2024

Utah Department of Health & Human Services

# Laboratory guidance letter

For laboratory managers, microbiology supervisors, and infection preventionists

Section 1

## Executive summary

The Utah Public Health Laboratory (UPHL) wants to thank you for your help during the past few years. You helped raise awareness of antimicrobial resistance in Utah. We've made great strides in our laboratory capacity and technology. Our team expanded the tests we can perform along with testing volume and we're now in our sixth year of operation as the regional Antimicrobial Resistance (AR) Laboratory Network for 8 mountain region states, which includes Utah.

Key takeaways:

- The most common carbapenem-resistant bacterial isolate submitted for testing was carbapenem-resistant *Pseudomonas aeruginosa* (CRPA). Strategies to optimize resource utilization in the CRPA surveillance are discussed on pages 12 and 13.
- The number of *Klebsiella spp.* samples submitted for testing were at a 3-year high.
- The most common carbapenem-resistant Enterobacterales (CRE) mechanism continues to be KPC, while the most common carbapenem-resistant *Acinetobacter baumannii* (CRAB) mechanism continues to be OXA-23. VIM is the most common CRPA mechanism.
- 17.3% of Utah isolates had at least 1 identified carbapenemase gene compared to 34.1% of isolates in the national Antimicrobial Resistance Lab Network (AR Lab Network) from 2017–2022.
- Local transmission of *Candida auris* (*C. auris)* has been identified in Utah. We need to watch this closely.

# Situational awareness

In 2023, we received a total of 989 carbapenem-resistant bacterial isolates (including carbapenem-resistant *Enterobacterales* (CRE), carbapenem-resistant *Acinetobacter baumannii* (CRAB) and carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)) as mandated by the Utah Communicable Disease Rule. The types of organism isolates submitted in 2023 were very similar to what was submitted in 2022.

Isolates were tested for carbapenemase production by phenotypic and genotypic methods. Fewer carbapenem-resistant bacterial isolates were submitted in 2023 than in 2022 (1,052 isolates submitted in 2022). Additionally, 73 *Candida* species isolates were submitted for yeast targeted surveillance and *C. auris* rule-out in 2023.

We appreciate your continued commitment to submit isolates for further testing.

