
Appendix 1: Carbapenem-Resistant Enterobacteriaceae (CRE)

- I. Definition: 2015 CDC definition of CRE are Enterobacteriaceae¹ that are:
 - A. Resistant to any carbapenem antimicrobial (i.e., minimum inhibitory concentrations of ≥ 4 mcg/ml for doripenem, meropenem, or imipenem OR ≥ 2 mcg/ml for ertapenem)
OR
 - B. Documented to produce carbapenemase
 - C. In addition, for bacteria that have intrinsic imipenem nonsusceptibility (i.e., *Morganella morganii*, *Proteus* spp., *Providencia* spp.), resistance to carbapenems other than imipenem is required.

- II. Background: **CP-CRE are of epidemiologic concern** and drive the infection prevention strategies and patient isolation at UCSF Health.
 - A. CRE are important for a number of reasons:
 1. These organisms are often resistant to multiple classes of antimicrobials substantially limiting treatment options.
 2. Infections caused by these organisms are associated with high mortality rates, up to 50% in some studies.
 3. Many CRE possess carbapenemases which can be transmitted from one Enterobacteriaceae to another potentially facilitating transmission of resistance.
 4. Enterobacteriaceae are a common cause of infections in both community and healthcare settings. Carbapenem resistance among these organisms could therefore have far-reaching impact.
 - B. Carbapenem resistance among Enterobacteriaceae can be due to several different mechanisms.
 1. Non-carbapenemase-producing CRE (non CP-CRE): Some CRE possess a β -lactamase (e.g., AmpC or extended-spectrum β -lactamase (ESBL)) which can render an organism nonsusceptible to carbapenems.
 2. Carbapenemase-producing CRE (CP-CRE): Some CRE possess a carbapenemase (carbapenemase-producing CRE or CP-CRE) that directly breaks down carbapenems.
 - a) Carbapenemase genes can be spread between bacteria with potential for widespread transmission of carbapenem resistance.

- III. Microbiology Testing Methodology
 - A. Patient samples sent for clinical bacterial cultures are assessed for growth of organisms. Enterobacteriaceae isolates meeting criteria for susceptibility testing (i.e. those that are predominant from an appropriate source and not considered to be part of normal flora)

are tested by broth microdilution (Trek Sensititre), E-test or disc diffusion (Kirby-Bauer) methods. Carbapenem-resistant isolates are confirmed by repeat MIC testing.
B. No separate screening test procedure is developed at the time of this writing. All samples sent for bacterial culture are tested.

IV. Infection Prevention Strategies

A. **CP-CRE** will be the target of infection prevention strategies at UCSF Health. Refer to CRE Testing and Isolation Algorithm:

