UTAH DEPARTMENT OF HEALTH

Carbapenem-Resistant Organism (CRO) Disease Plan, including:

Carbapenem-resistant *Enterobacteriaceae* (CRE)

Klebsiella species
Enterobacter species
Escherichia coli

Carbapenem-resistant *Acinetobacter* species (CRA)

Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)

Disease Plan

Quick Links

Last updated: 03/04/2019 by Maureen Vowles and Amanda Smith.

Questions about this disease plan?

Contact the Utah Department of Health Bureau of Epidemiology: 801-538-6191.

✓ CRITICAL CLINICIAN INFORMATION

Clinical Evidence
Signs/Symptoms • CRO infections can present as septicemia, pneumonia, urinary tract infection, wounds/abscesses, or as asymptomatic colonization.
Period of Communicability • Patients are communicable whether infected or colonized (colonization is when bacteria are present, but the patient does not have symptoms or signs of illness); all current or previously colonized or infected patients should be treated as having the potential for transmission. • Because CRO infections are often difficult to treat, infection or colonization can be prolonged. Therefore, a patient diagnosed with one of these organisms should be considered infectious until s/he has had three negative cultures at least one week apart from previously positive sites.
Incubation Period • The incubation period is not well defined.
Mode of Transmission • Direct contact with patient's body fluids and secretions. • Droplet transmission if patient has respiratory colonization or CRO-positive sputum culture. • Contact with inanimate objects such as medical equipment or surfaces that have been contaminated by body fluids or secretions.
Laboratory Testing
Type of Lab Test/Timing of Specimen Collection • Culture and all susceptibility (MICs and interpretations, including suppressed results) • Carbapenemase phenotypic and genotypic testing
Type of Specimens • Typical specimens include sputum, urine, abscesses, wounds, blood, stool, rectal and perirectal swabs.
Treatment Recommendations
Type of Treatment • Consult with the antibiotic susceptibility profile to identify antibiotics to which the organism is susceptible or resistant. For wounds/abscesses, incision and drainage is useful. Consider an infectious disease (ID) consult when treating a patient with a confirmed CRO. Patients who are colonized, but not infected should not be treated, but contact precautions should be put in place to prevent transmission.
Time Period to Treat • As soon as a CRO infection is identified
Prophylaxis • None (See Infection Control Procedures)
Contact Management
Isolation of Case • Contact Precautions are recommended for all patients with an active infection and should be considered for colonized patients residing in healthcare facilities.

Quarantine of Contacts

- None

Infection Control Procedures

- Contact Precautions are recommended for patients/residents who are infected OR who are colonized with CRE, CRA and/or CRPA.
- Contact Precautions include:
  - Performing hand hygiene before donning a gown and gloves
  - Donning gown and gloves before entering the affected patient/resident's room
  - Removing the gown and gloves and performing hand hygiene before exiting the patient/resident's room
  - Patient's currently infected or colonized should have dedicated rooms, equipment and staff (when possible)
  - Continue to monitor facility residents/staff for signs/symptoms of infection
- All patients/residents with known carbapenemase production whether infected or colonized, should be placed under contact precautions in healthcare facilities especially in acute care hospitals, long-term acute care hospitals, and ventilator units of skilled nursing facilities.(1)
- Per CDC recommendations, a patient diagnosed with one of these organisms should be considered infectious until s/he has had three negative cultures at least one week apart from previously positive sites.
- Use of Contact Precautions in lower-acuity settings, e.g., non-ventilator units of skilled nursing facilities and rehabilitation facilities, should be guided by the potential environmental contamination risk, e.g., stool and/or urine incontinence that is difficult to contain, or wound drainage that is difficult to contain. Appropriate PPE (gown, gloves and face shields) should be used when the potential for exposure to body fluids or secretions exists, such as when the following actions are provided by a healthcare worker:
  - Bathing residents
  - Assisting residents with toileting
  - Changing residents' briefs
  - Changing a wound dressing
  - Manipulating patient devices e.g., urinary catheter
  - Suctioning patient airways

Quick reference links

- Utah Reportable Conditions list
- Facility Communication Transfer Form (see appendix B)
- Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms (CROs).
- The Healthcare Infection Control Practices Advisory Committee – 2006 (HICPAC) developed guidance that serves as the standard for facility infection control. Their guidance on Management of Multidrug-Resistant Organisms in Healthcare Settings is the current gold standard for facility infection control.

- The CDC published a 2015 update entitled Facility Guidance for Control of Carbapenem-resistant *Enterobacteriaceae* (CRE). This update targets control in acute care hospitals and skilled nursing facilities for patients that require medical or nursing care. Please contact public health with questions or for additional guidance.
- Management of Multidrug-Resistant Organisms in Healthcare Settings (2006)
- CDC Carbapenem-resistant Enterobacteriaceae in Healthcare Settings provides a CRE toolkit for patients, clinicians, facilities and public health.

✓ WHY IS CRO IMPORTANT TO PUBLIC HEALTH?

Carbapenem-resistant organisms (CRO) are bacteria that are resistant to one or more of the carbapenem antibiotics, considered a last line treatment option in many circumstances. Additionally, CRO also tend to be resistant to many other antibiotic treatment options. Data from the Centers for Disease Control and Prevention (CDC) suggest that CRO are a significant cause of morbidity and mortality. CRO infections can be very difficult to treat and patients with these infections can transmit these organisms to other people, especially when housed in healthcare or long-term care facilities. Public health will work with all facilities along the continuum of care to prevent and contain CRO through surveillance, outbreak investigation, education, infection control improvements and enhanced inter-facility communication.

✓ CRO DISEASE AND EPIDEMIOLOGY

Clinical Description

Clinically, these organisms often are the cause of bacteremia, pneumonia, wounds/abscesses, and urinary tract infections (UTIs), but patients can have asymptomatic colonization rather than symptomatic infection.

Causative Agents

Carbapenems (doripenem, imipenem, meropenem and ertapenem) are antibiotics that tend to be reserved for use with bacteria that are resistant to most other antibiotics. The following three groups of carbapenem-resistant bacteria are currently reportable in the state of Utah:

- **CRE** (carbapenem-resistant *Enterobacteriaceae*) include *Enterobacter* sp., *Klebsiella* sp., or *E. coli*, from any specimen source, that are resistant to one or more of the common carbapenems in use today: doripenem, imipenem, meropenem, or ertapenem
- **CRA*** (carbapenem-resistant *Acinetobacter* species) are *Acinetobacter* species, from any specimen source, that are resistant to doripenem, imipenem, or meropenem.
- **CRPA*** (carbapenem-resistant *Pseudomonas aeruginosa)* is caused by *Pseudomonas aeruginosa*, from any specimen source, that are resistant to doripenem, imipenem, or meropenem.

**Ertapenem is used with Enterobacteriaceae only, Acinetobacter spp. and Pseudomonas aeruginosa are intrinsically resistant to ertapenem, and therefore, do not create a case.*[(2)]

Differential Diagnosis

The differential diagnosis for these conditions is identifying drug-resistant from drug-susceptible strains.

Laboratory Identification

(i) General laboratory CRO identification issues

Since the laboratory plays a key role in reporting and setting off alerts for epidemiological investigations, laboratory personnel need to be familiarized with the timely reporting of current

Utah reportable diseases to public health. Click on the following link for a list of reporting methods and current reportable and immediately reportable diseases required by Utah law to be submitted to the Utah Department of Health within three days or 24 hours of identification, respectively: http://health.utah.gov/epi/reporting/Rpt_Disease_List.pdf.

NOTE: Periodic updates and changes to this list are also viewable through The Communicable Disease Rule (R386-702) bulletin available from https://rules.utah.gov/publicat/bull_pdf.

