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Response Plan for an Emerging Multidrug-Resistant Threat: A Simulation Activity

HAI Epidemiology Team

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Antibiotic Resistance Laboratory Network (ARLN) Initiatives

HAI Epidemiology Team

Outline

- Antibiotic Resistance and Public Health Impact
- Detection Through Antibiotic Resistance Laboratory Network (ARLN)
- Containment Guidance
- *Candida auris*

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Nightmare Bacteria

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UNUSUAL ANTIBIOTIC-RESISTANT GERMS

- Resistant to all or most antibiotics tested, making them hard to treat, and
- Uncommon in a geographic area or the US, or
- Have special genes that allow them to spread their resistance to other germs

Examples of unusual resistance: Vancomycin-resistant *Staphylococcus aureus* (VRSA), *Candida auris*, and certain types of "nightmare bacteria" such as carbapenem-resistant Enterobacteriaceae (CRE).

Carbapenemases

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- Enzymes that degrade carbapenem antibiotics
- Enzymes of primary public health concern
  - K. pneumoniae carbapenemase (KPC)
  - New Delhi Metallo-β-lactamase (NDM)
  - Verona Integron Mediated Metallo-β-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
  - Between facilities
- Treatment options are limited
- Potential for spread into the community
- Has spread rapidly (CP-CRE) throughout U.S. and world

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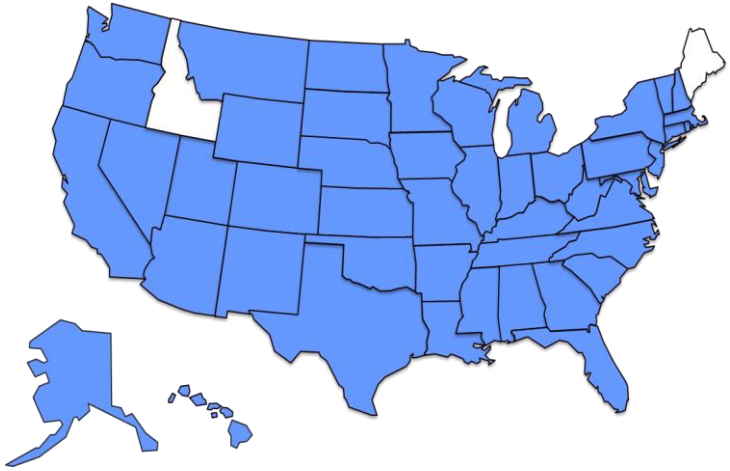
States with KPC-CRE Reported to CDC

2001



2016

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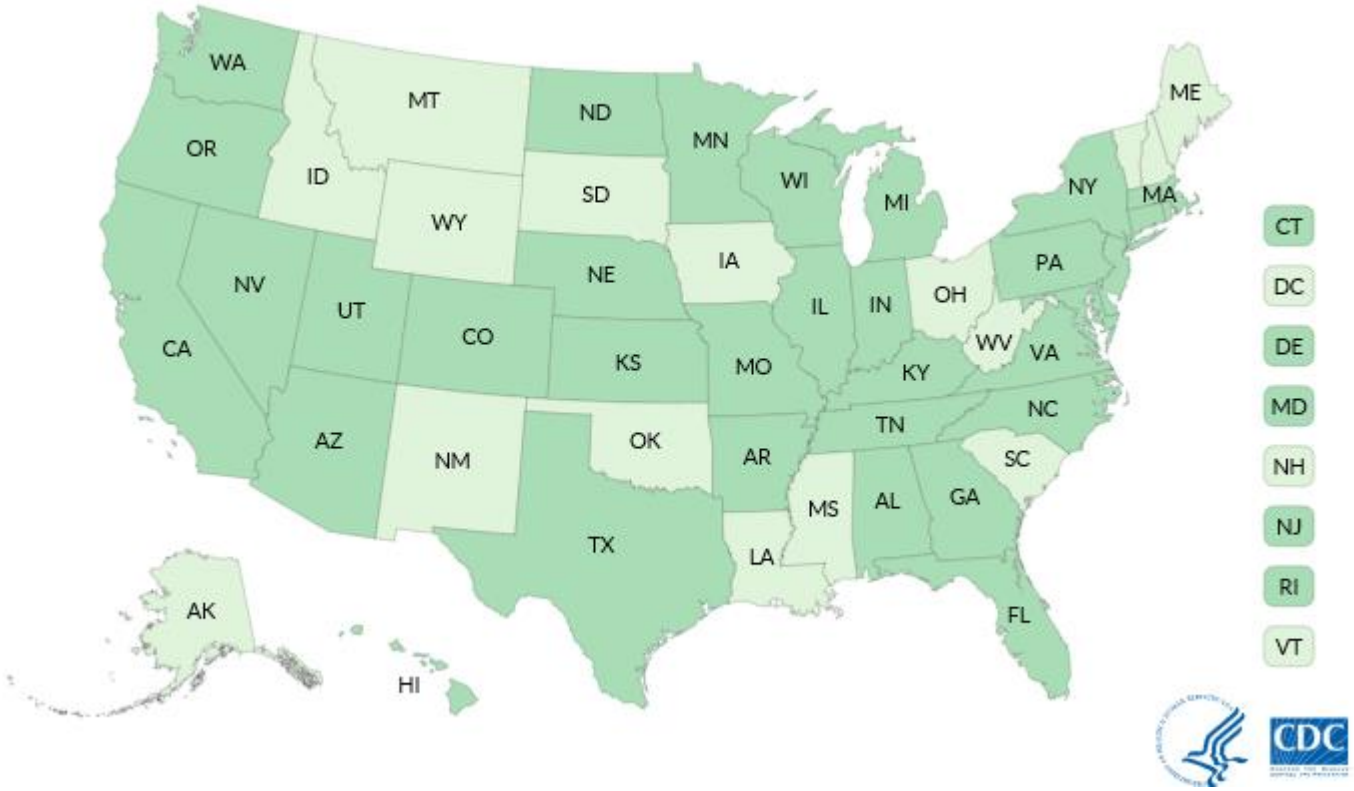
CP-CRE reported to the CDC as of December 2017