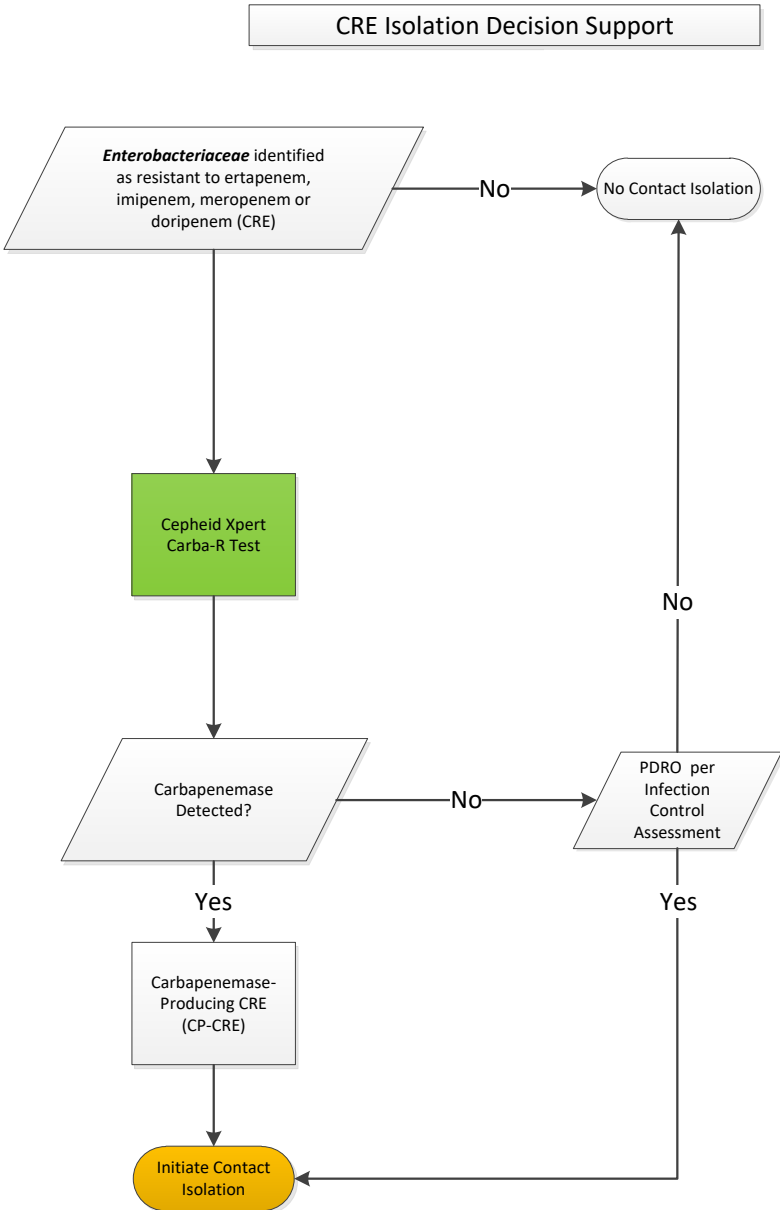


Figure 1. CRE Testing and Isolation Algorithm

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- B. Contact Isolation: Place patients with **CRE** in Contact Isolation pending results of the Cepheid Xpert Carba-R. If carbapenemase is detected (CP-CRE), continue Contact Isolation. If carbapenemase is not detected (non-CP-CRE), Contact Isolation may be discontinued unless recommended by HEIP and Infectious Diseases to continue.
1. Discontinuing Contact Isolation: At this time, CDC does not provide recommendations for discontinuing Contact Isolation for a patient who has tested positive for CP-CRE.
 - a) Continue Contact Isolation for the duration of hospitalization in which the CP-CRE was identified.
 2. Place patient in Contact Isolation for subsequent hospitalizations unless:
 - a. DPH has determined Contact Isolation may be discontinued.
 - b. Review by HEIP and Infectious Diseases determines discontinuing Contact Isolation is advised.
- C. Core Measures for Interrupting Transmission of CRE
1. Hand hygiene: Follow all UCSF instructions for cleaning hands (IC Policy 1.2) with every encounter with a patient with CRE.
 - a) Monitor compliance with hand hygiene instructions.
 - b) Provide immediate coaching for lapses
 2. Place patients with CP-CRE or history of CP-CRE in Contact Isolation, and continue Contact Isolation until discharge.
 3. Health care personnel education:
 - a) Hand Hygiene
 - b) Properly putting on and removing PPE
 4. Minimize use of indwelling devices (e.g., central lines, urinary catheters, endotracheal tubes)
 5. Practice antimicrobial stewardship -- please contact the Adult or Pediatric Antimicrobial Stewardship Programs (ASP) for guidance on antibiotic selection and duration.
- V. UCSF Internal Reporting
- A. UCSF Microbiology will report organisms meeting the 2015 CDC criteria for CRE to the patient's physician. These calls will include the patient name, medical record number; location, organism and susceptibility pattern. Place patients on Contact Isolation pending results of carbapenemase testing (Figure 1).
 - B. HEIP will notify:
 1. Nursing unit housing the patient to ensure the patient identified with CP-CRE is placed into Contact Isolation until discharge.
 2. Case Management, if the patient is currently an inpatient.