Most laboratories have the capacity to identify bacterial isolates to genus and species level. Testing includes routine culture and antibiotic susceptibility testing. Currently, most identification and antibiotic susceptibility testing are performed using automated standalone/walk away instruments. Problems with lab identification and susceptibility reporting can usually be traced to mixed cultures, over-inoculation or clerical errors. To ensure accurate public health reporting and infection control, laboratories need to implement appropriate remedial protocols that include but are not limited to: purity check plates, repeat susceptibility testing (usually by a different method) and regular clerical checking of patient reports for unusual susceptibility patterns (CAP, 2015).

The Utah Public Health Laboratory (UPHL) has capacity to provide antimicrobial susceptibility testing and carbapenemase testing on CRE isolates. ***Laboratories are requested to save all isolates suspected of being CROs so these isolates can be referred to the UPHL for confirmation and further testing as necessary. CRO isolates, regardless of colony count or source, should be requested and saved as quickly as possible since many clinical laboratories routinely discard isolates within 1-2 weeks.***

NOTE: Submission of clinical material does not replace the requirement for laboratories to report the event to public health as defined in Utah Title 386-702-6 and R386-702-7.

Since the Clinical and Laboratory Standards (CLSI) breakpoints used to determine interpretations change over time, the Council of State and Territorial Epidemiologists (CSTE) recommend that laboratories report minimum inhibitory concentration (MIC) values or Kirby Bauer zone sizes, along with interpretations to epidemiology. This not only ensures both correct reporting and investigation of CROs, but ensures that trend data is not lost.

Recommendation: Use the most current CLSI guidelines (M100-S27) for MIC breakpoints, available at: http://clsi.org/m100/ (free web version).

(ii) Laboratory identification of carbapenem-resistance in CRE, CRA and CRPA

Although most laboratories can routinely identify carbapenem-resistance in potential CRE, CRA and CRPA isolates, relatively few laboratories have the capability or capacity to identify whether carbapenem-resistance is caused by a carbapenemase. Consequently, isolates need to be submitted to UPHL for additional specialized phenotypic and genotypic testing to determine carbapenemase production (CP). The primary carbapenemase genes are:

- KPC (*Klebsiella* pneumoniae carbapenemase – this can live in organisms other than *Klebsiella pneumoniae*) – considered most common in the U.S.
- IMP (imipenemase metallo-beta-lactamase)

- NDM (New Delhi metallo-beta-lactamase) – Very common in Indian subcontinent.
- VIM (Verona integron-encoded metallo-beta-lactamase)
- OXA (oxacillin carbapenemase)

Carbapenemase genes are typically encoded on plasmids (extra-chromosomal DNA) and are easily transmitted between organisms and even across species.[3] Carbapenemase producers are of particular concern to public health because of their resistance to last-line antibiotic options and increased potential for spread.

In addition to carbapenemase genes, carbapenem resistance can spontaneously occur in response to antibiotic therapy and usually occurs via a distinct genetic mutation. This intrinsic resistance is generally not easily transmitted. However, there is little data available on the rate of intrinsic resistance that results in the production of a novel carbapenemase. Potential novel carbapenemase producers are sent to the regional Antibiotic Resistance Laboratory Network (ARLN) laboratory in Texas for further characterization and testing.

Treatment

Treatment is dependent upon the presentation status (e.g., colonized versus symptomatic). Patients who are colonized, but not infected should not be treated, but contact precautions should be put in place to prevent transmission. Appropriate antibiotics should be selected for symptomatic patients based on the antibiotic susceptibility profile of the organism. If the source of the infection is an abscess or wound, then incision and drainage (I&D) can also be helpful. An infectious disease consult should be considered to help the clinician select appropriate antibiotics.

Case Fatality

Case fatality rates are difficult to assess. Case fatality rates from uncomplicated UTIs are low, whereas case fatality rates rise for bacteremia and ventilator-assisted pneumonias.

Reservoir

Humans, both infected and colonized, are a reservoir for these diseases[1]. Livestock has also been identified as a potential reservoir, but its importance in transmission is not well described.

Transmission

Transmission usually occurs via direct contact, either by direct touching of a patient, or via fomites (inanimate objects) that were contaminated such as medical equipment, or surfaces such as bed rails, door knobs, etc. Patients that are either infected or colonized can be a transmission source.

Susceptibility

Generally, CRA and CRPA organisms are a problem in individuals that are elderly, immunocompromised, debilitated (individuals with quadriplegia or on ventilators, for example), and/or on long-term antibiotic therapy.[4] Travel history and surgical procedures outside of the U.S. pose a significant risk for CRE infection or colonization. However, patients with multiple risk factors are at increased risk.

Incubation Period

The incubation period is not well defined.

Period of Communicability

Until better information is available, all patients with a history of a CRO infection or colonization are considered capable of transmitting this organism. Because CRO infections are often difficult to treat, infection or colonization can be prolonged. Therefore, a patient diagnosed with one of these organisms should be considered infectious until s/he has had three negative cultures at least one week apart from previously positive sites. In order to implement contact precautions and prevent facility transmission, providers should be aware if a patient has a history of these CROs when making treatment decisions.

Epidemiology

With better surveillance, public health is seeing a clearer picture of the epidemiology of CROs in Utah.

(i) CRE

Carbapenem-resistant *Klebsiella* sp, *Escherichia coli* and *Enterobacter* sp. are reportable in Utah. Carbapenemase testing is required for these CRE, either through the reporting lab or through the UPHL.

In 2017, there were 84 cases of CRE reported to public health in Utah, however, this likely represents significant under-reporting.

- Seven of the 84 have a confirmed state case status (identified as a carbapenemase producer, either phenotypically or genotypically—CP-CRE).
- None of the 84 have a probable state case status (were pan-resistant to all antibiotics tested, but tested negative, or were not tested for a carbapenemase gene).
- 77 of the 84 were suspect state case status (were resistant to at least one carbapenem antibiotic, and were either negative for carbapenemase production, or were not tested).
- About two-thirds of all cases of CRE appear to be associated with community. transmission, and three-quarters of all cases occur in females. About three-quarters of the isolates are generally susceptible to other antibiotics.

Widespread outbreaks of CRE have not yet appeared in Utah. Single cases of carbapenemase-containing CRE reported from Utah healthcare facilities should be investigated rapidly and thoroughly to prevent possible spread. Therefore, the timely submission of isolates to UPHL is critical.

(ii) CRA

In 2017, 64 cases of CRA were reported to public health in Utah, with only one of those 64 having a confirmed case status (identified as possessing a carbapenemase gene—CP-CRA).

Again, this data likely represents significant under-reporting.

- Roughly two-thirds of all cases of CRA appear to be associated with facility transmission.

- Due to intrinsic resistance to many antibiotics, CRA is often multidrug-resistant (MDR) or extremely drug-resistant (XDR) and it is not uncommon for these isolates to only have one or two treatment options.

(iii) CRPA

Tracking of CRPA isolates is just beginning to be recognized in Utah, and even though anecdotal evidence suggests that it will be more common than either CRA or CRE, surveillance will provide a clearer picture. While rare, some of carbapenemase-producing Pseudomonas aeruginosa (CP-CRPA) have been identified in Utah.

✓ CRO PUBLIC HEALTH CONTROL MEASURES

Public Health Responsibility

The goal of public health is to prevent and control CRO transmission. This can occur by:

- Conducting CRO surveillance to identify potential transmission events
- Notifying facilities that CRE, CRA, and/or CRPA transmission may be occurring
- Educating facilities on:
    - Antibiotic stewardship
    - Risk assessment
    - Contact Precautions
    - Disinfectants and cleaning protocols, and
    - Urging facilities to inform (and document) receiving facilities and/or next provider of all patients transferred with known CRE, CRA, and/or CRPA infection or colonization. (See Appendix B for Facility Transfer Form.
- Working with facilities to contain CRO transmission by implementing activities outlined in the *Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms (CROs)*.

