

OREGON CARBAPENEM- RESISTANT ORGANISM (CRO) TOOLKIT

The Oregon CRO Toolkit is designed as a practical working document to aid health care workers involved with CRO prevention, detection, and response across the continuum of health care.

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Introduction

This Toolkit is designed to aid health care workers involved with CRO prevention, detection, and response across the continuum of health care. This includes infectious disease physicians, health care epidemiologists, infection preventionists, directors of nursing, nurses, microbiologists, and local public health authority personnel.

Carbapenem-resistant organisms (CROs) are an emerging threat to global health. The Centers for Disease Control and Prevention (CDC) 2019 Antibiotic Threat Report categorizes two concerning categories of CROs, carbapenem-resistant *Enterobacterales* (CRE) and carbapenem-resistant *Acinetobacter* (CRA), as “urgent,” the highest level of antibiotic resistance threat [1]. Cases of CRO infection have increased dramatically in recent years; infections starting during hospitalization rose 35% for CRE and 78% for CRA from 2019 to 2022 [2]. These organisms can be difficult to treat and can spread rapidly. It is important for public health to maintain a robust CRO prevention plan.

A coordinated, regional approach to prevent the spread of CROs is critical to reduce impact on all of Oregon’s health care facilities. Inappropriate antibiotic use and lack of infection prevention and control safeguards in one facility affect others because of shared health care providers and patient transfers.

Routine hand hygiene remains the single most important measure to prevent spread of CROs and other multidrug-resistant organisms (MDROs). However, additional practices including appropriate antibiotic use, interfacility communications, surveillance, and appropriate transmission-based precautions are also needed.

The 2023 Oregon CRO Toolkit updates the 2016 Oregon CRE Toolkit with new Oregon-specific definitions and protocols for various health care settings. This toolkit is also expanded to include other carbapenem-resistant organisms in addition to *Enterobacterales*.

The original draft of this toolkit written by the Drug-Resistant Organism Prevention and Coordinated Regional Epidemiology (DROP-CRE) work group was modeled after CDC’s 2012 CRE Toolkit. Updates to the Oregon toolkit include recommendations based on updated CDC guidance. CDC

updated its toolkit in 2015 and provided updated prevention and containment guidance for targeted MDROs in 2023. Links to these documents can be found in the references [3] [4] [5].

We are grateful to the health care providers who provided feedback so that Oregon health care facilities can continue their commitment to patient and resident safety.

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Carbapenem-Resistant Organisms (CROs) at a Glance

Carbapenem-resistant organism (CRO) is a general term that refers to any bacteria resistant to carbapenem antibiotics. Three types of CROs have clinical and public health significance:

1. Carbapenem-resistant *Enterobacteriales* (CRE) species

Enterobacteriales are a large order of Gram-negative bacilli (i.e., Gram-negative rods) mostly found in the gastrointestinal tract. Commonly encountered *Enterobacteriales* include *E. coli*, *Klebsiella* spp., *Enterobacter* spp., *Proteus* spp., *Providencia* spp., *Morganella* spp., *Citrobacter* spp., *Serratia* spp., and *Salmonella* spp.

2. Carbapenem-resistant *Acinetobacter* species (CRA)

Acinetobacter is a genus of Gram-negative bacilli commonly found in soil and water. *Acinetobacter baumannii* is the most common clinically encountered species of CRA.

3. Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)

Pseudomonas aeruginosa is a species of Gram-negative bacilli commonly found in the environment, particularly in water.

All of these organisms have the potential to cause healthcare-associated infections. CROs primarily affect people with chronic medical conditions, compromised immune function, or medical conditions requiring invasive lines or tubes. CRE and CRA are reportable in Oregon.

Carbapenems are an antibiotic class that includes doripenem, ertapenem, imipenem and meropenem. These important broad-spectrum antibiotics are used to treat severe healthcare-associated infections. When bacteria become resistant to carbapenems, few treatment options remain, and the risk of harm to patients increases.

The Resistance Mechanism Matters: Carbapenemase-Producing vs. Non-Carbapenemase-Producing CROs

The CRO resistance mechanism should guide prevention and response for the reasons cited below. Given that antimicrobial susceptibility testing does not reliably differentiate resistance mechanisms, OSPHL implemented a rapid mechanism for testing all Oregon CRO isolates.

Carbapenemase-producing organisms (CPOs)

Carbapenemase-producing organisms (CPOs) are the subset of CROs that produce carbapenemases, which are enzymes that break down carbapenem antibiotics. When genes for these carbapenemase enzymes are located on plasmids, this can facilitate transmission among bacterial species and contribute to rapid spread. For this reason, organisms that produce carbapenemases are an urgent public health threat. CPOs can be detected by testing performed at the Oregon State Public Health Laboratory (OSPHL).¹

CPOs have spread worldwide and become endemic in some regions of the world, including some areas of the United States. They remain relatively rare in Oregon (there were 76 cases between November 2010 and December 2022). **Potential for rapid spread, treatment difficulties and poor outcomes make it critically important for public health to support a robust prevention plan.** CPOs require an immediate, higher-tier response than do non-carbapenemase-producing CROs.

Carbapenemases of global importance include:

- *Klebsiella pneumoniae* carbapenemase (KPC)
- New Delhi metallo- β -lactamase (NDM)
- Verona integron encoded metallo- β -lactamase (VIM)
- Imipenemase (IMP)
- Oxacillinase-48 (OXA-48)
- Oxacillinase variants currently unique to *Acinetobacter* species (e.g., OXA-23-like, OXA-24/40-like, OXA-235-like)

Non-CP-CRO spread is less of a global threat since non-enzymatic mechanisms of antibiotic resistance are not as easily transferable among species. Rather than direct carbapenem hydrolysis, non-CP-CRO resistance usually involves a combination of mechanisms, typically through production of an extended spectrum cephalosporinase (e.g., AmpC) or an extended-spectrum β -lactamase (ESBL) *plus* decreased permeability of the bacterial cell wall (e.g., porin mutations). **Although in Oregon non-CP-CROs are more common and less worrisome than CPOs, these organisms are typically highly drug-resistant, important to control at the facility level, and require intensified infection control measures, including contact precautions.**

We define non-CP-CROs as organisms that meet the CRE or CRA definition but test phenotypically (e.g., by Carba NP) and genotypically (e.g., by PCR) negative for carbapenemases.

Table 1: CRO and CPO reporting and response by organism type

	Action	CROs			
		CRE	CRA	CRPA	CPOs ¹
Healthcare facilities	Notify the local public health authority within one working day	Yes	Yes	No	Yes
	Implement infection control guidance described in this toolkit	Yes	Yes	Yes	Yes
Laboratories	Notify the local public health authority within one working day	Yes	Yes	No ²	Yes
	Send isolates to the Oregon State Public Health Lab (OSPHL)	Yes	Yes	No ²	Yes

CRO=Carbapenem-resistant organisms, CRE=Carbapenem-resistant *Enterobacterales*. CRA= Carbapenem-resistant *Acinetobacter*, CRPA= Carbapenem-resistant *Pseudomonas Aeruginosa*, CPO=Carbapenemase-producing organism.

¹All carbapenemase-producing organisms, including carbapenemase-producing CRPA (CP-CRPA), are reportable.

²Any organism that is non-susceptible to all antibiotics on the clinical lab panel should be reported and submitted to OSPHL.

Oregon Health Authority (OHA) Carbapenem-Resistant Organism (CRO) Case Definitions

OHA Carbapenem-Resistant *Enterobacterales* (CRE) Case Definition

As of July 2015, Oregon defines CRE as *Enterobacterales* that test:

- resistant to any carbapenem including doripenem, ertapenem, imipenem¹ or meropenem using the current Clinical and Laboratory Standards Institute (CLSI) breakpoints; or
- positive by molecular test, such as PCR, or next-generation sequencing (NGS) for a specific carbapenemase (e. g., KPC, NDM, IMP, VIM, OXA-48); or
- positive for carbapenemase production by phenotypic test methods, such as the Carba NP test.

Table 2: CLSI breakpoints, *Enterobacterales*

	Current MIC breakpoints (µg/mL)		
	MIC interpretation		
Carbapenems	Susceptible	Intermediate	Resistant
Doripenem	≤1	2	≥4
Ertapenem	≤0.5	1	≥2
Imipenem	≤1	2	≥4
Meropenem	≤1	2	≥4
	Current disk diffusion zone diameters (mm)		
	Interpretation		
Carbapenems	Susceptible	Intermediate	Resistant
Doripenem	≥23	20–22	≤19
Ertapenem	≥22	19–21	≤18
Imipenem	≥23	20–22	≤19
Meropenem	≥23	20–22	≤19

MIC=minimum inhibitory concentration

¹*Proteus* spp., *Providencia* spp. and *Morganella* spp., which are intrinsically resistant to imipenem, are excluded from this definition if only imipenem resistance is detected. To fit the CRE definition any of these genera must also demonstrate resistance to other carbapenems.

