

Carbapenem-resistant *Enterobacteriaceae* (CRE) rev Jan 2016

BASIC EPIDEMIOLOGY

Infectious Agent

Carbapenemase producing *Enterobacteriaceae* or Carbapenem-resistant *Enterobacteriaceae*, specifically *Klebsiella* species and *E. coli*, are Gram-negative bacilli that have the ability to break down the carbapenem antibiotic rendering it ineffective. Carbapenem resistance by *Enterobacteriaceae* can occur by many mechanisms, including the production of a metallo-beta-lactamase or a carbapenemase (such as *Klebsiella pneumoniae* carbapenemase, KPC) which can be transmitted from one *Enterobacteriaceae* to another. Metallo-beta-lactamases such as New Delhi metallo-beta-lactamase (NDM), are more common outside the United States but, in rare cases, have been identified in American patients with exposure to healthcare in other countries where these strains are endemic. CRE can also have additional resistance mechanisms that enable them to be nonsusceptible to many other classes of commonly used antibiotics.

Transmission

Enterobacteriaceae are a family of bacteria that can be found in a person's gastrointestinal tract that can cause infections both in community and healthcare settings. When found in a clinical culture, CRE can represent an infection or colonization (the organism is present but not causing any symptoms or disease). Colonizing CRE strains can escalate into full blown infections if they gain access to body sites that are usually sterile, like the bloodstream, bone or joints.

Transmission can occur via direct person-to-person contact or secondary contact with contaminated environmental surfaces, medical devices, or equipment. Additionally, the hands of healthcare workers who frequently touch these objects in patient environments often become vectors of transmission if hand hygiene compliance and/or transmission-based precautions are not adhered to.

Incubation Period

There is no set incubation period for exposure-to-illness onset.

Symptoms associated with CRE infections generally vary based on the site that is infected (e.g., cough if in the lungs, urinary symptoms if in the bladder) but can also include general symptoms like fever or chills.

Communicability

The period of communicability is unknown and may be as long as the organism is present in the individual. Studies have shown that 39% of individuals may remain colonized with CRE at 1 year from initial test date.

Clinical Illness

CRE can cause infections in almost any part of the body including bloodstream infections, ventilator associated pneumonia, and intra-abdominal abscesses. Based on information from a CDC pilot surveillance system most CRE infections involve the urinary tract, often in people who have a urinary catheter or have urinary retention.

Severity

The case fatality rate of CRE can be as high as 50%, as reported for bloodstream infections.

DEFINITIONS

Clinical Case Definition

When found in a clinical culture, CRE can represent an infection or colonization. There is no set clinical case definition as both can cause many types of symptoms.

Laboratory Confirmation

Carbapenem-resistant *Enterobacteriaceae* (CRE):

- *Klebsiella* species or *E.coli* from any body site/source that is laboratory confirmed.

Case Classification

- **Confirmed:** A *Klebsiella* species or *E.coli* from any body site/ source that is laboratory confirmed.
 - *Klebsiella* species and *E. coli* that are **resistant** to any carbapenem, including meropenem, imipenem, doripenem, or ertapenem,
OR
 - Production of a carbapenemase (i.e. KPC, NDM, VIM, IMP, OXA-48) demonstrated by a recognized test (i.e. polymerase chain reaction, metallo-
 - B-lactamase test, modified Hodge test, Carba NP).
- **Probable:** there is no probable case definition

SURVEILLANCE AND CASE INVESTIGATION

Case Investigation

Local and regional health departments should promptly address all reports of CRE.

Investigators should first review control measures with the reporting facility, when applicable.

An interview to get the required information can be performed at a later date, if needed;

interviewee can be an infection preventionist (IP), the person in charge of IP, or a surrogate for the case-patient. Please use the CRE Investigation Form available on the DSHS Website:

<http://www.dshs.state.tx.us/idcu/investigation/>

Case Investigation Checklist

- Confirm that the laboratory results meet the confirmed case definition
 - If it is unclear, call a DSHS HAI Epidemiologists for assistance.
- Ensure control measures are in place for cases and/or facilities (see below)
- Review medical records or speak to an IP or someone at the medical facility to verify demographics, symptoms, and course of illness.
- Refer to the CRE Investigation form for list of questions to cover
- Enter all confirmed case investigations and submit a notification in the NBS within 30 days of initial report.

Control Measures

Control measures for Cases

Ideally the facility is performing control measures for the case and the Epi investigator is communicating directly with the facility, most likely with the IP or whoever is over infection prevention. The Epi investigator may also speak with the patient directly. In any situation, the investigator should make sure the below control measures are addressed:

