Antimicrobial Resistance Lab Network Updates 2021

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Wisconsin State Laboratory of Hygiene

Outline

- Introduction
- Submission Guidelines
- Summary of 2020 Data
  - Recent and noteworthy outbreaks
- Ongoing and Upcoming Surveillance Activities


VIRGINIA TECH™

N-(3-oxododecanoyl)-L-homoserine lactone interactions in the breast tumor microenvironment: Implications for breast cancer viability and proliferation in vitro

Brittany N Balhouse [1 2], Logan Patterson [3 4], Eva M Schmelz [5], Daniel J Slade [3], Scott S Verbridge [1 2]

SCHOOL of MEDICINE

SCHOOL of MEDICINE

Glucosylceramide production maintains colon integrity in response to Bacteroides fragilis toxin–induced colon epithelial cell signaling

Logan Patterson [1], Jawara Allen [2], Isabella Posey [3], Jeremy Joseph Porter Shaw [1], Pedro Costa-Pinheiro [1], Susan J Walker [4], Alexis Gademsey [4], Xinqun Wu [2], Shaoguang Wu [2], Nicholas C Zachos [2], Todd E Fox [4], Cynthia L Sears [2], Mark Kester [4]

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Dr. Melinda Poulter, PhD, D(ABMM)

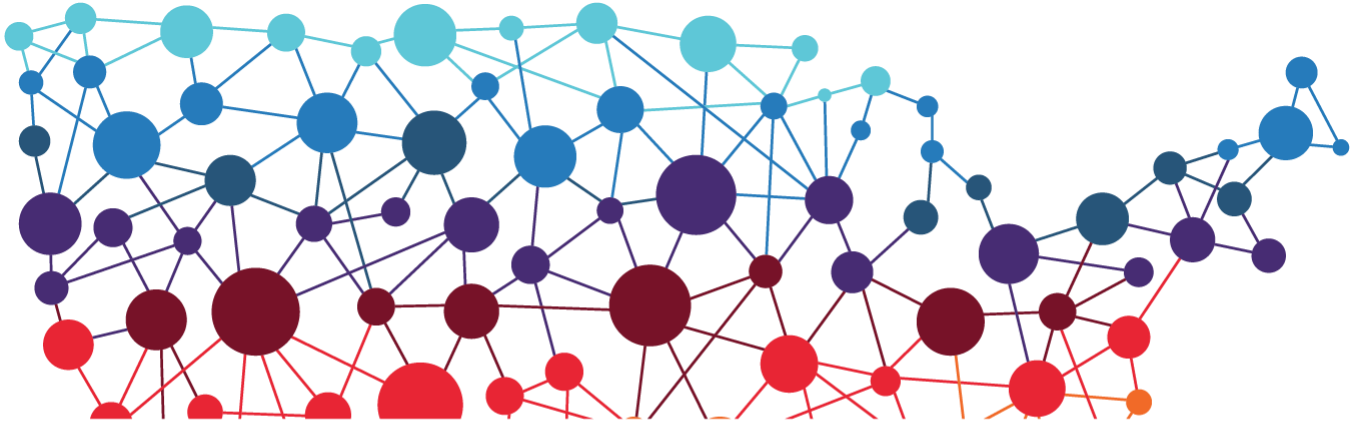
Director, Clinical Microbiology

Dr. Amy Mathers, MD

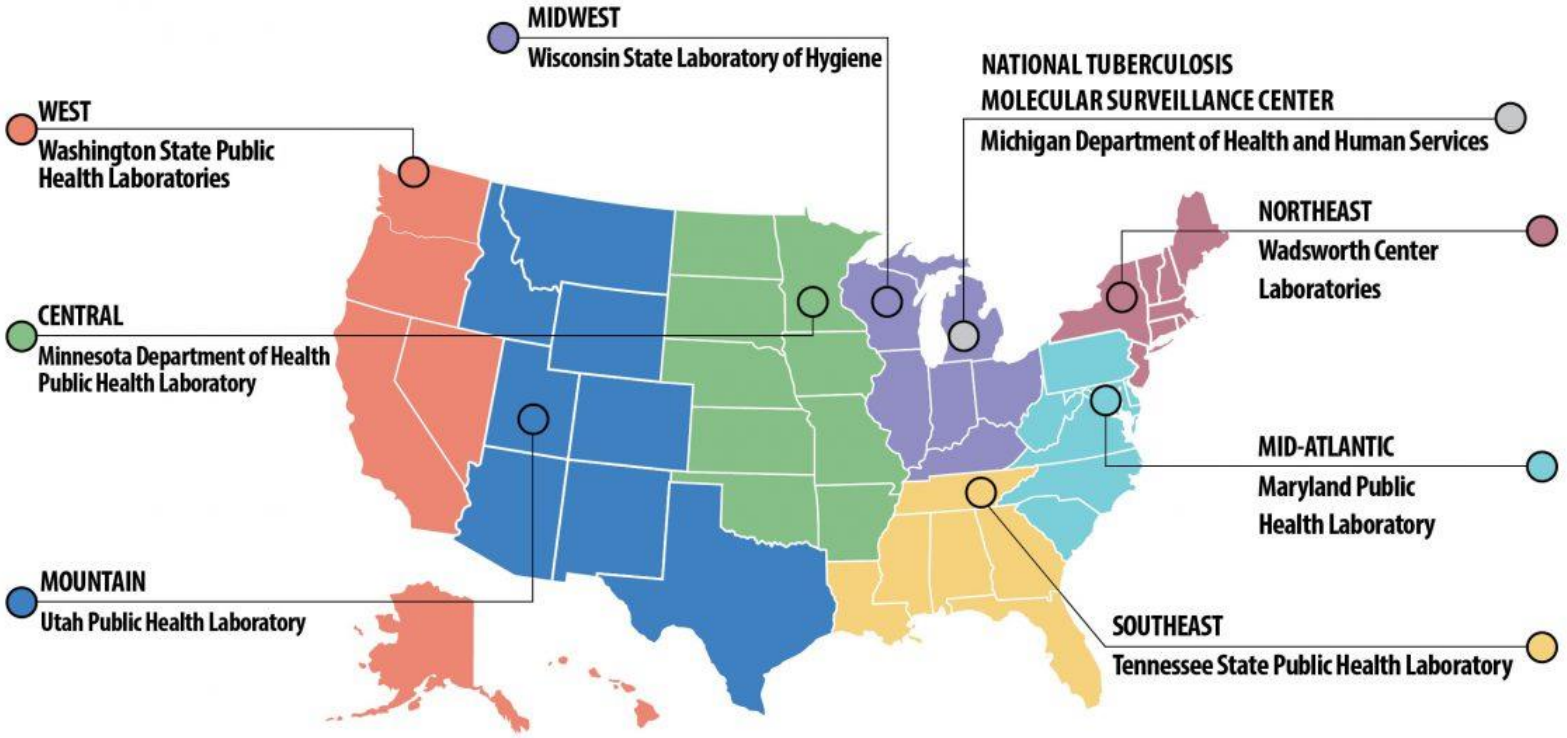
Associate Director, Clinical Microbiology

Medical Director Antimicrobial Stewardship

https://www.reuters.com/investigates/special-report/health-coronavirus-hospital-test/



ARLABnetwork



https://www.cdc.gov/drugresistance/laboratories.html

The AR Lab Network

- Core testing by all regional labs
  - Molecular testing to detect colonization of carbapenem-resistant *Enterobacteriaceae* (CRE)

https://www.cdc.gov/drugresistance/pdf/About-ARLN-Map-H.pdf

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  - Fungal susceptibility of *Candida* species to identify emerging resistance

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  - Fungal susceptibility of *Candida* species to identify emerging resistance
  - Identification and colonization screening to detect and help prevent spread of *Candida auris*

https://www.cdc.gov/drugresistance/pdf/About-ARLN-Map-H.pdf

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  - Perform expanded susceptibility testing to determine if new drugs or drug combinations will be effective to treat rare resistant pathogens

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  - Molecular testing to detect colonization of carbapenem-resistant *Enterobacteriaceae* (CRE)
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  - Fungal susceptibility of *Candida* species to identify emerging resistance
  - Identification and colonization screening to detect and help prevent spread of *Candida auris*
  - Perform expanded susceptibility testing to determine if new drugs or drug combinations will be effective to treat rare resistant pathogens
  - Isolates may be used for the CDC and FDA AR Isolate Bank and WGS projects

https://www.cdc.gov/drugresistance/pdf/About-ARLN-Map-H.pdf

The AR Lab Network

- Additional testing
  - Antimicrobial susceptibility and serotyping of multidrug-resistant *Streptococcus pneumoniae* (WI and MN)

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- Additional testing
  - Antimicrobial susceptibility and serotyping of multidrug-resistant *Streptococcus pneumoniae* (WI and MN)
  - Test CRE and carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) isolates for resistance mechanisms and antimicrobial susceptibility (AST)

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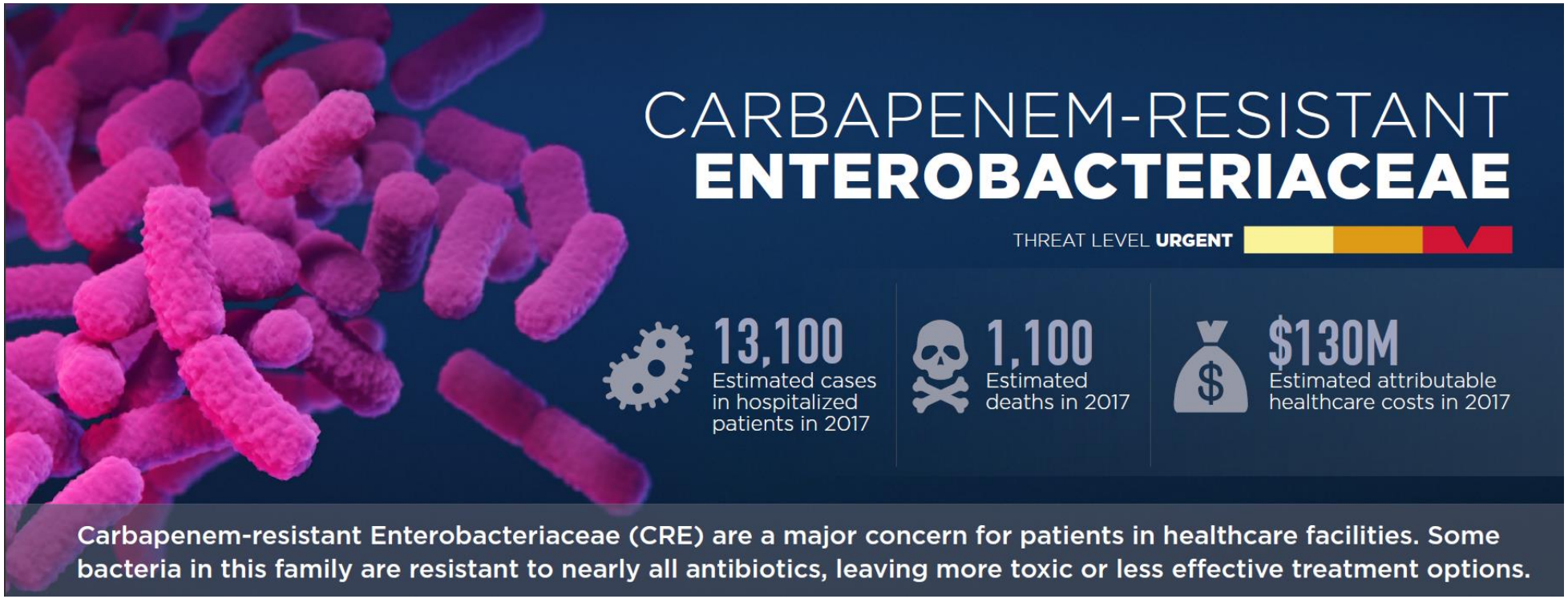
The AR Lab Network

- Additional testing
  - Antimicrobial susceptibility and serotyping of multidrug-resistant *Streptococcus pneumoniae* (WI and MN)
  - Test CRE and carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) isolates for resistance mechanisms and antimicrobial susceptibility (AST)
    - Modified carbapenem inactivation method (mCIM), PCR, AST, and whole genome sequencing (WGS)

https://www.cdc.gov/drugresistance/pdf/About-ARLN-Map-H.pdf

Carbapenem-resistant *Enterobacteriaceae* (CRE)



https://www.cdc.gov/drugresistance/pdf/threats-report/CRE-508.pdf

Carbapenem-resistant *Enterobacteriaceae* (CRE)

- Carbapenem-resistant *Enterobacteriaceae* (CRE)
  - CRE can carry mobile genetic elements that are easily shared between bacteria
    - Approximately 30% of CRE carry a mobile genetic element that make carbapenem antibiotics ineffective
  - Patients who require devices (e.g., catheters) and patients taking long courses of antibiotics are the most at risk

Organism	Isolates
Enterobacter spp.	176
Klebsiella spp.	165
Escherichia coli	77
Citrobacter freundii	24
Proteus mirabilis	16
Raoultella ornithinolytica	13
Serratia marcescens	11
Providencia rettgeri	8
Morganella morganii	7
Hafnia alvei	3
Pseudomonas aeruginosa	4
Misc.	4
Citrobacter koseri	1
Providencia stuartii	1
Total	**510**

https://www.cdc.gov/drugresistance/pdf/threats-report/CRE-508.pdf

AR surveillance and submission guidelines

- Carbapenem-resistant *Enterobacteriaceae* (CRE)
  - Resistant to any carbapenem