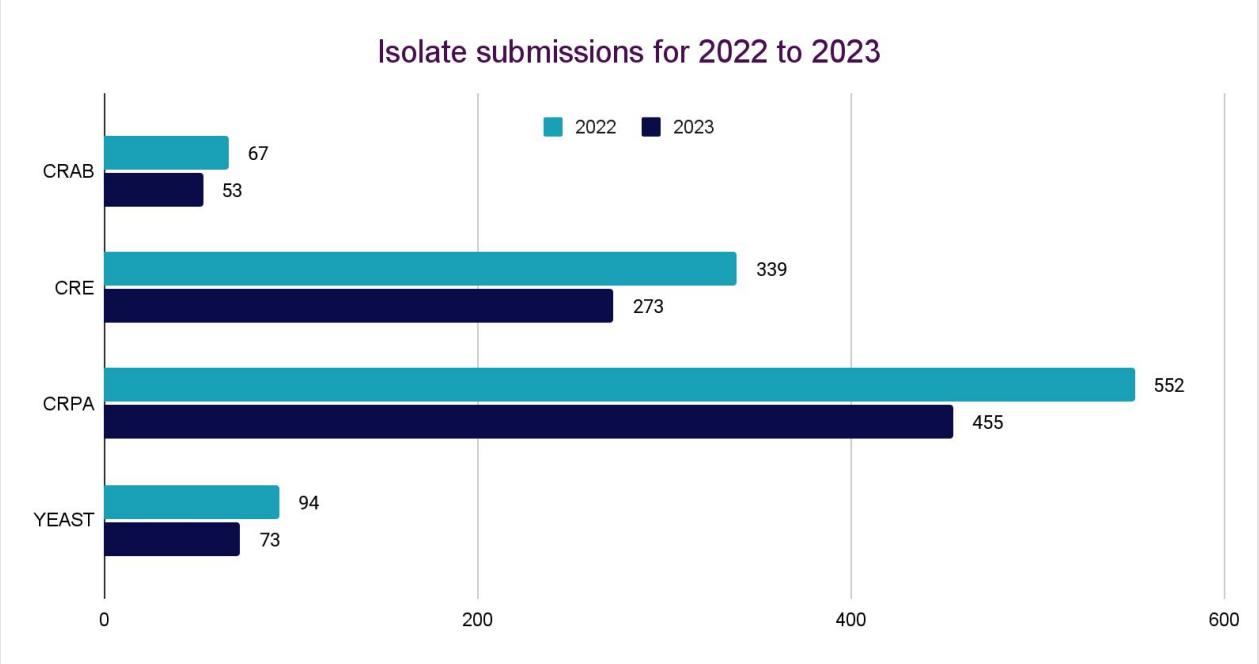



**Figure 1** Breakdown of Utah isolate submissions for additional characterization, Utah 2022 - 2023

# Utah isolate submissions

The following graphics show the submissions we received each quarter, grouped by organism. Organisms include Carbapenem-resistant *Acinetobacter baumannii* (CRAB), Carbapenem-resistant *Enterobacterales* (CRE), Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA), and yeast speciation *Candida auris* rule out.

Submissions of resistant organisms has remained stable over the past 3 years.

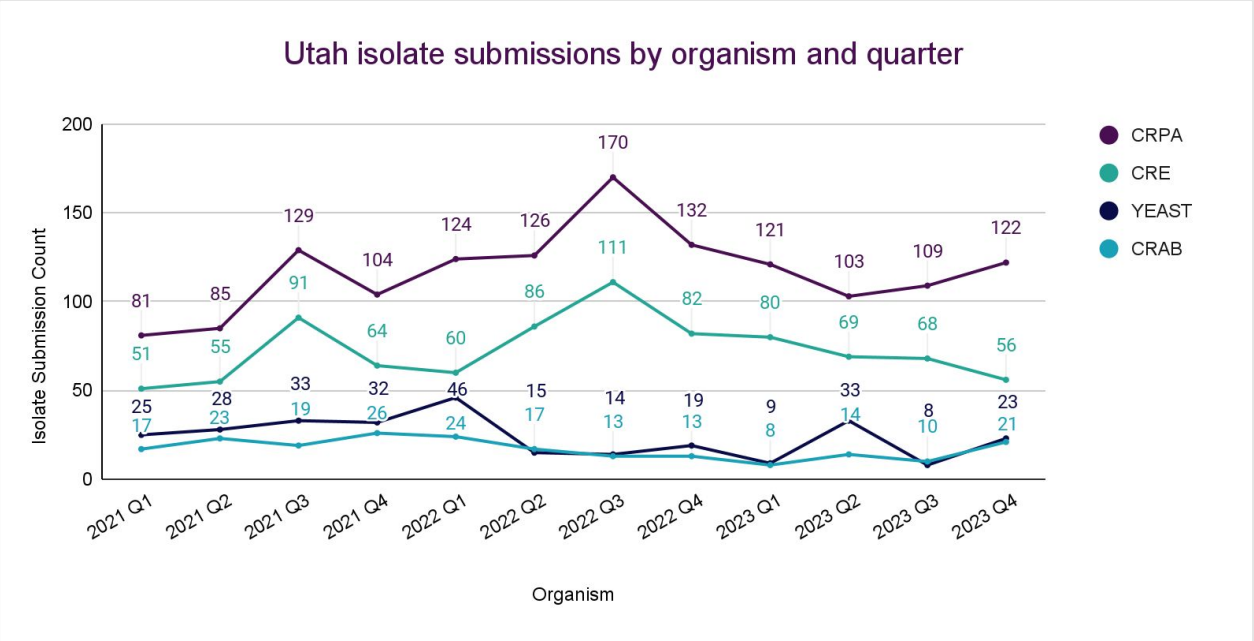



**Figure 2** Number of Utah isolate submissions for rule out of carbapenemase production by quarter and organism, Utah 2021–2023

