Carbapenem-resistant Enterobacterales (CRE)

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- Work funded by CDC grant
- Conflicts of interest?

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Learning Objectives

Following the presentation, participants will be able to..

- Identify what is a CRE
- Learn the Current Epidemiology of CRE's
- CRE Identification and Testing
- Identify CRE risk factors
- CRE Transmission
- CRE Mitigation

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What is a CRE or CP-CRE?

Enterobacterales that test resistant to at least one of the carbapenem antibiotics or produce a carbapenemase (an enzyme that can make them resistant to carbapenem antibiotics) are called CRE

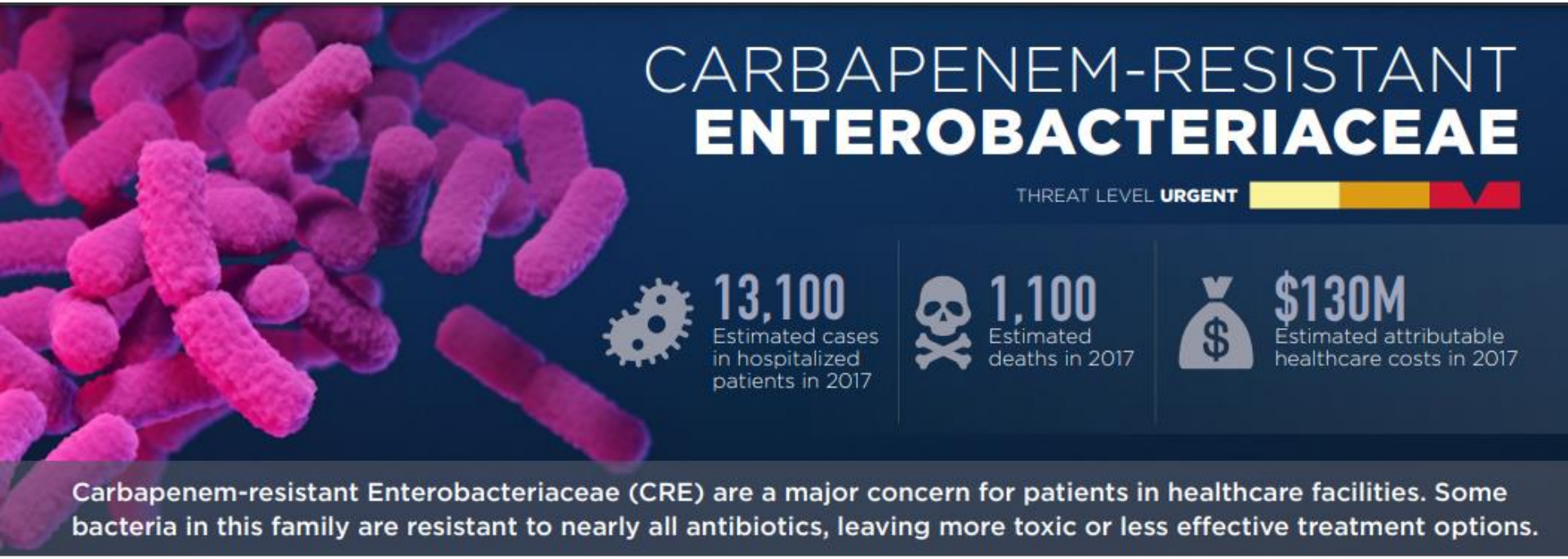
Common Plasmids:

- *K. pneumoniae* carbapenemase (KPC)
- New Delhi Metallo-beta-lactamase (NDM)
- Verona Integron-Encoded Metallo-beta-lactamase (VIM)
- Imipenemase (IMP)
- Oxacillinase-48 (OXA-48)

Carbapenem Antibiotics

- Doripenem
- Ertapenem
- Imipenem
- Meropenem

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



In the United States, CRE are generally associated with healthcare settings, and approximately 30% of CRE carry a carbapenemase. These carbapenemase genes are often on mobile genetic elements, which can be easily shared between bacteria, leading to the rapid spread of resistance