Prevention

As some of these organisms are resistant to all known treatment modalities, prevention assumes a large role in stopping outbreaks of these organisms. Prevention activities include hand hygiene, cleaning and disinfection, communication of patient's infectious status among care providers, and use of PPE to prevent exposure to contaminated surfaces or body fluids. It is the facility's responsibility to educate healthcare workers, patients and visitors, including the patient's family, how best to prevent transmission. Public health can provide materials to the facility to assist with this education.

Infection Control Guidance

1. The Healthcare Infection Control Practices Advisory Committee – 2006 (HICPAC) developed guidance that serves as the standard for facility infection control. Their guidance on Management of Multidrug-Resistant Organisms in Healthcare Settings is the current gold standard for facility infection control.
2. The CDC published a 2015 update entitled Facility Guidance for Control of Carbapenem-resistant *Enterobacteriaceae* (CRE). This update targets control in acute

care hospitals and skilled nursing facilities for patients that require medical or nursing care. Please contact public health with questions or for additional guidance.

3. CDC Guidance for Public Health Response to Contain Novel or Targeted MDROs – published in 2017 informs public health how to respond to cases of CROs in healthcare facilities.
4. Refer to the case and outbreak investigation section for a summary of case definitions and public health and facility actions. For all probable and confirmed cases, public health should coordinate with the facility to ensure the patient is in contact precautions and that MDRO status is communicated to the next provider. (Click on the link for the Utah Infection Control Transfer Form that can be used for patient transfer between facilities: http://health.utah.gov/epi/diseases/HAI/resources/IC_transfer_form.pdf).

Chemoprophylaxis

None.

Vaccine

None.

Isolation and Quarantine Requirements

Isolation: Contact Precautions recommended for all patients with an active infection and should be considered for colonized patients residing in healthcare facilities.

Hospital/long term care facilities: Contact Precautions

Quarantine: None.

✓ CRE, CRA and CRPA CASE and OUTBREAK INVESTIGATION

Surveillance and Reporting

Timely and complete surveillance is essential to interrupting transmission of multidrug-resistant organisms. Surveillance relies heavily on laboratory reporting. Complete laboratory surveillance depends upon each testing laboratory maintaining an automated process for identification of relevant results for submission to UDOH.

CRE, CRA and CRPA are reportable ***within three days***. While public health encourages all facilities to report, the majority of the reports come from laboratories performing the testing. Data entry personnel (at state and local public health departments) are encouraged to input cases into EpiTrax as soon as possible so that **investigations can be performed while the patient is still in the facility**.

Case Definition

CP-CRE is nationally notifiable. Utah follows the CSTE position statement criteria for defining CP-CRE cases outlined in Table I. CRA and CRPA, in addition to CRE, are reportable by Utah law.

Table I. Criteria for defining a case of CP-CRE[5]

Criterion	**CONFIRMED** CP-CRE *Klebsiella* spp.	**CONFIRMED** CP-CRE *Escherichia coli*	**CONFIRMED** CP-CRE *Enterobacter* spp.
Laboratory evidence			
Klebsiella spp. isolated from any clinical specimen, including screening/surveillance swabs	N		
Escherichia coli isolated from any clinical specimen, including screening/surveillance swabs		N	
Enterobacter spp. isolated from any clinical specimen, including screening/surveillance swabs			N
PCR positive (for KPC, NDM, OXA-48, VIM, or IMP)	O	O	O
mCIM positive	O	O	O
Positive for phenotypic carbapenemase production (e.g., mCIM, CIM, CarbaNP) but negative by PCR (e.g., Xpert Carba-R) for all known resistance mechanisms (KPC, NDM, OXA-48, VIM, IMP) e.g., likely novel carbapenemase	O	O	O
Criteria to distinguish a new case			
Different organism/species/ carbapenemases are counted as separate events from other species/ carbapenemases	N	N	N
Not counted as previous case in last 12 months	N	N	N
A person with a clinical case should not be counted as a screening/surveillance case thereafter (e.g., patient with known infection who later has colonization of GI tract is not counted as more than one case)	N	N	N
A person with a screening case can be later categorized as a clinical case (e.g., patient with positive peri-rectal screening swab who later develops blood stream infection would be counted in both categories).	N	N	N

N = All "N" criteria in the same column are Necessary to classify a case. A number following an "N" indicates that this criterion is only required for a specific disease/condition subtype (see below). If the absence of a criterion (i.e., criterion NOT present) is required for the case to meet the classification criteria, list the Absence of criterion as a Necessary component.
O = At least one of these "O" (One or more) criteria in each category (e.g., clinical evidence and laboratory evidence) in the same column—in conjunction with all "N" criteria in the same column—is required to classify a case. (These "O" criteria are alternatives, which means that a single column will have either no O criteria or multiple O criteria; no column should have only one O.) A number following an "O" indicates that this criterion is only required for a specific disease/condition subtype

Case Counting

New CRE, CRA and CRPA lab reports will create a new case in EpiTrax. If the person has an existing CRE, CRA or CRPA case, all new labs will be appended to that case for 12 months following the most recent isolate. Any new labs outside of 12 months will create a new case.

Clinical Criteria: None

Laboratory Criteria: Laboratory evidence of carbapenem resistance is based on antibiotic susceptibility testing (AST) and/or carbapenemase production in an isolate by a phenotypic method or positive for a known carbapenemase resistance mechanism by the specific testing methods, such as:

- Phenotypic methods for carbapenemase production:
  - Carba NP positive
  - Metallo-β-lactamase testing (e.g., E-test) positive
  - Modified Carbapenem Inactivation Method (mCIM) positive or indeterminate
  - Carbapenem Inactivation Method (CIM) positive
  - Positive for phenotypic carbapenemase production (e.g., mCIM, CIM, CarbaNP) but negative by PCR (e.g., Xpert Carba-R) for all known resistance mechanisms (e.g., KPC, NDM, OXA-48, VIM, IMP)
- Molecular methods for resistance mechanism:
  - Genotypic positive by Cepheid or Verigene PCR testing
  - Genotypic positive by whole genome sequencing (WGS)
  - Xpert Carba-R positive (for KPC, NDM, OXA-48, VIM, IMP)
  - Genotypic positive for novel carbapenemase

Table II: MIC values that define carbapenem resistance for CRE, CRA and CRPA[(2)]

	Doripenem	Ertapenem	Imipenem	Meropenem
E.coli	≥4 µg/ml	≥ 2 µg/ml	≥4 µg/ml	≥4 µg/ml
Klebsiella spp.	≥4 µg/ml	≥ 2 µg/ml	≥4 µg/ml	≥4 µg/ml
Enterobacter spp.	≥4 µg/ml	≥ 2 µg/ml	≥4 µg/ml	≥4 µg/ml
Acinetobacter spp.	≥8 µg/mL	N/A	≥8 µg/mL	≥8 µg/mL
Pseudomonas aeruginosa	≥8 µg/mL	N/A	≥8 µg/mL	≥8 µg/mL