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  - Screen positive for a carbapenemase using a phenotypic testing method (mCIM, CarbaNP)

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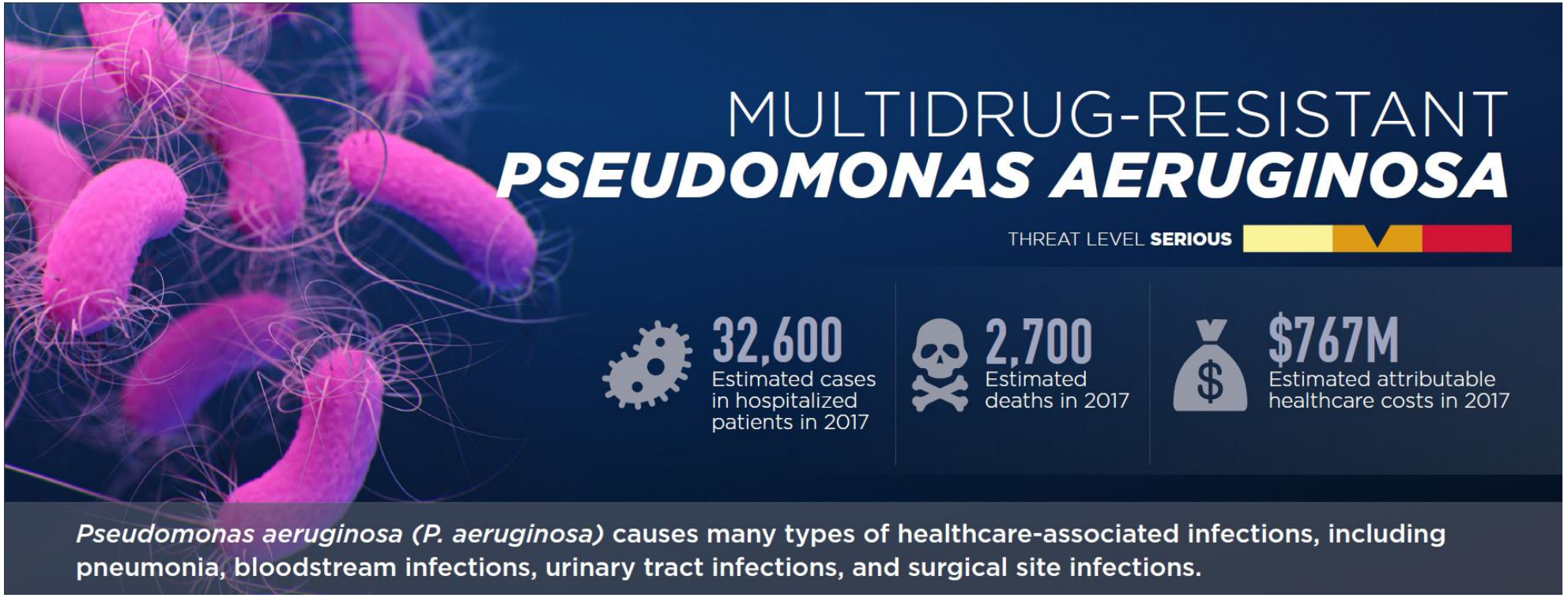
  - Screen positive for a carbapenemase using a phenotypic testing method (mCIM, CarbaNP)
  - Test positive for a carbapenemase gene using molecular methods (KPC, NDM, VIM, IMP, OXA-48)

AR surveillance and submission guidelines

- Carbapenem-resistant *Enterobacteriaceae* (CRE)
  - Resistant to any carbapenem
  - Screen positive for a carbapenemase using a phenotypic testing method (mCIM, CarbaNP)
  - Test positive for a carbapenemase gene using molecular methods (KPC, NDM, VIM, IMP, OXA-48)
- Exceptions
  - *Proteus spp.*, *Providencia spp.*, and *Morganella morganii* that are resistant to Imipenem ONLY (susceptible to Meropenem or Doripenem)

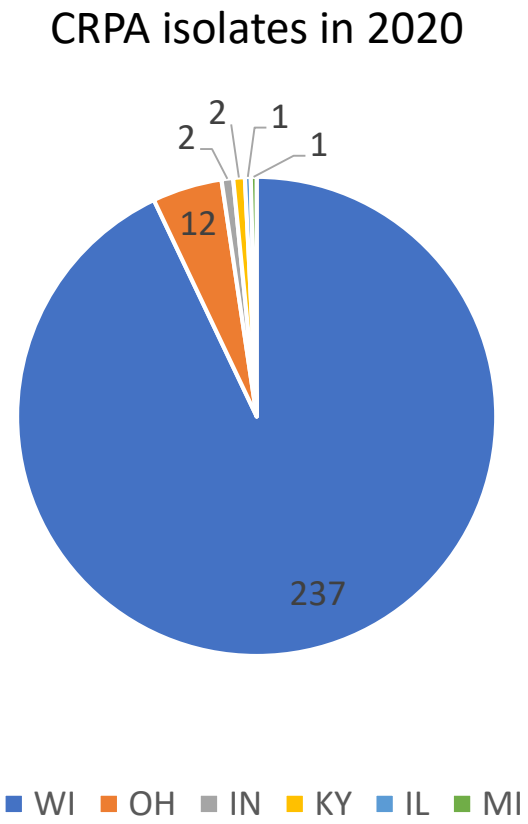
Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)



https://www.cdc.gov/drugresistance/pdf/threats-report/pseudomonas-aeruginosa-508.pdf

Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)

- Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)
  - *P. aeruginosa* infections usually occur in people in the hospital or with weakened immune systems
  - 2-3% of CRPA carry a mobile genetic element that makes a carbapenemase enzyme



https://www.cdc.gov/drugresistance/pdf/threats-report/pseudomonas-aeruginosa-508.pdf

AR surveillance and submission guidelines

- Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)
  - Resistant to a carbapenem (Doripenem, Imipenem, or Meropenem) AND non-susceptible to Cefepime and/or Ceftazidime

AR surveillance and submission guidelines

- Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)
  - Resistant to a carbapenem (Doripenem, Imipenem, or Meropenem) AND non-susceptible to Cefepime and/or Ceftazidime
- Exceptions
  - Isolates that are susceptible to Cefepime and/or Ceftazidime but are suspected of producing a carbapenemase may be accepted on a case-by-case basis

AR surveillance and submission guidelines

- Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)
  - Resistant to a carbapenem (Doripenem, Imipenem, or Meropenem) AND non-susceptible to Cefepime and/or Ceftazidime
- Exceptions
  - Isolates that are susceptible to Cefepime and/or Ceftazidime but are suspected of producing a carbapenemase may be accepted on a case-by-case basis
  - Do not submit resistant *P. aeruginosa* isolates from cystic fibrosis patients

Carbapenem-resistant *Acinetobacter baumannii* (CRAB)

https://www.cdc.gov/drugresistance/pdf/threats-report/acinetobacter-508.pdf

Carbapenem-resistant *Acinetobacter baumannii* (CRAB)

- Carbapenem-resistant *Acinetobacter baumannii* (CRAB)
  - Cause pneumonia, wound, bloodstream, and urinary tract infections
    - Infections tend to occur in intensive care units (ICUs)
  - Carry mobile genetic elements that are easily shared between bacteria, further enhancing the spread of carbapenemase producing organisms
  - Some *Acinetobacter* are resistant to nearly all antibiotics
    - Very few new drugs are in development

https://www.cdc.gov/drugresistance/pdf/threats-report/acinetobacter-508.pdf

Carbapenem-resistant *Acinetobacter baumannii* (CRAB)

- Carbapenem-resistant *Acinetobacter baumannii* (CRAB)
  - Often carry plasmid-encoded β-lactamases with carbapenemase activity (OXA-23, OXA-24/40, and OXA-58)
    - Denoted as OXA because of their ability to confer resistance to oxacillin
  - Presence of just one carbapenemase-hydrolyzing OXA enzyme may be enough for *A. baumannii* to become resistant to all carbapenems

https://pubmed.ncbi.nlm.nih.gov/24696435/

AR surveillance and submission guidelines

- Carbapenem-resistant *Acinetobacter baumannii* (CRAB)
  - Isolates resistant to a carbapenem from Southeast Wisconsin
    - Jefferson, Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha counties

AR surveillance and submission guidelines

- Carbapenem-resistant *Acinetobacter baumannii* (CRAB)
  - Isolates resistant to a carbapenem from Southeast Wisconsin
    - Jefferson, Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha counties
  - Pan-resistant isolates from facilities outside of Southeast Wisconsin, or isolates suspected of being part of an outbreak, please contact WSLH for guidance on submission (wiarln@slh.wisc.edu)

Candida auris

https://www.cdc.gov/drugresistance/pdf/threats-report/candida-auris-508.pdf

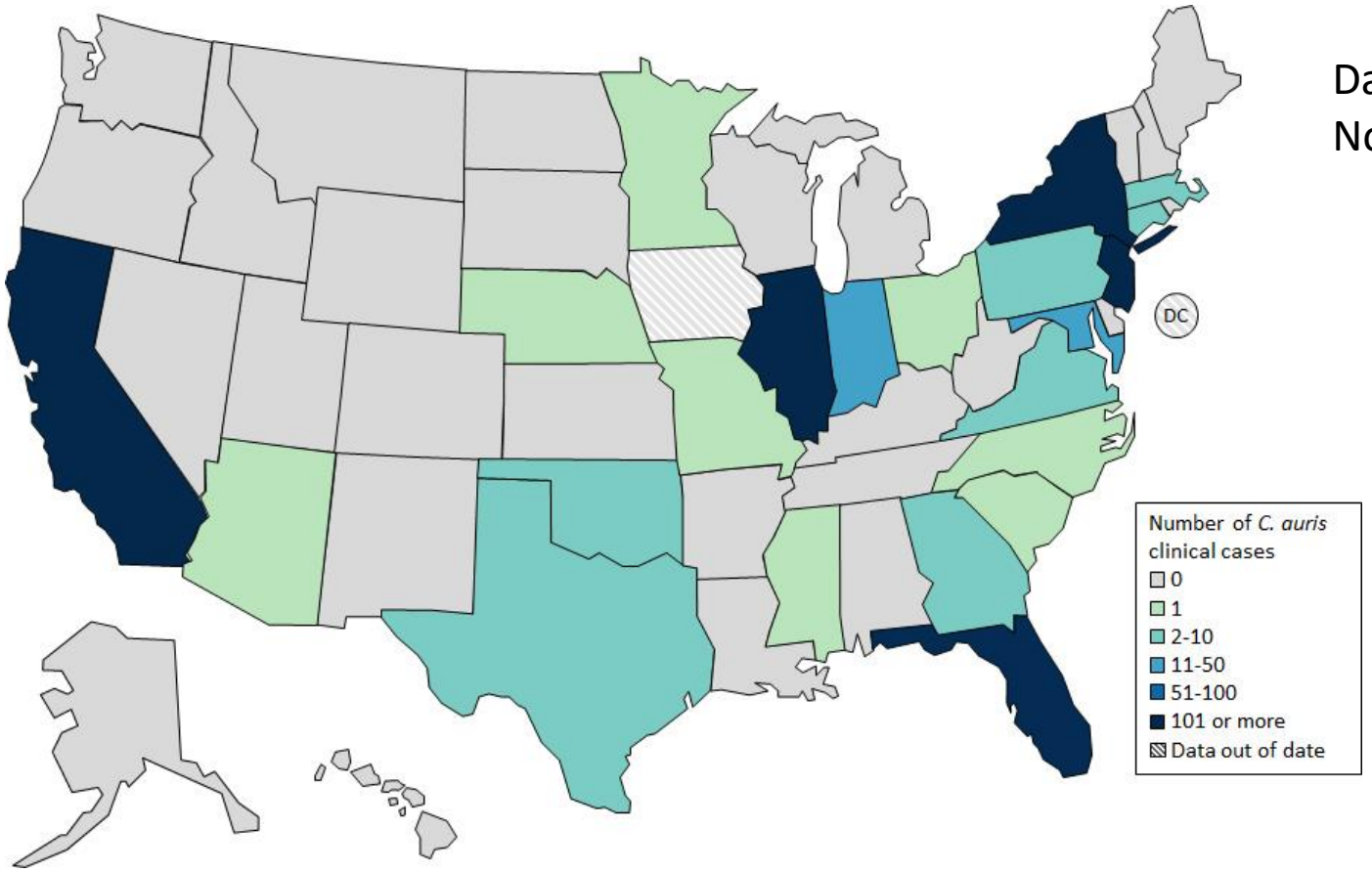
Candida auris

- *Candida auris*
  - Can cause outbreaks in healthcare facilities
  - Often multidrug-resistant, with some strains resistant to all three available classes of antifungals
  - Can be carried on patient's skin without causing infection, allowing further spread
  - Some common healthcare disinfectants are less effective at eliminating it

Organism	Isolates
C. auris	260
C. parapsilosis	40
C. glabrata	9
C. lusitaniae	8
Candida species, not *C. auris*	7
S. cerevisiae	6
C. albicans	4
C. dubliniensis	3
C. fermentati	1
C. haemulonii	1
C. orthopsilosis	1
C. kefyr	1
C. neoformans	1
C. tropicalis	1
Total	**343**

https://www.cdc.gov/drugresistance/pdf/threats-report/candida-auris-508.pdf

C. auris confirmed cases in the US



Data last updated
November 30, 2020

https://www.cdc.gov/fungal/candida-auris/tracking-c-auris.html

AR surveillance and submission guidelines

- *Candida* species
  - *Candida auris,* or suspected *C. auris*

AR surveillance and submission guidelines

- *Candida* species
  - *Candida auris,* or suspected *C. auris*
  - Invasive isolates of *Candida glabrata*

