

**Carbapenemase-Producing Carbapenem-Resistant Enterobacteriaceae (CP-CRE):  
Guidance for Local Public Health**  
**October 24, 2019**

**Webinar**

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# Objectives

1. Provide background information on CRE and CP-CRE
2. Review the new CP-CRE reporting requirements
3. Describe facility-based surveillance, investigation, and infection control activities
4. Present thresholds and actions for public health response to CRE reports

# Background



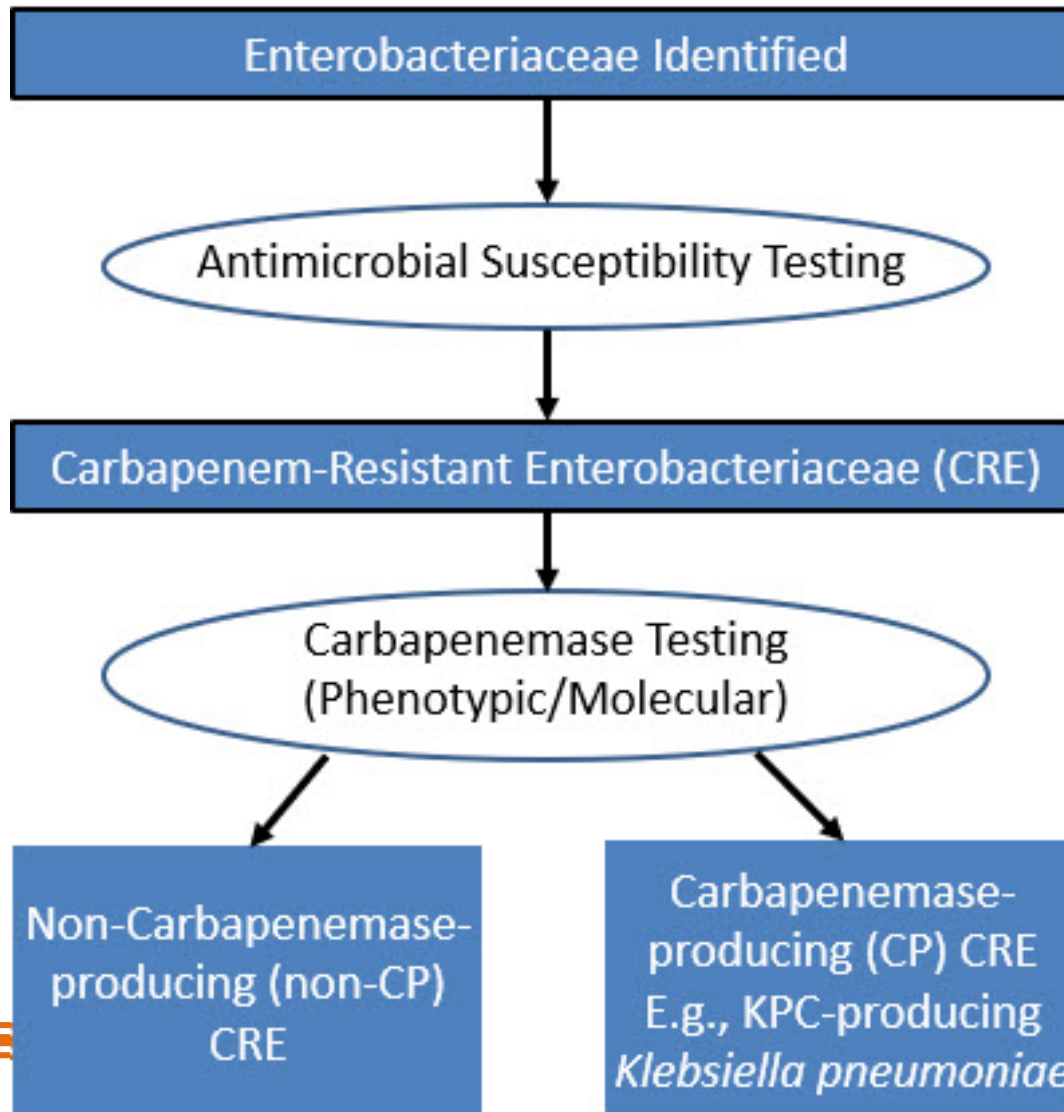
# Carbapenem-resistant Enterobacteriaceae (CRE)

