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# **The Resistance Persistence: A Closer Look at Antimicrobial Resistance and Outbreaks in Texas**

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**Texas Department of State Health Services  
Healthcare Safety Team**



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# Objectives

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- Describe the clinical significance of detecting antimicrobial resistance
- Define the role of the HAI Epidemiologist during an HAI outbreak

# CRE and MDR-A

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**Bobbiejean Garcia, MPH, CIC, FAPIC**

- Multidrug resistant organisms across Texas



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# Quick History

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- Official Reporting began April 20, 2014
- CRE: *Klebsiella* species and *E.coli*
- MDR-A: All *Acinetobacter baumannii*
- Case definition change in January 2015

# CRE Through the Years



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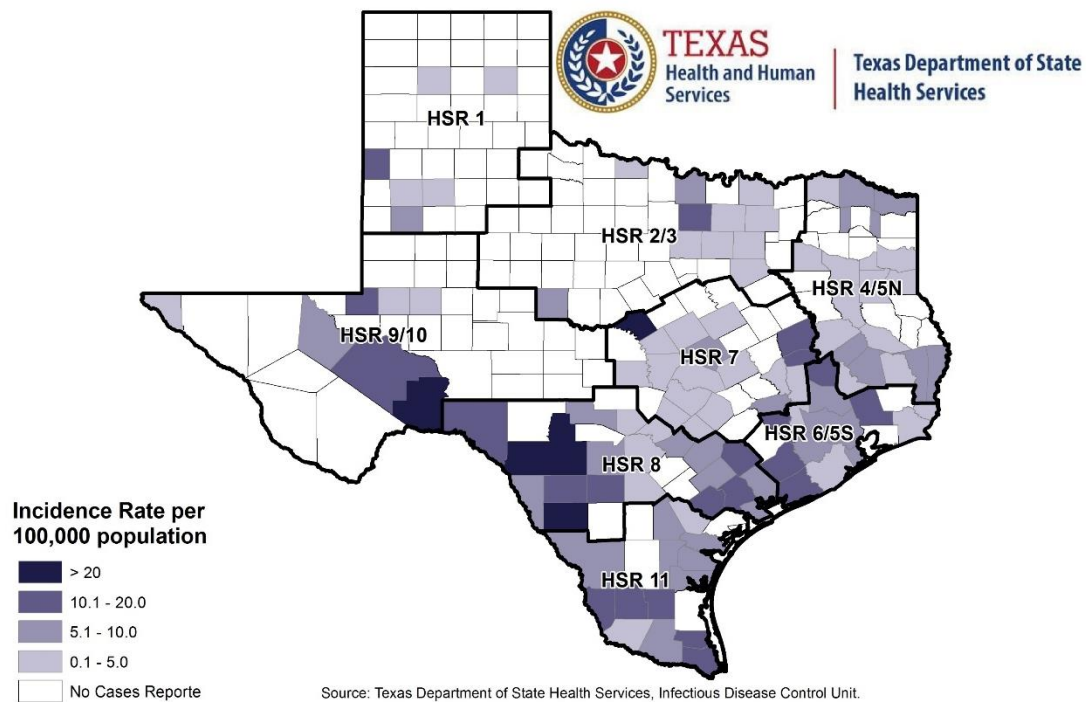
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Incidence Rate of CRE in Texas by Residency, 2015

Incidence Rate of CRE in Texas by Residency, 2016

Incidence Rate of CRE in Texas by Residency, 2017



Prepared: July, 2018

# MDR-A Through the Years



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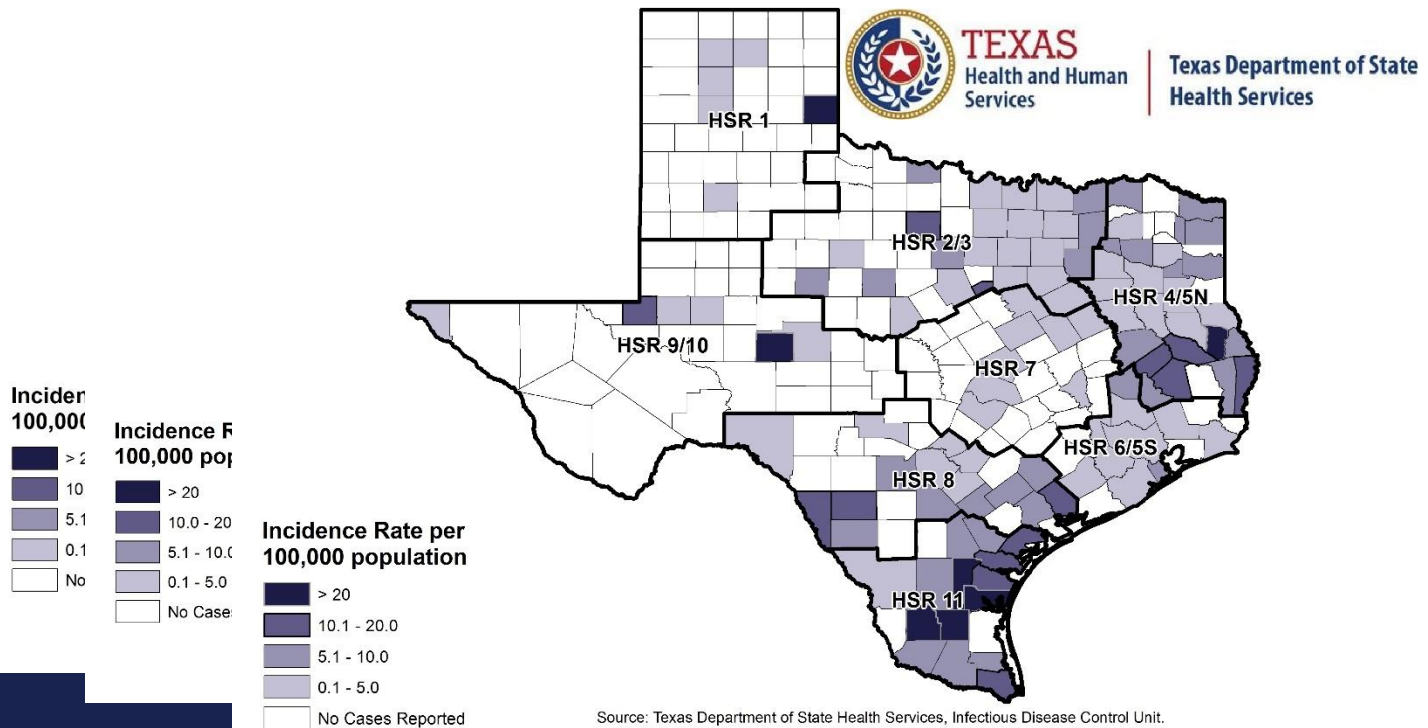
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Incidence Rate of MDR-A in Texas by Residency, 2015

Incidence Rate of MDR-A in Texas by Residency, 2016

Incidence Rate of MDR-A in Texas by Residency, 2017



# Closer Look at 2017



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Organism	Count
Total CRE	1,138
Total MDR-A	1,144
Total CRE & MDR-A	2,282