**OHA Carbapenem-Resistant *Acinetobacter* (CRA) Case Definition
As of October 2023, Oregon defines CRA as *Acinetobacter* species
that test:**

- resistant to any carbapenem including doripenem, imipenem or meropenem, using the current CLSI breakpoints; or
- positive by molecular test, such as PCR, or next-generation sequencing (NGS) for a specific carbapenemase (e. g., KPC, NDM, IMP, VIM, OXA-48, OXA-23, OXA-24/40, OXA-58, or OXA-235).¹

Table 3: CLSI breakpoints, *Acinetobacter* species

	Current MIC breakpoints (µg/mL)		
	MIC interpretation		
Carbapenems	Susceptible	Intermediate	Resistant
Doripenem	≤2	4	≥8
Ertapenem ²	-	-	-
Imipenem	≤2	4	≥8
Meropenem	≤2	4	≥8
	Current disk diffusion zone diameters (mm)		
	Interpretation		
Carbapenems	Susceptible	Intermediate	Resistant
Doripenem	≥18	15–17	≤14
Ertapenem ²	-	-	-
Imipenem	≥22	19–21	≤18
Meropenem	≥18	15–17	≤14

¹Organisms with known chromosomal carbapenemase genes are excluded from this definition if they are susceptible to carbapenems and have no additional acquired carbapenemase genes. An example is *Acinetobacter radioresistens* carrying a chromosomal OXA-23 gene which may not be expressed [8].

²Ertapenem has weak activity against *Acinetobacter* spp. and should not be used to determine carbapenem resistance.

OHA Carbapenemase-Producing Organism (CPO) Definition

We define CPO as organisms that are positive for carbapenemase production (e.g., KPC, NDM, VIM, IMP, OXA-48, OXA-23, OXA-24/40, OXA-235) by molecular test (e.g., PCR) or next-generation sequencing (NGS); or that are positive for carbapenemase production by phenotypic test (e.g., Carba NP).

Organisms with known chromosomal carbapenemase genes are excluded from this definition unless they have additional non-chromosomal carbapenemase genes. Chromosomal carbapenemases have a limited potential for rapid global spread. The most aggressive control measures otherwise recommended for CPOs do not apply for organisms such as:

- *Serratia marcescens* that produce a chromosomally encoded carbapenemase called the *S. marcescens* enzyme (SME).
- *Acinetobacter radioresistens* that produce a chromosomally encoded OXA-23 carbapenemase.

Timeline of OHA's CRO Case Definition Changes

Table 4: a timeline of OHA's carbapenem-resistant *Enterobacterales* (CRE) case definition changes

2011	CRE became reportable in Oregon in November 2011. The first CRE surveillance case definition was <i>Enterobacteriaceae</i> that test carbapenem non-susceptible and resistant to any third-generation cephalosporin. Ultimately, this definition was found to be nonspecific and overly complicated.
2014	The CRE case definition was updated to <i>Enterobacteriaceae</i> that test non-susceptible to doripenem, meropenem or imipenem and resistant to all third generation cephalosporins. This aligned with the 2012 CDC Toolkit CRE definition. Subsequently, CDC found that this definition lacked sensitivity for CP-CRE detection and remained unnecessarily complicated.
2015	OHA adopted the 2015 revised CDC case definition, <i>Enterobacteriaceae</i> that test carbapenem-resistant. The accuracy of this more straightforward definition is a compromise between the relatively nonspecific 2013 CRE case definition and the relatively insensitive 2014 CRE case definition. The current CDC case definition of CRE can be found on the CDC CRE website .
2016	A taxonomic change was proposed that split the family <i>Enterobacteriaceae</i> into seven families under the order <i>Enterobacterales</i> . In the following years, this proposal has been widely embraced by the greater scientific and public health community and has required a nomenclature change from carbapenem-resistant <i>Enterobacteriaceae</i> (CRE) to carbapenem-resistant <i>Enterobacterales</i> (CRE). CDC began updating digital and print materials to reflect this change in 2020, and OHA began updating resources beginning in 2021.

Table 5: A timeline of OHA's carbapenem-resistant *Acinetobacter* (CRA) case definition changes

2011	OHA began <i>Acinetobacter baumannii</i> surveillance as a part of the CDC Multi-site Gram-negative Surveillance Initiative (MuGSI). This relied on voluntary reporting of carbapenem non-susceptible <i>Acinetobacter baumannii</i> [9].
2014	Carbapenem-resistant <i>Acinetobacter</i> (CRA) became reportable in Oregon in October 2023. The new surveillance definition mirrors the OHA CRE case definition and relies on current CLSI guidance: <i>Acinetobacter</i> that test carbapenem-resistant [10].

Recommendations for CRO Infection Prevention and Control

Overview

In each of the sections below, you will find setting-specific recommendations divided into three parts: preventing carbapenem-resistant organisms (CROs), responding to CROs, and responding to carbapenemase-producing organisms (CPOs). The recommendations and strategies provided are based on CDC Guidance [5] [4]. More detailed guidance is provided for facility types that are most at risk of encountering CROs and CPOs. However, CROs and CPOs can be identified in patients and residents in all health care settings. The steps outlined are actions that facilities should prioritize for prevention and response but are not inclusive of all infection prevention and control (IPC) best practices. Public health personnel from your local public health authority (LPHA) and Oregon Health Authority (OHA) are available to assist and provide additional recommendations as needed.

Part 1: Preventing CROs

This section outlines the strategies health care facilities can put in place to strengthen infection prevention and control, prepare for responding when a patient with a CRO or CPO is identified, and prevent the spread of these organisms. Although this toolkit focuses on CROs, the prevention strategies outlined are effective for preventing many types of multidrug-resistant organisms (MDROs) and other healthcare-associated infections (HAIs).

Part 2: Responding to CROs

This section outlines actions health care facilities should prioritize when a patient or resident with a CRO is identified. Public health personnel from your LPHA and OHA are available to assist and provide additional recommendations as needed.

Part 3: Responding to CPOs

This section outlines additional actions health care facilities should prioritize when a patient or resident who has tested positive for a CPO should follow the steps outlined in both parts 2 and part 3 for their facility type. Public health personnel from your LPHA and OHA will assist and provide additional recommendations as needed.

Long-term Acute Care Hospitals (LTACHs) and Ventilator-Capable Skilled Nursing Facilities (vSNFs)

Part 1: Preventing CROs in LTACHs and vSNFs

Following CDC guidance, OHA recommends that LTACHs and vSNFs establish a prevention program for MDROs, including CROs. Certain common characteristics, such as high-acuity patients, long length of stay, and prevalence of indwelling medical devices, increase CRO and CPO risk in LTACHs and vSNFs.

Although this toolkit addresses CROs, many of the risk factors for CROs and *Candida auris*, a health care-associated fungal pathogen, are the same, and these organisms often co-colonize or infect patients. By implementing the strategies outlined below, facilities can protect patients from CROs, CPOs, and *C. auris* and improve patient safety related to all MDROs. For more about *C. auris*, please see the CDC [Candida auris website](#).

OHA recommends five primary strategies as a part of MDRO prevention programs in LTACHs and vSNFs. For each of these strategies, a detailed checklist is provided on the following pages.

[Strategy 1: Provide education](#)

[Strategy 2: Improve infection prevention and control \(IPC\) practices](#)

[Strategy 3: Detect colonized individuals through surveillance](#)

[Strategy 4: Improve interfacility communication](#)

[Strategy 5: Improve antimicrobial stewardship](#)

Strategy 1: Provide Education

- **Educate staff.** Provide training about CROs and the importance of following IPC measures. Include physicians, respiratory care, nursing, housekeeping, chaplains, food service, facilities personnel, and other support staff in the training programs. See [Appendix 1](#) for resources and materials.
 - **CROs:** Consider providing mandatory in-service to staff about CROs and other MDROs.
 - **PPE donning and doffing:** Provide in-the-moment education and reinforcement. Reinforce and monitor adherence to appropriate PPE practices.
 - **Cleaning and disinfection:** Include information about appropriate EPA-registered disinfectants and their contact time (also known as wet, dwell, or kill time).

Strategy 2: Improve Infection Prevention and Control (IPC) Practices

- **Align your facility's CRO case definition with [OHA's definition](#).**
- **Schedule a proactive MDRO-focused infection control assessment and response (ICAR) visit with an OHA Regional Infection Preventionist (IP)** using the [request form](#). OHA will work with you to strengthen IPC practices. ICARs are designed to be collaborative and are recommended once per year.
- **Establish a reporting process to make sure CRO cases are rapidly reported** to IPC staff at your facility.
 - Internal processes should include laboratory notification of facility staff and Infection Preventionist (IP).
 - Both laboratories and clinicians are required to report carbapenem-resistant *Enterobacterales* and *Acinetobacter* species to the local public health authority (LPHA).
 - Information on reporting can be found [here](#).
- **Reinforce and monitor routine adherence to hand hygiene.** See [appendix 2](#) for resources.
- **Provide appropriate personal protective equipment (PPE).** Ensure that sufficient appropriate PPE is provided for staff. Gloves, gowns, and eye protection should be available and easy to access where they are needed, preferably at the entry to each patient's room.
- **Review your antibiotic stewardship program (ASP).** If your facility does not have an ASP, begin work to implement a formal stewardship program. See [appendix 2](#) to learn more.

- **Audit key infection control program elements.** This includes hand hygiene compliance, PPE donning and doffing, and routine and special cleaning and disinfection processes and effectiveness (with direct observation, blue light, or adenosine triphosphate (ATP) bioluminescence).