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- *Candida* species
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  - Invasive isolates of *Candida glabrata*
  - *Candida spp.* that are unable to be identified

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- *Candida* species
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  - Invasive isolates of *Candida glabrata*
  - *Candida spp.* that are unable to be identified
  - Unusual *Candida spp.*
    - Species other than *C. albicans, C. dublinensis, C. krusei, C. lusitaniae, C. parapsilosis,* or *C. tropicalis*

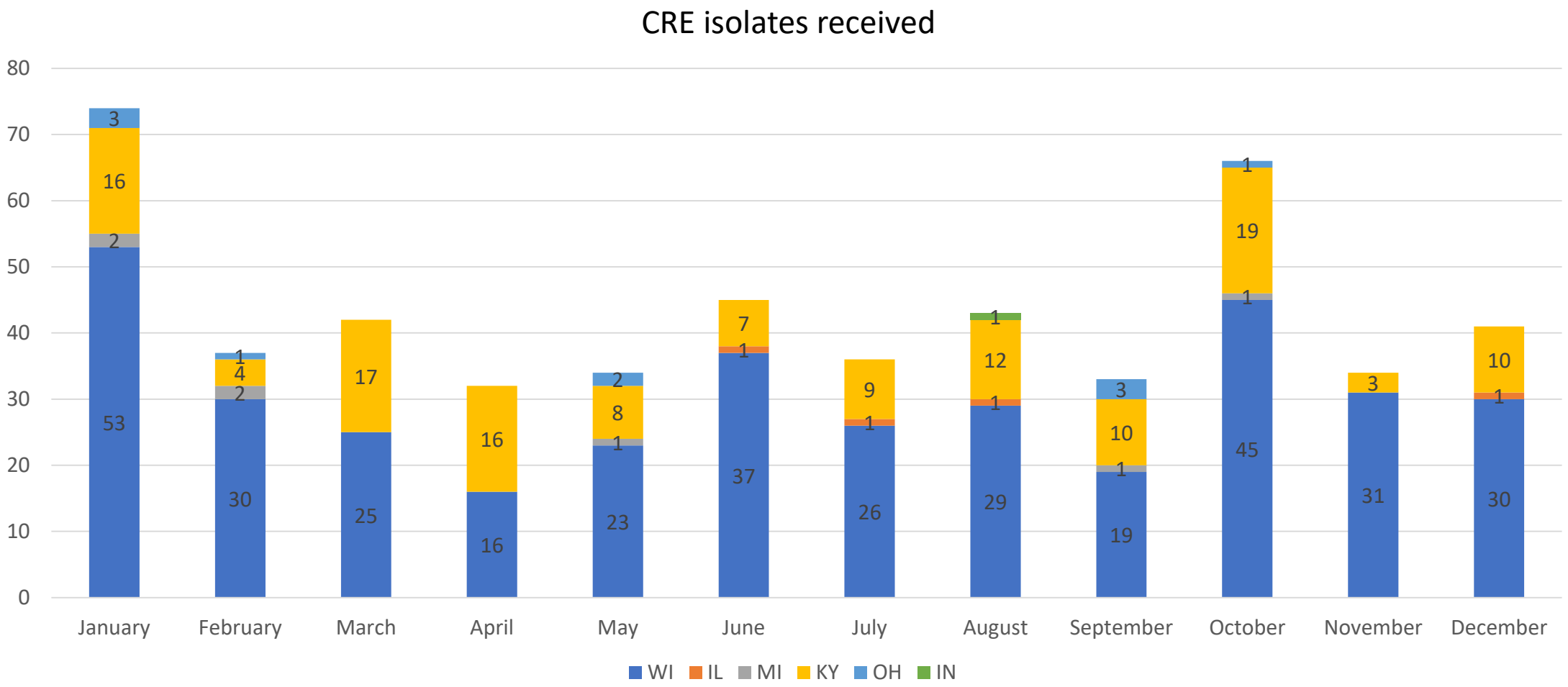
AR surveillance and submission guidelines

- *Candida* species
  - *Candida auris,* or suspected *C. auris*
  - Invasive isolates of *Candida glabrata*
  - *Candida spp.* that are unable to be identified
  - Unusual *Candida spp.*
    - Species other than *C. albicans, C. dublinensis, C. krusei, C. lusitaniae, C. parapsilosis,* or *C. tropicalis*
  - *Candida spp.* resistant to two or more antifungal classes

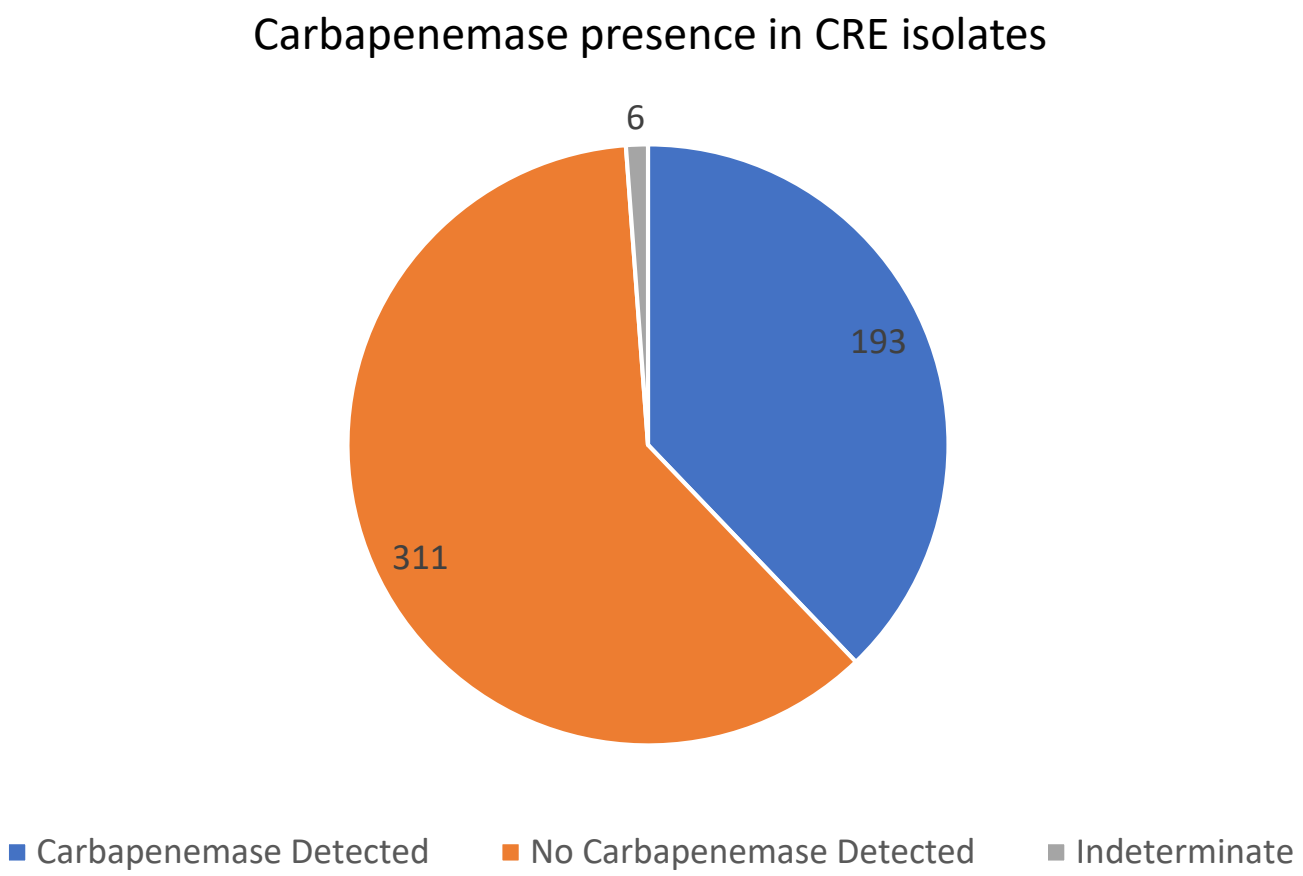
Testing performed on submitted isolates

- CRE/CRPA
  - MALDI, modified carbapenem inactivation method (mCIM), AST, carbapenemase PCR (if mCIM+), and WGS