CRE Breakdown	Count
CRE-E.coli	259
CRE-K.oxytoca	32
CRE-K.pneumoniae	845
Other Klebsiella spp	2

# Closer Look at 2017



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Gender	Count
Male	1,109
Female	1,173
Total	2,282

Death Related to MDRO	Count
Yes	50
No	21
Unknown/Blank	98
Total Patients Deaths	169



# Closer Look at 2017



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Admitted to HCF	Count
Yes	1,837
No	431
Unknown	14

Patient came from	Count
Home	1,110
Long-term Care	542
Acute Care	302
LTAC	117
Other categories	79
Unknown	132

# Antibiotic Resistance Laboratory Network (ARLN) Initiatives

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**Thi Dang, MPH, CHES, CIC**

**Gillian Blackwell, BSN, RN, CIC**



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# Outline

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- Antibiotic Resistance and Public Health Impact
- Detection Through Antibiotic Resistance Laboratory Network (ARLN)
- Containment Guidance
- Texas Data
- Texas Investigations



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# U.S. Antibiotic Resistance Threats



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- Estimated more than 2 million antibiotic-resistant infections resulting in at least 23,000 deaths in US each year
- Urgent threat: Carbapenem-resistant Enterobacteriaceae (CRE)
- Serious threats: Extended-Spectrum Beta-lactamase producers (ESBLs), multidrug-resistant *Pseudomonas aeruginosa*, multidrug-resistant *Acinetobacter*
- Emergence of new multidrug-resistance organisms (MDROs)

# Carbapenemases



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- Enzymes that degrade carbapenem antibiotics
- Enzymes of primary public health concern
  - K. pneumoniae carbapenemase (KPC)
  - New Delhi Metallo- $\beta$ -lactamase (NDM)
  - Verona Integron Mediated Metallo- $\beta$ -lactamase (VIM)
  - Imipenemase (IMP)
  - OXA-48-type
  - mcr-1, mcr-2

# Why are these mechanisms a public health priority?

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- Cause infections associated with high mortality rates
- Resistance is highly transmissible
  - Between organisms
  - Between patients
- Treatment options are limited
  - Pan-resistant strains identified
  - Could be years before new agents are available to treat
- Potential for spread into the community
- Has spread rapidly (CP-CRE) throughout US and world

# States with KPC-CRE Reported to CDC



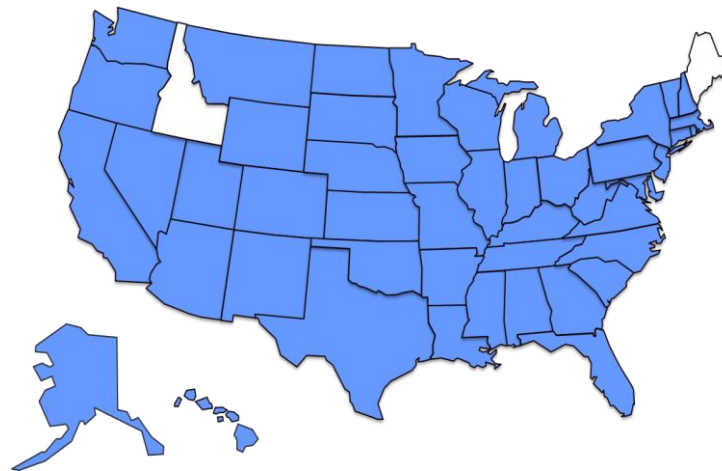
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2001



2016

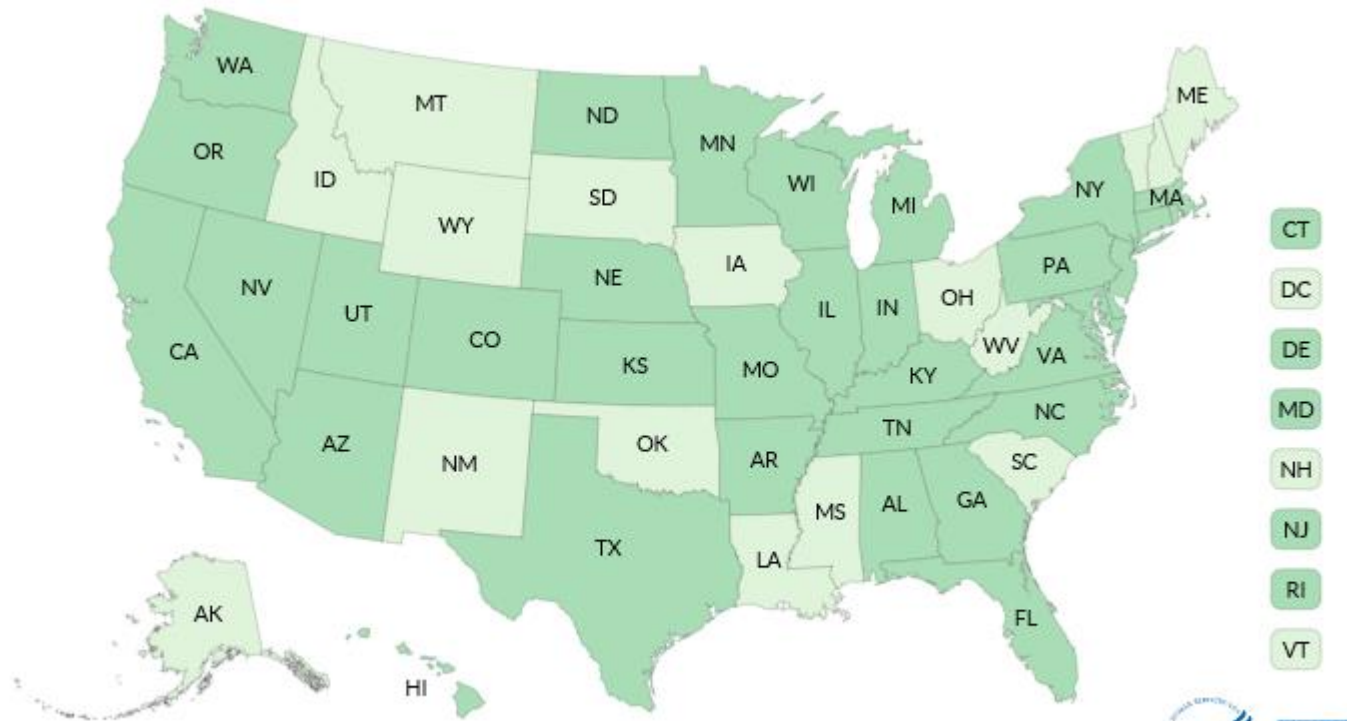
# CP-CRE reported to the CDC as of December 2017