| Species | 2021 | 2022 | 2023 |
|---|---|---|---|
| ***Carbapenem-resistant Acinetobacter spp. (CRAB)*** | 78 | 66 | 53 |
| ***Carbapenem-resistant Pseudomonas aeruginosa (CRPA)*** | 399 | 553 | 455 |
| ***Enterobacter spp.*** | 127 | 150 | 105 |
| ***Escherichia coli (E. coli)*** | 35 | 45 | 30 |
| ***Klebsiella spp.*** | 64 | 5 | 90 |
| ***Other Enterobacterales (e.g., Citrobacter spp., Providencia spp., etc.)*** | 31 | 53 | 47 |

# Utah AR mechanisms in bacterial isolates

Antimicrobial resistance mechanisms fall into 4 main categories: limiting uptake of a drug, modifying a drug target, inactivating a drug, and active drug efflux. These mechanisms may be native to the microorganisms or acquired from other microorganisms.

Understanding more about these mechanisms should lead to developing antimicrobial drugs that can withstand the microorganisms attempts to become resistant. New antimicrobial drugs could improve treatment options for people diagnosed with infectious diseases. Utah's Healthcare-Associated Infection/Antimicrobial Resistance (HAI/AR) program is collaborating with healthcare partners to teach about antimicrobial resistance.

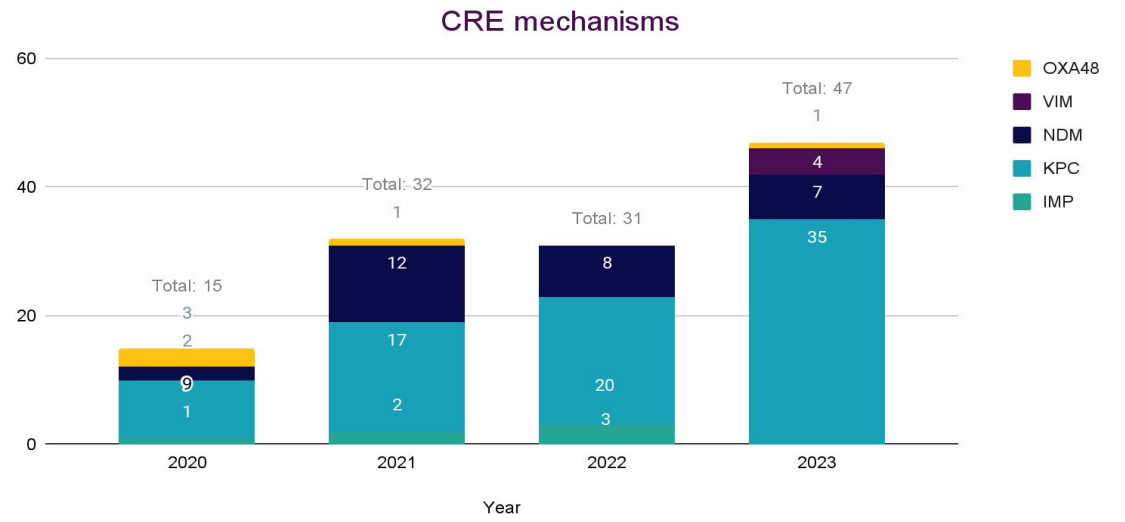



**Figure 3** Mechanisms of carbapenem-resistant *Enterobacterales* from isolates submissions, Utah 2020-2023.
*The COVID-19 pandemic may have impacted isolate submission in 2020.