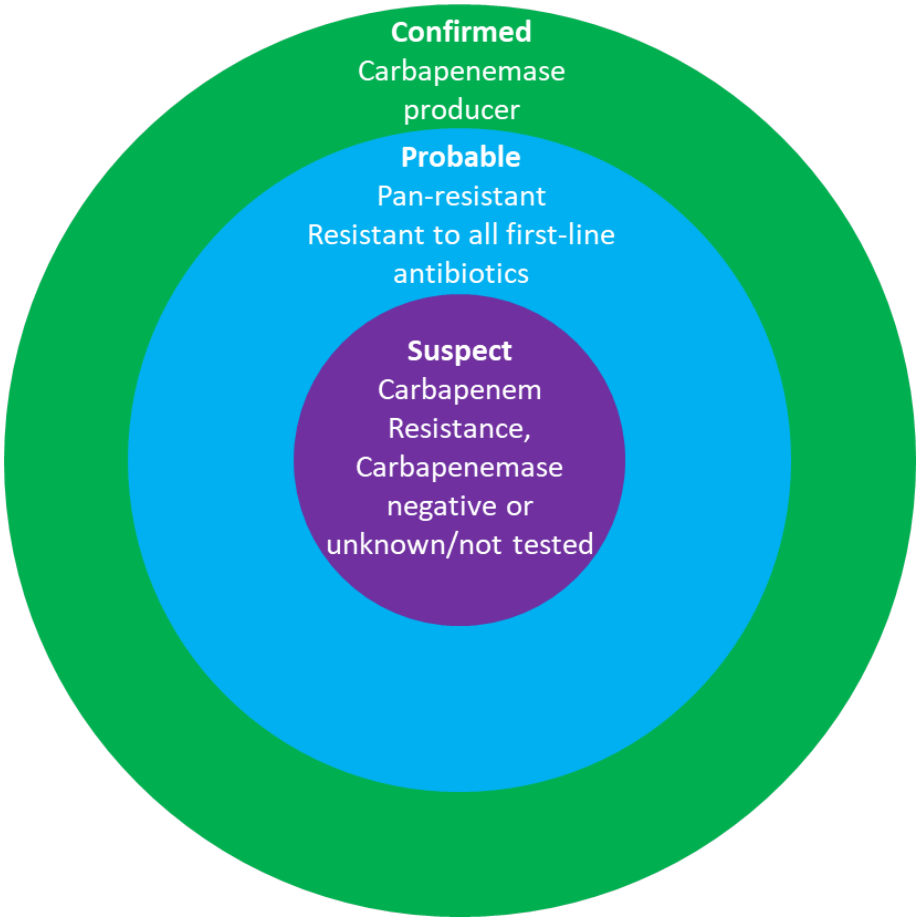
Note: Resistance is based on the MIC value, NOT the lab interpretation. Some labs in Utah are using different breakpoints and may indicate that a resistant isolate is 'intermediate' or possibly even 'susceptible.' The HAI/AR Epidemiologist is available to consult about interpretations and breakpoints.

Case Classification

Table III: Carbapenem-resistant organism cheat sheet

	Carbapenem Resistant	Resistant to all 1st and 2nd line antibiotics (pan-resistant)	Carbapenemase Production	Investigation Required	Contact Precautions
Suspect					
CRE	+	-	- or not tested	No	Yes
CRA	+	-	- or not tested	No	Yes
CRPA	+	-	- or not tested	No	Yes
Probable					
CRE	+	+	- or not tested	Yes	Yes
CRA	+	+	- or not tested	Yes	Yes
CRPA	+	+	- or not tested	No	Yes
Confirmed					
CRE	+	+/-	+ (phenotypic or genotypic confirmation)	Yes	Yes
CRA	+	+/-	+ (phenotypic or genotypic confirmation)	Yes	Yes
CRPA	+	+/-	+ (phenotypic or genotypic confirmation)	Yes	Yes
Organisms: CRE: *E. coli, Klebsiella species, Enterobacter species*, CRA: *Acinetobacter species*, CRPA: *Pseudomonas aeruginosa*					

Figure I: Case status cheat sheet



Confirmed

E. coli, Klebsiella spp., *Enterobacter* spp. *Acinetobacter* spp., or *Pseudomonas aeruginosa* from any isolate that is:

Positive for known carbapenemase resistance mechanism (e.g., KPC, NDM, VIM, IMP, OXA) demonstrated by a recognized test (e.g., PCR by Cepheid or Verigene systems or WGS)

OR

Positive on a phenotypic test for carbapenemase production (e.g., metallo-β-lactamase test, Carba NP, carbapenem inactivation method (CIM), or modified CIM (mCIM)).

AND

Resistant to doripenem, meropenem, imipenem or ertapenem* (MIC values given in Table I based on current CLSI breakpoints)

Probable

E. coli, Klebsiella spp., *Enterobacter* spp. *Acinetobacter* spp., or *Pseudomonas aeruginosa* from any isolate that is:

Resistant to doripenem, meropenem, imipenem or ertapenem*

AND

Non-susceptible to all antibiotics tested by the submitting clinical lab (pan-resistant).

Suspect

E. coli, Klebsiella spp., *Enterobacter* spp. *Acinetobacter* spp., or *Pseudomonas aeruginosa* from any isolate that is:

Resistant to doripenem, meropenem, imipenem, or ertapenem*

AND

The isolate was not tested for or does not have any evidence of a carbapenemase.

**Ertapenem is used with Enterobacteriaceae only, Acinetobacter spp. and Pseudomonas aeruginosa are intrinsically resistant to ertapenem, and therefore, do not create a case.*[(2)]

NOTES:

1. Cases involving isolates that are phenotypically positive for carbapenemase production (e.g., mCIM), but negative for KPC, NDM, OXA-48, VIM, and IMP should be counted as confirmed CP-CRE*, CP-CRA or CP-CRPA. Isolates should be submitted to the regional laboratories of the ARLN (Antibiotic Resistance Laboratory Network, for further characterization (potential novel mechanism).
    *In the rare case of *Enterobacter* spp. with a positive phenotypic carbapenemase test AND are susceptible to Cefepime AND negative for KPC, NDM, OXA-48, VIM, and IMP genes, these cases are likely caused by a hyper ampC production and will NOT be counted as a confirmed case, rather will be counted as a suspect case.
2. If isolate is indeterminate on mCIM and negative by PCR for KPC, NDM, OXA-48, VIM and IMP, isolate should be sent to the ARLN regional laboratory for further testing.
3. Carbapenemase testing in *Acinetobacter* is done by PCR methodology using the Cepheid Genexpert because there are currently limited options for phenotypic testing. However, one of the more common carbapenemase genes in *Acinetobacter* is OXA-23, which is not currently identified in commonly used Cepheid PCR testing methodology, so carbapenemase production cannot be ruled out in CRA cases without WGS.

Case Investigation Process

1. UDOH will review all new CRO events during normal business hours, Monday through Friday. The UDOH HAI epidemiologist will verify that the antibiotic susceptibility is attached to EpiTrax, either by PDF or ELR. The susceptibility should represent all of the antibiotics that were tested (MIC values and Interpretations). If it does not, the HAI epidemiologist will call the performing lab and the complete susceptibility pattern will be requested by fax. The UDOH fax number is 801-538-9923. Documentation of testing is an essential part of the investigation process.
2. According to the Communicable Disease Rule, all carbapenem-resistant *E. coli, Klebsiella species, Enterobacter species*, *Acinetobacter species*, and *Pseudomonas aeruginosa* should be submitted to UPHL for follow-up carbapenemase testing. Isolates should be shipped to the Utah Public Health Laboratory (UPHL) at 4431 South 2700 West, Taylorsville, UT 84129, phone 801-965-2400. If the reporting lab is in Utah, a UPHL courier can assist with delivery. The public health isolate submission form can

be found at: http://health.utah.gov/lab/infectious-diseases/documents/UPHL%20ID%20requisition%20form.pdf.

3. The UDOH HAI epidemiologist will verify that the event has been routed to the appropriate LHD.
    - CRE and CRA are facility-based conditions, rather than person-based. As such, the investigating jurisdiction is based on the location of the facility. If the patient was not in a hospital or a long-term care facility, the investigating jurisdiction is the patient's home address.
    - CRPA is a surveillance event captured by electronic laboratory reporting (ELR). CRPA cases are routed to the state. However, cases with confirmed carbapenemase production are routed to the jurisdiction for investigation.