NDM

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

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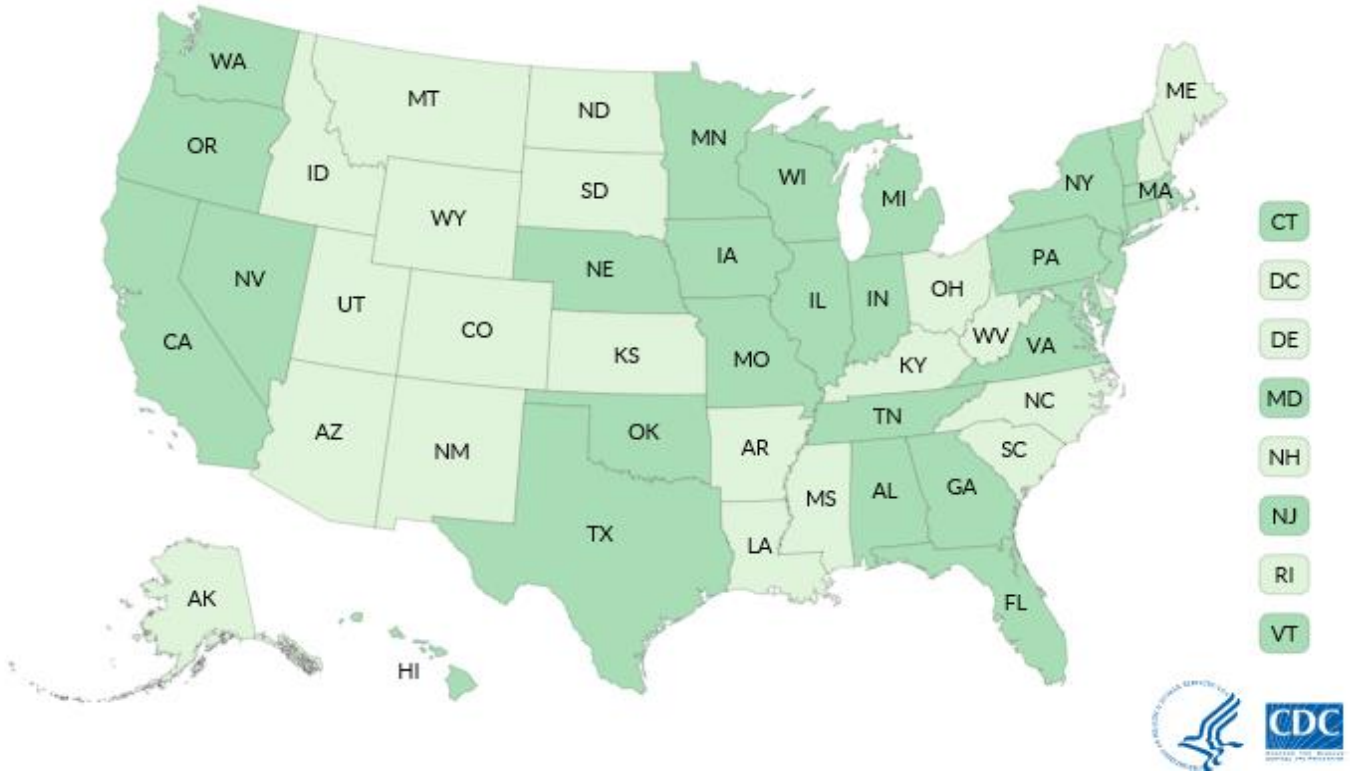
CP-CRE reported to the CDC as of December 2017