Strategy 3: Detect Cases through Surveillance

- **Implement recurring point prevalence surveys (PPS).**
 - A PPS involves collecting specimens from all patients in your facility (or on a particular unit) to test for targeted MDROs on the same day.
 - Because the presence of CPOs is often associated with *Candida auris*, OHA recommends screening for both CPOs and *C. auris* as a part of this activity.
 - PPS can identify patients in the facility or unit who are colonized with MDROs. The facility can then put measures in place to prevent the spread of these organisms. Done over time, PPS help to identify changes in the number of patients with MDROs.
 - CDC modeling shows that recurring PPS at LTACHs and vSNFs help to reduce the burden of MDROs across the entire health care system.
 - OHA recommends completing a PPS every six months in all LTACHs and vSNFs.
 - OHA will supply the swabs, shipping supplies, and laboratory tests for PPS free of charge.
- **Implement admission screening of high-risk patients.**
 - Admission screening involves collecting specimens from certain patients at the time they are admitted to your facility to test for targeted MDROs.
 - Admission screening identifies patients who may be colonized with targeted MDROs when they enter your facility.
 - Once identified, these patients can be placed on appropriate transmission-based precautions to help prevent spread of these organisms to other patients.
 - Based on local, regional, national, and international epidemiology, OHA recommends the following minimum CPO screening criteria: patients who received health care (defined as overnight hospital or long-term care, outpatient surgery, or hemodialysis) outside of

- Oregon in the past 12 months. This includes medical care outside of the United States.
- Because the presence of CPOs is often associated with *Candida auris*, OHA recommends screening for both CPOs and *C. auris* as a part of this activity.
 - Facilities may choose to work with a private microbiology laboratory or the public health lab. If conducting screening through OHA, all materials including, swabs, shipping supplies, and laboratory tests for admission screening of high-risk patients are provided free of charge.

Strategy 4: Improve Interfacility Communication

- **Implement the 2014 OHA “Communication During Patient Transfer of Multidrug-Resistant Organisms (MDRO)” rule** ([OAR 333-019-0052](#)).
 - When a referring health care facility transfers or discharges a patient who is infected or colonized with an MDRO or pathogen that warrants transmission-based precautions, it must include written notification of the infection or colonization to the receiving facility in transfer documents for 1 year following the last positive CRO test.
 - The referring facility must ensure that the documentation is readily accessible to all parties involved in patient transfer.
 - More information on the interfacility transfer communication rule can be found on OHA’s [website](#). Sample interfacility transfer forms can be found online and linked in [appendix 2](#).

Strategy 5: Improve Antimicrobial Stewardship

- **Review your antimicrobial stewardship program (ASP).** If your facility does not have an ASP, begin work to implement a formal stewardship program. See [appendix 2](#) to learn more.

Part 2: Responding to CROs in LTACHs and vSNFs

- **Promote and monitor hand hygiene. The single most important measure to prevent CRO transmission is hand hygiene.** Resources related to hand hygiene can be found in [appendix 2](#).

- **Notify the local public health authority (LPHA) where the patient lives within one working day** of identifying certain CROs. This includes new cases and cases transferred from out of state.
 - Both laboratories and clinicians are required to report carbapenem-resistant *Enterobacterales* and *Acinetobacter* species. Reporting information can be found [here](#).
 - LPHA contact information can be found [here](#).
- **Notify receiving facilities verbally and in writing when a patient with CRO is transferred.** Make sure staff at the receiving facility, including those caring directly caring for the patient, those responsible for transportation, and those responsible for infection prevention and control are aware of the patient's CRO status.
- **Place CRO-positive patients on contact precautions.** Contact precautions should continue for the duration of the patient's stay.
- **Place CRO-positive patients in private rooms with private bathrooms.** Where single rooms are limited, prioritize private rooms for CRO-positive patients with higher transmission risk such as active infection, major wounds, or incontinence of urine or stool. If necessary, cohort CRO-positive patients in the same room or area of the facility.
- **Flag the patient's health record** so that the patient can be identified and placed on contact precautions immediately if re-admitted.
- **Educate staff about CROs.** Education helps reduce spread. Sample education materials are provided in [appendix 1](#).
- **Educate CRO-positive patients, their visitors, and families.** Education helps reduce spread. Provide the patient with [written information](#) about CRO at the time of discharge.
- **Review cleaning and disinfection with environmental services staff.** This includes daily room and bathroom cleaning and disinfection, and attention to high-touch surfaces such as light switches, doorknobs, reusable medical equipment, and bathroom surfaces. Consider providing dedicated medical equipment to CRO-positive patients. Resources related to cleaning and disinfection can be found in [appendix 2](#).

- **Notify clinicians and leadership who need to know about the CRO case.** This might include the Medical Director, Director of Nursing, Pharmacist, and those caring directly for the patient.
- **Implement a daily review of all invasive devices** to facilitate removal when clinically appropriate.
- **Review antibiotic use, culture orders, and susceptibility patterns.** Evaluate antibiotic use to identify if unnecessary antibiotics and cultures are being ordered and discuss with providers.

Part 3: Responding to CPOs in LTACHs and vSNFs

*For carbapenem-resistant organisms (CROs) that produce a carbapenemase (carbapenemase-producing organisms or CPOs), complete all the recommendations provided for CRO **and** the steps listed below. Information about why CPOs require additional action steps is provided [earlier in this document](#). Your lab, local, or state public health authority will notify you if a patient tests positive for a CPO.*

- **Meet with OHA epidemiologists and clinicians as soon as possible.** OHA staff will reach out to schedule a meeting, usually within one working day of identifying a CPO. Make sure staff at the receiving facility, including those caring directly for the patient, those responsible for transportation, and those responsible for infection prevention and control are aware of the patient's CRO status.
- **Schedule an onsite infection control assessment with an OHA Regional Infection Preventionist (IP).** OHA staff will connect you with the IP for your region, who will work with you to strengthen infection prevention and control practices. Assessments are designed to be supportive and collaborative, rather than punitive or regulatory.
- **Work with OHA to conduct CPO screening.** CPO screening is almost always recommended. Screening of residents can help determine whether any spread of CPO has occurred. OHA epidemiologists and clinicians will advise you on the most appropriate plan for screening at your LTACH or vSNF.
- **Notify facility administration.** Prevention of spread needs to be a priority for the whole LTACH or vSNF, which requires leadership and financial support.
- **Notify both the local public health authority (LPHA) and receiving facilities when a CPO-positive patient is transferred.** Fax a copy of

the transfer notification to the LPHA where the patient lives. LPHA's contact information can be found [here](#).

- **Place CPO-positive patients in private rooms with private bathrooms.**
 - When more than one CPO case is identified at the facility, it is best to cohort affected patients in private rooms in the same area (unit, floor, room cluster).
 - Cohort nursing staff that care for CPO-positive patients as resources allow. This is most important when more than one CPO-positive patient has been identified.
- **Alert environmental services and monitor environmental cleaning and disinfection.** Encourage frequent and thorough cleaning and disinfection of high-touch surfaces, particularly those near the patient and common areas outside the room. Evaluate terminal cleaning using visual inspection and quantitative strategies such as direct observation, UV fluorescence marker, or ATP monitor before placing another patient in that room. If available, supplement manual cleaning with UV light, hydrogen peroxide vapor, or another “no touch” method. See [appendix 2](#) for additional resources.
- **Implement daily chlorhexidine (CHG) bathing.** Consider unit wide CHG bathing, especially if more than one CPO case has been identified.
- **Verify and audit decontamination, disinfection, reprocessing, and sterilization (when needed) of reusable medical equipment** used for CPO-positive patients. To the greatest extent possible, provide dedicated equipment for these patients during their stay.
- **Review laboratory records to identify organisms with similar resistance patterns** in the three months before the index case was identified. This can help identify undetected outbreaks.

Acute Care Hospitals (ACHs)

Part 1: Preventing CROs in ACHs

Following Center for Disease Control and Prevention (CDC) guidance, Oregon Health Authority (OHA) recommends that acute care settings, including acute care, critical access, and other hospitals, establish a prevention program for multidrug-resistant organisms (MDROs), including carbapenem-resistant organisms (CROs).

Although this toolkit addresses CROs, many of the risk factors for CROs and *Candida auris*, a health care-associated fungal pathogen, are the same and these organisms often co-colonize or infect patients. By implementing the strategies outlined below, facilities can protect patients from CROs, CPOs, and *C. auris* and improve patient safety related to all MDROs. For more about *C. auris*, please see the CDC [Candida auris website](#) and contact your OHA Regional Infection Preventionist.

OHA recommends five primary strategies as a part of MDRO prevention programs in ACHs. For each of these strategies, a detailed checklist is provided on the following pages.

[Strategy 1: Provide education](#)

[Strategy 2: Improve infection prevention and control \(IPC\) practices](#)

[Strategy 3: Detect colonized individuals through surveillance](#)

[Strategy 4: Improve interfacility communication](#)

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Strategy 1: Provide Education

- **Educate staff.** Provide training about CROs and the importance of following infection prevention and control measures. Include physicians, respiratory care, nursing, housekeeping, chaplains, food service, facilities personnel, and other support staff in the training programs. See [appendix 1](#) for resources and materials.
 - **CROs:** Consider providing mandatory in-service to staff about CRO and other MDROs.
 - **PPE donning and doffing:** Provide in-the-moment education and reinforcement. Reinforce and monitor adherence to appropriate PPE practices.
 - **Cleaning and disinfection:** Include information about appropriate Environmental-Protection Agency (EPA) registered disinfectants and their contact time (also known as wet, dwell, or kill time).