Determining jurisdiction

- Routing for HAI conditions is by FACILITY jurisdiction, and not by home address.
- If no facility is listed, the event is defaulted to the local health jurisdiction based on the patient's home address.
- Out-of-state patients in Utah facilities are routed to the appropriate Utah facility jurisdiction.
- If a Utah patient is in a facility in another state, this becomes an 'out-of-state' case.
- Backup: If the system flags and does not know where to route it to, it defaults to the Utah State HAI queue and will be manually assigned to the correct jurisdiction by a member of the HAI Program.

CRO investigations should be completed by the public health investigator within 30 days of notification to public health.

4. Setting the Case Status and Investigation

    Is the case an *E. coli*, *Klebsiella* species, *Enterobacter, Acinetobacter* or *Pseudomonas aeruginosa* species that is resistant to *ertapenem, meropenem, doripenem, or imipenem? (Refer to Table I)

    - If yes –
        Mark the **Case Status** as **Suspect**.
    - If no –
        Mark the **Case Status** to **Not a Case** and the jurisdiction will close the event without an investigation. (Note: due to the technicality of these labs, there is a relatively high frequency of "Not a Case" events).

    Does the AST profile show non-susceptibility (resistant or intermediate) to all tested antibiotics?

    - If yes (pan-resistant) –
        Investigators will fill out the investigation form and an on-site investigation may be scheduled. Mark the **Case Status** to **Probable**. Consult with UDOH HAI/AR Epidemiologist for further guidance.

- If no –
  Wait for the carbapenemase test results.

Does the isolate test positive for a carbapenemase?

- If yes –
  Investigators will fill out the investigation form and an on-site investigation may be scheduled. Mark the **Case Status** to **Confirmed**. Consult with UDOH HAI/AR Epidemiologist for further guidance.

- If no –
  Keep the **Case Status** as **Suspect** and close the case without further investigation.

*Ertapenem is used with *Enterobacteriaceae* only, *Acinetobacter* spp. and *Pseudomonas aeruginosa* are intrinsically resistant to ertapenem and therefore do not create a case.

5. Investigation
   a. The investigation form (Appendix A) should be filled out for all probable and confirmed cases. LHD and UDOH investigators should coordinate to determine if an on-site investigation is recommended (Figure III)
   b. Carbapenemase-producing isolates that are submitted by outpatient facilities (such as urgent care or family medicine) will be considered community cases and will require an investigation to assess transmission risk. Investigators will provide a notification letter (a sample letter can be found at http://health.utah.gov/epi/diseases/CRE/) to the patient that they should take with them to healthcare visits, advising their physicians that they have a highly resistant organism.

For confirmed (carbapenemase producer) cases, a team of LHD and UDOH representatives will offer an on-site consultative visit with the facility (if deemed necessary). The onsite facility assessment may include the following activities:

- Review of the facility's infection prevention and control program, including hand hygiene compliance, cleaning and disinfection practices, implementation of isolation precautions, antibiotic stewardship and communication of patient's infectious status to next care providers.
- Conduct a contact investigation.
- Consider screening of roommates or close household contacts if not in contact precautions for the duration of their stay.
- Conduct a prevalence study (if deemed necessary).
- Collect environmental samples (if deemed necessary).
- Consider cultures of healthcare personnel (if deemed necessary).

Cheat sheet

- All carbapenemase positive (CP-CRE, CP-CRA and CP-CRPA) = **Confirmed** + Investigation form + Onsite evaluation
- Carbapenemase negative or not performed plus non-susceptible to all 1st and 2nd line antibiotics = **Probable** + Investigation form + Consider onsite evaluation
- Meropenem/imipenem/doripenem/ertapenem-resistant (CRE, CRA and CRPA); carbapenemase – negative or not performed = **Suspect**, no investigation

Outbreak/Complex Investigation Protocol

Criteria

At least one additional facility acquired case in the same facility (total ≥ 2 cases) within six months

Same carbapenemase

OR

Pan-resistant organisms

OR

Same organism with very similar resistance pattern (≤2 differences in antibiotic susceptibilities tested).

If an organism is identified with a novel carbapenemase, it will also trigger an outbreak investigation.

Figure II: Outbreak Definition Guidance

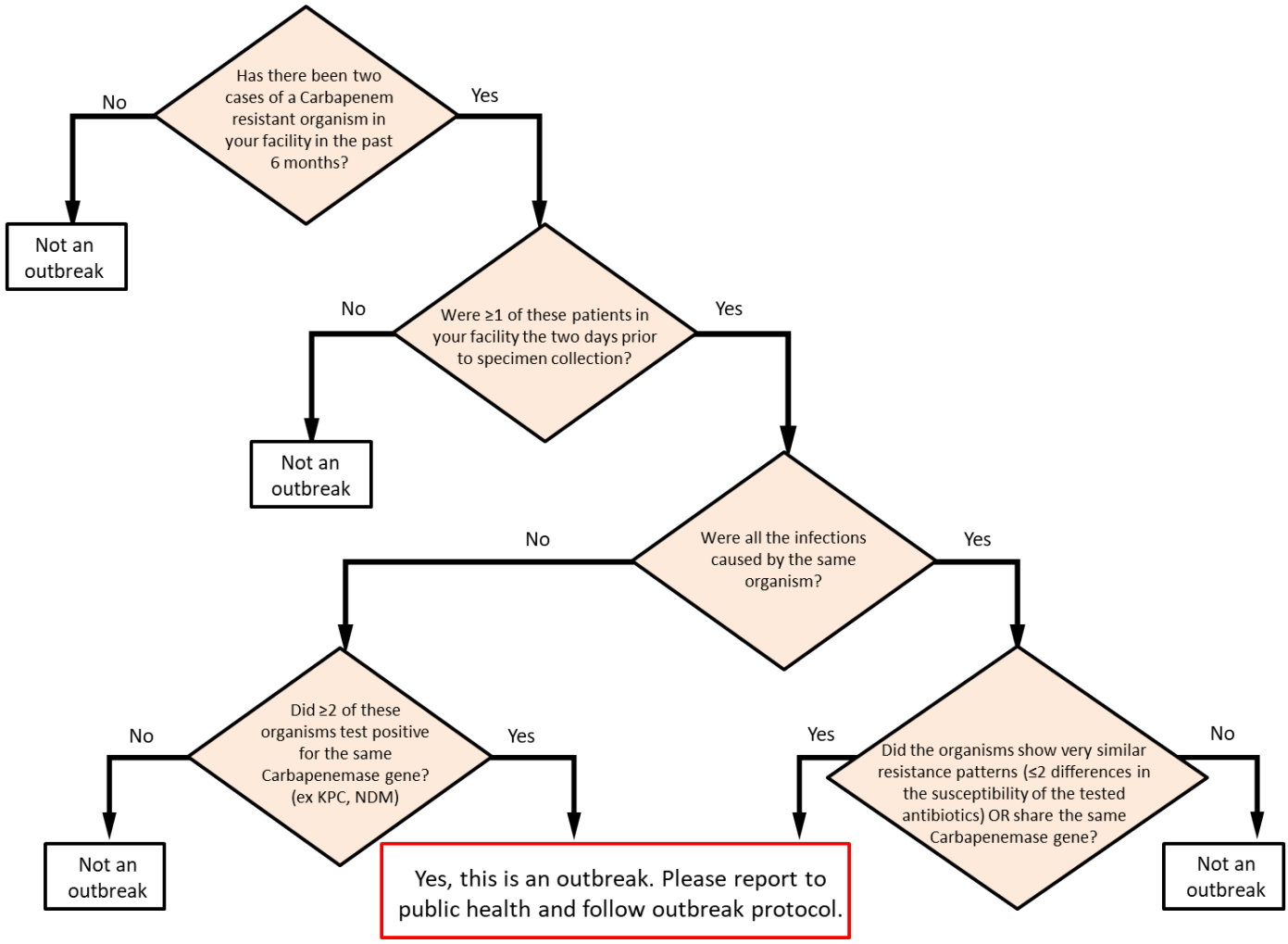


Fig III: Outbreak activity guidance[6]