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NDM

<https://www.cdc.gov/hai/organisms/cre/trackingcre.html>



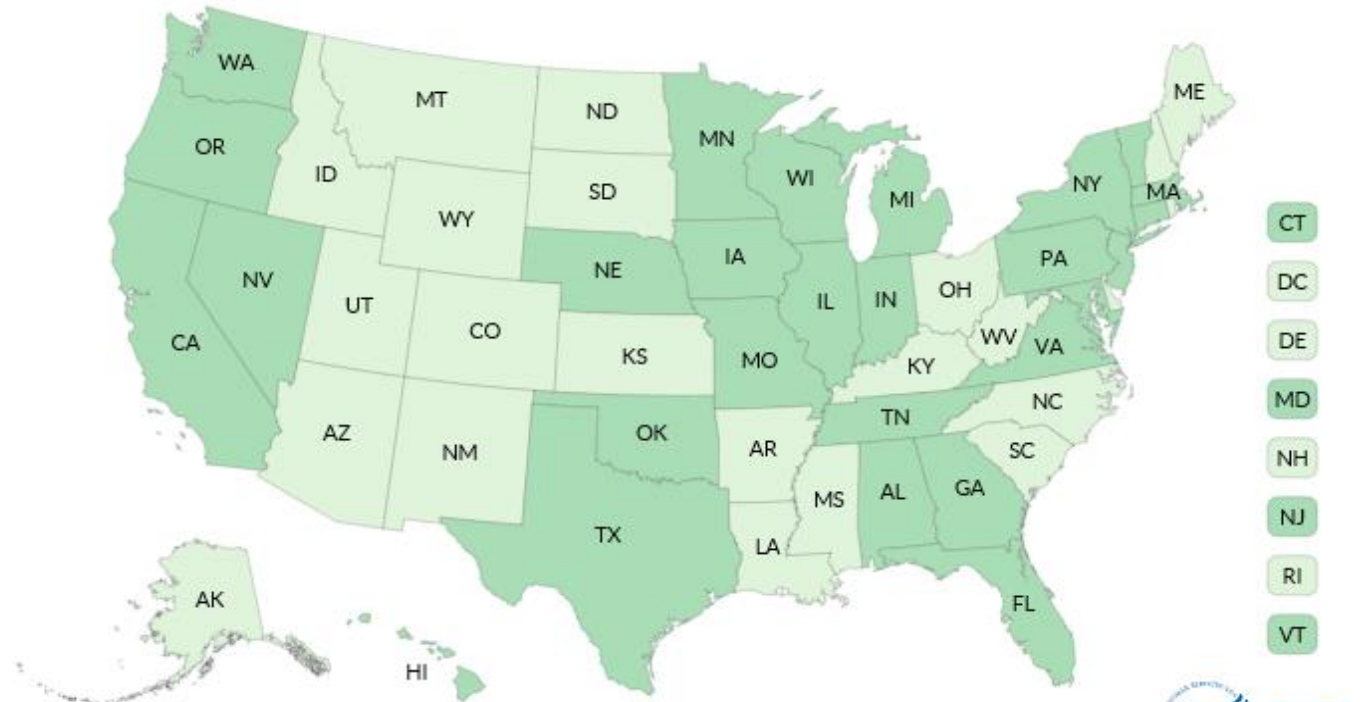
# CP-CRE reported to the CDC as of December 2017



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OXA-48

<https://www.cdc.gov/hai/organisms/cre/trackingcre.html>

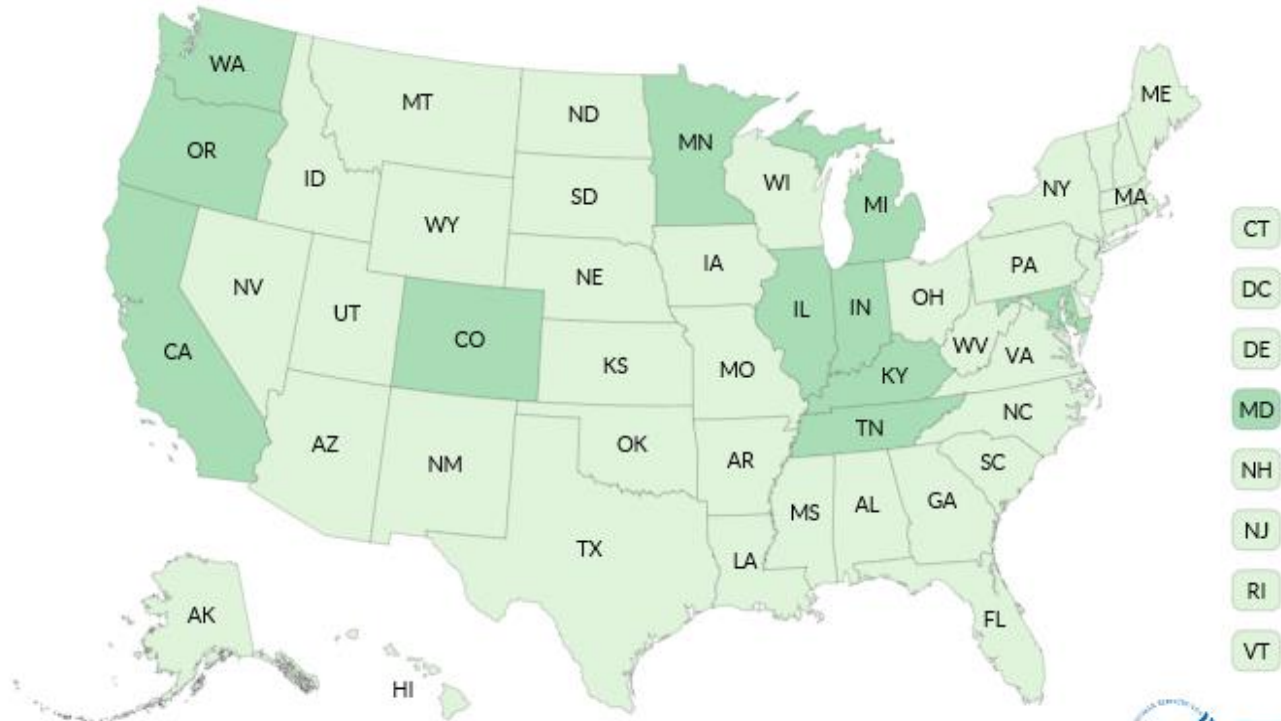
# CP-CRE reported to the CDC as of December 2017