Strategy 2: Improve Infection Prevention and Control (IPC) Practices

- **Align your hospital's carbapenem-resistant organism definition (CRO) case with [Oregon Health Authority's \(OHA\) definition](#).**
- **Establish a reporting process to make sure CRO cases are rapidly reported** to infection prevention and control (IPC) staff at your hospital.
 - Internal processes should include laboratory notification of hospital and Infection Preventionist (IP) staff.
 - Both laboratories and clinicians are required to report carbapenem-resistant *Enterobacteriales* and *Acinetobacter* species to the local public health authority (LPHA).
 - Information on reporting can be found [here](#).
- **Request a proactive MDRO-focused infection control assessment (ICAR) with an OHA Regional Infection Preventionist (IP)** using the [request form](#). OHA will work with you to strengthen infection prevention and control practices. ICARs are designed to be supportive and collaborative, rather than punitive or regulatory.
- **Reinforce and monitor routine adherence to hand hygiene.** See [appendix 2](#) for resources.
- **Provide appropriate personal protective equipment (PPE).** Ensure enough appropriate PPE is provided for staff. Gloves, gowns, and eye protection should be available and easy to access, preferably at the entry to each patient's room.
- **Audit key infection control program elements.** This includes hand hygiene compliance, PPE donning and doffing, along with effectiveness

of cleaning and disinfection processes (with direct observation, blue light, or ATP).

Strategy 3: Detect Cases through Surveillance

- **Strongly consider implementing admission screening of high-risk patients**, especially if your hospital frequently receives patients from long-term acute care hospitals, ventilator capable skilled nursing facilities, or out-of-state health care facilities.
 - Admission screening involves collecting specimens from certain patients at the time they are admitted to your facility to test for targeted multidrug-resistant organisms (MDROs).
 - Admission screening identifies patients who may be colonized with targeted MDROs when they enter your facility.
 - Once identified, these patients can be placed on appropriate transmission-based precautions to help prevent spread of these organisms to other patients.
 - Based on local, regional, national, and international epidemiology, OHA recommends screening patients who received health care (defined as overnight hospital or long-term care, outpatient surgery, or hemodialysis) outside of Oregon in the past 12 months for CPOs. This includes medical care outside of the United States. Hospitals may choose to adapt these screening criteria based on local epidemiology and patient population.
 - Because the presence of CPOs is often associated with *Candida auris*, OHA recommends screening for both CPO and *C. auris* as a part of this activity.
 - Facilities may choose to work with a private microbiology laboratory or the public health lab. If conducting screening through public health, public swabs, shipping supplies, and laboratory tests for admission screening of high-risk patients are provided free of charge.
- **Consider conducting ad hoc point prevalence surveys (PPS)**, especially if your hospital frequently receives patients from long-term acute care hospitals, ventilator capable skilled nursing facilities, or out-of-state health care facilities.

Strategy 4: Improve Interfacility Communication

- **Implement the 2014 OHA “Communication During Patient Transfer of Multidrug-Resistant Organisms (MDRO)” rule ([OAR 333-019-0052](#)).**
 - When a referring health care facility transfers or discharges a patient who is infected or colonized with an MDRO or pathogen which warrants transmission-based precautions, it must include written notification of the infection or colonization to the receiving facility in transfer documents for 1 year following the last positive CRO test.
 - The referring facility must ensure that the documentation is readily accessible to all parties involved in patient transfer.
 - More information on the interfacility transfer communication rule can be found on OHA’s [website](#).

Strategy 5: Improve Antimicrobial Stewardship

- **Review your antimicrobial stewardship program (ASP).** If your facility does not have an ASP, begin work to implement a formal stewardship program. See [appendix 2](#) to learn more.

Part 2: Responding to CROs in ACHs

- **Promote and monitor hand hygiene. The single most important measure to prevent CRO transmission is hand hygiene.** Resources related to hand hygiene can be found in [appendix 2](#).
- **Notify the local public health authority (LPHA) where the patient lives within one working day** of identifying certain CRO. This includes new cases and cases transferred from out-of-state.
 - Both laboratories and clinicians are required to report carbapenem-resistant *Enterobacterales* and *Acinetobacter* species. Reporting information can be found [here](#).
 - LPHA contact information can be found [here](#).
- **Notify receiving facilities verbally and in writing when a patient with a CRO is transferred.** Make sure staff at the receiving facility are aware of the patient’s CRO status, including those directly caring for the patient, those responsible for transportation, and those responsible for infection prevention and control.

- **Place CRO-positive patients on contact precautions.** Contact precautions should continue for the duration of the patient's stay.
- **Place CRO-positive patients in private rooms with private bathrooms.** Where single rooms are limited, prioritize private rooms for CRO-positive patients who have conditions associated with higher transmission risk, such as active infection, major wounds, or incontinence of urine or stool. If necessary, cohort CRO-positive patients in the same room or area of the facility.
- **Flag the patient's health record** so that the patient can be identified and placed on contact precautions immediately if re-admitted.
- **Educate staff about CROs.** Education helps reduce spread. Sample education materials are provided in [appendix 1](#).
- **Educate CRO-positive patients, their visitors, and families.** Education helps reduce spread. Provide the patient with [written information](#) about CROs at the time of discharge.
- **Review cleaning and disinfection with environmental services staff.** This includes daily room and bathroom cleaning and disinfection, and attention to high-touch surfaces such as light switches, doorknobs, reusable medical equipment, and bathroom surfaces. Consider providing dedicated medical equipment to CRO-positive patients. Resources related to cleaning and disinfection can be found in [appendix 2](#).
- **Notify clinicians and leadership who need to know about the CRO case.** This might include the Medical Director, Director of Nursing, Pharmacist, and those caring directly for the patient.
- **Implement a daily review of all invasive devices** to facilitate removal when clinically appropriate.
- **Review antibiotic use, culture orders, and susceptibility patterns.** Evaluate antibiotic use to find whether unnecessary antibiotics and cultures are being ordered and discuss with providers.

Part 3: Responding to CPOs in ACHs

For CROs that produce a carbapenemase (carbapenemase-producing organisms or CPOs), complete all the recommendations provided for CROs **and** the steps listed below. Information about why CPOs require additional action steps is provided [earlier in this document](#). Your lab or local or state public health authority will notify you if a patient tests positive for a CPO.

- **Meet with OHA epidemiologists and clinicians as soon as possible.** OHA staff will reach out to schedule a partner call, usually within one working day of identifying a CPO. Make sure staff at the receiving facility are aware of the patient's CRO status, including those caring directly for the patient, those responsible for transportation, and those responsible for infection prevention and control (IPC).
- **Schedule an onsite infection control assessment with an OHA Regional Infection Preventionist (IP).** OHA staff will connect you with the IP for your region, who will work with you to strengthen IPC practices. Assessments are designed to be supportive and collaborative, rather than punitive or regulatory.
- **Work with OHA to conduct CPO screening.** CPO screening is almost always recommended. Screening of residents can help determine whether any spread of CPO has occurred. OHA epidemiologists and clinicians will advise you on the most appropriate plan for screening at your LTACH or vSNF.
- **Notify facility administration.** Prevention of spread needs to be a priority for the whole hospital, which requires leadership and financial support.
- **Notify both the local public health authority (LPHA) and receiving facilities when a CPO-positive patient is transferred.** Fax a copy of the transfer notification to the LPHA where the patient lives. LPHA contact information can be found [here](#).
- **Place CPO-positive patients in private rooms with private bathrooms.**
 - When more than one CPO case is identified at the facility, it is best to cohort affected patients in private rooms in the same area (unit, floor, room cluster).
 - Cohort nursing staff that care for CPO-positive patients as resources allow. This is most important when more than one CPO-positive patient has been identified.
- **Alert environmental services and monitor environmental cleaning and disinfection.** Encourage frequent and thorough cleaning and

disinfection of high-touch surfaces, particularly those near the patient and common areas outside the room. Evaluate terminal cleaning using visual inspection and quantitative strategies such as direct observation, a UV fluorescence marker, or an ATP monitor before placing another patient in that room. If available, supplement manual cleaning with UV light, hydrogen peroxide vapor, or another “no touch” method. See [appendix 2](#) for additional resources.

- **Implement daily chlorhexidine gluconate (CHG) bathing.** Consider unit-wide CHG bathing, especially if more than one CPO case has been identified.
- **Verify and audit decontamination, disinfection, reprocessing, and sterilization (when needed) of reusable medical equipment** used for CPO-positive patients. To the greatest extent possible, provide dedicated equipment for these patients during their stay.
- **Review laboratory records to identify organisms with similar resistance patterns** in the three months before the index case was identified. This can help identify undetected outbreaks.
- **Conduct prospective laboratory surveillance.** For at least three months after identification of a CPO case, test all such isolates to determine whether they have the same mechanism of resistance as the index case.

Skilled Nursing Facilities (SNFs)

Part 1: Preventing CROs in SNFs

- **Align your facility’s CRO case definition with [OHA’s](#).**
- **Establish a reporting process to make sure CRO cases are rapidly reported** to IPC staff at your SNF.
 - Internal processes should include laboratory notification of SNF and IP staff.
 - Both laboratories and clinicians are required to report carbapenem-resistant *Enterobacterales* and *Acinetobacter* species to the LPHA.
 - Information on reporting can be found [here](#).
- **Implement the 2014 OHA “Communication During Transfer of Patients with MDROs” rule ([OAR 333-019-0052](#)).**
 - When a referring health care facility transfers or discharges a patient who is infected or colonized with an MDRO or pathogen that warrants transmission-based precautions, it must include written notification of the infection or colonization to the receiving facility in transfer documents for 1 year following the last positive CRO test.
 - The referring facility must ensure that the documentation is readily accessible to all parties involved in patient transfer.
 - More information on the interfacility transfer communication rule can be found on OHA’s [website](#).
- **Request a proactive MDRO-focused infection control assessment (ICAR) with an OHA Regional Infection Preventionist (IP)** using the [request form](#). OHA will work with you to strengthen IPC practices. ICARs are designed to be supportive and collaborative, rather than punitive or regulatory.
- **Reinforce and monitor routine adherence to hand hygiene.** See [appendix 2](#) for resources.
- **Provide appropriate personal protective equipment (PPE).** Ensure that sufficient appropriate PPE is provided for staff. Gloves, gowns, and eye protection should be available and easy to access where they are needed, preferably at the entry to each patient’s room.
- **Educate staff.** Provide training about CROs and the importance of following IPC measures. Include physicians, respiratory care, nursing, housekeeping, chaplains, food service, facilities personnel, and other

support staff in the training programs. See [appendix 1](#) for resources and materials.