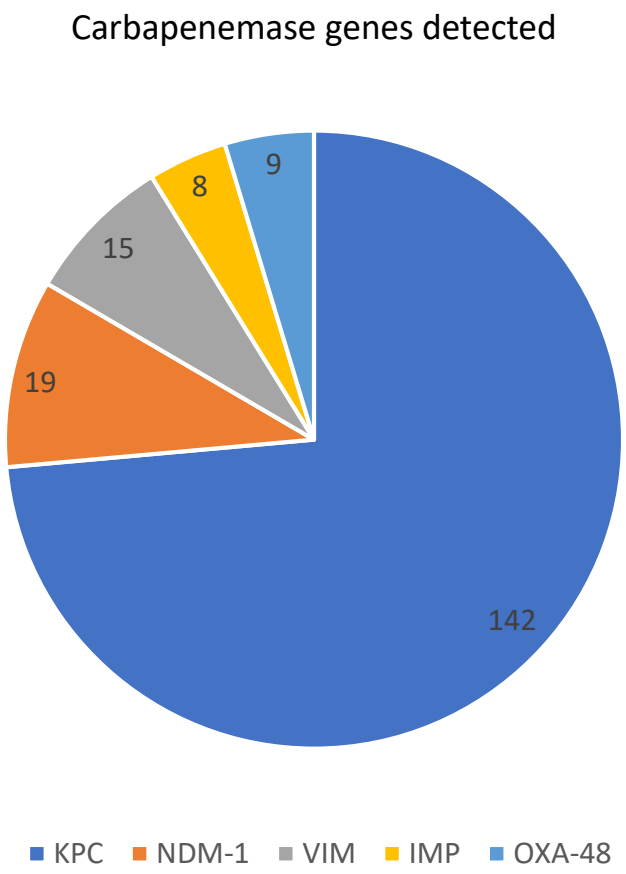
2020 CRE data



2020 CRE data

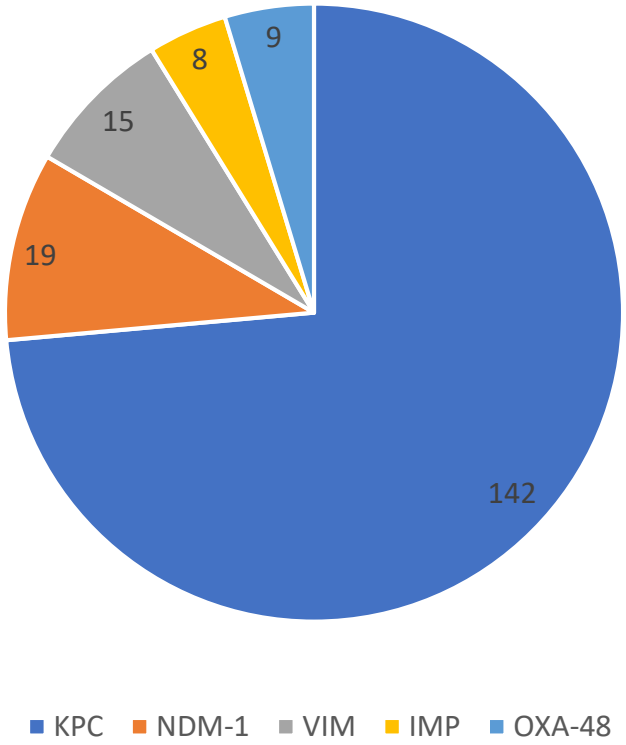


2020 CRE data

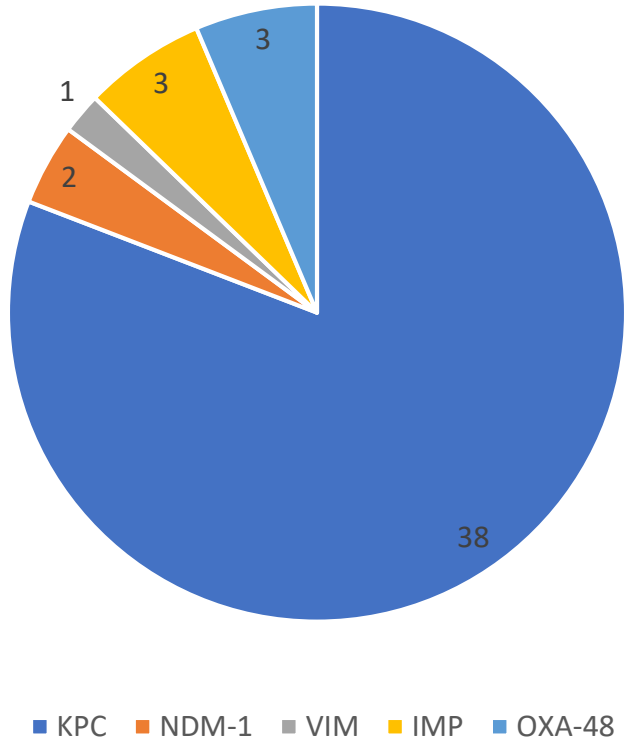


2020 CRE data

Carbapenemase genes detected



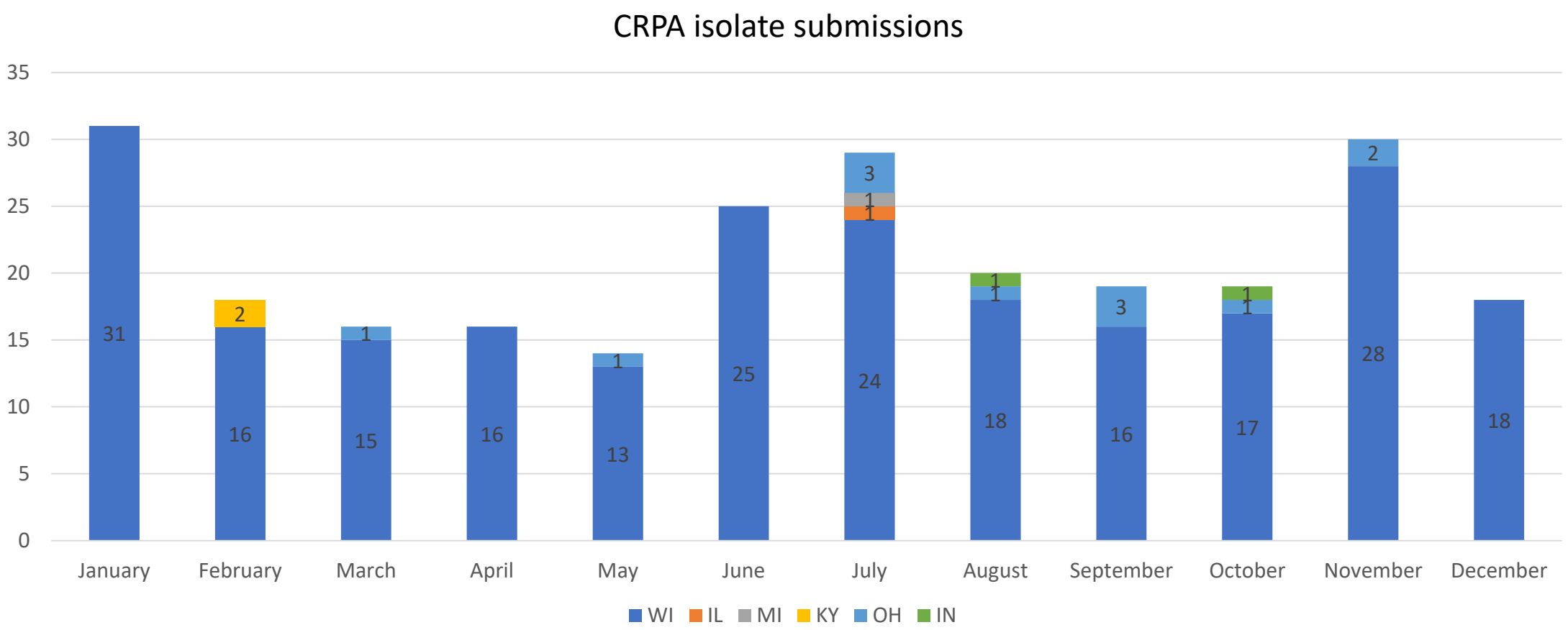
Carbapenemase genes detected-Wisconsin



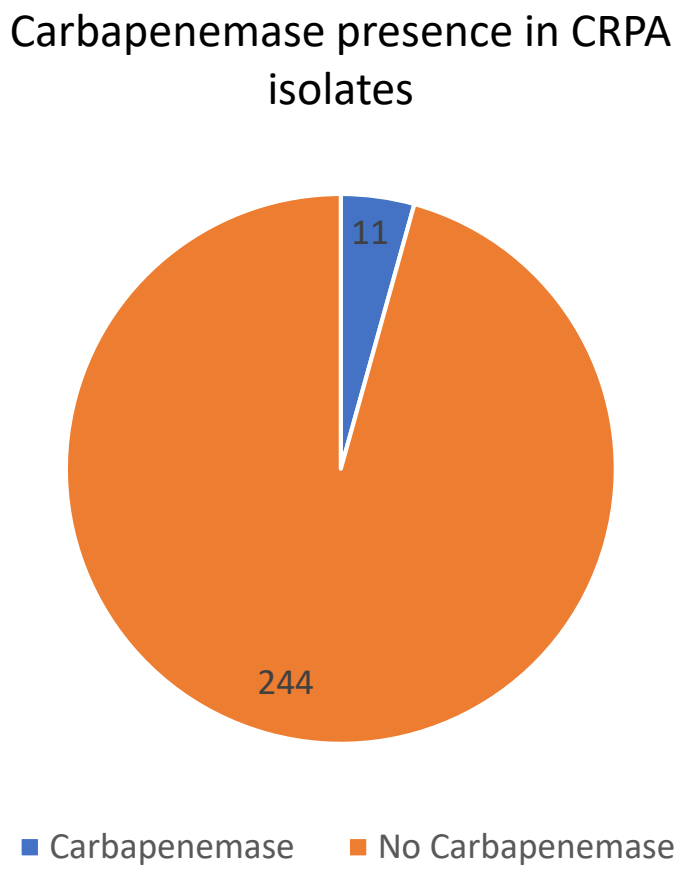
2020 CRE data

Pan non-susceptible isolates			
Month	**State**	**Organism**	**Mechanism(s)**
January	OH	Klebsiella pneumoniae	KPC
January	MI	Klebsiella pneumoniae	NDM-1
January	KY	Klebsiella pneumoniae	OXA-48
February	OH	Klebsiella pneumoniae	KPC
March	KY	Klebsiella pneumoniae	OXA-48
May	OH	Klebsiella pneumoniae	KPC
May	KY	Escherichia coli	NDM-1
July	KY	Escherichia coli	NDM-1 and OXA-48
July	IL	Klebsiella pneumoniae	KPC and NDM-1
October	MI	Klebsiella pneumoniae	NDM-1 and OXA-48
December	WI	Klebsiella pneumoniae	

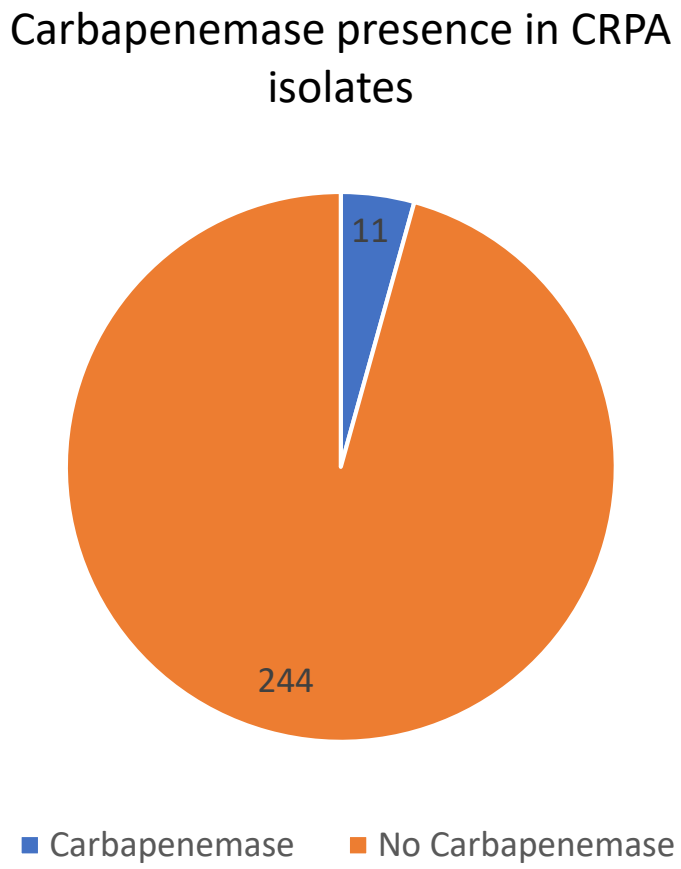
2020 CRPA data



2020 CRPA data

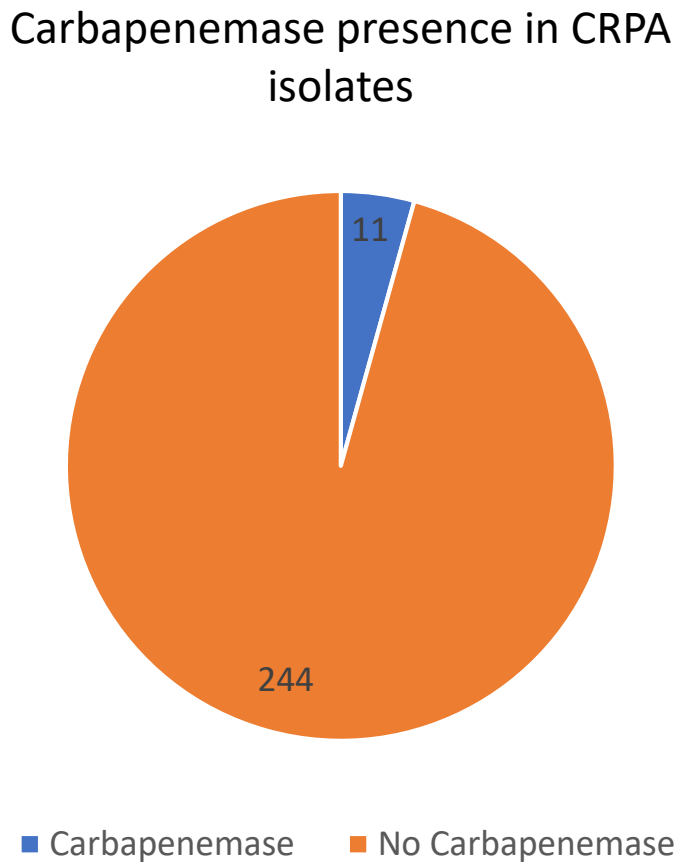


2020 CRPA data



Date	State	Mechanism
March	OH	VIM
May	OH	Potential novel
May	WI	Potential novel
July	OH	Potential novel
July	OH	Potential novel
July	OH	Potential novel
July	MI	Potential novel
October	OH	Potential novel
November	OH	Potential novel
December	WI	NDM-1
December	WI	NDM-1

2020 CRPA data



Date	State	Mechanism	Pan-NS?
March	OH	VIM	No
May	OH	Potential novel	No
May	WI	Potential novel	No
July	OH	Potential novel	No
July	OH	Potential novel	No
July	OH	Potential novel	No
July	MI	Potential novel	No
October	OH	Potential novel	No
November	OH	Potential novel	No
December	WI	NDM-1	Yes
December	WI	NDM-1	No

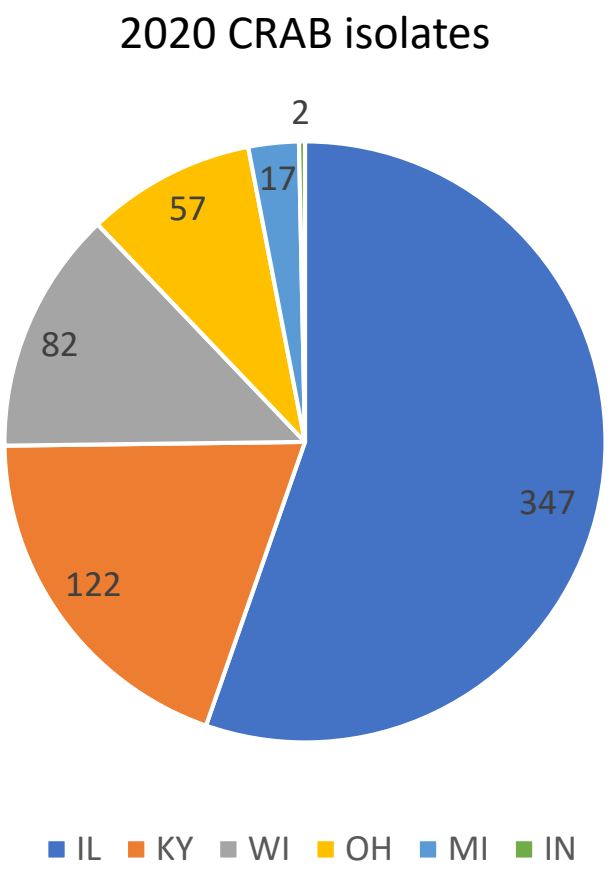
2020 CRPA data

Date	State	Mechanism	Pan-NS?
May	WI	None detected	Yes
June	WI	None detected	Yes
July	WI	None detected	Yes
August	WI	None detected	Yes
August	OH	None detected	Yes
August	WI	None detected	Yes
December	WI	NDM-1	Yes