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VIM

<https://www.cdc.gov/hai/organisms/cre/trackingcre.html>

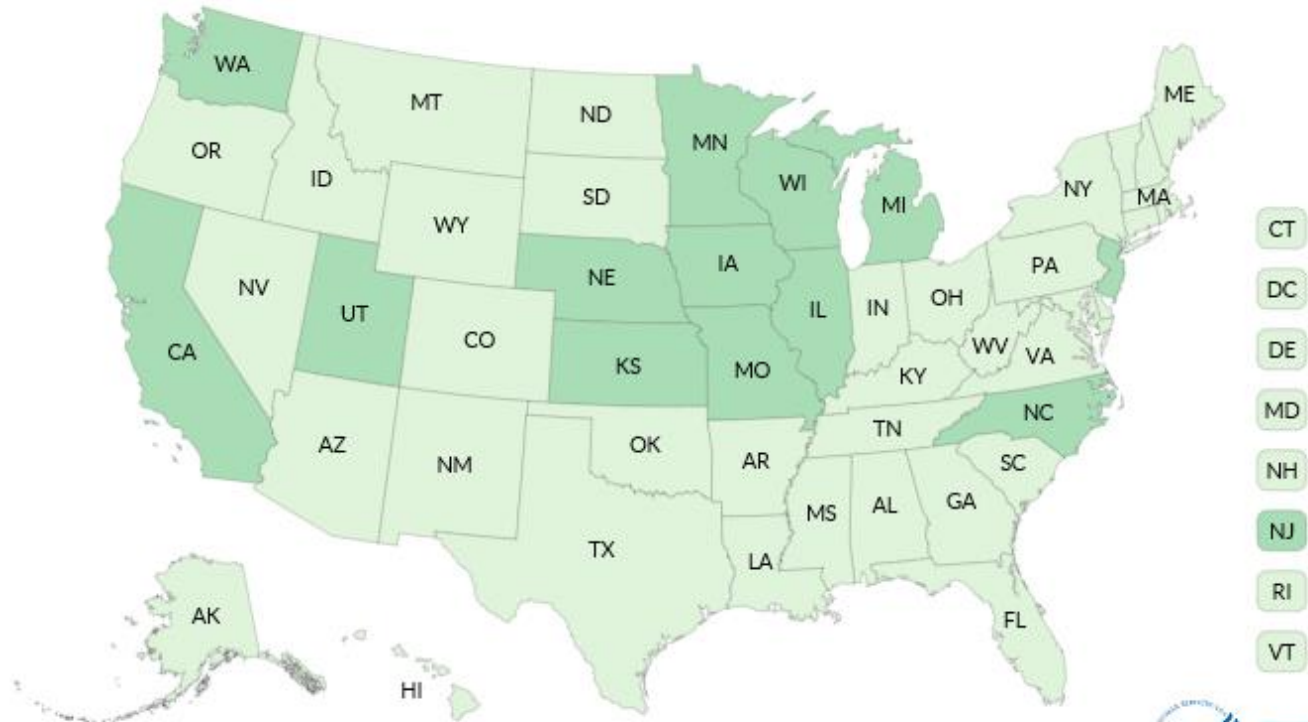
# CP-CRE reported to the CDC as of December 2017



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IMP

<https://www.cdc.gov/hai/organisms/cre/trackingcre.html>



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# Detection of Targeted MDROs

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# Detection

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- Restricted capacity to detect and respond to emerging resistance if CDC is the only sentinel surveillance program for AR
- Limited state capacity for AR testing
- In clinical labs, data is not often connected to public health action



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# Solution

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- Antibiotic Resistance Laboratory Network (ARLN)
- Transform the national lab infrastructure with regional laboratories and local labs with gold-standard methods and technology
- Enhanced testing capacity in all 50 states and five local jurisdictions
- Faster detection for rapid and improved public health response
- Communication channels to engage clinical laboratory partners

# ARLN Locations

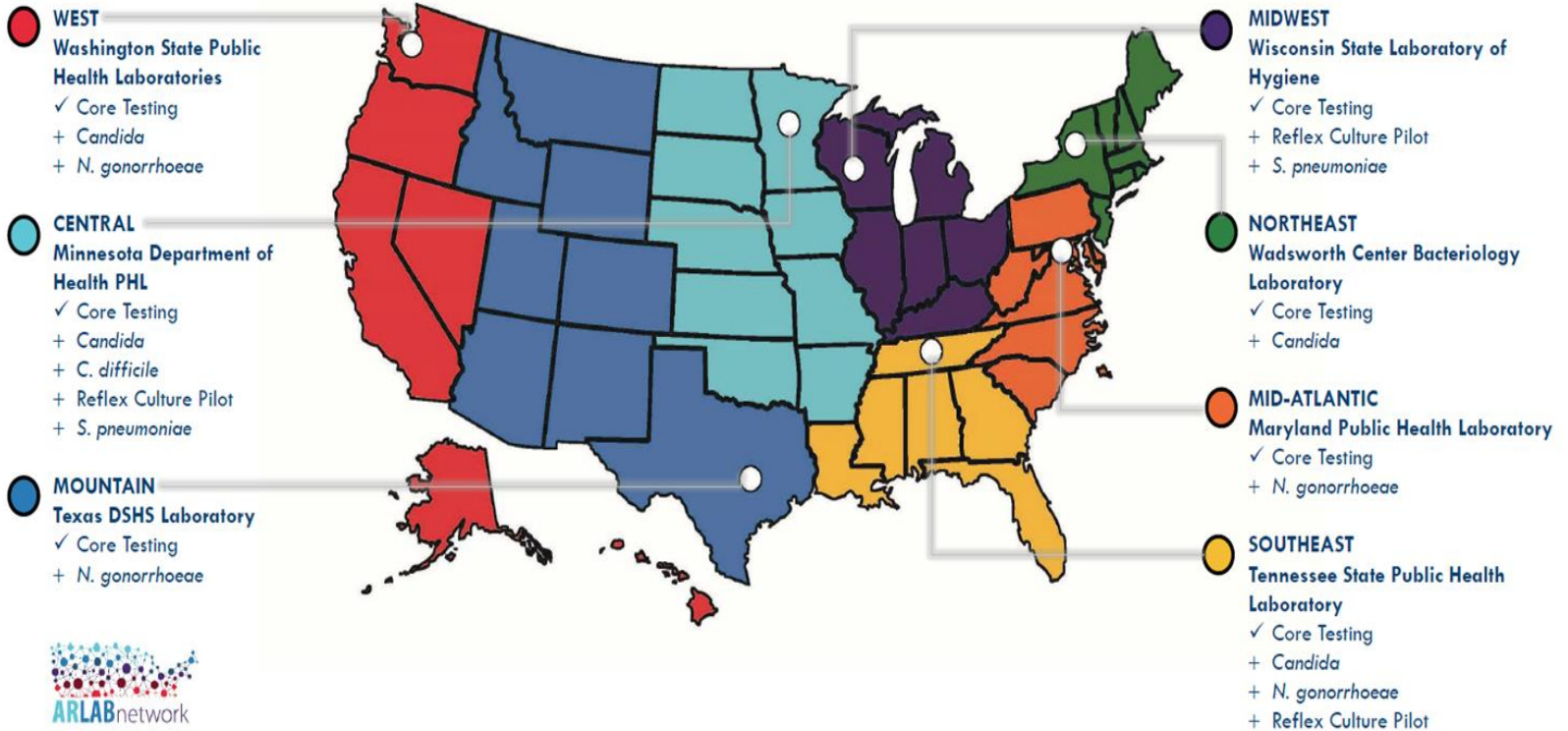


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## CDC Antibiotic Resistance Laboratory Network: 7 Regional Labs