- **Audit key infection control program elements.** These include hand-hygiene compliance, PPE donning and doffing, and routine and special cleaning and disinfection processes and effectiveness (with direct observation, blue light, or ATP).
- **Consider initiating additional prevention activities recommended by the Centers for Disease Control and Prevention (CDC),** especially if your SNF frequently receives patients from long-term acute care hospitals, ventilator-capable facilities, or out-of-state health care facilities:
 - **Admission screening for patients at high risk.**
 - **Ad hoc point-prevalence surveys.**

Part 2: Responding to CROs in SNFs

- **Promote and monitor hand hygiene, which is the single most important measure to prevent CRO transmission.** Resources related to hand hygiene can be found in [appendix 2](#).
- **Notify within one working day the local public health authority (LPHA) where the patient with CRO resides.** This includes new cases and cases transferred from out of state.
 - Both laboratories and clinicians are required to report carbapenem-resistant *Enterobacterales* and *Acinetobacter* species. Reporting information can be found [here](#).
 - LPHA contact information can be found [here](#).
- **Notify receiving facilities verbally and in writing when a patient with CRO is transferred.** Make sure staff at the receiving facility, including those caring directly caring for the patient, those responsible for transportation, and those responsible for IPC are aware of the patient's CRO status.
- **Place CRO-positive patients on Enhanced Barrier Precautions** (when Contact Precautions do not otherwise apply). Enhanced Barrier Precautions should also be used for residents at higher risk of acquiring a CRO. This includes patients with wounds or indwelling medical devices (e.g., central line, urinary catheter, feeding tube, tracheostomy, ventilator).

- Refer to “[When and How to Apply Contact Precautions to Residents](#)” below.
- **Flag the resident’s health record** so that the resident can be identified and placed on appropriate precautions immediately if re-admitted.
- **Educate staff about CROs.** Education helps reduce spread. Sample education materials are provided in [appendix 1](#).
- **Educate CRO-positive patients, their visitors, and families.** Education helps reduce spread. Provide the patient with [written information](#) about CROs at the time of discharge.
- **Review cleaning and disinfection with environmental services staff.** These include daily room and bathroom cleaning and disinfection, and attention to high-touch surfaces such as light switches, doorknobs, reusable medical equipment, and bathroom surfaces. Consider providing dedicated medical equipment to CRO-positive patients. Resources related to cleaning and disinfection can be found in [appendix 2](#).
- **Notify clinicians and leadership who need to know about the CRO case.** This might include the Medical Director, Director of Nursing, Pharmacist, and those caring directly for the patient.
- **Implement a daily review of all invasive devices** to facilitate removal when clinically appropriate.
- **Review antibiotic use, culture orders, and susceptibility patterns.** Evaluate antibiotic use to determine if unnecessary antibiotics and cultures are being ordered and discuss with providers.

Part 3: Responding to CPOs in SNFs

*For CROs that produce a carbapenemase (carbapenemase-producing organisms or CPOs), complete all the recommendations provided for CROs on the previous page **and** the steps listed below. Information about why CPOs require additional action steps is provided [earlier in this document](#). Your lab or local or state public health authority will notify you if a resident tests positive for a CPO.*

- **Meet with OHA epidemiologists and clinicians as soon as possible.** OHA staff will reach out to schedule a partner call, usually within one working day of identifying a CPO. IPC staff, staff who are familiar with

the layout and workflow of the affected unit(s), and those responsible for decision making at your facility should plan to attend.

- **Schedule an onsite infection control assessment with an OHA Regional Infection Preventionist (IP).** OHA staff will connect you with the IP for your region, who will work with you to strengthen IPC practices. Assessments are designed to be supportive and collaborative, rather than punitive or regulatory.
- **Work with OHA to conduct CPO screening.** CPO screening is almost always recommended. Screening of residents can help determine if any spread of CPO has occurred.
 - OHA epidemiologists and clinicians will advise you on the most appropriate plan for screening at your SNF.
 - OHA will provide materials and support. Refer to the [CPO responsive screening checklist](#).
- **Notify facility administration.** Prevention of spread needs to be a priority for the whole SNF, which requires leadership and financial support.
- **Notify both the LPHA and receiving facilities when a CPO-positive resident is transferred.** Fax a copy of the transfer notification to the LPHA where the resident lives. LPHA contact information can be found [here](#).
- **Place CPO-positive resident(s) on Contact Precautions.** Refer to “[When and How to Apply Contact Precautions to Residents](#)” below.
- **Place CPO-positive residents in private rooms with private bathrooms whenever possible.**
 - When more than one CPO case is identified at your SNF, it is best to cohort affected residents in private rooms in the same area (unit, floor, room cluster).
 - Cohort nursing staff that care for CPO-positive residents as resources allow. This is most important when more than one CPO-positive resident has been identified.
- **Alert environmental services and monitor environmental cleaning and disinfection.** Encourage frequent and thorough cleaning and disinfection of high-touch surfaces, particularly those near the patient and common areas outside the room. Evaluate terminal cleaning using visual inspection and quantitative strategies such as direct observation, UV fluorescence marker, or ATP monitor before placing another patient in that room. If available, supplement manual cleaning with UV light, hydrogen peroxide vapor, or another “no-touch” method. See [appendix 2](#) for additional resources.

- **Provide dedicated equipment for CPO-positive patients** during their stay, to the extent possible.
- **Review laboratory records to identify organisms with similar resistance patterns** in the three months before the index case was identified. This can help identify undetected outbreaks.

When and how to apply Contact Precautions for CRO-positive residents in SNFs

For Whom:

- **CPO-positive (infected or colonized) residents.**
- **Residents colonized with CRO that are not carbapenemase-producing or other targeted MDROs who are at a higher risk for transmission.**

How to Apply: Staff must use gowns and gloves for all in-room resident care.

Important Details:

1. **Room restriction:** CRO-positive residents should not be discouraged from participating in daily community meals and activities outside of their room, provided their source of CRO is covered and contained.
2. **Hand hygiene is key to preventing CRO transmission**, and the appropriate use of in-room care contact precautions provides an additional measure of protection. Staff should be reminded to perform hand hygiene before donning and after doffing gloves and gowns.
3. **Standard precautions should be employed for all residents.** These include the use of gowns and gloves for anticipated contact with body fluid or potential splashes and when changing soiled bed linens. Refer to the CDC [Standard Precautions website](#).
4. **Enhanced barrier precautions** should be employed for patients colonized or infected with an MDRO when contact precautions do not apply, and for all patients with wounds or indwelling medical devices regardless of MDRO colonization status. Refer to the [CDC Implementation of PPE in Nursing Homes guidance](#).

Working definition of residents at “higher risk for transmission” based on CDC guidance: [11]

- Ventilator-dependent
- Uncontained incontinence of stool
- Uncontained incontinence of urine
- Wounds with difficult-to-control drainage

Consult public health for individualized case recommendations when the need for Contact Precautions is uncertain.

When can contact precautions for residents with CPOs be discontinued?

Contact precautions for residents with CPOs should not be discontinued. Patients may be colonized with a CPO for many years and only intermittently positive on screening or clinical cultures.

If contact precautions are interfering with patient care or wellbeing, consult with public health before implementing the discontinuation protocol outlined in Appendix 4.

Measure	CPO infection	CPO colonization	CRO infection	CRO colonization
Notify receiving facility upon transfer*	Yes	Yes	Yes	Yes
Notify LPHA upon transfer or death	Yes	Yes	No	No
Standard Precautions always apply				
Enhanced Barrier Precautions	-	-	-	Yes, for colonized residents <u>not</u> at higher risk for CRO transmission
Contact Precautions†	Yes	Yes	Yes	Yes, for colonized residents at higher risk for CRO transmission
Gown & gloves for in-room resident care	Yes	Yes	Yes	Yes, for colonized residents at higher risk for CRO transmission
Door signage	Yes	Yes	Yes	For residents at higher risk for CRO transmission
Private room and bathroom	Yes (strongly encouraged)	Yes (strongly encouraged)	Yes	Yes
Restricted to room	Yes	No**	No**	No**
Enhanced environmental cleaning	Yes	Yes	Yes	Yes
Designated or disposable equipment	Yes	Yes	Yes	Yes
If >1 case, cohort staff if feasible	Yes	Yes	Optional	Optional
If >1 case, cohort residents if feasible	Yes	Yes	Optional	Optional
Consult with OHA regarding screening cultures	Yes	Yes	No	No
Visitor recommendations:				
Perform Hand Hygiene often, particularly after leaving the resident's room.	Yes	Yes	Yes	Yes
Gown/gloves if contact with body fluids is anticipated.	Yes	Yes	Yes	Yes
Gown/gloves if no contact with body fluids is anticipated.	No	No	No	No

See footnotes on next page.

