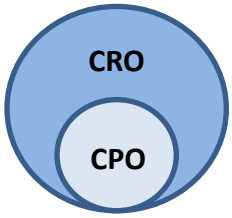
California Department of Public Health

Carbapenemase-Producing Organisms Quicksheet

The CDPH Healthcare-Associated Infections (HAI) Program created the carbapenemase-producing organisms (CPOs) Quicksheet to provide guidance to local health departments (LHDs) responding to CPO cases at **all levels** of local CPO endemicity. This Quicksheet is designed to be used alongside the CDPH Regional CPO Prevention and Response Strategy[1] ("Response Phases" document), which provides additional infection prevention and control (IPC) and screening recommendations that change based on local or regional CPO epidemiology**. Implementing some practices (e.g., cohorting) in this guidance can be challenging or not feasible in some healthcare facilities, but this should not preclude facilities from accepting and caring for patients and residents with CPOs.**

Background and Epidemiology

- Carbapenem-resistant organisms (CROs) are gram-negative bacteria that are resistant to at least one carbapenem antibiotic (e.g., meropenem). CROs include carbapenem-resistant Enterobacterales (CRE), *Pseudomonas aeruginosa* (CRPA), and *Acinetobacter baumannii* (CRAB).
- A ***subset*** of CROs are carbapenemase-producing organisms (CPOs). CPOs make carbapenemase enzymes (e.g., NDM, KPC, OXA, VIM, IMP[2]) which inactivate carbapenem antibiotics. Examples of CPOs that have been identified in California include VIM-CRPA, NDM-CRAB, and KPC-*E. coli*.



- Carbapenemase genes can be transmitted within and between bacterial species on mobile genetic elements, which can increase the spread of antimicrobial resistance.
- CPOs can cause outbreaks in healthcare settings, tend to be more difficult to treat, and have poorer patient outcomes.
- CPOs can spread patient-to-patient via transient contamination of the hands or clothing of healthcare personnel (HCP), or via contaminated equipment or the healthcare environment.
- Risk factors include presence of indwelling medical devices, broad-spectrum antibiotic or antifungal use, and recent international travel or healthcare exposure.
- In California, CPO cases have been increasing since 2019 (Fig. 1). We are also seeing a rise in dual mechanism CPOs, and rarer organism and mechanism CPO combinations (Fig. 2).

Fig. 1. CPO Cases Reported by Organism, 2019–2023

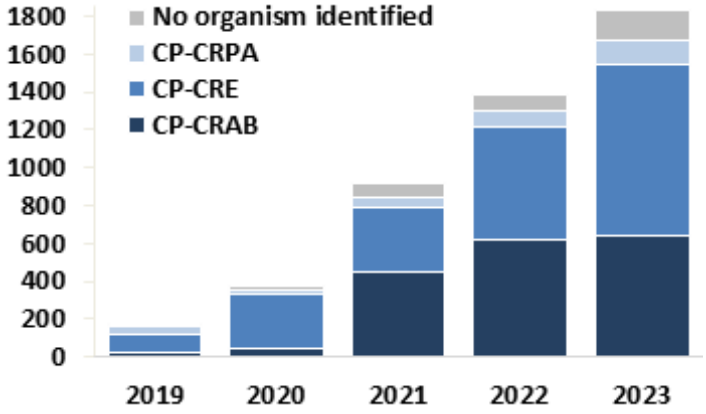
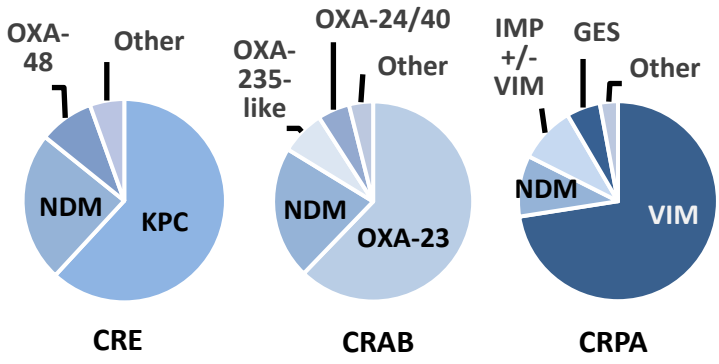


Fig. 2. Carbapenemases Identified in CRE, CRAB and CRPA Isolates, 2019–2023



[1] CDPH CPO Response Phases (PDF) (www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CPO_Phases.pdf)

[2] GES = Guiana extended-spectrum β-lactamase, KPC = *Klebsiella pneumoniae* carbapenemase, IMP = imipenemase, NDM = New Delhi metallo-β-lactamase (NDM), OXA = oxacillinase, VIM = Verona integron metallo-β-lactamase

For more information or consultation, contact HAIProgram@cdph.ca.gov or call 510-412-6060.