OXA-48

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

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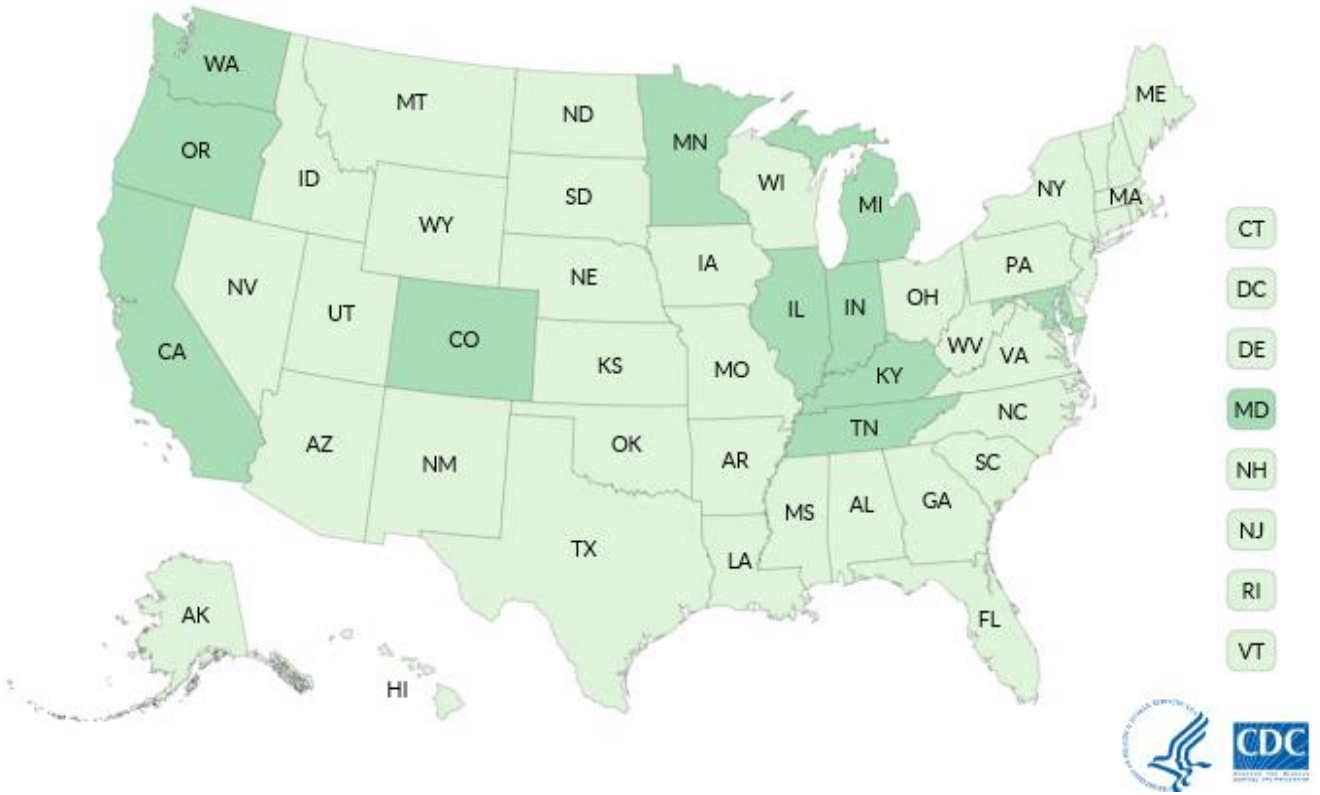
CP-CRE reported to the CDC as of December 2017



VIM

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

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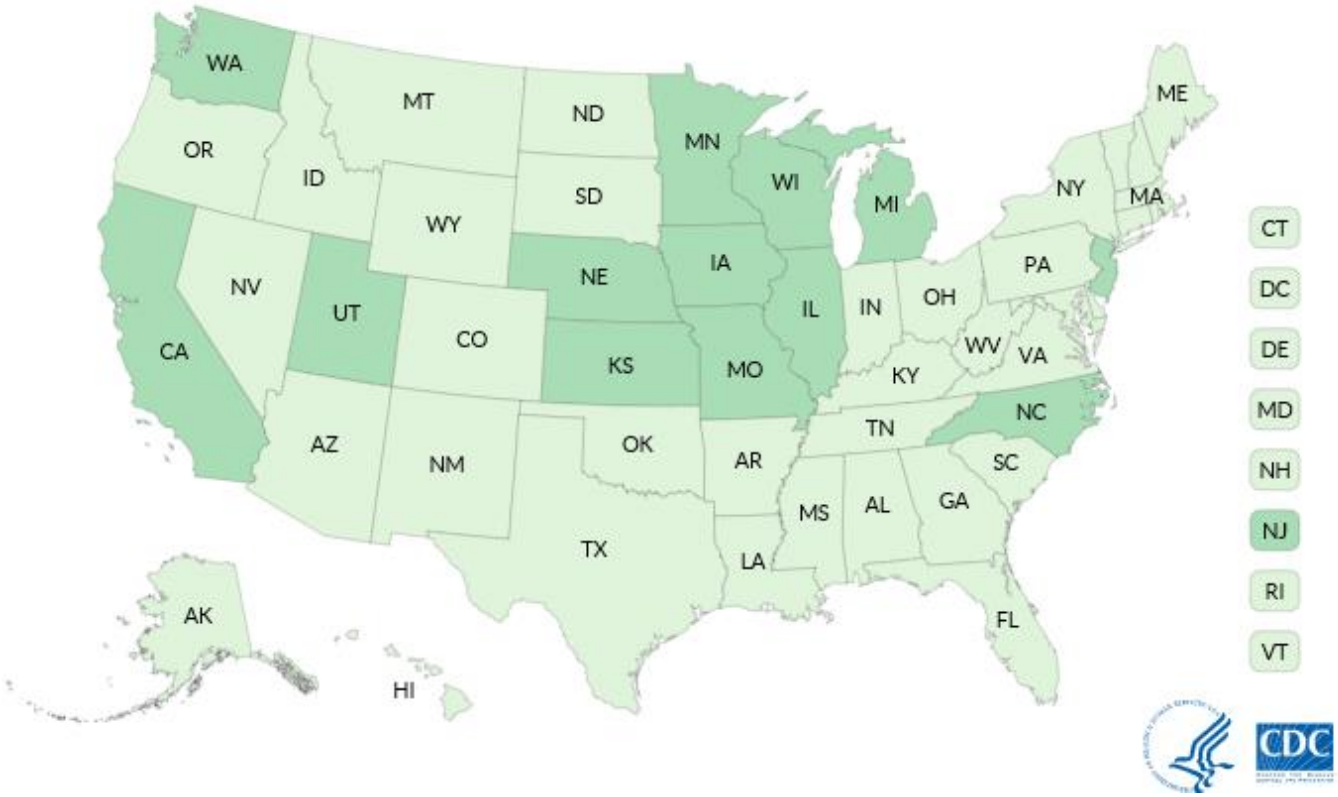
CP-CRE reported to the CDC as of December 2017