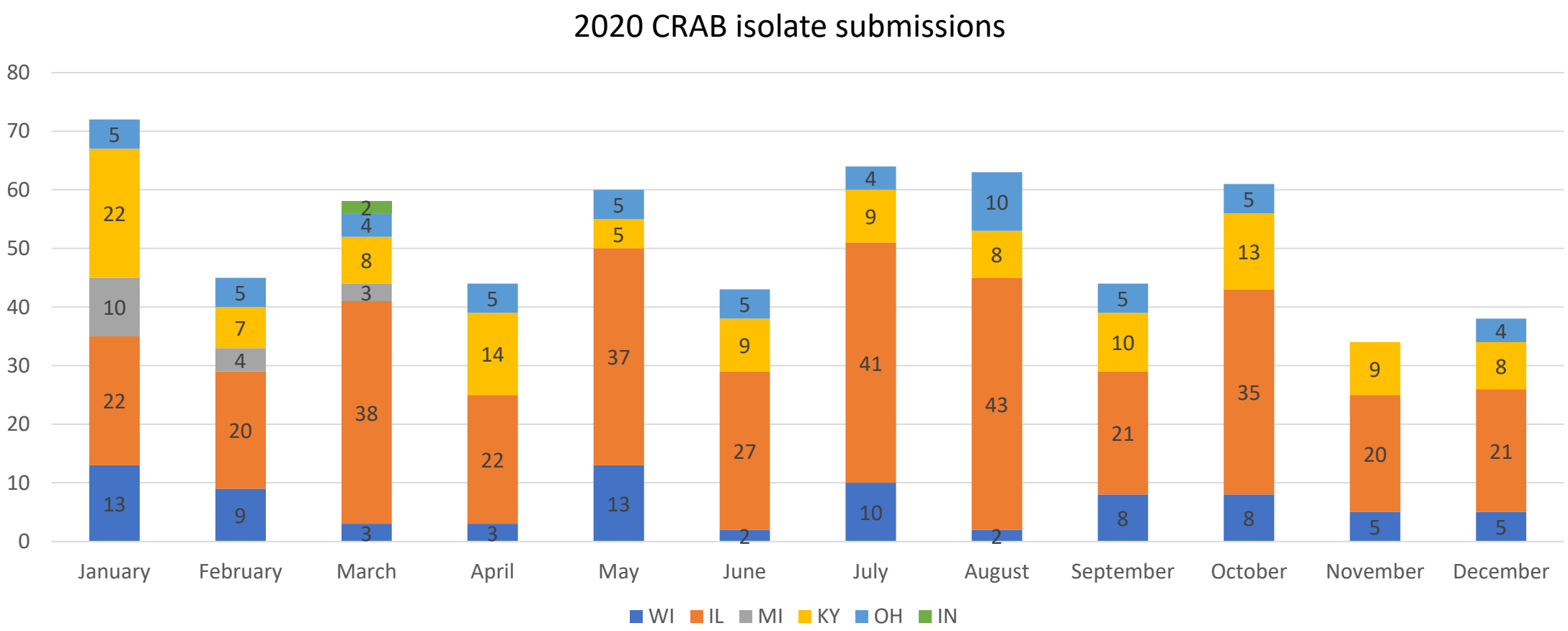
Testing performed on submitted isolates

- CRE/CRPA
  - MALDI, modified carbapenem inactivation method (mCIM), AST, carbapenemase PCR (if mCIM+), and WGS
- CRAB
  - MALDI, AST, carbapenemase PCR, and WGS

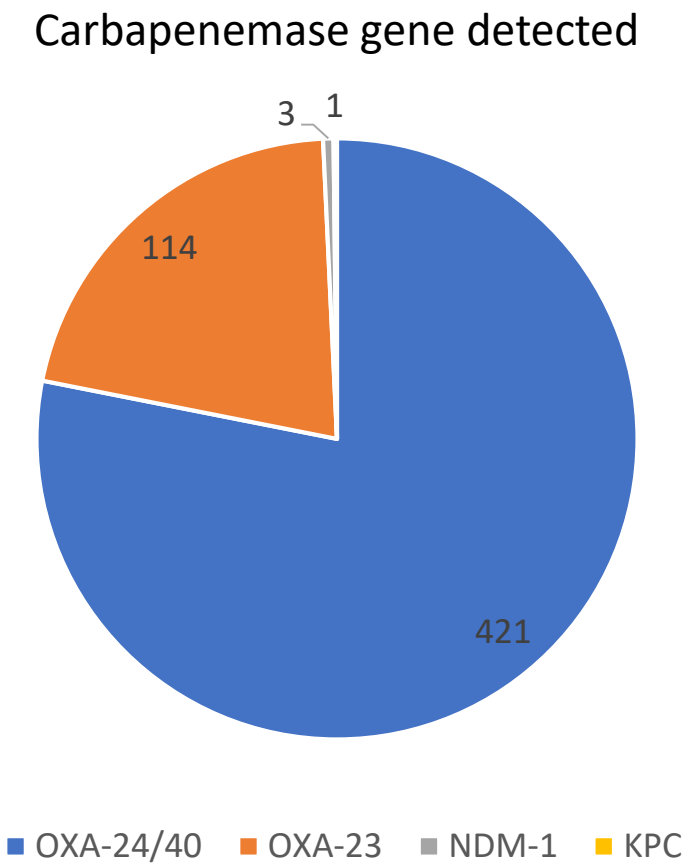
2020 CRAB data



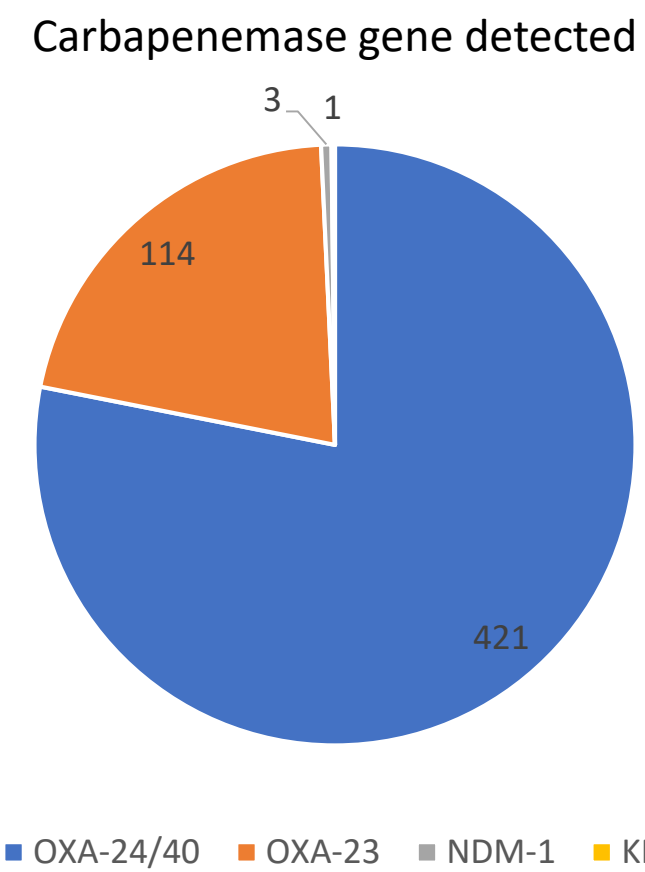
2020 CRAB data

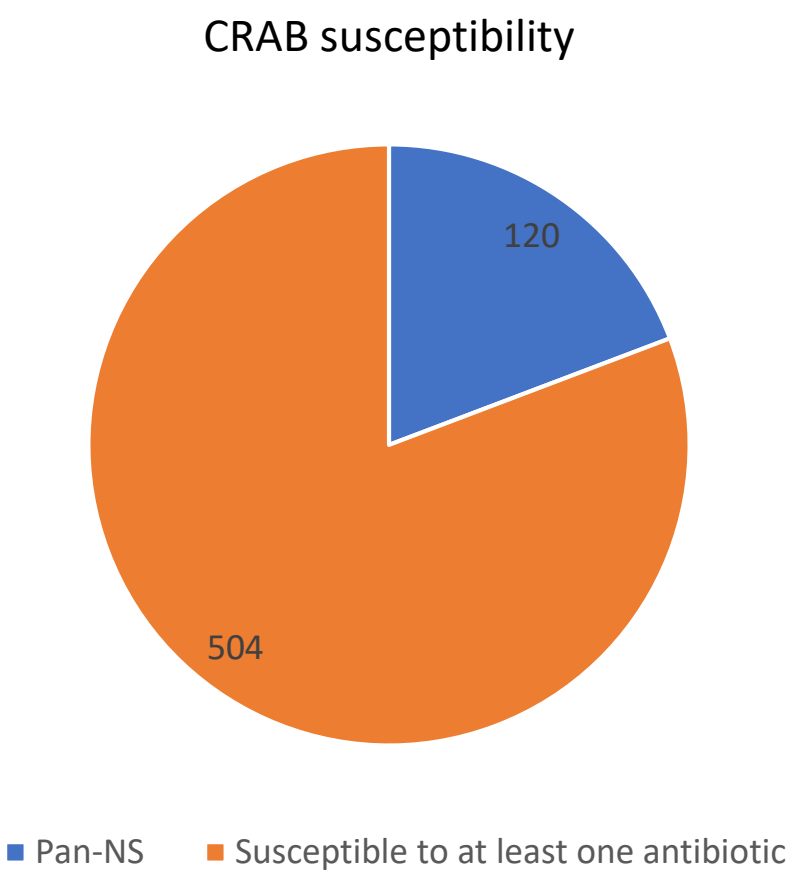


2020 CRAB data



2020 CRAB data





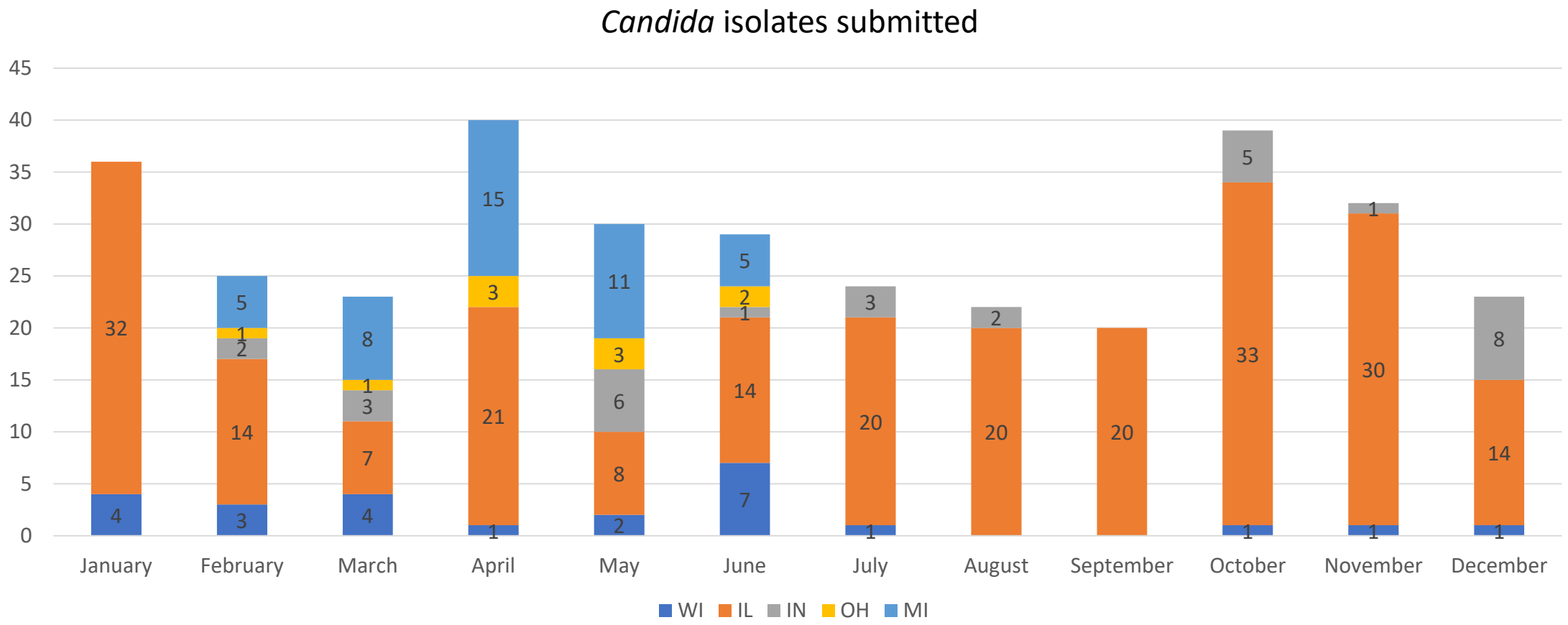
2020 CRAB data-Wisconsin

Month	Isolates	Pan-NS?	OXA-24/40+
January	13	0	8
February	9	0	8
March	3	0	3
April	3	0	3
May	13	6	12
June	2	2	2
July	10	2	10
August	2	0	2
September	8	1	6
October	8	2	5
November	5	1	5
December	5	1	5
Total	**81**	**15**	**69**

Testing performed on submitted isolates

- CRE/CRPA
  - MALDI, modified carbapenem inactivation method (mCIM), AST, carbapenemase PCR (if mCIM+), and WGS
- CRAB
  - MALDI, AST, carbapenemase PCR, and WGS
- *Candida spp.*
  - MALDI and AST

2020 *Candida* data



The impact(s) of the COVID-19 pandemic

COVID-19 Units Seeing Increasing Rates of Multi-Drug Resistant Organism Outbreaks

Kansas Department of Health and Environment

December 21, 2020

RE: Possibility of increasing multidrug-resistant organisms (MDROs) amid the COVID-19 pandemic

https://www.communitycareks.org/wp-content/uploads/2020/12/12-21-20COVID-19andIncreaseMDRORisks.pdf

COVID-19 and the spread of CRE

J Clin Med. 2020 Aug 25;9(9):2744. doi: 10.3390/jcm9092744.

Antimicrobial Stewardship Program, COVID-19, and Infection Control: Spread of Carbapenem-Resistant Klebsiella Pneumoniae Colonization in ICU COVID-19 Patients. What Did Not Work?