	Tier 1-Outbreak or complex investigation	Tier 2-Case investigation	Tier 3-No investigation
Example Organisms	VRSA, Candida auris, Candida Haemulonii, novel carbapenemase producers and pan-resistant organisms (resistant to all antibiotics tested), Outbreaks (≥2 epi-linked cases)	Carbapenemase Producers	Organisms resistant to ≥1 carbapenem but not a confirmed carbapenemase producer
Onsite facility visit			
Infection control assessment			
Prospective Surveillance			
Lab lookback			
Screening of healthcare roommates			
Broader screening of healthcare contacts			
Household contact screening			
Environmental sampling			
Healthcare personnel screening			

Recommended | Activity as Needed | Not Recommended

Outbreak Activities

- Refer to Figure III to determine which outbreak activities are most appropriate.
- Fill out investigation forms (Appendix A) for all cases potentially linked to the outbreak.
- Document outbreak in EpiTrax Outbreak Module.
    1. Initiate a new outbreak in EpiTrax.
    2. Enter the facility's name, organism and investigation date (month and year) as the outbreak name.
    3. Complete the Type and Agency as appropriate.
    4. Enter the correct disease in the outbreak condition field.
    5. Save the new outbreak and find it again in the list.
    6. On the admin tab, change the disease type to Healthcare-associated Infections.
    7. On the Investigation tab fill in the facility type, date of exposure, and facility address, investigation findings and further findings as needed, etc.
    8. Attach any relevant events to the outbreak.

- Offer on-site facility visit.
    - UDOH HAI/AR program and LHD should coordinate on facility visit.
    - Provide assessment of infection control practices (using CDC Infection Control Assessment Report (ICAR) or Targeted Assessment for Prevention (TAP) tools) and guidance for reducing future transmission.
    - Onsite infection control observations should be conducted to identify potential infection control gaps.
- Lab lookback
    - Request the Infection Preventionist (IP) of the facility and reporting lab provide a line list of cases of the same organism for the preceding three months.
    - IPs should consider flagging patient records identified in this lab lookback so that they can be re-screened or assessed for contact precautions upon facility admission.
    - If the reporting lab still has these specimens, they should be sent to UPHL for follow-up testing to determine if they match the organisms isolated in the outbreak (e.g., similar resistance patterns or genetic analysis)
- Prospective surveillance
    - Request submitting lab perform prospective surveillance for the next three months.
        - Labs should flag and send any isolates of the same organism with similar resistance pattern to UPHL for follow-up testing to determine if they match the organism of interest.
- Screening of healthcare roommates (if patient was not in contact precautions for the duration of their stay).

Optional Outbreak Activities (as necessary)[6]

- Broader screening of healthcare contacts
    - Before considering screening, the facility should have a protocol in place of how to manage colonized patients (e.g., contact precautions and communication of MDRO colonization status to next provider).
    - Recommended for novel carbapenem-resistant organisms where transmission data is not available.
    - Should follow ring surveillance in which the highest risk patients are screened first and if positives are identified, then the ring should be expanded to include other patients at risk, or the whole facility. = Highest risk patients include:
        - Patients who overlapped with the index patient at the facility for ≥3 days

          AND
        - Have one of the following risk factors:
            - Patient is bedbound
            - Patient requires higher levels of care
            - Patient is currently on antibiotics or has a history of antibiotic use
            - Patient is on mechanical ventilation
- Screening of household contacts
    - Recommended for close household contacts or persons that were physically caring for the patient in the home

        - Priority
            1. Persons sharing a room with patient
            2. Persons physically caring for the patient
            3. Persons also living in the house with the patient
- Environmental Sampling
    - Public health investigators should work with the facility to develop hypotheses about potential transmission risks (possible environmental reservoirs) to determine high-risk areas or equipment for environmental screening.
    - Should be reserved for organisms with a known persistence in the environment (e.g., *Acinetobacter spp.*).
    - Environmental cultures will not generally be used to determine cleaning effectiveness.
    - Caution: Identification of a reservoir by environmental screening does exclude other modes of transmission and does not confirm it was the only method of transmission. Environmental cultures are meant to identify potential reservoir.
- Screening of healthcare personnel
    - Recommended for novel CROs where transmission risk is not known.
    - Should be considered if there is a suspected transmission/exposure event.
    - **Before considering screening of healthcare personnel, the facility should have a protocol in place to manage any healthcare workers that screen positive (e.g., work restrictions).

Additional CRO outbreak guidance can be found at https://www.cdc.gov/hai/outbreaks/mdro/index.html.

✓ MINIMUM DATASET/INVESTIGATION FORMS

Investigation Form

Process

The date of specimen collection is the Event Date. Subtract two calendar days from the Event Date. Determine whether the patient was admitted or had a facility exposure in a nursing home, a long-term acute care hospital (LTAC), or any hospital on that day.

- If NO – the infection is not considered "Facility-associated," indicate this on the investigation form.
- If YES – the infection is considered "Facility-associated," indicate this on the investigation form.

Notify the IP at the facility, **AND**:

- Ensure the patient is in strict contact precautions.
- Ensure that whenever the patient leaves (even temporarily) for additional healthcare (e.g., transfer to hospital or visiting wound clinics or rehab) that the receiver is phoned and notified about the patient's CRO status AND that a paper transfer form is sent with the patient (Transfer form can be found in Appendix C or at http://health.utah.gov/epi/diseases/HAI/resources/IC_transfer_form.pdf).
- Particular attention should be paid to terminal cleaning of the patient's room once they are discharged.
    - If you are unclear or unsure about any of these options, please send an email to HAI@utah.gov, and someone from the UDOH HAI program will assist you with this activity.

Investigation Form

The investigation form can be found in Appendix A of this document or can also be found at http://health.utah.gov/epi/diseases/CRE/.

Identifying Case Contacts

Case contacts will not routinely be identified except in the cases of suspected facility transmission events. In the event that ring surveillance becomes necessary, patients who are tested for colonization will be listed as case contacts.

Case Contact Management

Case contacts will not be managed. Contacts that are positive for CRO will become cases, and thus, be managed as cases.

✓ REFERENCES

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4. Kanafani Z, Kanj S. Acinetobacter infection: Treatment and prevention [Internet]. UpToDate. Last updated: 2018. Available from: https://www.uptodate.com/contents/acinetobacter-infection-treatment-and-prevention
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6. Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms (MDROs) [Internet]. Centers for Disease Control and Prevention. Centers for Disease Control and Prevention; 2017. Available from: https://www.cdc.gov/hai/outbreaks/mdro/index.html.

✓ VERSION CONTROL

V. 02/19: Incorporated EAG comments
V.01/19: Added CSTE CP-CRE case definitions
V.09/17: Plan rewritten to be facility-centric
V.08/17: Plan rewritten to conform to CSTE position statement and updated Communicable Disease Rule; updated Critical Clinician Information, CRO Disease and Epidemiology to include carbapenem-resistant *Pseudomonas aeruginosa* (CRPA), updated CRO Public Health Control Measures to include CRPA and revise case definitions, updated CRE, CRA and CRPA Case and Outbreak Investigation laboratory criteria, case definitions, and case and outbreak investigation processes, updated UT-NEDSS Minimum/Required Fields by Tab to include changes to investigation forms, added Electronic Laboratory Reporting Processing Rules for CRE, CRA and CRPA, added the CRE, CRA and CRPA Investigation Form, added Infection Control Transfer Form

✓ UT-NEDSS Minimum/Required Fields by Tab

Optional fields in red

Demographic

- Date first reported to public health
- Last name
- First name
- Middle name
- Parent/Guardian
- Current Address
- Address at Diagnosis
  - Is this a long-term care hospital or nursing home?
  - Name of facility
  - Type of facility
- Date of birth (age)
- Phone type/code/number/extension
- Birth gender
- Ethnicity
- Race

Clinical

- Disease
- Hospitalized
- Onset date
- Admission date
  - Discharge date (if available – do not hold open to get it)
  - Medical record number
  - Died
  - Date of death
- Diagnostic Date
- Reporting facility (this is where the patient was when the doctor ordered the culture)
  - Facility Name
  - Facility Type
  - Facility Address
- Was the patient in contact precautions for the duration, or part of their stay?
- Was the infection healthcare facility or community acquired?
- Does the patient have a history of an MDRO infection?
- Was the patient's MDRO status communicated to the facility?