# Carbapenem-Resistant (CR) Organisms of Interest

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- CRE to include:
  - *Escherichia coli*
  - *Klebsiella pneumoniae*
  - *Klebsiella oxytoca*
  - *Enterobacter* species
- CR-*Acinetobacter baumannii* (CRAb)
- CR-*Pseudomonas aeruginosa* (CRPA)
- ESBL





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# Epidemiology Response

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# CDC Response Guidance

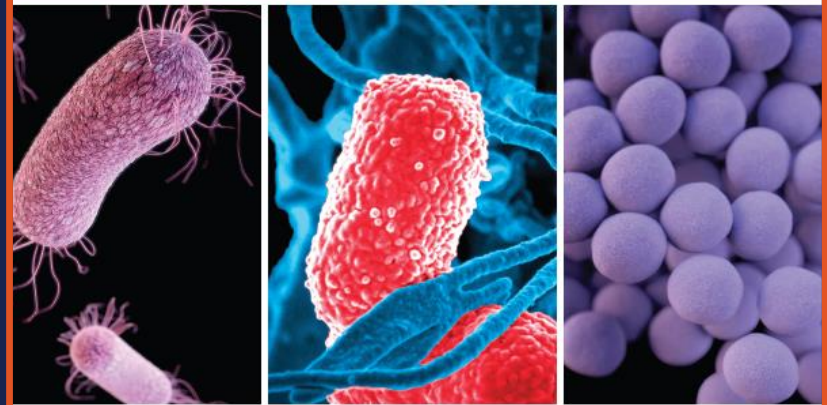
Goal:  
Slow spread of novel or rare multidrug-resistant organisms or mechanisms



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



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



# Containment

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- Systematic, aggressive response to single cases of high concern antimicrobial resistance
- Focus on stopping transmission
- Response activities have tiered approach based on organism/mechanism attributes
- Complements existing guidance
  - CRE Toolkit
  - Vancomycin Resistant *Staphylococcus aureus* (VRSA) Investigation Guide



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# Containment Response Elements



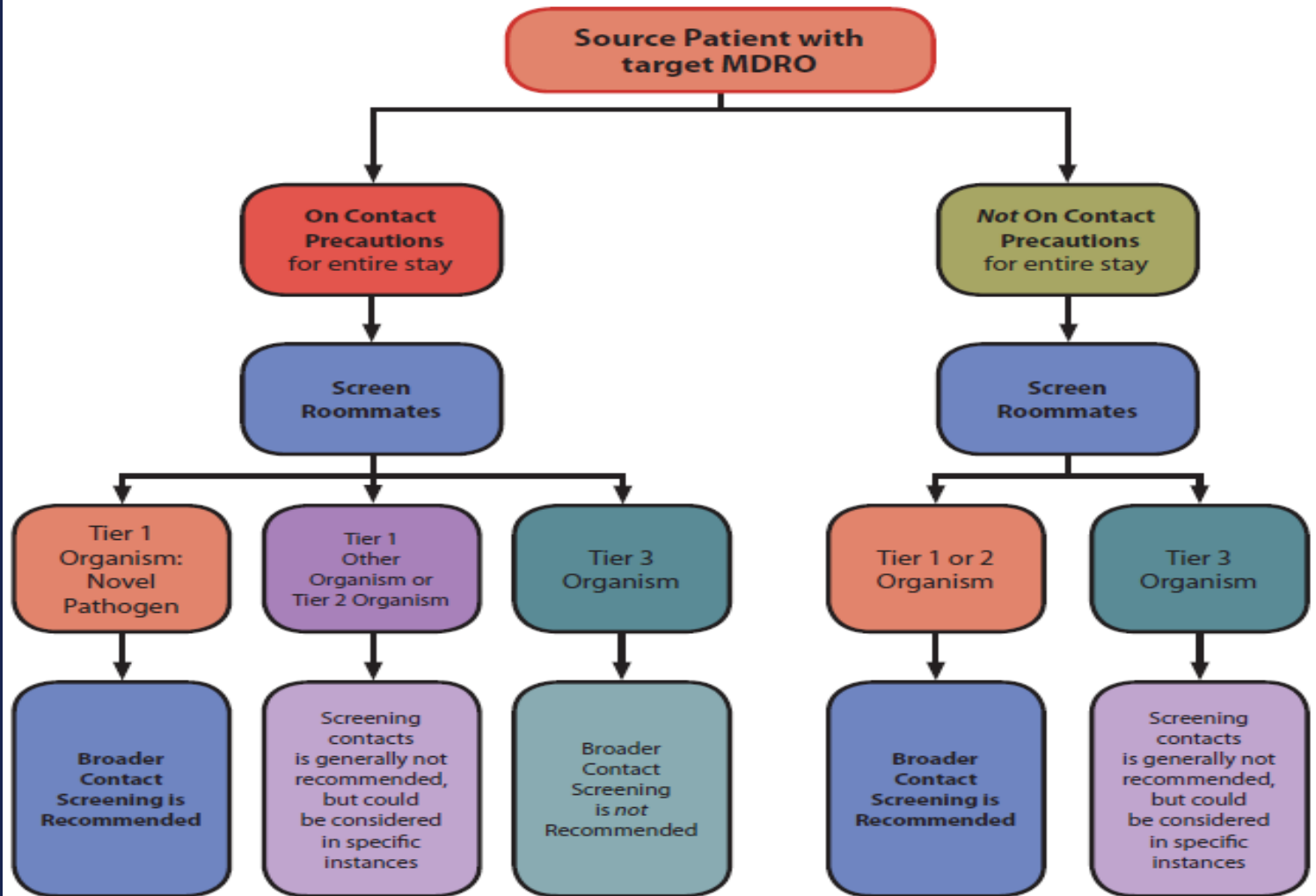
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Containment Elements	Tier 1 Novel resistance mechanisms, PanR	Tier 2 Mechanisms and organisms not regularly found in a region	Tier 3 Mechanisms and organisms regularly found in a region but not endemic
Infection Control Assessment	Yes	Yes	Yes
Prospective Surveillance	Yes	Yes	Yes
Lab Lookback	Yes	Yes	Yes
Screening of Healthcare Roommates	Yes	Yes	Yes
Broader Screening of Healthcare Contacts	Yes	Sometimes	No
Household Contact Screening	Yes	Sometimes	No
Environmental Sampling	Sometimes	No	No
Healthcare Personnel Screening	Sometimes	No	No

# Healthcare Contacts

Figure 1: Approach to screening healthcare contacts following identification of novel or targeted multidrug-resistant organisms



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# ARLN Results

## June 2017-March 2018



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<b>CRE</b>	<b>CRPA</b>	<b>CRAb</b>	<b>ESBL</b>	<b>Total</b>
244	485	188	163	1080

