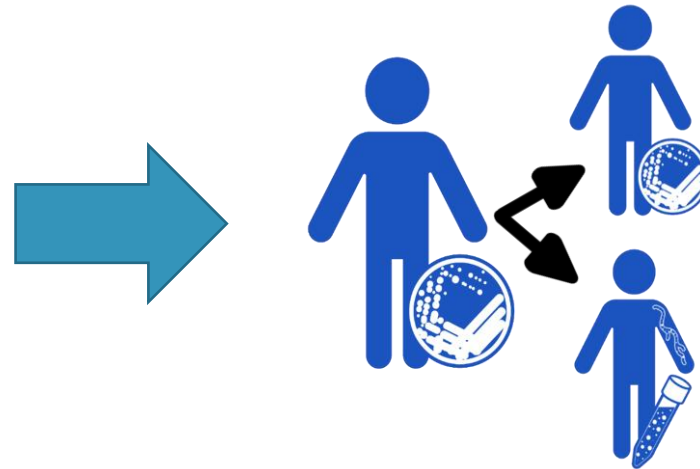
### *Candida auris*



Data from 2018-2020 are preliminary.

### Multidrug-resistant *Pseudomonas aeruginosa*

# *Candida auris* is a Public Health Concern



## **Colonization amplifies the problem**

5-10% develop invasive infections  
~45% mortality within 30 days of invasive infection



## **Spreads in healthcare settings**

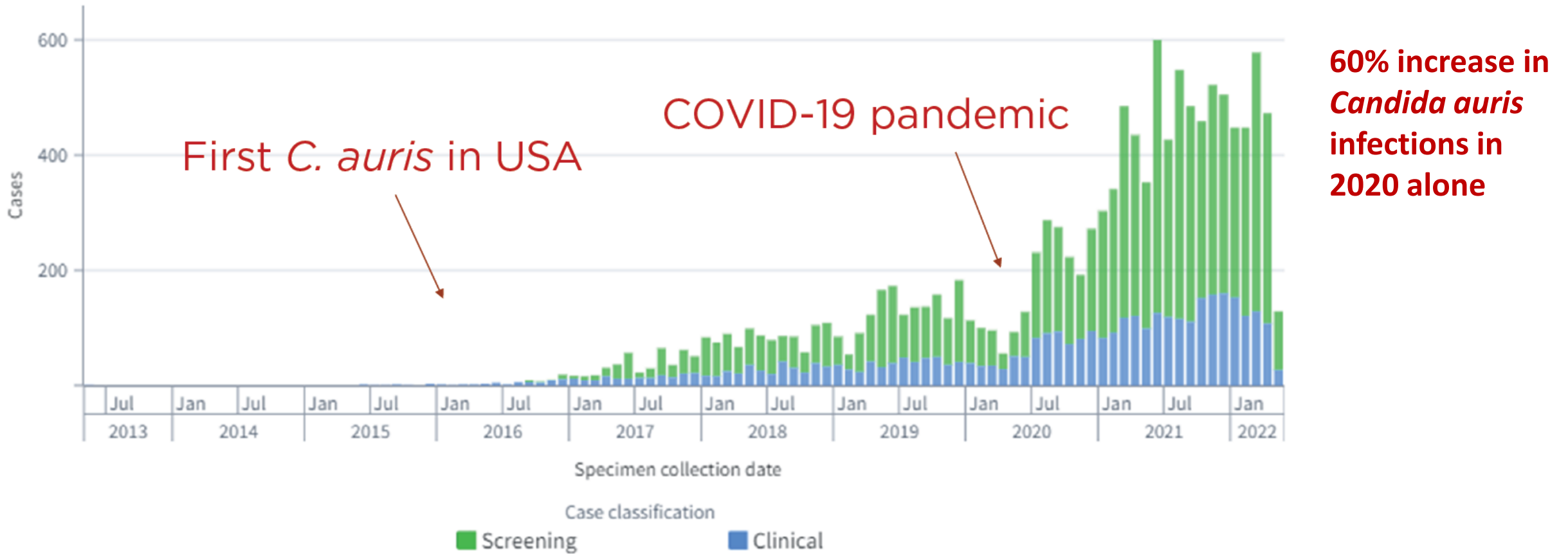
Some facilities can develop >70%  
colonization prevalence  
Outbreaks can be difficult to  
control



## **Only 3 classes of antifungals**

>80% resistant to 1  
>25% resistant to 2  
>30 isolates pan-resistant

# *Candida auris* Transmission is Increasing



# *Candida auris* Transmission is Increasing

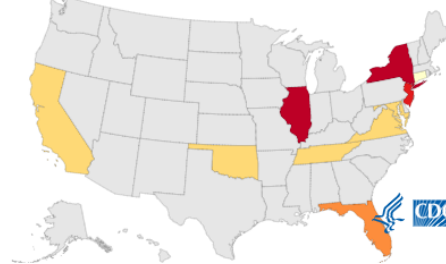
Reported clinical cases of *Candida auris*, 2013-2016



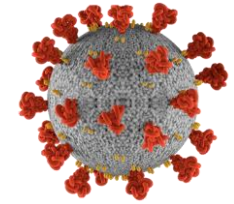
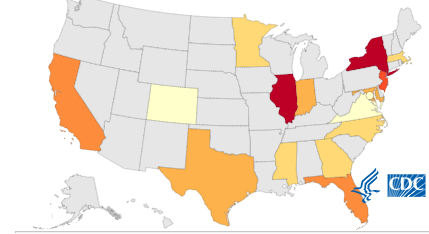
Reported clinical cases of *Candida auris*, 2017



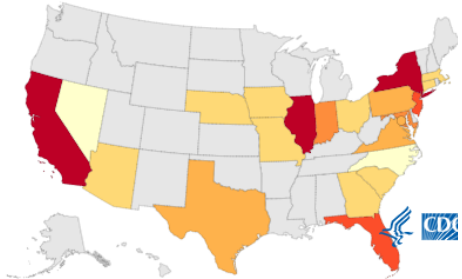
Reported clinical cases of *Candida auris*, 2018



Reported clinical cases of *Candida auris*, 2019



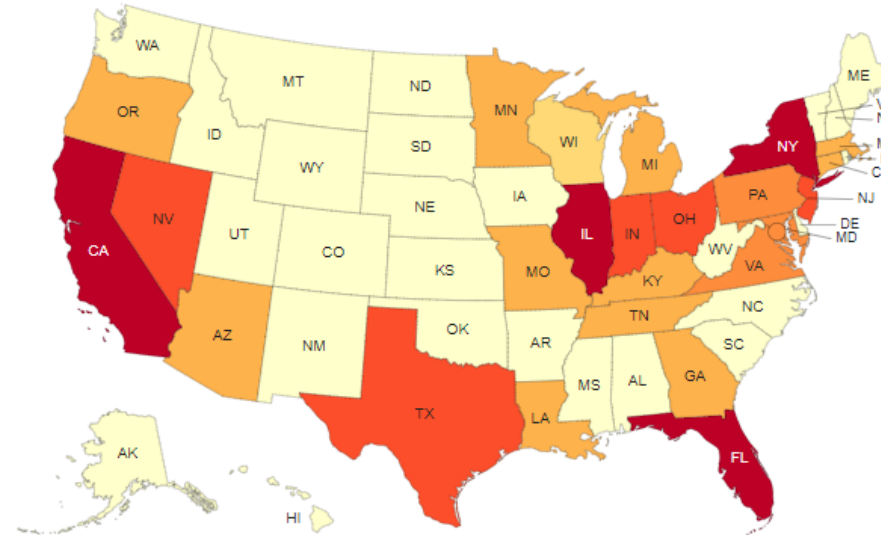
Reported clinical cases of *Candida auris*, 2020