*Report MDROs on [transfer communication form](#) for 1 year following the most recent positive CRO test.

†Contact precautions means using a gown and gloves for any in-room resident care. Residents colonized with a CRO that does not produce carbapenemase require contact precautions if they are at higher risk for CRO transmission (see text).

**Restricted to room. Residents should be restricted to their rooms should they not be able to contain their secretions and excretions. Residents for whom secretions and excretions can be contained may leave their rooms; upon leaving their rooms, all residents should be clean, fluids contained, able to follow instructions with assistance, and should wash their hands.

Community-Based Care (CBC) and Other Residential Care Settings

Part 1: Preventing CROs in CBC and Residential Care Settings

- **Establish a process to make sure carbapenem-resistant organisms (CROs) are rapidly reported** to whomever is responsible for infection prevention and control (IPC) at your facility or care setting. Information on reporting can be found [here](#).
- **Implement the 2014 Oregon Health Authority’s (OHA) “Communication During Patient Transfer of Patients with MDROs” rule ([OAR 333-019-0052](#)).**
 - When a referring health care facility transfers or discharges a resident who is infected or colonized with an MDRO or pathogen that warrants transmission-based precautions, it must include written notification of the infection or colonization to the receiving facility in transfer documents for 1 year following the last positive CRO test.
 - The referring facility must ensure that the documentation is readily accessible to all parties involved in patient transfer.
 - More information on the interfacility transfer communication rule can be found on OHA’s [website](#).
- **Reinforce and monitor routine adherence to hand hygiene. Knowing when and how to perform hand hygiene is the single most important step for preventing the spread of multidrug-resistant organisms (MDROs), including CROs.** See [appendix 2](#) for resources.
 - The preferred way to clean your hands is with an alcohol-based hand rub.
 - Use soap and water when hands are visibly dirty or after caring for patients with known or suspected infectious diarrhea such as *Clostridioides difficile* or norovirus.
- **Provide personal protective equipment (PPE) when appropriate.** Make sure that sufficient appropriate PPE is provided for staff. Gloves, gowns, and eye protection should be available and easy to access where they are needed, for example at the entry to each patient’s room in residential care facilities (RCFs) and Memory Care Communities (MCCs).
 - Wear gloves when providing care that has potential for contact with blood, body fluids, non-intact skin, or contaminated medical equipment. Do not wash or reuse gloves.

- Wear a gown when providing care that has potential for contact with blood or body fluids. Do not wear the same gown for the care of more than one resident.
- Wear mouth, nose, and eye protection when providing care that may create splashes or sprays of blood or body fluids.
- Reinforce and monitor adherence to appropriate PPE practices.
- **Educate staff.** Provide education for all staff, including nursing, housekeeping, food service, facilities personnel, and all other support staff. Topics could include:
 - **CROs:** Consider providing in-service training to staff about CROs and other MDROs.
 - **PPE donning and doffing:** provide in-the-moment education and reinforcement.
 - **Cleaning and disinfection:** Include information about appropriate Environmental Protection Agency (EPA) registered disinfectants and their contact time (also known as wet, dwell, or kill time).
 - See [appendix 1](#) for resources and materials.
- **Consider requesting a proactive infection control assessment (ICAR) with an OHA Regional Infection Preventionist (IP)** using the [request form](#). OHA will work with you to strengthen infection prevention and control practices. ICARs are designed to be supportive and collaborative, rather than punitive or regulatory.

Part 2: Responding to CROs in CBC and Residential Care Settings

- **Promote and monitor hand hygiene. The single most important measure to prevent CRO transmission is hand hygiene.** Resources related to hand hygiene can be found in [appendix 2](#).
- **Notify the local public health authority (LPHA) where the patient lives within one working day** of identifying certain CROs. This includes new cases and cases transferred from out-of-state.
 - Both laboratories and clinicians are required to report carbapenem-resistant *Enterobacterales* and *Acinetobacter* species. Reporting information can be found [here](#).
 - LPHA contact information can be found [here](#).
- **Notify receiving facilities verbally and in writing when a resident with a CRO is transferred.** Make sure staff at the receiving facility, including those caring directly for the patient, those responsible

for transportation, and those responsible for IPC are aware of the patient's CRO status.

- **Place CRO-positive residents on appropriate transmission based-precautions.**
 - **Wear gloves when providing care that has potential for contact with blood, body fluids, non-intact skin, soiled linens or clothing, and contaminated medical equipment.** Do not wash or reuse gloves. Perform hand hygiene immediately after removing gloves.
 - **Wear a gown when providing care that has potential for contact with blood or body fluids.** Do not wear the same gown for the care of more than one resident.
 - **Wear mouth, nose, and eye protection when providing care that may create splashes or sprays of blood or body fluids.**
 - **Remove and discard personal protective equipment (PPE) before leaving the patient's room or area.**
 - **Wear a surgical mask when placing a catheter into the spinal canal or subdural space and when injecting material into these spaces.**
- **Flag the patient's health record** so that the resident can be identified and placed on contact precautions immediately if re-admitted.
- **Educate staff about CROs.** Education helps reduce spread. Sample education materials are provided in [appendix 1](#).
- **Educate CRO-positive residents, their visitors, and families.** Education helps reduce spread. Provide the resident with [written information](#) about CROs at the time of discharge.
- **Review cleaning and disinfection with environmental services staff.** This includes daily room and bathroom cleaning and disinfection, and attention to high-touch surfaces such as light switches, doorknobs, reusable medical equipment, and bathroom surfaces. Consider providing dedicated medical equipment to CRO-positive patients. Resources related to cleaning and disinfection can be found in [appendix 2](#).
- **Notify clinicians and leadership who need to know about a CRO case.** This might include the Medical or Executive Director, Director of Nursing, Pharmacist, and those caring directly for the patient.

Part 3: Responding to CPOs in Community-Based and Residential Care Settings

*For carbapenem-resistant organisms (CROs) that produce a carbapenemase (carbapenemase-producing organisms or CPOs), complete all the recommendations provided for CROs **and** the steps listed below. Information about why CPOs require additional action steps is provided [earlier in this document](#). Your lab or local or state public health authority will notify you if a patient tests positive for a CPO.*

- **Meet with OHA epidemiologists and clinicians as soon as possible.** OHA staff will reach out to schedule a partner call, usually within one working day of identifying a CPO. Infection prevention and control, staff who are familiar with the layout and workflow of the affected unit(s), and those responsible for decision making at your facility should plan to attend.
- **Schedule an onsite infection control assessment (ICAR)** with an OHA Regional Infection Preventionist (IP). OHA staff will connect you with the IP for your region, who will work with you to strengthen infection prevention and control practices. Additional recommendations specific to your care setting will be provided as a part of this onsite assessment. ICARs are designed to be supportive and collaborative, rather than punitive or regulatory.
- **Determine if the CPO-positive residents need to be on contact precautions** by consulting with your OHA Regional IP and local public health authority (LPHA).
- **Work with OHA to conduct CPO screening.** CPO screening is almost always strongly recommended. Screening of residents can help determine if any spread of CPO has occurred. OHA epidemiologists and clinicians will advise you on the most appropriate plan for screening at your facility. OHA will provide materials and support. Refer to the [CPO responsive screening checklist](#).
- **Notify both the LPHA and receiving facilities when a CPO-positive resident is transferred.** Fax a copy of the transfer notification to the LPHA where the resident lives. LPHA's contact information can be found [here](#).
- **Place CPO-positive patients in private rooms with private bathrooms whenever possible.**
 - When more than one CPO case is identified at your facility or care setting, it is best to cohort involved patients in private rooms in the same area (unit, floor, room cluster).

- Cohort staff that care for CPO- positive patients as resources allow. This is most important when more than one CPO-positive patient has been identified.
- **Alert environmental services and monitor environmental cleaning.** Encourage frequent and thorough cleaning of high-touch surfaces, particularly those near the patient, and common areas outside the room. See [appendix 2](#) for additional resources.

Outpatient and Other Health Care Settings

Including Ambulatory Care, Ambulatory Surgery Centers, Hemodialysis Centers, Home Health, and Hospice

Part 1: Preventing CROs in Outpatient and Other Health Care Settings

- **Establish a process to make sure carbapenem-resistant organism (CRO) cases are rapidly reported** to whomever is responsible for infection prevention and control (IPC) at your facility or care setting. Information on reporting can be found [here](#).
- **Know the 2014 Oregon Health Authority’s “Communication During Transfer of Patients with of MDROs” rule** ([OAR 333-019-0052](#)).
 - When a referring ambulatory surgery center, hemodialysis center, or hospice facility transfers or discharges a resident who is infected or colonized with an MDRO or pathogen which warrants transmission-based precautions, it must include written notification of the infection or colonization to the receiving facility in transfer documents for 1 year following the last positive CRO test.
 - The referring facility must ensure that the documentation is readily accessible to all parties involved in patient transfer.
 - More information on the interfacility transfer communication rule can be found on OHA’s [website](#).
- **Reinforce and monitor routine adherence to hand hygiene. Knowing when and how to perform hand hygiene is the single most important measure to prevent the spread of multidrug-resistant organisms (MDROs), including CROs.** See [appendix 2](#) for resources.
 - The preferred way to clean your hands is with an alcohol-based hand rub.
 - Use soap and water when hands are visibly dirty or after caring for patients with known or suspected infectious diarrhea such as *Clostridioides difficile* or norovirus.
- **Provide personal protective equipment (PPE) when appropriate.** Make sure that sufficient appropriate PPE is provided for staff. Gloves, gowns, and eye protection should be available and easy to access where they are needed. Educate all health care providers on proper selection and use of PPE. Reinforce and monitor adherence to appropriate PPE practices.
 - **Wear gloves when providing care that has potential for contact with blood, body fluids, non-intact skin, or contaminated medical equipment.** Do not wash or reuse gloves.