<b>CP-CRE</b>	<b>CP-CRPA</b>	<b>CP-CRAb</b>	<b>Total CP</b>
115	27	0	142

# ARLN Results

## CRE

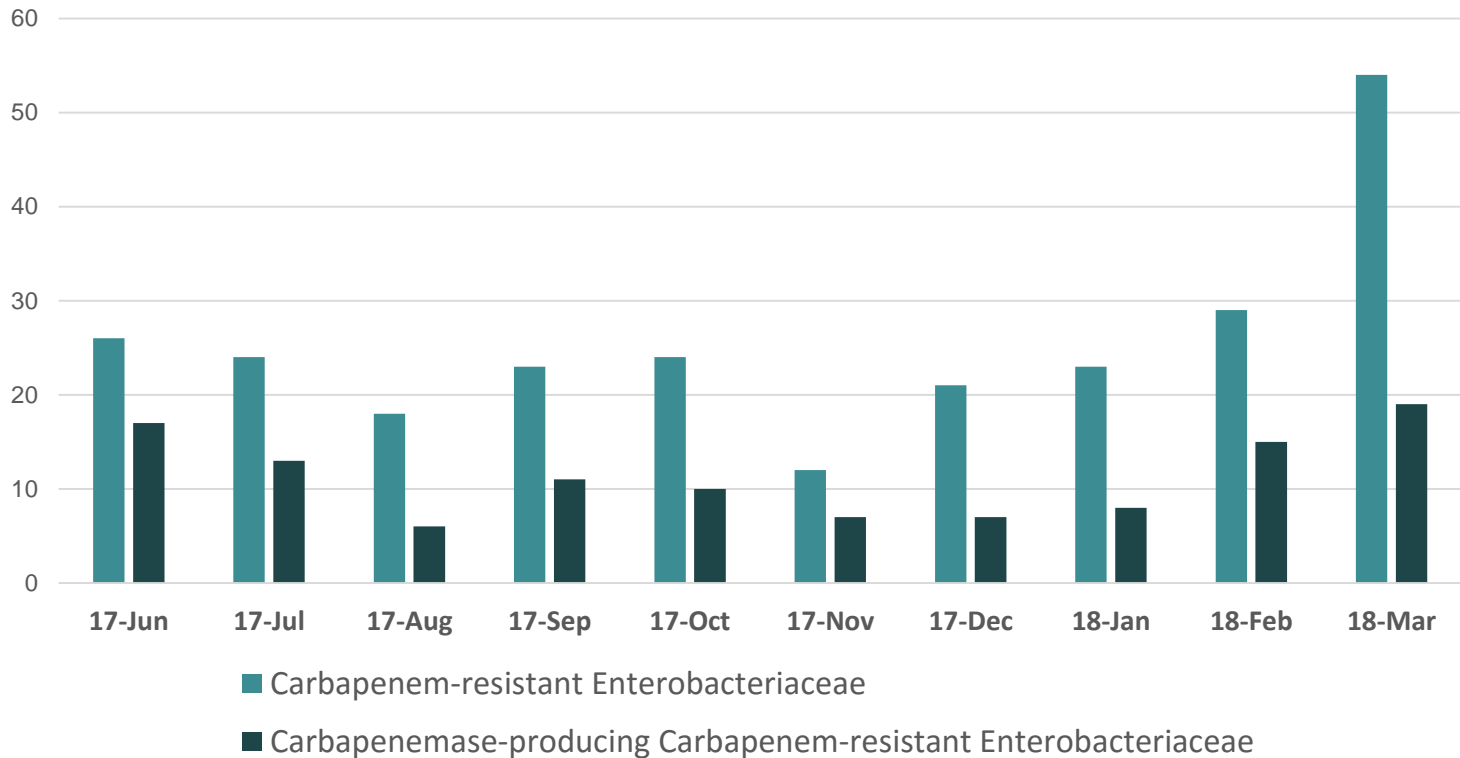


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### 2017-2018 Texas ARLN Isolate Submission Counts Carbapenemase-resistant Enterobacteriaceae



# ARLN Results

## CRPA

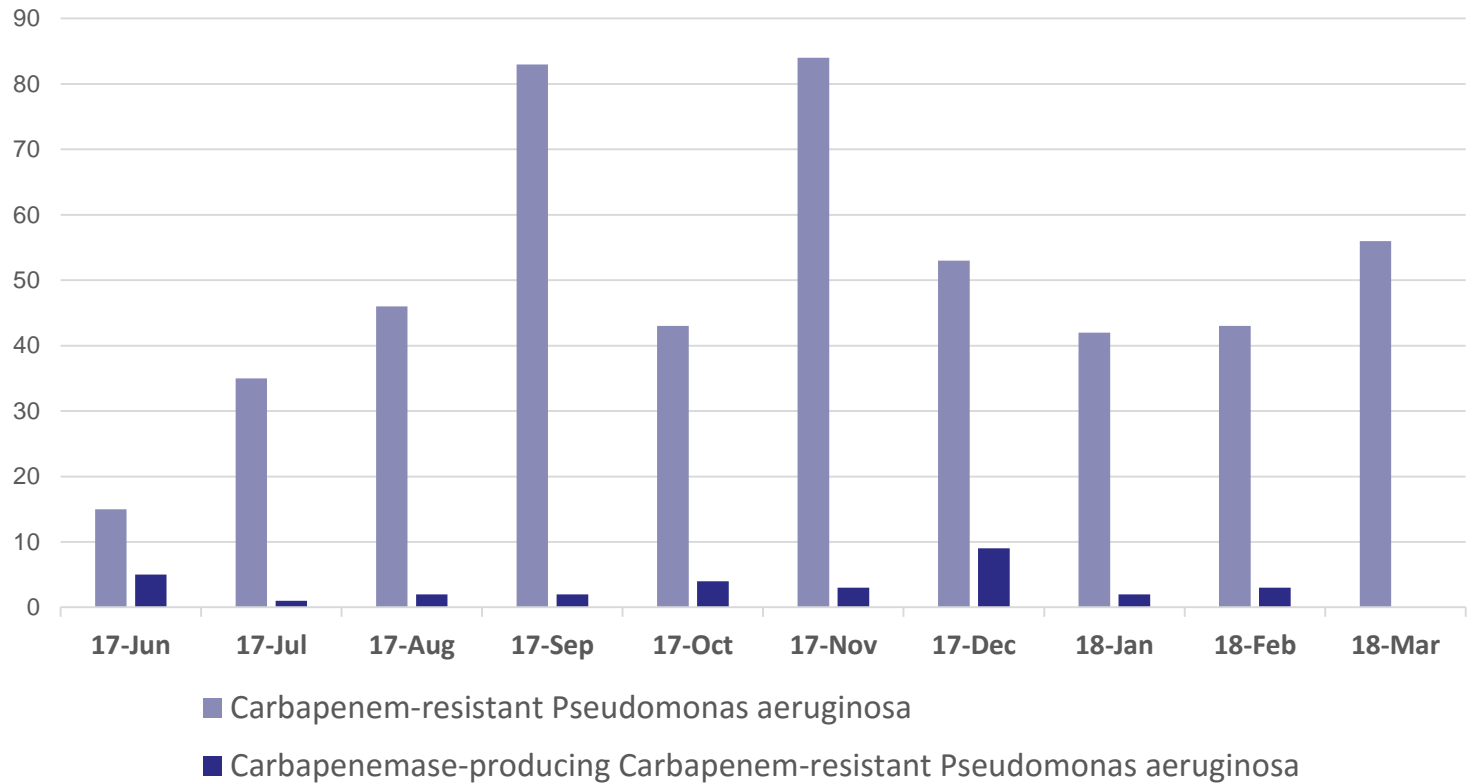


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2017-2018 Texas ARLN Isolate Submission Counts  
Carbapenem-resistant *Pseudomonas aeruginosa*