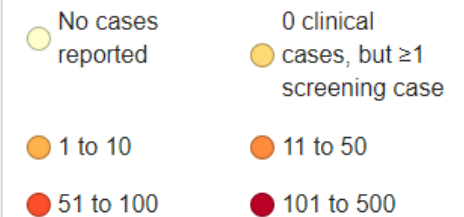
Reported clinical cases of *Candida auris*, 2021



Reported clinical cases of *Candida auris*, June 1, 2021-May 31, 2022



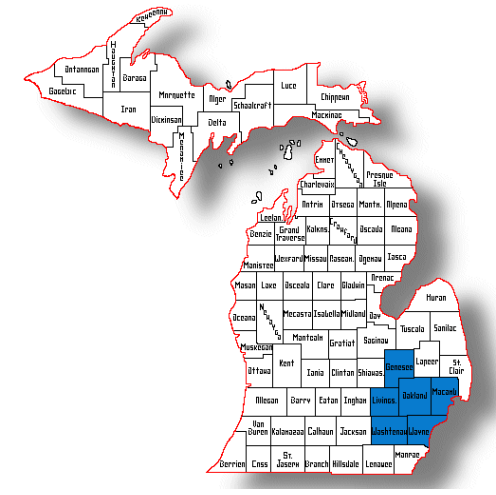
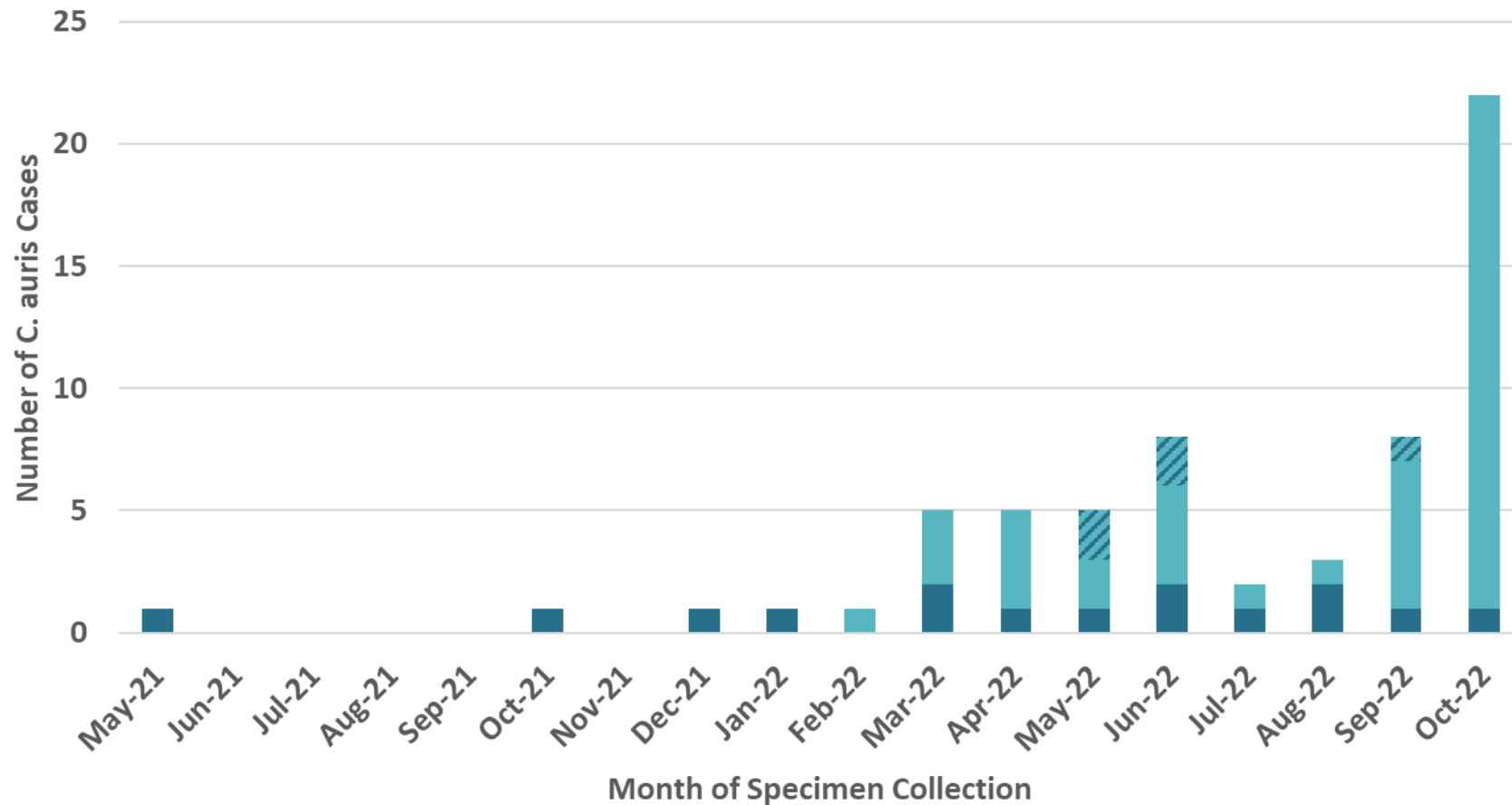
## Number of Clinical Cases



Territories

AS GU PR VI MP

# Candida auris Cases in Michigan



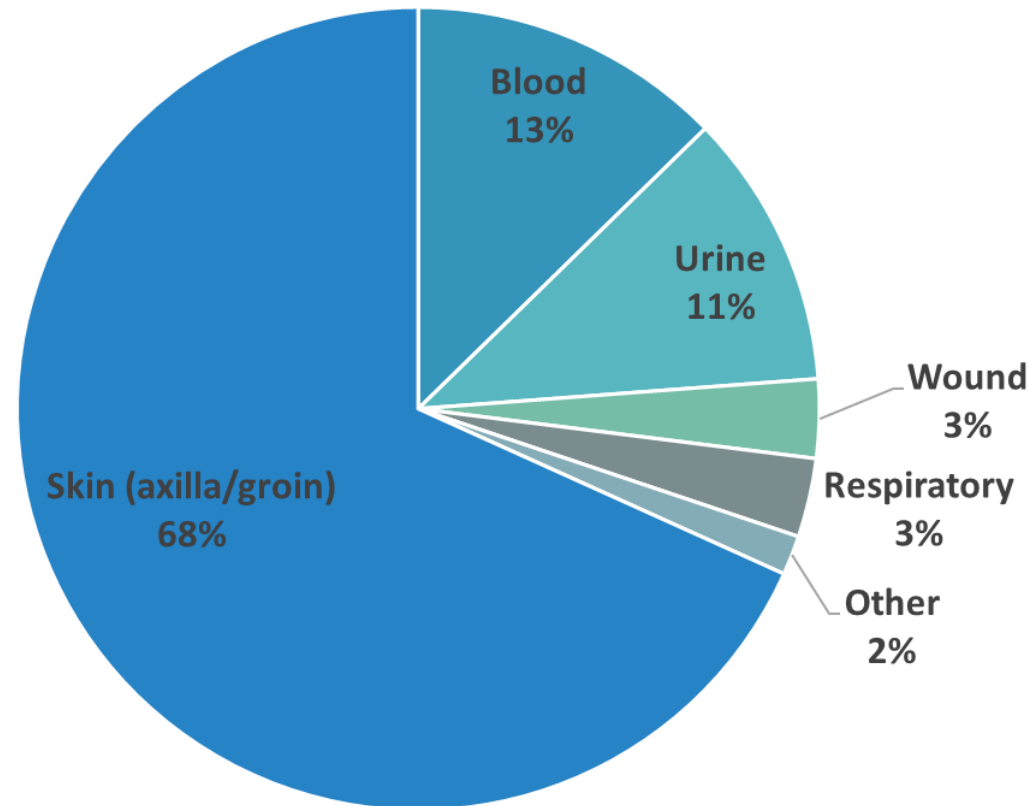
## 63 Cases Detected in 58 Patients:

- 15 patients by clinical cultures
- 5 patients initially identified on colonization screening subsequently had positive clinical cultures
- 38 patients by colonization screening only

■ Screening to Clinical  
■ Screening  
■ Clinical

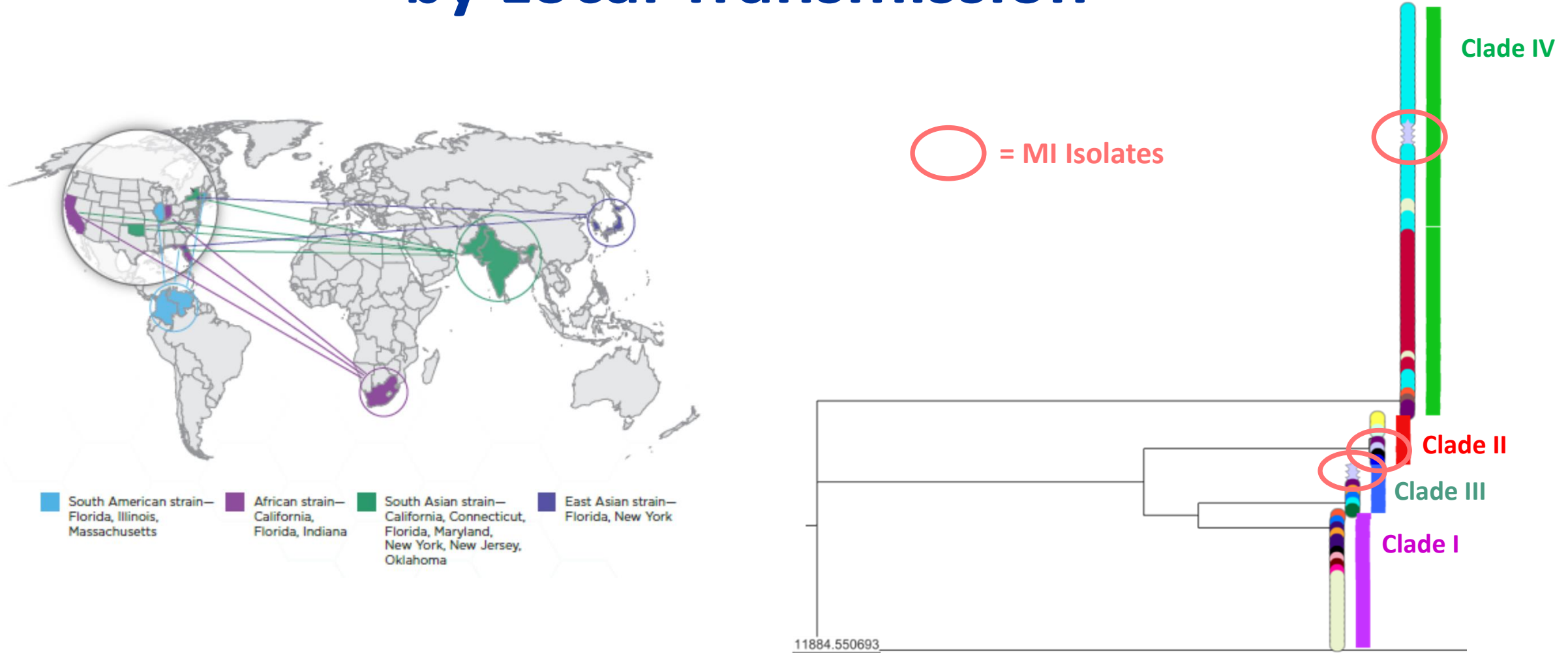
*Preliminary data available 10-21-22*

# Specimen Source of MI *Candida auris* Isolates



*Preliminary data available 10-21-22*

# Multiple Introductions of *C. auris* Followed by Local Transmission



# Risk Factors for *Candida auris* in MI Cases



## Older age

Median 59 yrs  
(range 23->89)



## Indwelling devices

Recent Mechanical Ventilation (72%)  
Tracheostomy (62%)  
PEG tube (62%)  
CVC/PICC (52%)  
Urinary Cath (38%)



## Wounds

Chronic non-healing or surgical (67%)



## Antifungals and antibiotics

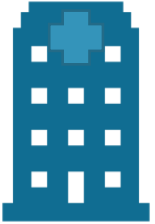



Hx MDROs (53%)



## Comorbid conditions




Chronic Lung Disease  
Diabetes  
Renal Disease  
Cardiovascular Disease  
Cancer