- Gram-negative bacteria
- Enterobacteriaceae family
  - E.g., *Klebsiella pneumoniae*, *E. coli*, *Enterobacter cloacae*
- Normally inhabit the gut
- Resistant to carbapenem antibiotics
  - Doripenem, ertapenem, imipenem, and meropenem

# Carbapenemase-producing CRE (CP-CRE)

- Carbapenemases are beta-lactamase enzymes
  - Inactivate carbapenems, other beta-lactam antibiotics (e.g., penicillins, cephalosporins)
  - On mobile genetic elements (plasmids), enabling transfer across bacterial species
  - Examples include: KPC (most common in U.S.), NDM, IMP, VIM, OXA-48
- 2 types of carbapenemase testing
  - **Phenotypic** – detects presence of carbapenemase (yes/no)
  - **Molecular** – identifies specific carbapenemase (e.g., KPC)

# CRE Identification Algorithm



# Reporting Requirements



# CP-CRE Reporting Requirements

- Title 17, Section 2505, Subsection (e)(2) **laboratory reportable** conditions list, effective October 1, 2019
- [CDC case definition](https://wwwn.cdc.gov/nndss/conditions/carbapenemase-producing-carbapenem-resistant-enterobacteriaceae/)  
(<https://wwwn.cdc.gov/nndss/conditions/carbapenemase-producing-carbapenem-resistant-enterobacteriaceae/>)
- No clinical criteria, no submission requirements
- Electronic laboratory reporting (ELR)
  - Currently “Locally Reportable CRE”
  - Will be “Carbapenem-resistant Enterobacteriaceae, carbapenemase-producing”
- Local reporting requirements do **not** change



# CP-CRE Reporting Requirements

1. Laboratories that perform carbapenemase testing, or use a public health or reference laboratory to obtain carbapenemase testing, will report the following:

Any *Enterobacter* spp., *E. coli*, or *Klebsiella* spp. where the isolate is:

- Positive for carbapenemase production by a **phenotypic** method

**-OR-**

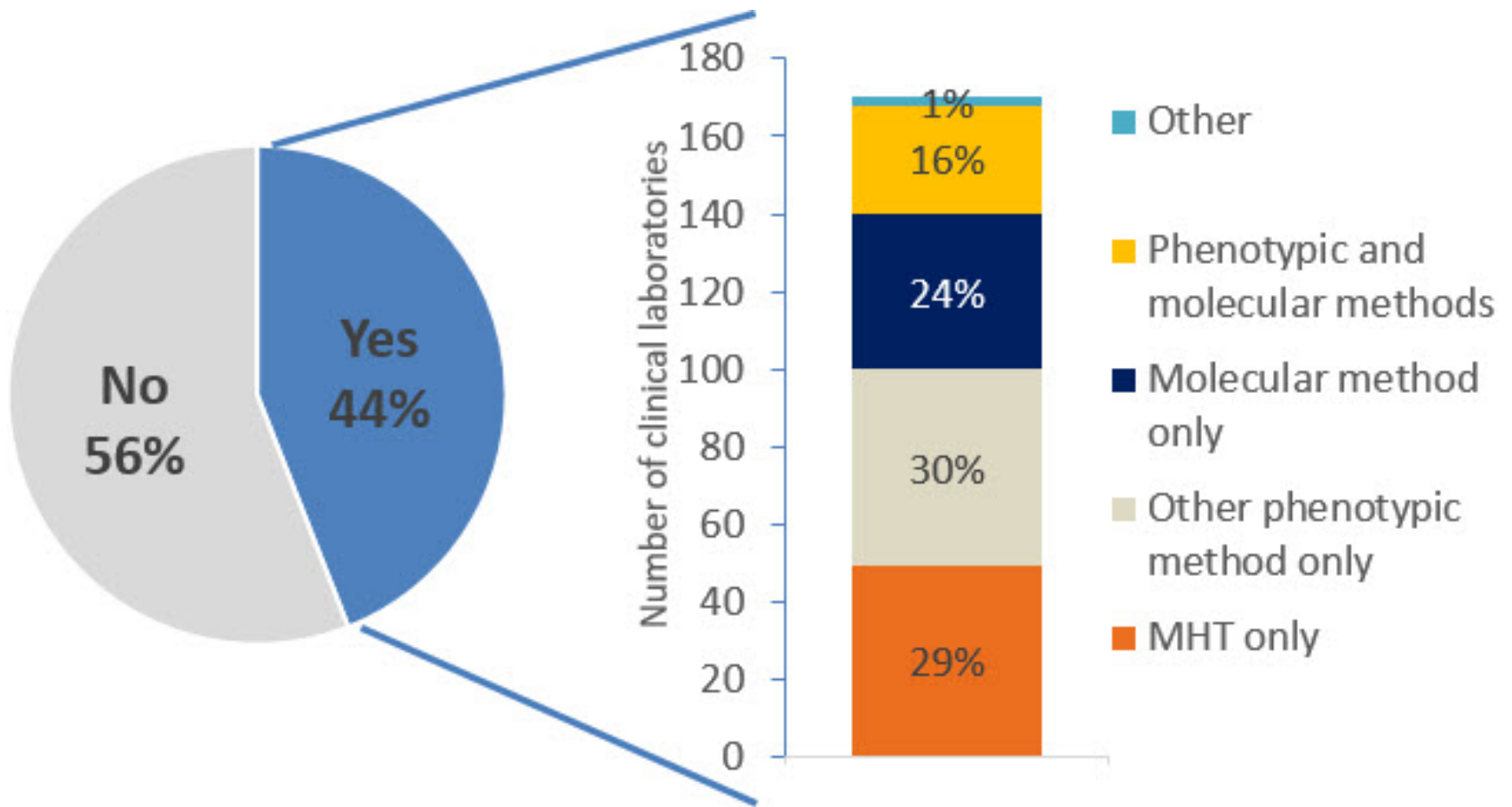
- Positive for a known carbapenemase resistance mechanism (KPC, NDM, IMP, VIM, OXA-48, novel carbapenemase) by a recognized **molecular** test