# Mechanisms Identified in Texas Facilities

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- NDM
- mcr-1
- VIM
- OXA-48
- KPC
- IMP



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# Colonization Studies

## June 2017-March 2018



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Resistance Mechanism	Studies Conducted	Specimens Tested	Total Positive
NDM	0	0	0
mcr-1	2	26	0
VIM	4	17	0
OXA-48	1	3	0
KPC	9	160	19
IMP	1	12	1
<i>C. auris</i>	3	41	0



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# Texas Investigations

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# IMP-PA

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- 4 MDR-*Pseudomonas* cases among pediatric patients at burn hospital
  - 2 patients identified with IMP-*Pseudomonas aeruginosa* (PA)
  - Investigation suggests importation and transmission

# mcr-1

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- *mcr-1* from ESBL *E. coli* in urine from a 49-year-old male without international travel
  - 20<sup>th</sup> U.S. case (1<sup>st</sup> in TX)
  - Admitted to:
    - 2 acute care hospitals
    - 1 long-term acute care hospital
    - 2 inpatient rehabilitation facilities

# OXA-48

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- First OXA-48 identified in *E. coli* from a wound culture at a rehab facility
  - Screened 3 healthcare contacts in close proximity to patient's room (all negative)

# KPC



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Facility Type	Infections Identified by ARLN	Number of Colonization Studies	Colonization Screenings performed	Number Colonized
Acute Care Hospital	3	1	1	0
Skilled Nursing Facility	0	2	34	6

- 9 positive specimens identified in 2 facilities from December 2017 – March 2018
  - 8 *Klebsiella pneumoniae* KPC
  - 1 *Serratia marcescens* KPC

# Review

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- Antibiotic Resistance and Public Health Impact
- Detection Through Antibiotic Resistance Laboratory Network (ARLN)
- Containment Guidance
- Texas Data
- Texas Investigations



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# HAI Outbreaks

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**Sandi Arnold, RN, CIC**

**Annie Nutt, MPH, CIC**



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# HAI Outbreak Detection

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## Simple Definition:

An increase in the number of hospital-acquired or healthcare facility-acquired cases of disease among patients or staff over & above the expected number of cases



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# HAI Outbreak Detection

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- Notifiable Conditions: Texas Administrative Code §97.3 (2016)
- Alerts from clinical, reference, and public health labs of increases in isolates
- National alerts of multi-state outbreaks, sometimes linked to contaminated products
- Alerts from regulatory agencies

*In addition to specified reportable conditions, any outbreak, exotic disease, or unusual group expression of disease that may be of public health concern should be reported by the most expeditious means available*



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# HAI Outbreak Detection

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- Influenza: 1 laboratory-confirmed case along with other cases of respiratory infection in a unit of a long-term care facility (3 day period)
- Norovirus: A Norovirus outbreak is defined as onset of 2 or more epidemiologically linked cases within a three day period, where a case is defined as someone with 2 or more episodes of vomiting or 3 or more episodes of diarrhea within 24 hours.



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# HAI Outbreak Detection

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- A Multidrug Resistant Organism (MDRO) outbreak is defined as an increase in the number of facility-acquired MDRO cases above and beyond the endemic (baseline) level in a certain facility/unit during a specific time period, and may include an increase in cases of MRSA, VRE, CRE, MDR-A or any other multidrug resistant organism



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# HAI Outbreak Detection

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A single case may constitute an outbreak, for example:

- VISA or VRSA
- Any unusual or novel MDRO or MDRO with an unusual resistance pattern conferring resistance to critical antibiotic(s)
- Legionellosis if the patient has been in the healthcare facility for the entire incubation period (10 days) or association was defined as any exposure to a health care facility for a portion of the 10 days preceding symptom onset.
- Post-procedure infection with an unusual organism (e.g. invasive fungal infection after an epidural procedure in an immunocompetent patient.)

# 2017 HAI Outbreaks

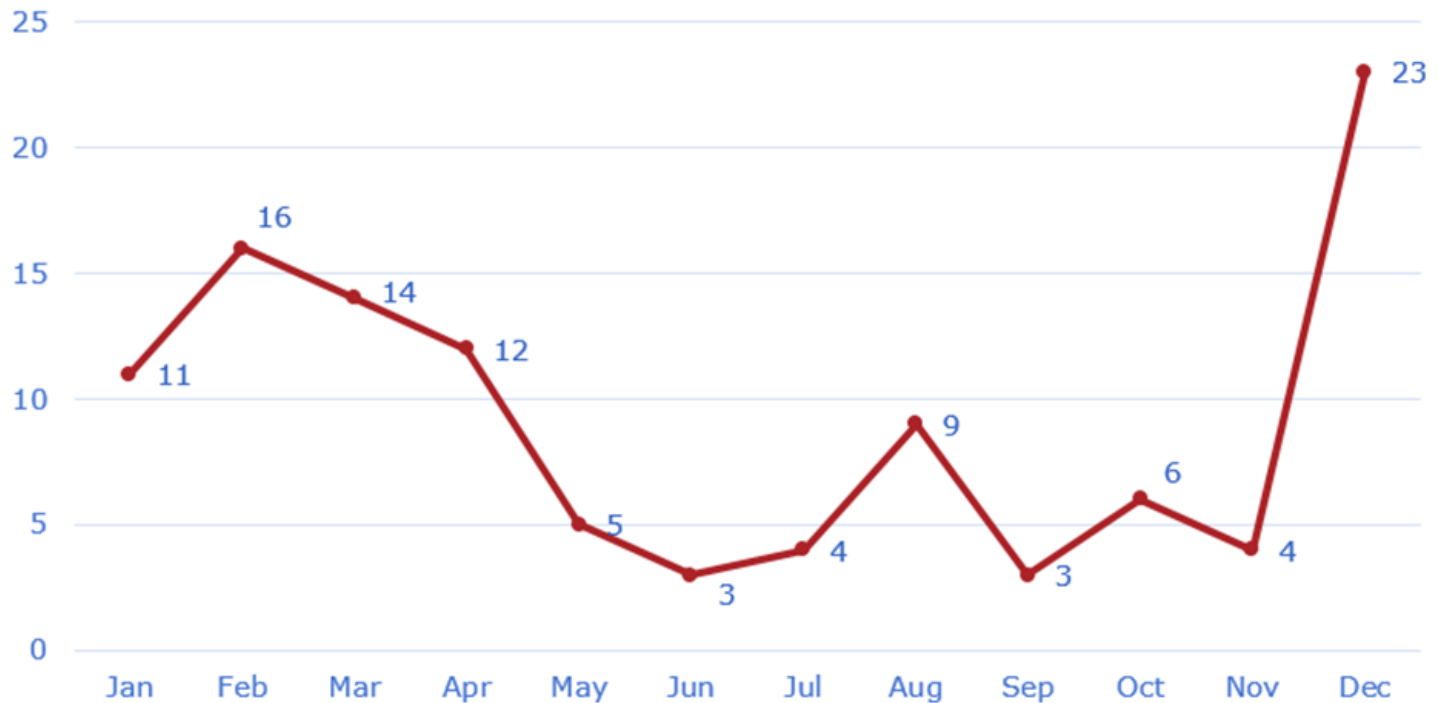


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## 2017 HAI Outbreaks by Month of Notification