Beatrice Tiri [1], Emanuela Sensi [2], Viola Marsiliani [2], Mizar Cantarini [2], Giulia Priante [3], Carlo Vernelli [3], Lucia Assunta Martella [3], Monya Costantini [4], Alessandro Mariottini [5], Paolo Andreani [5], Paolo Bruzzone [6], Fabio Suadoni [7], Marsilio Francucci [8], Roberto Cirocchi [9], Stefano Cappanera [1]

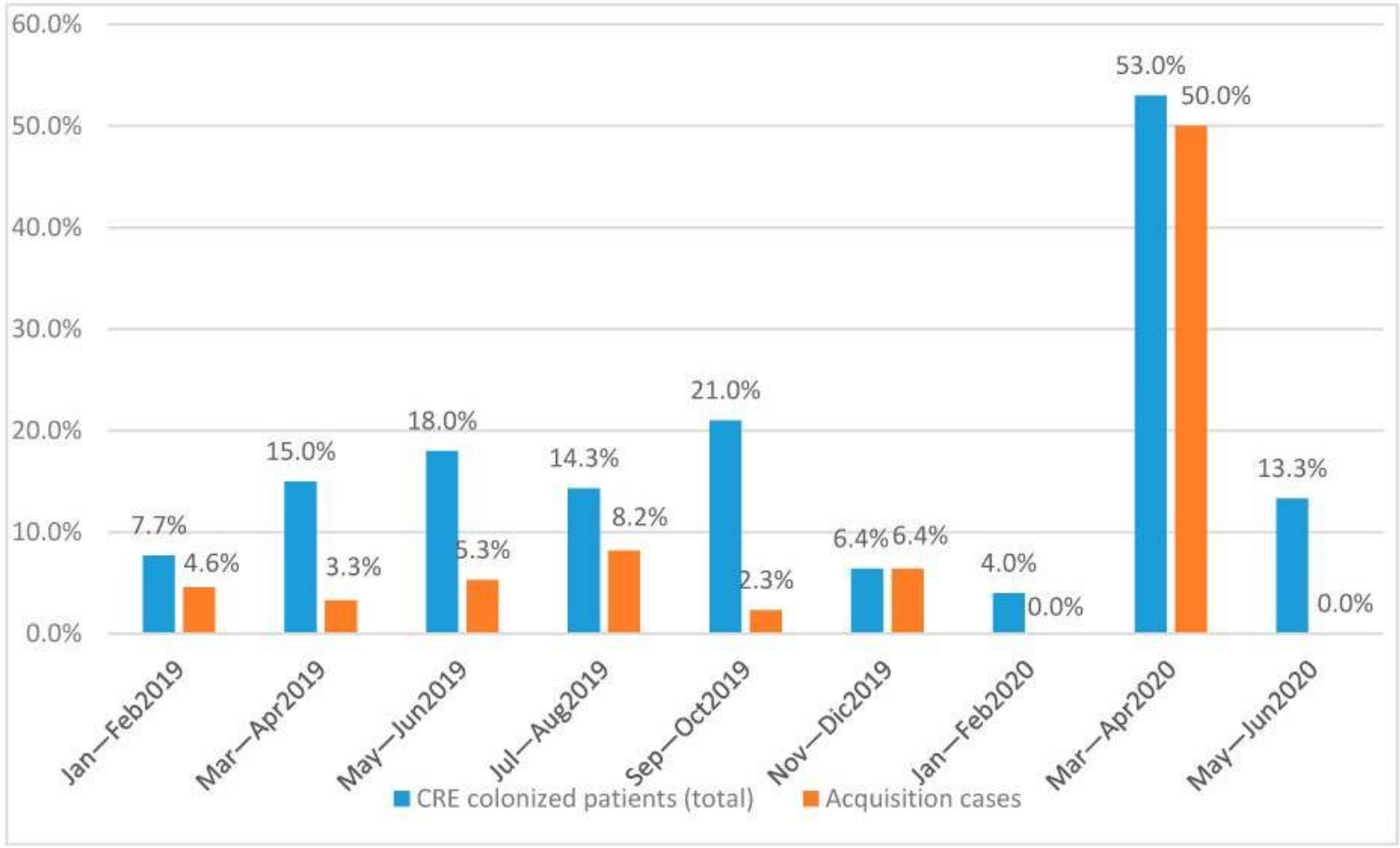
Affiliations + expand

PMID: 32854334 PMCID: PMC7563368 DOI: 10.3390/jcm9092744

Free PMC article

https://pubmed.ncbi.nlm.nih.gov/32854334/

COVID-19 and the spread of CRE



Tiri *et al.*, 2020

https://pubmed.ncbi.nlm.nih.gov/32854334/

COVID-19 and the spread of CRE

J Antimicrob Chemother. 2021 Jan 19;76(2):380-384. doi: 10.1093/jac/dkaa466.

Carbapenemase-producing Enterobacterales causing secondary infections during the COVID-19 crisis at a New York City hospital

Angela Gomez-Simmonds [1], Medini K Annavajhala [1], Thomas H McConville [1], Donald E Dietz [1], Sherif M Shoucri [1], Justin C Laracy [1], Felix D Rozenberg [1], Brian Nelson [1], William G Greendyke [1], E Yoko Furuya [1], Susan Whittier [2], Anne-Catrin Uhlemann [1]

Affiliations + expand

PMID: 33202023 PMCID: PMC7717307 DOI: 10.1093/jac/dkaa466

Free PMC article

https://pubmed.ncbi.nlm.nih.gov/33202023/

Importance of antimicrobial stewardship

Meta-Analysis > Clin Microbiol Infect. 2020 Dec;26(12):1622-1629.
doi: 10.1016/j.cmi.2020.07.016. Epub 2020 Jul 22.

Bacterial co-infection and secondary infection in patients with COVID-19: a living rapid review and meta-analysis

Bradley J Langford [1], Miranda So [2], Sumit Raybardhan [3], Valerie Leung [4], Duncan Westwood [5], Derek R MacFadden [6], Jean-Paul R Soucy [7], Nick Daneman [8]

Affiliations + expand

PMID: 32711058 PMCID: PMC7832079 DOI: 10.1016/j.cmi.2020.07.016

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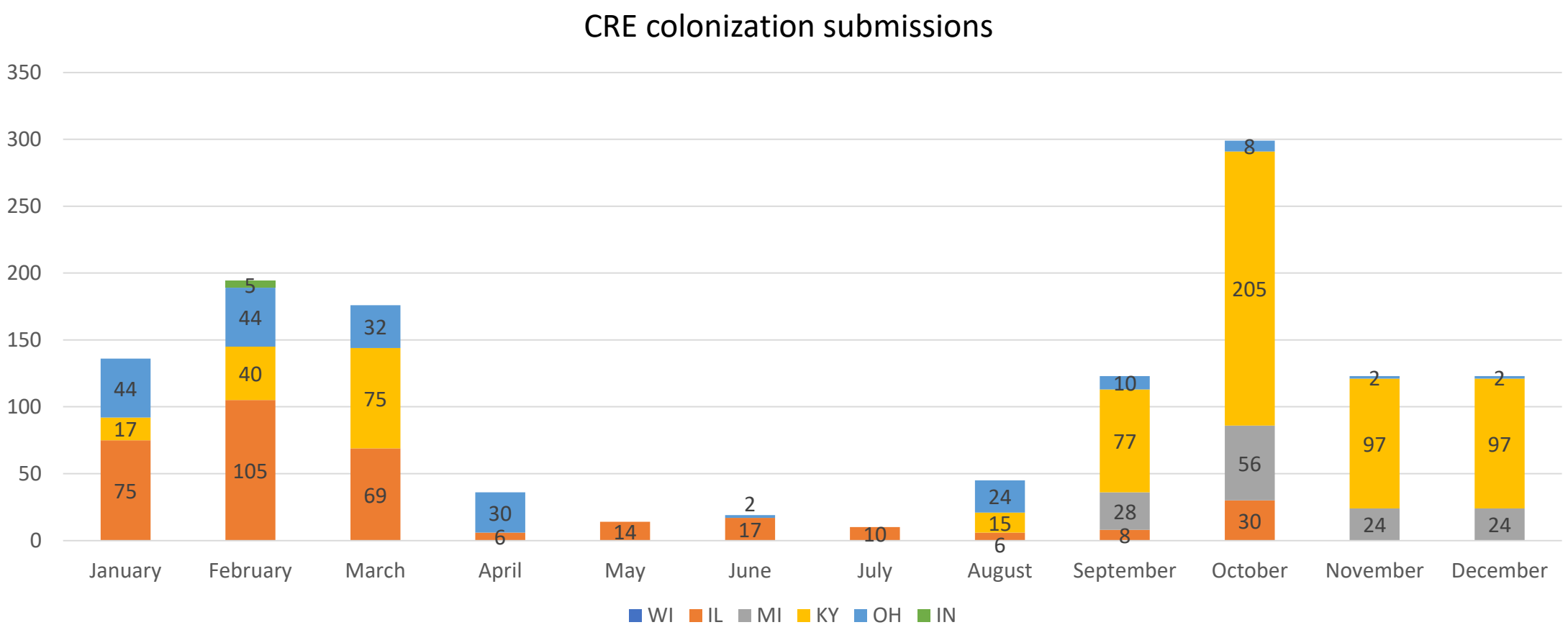
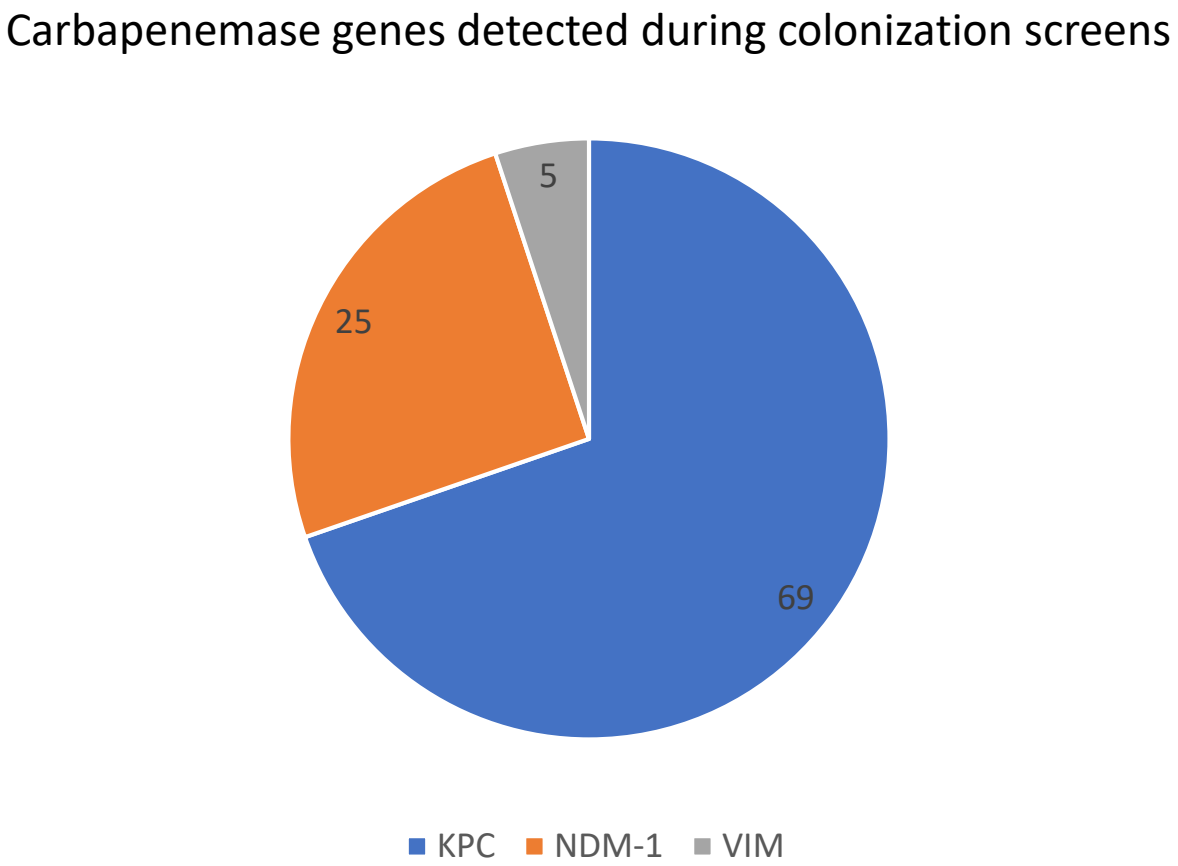
https://pubmed.ncbi.nlm.nih.gov/32711058/

2020 CRE colonization data



2020 CRE colonization data



COVID-19 and the impact on CRAB

Infection Prevention in Practice. 2021 Mar; 3(1): 100113. PMCID: PMC7794049
Published online 2021 Jan 9. doi: 10.1016/j.infpip.2021.100113

An outbreak of carbapenem-resistant *Acinetobacter baumannii* in a COVID-19 dedicated hospital

Tamar Gottesman,[a,b] Rina Fedorowsky,[a] Rebecca Yerushalmi,[c] Jonathan Lellouche,[d] and Amir Nutman[b,d,*]

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7794049/

COVID-19 and the impact on CRAB

MMWR Morb Mortal Wkly Rep. 2020 Dec 4;69(48):1827-1831. doi: 10.15585/mmwr.mm6948e1.