# Carbapenemase Testing Methods

Phenotypic tests for carbapenemase production	Molecular tests for type of carbapenemase (resistance mechanism)
Carba NP	BioFire
Carbapenem inactivation method (CIM)	Polymerase chain reaction (PCR)
Metallo- $\beta$ -lactamase test (e.g., E-test)	Verigene
Modified carbapenem inactivation method (mCIM)	Whole-genome sequencing (WGS)
Modified Hodge test (MHT)*	Xpert Carba-R

\*A positive MHT can be used to confirm CP-CRE for *Klebsiella* spp and *E. coli* but **not** *Enterobacter* spp. An isolate that tests positive on MHT but negative by PCR for KPC, NDM, OXA-48, VIM, and IMP should have additional characterization performed with another phenotypic test for carbapenemase such as mCIM.

# Carbapenemase Testing Capacity among Hospital Labs in California (N=386)



Source: National Healthcare Safety Network (NHSN) 2018 Annual Hospital Survey

# CP-CRE Reporting Requirements

## 2. Laboratories that do not perform or obtain carbapenemase testing, will report the following:

*Enterobacter* spp., *E. coli*, or *Klebsiella* spp. from any site, resistant to any carbapenem (doripenem, ertapenem, imipenem, meropenem)

- Contact local health department for access to public health laboratory resources