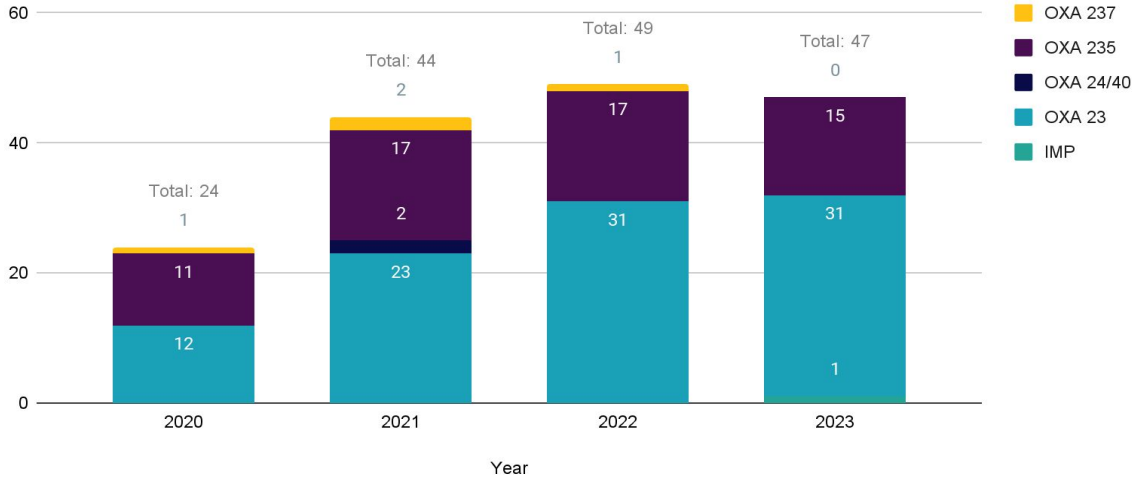



**Figure 4** Mechanisms of carbapenem-resistant *Acinetobacter baumannii* from isolates submitted in Utah, 2020-2023
*The COVID-19 pandemic may have impacted isolate submission in 2020.