Increase in Hospital-Acquired Carbapenem-Resistant Acinetobacter baumannii Infection and Colonization in an Acute Care Hospital During a Surge in COVID-19 Admissions - New Jersey, February-July 2020

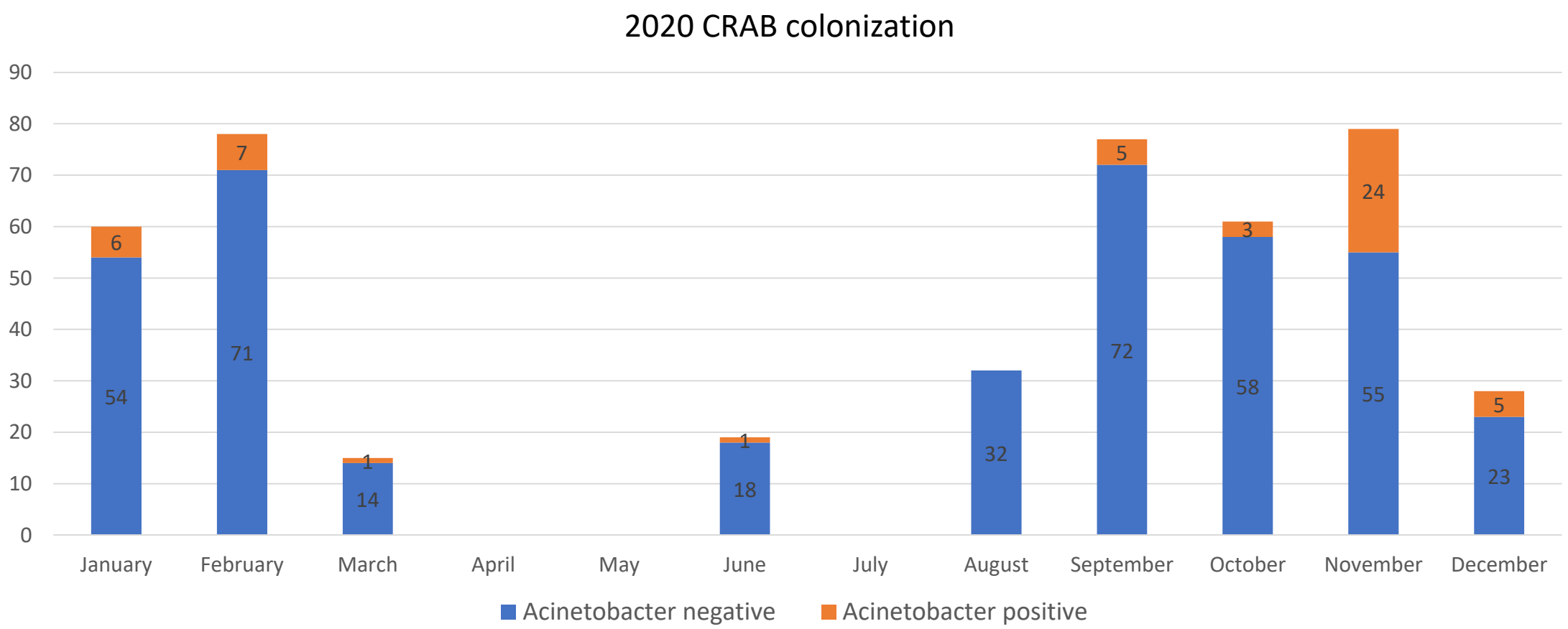
Stephen Perez, Gabriel K Innes, Maroya Spalding Walters, Jason Mehr, Jessica Arias, Rebecca Greeley, Debra Chew

PMID: 33270611 PMCID: PMC7714028 DOI: 10.15585/mmwr.mm6948e1

Free PMC article

https://pubmed.ncbi.nlm.nih.gov/33270611/

2020 CRAB colonization data



The rise of *C. auris* during the COVID-19 pandemic

J Glob Antimicrob Resist. 2020 Sep;22:175-176. doi: 10.1016/j.jgar.2020.06.003. Epub 2020 Jun 12.

The lurking scourge of multidrug resistant Candida auris in times of COVID-19 pandemic

Anuradha Chowdhary [1], Amit Sharma [2]

Affiliations + expand

PMID: 32535077 PMCID: PMC7289732 DOI: 10.1016/j.jgar.2020.06.003

Free PMC article

https://pubmed.ncbi.nlm.nih.gov/32535077/

The rise of *C. auris* during the COVID-19 pandemic

› Emerg Infect Dis. 2020 Nov;26(11):2694-2696. doi: 10.3201/eid2611.203504. Epub 2020 Aug 27.

Multidrug-Resistant Candida auris Infections in Critically Ill Coronavirus Disease Patients, India, April–July 2020

Anuradha Chowdhary, Bansidhar Tarai, Ashutosh Singh, Amit Sharma

PMID: 32852265 PMCID: PMC7588547 DOI: 10.3201/eid2611.203504

Free PMC article

https://pubmed.ncbi.nlm.nih.gov/32852265/

The rise of *C. auris* during the COVID-19 pandemic

› Clin Microbiol Infect. 2021 Jan 8;S1198-743X(20)30790-4. doi: 10.1016/j.cmi.2020.12.030.
Online ahead of print.

Outbreak of Candida auris infection in a COVID-19 hospital in Mexico

Hiram Villanueva-Lozano [1], Rogelio de J Treviño-Rangel [1], Gloria M González [1], María Teresa Ramírez-Elizondo [2], Reynaldo Lara-Medrano [3], Mary Cruz Aleman-Bocanegra [3], Claudia E Guajardo-Lara [4], Natalia Gaona-Chávez [3], Fernando Castilleja-Leal [5], Guillermo Torre-Amione [5], Michel F Martínez-Reséndez [6]

Affiliations + expand

PMID: 33429028 PMCID: PMC7835657 DOI: 10.1016/j.cmi.2020.12.030

Free PMC article

https://pubmed.ncbi.nlm.nih.gov/33429028/

The rise of *C. auris* during the COVID-19 pandemic

MMWR Morb Mortal Wkly Rep. 2021 Jan 15;70(2):56-57. doi: 10.15585/mmwr.mm7002e3.

Candida auris Outbreak in a COVID-19 Specialty Care Unit – Florida, July–August 2020

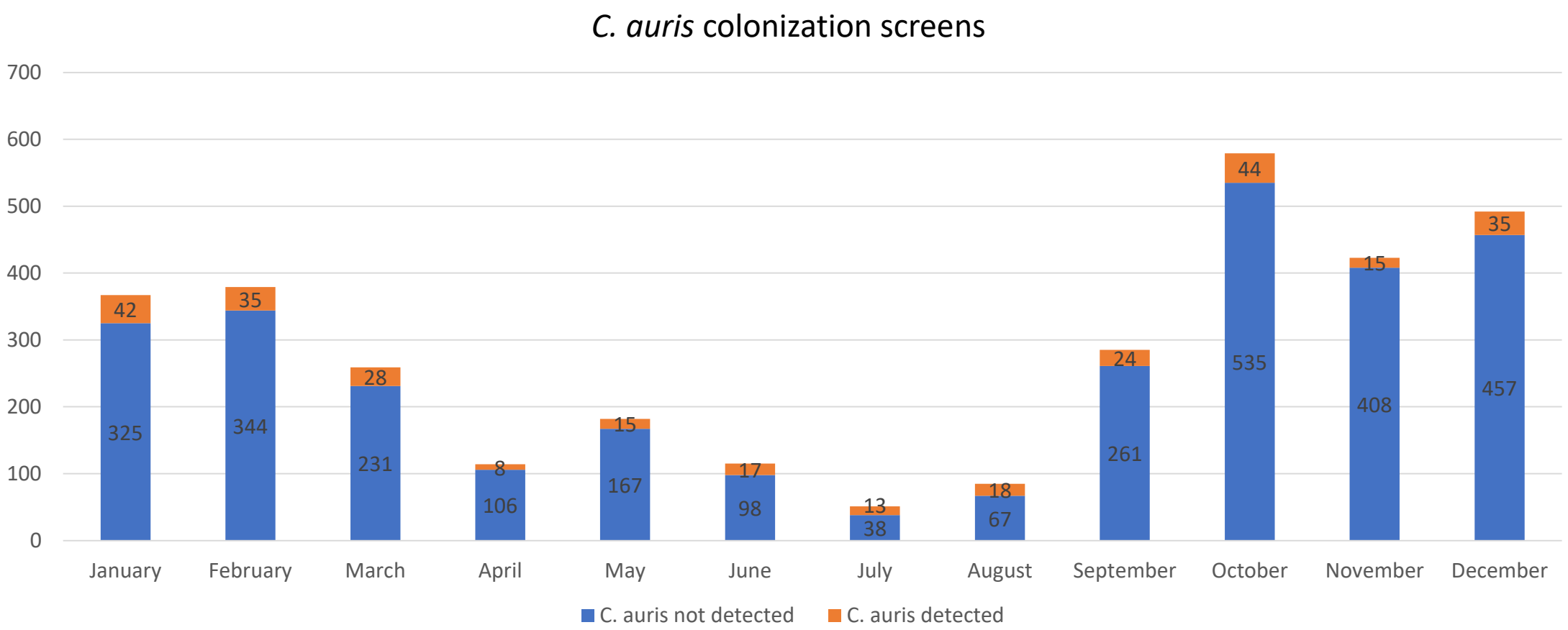
Christopher Prestel, Erica Anderson, Kaitlin Forsberg, Meghan Lyman, Marie A de Perio, David Kuhar, Kendra Edwards, Maria Rivera, Alicia Shugart, Maroya Walters, Nychie Q Dotson