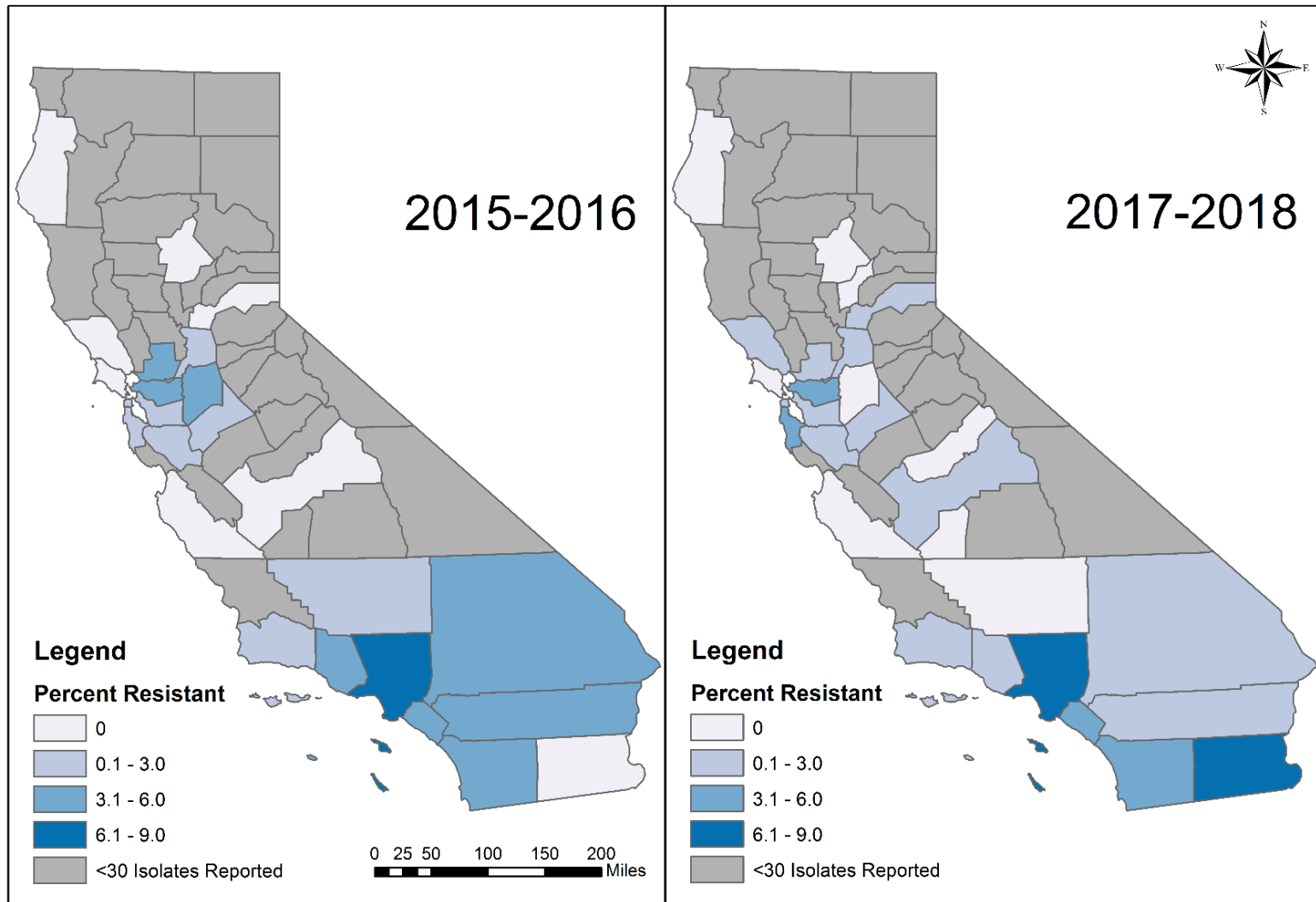
# Other Reporting Requirements

- Unusual infectious disease occurrence
  - Other carbapenemase-producing organisms
    - *Pseudomonas aeruginosa*
    - *Acinetobacter baumannii*
    - Other Enterobacteriaceae (e.g., *Citrobacter freundii*)
    - No organism identified (e.g., rectal swab)
- Outbreaks

# CRE Epidemiology



# CRE among isolates reported to NHSN\* (2015-2018)



\*SSI, CAUTI, CLABSI for *Klebsiella* and *Enterobacter* spp., *E. coli* in hospitals

# Regional CRE Prevalence Definitions

Prevalence	Definition
High or endemic	CRE are routinely identified; e.g., hospitals have >1 case a month
Lower prevalence	CRE identified with regularity; e.g., hospitals have 3-12 cases a year
Very low prevalence	CRE rarely identified; e.g., hospitals have 1 or 2 cases a year

- Highest prevalence facilities: Long-term acute care hospitals (LTACH), ventilator-equipped skilled nursing facilities (vSNF)

**Sources:** CORHA Proposed Definitions: <https://corha.org/resources-and-products/>

McKinnell JA, Singh RD, Miller LG, et al. The SHIELD Orange County Project: Multidrug-resistant Organism Prevalence in 21 Nursing Homes and Long-term Acute Care Facilities in Southern California, Clin Infect Dis 2019.