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CRO versus CPO

- If not already completed, CROs should be tested for carbapenemases.[3]
- Some IPC measures are implemented for patients with CROs. However, contact tracing and screening are reserved for confirmed CPO cases and generally not indicated for CRO cases.
- See IPC practice and carbapenemase testing recommendations for CROs in the companion document at the end of the Quicksheet.

CPO Reporting Requirements[4, 5, 6]

✓ CPOs are reportable by laboratories.
✓ Report unusual infectious disease occurrences and outbreaks to CDPH Licensing & Certification if in a licensed healthcare facility.

CPO Containment Recommendations

1. Surveillance

a. Identification of CPOs from Clinical Isolates

- Clinical labs perform carbapenemase testing on confirmed CRE, CRPA (additionally non-susceptible to cefepime or ceftazidime, or resistant to ceftolozane/tazobactam), and CRAB isolates.[3]
- Carbapenemase testing is available at some local public health labs and the CDPH Microbial Diseases Laboratory (MDL).[7]
- Clinical labs immediately notify clinicians and infection prevention staff whenever a CPO is identified.

b. Enhanced Detection among High-Risk Populations

- For the following patients at risk of CPO acquisition, healthcare facilities screen for CPOs and place on empiric Contact Precautions, or implement Enhanced Barrier Precautions (EBP)[8] empirically in SNFs with no outbreak, pending the test result[9]:
  - patients admitted **to** any long-term acute care hospital (LTACH) or ventilator-equipped skilled nursing facility (vSNF) ventilator unit
  - patients admitted **from** any LTACH, vSNF ventilator unit, or other facility with known CPO outbreak.
    - In short-stay acute care hospitals, alternatively or additionally consider screening patients admitted to high-risk units (e.g., ICU).
  - high-risk contacts of a confirmed CPO case, including roommates, those who shared a bathroom, those who occupy the same bedspace immediately after the index patient.[10]
    - Consider patients in the same unit or facility based on LHD phase[1] and facility type.
  - Consider screening patients not included above with other known risk factors such as patients:
    - with indwelling devices, particularly those who are mechanically ventilated or trached;
    - colonized or infected with *Candida auris*, especially those requiring high-level care (e.g., indwelling medical devices, mechanical ventilation); and
    - with healthcare exposure outside of California in the past 12 months (i.e., in other states or countries).
- See Response Phases guidance for additional screening considerations.[1]

2. Investigation

- Investigate all clusters and uncommon CPOs. LHD staff may provide specific recommendations for

[3] CDPH Prioritizing Carbapenemase Testing Algorithm (PDF) (www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CPTestingPrioritizationAlgorithm.pdf)
[4] CDPH CPO Reporting FAQ (PDF) (www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CPOReportingFAQ.pdf)
[5] CDPH Reportable Diseases and Conditions (www.cdph.ca.gov/Programs/CID/DCDC/Pages/Reportable-Disease-and-Conditions.aspx)
[6] CDPH All Facilities Letter 23-08 (www.cdph.ca.gov/Programs/CHCQ/LCP/Pages/AFL-23-08.aspx)
[7] CDPH MDL Carbapenemase Testing FAQ (www.cdph.ca.gov/Programs/CID/DCDC/Pages/MDL-Expanded-Carbapenemase-Testing-Services-FAQs.aspx)
[8] CDC Enhanced Barrier Precautions (www.cdc.gov/long-term-care-facilities/hcp/prevent-mdro/PPE.html)
[9] CDC Preventing MDROs: FAQs (www.cdc.gov/healthcare-associated-infections/php/preventing-mdros/preventing-mdros-faqs.html)
[10] CDPH Screening Decision Tree (PDF) (www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/Tier2_Pathogen_Screening_Decision_Tree.pdf)

individual case investigation and notification based on local epidemiology.[1]

3. Initial Response and Recommendations

- LHD ensures the following information is complete in the case report:
  - Patient name, date of birth, race, ethnicity, gender, collection facility, collection facility type, date of collection, specimen source
- Phase 1 and 2 LHDs[1] collect additional epidemiological information for all healthcare exposures from at least 30 days prior to specimen collection (using CalREDIE or line list as relevant):
  - Dates of admission, discharge, initiation of Contact Precautions or EBP (if SNF)
  - Previous, subsequent healthcare exposure
  - Locations (e.g., units, rooms)
  - Additionally collect information about healthcare exposures outside California or the U.S. in the previous 12 months
- In hospitals, implement Contact Precautions and place the patient in a single-bed room. In SNFs, implement EBP if no outbreak; if no single-bed room is available, cohort with another resident colonized with the same CPO, whenever possible.[11]
- Inform receiving facilities of patient's CPO status at time of transfer (see section 5).