PMID: 33444298 PMCID: PMC7808709 DOI: 10.15585/mmwr.mm7002e3

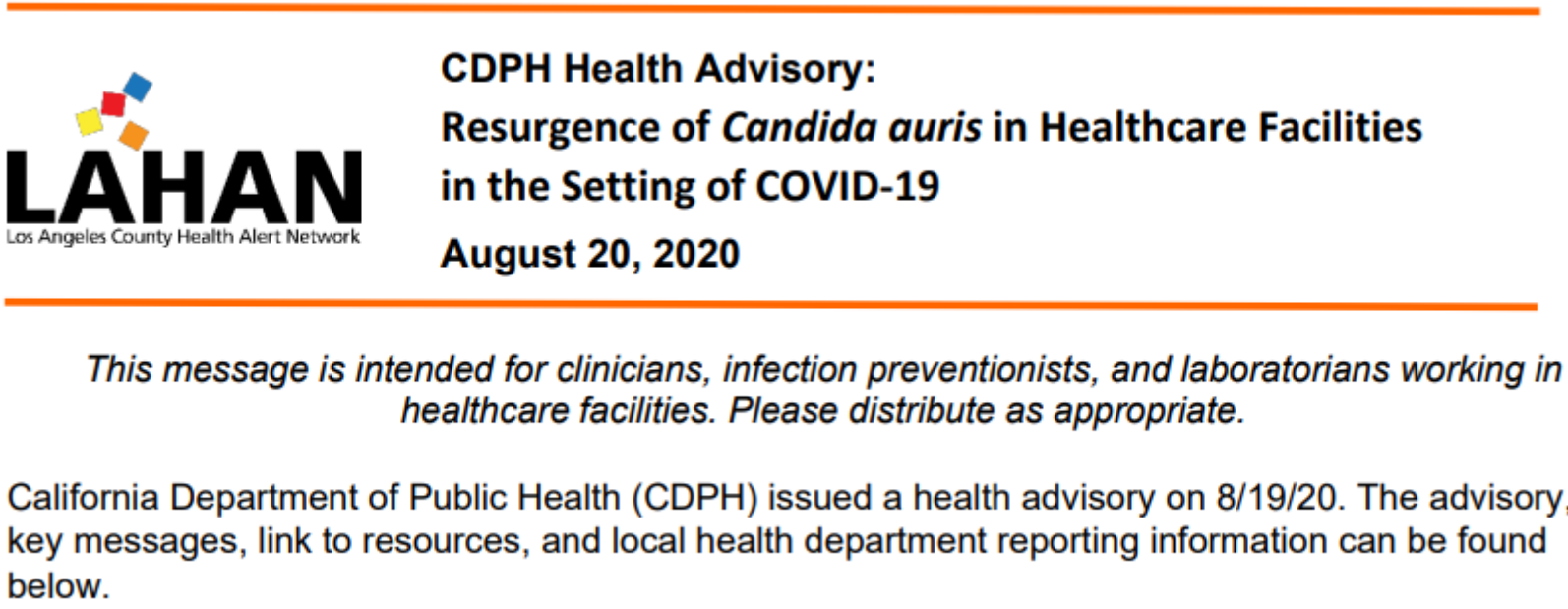
Free PMC article

https://pubmed.ncbi.nlm.nih.gov/33444298/

2020 *Candida* colonization data



The rise of *C. auris* during the COVID-19 pandemic



LAHAN
Los Angeles County Health Alert Network

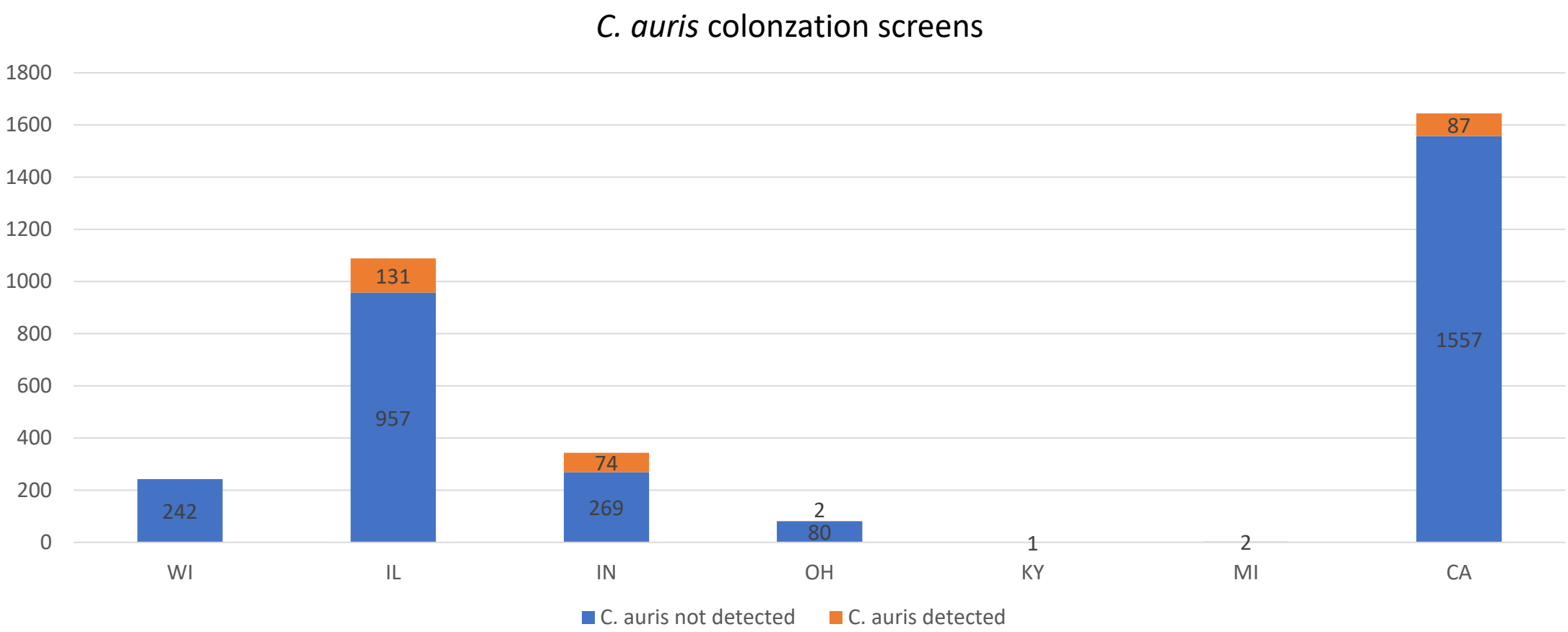
CDPH Health Advisory:
Resurgence of *Candida auris* in Healthcare Facilities in the Setting of COVID-19
August 20, 2020

This message is intended for clinicians, infection preventionists, and laboratorians working in healthcare facilities. Please distribute as appropriate.

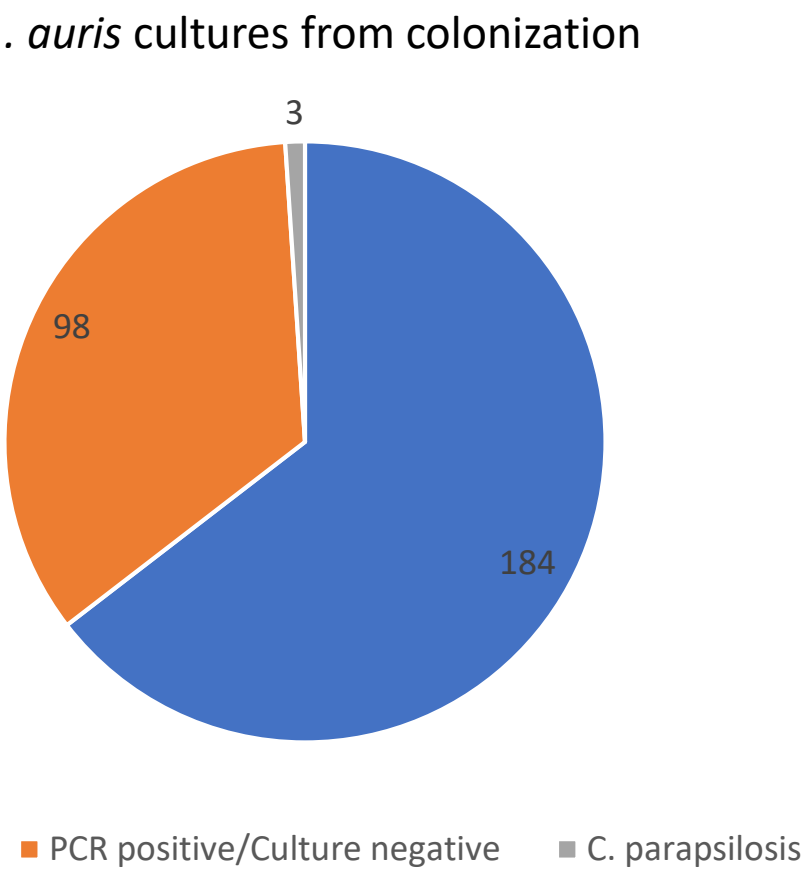
California Department of Public Health (CDPH) issued a health advisory on 8/19/20. The advisory, key messages, link to resources, and local health department reporting information can be found below.

http://publichealth.lacounty.gov/eprp/lahan/alerts/CAHANCauris082020.pdf

2020 *Candida* colonization data



2020 *Candida* colonization data



Ongoing AR activities

- GN7F AST panel validation
- WGS progress
- Other AR activities

GN7F AST panel validation

- GN7F panel will replace GNX2F AST panel
  - Key differences between the two panels

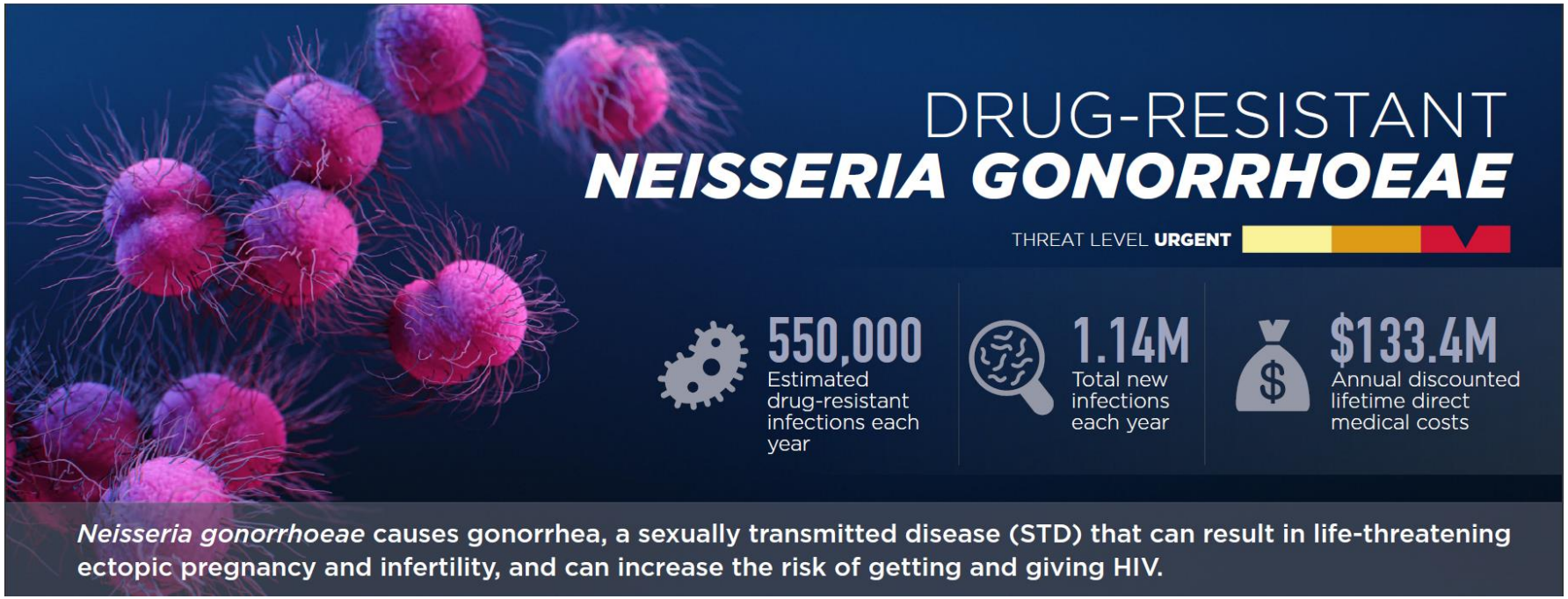
New drugs on the GN7F panel	Drugs not included in the GN7F panel
Ampicillin	Cefotaxime
Ampicillin-Sulbactam	Colistin
Cefazolin	Doxycycline
Ceftazidime-Avibactam	Polymixin B
Ceftolozane-Tazobactam	Ticarcillin/Clavulanic Acid
Ceftriaxone	
Nitrofurantoin	
Tetracycline	

Whole genome sequencing

- Isolates being sequenced
  - Pan-nonsusceptible
  - Novel carbapenemase (mCIM+/PCR-)
  - Non-KPC carbapenemase in *Enterobacterales*
  - Carbapenemase in *Pseudomonas*
  - Non-OXA carbapenemase in *Acinetobacter*
  - Carbapenemase detected during colonization (excludes KPC)

Other AR activities

- Drug resistant *Neisseria gonorrhoeae*
  - Testing handled by Utah Public Health Laboratory, Tennessee State Public Health Laboratory, and Washington State Public Health Laboratories



https://www.cdc.gov/drugresistance/pdf/threats-report/gonorrhea-508.pdf

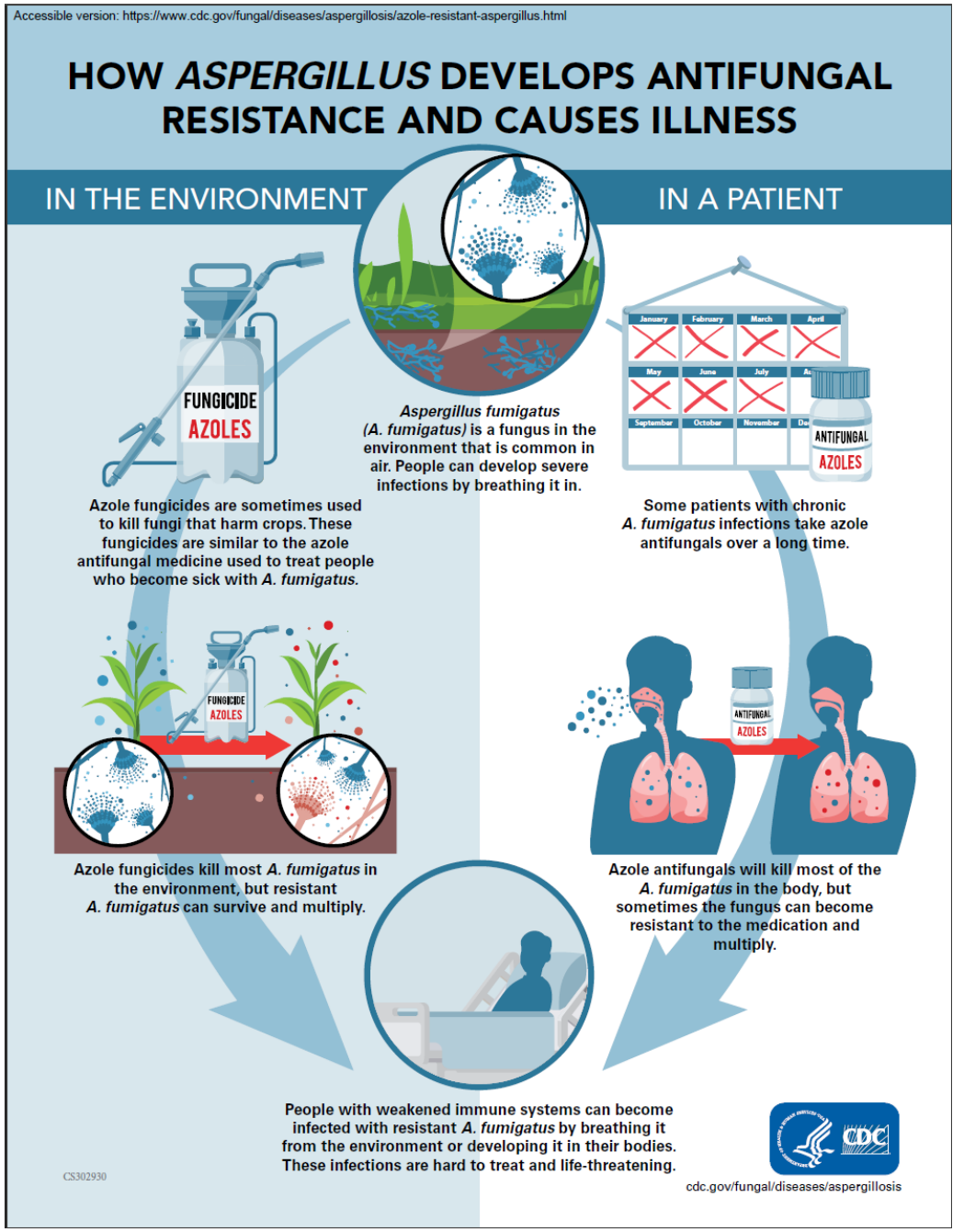
Other AR activities

- *Clostridioides difficile*
  - Testing handled by Minnesota Department of Health Public Health Laboratory

https://www.cdc.gov/drugresistance/pdf/threats-report/clostridioides-difficile-508.pdf

Other AR activities

- Azole-resistant *Aspergillus fumigatus*
  - Now on the CDC AR Watch List
  - Testing by the Maryland Public Health Laboratory and the Tennessee State Public Health Laboratory



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  - Mike Mamerow
  - Diane Podzorski
  - Christopher Reigel
  - Alana Sterkel
  - Ann Valley