# Utah AR mechanisms in bacterial isolates (cont.)

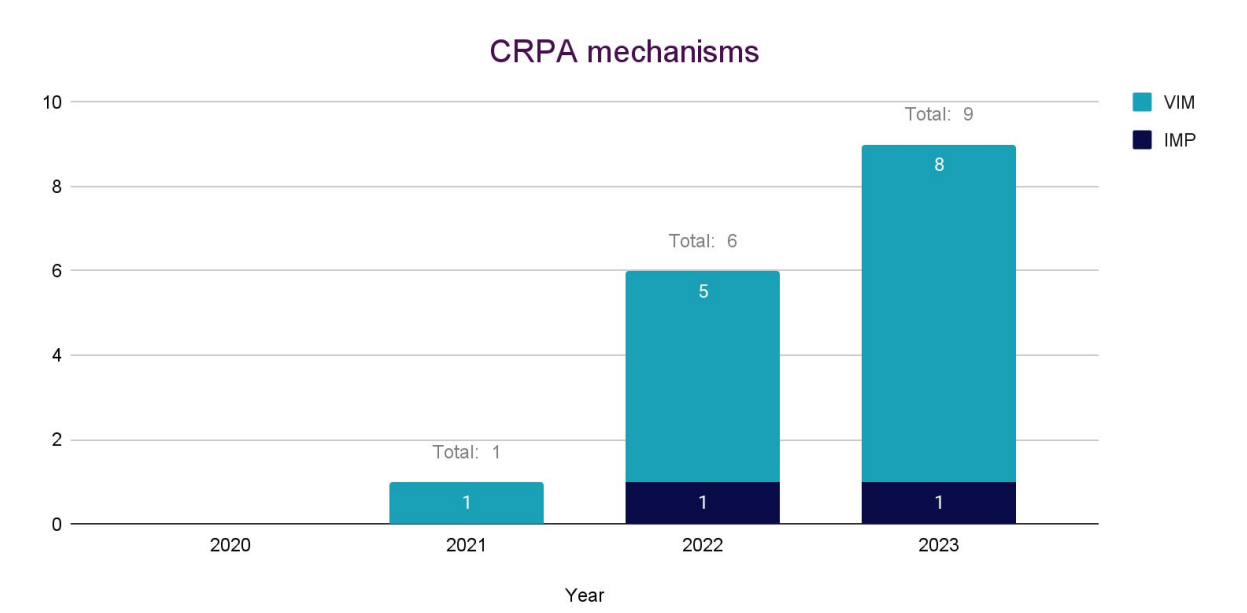



**Figure 5** Mechanisms of CRPA from isolates submitted in Utah, 2020-2023

| Percentages of carbapenemase producing mechanisms in Utah by organism and year | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **2020** | | | **2021** | | | **2022** | | | **2023** | | |
| **Analysis** | **CRA** | **CRPA** | **CRE** | **CRA** | **CRPA** | **CRE** | **CRA** | **CRPA** | **CRE** | **CRA** | **CRPA** | **CRE** |
| **Isolates submitted** | 37 | 232 | 201 | 85 | 399 | 261 | 67 | 552 | 339 | 53 | 455 | 273 |
| **No mechanism** | 35.1% | 100% | 92.5% | 48.2% | 99.7% | 88.1% | 26.9% | 98.9% | 90.9% | 13.2% | 98.0% | 83.5% |
| **IMP** | 0.0% | 0.0% | 0.5% | 0.0% | 0.0% | 0.8% | 0.0% | 0.2% | 0.9% | 1.9% | 0.2% | 0.0% |
| **KPC** | 0.0% | 0.0% | 4.5% | 0.0% | 0.0% | 6.5% | 0.0% | 0.0% | 5.9% | 0.0% | 0.0% | 12.8% |
| **NDM** | 0.0% | 0.0% | 1.0% | 0.0% | 0.0% | 4.6% | 0.0% | 0.0% | 2.4% | 0.0% | 0.0% | 2.6% |
| **VIM** | 0.0% | 0.0% | 0.0% | 0.0% | 0.3% | 0.0% | 0.0% | 0.9% | 0.0% | 0.0% | 1.8% | 1.5% |
| **OXA 48** | 0.0% | 0.0% | 1.5% | 0.0% | 0.0% | 0.4% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.4% |
| **OXA 23** | 32.4% | 0.0% | 0.0% | 27.1% | 0.0% | 0.0% | 46.3% | 0.0% | 0.0% | 58.5% | 0.0% | 0.0% |
| **OXA 24/40** | 0.0% | 0.0% | 0.0% | 2.4% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **OXA 58** | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **OXA 235** | 29.7% | 0.0% | 0.0% | 20.0% | 0.0% | 0.0% | 25.4% | 0.0% | 0.0% | 28.3% | 0.0% | 0.0% |
| **OXA 237** | 2.7% | 0.0% | 0.0% | 2.4% | 0.0% | 0.0% | 1.5% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |

Section 5

# How does Utah stack up against other states?

Overall, carbapenemase producing (CP) CRE in Utah has increased in recent years from 8.5% in 2020 to 16.5% in 2023. The CDC patient safety portal interactive tool was used to evaluate and compare the number of CP-CRE isolates by state and region from 2017–2022. During this time period, 17.37% of Utah isolates had at least 1 identified carbapenemase gene. In contrast, a carbapenemase was identified in 35.99% of isolates in the national Antimicrobial Resistance Lab Network (AR Lab Network). Mountain region states (UT, ID, WY, CO, NM, AZ, TX and MT) in the AR Lab Network had slightly higher rates of 37.9%. This data shows that despite rising rates of CP-CRE, Utah continues to be a low prevalence state. Visit the CDC's website to learn more about the CDC's most current AR threats in the United States.