# Multiple Healthcare Exposures are Common

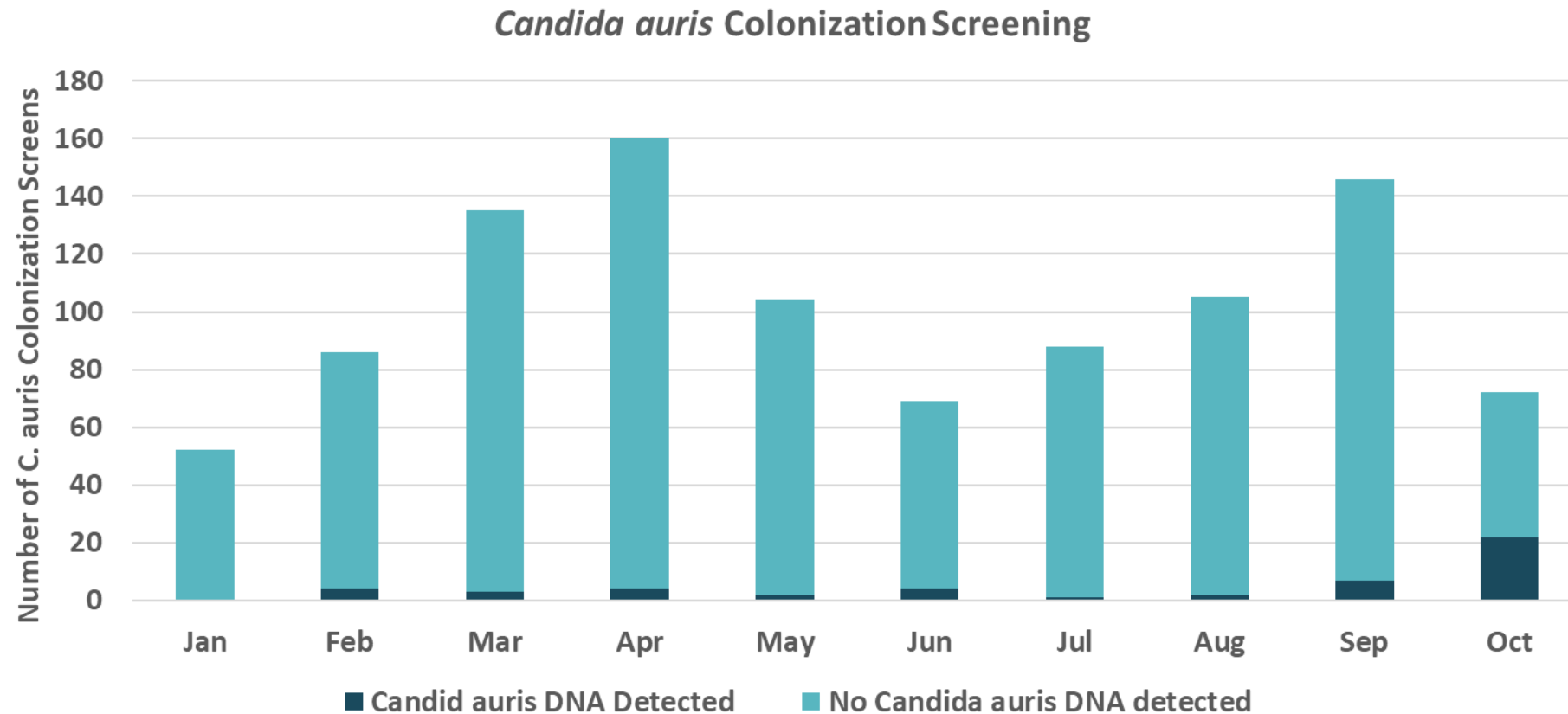
Healthcare Setting				
	Acute Care Hospital	Long-term Acute Care Hospital	Skilled Nursing Facility w/Ventilator Care	Skilled Nursing Facility
At Time of Detection	34%	66%	-	-
Exposures in Last 90 Days	98%	67%	14%	24%

*Preliminary data available 10-21-22*

# Antifungal Resistance is Common in *C. auris*

Antifungal Class		US Isolates	MI Isolates
	Azoles	88%	94%
	Polyenes	34%	0%
	Echinocandins (First Line)	3%	22%
Resistant to 2		>25%	22%
Pan-resistant		>30 isolates	0 isolates

# Colonization Screening Conducted as Part of Public Health Follow-up



# *Candida auris* Outbreaks Detected

## Acute Care Hospitals



Medical ICU  
3 patients



Med/Surg ICUs  
4 patients



Medical ICU  
3 patients\*  
2 patients

## Long-term Acute Care Hospitals



LTAC  
12 patients



LTAC  
25 patients

## Skilled Nursing Facility w/Ventilator Care



Ventilator Unit  
2 patients

## Skilled Nursing Facility



New Admit/COVID-19 PUI Unit  
2 patients

\*The first patient in this outbreak was identified by admission screening, the rest of the outbreaks were first detected by positive clinical cultures

# Whole Genome Sequencing Detected At Least 2 Separate *C. auris* Introductions into HCF A

Genetic *C. auris* Clade

Clade I

Clade II

Clade III

Clade IV

★ = Michigan *C. auris* Isolate



First isolate detected at HCF A in urine culture

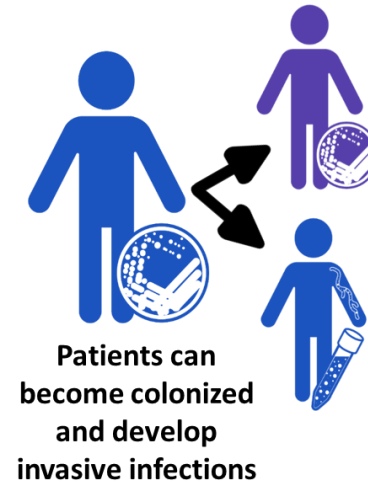
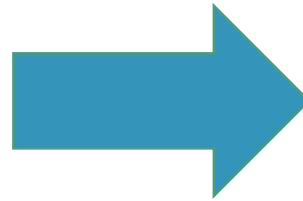
**Azole-R, Echinocandin-S**