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

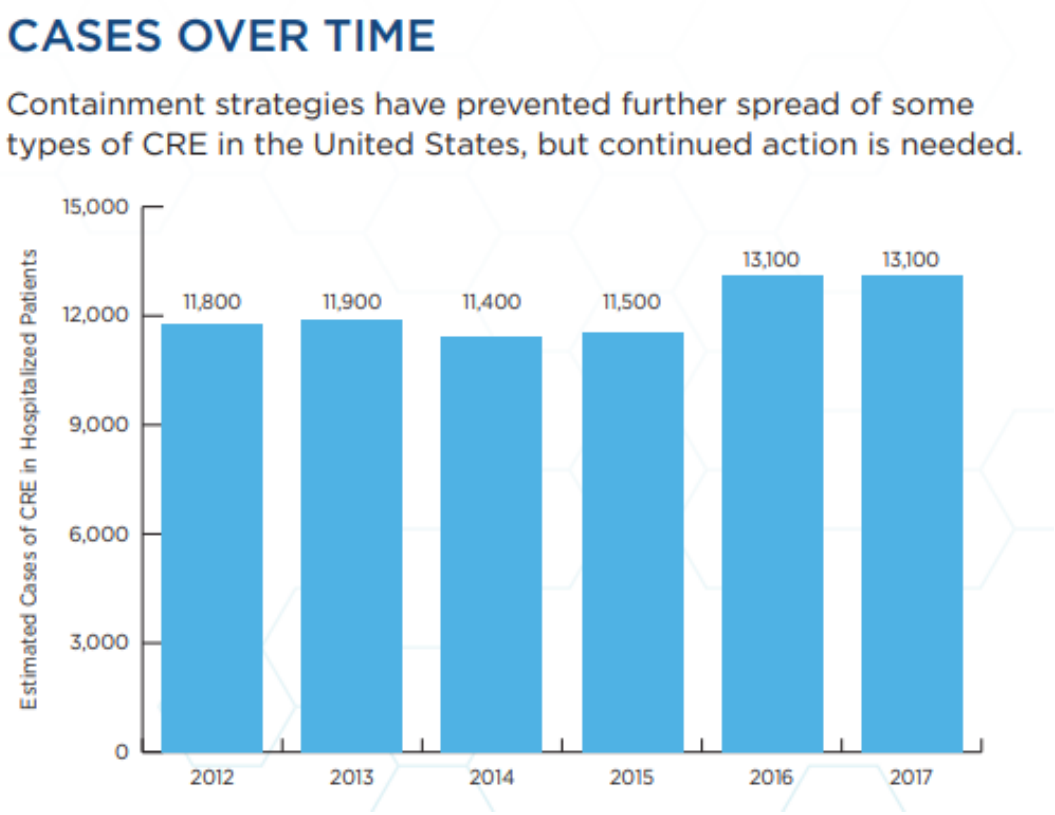
Why are CP-CRE Considered Epidemiologically Important?

- CRE organisms are often resistant to multiple classes of antibiotics, substantially limiting treatment options.
- Infections caused by these organisms are associated with high mortality rates among hospitalized patients, up to 50% in some studies.
- Many CRE produce carbapenemases, which can be transmitted from Enterobacterales to other germs, facilitating spread of resistance.
- Enterobacterales are a common cause of infections in both community and healthcare settings. Although CRE is currently primarily associated with inpatient healthcare settings, it has the potential to spread to community settings.

https://www.cdc.gov/hai/organisms/cre/cre-clinicians.html

Current CDC CRE Statistics

- Containment strategies have prevented further spread of some types of CRE in the United States, but continued action is needed.



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

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CRE and Carbapenemase Identification

CRE Identification

- Enterobacterales that test resistant to at least one of the carbapenem antibiotics on microbiology sensitivity report

Carbapenemase Identification

- Phenotypic tests for carbapenemase production
- Molecular assay for the presence of a carbapenemase gene

https://www.cdc.gov/hai/organisms/cre/technical-info.html#:~:text=Types%20of%20CRE-,How%20does%20CDC%20define%20CRE%3F,carbapenem%20antibiotics)%20are%20called%20CRE.