IMP

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

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Detection of Targeted MDROs

Detection

- 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

- 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

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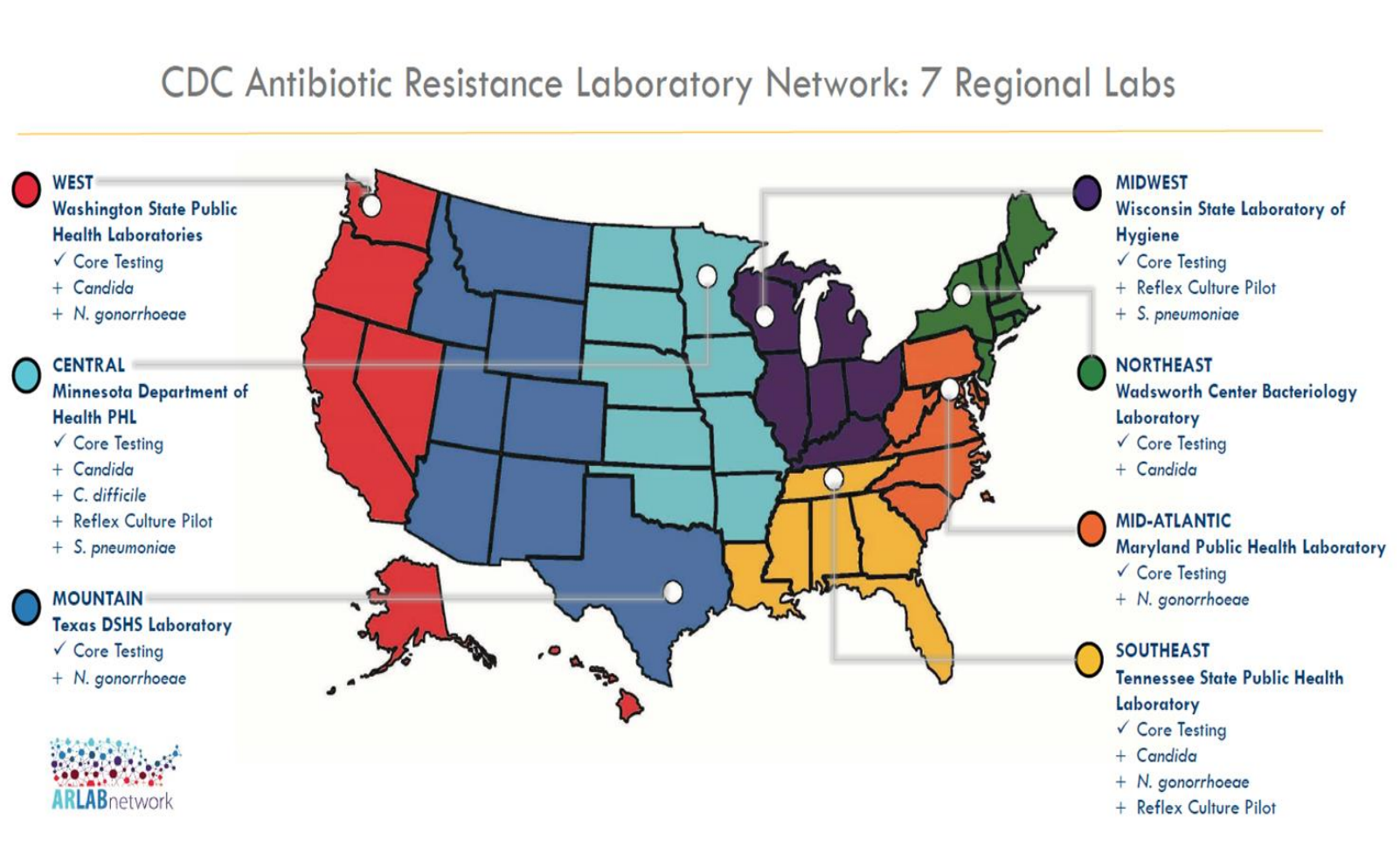
ARLN Locations