3 isolates detected at HCF A on 1st PPS 3 weeks later  
in axilla/groin swabs

**Azole-R, Echinocandin-R**

# Carbapenemase-Producing Organisms are a Public Health Concern



Spreads in healthcare  
settings

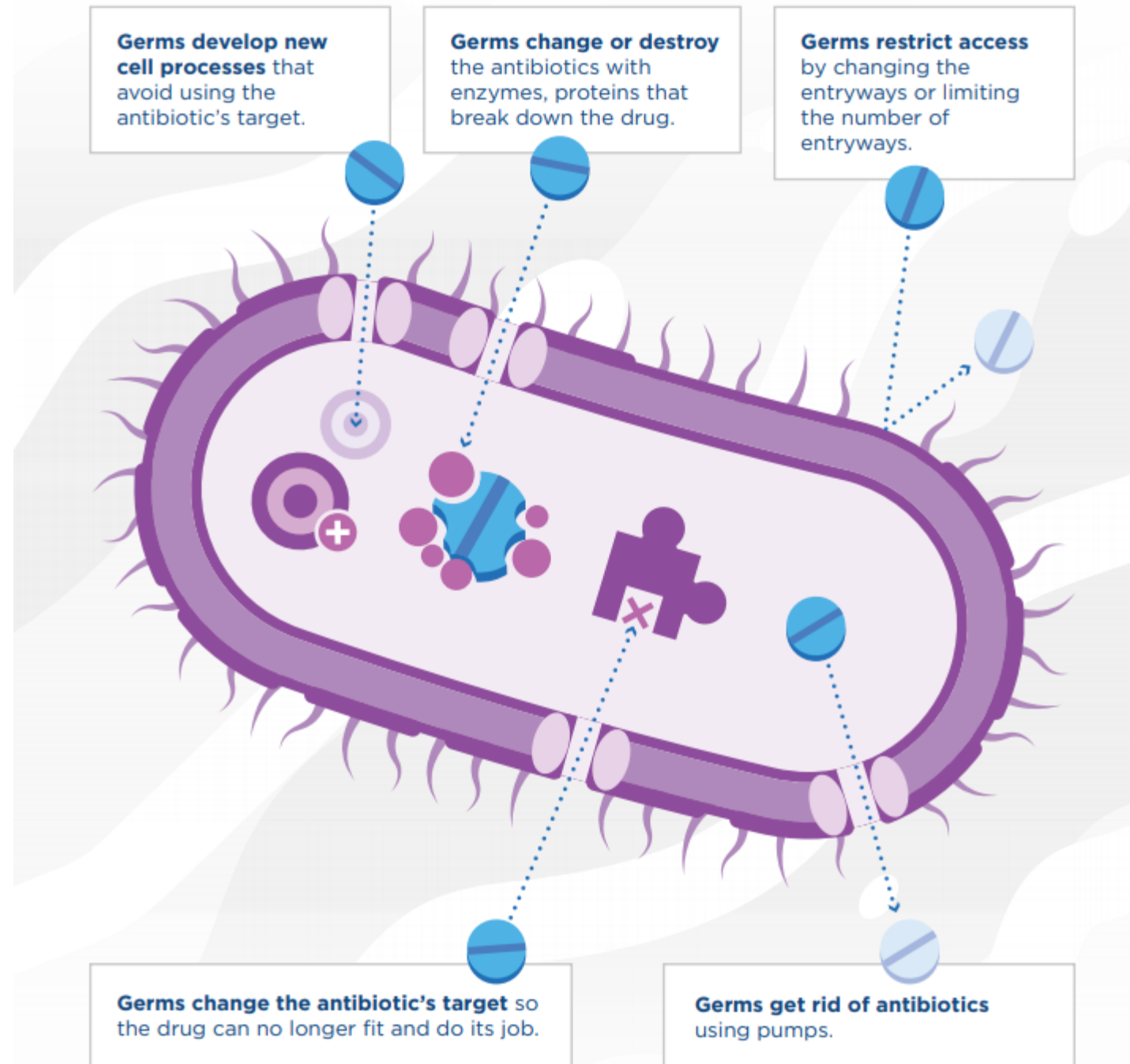


Highly  
drug-resistant

# Mechanisms of Carbapenem Resistance

- Altered targets
- Avoidance of targets
- Porin loss
- Efflux pumps
- Enzymes

Carbapenemases



# Carbapenemases Vary by Organism



Carbapenem-resistant  
*Enterobacterales*

25-30% are CP



Carbapenem-resistant  
*Pseudomonas aeruginosa*

<5% are CP



Carbapenem-resistant  
*Acinetobacter*

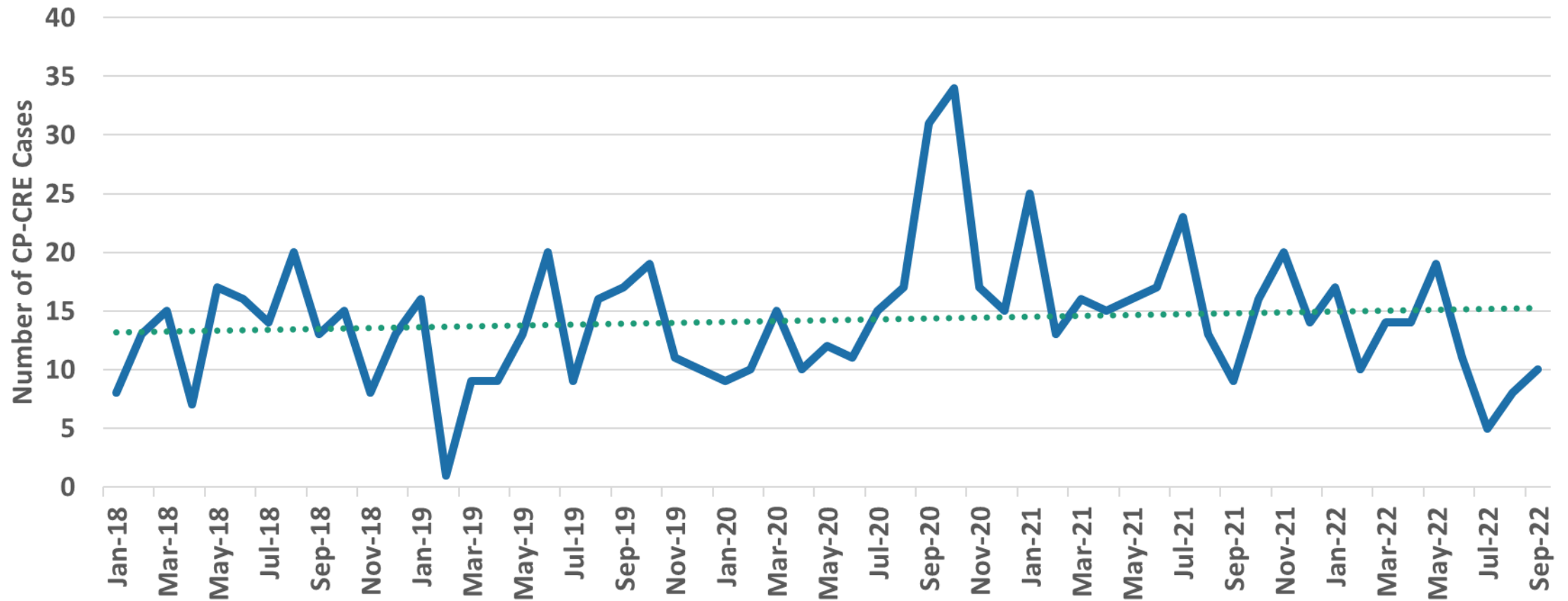
>90% are CP

KPC, NDM, OXA-48-like, IMP, VIM

OXA-23, -24/40, 58, -235-like

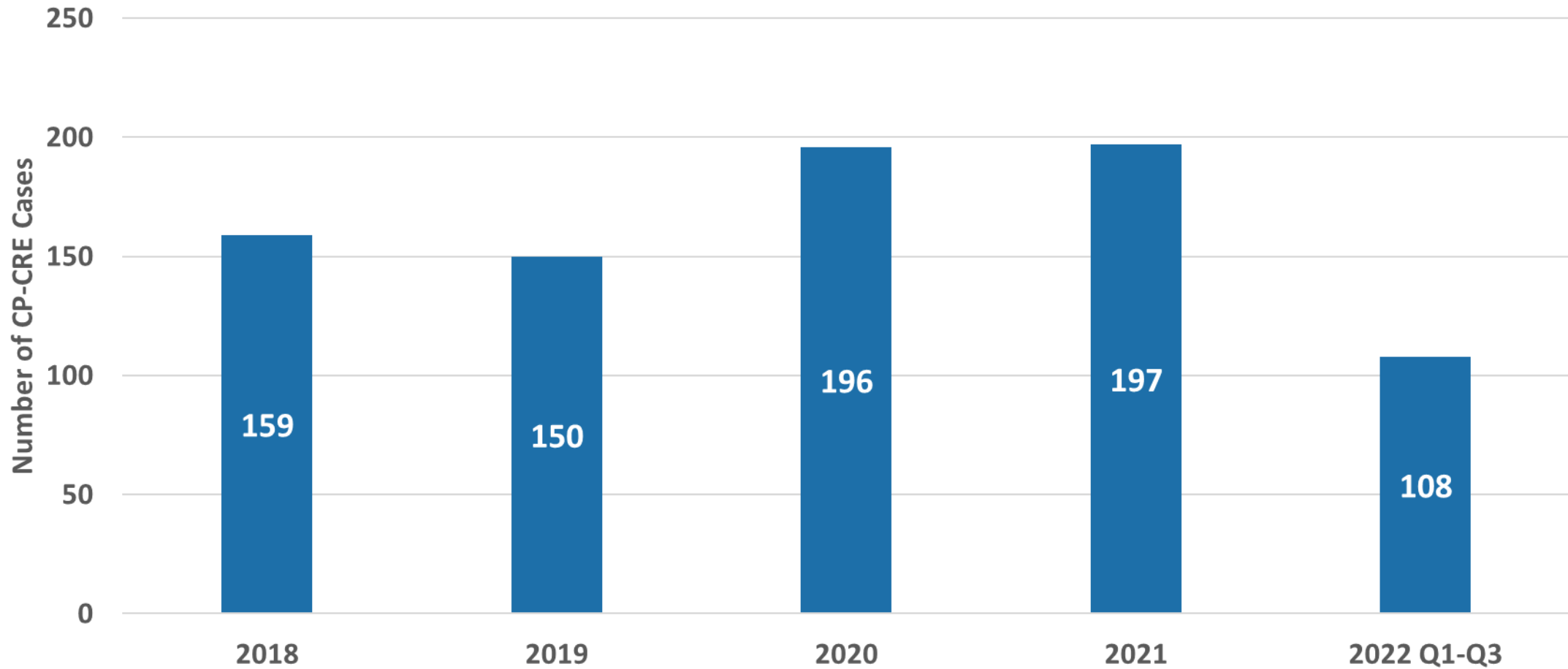
# Confirmed CP-CRE Cases Reported to MDSS