4. Additional IPC Recommendations

Room Placement Considerations

- Facilities with multiple patients with CPO(s) may create cohorts within rooms or in the same geographic area of the facility. Factor in other communicable disease status (e.g., *C. auris*) when creating cohorts, whenever possible.[11]
- In multi-bed rooms, treat each bed space as a separate room, even when patients are cohorted. HCP must change gown and gloves and perform hand hygiene between contact with patients in the same room.

Hand Hygiene

- Follow and audit hand hygiene practices, including the use of alcohol-based hand sanitizer as the preferred method for cleaning hands if not visibly soiled; if visibly soiled, wash with soap and water.

Transmission-based Precautions

- Contact Precautions consist of HCP use of gowns and gloves upon entry to the patient room; patients may only leave room when medically necessary.
- Continue Contact Precautions for the duration of admission in hospitals, including LTACHs.
- In SNFs, implement Contact Precautions during a CPO outbreak until containment can be demonstrated; in the absence of an outbreak, implement EBP consisting of gown and glove use during high-contact care activities. Residents may leave their room if they can be maintained in hygienic condition and don clean clothing.[12]
- Do not perform repeated cultures or screening to demonstrate CPO "clearance" for purposes of discontinuing Transmission-based Precautions, as patients may remain colonized for many months or years, possibly indefinitely.[9]

Dedicated Equipment and Staff

- Dedicate patient care equipment as much as possible to patients with CPOs, and consider using single-use, disposable devices.
- In facilities with CPO cohorts, dedicate primary HCP (e.g., nursing) to care only for patients with CPOs, whenever feasible.
- Consider providing physical therapy or other ancillary care for patients with CPOs in their room or scheduling at the end of the day.

Environmental Cleaning and Disinfection

- Conduct and audit daily and terminal cleaning and disinfection of patient care environment including high-touch surfaces, and non-dedicated equipment after use, with an EPA-registered hospital-grade disinfectant effective against gram-negative bacteria. See Response Phases guidance for phase-specific disinfectant use recommendations.[1]
- During an outbreak or when transmission is difficult to control, consider double terminal cleaning in rooms with patients with CPOs or on

[11] CDPH Cohorting Guidance (PDF) (www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/MDROCohorting.pdf)

[12] CDPH EBP: Additional Considerations for CA SNFs (PDF) (www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/EBP_AdditionalConsiderationsForCA_SNF.pdf)

affected units, i.e., perform two rounds of terminal cleaning and disinfection, with a fluorescent marker audit after each.

Adherence Monitoring and Feedback

- Conduct regular adherence monitoring to evaluate implementation of IPC measures using standardized tools and provide feedback to HCP and facility leadership.[13]
- During an outbreak, increase the frequency of adherence monitoring and feedback (e.g., weekly).

Onsite IPC Assessment

- LHDs can recommend an onsite IPC assessment in response to a CPO case or outbreak; CDPH HAI Program may be consulted as needed.

5. Communication and Follow-up

- When transferring patients with CPOs to another healthcare facility, communicate the patients' CPO status to the receiving facility at time of transfer.[14]
- When receiving transferred patients, facilities should actively seek information on multidrug-resistant organism status.
- Facilities with CPO outbreaks must inform facilities to which they transfer patients. Receiving facilities should screen such patients for the CPO(s) and place them on empiric Contact Precautions or implement EBP empirically in SNFs pending the test result.
- If a patient tests positive for a CPO on admission, notify transferring facility of the CPO status. The transferring facility should also conduct a contact investigation or point prevalence survey (PPS).
- LHDs may request to be notified when healthcare facilities transfer patients with CPOs.
- Flag the medical record of patients with CPOs to ensure IPC measures are implemented upon readmission. Do not rescreen patients who have previously tested positive for a CPO(s) unless they are at risk for a different CPO (e.g., patient has NDM-CRAB but was exposed to VIM-CRPA).
- Provide education materials to patients, their families, and HCP as needed.[15]
  - A template letter is available that healthcare facilities can provide to patients when they discharge home.