Carbapenem-Resistant (CR) Organisms of Interest

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

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Epidemiology Response

Containing Unusual Resistance

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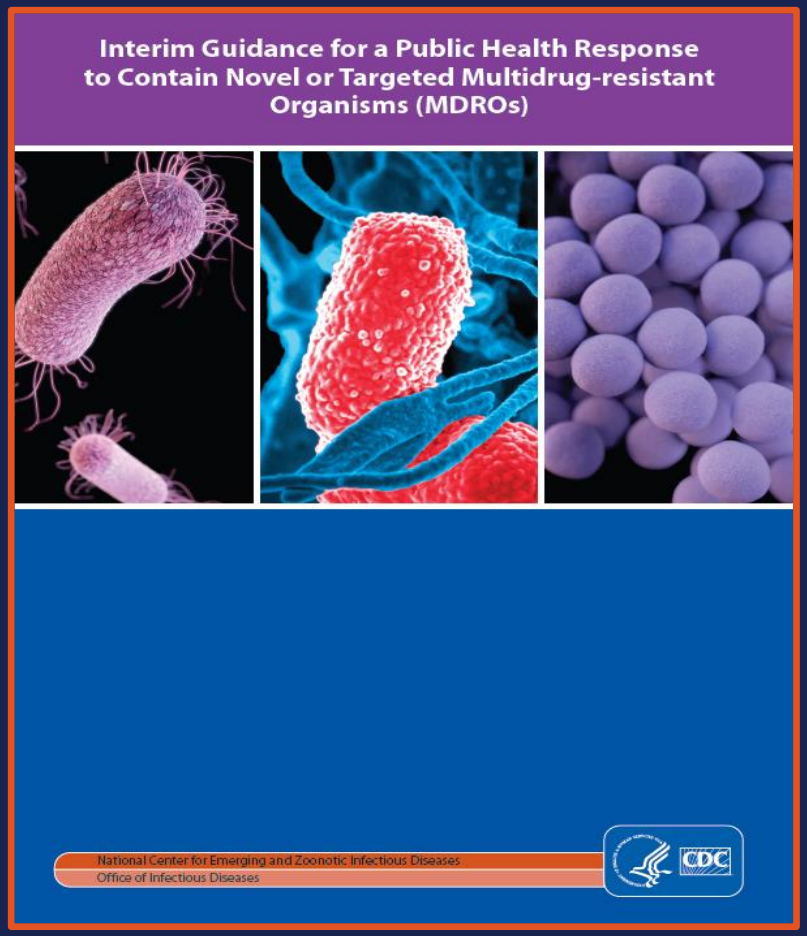
- Early and aggressive action, when even a single case is found, can keep these germs from spreading in healthcare facilities and causing hard-to-treat or even untreatable infections
- CDC estimates show that this aggressive approach could prevent 1,600 cases of CRE in one state over three years