- **Wear a gown when providing care that has potential for contact with blood or body fluids.** Do not wear the same gown for the care of more than one patient.
- **Wear mouth, nose, and eye protection when providing care that may create splashes or sprays** of blood or body fluids.
- We strongly recommend using the checklist included in the CDC booklet titled the “[Guide to Infection Prevention for Outpatient Settings: Minimum Expectations for Safe Care](#)” to review current policies and practices.
- **Educate staff.** Provide education for all staff, including environmental services, about the prevention of MDROs, including PPE donning and doffing, and cleaning and disinfection. See [appendix 1](#) for resources and materials.
- **Consider requesting a proactive infection control assessment (ICAR) with an OHA Regional Infection Preventionist (IP)** using the [request form](#). OHA will work with you to strengthen IPC practices. ICARs are designed to be supportive and collaborative, rather than punitive or regulatory.

Part 2: Responding to CROs in Outpatient and Other Health Care Settings

- **Promote and monitor hand hygiene. The single most important measure to prevent CRO transmission is hand hygiene.** Resources related to hand hygiene can be found in [appendix 2](#).
- **Notify the local public health authority (LPHA) where the patient lives within one working day** of identifying certain CROs. This includes new cases and cases transferred from out of state.
 - Both laboratories and clinicians are required to report carbapenem-resistant *Enterobacteriales* and *Acinetobacter* species. Reporting information can be found [here](#).
 - LPHA contact information can be found [here](#).
- **Place CRO-positive patients on appropriate transmission based-precautions.**
 - **Wear gloves when providing care that has potential for contact with blood, body fluids, non-intact skin, or contaminated medical equipment.** Do not wash or reuse gloves. Perform hand hygiene immediately after removing gloves.
 - **Wear a gown when providing care that has potential for contact with blood or body fluids.** Do not wear the same gown for the care of more than one patient.

- **Wear mouth, nose, and eye protection when providing care that may create splashes or sprays** of blood or body fluids.
- **Remove and discard personal protective equipment (PPE) before leaving the patient's room or area.**
- **Wear a surgical mask when placing a catheter into the spinal canal or subdural space** and when injecting material into these spaces.
- **Educate staff about CRO.** Education helps reduce spread. Sample education materials are provided in [appendix 1](#).
- **Educate CRO-positive patients and families.** Education helps reduce spread. Provide the patient with [written information](#) about CRO.
- **Review cleaning and disinfection with environmental services staff.** This includes daily room and bathroom cleaning and disinfection, and attention to high-touch surfaces such as light switches, doorknobs, reusable medical equipment, and bathroom surfaces. Consider using disposable medical equipment for CRO-positive patients. Resources related to cleaning and disinfection can be found in [appendix 2](#).
- **Notify clinicians and leadership who need to know about a CRO case.** This might include the Clinic Manager, Medical Director, Director of Nursing, Pharmacist, and those caring directly for the patient.

Part 3: Responding to CPOs in Outpatient and Other Health Care Settings

*For carbapenem-resistant organisms (CROs) that produce a carbapenemase (carbapenemase-producing organisms or CPOs), complete all the recommendations provided for CROs **and** the steps listed below. Information about why CPOs require additional action steps is provided [earlier in this document](#). Your lab or local or state public health authority will notify you if a patient tests positive for a CPO.*

- **Consult with OHA epidemiologists as soon as possible.** OHA staff will reach out to discuss the case and provide initial recommendations. If necessary, additional calls may be scheduled with facility infection prevention, staff who are familiar with the layout and workflow of the affected facility and those responsible for decision making.
- **Schedule a consult with an OHA Regional Infection Preventionist (IP).** This may be an onsite infection control assessment (ICAR) or a phone consult. OHA staff will connect you with the IP for your region,

who will work with you to strengthen infection prevention and control practices. Additional recommendations specific to your care setting will be provided. ICARs are designed to be supportive and collaborative, rather than punitive or regulatory.

- **Work with OHA to conduct CPO screening.** OHA epidemiologists and clinicians will advise you on the most appropriate plan for screening at your facility. If screening is recommended, OHA will provide materials and support. Refer to the [CPO responsive screening checklist](#).
- **Determine if the CPO-positive residents need to be on contact precautions** by consulting with your OHA Regional IP and local public health authority (LPHA).
 - A gown and gloves should be worn for all patient care if contact with body fluids is anticipated.
 - Reinforce adherence to hand hygiene.
- **Flag the patient's health record** so that the patient can be identified and contact precautions can be used when providing care to the patient.
- **Alert environmental services and monitor environmental cleaning and disinfection.** Encourage frequent and thorough cleaning and disinfection of high-touch surfaces, particularly those that were near the patient, and common areas outside the room(s) where the patient was seen. See [appendix 2](#) for additional resources.
- **Review laboratory records to identify organisms with similar resistance patterns** in the three months before the index case was identified. This can help identify undetected outbreaks.

Recommendations for Microbiology Laboratories

- **Determine carbapenem susceptibility using updated Clinical and Laboratory Standards Institute (CLSI)-recommended procedures and interpretive criteria.** In 2010, CLSI lowered the carbapenem susceptibility breakpoints for *Enterobacterales*. In 2012, the ertapenem breakpoint was increased by a one-fold dilution. Breakpoints for the carbapenems have not changed since 2012.
- **Report carbapenem-resistant *Enterobacterales* (CRE), carbapenem-resistant *Acinetobacter* (CRA), and carbapenemase-producing organisms (CPOs) to your local public health authority (LPHA) within one working day.** Use [Oregon Health Authority \(OHA\) case definitions](#) in this document.
- **Send *Enterobacterales* and *Acinetobacter* spp. isolates that meet the OHA CRE or CRA case definition and isolates that meet the OHA CPO case definition to the Oregon State Public Health Laboratory (OSPHL) for further testing.**

All submitted isolates will be tested for carbapenemase production at OSPHL or the regional Antimicrobial Resistance Laboratory Network (ARLN).

How to send isolates:

- Use the red [General Microbiology Request Form](#) (form 60). Forms are available [online](#).
- In "tests requested," check "carbapenemase testing" and write in the organism genus and species.
- Send the antimicrobial susceptibility report along with the isolate.
- Send a pure, viable isolate on a slant or a plate.
- Include two patient identifiers, collection date, source of specimen, and patient medical record number in the submission.

All request forms and specimens **must** have two patient identifiers (e.g., name and date of birth).

Address to:

OSPHL
7202 NE Evergreen Parkway, Suite 100
Hillsboro, OR 97124-6536
503-693-4100 (phone) 503-693-5604 (fax)

- **CRE and CRA screening cultures for case contacts should be performed as recommended by local facility Infection Prevention and Control staff, *in consultation with OHA*.** The number of surveillance cultures requested is based on pertinent epidemiology.
 - Laboratory testing of surveillance swabs can be performed at no cost with approval from OHA.
 - If your lab is performing screening, confirm candidate CRE and CRA organisms via routine identification and susceptibility; send all confirmed CRE and CRA isolates to OSPHL in accordance with [OAR 333-018-0018](#).
 - Generally, the cost of screening cultures should not be billed to the patient; discuss billing with Infection Prevention and Control (IPC), facility leadership, and OHA.
- **Discuss with IPC how results of screening cultures will be reported.**

Oregon defines CPOs as organisms that are positive for carbapenemase production (e.g., KPC, NDM, VIM, IMP, OXA-48, OXA-23, OXA-24/40, OXA-235) by molecular test (e.g., PCR) or next-generation sequencing (NGS), or that are positive for carbapenemase production by phenotypic test (e.g., Carba NP).

Organisms with known chromosomal carbapenemase genes are excluded from this definition unless they have additional non-chromosomal carbapenemase genes. Chromosomal carbapenemases have a limited potential for rapid global spread. The most aggressive control measures otherwise recommended for CPOs do not apply for organisms such as:

- *Serratia marcescens* that produce a chromosomally encoded carbapenemase called the *S. marcescens* enzyme (SME).
- *Acinetobacter radioresistens* that produce a chromosomally encoded OXA-23 carbapenemase.

Detection Methods for Carbapenemase-Producing Organisms (CPOs)

Carba NP Test: A rapid, accurate technique for carbapenemase detection in *Enterobacteriales* and *Pseudomonas aeruginosa* [12] [13] [14]. While accurate for the most common carbapenemases in the U.S. (KPC and NDM), Carba NP did not reliably detect OXA-48 in our validation study.

Modified carbapenem inactivation method (mCIM) and EDTA-modified carbapenem inactivation method (eCIM): Methods to detect carbapenemase production in *Enterobacterales* and *Pseudomonas aeruginosa* by assessing the ability of the organism to inactivate carbapenem antibiotics. The eCIM further distinguishes between metallo- β -lactamase (MBL) carbapenemases (NDM, IMP, VIM) and non-MBL carbapenemases (OXA-48, KPC) [15] [16].

Next-Generation Sequencing (NGS): A sequencing technology that is used to determine the entire genome of an organism or targeted regions of DNA or RNA. Whole-genome sequencing (WGS) is an NGS technology that allows laboratories to perform a wide variety of applications such as the characterization of bacterial pathogens, antibiotic resistance and virulence genes, and phylogenetic analysis. WGS has become more accessible and is currently used by the OSPHL and the regional Antimicrobial Resistance Laboratory Network (ARLN) laboratory to characterize certain CPOs from pure colonies of bacteria obtained by culture [17] [18].