# CP-CRE Epidemiology

- Highly-transmissible in healthcare settings
- Colonized and infected patients can serve as sources of transmission
- **Risk factors:**
  - International healthcare exposure
  - Antimicrobial treatment
  - Presence of indwelling devices (e.g., urinary catheters, endotracheal tubes)
  - Mechanical ventilation
- Difficult-to-treat infections → high mortality rates

# **CP-CRE is a public health priority**

# Thresholds for Facility Action and Reporting, and Public Health Investigation

# Thresholds: Higher or Endemic

Prevalence	Definition	Threshold level	Investigate / Notify
<b>Higher or endemic</b>	CRE are routinely identified (> 1 case/month)	1 non-KPC CP-CRE  Same organism within 4 weeks: <ul style="list-style-type: none"> <li>• 2 KPC-CRE</li> <li>-OR-</li> <li>• 2 CP-CRE (unknown mechanism)</li> <li>-OR-</li> <li>• 2 CRE (non-CP or CP testing not performed)</li> </ul>	✓  ✓ same unit/ epi-linked
<b>Lower</b>	CRE identified with regularity (3-12 cases/year)	1 CP-CRE  2 CRE (non-CP or CP testing not performed), same organism within 4 weeks	✓  ✓ same unit/ epi-linked
<b>Very low</b>	CRE rarely identified (1-2 cases/year)	1 CRE	✓

# Thresholds: Lower Prevalence

Prevalence	Definition	Threshold level	Investigate / Notify
Higher or endemic	CRE are routinely identified (> 1 case/month)	1 non-KPC CP-CRE  Same organism within 4 weeks: <ul style="list-style-type: none"> <li>• 2 KPC-CRE</li> <li>-OR-</li> <li>• 2 CP-CRE (unknown mechanism)</li> <li>-OR-</li> <li>• 2 CRE (non-CP or CP testing not performed)</li> </ul>	√  √ same unit/ epi-linked
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Very low	CRE rarely identified (1-2 cases/year)	1 CRE	√

# Thresholds: Low Prevalence

Prevalence	Definition	Threshold level	Investigate / Notify
<b>Higher or endemic</b>	CRE are routinely identified (> 1 case/month)	1 non-KPC CP-CRE  Same organism within 4 weeks: <ul style="list-style-type: none"> <li>• 2 KPC-CRE</li> <li>-OR-</li> <li>• 2 CP-CRE (unknown mechanism)</li> <li>-OR-</li> <li>• 2 CRE (non-CP or CP testing not performed)</li> </ul>	√  √ same unit/ epi-linked
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<b>Very low</b>	CRE rarely identified (1-2 cases/year)	1 CRE	√

# Facility Actions

- Routine surveillance
    - Detect CRE and notify clinical and IP staff
    - Perform or obtain carbapenemase testing
  - Active surveillance
    - Screen for CP-CRE, pre-emptive Contact precautions
      - Admitted from LTACH or facility with transmission
      - Epi-linked to new case
      - History of international healthcare exposure in last year
  - Investigation
    - Establish baseline
    - Investigate and notify using thresholds
- 
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# Public Health Response





# CDC Containment Strategy

## [Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms \(MDROs\)](https://www.cdc.gov/hai/containment/guidelines.html)

(<https://www.cdc.gov/hai/containment/guidelines.html>)

## Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms (MDROs)



Centers for Disease  
Control and Prevention  
National Center for Emerging and  
Zoonotic Infectious Diseases

Updated January 2019

<https://www.cdc.gov/hai/containment/guidelines.html>

# 1. Initial Response and Recommendations

- Recommend patient placement in single-bed room on Contact precautions
- Ensure communication of patient CP-CRE status at time of transfer
- Gather information – put on your epi hat!



# Information Gathering: Person, Place, Time

## Person

- Brief medical history
- Indwelling devices
- Invasive procedures
- Other transmission risk factors

## Place

- Current/Previous/Subsequent healthcare exposures
  - Locations (e.g., units, wings)
  - Contacts
- International travel, healthcare exposure in prior 12 months

## Time

- Admission/Discharge dates

# Person

## TRANSMISSION RISK FACTORS

The following risk factors for transmission can guide public health recommendations; for example, when recommending infection control measures to receiving facility at time of transfer.