CDC Response Guidance

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



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Containment

- 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

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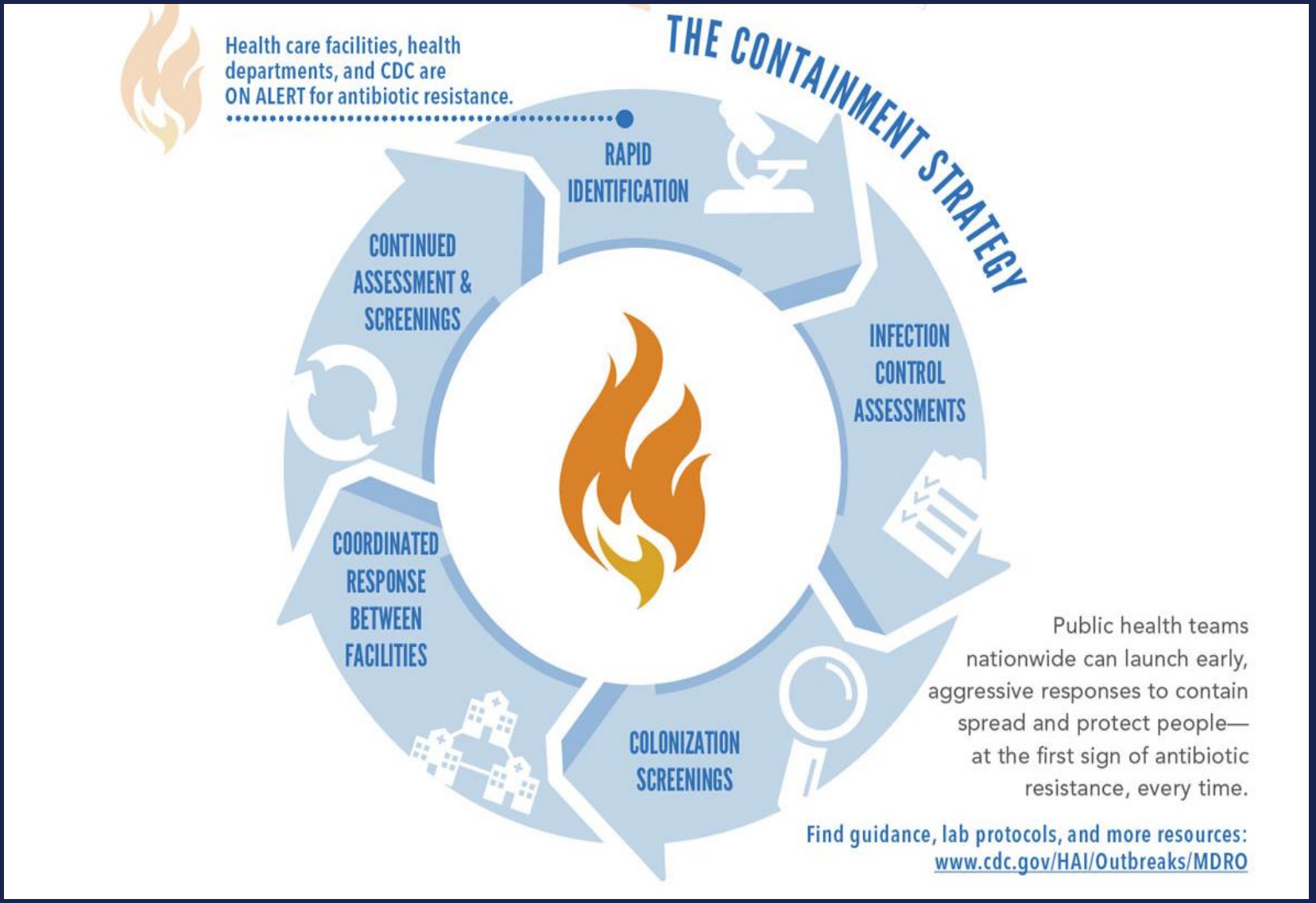

Containment Response Elements

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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

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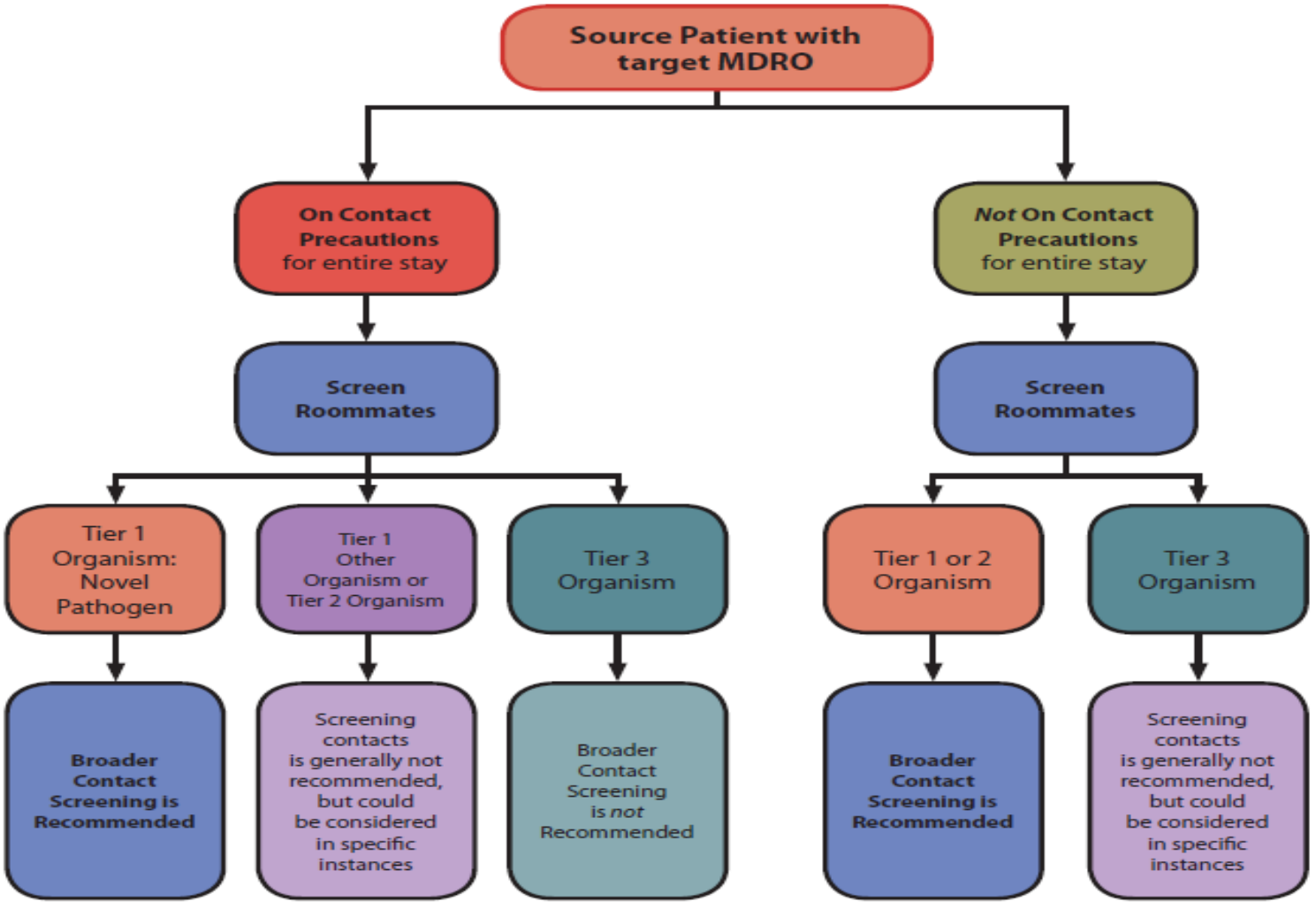
Figure 1: Approach to screening healthcare contacts following identification of novel or targeted multidrug- resistant organisms