Nucleic acid amplification testing (NAAT): NAAT is typically performed on pure colonies of bacteria obtained by culture, which involves growing, isolating, and identifying an organism from clinical samples. NAAT testing for resistance markers directly from positive blood culture bottles is also possible. Examples of NAAT include PCR and transcription-mediated amplification (TMA).

- **NAAT: Isolated colonies.** Genotypic testing for the presence of carbapenemase from pure isolates through methods like PCR is **the most accurate way to detect CPOs** among *Enterobacterales*, *Pseudomonas aeruginosa*, and *Acinetobacter* species. OSPHL can perform PCR testing for the most common carbapenemases including KPC, NDM, VIM, IMP and OXA variants. Some Oregon clinical labs have added capacity for culture-based PCR testing through methods like GeneXpert® Carba-R (Cepheid).
- **NAAT: Positive blood cultures.** Several molecular platforms are FDA-cleared for identifying organisms and detecting antibiotic resistance markers, including carbapenemases, directly from positive blood-culture bottles. Example platforms include the FilmArray® Blood Culture Identification (BCID) Panel (BioFire Diagnostics) and the Verigene® Gram-Negative Blood Culture Test (Luminex Corporation) [16].

- **NAAT: Rectal screening swabs.** In the context of CPO outbreaks, rectal screening swabs can be tested directly for carbapenemases by PCR. GeneXpert[®] Carba-R (Cepheid) is a commonly used PCR assay for this type of screening.

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Appendices

Appendix 1: CRO and CPO Education Materials

For additional resources and documents, visit:

<https://www.oregon.gov/oha/ph/diseasesconditions/communicabledisease/hai/prevention/pages/MDRO.aspx>

Patient and Family Education

- [CDC Patient Safety: What You Can Do to Be a Safe Patient](https://www.cdc.gov/hai/patientsafety/patient-safety.html) (<https://www.cdc.gov/hai/patientsafety/patient-safety.html>)
- [CPO Patient Wallet Card](https://rebrand.ly/CPOWalletCard) (<https://rebrand.ly/CPOWalletCard>)
- [CPO Screening Patient FAQ](https://rebrand.ly/CPOScreeningFAQ) (<https://rebrand.ly/CPOScreeningFAQ>)
- [CPO Infected/Colonized Patient FAQ](https://rebrand.ly/CROCPOInfectedColonizedFAQ) (<https://rebrand.ly/CROCPOInfectedColonizedFAQ>)
- [CRO patient and family education](https://rebrand.ly/CROFAQOnePage) (<https://rebrand.ly/CROFAQOnePage>)
- [Detailed patient and family education](https://rebrand.ly/CROFAQ) (<https://rebrand.ly/CROFAQ>)

Health Care Staff Education

- [CDC Frequently Asked Questions about MDRO Prevention and Response](https://www.cdc.gov/hai/mdro-guides/index.html#faqs) (<https://www.cdc.gov/hai/mdro-guides/index.html#faqs>)
- [CDC MDRO Containment Webinar Series](https://www.vdh.virginia.gov/haiar/mdro-containment-webinar-series/) (<https://www.vdh.virginia.gov/haiar/mdro-containment-webinar-series/>)
- [Tune in to Safe Healthcare CDC Webinar](https://www.cdc.gov/infectioncontrol/training/safe-healthcare-webinars.html) (<https://www.cdc.gov/infectioncontrol/training/safe-healthcare-webinars.html>)
- [OHA MDRO Prevention in Acute Care Settings PowerPoint Slides](https://rebrand.ly/MDROResponseOverview) (<https://rebrand.ly/MDROResponseOverview>)

Appendix 2: Infection Prevention and Control (IPC) and Antibiotic Stewardship Resources

General IPC Resources:

- [OHA Patient/Resident Interfacility Transfer Form](https://rebrand.ly/OR-IFT-Form)
(<https://rebrand.ly/OR-IFT-Form>)
- [CDC Environmental Checklist for Monitoring Cleaning of Patient/Resident Rooms](https://www.cdc.gov/hai/pdfs/toolkits/environmental-cleaning-checklist-10-6-2010.pdf)
(<https://www.cdc.gov/hai/pdfs/toolkits/environmental-cleaning-checklist-10-6-2010.pdf>)
- [CDC Options for Evaluating Environmental Cleaning](https://www.cdc.gov/HAI/toolkits/Evaluating-Environmental-Cleaning.html)
(<https://www.cdc.gov/HAI/toolkits/Evaluating-Environmental-Cleaning.html>)
- [CDC Healthcare Environmental Infection Prevention and Control Website](https://www.cdc.gov/hai/prevent/environment/index.html) (<https://www.cdc.gov/hai/prevent/environment/index.html>)
- [CDC Quick Observation Tools for IPC](https://www.cdc.gov/infectioncontrol/tools/quotes.html)
(<https://www.cdc.gov/infectioncontrol/tools/quotes.html>)
- [Oregon Patient Safety Commission Infection Prevention and Control Education Videos](https://www.youtube.com/@OregonpatientsafetyOrg/playlists)
(<https://www.youtube.com/@OregonpatientsafetyOrg/playlists>)

Acute Care Hospitals:

- [CDC MDRO Prevention Program Assessment Tool](https://www.cdc.gov/hai/pdfs/prevent/mdro-facility-assessment_7_28.pdf)
(https://www.cdc.gov/hai/pdfs/prevent/mdro-facility-assessment_7_28.pdf)
- [CDC Core Elements of Antibiotic Stewardship Programs for Hospitals](https://www.cdc.gov/antibiotic-use/core-elements/hospital.html)
(<https://www.cdc.gov/antibiotic-use/core-elements/hospital.html>)

Long-term Care Facilities:

- [OHA Long-Term Care Facility HAI Toolkit](https://www.oregon.gov/oha/ph/diseasesconditions/communicabledisease/hai/pages/long-term-care-facilities.aspx)
(<https://www.oregon.gov/oha/ph/diseasesconditions/communicabledisease/hai/pages/long-term-care-facilities.aspx>)
- [CDC Infection Prevention and Control Tools for Long-term Care Facilities](https://www.cdc.gov/longtermcare/prevention/index.html) (<https://www.cdc.gov/longtermcare/prevention/index.html>)
- [CDC Core Elements of Antibiotic Stewardship for Nursing Homes](https://www.cdc.gov/antibiotic-use/core-elements/nursing-homes.html)
(<https://www.cdc.gov/antibiotic-use/core-elements/nursing-homes.html>)

Outpatient Settings:

- [CDC Guide to IPC for Outpatient Settings Minimum Expectations for Care](https://www.cdc.gov/infectioncontrol/pdf/outpatient/guide.pdf) (<https://www.cdc.gov/infectioncontrol/pdf/outpatient/guide.pdf>)
- [CDC Core Elements of Antibiotic Stewardship for Outpatient Settings](https://www.cdc.gov/antibiotic-use/core-elements/outpatient.html)
(<https://www.cdc.gov/antibiotic-use/core-elements/outpatient.html>)

Hemodialysis Facilities:

- [CDC Audit Tools and Checklists](https://www.cdc.gov/dialysis/prevention-tools/audit-tools.html)
(<https://www.cdc.gov/dialysis/prevention-tools/audit-tools.html>)

Appendix 3: CRO and CPO Response Protocols and Resources

- [CRO Response Diagram](https://rebrand.ly/ResponseDiagram) (https://rebrand.ly/ResponseDiagram)
- [CPO Response Guide for Health Care Facilities](https://rebrand.ly/CPO-FacilityResponseGuide)
(https://rebrand.ly/CPO-FacilityResponseGuide)
- [CPO Patient/Resident Responsive Screening Verbal Consent Script](https://rebrand.ly/CPOAssentScript)
(https://rebrand.ly/CPOAssentScript)
- [CPO Provider FAQ](https://rebrand.ly/CPOProviderFAQ) (https://rebrand.ly/CPOProviderFAQ)
- [Oregon State Public Health Lab \(OSPHL\) CRO Rectal Screening Specimen Collection Protocol](https://rebrand.ly/OSPHLCREInstructions)
(https://rebrand.ly/OSPHLCREInstructions)
- [Antibiotic Resistance Laboratory Network \(ARLN\) CRO Rectal Screening Specimen Collection Protocol](https://rebrand.ly/MDROResponseOverview)
(https://rebrand.ly/MDROResponseOverview)
- [ARLN Shipment Manifest](https://rebrand.ly/ARLNShipSheet) (https://rebrand.ly/ARLNShipSheet)

Appendix 4: Discontinuation of contact precautions

CRO and CPO colonization can be prolonged. When contact precautions are indicated based on facility and patient characteristics described in this document, they should be maintained until:

- For CROs, at least one year after the most recent positive lab test
- For CPOs, indefinitely

Discontinuation of contact precautions for CPOs is discouraged but may be considered in consultation with public health if it would benefit the patient. In these limited cases, discontinue contact precautions when the resident has had at least three (3) negative screening cultures of specimens obtained:

- at least 3 months after the last positive culture AND
- at least 3 months after last course of antibiotics AND
- ≥ 1 week apart.

The recommended screening sites are rectal or perirectal. If the original site of infection is still present, e.g., a wound that hasn't healed or urine from a chronically catheterized patient, at least one specimen from each such site should also be cultured before discontinuing contact precautions.