### Functional status

[Link to Functional Status Assessment definitions here.](#)

### Can comply with instructions for hand hygiene?

### Requires physical or occupational therapy?

### Incontinence of urine?

### Incontinence of stool?

### Ventilator-dependent?

### Indwelling medical devices

- |  |  |   |
|--|--|---|
| <input type="checkbox"/> Endotracheal tube       | <input type="checkbox"/> Tracheostomy tube | <input type="checkbox"/> Urinary catheter |
| <input type="checkbox"/> Nephrostomy tube        | <input type="checkbox"/> Gastrostomy tube  | <input type="checkbox"/> Surgical drain   |
| <input type="checkbox"/> Central venous catheter | <input type="checkbox"/> Wound VAC         | <input type="checkbox"/> Other            |

### If Other, specify

### Wounds present?

### If Yes, describe

### Other risk factors

- |                                       |  |   |
|---------------------------------------|--|---|
| <input type="checkbox"/> Hemodialysis | <input type="checkbox"/> Peritoneal dialysis | <input type="checkbox"/> Respiratory therapy treatments |
| <input type="checkbox"/> Other        |  |   |

### If Other, specify

# Place and Time

## CRE INVESTIGATION INFORMATION

Healthcare setting where case identified

If Other, specify

## HEALTHCARE FACILITY INVESTIGATION

For this section, please include information that pertains to the healthcare facility where the case was identified (i.e., index facility). There are additional sections below to enter information on previous and subsequent healthcare settings.

Name of healthcare facility

Admitting diagnosis(es)

Date of admission

Date of discharge

Date contact precautions initiated

Did the patient have a roommate(s) during this admission?

Date first positive specimen collected

Invasive procedures(e.g., endoscopy) during stay?

If Yes, describe

Was CRE previously identified in this person at another healthcare facility?

If Yes, name of healthcare facility where CRE identified

Was patient's CRE status communicated to the receiving facility prior to admission?

Were contact precautions implemented by the receiving facility at the time of notification?



## EXPOSURE RISK FACTORS

If responding yes to any of the following questions about exposures, please fill out the corresponding section below.

Any previous hospitalizations or Skilled Nursing Facility stays in the US during the 6 months preceding the collection date?

Did the patient have any invasive procedures (e.g., endoscopy) as an outpatient during the 6 months preceding the collection date?

Did the patient travel or reside outside of the US during the 12 months preceding the collection date?

## SUBSEQUENT HEALTHCARE FACILITY

ID-001

Use the fields below to describe any healthcare facilities where the patient resided after the encounter described in the Healthcare Facility Investigation section.

Name of healthcare facility



Facility Type

Admitting diagnosis(es)

Date of admission



Date of discharge



Was patient's CRE status communicated to the receiving facility prior to admission?

Date contact precautions initiated



Did the patient have a roommate(s) during this admission?

## 2. Retrospective and Prospective Lab Surveillance

- During **previous 6 months**: identify additional cases
- For **at least 3 months**: retain clinical isolates for further testing
  - Inform public health
  - Obtain carbapenemase testing
  - Submit isolates to public health

# 3. Contact Investigation

- Epi-linked patient contacts
  - Roommate
  - Shared bathroom
  - Common device (e.g., duodenoscope)
  - Shared clinical services (e.g., wound care, respiratory therapy)
  - Shared primary healthcare personnel (e.g., nursing staff)

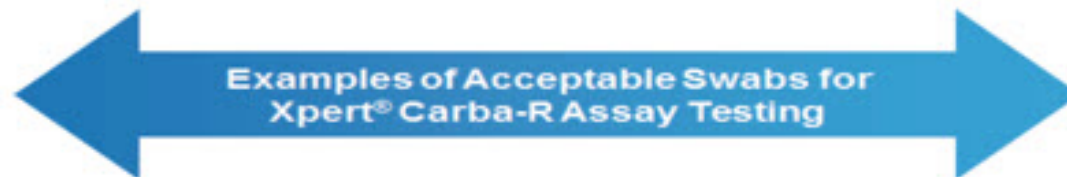


### 3. Contact Investigation

- Point prevalence survey (PPS)
  - Patients not previously identified with CP-CRE on same unit where transmission suspected
  - If 1+ patient identified with CP-CRE, conduct serial PPS at 2-week intervals until 2 consecutive negative PPS