https://www.cdc.gov/hai/outbreaks/mdro/index.html

Why is *Candida auris* a public health threat?

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All the makings of a fungal superbug!

- Highly drug-resistant yeast
- Causes invasive infections associated with high mortality
- Spreads easily in healthcare settings
- Difficult to identify

Resistance: *C. auris*

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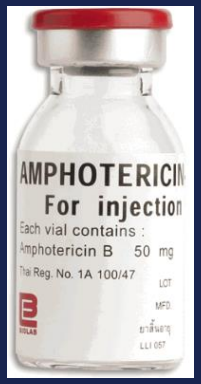
1

98.6%

Azoles

2



73.6%

Polyenes

3

0.6%

- 33.5% multidrug resistant
- No pan-resistance found through AR Lab Network

C. Auris: Difficult to Identify

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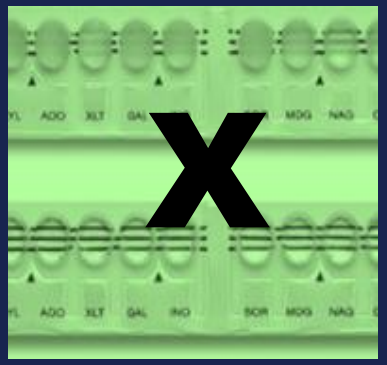
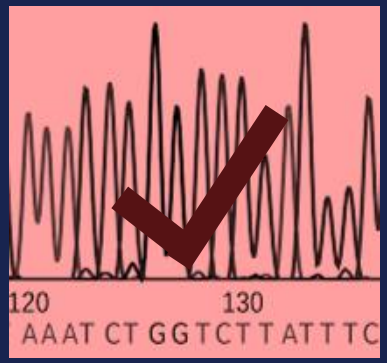


* Ver 8.01 software

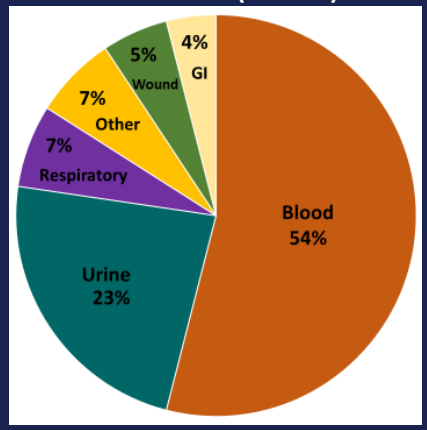
* RUO with Saramis Ver 4.14



Challenges with identification

- >40% of clinical cases in the US have been from non-bloodstream isolates (e.g., urine, bile, wounds)
- Species from non-sterile isolates often not identified

Initial culture site of *C. auris* clinical cases (n = 150)



Texas *C. auris* detection

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- Texas ARLN
  - *Candida* speciation
- CDC & other ARLNs
  - *Candida* antibiotic susceptibility testing
  - *Candida* colonization testing (one swab used for bilateral axilla and groin)

Texas *C. auris* Containment

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- Since June 2017, three patients identified with *C. auris* infections received healthcare in Texas
- On-site infection control assessments implemented at 3 facilities
- 3 colonization studies implemented
- 41 specimens tested
- No positive colonization results
- No positive prospective surveillance cultures

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Simulation Activity

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Part 1: Suspected Case of *C. auris*

You get a call from a clinical laboratorian about a possible case of *C. auris.*

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Part 1: Suspected Case

July 9, 2018

You Learn That...

A clinical laboratorian calls you because she has identified *Candida haemulonii* from a bloodstream specimen. Blood cultures were drawn on July 6, 2018. She recently read a state-wide laboratory alert about *C. auris* and wants to know if she should be concerned about *C. auris* and wants to know what (if anything) to do next.

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Part 1: Suspected Case

July 9, 2018

Discussion Questions

1. Should she be concerned about *C. auris*?
2. What additional information would you want to know?
3. What should you advise her to do?
4. What should you do next?