Laboratory

- Lab (performing)
- Test type
- Organism
- Test result
- Specimen source
- Collection date
- Specimens sent to state lab
- Antibiotic or Antifungal Sensitivities (MIC and Interpretations if available)

Epidemiological

None

Reporting

- Date first reported to public health

Contacts

- Healthcare roommate
- Healthcare worker with possible exposure
- Close household contact

Investigation

- ICU Facility History
- Surgical Procedure History
- Outpatient Procedure History
- Invasive Device History
- Travel History
- Was MDRO status communicated to the receiving facility?
- Is the patient bed-bound?
- Is the patient incontinent?
- Has the patient been on mechanical ventilation in the past year?

Administrative

- Date first reported to public health
- LHD case status

✓ Electronic Laboratory Reporting Processing Rules

[CRE— including *E.coli* carbapenem-resistant, *Enterobacter* species carbapenem-resistant and *Klebsiella* species carbapenem-resistant]

Rules for Entering Laboratory Test Results

The following rules describe how laboratory results reported to public health should be added to new or existing events in UT-NEDSS. These rules have been developed for the automated processing of electronic laboratory reports, although they apply to manual data entry, as well.

Test-Specific Rules

Test specific rules describe what test type and test result combinations are allowed to create new morbidity events in UT-NEDSS, and what test type and test result combinations are allowed to update existing events (morbidity or contact) in UT-NEDSS.

Test Type	Test Result	Create a New Event	Update an Existing Event
Meropenem resistance (MIC ≥4 µg/mL or KB zone ≤19 mm)	Resistant	Yes	Yes
	Susceptible	No	Yes
	Intermediate	No	Yes
Imipenem resistance (MIC ≥4 µg/mL or KB zone ≤19 mm)	Resistant	Yes	Yes
	Susceptible	No	Yes
	Intermediate	No	Yes
Doripenem resistance (MIC ≥4 µg/mL or KB zone ≤19 mm)	Resistant	Yes	Yes
	Susceptible	No	Yes
	Intermediate	No	Yes
Ertapenem resistance (MIC ≥2 µg/mL or KB zone ≤18 mm)	Resistant	Yes	Yes
	Susceptible	No	Yes
	Intermediate	No	Yes

Whitelist Rules

Whitelist rules describe how long an existing event can have new laboratory data appended to it. If a laboratory result falls outside the whitelist rules for an existing event, it should not be added to that event, and should be evaluated to determine if a new event (CMR) should be created.

[CRE— including *E.coli* carbapenem-resistant, *Enterobacter* species carbapenem-resistant and *Klebsiella* species carbapenem-resistant]

Morbidity Whitelist Rule: If the specimen collection date of the laboratory result is 1 year or less after the date of the last morbidity event, the laboratory result should be added to the morbidity event.

[CRE— including *E.coli* carbapenem-resistant, *Enterobacter* species carbapenem-resistant and *Klebsiella* species carbapenem-resistant]

Contact Whitelist Rule: If the specimen collection date of the laboratory result is 6 months or less after the date of the contact event, the laboratory result should be added to the contact event.

Graylist Rule

We often receive laboratory results through ELR that cannot create cases, but can be useful if a case is created in the future. These laboratory results go to the graylist. The graylist rule describes how long an existing event can have an old laboratory result appended to it.

[CRE— including *E.coli* carbapenem-resistant, *Enterobacter* species carbapenem-resistant and *Klebsiella* species carbapenem-resistant]

Graylist Rule: If the specimen collection date of the laboratory result is 3 months before to 3 months after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

Other Electronic Laboratory Processing Rules

- If an existing event has a state case status of "not a case," ELR will never add additional test results to that case. New labs will be evaluated to determine if a new CMR should be created.

[CRA— *Acinetobacter* species carbapenem-resistant]

Rules for Entering Laboratory Test Results

The following rules describe how laboratory results reported to public health should be added to new or existing events in UT-NEDSS. These rules have been developed for the automated processing of electronic laboratory reports, although they apply to manual data entry, as well.

Test-Specific Rules

Test specific rules describe what test type and test result combinations are allowed to create new morbidity events in UT-NEDSS, and what test type and test result combinations are allowed to update existing events (morbidity or contact) in UT-NEDSS.

Test Type	Test Result	Create a New Event	Update an Existing Event
Meropenem resistance (MIC ≥8 µg/mL or KB zone ≤14 mm)	Resistant	Yes	Yes
	Susceptible	No	Yes
	Intermediate	No	Yes
Imipenem resistance (MIC ≥8 µg/mL or KB zone ≤18 mm)	Resistant	Yes	Yes
	Susceptible	No	Yes
	Intermediate	No	Yes
Doripenem resistance (MIC ≥8 µg/mL or KB zone ≤14 mm)	Resistant	Yes	Yes
	Susceptible	No	Yes
	Intermediate	No	Yes

Whitelist Rules

Whitelist rules describe how long an existing event can have new laboratory data appended to it. If a laboratory result falls outside the whitelist rules for an existing event, it should not be

added to that event, and should be evaluated to determine if a new event (CMR) should be created.

[CRA— *Acinetobacter* species carbapenem-resistant]

Morbidity Whitelist Rule: If the specimen collection date of the laboratory result is 1 year or less after the date of the last morbidity event, the laboratory result should be added to the morbidity event.

[CRA— *Acinetobacter* species carbapenem-resistant]

Contact Whitelist Rule: If the specimen collection date of the laboratory result is 6 months or less after the date of the contact event, the laboratory result should be added to the contact event.

Graylist Rule

We often receive laboratory results through ELR that cannot create cases, but can be useful if a case is created in the future. These laboratory results go to the graylist. The graylist rule describes how long an existing event can have an old laboratory result appended to it.

[CRA— *Acinetobacter* species carbapenem-resistant]

Graylist Rule: If the specimen collection date of the laboratory result is 3 months before to 3 months after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

Other Electronic Laboratory Processing Rules

- If an existing event has a state case status of “not a case,” ELR will never add additional test results to that case. New labs will be evaluated to determine if a new CMR should be created.

[CRPA— *Pseudomonas aeruginosa* carbapenem-resistant]

Rules for Entering Laboratory Test Results

The following rules describe how laboratory results reported to public health should be added to new or existing events in UT-NEDSS. These rules have been developed for the automated processing of electronic laboratory reports, although they apply to manual data entry, as well.

Test-Specific Rules

Test specific rules describe what test type and test result combinations are allowed to create new morbidity events in UT-NEDSS, and what test type and test result combinations are allowed to update existing events (morbidity or contact) in UT-NEDSS.

Test Type	Test Result	Create a New Event	Update an Existing Event
Meropenem resistance (MIC ≥8 µg/mL or KB zone ≤15 mm)	Resistant	Yes	Yes
	Susceptible	No	Yes
	Intermediate	No	Yes
Imipenem resistance (MIC ≥8 µg/mL or KB zone ≤15 mm)	Resistant	Yes	Yes
	Susceptible	No	Yes
	Intermediate	No	Yes
Doripenem resistance (MIC ≥8 µg/mL or KB zone ≤15 mm)	Resistant	Yes	Yes
	Susceptible	No	Yes
	Intermediate	No	Yes

Whitelist Rules

Whitelist rules describe how long an existing event can have new laboratory data appended to it. If a laboratory result falls outside the whitelist rules for an existing event, it should not be added to that event, and should be evaluated to determine if a new event (CMR) should be created.