## 2018 - 2022Q3\*



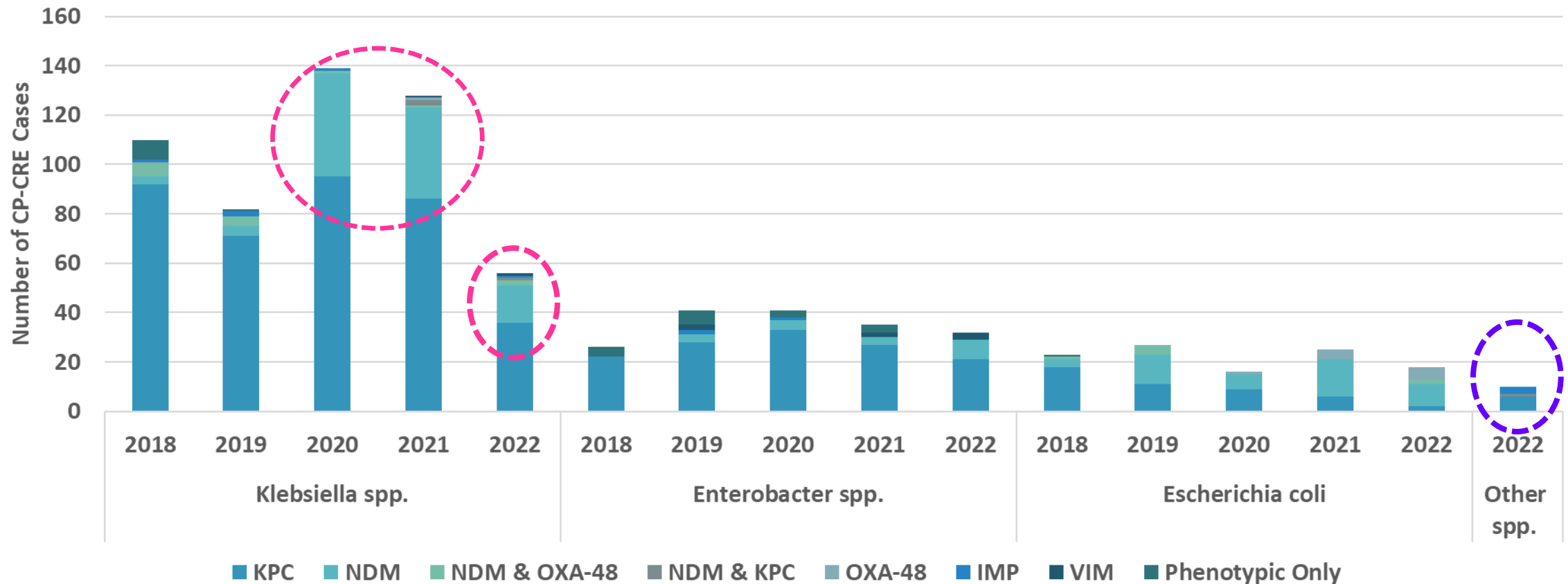
*Preliminary – Data Subject to Change*

# Confirmed CP-CRE Cases Reported to MDSS 2018 - 2022Q3\*



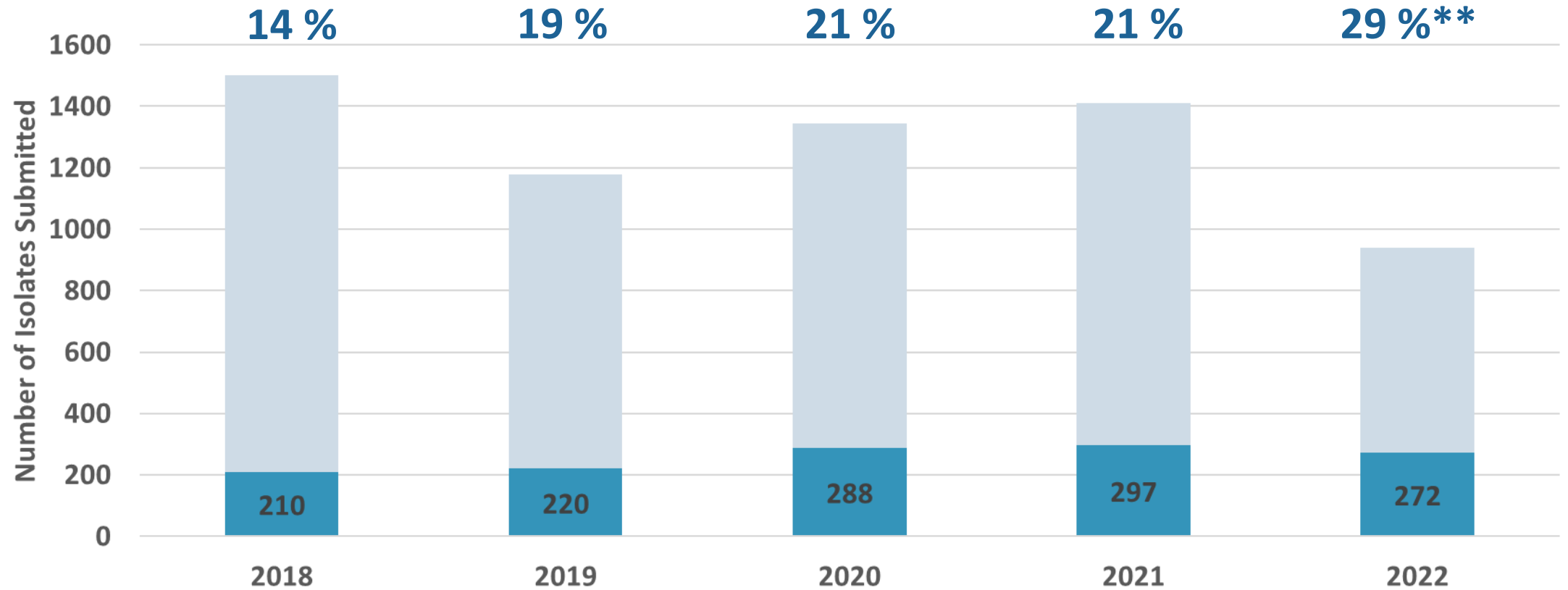
*Preliminary – Data Subject to Change*

# Confirmed CP-CRE Cases Reported to MDSS 2018-2022Q3\*



# CRE Isolates Submitted to BOL

## 2018 – 2022Q3\*



*Preliminary – Data Subject to Change*

CRE = Carbapenem-resistant Enterobacterales

Carbapenemase genes include KPC, NDM, OXA-48, IMP, VIM

\*\*CP-CRE isolate submission required in 2022

Phylogenetic tree and AMR gene presence heatmap for 15 *Pseudomonas aeruginosa* strains. The tree shows relationships between strains, with CL22-201340 and CL22-201501 as outliers. The heatmap shows the presence of 15 AMR genes for each strain. A legend identifies the patients and the AMR genes.