6. Considerations for Other Healthcare Settings (e.g., dialysis, outpatient, home health)[16]

- IPC practices for CPOs are similar across other healthcare settings. Ensure:
  - hand hygiene before and after entering the patient's room and providing care.
  - implementation of Contact Precautions, or EBP for inpatient settings.
  - scheduling the patient to receive care at the end of the day, whenever possible.
  - environmental cleaning and disinfection of the patient's care environment and any reusable medical equipment with a disinfectant effective against the CPO. See Response Phases guidance for phase-specific disinfectant use recommendations.[1]
  - the patient's CPO status is communicated if the patient needs to be transferred to a healthcare facility.
- Healthcare settings within correctional facilities should generally follow the recommended IPC practices for the type of healthcare provided. Specific IPC measures are generally not indicated for non-healthcare settings in correctional facilities.
- LHDs can consider adapting many of these practices to non-healthcare congregate residential settings (e.g., implementation of EBP in assisted living facilities, group or board and care homes).
- In any of these settings, screening contacts may be indicated in certain circumstances.
- LHD may consult with HAI Program for additional guidance.

[13] CDPH Adherence Monitoring (www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/MonitoringAdherenceToHCPracticesThatPreventInfection.aspx)

[14] CDPH Interfacility Transfer Communications (www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/InterfacilityCommunication.aspx)

[15] CDPH CPO for Patients and their Families (www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/CPO_InfoForPatientsAndFamilies.aspx)

[16] CDC IPC for *C. auris* provides IPC guidance for *C. auris* that can also apply to CPOs (www.cdc.gov/candida-auris/hcp/infection-control/index.html)

Guidance for Local Health Department Follow-up on Carbapenem-Resistant Organism (CRO) Isolates

As CRO and carbapenemase-producing organism (CPO) cases continue to increase in California, CDPH recommends prioritizing public health action that will have the greatest impact at reducing the spread of the most concerning antimicrobial-resistant pathogens. This includes focusing containment and response efforts on confirmed CPO cases; however, there are still infection prevention and control (IPC) and carbapenemase testing considerations for patients identified with CROs.

A. CROs that *HAVE NOT* been tested for carbapenemases

1. When resources allow and if the CRO isolate is still available, perform or access carbapenemase testing based on the CDPH carbapenemase testing prioritization algorithm.[a]
   - CRO isolates can be tested at clinical or reference laboratories[b]; they can also be forwarded for carbapenemase testing at some local public health laboratories[c] or the CDPH Microbial Diseases Laboratory (MDL).[d]
   - Depending on the carbapenemase test result, manage according to section B1 or B2 below.
2. If the CRO isolate is not available, consider all carbapenem-resistant *Acinetobacter baumannii* (CRAB) to be carbapenemase-producing. For non-tested carbapenem-resistant Enterobacterales (CRE) and *Pseudomonas aeruginosa* (CRPA), consider reculturing and accessing carbapenemase testing for patients or residents with ongoing or anticipated stays in a healthcare facility and based on known epidemiological risk factors including prior exposure to a CPO outbreak facility, being a close contact of a known CPO-positive patient, receipt of healthcare outside the US in the past 12 months, or having a highly resistant isolate.
   - If the patient has no known risk factors, manage non-tested CRE and CRPA like a CRO case confirmed negative for carbapenemases (see B1).
3. Communicate the patient's CRO status if the patient is going to be transferred to another healthcare facility.

B. CROs that *HAVE* been tested for carbapenemases

1. CRO **confirmed negative** for carbapenemases
   - Manage as determined by facility-specific policy or local health department guidance.
   - In SNFs, implement Enhanced Barrier Precautions (EBP) based on presence of indwelling devices or unhealed wounds.[e]
2. CRO **confirmed positive** for carbapenemases (i.e., CPO)
   - Implement Contact Precautions in hospitals or EBP in SNFs.
   - See Quicksheet for reporting (page 2), surveillance (page 2, section 1), and IPC (pages 3-4, sections 3-6) recommendations.
3. Communicate the patient's CRO or CPO status if the patient is going to be transferred to another healthcare facility.

[a] CDPH Prioritizing Carbapenemase Testing Algorithm (PDF) (www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CPTestingPrioritizationAlgorithm.pdf)
[b] LACDPH List of Carbapenemase Testing Resources (PDF) (publichealth.lacounty.gov/acd/docs/LaboratorieswithCPOScreening.pdf)
[c] California Public Health Laboratories (www.caphld.org/network-laboratories)
[d] CDPH MDL Carbapenemase Testing FAQ (www.cdph.ca.gov/Programs/CID/DCDC/Pages/MDL-Expanded-Carbapenemase-Testing-Services-FAQs.aspx)
[e] CDC Enhanced Barrier Precautions (www.cdc.gov/long-term-care-facilities/hcp/prevent-mdro/PPE.html)