# 2017 HAI Outbreaks

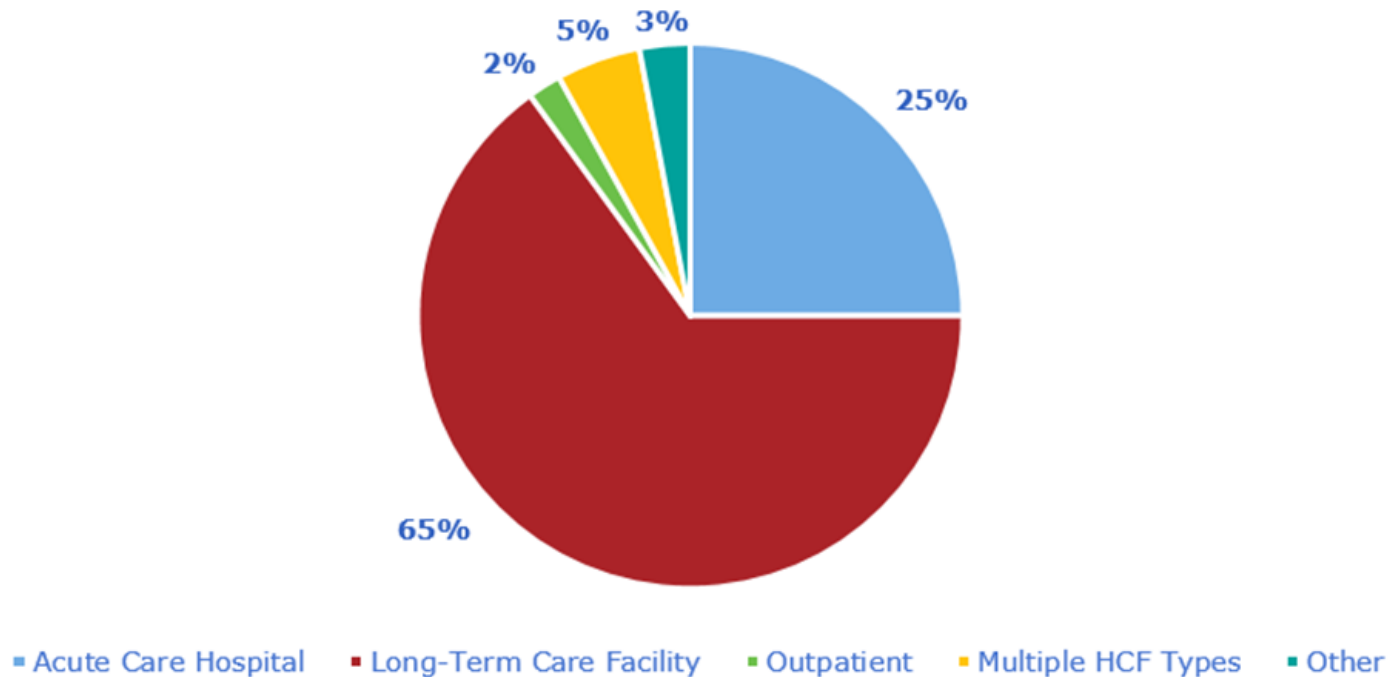


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## 2017 HAI Outbreaks by Healthcare Facility Type





# Lab Assistance for HAI Outbreaks

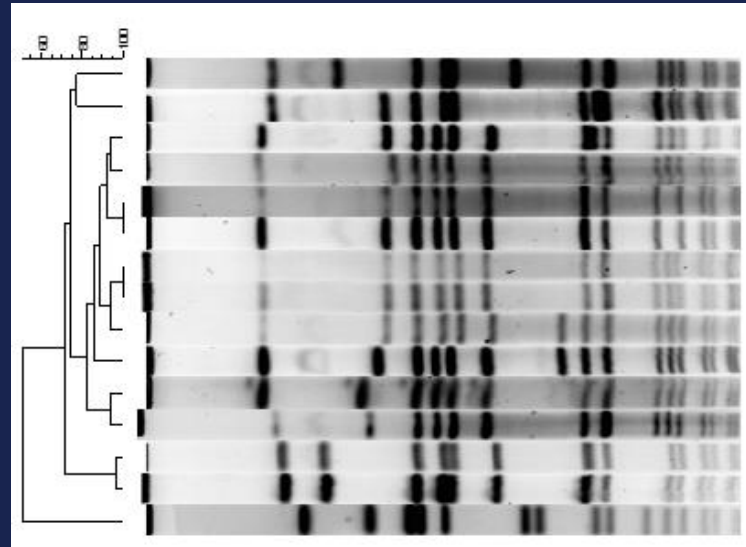


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- Identification
- PFGE
- ARLN



# 2017 HAI Outbreaks



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# 2017 HAI Outbreaks - Highlights

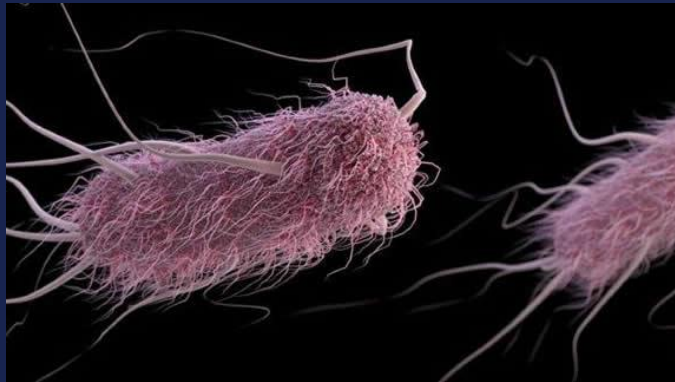


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- The first case of mcr-1 detected in Texas
- Brucellosis investigation



CDC A-Z INDEX ▾

## Morbidity and Mortality Weekly Report (MMWR)

[CDC](#) > [MMWR](#)

*Notes from the Field: Brucella abortus* Vaccine Strain RB51 Infection and Exposures Associated with Raw Milk Consumption – Wise County, Texas, 2017

Weekly / March 9, 2018 / 67(9):286





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# Thank you

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