**Legend:**

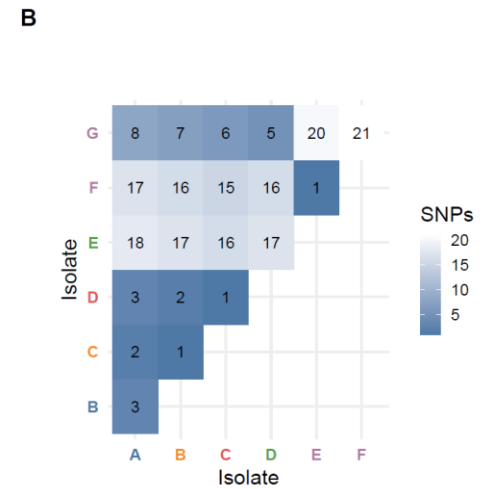
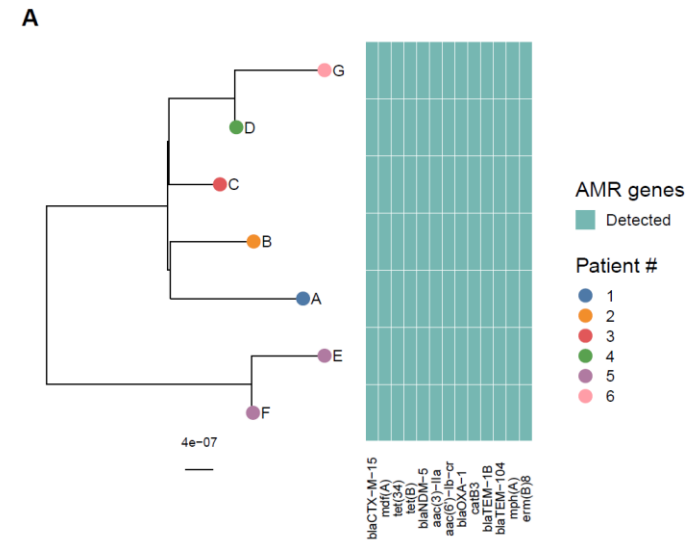
- AMR Gene Present:**
  - No (Grey)
  - Yes (Black)
- Patient:**
  - P112 (Red)
  - P159 (Yellow)
  - P191 (Green)
  - P212 (Cyan)
  - P223 (Blue)
  - P248 (Magenta)
  - P276 (Pink)

**Strains and Patient:**

- CL22-200491 (P112)
- CL22-200268 (P112)
- CL22-201340 (P159)
- CL22-201348 (P159)
- CL22-200336 (P191)
- CL22-200221 (P212)
- CL22-200695 (P223)
- CL22-200322 (P223)
- CL22-201501 (P248)
- CL22-201395 (P276)
- CL21-201881 (P276)
- CL21-201001 (P276)
- CL19-203074 (P276)

**AMR Genes:**

- ampC
- blaOXA-1
- blaOXA-2
- blaOXA-3
- blaOXA-4
- blaOXA-5
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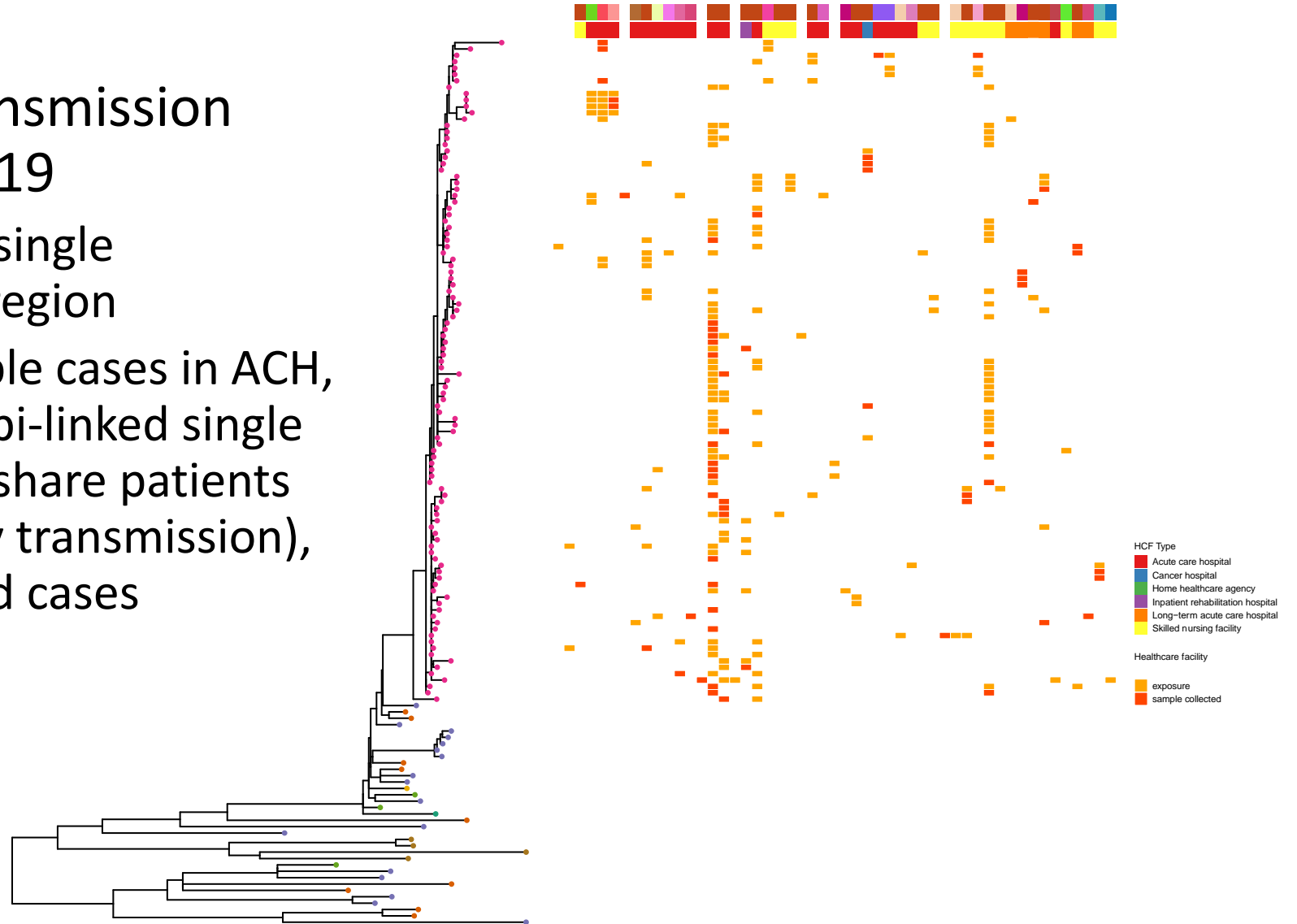
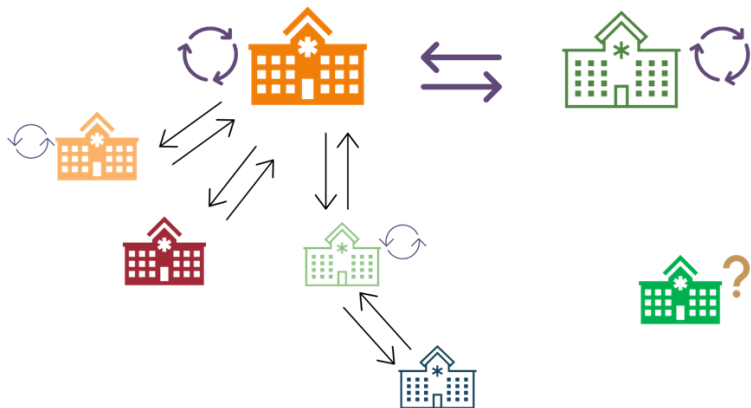
- Multiple outbreaks across settings
- Particularly in COVID-19 unit or during times of COVID-19 surges
- NDM *Klebsiella pneumoniae* ST 219 - >100 cases regionally (R2N, 2S)
- VIM *Enterobacter cloacae* ST 114 – 7 cases (R3)