# Colonization Testing Resources

- Available at West Regional AR Lab in Washington free of charge
  - Rectal swab kits with instructions
  - Requisition form
  - Secure fax authorization (transitioning to electronic system)
  - Verbal assent script
- Request and coordinate through HAI Program



# 4. Infection Control Assessment and Recommendations for Facilities

## HAI Program resources available:

- Epi assistance to focus infection control assessment and recommendations, support screening strategies
- Infection preventionists (IP) can assist with on-site infection control assessments
- Adherence monitoring and assessment tools
- [CRE website resources](https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/CRE_InfectionPreventionStrategies.aspx)  
([https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/CRE\\_InfectionPreventionStrategies.aspx](https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/CRE_InfectionPreventionStrategies.aspx))

# Room Placement

- Single-bed room when possible, with Contact precautions
- If multi-bed rooms:
  - Like with like (same carbapenemase, e.g., KPC)
  - Treat each bed space like separate room
  - HCP change gloves/gowns + hand hygiene between patient contacts

# Transmission-based Precautions

## Contact precautions

- Perform hand hygiene, don gown/gloves before entering patient room
- Remove gown/gloves, perform hand hygiene before exiting patient room
- Patients leave room only when medically necessary
- Continue for entire admission in hospital

# Transmission-based Precautions

## Enhanced standard precautions (skilled nursing facilities)

- If no transmission suspected
- For residents with transmission risk factors
- Perform hand hygiene, don gown/gloves at point of care for high-contact activity
- [CDPH Enhanced Standard Precautions for SNF Guidance](https://www.cdph.ca.gov/Programs/CHCQ/LCP/CDPH%20Document%20Library/Enhanced-Standard-Precautions.pdf)(PDF)  
(<https://www.cdph.ca.gov/Programs/CHCQ/LCP/CDPH%20Document%20Library/Enhanced-Standard-Precautions.pdf>)

Repeat cultures **not** necessary for “clearance” – patients remain colonized

# Dedicated Staff and Equipment

## Equipment

- Dedicate daily care equipment (e.g., blood pressure cuffs)
- Consider using single-use, disposable, non-critical devices (e.g., temperature probe)

## Patient and staff cohorting (if > 1 patient)

- Place patients in same geographic area
- Dedicate HCP to care for CP-CRE patients only
  - If dedicated HCP not feasible, care for CP-CRE patients **after** non-CP-CRE patients

# Environmental Cleaning

Clean and disinfect with Environmental Protection Agency (EPA)-approved healthcare grade disinfectant at regular intervals:

- Non-dedicated equipment after use
- High-touch surfaces (e.g., bed rails, overbed table, light switch)
- According to manufacturer directions (e.g., contact time)



# Adherence Monitoring

- Evaluate implementation of infection control measures with tools
- Provide feedback to HCP
- [Adherence monitoring tools](http://www.cdph.ca.gov/programs/hai/Pages/AdherenceMonitoringTools.aspx)  
(<http://www.cdph.ca.gov/programs/hai/Pages/AdherenceMonitoringTools.aspx>)



Healthcare-Associated Infections Program Adherence Monitoring  
Hand Hygiene

Assessment completed by:  
Date:  
Unit:

Regular monitoring with feedback of results to staff can improve hand hygiene adherence. Use this tool to identify gaps and opportunities for improvement. Monitoring may be performed in any type of patient care location.

**Instructions:** Observe at least 10 hand hygiene (HH) opportunities per unit. Observe a staff member and record his/her discipline. Check the type of hand hygiene opportunity you are observing. Indicate if HH was performed. Record the total number of successful HH opportunities and calculate adherence.