Specific Control Measures

- Facilities should ensure that healthcare personnel are vigilant with hand hygiene practices and ensure that:
 - Hand hygiene sinks are accessible and free from clutter/supplies;
 - Alcohol-based hand sanitizers are also accessible and well stocked.
- Ensure the patient is on contact precautions/ contact isolation. Contact precautions entail:
 - Performing hand hygiene before entry into the room;
 - Donning (putting on) at a minimum gown and gloves either before or upon immediate entry into patient's room;
 - Doffing (removing) gown, gloves and any other personal protective equipment (PPE) before exiting or upon immediate exiting of the patient's room;
 - Performing hand hygiene before exiting or upon immediate exiting of the patient's room.
 - No recommendation currently exists for when to discontinue contact precautions. A facility should consult with an infectious disease physician or the IP or other provider that initiated the precautions; they may also call a DSHS HAI Epidemiologists for assistance.
- Ensure disinfection of reusable equipment before and after each use.
- Recommend optional screening for cohabitant of patient (if one exists) for CRE, via rectal swab. See CDC Laboratory Protocol http://www.cdc.gov/hai/pdfs/labsettings/klebsiella_or_ecoli.pdf
- Recommend single patient rooms if available.
 - If single rooms are not feasible, recommend cohorting like patients (ex: a patient with CRE and another patient with CRE)
- Also recommend staff cohorting if possible.
- Recommend reducing the use of invasive medical devices for patients on the unit where the case was cared for, as invasive devices increase patient's risk of infection.
- If the patient has been discharged from the reporting facility and the receiving facility is known, the investigator will need to contact the receiving facility and inform them of the MDRO and ensure control measures are in place. The investigator might have to further educate about the MDRO and control measures depending on the healthcare facility.

Treatment

Each case will have a unique treatment option. It is recommended that the reporting facility work with a clinical pharmacist and/or an infectious disease physician for an individualized treatment plan.

Exclusions

Students (K-12) and daycare age children with CRE wound infection need to be excluded from attendance until drainage from wounds or skin and soft tissue infections is contained and maintained in a clean dry bandage; restrict from situations that could result in the infected area becoming exposed, wet, soiled, or otherwise compromised. No other exclusions apply.

MANAGING SPECIAL SITUATIONS

Outbreaks

If an outbreak is suspected, notify a DSHS HAI Epidemiologist for your Health Service Region (HSR).

Outbreak Definition

At this time there are no defined criteria for an outbreak. If your health department believes they are working an outbreak, it is recommended to speak with your HSR HAI Epidemiologists.

REPORTING AND DATA ENTRY REQUIREMENTS

Provider, School and Child-care Facilities, and General Public Reporting Requirements

Cases of Carbapenem-resistant *Enterobacteriaceae* (CRE) should be reported within 1 working day to the local or regional health department. If the jurisdiction is unclear, call a DSHS HAI Epidemiologist or Emerging and Acute Infectious Disease Branch (EAIDB) at 512-776-7676 for assistance.

Local and Regional Reporting and Follow-up Responsibilities

Local and regional health departments should:

- Promptly investigate all reported cases
- Ensure control measures are in place and provide education to prevent further spread of disease
- Enter the case into NBS when first occurrence is reported. Submit an NBS notification on all confirmed cases of CRE to DSHS within 30 days.
 - Please refer to the NBS Data Entry Guide for specific details on how to properly complete an NBS investigation, laboratory report and notification.

When a cluster or an outbreak is investigated, local and regional health departments should:

- Report suspected outbreaks within 24 hours of identification to a DSHS HAI Epidemiologist.
 - Fax the investigation form and all other supporting documents to the regional DSHS HAI Epidemiologist.
- If labeling a case as part of an outbreak, the outbreak must be named in NBS. Outbreak names must be requested through the NEDSS (NBS) office. The staff can be reached by phone (512) 458-7111 ext. 7729 or email nedss@dshs.state.tx.us

DISEASE REPORTING

Purpose of Reporting and Surveillance

- To prevent transmission of infections with CRE, specifically CRE-*Escherichia coli* (CRE-*E.coli*) and CRE-*Klebsiella* species in healthcare facilities and the community, by decreasing the likelihood of transmission through the investigation process.
- To improve the detection, monitoring and epidemiological characterization of CRE in Texas.
- To develop, implement and evaluate strategies to prevent the emergence, transmission and persistence of CRE.

- To conduct and support epidemiological studies to identify outbreaks and potential sources of ongoing transmission in various populations.
- To identify further trends related to continued antibiotic resistance and the development of MDROs in Texas.

Requested Reporting

- As of April 20, 2014, healthcare providers, healthcare facilities and/or laboratories are required to report CRE (only *Klebsiella* species and *E. coli*) which is a notifiable conditions in Texas. Report to the most local health jurisdiction **within 1 working day.**

Local Health Jurisdiction Investigation Responsibilities

- Local health departments may choose to request assistance with the investigation and reporting of CRE from a regional DSHS HAI Epidemiologists.
- Because of the potential for transmission of CRE to vulnerable patients in healthcare settings, public health action is imperative in controlling further transmission by: instituting control measures, identifying and screening close contacts of cases that could transmit in healthcare settings, if indicated, and ensuring that the facility IP has been notified and that appropriate infection control measures are in place.

LABORATORY PROCEDURES

Clinical laboratories are not required to submit isolates to the DSHS Laboratory. To obtain confirmatory, gene sequencing or phenotypic testing, clinical laboratories should contact a reference laboratory for those services. The reference lab will give guidance on specimen collection, submission form and shipping.

Any specimen sent to the DSHS Laboratory for possible outbreak situations or molecular testing requires prior approval from a DSHS HAI epidemiologist.

UPDATES

- Added CRE as its own condition.
- Updated the CRE definition per the CSTE position paper that came out April 2015.
- Deleted most of the section related to control measures for cases (aka patients) to avoid confusion as it is not necessary in most MDRO investigations to interview the patient.
- Clarified verbiage on who to contact if assistance is needed by the LHD/ HSR; contact your DSHS HAI epidemiologist.