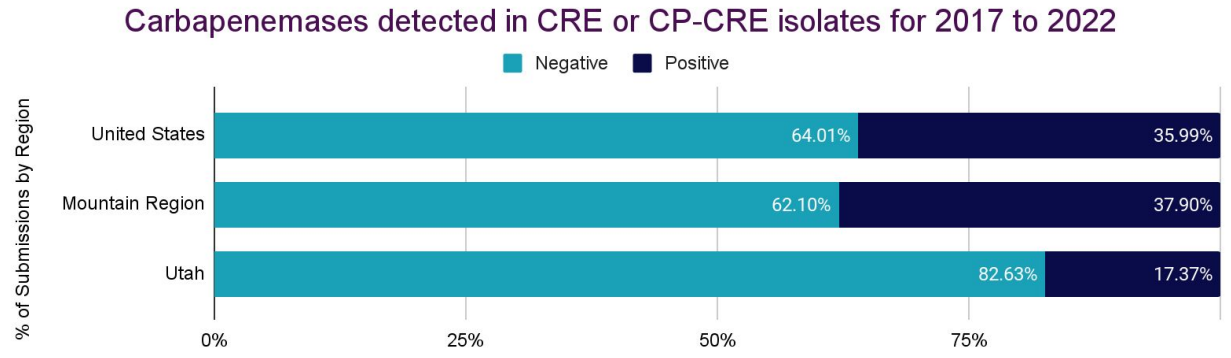



**Figure 6** Comparison of isolates submitted by region testing positive for Carbapenemases, 2017-2022

Additionally, Utah also has low rates of *Candida auris* (*C. auris*). *C. auris* is an emerging multidrug-resistant yeast with a high mortality rate. It has been identified in more than 27 states, including some mountain region states. There have been 3 locally acquired case of *C. auris* in Utah to date. *C. auris* was introduced to Utah through patients transferring from other state facilities to Utah facilities. This data highlights the need to increase awareness of high-risk patients with travel history or patients who transfer into Utah facilities from out-of-state facilities.

Thanks to notifications from the out of state facility, Utah facilities can screen patients during admission and place them on precautions, if needed. Utah facilities work closely with the HAI/AR program to implement infection prevention and control practices. *C. auris* can also be differentiated from other yeast species in clinical specimens from both sterile and non-sterile sites. We provide colonization screening for free. Learn more about colonization screening in the next section that discusses available testing.

More information about the emerging threat of *C. auris* can be found on the CDC website. Additionally, the *C. auris* disease plan is available on the DHHS website. The *C. auris* response plan in appendix B outlines how public health and facilities work together to respond to cases of *C. auris* in Utah.

Section 6

# Utah *candida* isolates speciation

| Species | 2021 | 2022 | 2023 |
|---|---|---|---|
| ***Candida glabrata*** | 41 | 26 | 28 |
| ***Candida parapsilosis*** | 29 | 19 | 17 |
| ***Candida albicans*** | 4 | 25 | 11 |
| ***Candida tropicalis*** | 22 | 4 | 7 |
| ***Candida lusitaniae*** | 6 | 9 | 2 |
| ***Candida kefyr*** | 3 | 3 | 2 |
| ***Saccharomyces cerevisiae*** | 3 | 2 | 1 |
| ***Candida krusei*** | 1 | 2 | 1 |
| ***Candida auris*** | 0 | 1 | 5 |
| ***Candida dubliniensis*** | 1 | 0 | 0 |
| ***Candida fermentati*** | 1 | 0 | 0 |
| ***Candida guilliermondii*** | 1 | 0 | 0 |
| ***Candida metapsilosis*** | 1 | 0 | 1 |
| ***Candida orthopsilosis*** | 2 | 1 | 0 |
| ***Candida pelliculosa*** | 1 | 0 | 0 |
| ***Cyberlindnera fabianii*** | 1 | 0 | 0 |
| ***Magnusiomyces capitatus*** | 0 | 1 | 0 |
| ***Yarrowia (Candida) lipolytica*** | 0 | 0 | 1 |

Suspected *C. auris* isolates can be sent to the CDC's AR Lab Network at UPHL for identification and antifungal susceptibility testing. We provide this testing for free.

Email the HAI/AR team at HAI@utah.gov for more information and to schedule a test.

Section 7

# Mountain Region AR Laboratory Network report

The Mountain Region Antimicrobial Resistance (AR) Laboratory Network report is a compilation of testing results performed in 2021 (Q3-Q4), 2022, and 2023 (Q1-Q2) at the the AR Laboratory Network Regional Lab in Utah. The mountain region AR Laboratory Network receives specimens from public health labs in 8 states: Arizona, Colorado, Idaho, Montana, New Mexico, Texas, Utah, and Wyoming.