CRE Example

Escherichia coli

AUTOMATED SUSCEPTIBILITY	DISK DIFFUSION	Breakpoint	S.I.R.
Amikacin		16 ug/mL	Susceptible
Amoxicillin/Clavulanic		>16/8 ug/mL	**Resistant**
Ampicillin		>16 ug/mL	**Resistant**
Ampicillin/Sulbactam		>16/8 ug/mL	**Resistant**
Aztreonam		<=1 ug/mL	Susceptible
Cefazolin		>32 ug/mL	**Resistant**
Cefepime		>16 ug/mL	**Resistant**
Ceftazidime		>16 ug/mL	**Resistant**
Ceftriaxone		>32 ug/mL	**Resistant**
Cefuroxime		>16 ug/mL	**Resistant**
Ciprofloxacin		>2 ug/mL	**Resistant**
Doripenem	**Resistant**		
Ertapenem	**Resistant**		
Gentamicin		2 ug/mL	Susceptible
Imipenem	**Resistant**		
Levofloxacin		>4 ug/mL	**Resistant**
Meropenem	**Resistant**		
Nitrofurantoin		>64 ug/mL	**Resistant**
Piperacillin/Tazobactam		>64/4 ug/mL	**Resistant**
Tetracycline		>8 ug/mL	**Resistant**
Tobramycin		>8 ug/mL	**Resistant**
Trimethoprim/Sulfamethoxazole		<=0.5/9.5 ug/ml	Susceptible

PCR Testing	NDM-1

How to Test for CRE

- Clinical laboratories can perform phenotypic tests for carbapenemase production (e.g., CarbaNP, mCIM, and mCIM with eCIM) or molecular assays for the presence of a carbapenemase gene
- Carbapenemase testing is available through the AR Lab Network. This testing includes phenotypic testing for carbapenemase activity and molecular identification of the five carbapenemases most frequently identified in CRE: KPC, NDM, VIM, OXA-48-type, and IMP

https://www.cdc.gov/hai/organisms/cre/technical-info.html#Common

How Common are CRE Infections?

- In 2017, CRE caused an estimated 13,100 infections in hospitalized patients, and 1,100 estimated deaths in the United States [Source: 2019 AR Threats Report].
- NDM, VIM, and IMP are less commonly identified in CRE in the United States relative to KPC. Since the AR Lab Network began testing in 2017, only about 10% of carbapenemases identified have been metallo-β-lactamases (MBLs).

https://www.cdc.gov/hai/organisms/cre/cre-clinicians.html

Who is Most Likely to get a CRE Infection?

- Healthy people usually do not get CRE infections—
- Patients in hospitals and long-term care facilities like skilled nursing facilities and long-term acute care hospitals.
- Patients whose care requires devices like ventilators (breathing machines), urinary (bladder) catheters, or intravenous (vein) catheters
- Patients who are taking long courses of certain antibiotics
- Patients with weakened immune systems
- Healthcare-related risk factors include requiring help with most activities of daily living, like toileting and bathing, exposure to an intensive care unit, and mechanical ventilation.
- Several antibiotics have been associated with getting CRE, including carbapenems, cephalosporins, fluoroquinolones, and vancomycin.

https://www.cdc.gov/hai/organisms/cre/cre-clinicians.html

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How are CRE Germs Spread or Transmitted?

- In healthcare settings, CRE are transmitted from person to person, often via the hands of healthcare personnel or through contaminated medical equipment. Additionally, sink drains and toilets are increasingly recognized as an environmental reservoir and CRE transmission source.

https://www.cdc.gov/hai/organisms/cre/cre-clinicians.html

What Can Clinicians do to Prevent CRE Transmission?