- Contaminated Duodenoscopes
- NDM *Escherichia coli* ST648

# NDM *Klebsiella pneumoniae* ST 219

- Sustained regional transmission detected since late 2019
  - Clonal outbreak from single introduction into the region
  - Outbreaks with multiple cases in ACH, vSNF, SNF as well as epi-linked single cases in facilities that share patients (intra and inter-facility transmission), and few non epi-linked cases



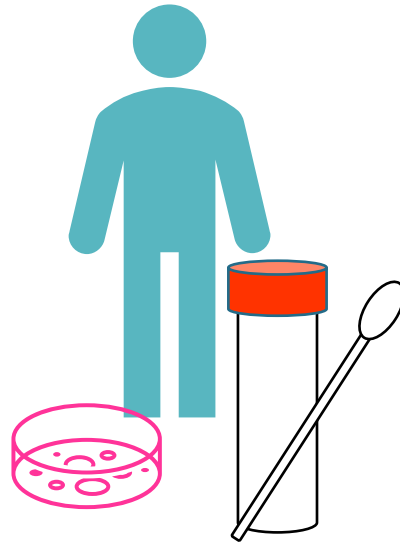
# Summary of Targeted MDRO Trends

- Emergence of localized transmission of *Candida auris* in SE MI in 2022
  - Most cases are colonized, unrecognized status driving transmission
  - Outbreaks detected across healthcare settings, largest occurring in LTACHs
  - Multiple clades, some echinocandin-R strains detected
- Early analysis may indicate slightly lower rates of CP-CRE in 2022 vs 2020-2021
  - *very preliminary: data cleaning/case closeout in progress, isolate submissions(?)*
  - Continued detection and spread of NDM carbapenemases
  - Detection of targeted carbapenemases in non-Big 3 organisms
    - *Serratia & Citrobacter* spp. (KPC), *Proteus & Providencia* spp. (IMP)

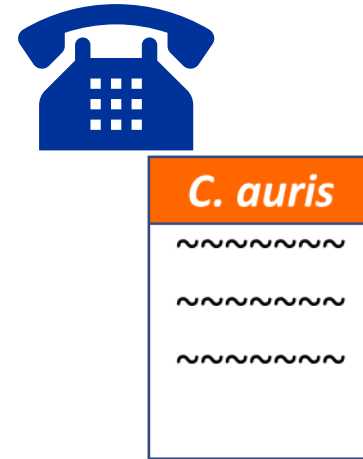
# What Can Healthcare Facilities Do?



**Infection Prevention  
Practices**



**Identify Colonized  
and Infected  
Individuals**



**Communicate MDRO  
Status**



**Antibiotic &  
Antifungal  
Stewardship**

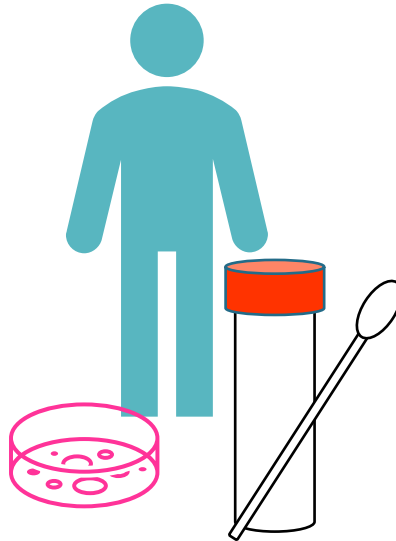
# Public Health

## What Can ~~Healthcare Facilities~~ Do?



**Infection Prevention  
Practices**

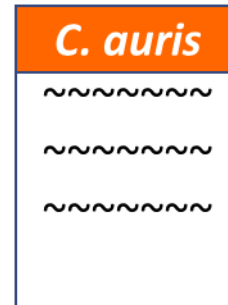
**Facilitate  
Screening  
& Isolate  
Submission**



**Identify Colonized  
and Infected  
Individuals**

**Assist w/Notifications**

**Promote Transfer Forms**



**Communicate MDRO  
Status**



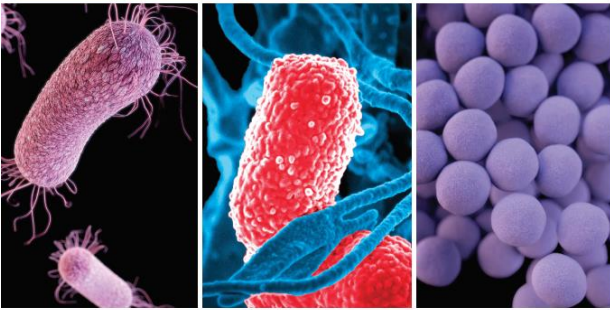
**CHARM Project**



**Antibiotic &  
Antifungal  
Stewardship**

# New & Updated CDC Guidance & Tools for 2022

Interim Guidance for a Public Health Response  
to Contain Novel or Targeted Multidrug-resistant  
Organisms (MDROs)



Updates  
Coming  
Soon

National Center for Emerging and Zoonotic Infectious Diseases  
Office of Infectious Diseases



Response Guidance  
“Containment”

Interim Guidance for Public  
Health Measures to  
Prevent the Spread of  
Novel or Targeted  
Multidrug-resistant  
Organisms

NEW  
Coming  
Soon


Proactive Guidance  
“Prevention”

Infection Control Response  
and Assessment (ICAR)  
Tools


Updates  
Coming  
Soon

ICAR Tools For All  
Healthcare Settings


**STOP** **ENHANCED BARRIER PRECAUTIONS** **STOP**  
**EVERYONE MUST:**

 Clean their hands, including before entering and when leaving the room.


**PROVIDERS AND STAFF MUST ALSO:**

 Wear gloves and a gown for the following High-Contact Resident Care Activities:

- Dressing
- Bathing/Showering
- Transferring
- Changing Linens
- Providing Hygiene
- Changing briefs or ass.
- Device care or use: central line, urinary catheter, tracheostomy
- Wound Care: any skin opening

 Do not wear the same gown and gloves for the care of more than one person.

**Updated July**

 U.S. Department of Health and Human Services  
Centers for Disease Control and Prevention

Enhanced Barrier  
Precautions Guidance  
Nursing Homes

# Thank You

Surveillance for Healthcare Associated and Resistant Pathogens (SHARP) Unit  
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