Part 2: Confirmed Case of *C. auris*

ARLN lab confirms that the *C. haemulonii* was in fact *C. auris.*

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Part 2: Confirmed Case of *C. auris*

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July 13, 2018

You Learn That...

The Texas ARLN lab confirms that the *C. haemulonii* isolate is in fact *C. auris.* Antifungal susceptibility testing results are not yet available. The report is sent immediately to the appropriate jurisdiction.

Part 2: Confirmed Case of *C. auris*

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July 13, 2018

Discussion Questions

1. What should the local or regional health department do next?

Part 3: Case History

The infection preventionist at the facility provides the state epi/HAI coordinator with the case patient history.

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Part 3: Case History

May 2018

You Learn That...

Hospitalized abroad for five weeks:

- The patient was in India when she developed symptoms of a stroke.
- She was admitted to the ICU in a hospital in India, where she underwent numerous neurosurgical procedures and received lots of antibiotics. After 3 weeks in the ICU, she was moved to a step-down unit.
- Following 10 days in the step-down unit, she was transferred directly to a U.S. acute care hospital.
- She has a tracheostomy and is ventilator-dependent and has a urinary catheter.

Part 3: Case History

June/July 2018

You Learn That...

Direct transfer to a U.S. short-stay acute care hospital for one week:

- On June 26, she was directly admitted to a stepdown unit in an acute care hospital.
- She was not initially on contact precautions.
- She had two roommates during the first week of the admission.
- On hospital day 7 (July 3), a sputum specimen revealed CRE-*E. coli.* She was immediately placed on contact precautions.
- On hospital day 10 (July 6), blood culture was drawn and yielded a yeast.

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Part 3: Case History

Discussion Questions

1. What are the key pieces of information?

Part 3: Case History

July 13, 2018

You Learn That…

Notifications:

- On July 13, you received the ARLN notification that this patient was confirmed to have *C. auris.*

Part 3: Case History

Discussion Questions

Based on the case history,

1. Do you need to notify any facilities about this patient's status?
2. What recommendation(s) should be made to prevent spread of *C. auris*?
3. Do you anticipate challenges in implementation of these recommendations?
4. Has this misidentification occurred before in the facility?

Part 4: Facility Assessments and Contact Evaluation

You have decided to visit the hospital to perform an infection control assessment and determine the need for screening.

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Part 4: Facility Assessments and Contact Evaluation

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July 16, 2018

You Learn That...

- The infection control assessment shows that adherence to hand hygiene and contact precautions is excellent and environmental cleaning is thorough.
- The hospital has 320 beds (80 per floor). Each floor is divided into four 20-bed units.

Part 4: Facility Assessments and Contact Evaluation

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Discussion Questions

1. Do you recommend screening to assess for *C.auris* transmission?
2. If yes, which patients should be screened?
3. How would you explain the importance of screening to the facility?
4. How would you explain available resources and screening logistics to the facility?

Part 5: Colonization Screening

Your health department decides to implement screening at the hospital. Your job is to identify a process for screening and determine how to engage all relevant partners.

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Part 5: Colonization Screening

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Screening Ability & Capacity

You Learn That…

Patient Screening:

- You and the facility agree to screen the patients who overlapped with the index case for three or more days, including her roommates. You identify 12 patients who overlapped with the case patient on the unit. Nine are still admitted, including her roommates.

Part 5: Colonization Screening

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Discussion Questions

1. Who approves each request for colonization screening?
2. How will you coordinate with the AR Lab Network regional lab for screening?
3. Who provides the screening supplies?
4. Who obtains patient consent and collects the swabs?
5. Who will receive testing results?

Part 5: Colonization Screening

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July 19, 2018

You Learn That…

Contact Screening:

- July 19, 2018: 9 patients are screened:
  - On August 6, 2018 the Texas ARLN reports that one of the patient's roommates screened positive for *C. auris*. The other 8 patients screened negative.
- On August 1, 2018 the patient is transferred to a nursing home.

Part 5: Colonization Screening

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Discussion Questions

1. What are your next steps (interventions/screening)?
2. How can you evaluate whether infection control practices are improving?
3. What are your next steps for the nursing home?

Part 6: Additional Screening

Your health department decides additional screening is necessary to ensure your recommendations are effective. Your job is to conduct follow-up point prevalence surveys and determine whether transmission is occurring.

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Part 6: Additional Screening

August 8, 2018

You Learn That…

Point Prevalence Survey #1:

- Screening is expanded to a point prevalence survey of the whole unit. Twenty patients are screened on August 8, 2018.
  - Results on August 22: no new cases are identified.

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Part 6: Additional Screening

Discussion Questions

1. Is further screening recommended?

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Part 6: Additional Screening

August 23, 2018

You Learn That…

Point Prevalence Survey #2:

- Fifteen patients are screened in the second point prevalence survey.
  - Results available on September 6: no new cases are identified.

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Part 6: Additional Screening

Discussion Questions

1. Is further screening recommended?
2. What kind of continued monitoring should be put in place?

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Thank you