- Know if patients with CRE are admitted to your facility and stay aware of CRE infection rates in your facility.
- When you transfer a patient with CRE, use an inter-facility transfer form to alert the receiving facility during the transition of care.
- Ask if a patient has received medical care somewhere else, including another facility or other countries.
- Screen patients who have had an overnight stay in a healthcare facility outside the United States in the prior 6 months for the presence of carbapenemase-producing CRE. Free admission screening is available through the AR Lab Network. Contact your HAI coordinator for more information on accessing AR Lab Network testing.
- Whenever possible, place patients currently or previously colonized or infected with CRE in a private room with a bathroom and dedicate noncritical equipment (e.g., stethoscope, blood pressure cuff) to CRE patients.
- Wear a gown and gloves when caring for patients with CRE.

https://www.cdc.gov/hai/organisms/cre/cre-clinicians.html

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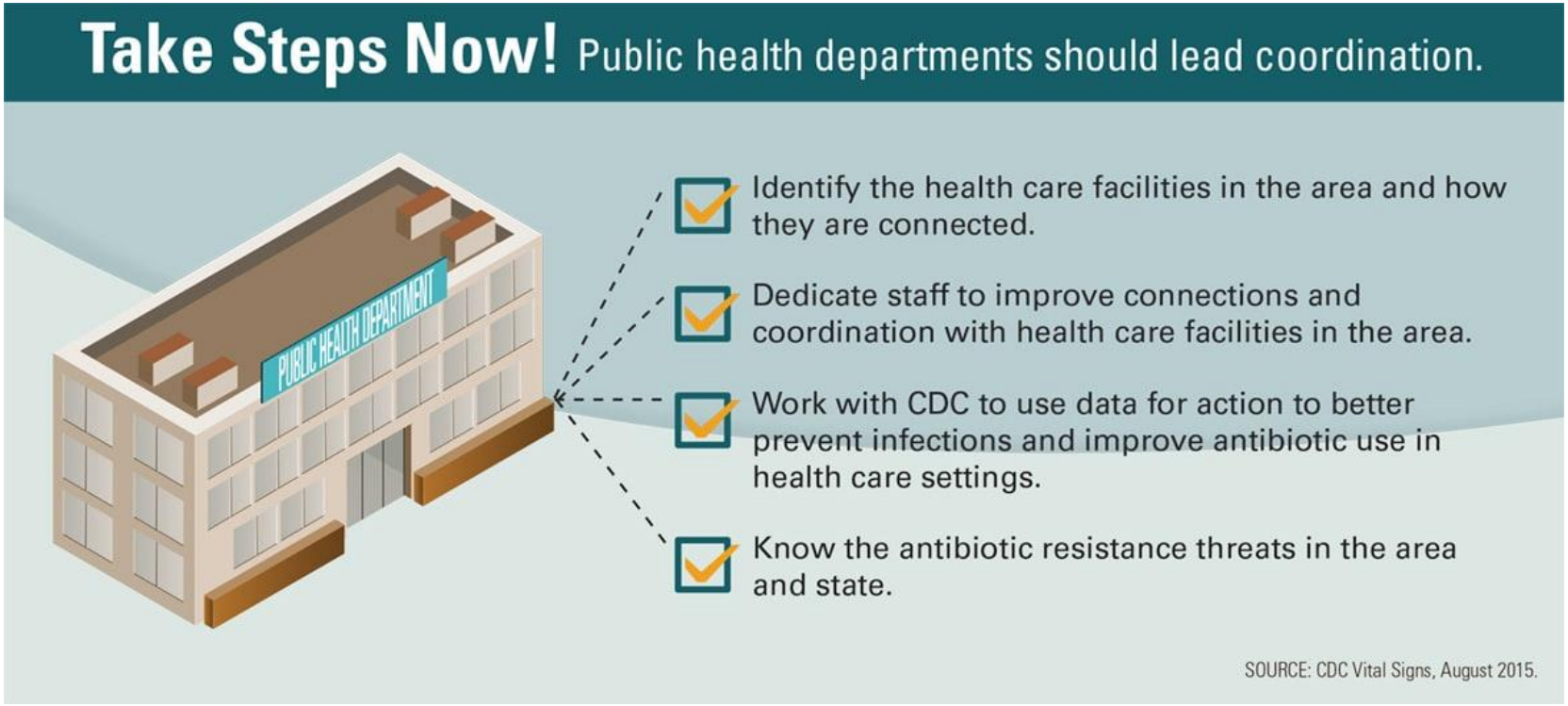
What Can Clinicians do to Prevent CRE Transmission?