This report displays numbers and tracks regional trends around colonization screening; carbapenem-resistant *Enterobacterales* (CRE), carbapenem-resistant *Pseudomonas aeruginosa* (CRPA), carbapenem-resistant *Acinetobacter* (CRAB) isolate testing; and yeast isolate testing.

Review the report through the following links:

- AR Lab Network, Mountain Region Report 2020-2021 (1Q-2Q)
- AR Lab Network, Mountain Region Report 2021 (Q3-Q4), 2022, 2023 (Q1-Q2)

Section 8

# AR Laboratory Network testing menu

The following information is a summary of testing offered through the CDC's Antimicrobial Resistance Laboratory Network (AR Lab Network) Regional Lab based at the UPHL. The Antimicrobial Resistance Laboratory Network (AR Lab Network) works with laboratories nationwide to identify, track and respond to emerging and enduring antimicrobial-resistant threats.

For more information about the CDC's AR Laboratory Network click here.

| Characterization of presumptive CRE, CRA, and CRPA | |
|---|---|
| Description | Rule out of carbapenemase production by phenotypic and genotypic methods |
| Specimen type | Pure isolate of the organism on nutrient media slant or plate that supports organism growth |
| Transport | 2-8$^{0}$C or Ambient |
| Methodology | MALDI-TOF, Modified Carbapenem Inactivation Method (mCIM) (mCIM for CRE and CRPA only) and molecular characterization by PCR or WGS |
| Turnaround time | PCR for 2-5 days |

| Yeast speciation and antifungal susceptibility | |
|---|---|
| Description | Yeast identification including *Candida auris* rule-out |
| Specimen type | Identification by MALDI-TOF and Antifungal susceptibility testing includes; Amphotericin B, Micafungin, Anidulafungin, Fluconazole, Itraconazole, Isavuconazole, Posaconazole, Voriconazole, and the triterpenoid Ibrexafungerp (an investigational drug for the treatment of echinocandin resistant and pan-resistant *C. auris* infections). |
| Transport | 2-8$^{0}$C or Ambient |
| Methodology | Identification by MALDI-TOF and Antifungal susceptibility testing |
| Turnaround time | 2-7 days |

| Expanded AST (ExAST) for difficult-to-treat infections | |
|---|---|
| Description | Includes new-to-market drugs like aztreonam/ avibactam. Only for Enterobacterales producing IMP, VIM, and NDM carbapenemases to improve patient care. More information about ExAST on https://uphl.utah.gov/arln-utah/. |
| Specimen type | Pure isolate of the organism on nutrient media slant or plate that supports organism growth |
| Transport | 2-8$^{0}$C or Ambient |
| Methodology | A digital dispenser is used to prepare custom broth microdilution panels |
| Turnaround time | 2-5 days |

# AR Laboratory Network testing menu (cont.)

CDC's colonization screening, offered through the AR Lab Network, detects colonization with carbapenemase-producing carbapenem-resistant organisms and antifungal-resistant candida. Colonization screening is a CDC-recommended intervention that can help stop the spread of carbapenem and antifungal resistant organisms.

Colonization testing is free. Email the HAI/AR team at hai@utah.gov to learn more.

| Colonization screening for CRE and CRPA | |
|---|---|
| Description | PCR testing assesses for the 'Big 5' carbapenemases (IMP, VIM, OXA-48, KPC, NDM) |
| Specimen type | Dual rectal swabs |
| Transport | 2-8$^0$C or Ambient |
| Methodology | Cepheid Carba-R PCR (culture-based methods also available) |
| Turnaround time | <1 day for PCR |

| Colonization screening for CRAB | |
|---|---|
| Description | Culture-based recovery of CRAB |
| Specimen type | Composite axillary/groin swab (Puritan Enviromax and e-swab) wound swab (e-swab) and suctioned sputum from vent/trach patients |
| Transport | 2-8$^0$C or Ambient |
| Methodology | Enrichment broth step and selection on Chromagar Acinetobacter + MDR supplement. MALDI identification and molecular characterization by PCR or WGS |
| Turnaround time | 2-3 days |

| Colonization screening for *Candida auris* | |
|---|---|
| Description | Screening test to detect the presence of *Candida auris* yeast |
| Specimen type | Composite axillary/groin swab (e-swab) |
| Transport | 2-8$^0$C or Ambient |
| Methodology | PCR (culture-based methods also available) |
| Turnaround time | <1 day for PCR |