[CRPA— Pseudomonas aeruginosa carbapenem-resistant]

Morbidity Whitelist Rule: If the specimen collection date of the laboratory result is 1 year or less after the date of the last morbidity event, the laboratory result should be added to the morbidity event.

[CRPA— Pseudomonas aeruginosa carbapenem-resistant]

Contact Whitelist Rule: If the specimen collection date of the laboratory result is 6 months or less after the date of the contact event, the laboratory result should be added to the contact event.

Graylist Rule

We often receive laboratory results through ELR that cannot create cases, but can be useful if a case is created in the future. These laboratory results go to the graylist. The graylist rule describes how long an existing event can have an old laboratory result appended to it.

[CRPA— Pseudomonas aeruginosa carbapenem-resistant]

Graylist Rule: If the specimen collection date of the laboratory result is 3 months before to 3 months after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

Other Electronic Laboratory Processing Rules

- If an existing event has a state case status of “not a case,” ELR will never add additional test results to that case. New labs will be evaluated to determine if a new CMR should be created.

UTAH DEPARTMENT OF HEALTH

Carbapenem-resistant *Enterobacteriaceae* (CRE), Carbapenem-resistant *Acinetobacter* (CRA) and Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) Investigation Form

Patient Demographics

First Name:	Middle Name:	
Last Name:		
Date of Birth:		
Parent/Guardian:		
Address:		
City:	State:	Zip:
Is this address for a long-term care hospital or nursing home?	Yes ☐	No ☐
Name of Facility:	Facility Type:	
Phone Number:	Sex: M ☐ F ☐	
Email Address:		
Primary Language:		

Ethnicity		Race	
Not Hispanic or Latino ☐	Hispanic or Latino ☐	White ☐	Black or African American ☐
		American Indian or Alaska Native ☐	Asian ☐
		Native Hawaiian or Other Pacific Islander ☐	Unknown ☐

Reporting Facility Information

Facility Name:			Facility Type:			
Facility Address:			Was the patient in contact precautions for the duration, or part of their stay?		Was this infection health care facility acquired? (In a facility 2 days prior to culture collection and no previous positive culture)	
Facility City:	Facility State:	Facility ZIP:	Duration ☐	Part of stay ☐	Yes ☐	No ☐
Was the patient admitted to the facility?	Yes ☐	No ☐	Did the patient have a history of infection with a carbapenem resistant organism?		Yes ☐	No ☐
			Was the patient's carbapenem resistant status communicated to the facility?		Yes ☐	No ☐
Admit Date:	Discharge Date:		Died from illness?	Yes ☐ No ☐	Date of death:	

Risk Factors

Was the patient admitted to an intensive care unit in the past 6 months?	Yes ☐	No ☐	Facility Name: Month/year:
Was the patient transferred to any other facility from the reporting facility?	Yes ☐	No ☐	Facility Name: Month/year:

Appendix A: CRE, CRA and CRPA Investigation Form

Acute care hospital ☐	Long-term care facility ☐	Long-term acute care hospital ☐
Was CRE status communicated to receiving facility?	Yes ☐	No ☐
Has the patient had any surgical procedures in the past year?	Yes ☐	No ☐
List Surgical Procedures:		
Has the patient had any out-patient procedures in the past year?	Yes ☐	No ☐
List Out-Patient Procedures:		
Is the patient bed-bound?	Yes ☐	No ☐
Is the patient incontinent?	Yes ☐	No ☐
Has the patient been on a ventilator in the past year?	Yes ☐	No ☐

Has the patient had exposure to any of the following devices in place in the past 6 months? (check all that apply)

Duodenoscope ☐	Central venous catheter ☐	Peripheral IV ☐	Dialysis catheter ☐
Urinary catheter ☐	ET/NT tube ☐	Gastrostomy tube ☐	NG Tube ☐
Tracheostomy ☐	Nephrostomy tube ☐	Surgical drain ☐	Other (please specify):

Travel History

Has the patient traveled outside of the country in the past year?		Location:	Date:
Yes ☐	No ☐	Location:	Date:
Did the patient receive medical care outside of the U.S.?		Location:	Date:
Yes ☐	No ☐	Location:	Date:

Contacts

Please list all contacts below and indicate if they are a familial contact, healthcare worker contact, or facility roommate.

Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:

Appendix A: CRE, CRA and CRPA Investigation Form

Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Name:	Phone Number:	Contact type:
Additional Notes:		

INFECTION CONTROL TRANSFER FORM

This form should be sent with the patient/resident upon transfer. It is NOT meant to be used as criteria for admission, only to foster the continuum of care once admission has been accepted.

Affix any patient labels here

Demographics

Patient/Resident *(Last Name, First Name)*: ,

Date of Birth:	**MRN:**	**Transfer Date:**

Sending Facility Name:

Contact Name:	**Contact Phone:**

Receiving Facility Name:

⚠ **Currently in Isolation Precautions?** ☐ **Yes**
If Yes, check: ☐ Contact ☐ Droplet ☐Airborne ☐ Other:

☐ **No** isolation precautions

Organisms

Did or does have (send documentation, e.g. culture and antimicrobial test results with applicable dates):	**Current** (or previous infection or colonization, or ruling out*)
Acinetobacter resistant to carbapenem antibiotics (CRA)	☐
E. coli, *Klebsiella* or *Enterobacter* resistant to carbapenem antibiotics (CRE)	☐
Pseudomonas aeruginosa resistant to carbapenem antibiotics (CRPA)	☐
Carbapenemase production in any of the above organisms (CP +)	☐
MRSA	☐
VRE	☐
E. coli, *Klebsiella* resistant to expanded-spectrum cephalosporins (ESBL)	☐
C. difficile	☐
Other^: ^*e.g. C. auris, C. haemulonii, lice, scabies, disseminated shingles, norovirus, influenza, TB, etc.*	☐ **(current or ruling out*)**

☐ **No** known MDRO or communicable diseases

***Additional information if known:**

Symptoms

Check yes to any that currently apply:**

☐ Cough/uncontrolled respiratory secretions
☐ Incontinent of urine
☐ Vomiting
☐ Concerning rash (e.g.; vesicular)
☐ Acute diarrhea or incontinent stool
☐ Draining wounds
☐ Other uncontained bodily fluid/drainage

****NOTE: Appropriate PPE required ONLY if incontinent/drainage/rash NOT contained.**

☐ **No** Symptoms / PPE not required as "contained"

PPE

PERSONAL PROTECTIVE EQUIPMENT CONSIDERATIONS

☐ ☐ ☐

CHECK ALL PPE TO BE CONSIDERED AT RECEIVING FACILITY

ANY YES ← **Answers to sections above** → **ALL NO**

Person completing form:
Role: Date:

Other MDRO Risk Factors

Is the patient currently on antibiotics? ☐ **Yes** ☐ **No**

Antibiotic:	**Dose, Frequency:**	**Treatment for:**	**Start date:**	**Stop date:**

Does the patient currently have any of the following devices? ☐ **Yes** ☐ **No**

☐ Central line/PICC, Date inserted:
☐ Hemodialysis catheter
☐ Urinary catheter, Date inserted:
☐ Suprapubic catheter
☐ Percutaneous gastrostomy tube
☐ Tracheostomy
☐ Fecal management system

Immunizations

Were immunizations received at sending facility? ☐ **Yes** ☐ **No**
If yes, specify: Date(s):