

What is Carbapenem-resistant Enterobacteriaceae?

Carbapenem-resistant Enterobacteriaceae (CRE) is increasingly becoming a worldwide clinical and public health problem. Resistance to carbapenem is defined as resistance to any antibiotic in the carbapenem class. Carbapenems currently available in the US for intravenous use include imipenem, doripenem, ertapenem, and meropenem. Organisms from the Enterobacteriaceae family found to produce carbapenemase, an enzyme that inactivates the antibiotic, also meet the definition of CRE.

Some of the most clinically relevant and commonly found CRE include *E. coli*, *Klebsiella* and *Enterobacter* species.

CRE are typically multi-drug resistant, limiting treatment options.

What is Carbapenemase -producing Carbapenem-resistant Enterobacteriaceae (CP-CRE)?

Carbapenemase -producing Carbapenem-resistant Enterobacteriaceae (CP-CRE) are Enterobacteriaceae that have the capability of producing carbapenemases. These enzymes inactivate carbapenem antibiotics, rendering the antibiotic ineffective. Although intrinsic carbapenem resistance associated with carbapenemase production exist, genes encoding carbapenemase production are frequently carried by plasmids. These plasmids can be transferred into other gram-negative bacteria, rendering the receiving organisms resistant to the action of carbapenems. Plasmid exchange is common in nature, increasing the risk of widespread resistance among different species of gram-negative bacteria. The number of carbapenemases reported continue to grow with cases reported in all 50 states, the most commonly encountered are KPC, VIM, IMP, NDM, OXA-48.

What is the difference between CRE and carbapenemase-producing (CP)-CRE?

CRE are defined by their phenotype based on the antibiotic susceptibility pattern. CRE have multiple mechanisms of resistance which include:

- Carbapenemase(s) production CP-CRE that inactivate carbapenems. These include enzymes like KPC, NDM, VIM, and IMP.
- Non-CP-CRE have other mechanisms of resistance; most commonly the production of beta-lactamases (e.g., AmpC) in combination with alterations in the bacteria's cell membrane (e.g., porin mutations)

CP-CRE are epidemiologically important and targeted for prevention due to the ability to spread rapidly and association with high mortality rates

How common are beta-lactamase producing

CP-CRE in New Mexico?

KPCs are the most common type of carbapenemase-producing CRE found in New Mexico. In addition, NDM, VIM, and OXA-48 have also been found in the state. CP-CRE have been found in patients in the community and healthcare settings.

Why are CP-CRE considered epidemiologically important?

Organisms within the Enterobacteriaceae family are commonly found to be etiological agents of both, community and healthcare associated infections. CP-CRE are considered epidemiologically important due to their ability to transfer genetic material encoding resistance into other organisms, thus spreading resistance. Treatment choices are limited to the use of highly toxic antibiotics such as colistin, or tailored regimens utilizing a combination of drugs in an attempt to overcome resistance mechanisms. The latter is challenging, not well-studied, and only available in centers with appropriate experience and expertise. Whenever possible, removal of the source of infection is one of the most effective strategies to achieve cure. Mortality rates associated to CRE infections, has been reported to be as high as 50% (MMWR 2013).

What is the Difference Between Being Colonized and Being Infected with CRE?

A person can either be colonized or infected with CRE. Individuals colonized with CRE carry the organism in their gastrointestinal tract, but do not have signs or symptoms of illness, and usually unaware that they are carriers. The duration of colonization status is unknown at this time; therefore, it is considered indefinite. As more experience and data become available this assumption may change. Decolonization is not recommended, nor known to be effective. A colonized person does not need antibiotics for their CRE. If a person is infected, s/he will likely be exhibiting signs and symptoms corresponding to the infection site.

Which Patients are at Increased Risk for CRE Acquisition?

- Individuals with multiple comorbidities
- Individuals with devices such as central lines and urinary catheters
- Hospitalized patients
- Nursing home residents and people admitted to other post-acute healthcare settings.
- Individuals taking long or frequent courses of antibiotics. Several antibiotics have been associated with CRE acquisition including carbapenems, cephalosporins, fluoroquinolones, and vancomycin. (CDC, 2015)

What Kind of Infections are Associated with CRE?

Infections that are associated with CRE include: pneumonia, urinary tract infection, wound infection, bloodstream infection, and intra-abdominal infections.

How are CRE Transmitted?

CRE are usually transmitted from person to person, often via the hands of healthcare personnel or via contaminated medical equipment in the healthcare setting. As Enterobacteriaceae can commonly be found in stool or wounds, contact with these might be particularly concerning. Ensuring the use of personal protective equipment during contact with bodily fluids/secretions/excretions and good hand hygiene following exposure to the patient's immediate environment, is very important.

What can Clinicians do to Prevent CRE Transmission?

Strategies to eliminate CRE transmission in healthcare settings focus primarily on recognizing cases, placing colonized or infected patients on Contact Precautions, using medical devices and antibiotics appropriately. Recommendations for the prevention of CRE transmission in healthcare settings includes;

- Hand hygiene
- Contact Precautions
- Healthcare Personnel Education
- Inter-facility Communication/ Identification of CRE Patients at Admission
- Laboratory Notification
- Patient and Staff Cohorting
- Screening Contacts of CRE Patients
- Environmental Cleaning

For more detailed recommendations, please see the Centers for Disease Control and Prevention (CDC) toolkit <https://www.cdc.gov/hai/organisms/cre/cre-toolkit/index.html>

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