- Perform hand hygiene—use alcohol-based hand rub or wash hands with soap and water before and after contact with patient or their environment.
- Make sure labs immediately alert clinical and infection prevention staff when CRE are identified. If your laboratory does not perform testing for carbapenemases, talk to your HAI coordinator about getting isolates tested through the AR Laboratory Network.
- Prescribe and use antibiotics appropriately.
- Discontinue devices like urinary catheters as soon as no longer necessary.
- When a patient with an unusual type of carbapenemase-producing CRE is identified in your facility, work with public health to prevent spread, including following guidance to assess for ongoing transmission.

https://www.cdc.gov/hai/organisms/cre/cre-clinicians.html

Public Health Departments and CRE



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Health Departments Should

- Understand the prevalence or incidence of CP-CRE in their jurisdiction by performing some form of regional surveillance for these organisms.
- Increase awareness among healthcare facilities of the regional prevalence of CP-CRE and prevention strategies and initiatives.
- Provide a standardized form for facilities to use during patient transfers, especially between hospitals and long-term care facilities.
- Consider including CRE infections on your state's Notifiable Diseases List.
- Include a range of facility types when developing regional CRE prevention projects.
- Be a resource for healthcare facilities on appropriate infection prevention measures and antimicrobial stewardship

https://www.cdc.gov/hai/mdro-guides/prevention-strategy.html

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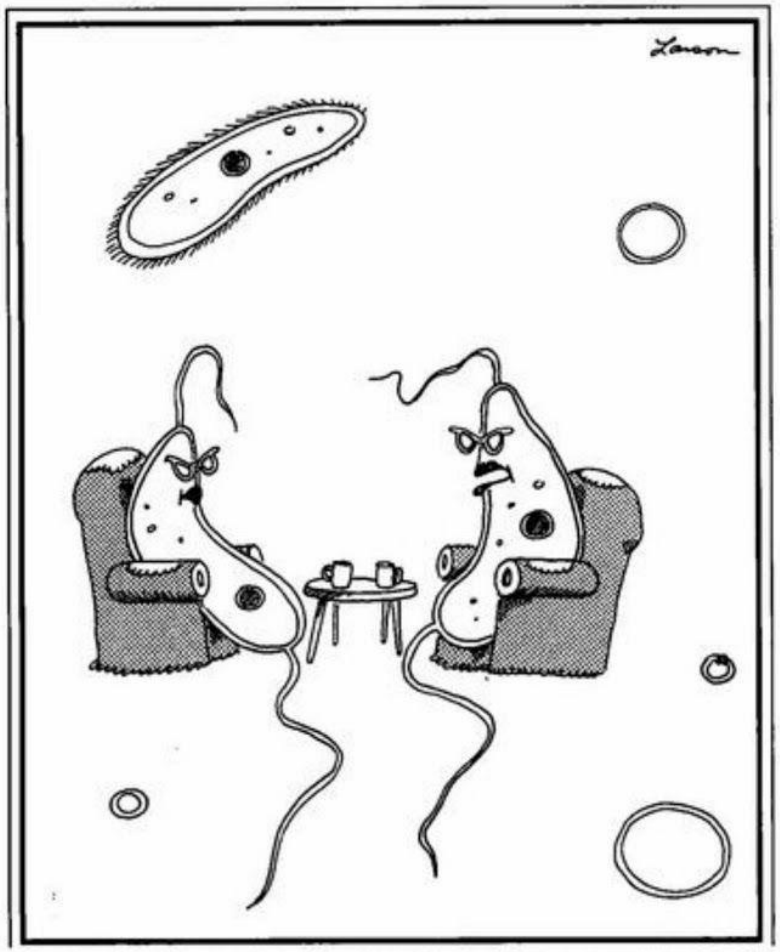
Questions?



"He told you *that*? Well, he's pulling your flagellum, Nancy."

Resources

- https://www.cdc.gov/hai/organisms/cre/index.html
- https://www.cdc.gov/drugresistance/pdf/threats-report/CRE-508.pdf
- https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf
- https://www.cdc.gov/hai/containment/PPE-Nursing-Homes.html
- https://www.cdc.gov/drugresistance/solutions-initiative/ar-lab-network.html