HH Opportunity	Discipline	What type of HH opportunity was observed? (select/ <input checked="" type="checkbox"/> 1 per line)	Was HH performed for opportunity observed? ✓ or ∅
<i>Example</i>	N	<input type="checkbox"/> before care/entering room* <input type="checkbox"/> before task <input type="checkbox"/> after body fluids <input type="checkbox"/> after care* <input checked="" type="checkbox"/> upon leaving room <small>*Remember: Hand hygiene should be performed before <u>and</u> after glove use</small>	✓
HH1.		<input type="checkbox"/> before care/entering room <input type="checkbox"/> before task <input type="checkbox"/> after body fluids <input type="checkbox"/> after care <input type="checkbox"/> upon leaving room	
HH2.		<input type="checkbox"/> before care/entering room <input type="checkbox"/> before task <input type="checkbox"/> after body fluids <input type="checkbox"/> after care <input type="checkbox"/> upon leaving room	

## 5. Communication

### Facility communicates patient's CRE status:

- When transferring patient to another facility, including home healthcare
- During an outbreak
  - Screening
  - Pre-emptive Contact precautions
- Within the facility by flagging the medical record
- To patients, their families and HCP
  - Provide education materials
- Adapt CDPH Infection Control Transfer Form

# Infection Control Transfer Form

(<https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/IntefacilityCommunication.aspx>)

## HEALTHCARE FACILITY TRANSFER FORM (ABBREVIATED)

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




<b>Patient Name</b> (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?**  
 Yes    No

Personal Protective equipment (PPE) to consider at receiving facility:

If yes, check all that apply:

<input type="checkbox"/> Contact precautions			
<input type="checkbox"/> Droplet precautions	<input type="checkbox"/> Gloves	<input type="checkbox"/> Gowns	<input type="checkbox"/> Masks
<input type="checkbox"/> Airborne precautions			

### ORGANISMS

**Patient has multidrug-resistant organism (MDRO) or other lab results for which the patient should be in isolation?**  
 Yes    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.

# Follow-up

- Ongoing surveillance
- HAI Program may assist with follow-up on-site infection control assessment
  - Focus on gaps
  - Ensure implementation of recommendations
- Repeat PPS – every 2 weeks until 2 consecutive negative PPS, then consider monthly or less frequently
- Interfacility communication upon transfer
- Periodic phone check-in with facility

# Resources

- [CDPH CRE Website](https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/CRE_InfectionPreventionStrategies.aspx)

([https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/CRE\\_InfectionPreventionStrategies.aspx](https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/CRE_InfectionPreventionStrategies.aspx))

- [CDPH CRE Quicksheet \(PDF\)](https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CRE_QuicksheetOct2019.pdf)

([https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CRE\\_QuicksheetOct2019.pdf](https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CRE_QuicksheetOct2019.pdf))

- [CDPH FAQ for CP-CRE Reporting \(PDF\)](https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CP-CRE_ReportingFAQ_Approved_10.4.19_ADA.pdf)

([https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CP-CRE\\_ReportingFAQ\\_Approved\\_10.4.19\\_ADA.pdf](https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CP-CRE_ReportingFAQ_Approved_10.4.19_ADA.pdf))

- [CDPH MDL Carbapenemase Testing \(PDF\)](https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CA_AR_LabNetwork_CarbapenemaseTestingAtCDPH_%20110817-ADA.pdf)

([https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CA\\_AR\\_LabNetwork\\_CarbapenemaseTestingAtCDPH\\_%20110817-ADA.pdf](https://www.cdph.ca.gov/Programs/CHCQ/HAI/CDPH%20Document%20Library/CA_AR_LabNetwork_CarbapenemaseTestingAtCDPH_%20110817-ADA.pdf))

# Resources

- [CDPH Adherence Monitoring Tools](#)

(<https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/MonitoringAdherenceToHCPracticesThatPreventInfection.aspx>)

- [CDPH All Facilities Letter for Reporting Outbreaks and Unusual Infectious Disease Occurrences \(PDF\)](#)

(<https://www.cdph.ca.gov/Programs/CHCQ/LCP/CDPH%20Document%20Library/AFL-19-18.pdf>)

- [CORHA Proposed Investigation/Reporting Thresholds for CRE \(PDF\)](#)

(<https://corha.org/wp-content/uploads/2019/06/CORHA-Proposed-CRE-Thresholds-and-Definition-08-19.pdf>)

- [CDC Containment Strategy Guidelines](#)

(<https://www.cdc.gov/hai/containment/guidelines.html>)

- [CDC CRE Website](#)

(<https://www.cdc.gov/hai/organisms/cre/index.html>)

**We're here to help!**  
**Contact the HAI Program**  
**at:**  
**[HAIProgram@cdph.ca.gov](mailto:HAIProgram@cdph.ca.gov)**