- a. Send email communication including Healthcare Facility Transfer Form (Abbreviated)- See below
- C. Prior to discharge, Case Management will:
 - 1. Notify the receiving facility, if patient identified with CRE is transferred to another facility, using the Healthcare Facility Transfer Form (Abbreviated), below
- D. As needed, HEIP will communicate with Infection Prevention of the receiving facility to review the patient's CP-CRE history and status.
- E. HEIP will consult with UCSF Infectious Diseases, San Francisco Department of Public Health (SFDPH) as necessary to ensure a smooth transition.
- F. SFDPH will communicate with the local jurisdiction of the patient's destination as necessary.
- G. Local jurisdictions have varying reporting requirements; if CMR is requested, requesting jurisdiction will be directed to communicate with the patient's provider.

VI. Documentation

- A. HEIP will document in the patient's medical record:
 - 1. Consult note (if the patient is currently an inpatient) identifying the pathogen(s) as CP-CRE, and the need for Contact Isolation.
 - 2. On the Infection tab, complete the Infection portion of the record to indicate CP-CRE (if appropriate). This will identify the patient as CP-CRE positive upon future admissions to UCSF.
- B. Case Management will complete the Healthcare Facility Transfer Form (Abbreviated), below.
 - 1. SFDPH may be contacted to assist a facility without experience caring for a patient with CP-CRE.

VII. Departments of Public Health required reporting:

- A. Per Title 17, California Code of Regulations (CCR), Section 2505, laboratories are required to report test results suggestive of Carbapenem-resistant Enterobacteriaceae (Carbapenemase-producing).
- B. Several counties in the State of California require reporting cases of CP-CRE; SFDPH will communicate with those counties, should patients with CP-CRE be transferred to or from those jurisdictions.

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- C. HEIP will monitor reporting requirements and adhere to evolving reporting requirements.




Affix patient labels here.

HEALTHCARE FACILITY TRANSFER FORM (ABBREVIATED)

Use this form for all transfers to an admitting healthcare facility.

Patient Name (Last, First):		
Date of Birth:	MRN:	Transfer Date:
Receiving Facility Name:		
Sending Facility Name:		
Contact Name:	Contact Phone:	

ISOLATION PRECAUTIONS

Patient currently on isolation precautions? <input type="checkbox"/> Yes <input type="checkbox"/> No		
If yes, check all that apply: <input type="checkbox"/> Contact precautions <input type="checkbox"/> Droplet precautions <input type="checkbox"/> Airborne precautions		
Personal Protective equipment (PPE) to consider at receiving facility:		
 <input type="checkbox"/> Gloves	 <input type="checkbox"/> Gowns	 <input type="checkbox"/> Masks

ORGANISMS

Patient has multidrug-resistant organism (MDRO) or other lab results for which the patient should be in isolation? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, specify organism(s) and include specimen source and collection date.		
Organism	Source	Date
<input type="checkbox"/> <i>C.difficile</i>		
<input type="checkbox"/> Carbapenem-resistant <i>Enterobacteriaceae</i> (CRE) (e.g., <i>Klebsiella</i> , <i>Enterobacter</i> or <i>E.coli</i>)		
<input type="checkbox"/> Extended-spectrum beta lactam-resistant (ESBL) (e.g., <i>E.coli</i> , <i>Klebsiella</i>)		
<input type="checkbox"/> MDR gram negatives (e.g., <i>Acinetobacter</i> , <i>Pseudomonas</i>)		
<input type="checkbox"/> Methicillin-resistant <i>Staphylococcus aureus</i> (MRSA)		
<input type="checkbox"/> Vancomycin-resistant <i>Enterococcus</i> (VRE)		
<input type="checkbox"/> Other, specify: (e.g., lice, scabies, disseminated shingles (<i>Herpes zoster</i>), norovirus, influenza, tuberculosis)		

Include copy of lab results with organism I.D. and antimicrobial susceptibilities.