# AR Laboratory Network testing menu (cont.)

| GC-Etest strip | |
|---|---|
| Description | *Neisseria gonorrhoeae* gradient strip AST for clinical cases of suspected treatment failure or disseminated gonorrhea infections is now offered at UPHL. |
| Specimen type | Bacterial isolates, pre-approval is required. Specimens sent without prior approval will not be tested. Email arlnutah@utah.gov for more information. |
| Transport | Frozen sample in 10-20 % glycerol for identification, ship using an insulated cooler with dry ice; or a slant or plate (MTM, chocolate agar), fresh subculture less than 24 hours old, ship at ambient temperature. |
| Methodology | E-test gradient strip. |
| Turnaround time | 10 days |

| Whole genome sequencing (WGS) | |
|---|---|
| Description | Identify isolates that may be related, predict resistance, and/or identify underlying causes of resistance in an organism. WGS can also be used to predict resistance in certain organisms by looking at the genes and mechanisms that are identified. Pre-approval is required before submitting isolates for WGS projects. Email arlnutah@utah.gov for more information. |
| Specimen type | Pure isolate of the organisms to be compared on nutrient media slant or plate that supports organism growth |
| Transport | 2-8$^{0}$C or Ambient |
| Methodology | Illumina-based NGS |
| Turnaround time | 1-2 weeks |

For more information on testing, visit to the UPHL website: uphl.utah.gov/arln-utah/

For the current requisition form for ARLN testing, review the ARLN Test Request Form 2023

To schedule testing or request supplies email ARLNutah@utah.gov.

Section 9

# Reporting and isolate submission requirements

There were no changes to the Utah Communicable Disease Rule for multidrug-resistant organisms (MDROs) in 2023. Current reporting and submission requirements are outlined in the table below.

For a comprehensive list, review the reportable disease list under R386-702. Print the list and post it in a prominent place in your microbiology lab.

| Genus & species | Reporting and submission notes |
|---|---|
| Carbapenem-resistant Enterobacterales (CRE)<br>*E. coli Klebsiella* spp.<br>**Enterobacter* spp. | • Statewide reporting (within 3 working days)<br>• Submission of screening/surveillance and clinical isolates<br>• Documented production of carbapenemase is reportable in all Enterobacteriaceae<br>• Please note: although there is no current requirement for reporting/submission of other members of the *Enterobacteriaceae family, these isolates can be submitted to UPHL for rule out of carbapenemase production using the listed criteria: *Providencia* spp., *Proteus* spp. and *Morganella* spp. with resistance to a carbapenem antibiotic (excluding imipenem)<br>• *Citrobacter* spp*. and Serratia* spp*. w*ith resistance to any carbapenem antibiotic |
| Carbapenem-resistant *Acinetobacter* spp. (CRA) | • Statewide reporting (within 3 working days) and isolate submission<br>• Documented carbapenemase production reportable |
| Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) | • Statewide reporting by electronic laboratory reporting (ELR) for surveillance only and submission<br>• Documented carbapenemase production reportable<br>• A 2019 CDC study showed that 83-100% of carbapenemase production in CRPA can be identified by looking at the susceptibility profiles of imipenem or meropenem in conjunction with ceftazidime or cefepime or ceftolozane/tazobactam. These criteria can be utilized to better target CRPA isolate submission for CP-testing.<br>(See page 13 for more details and the CDC flowchart to rule out isolate submissions) |
| *Candida auris (C. auris)* | • Statewide reporting and submission of both screening/surveillance clinical isolates<br>• *Candida haemulonii* and other rare *Candida* spp. or *Candida* spp. from sterile sites implicated in invasive disease that cannot be accurately speciated should also be submitted<br>• Since *C. auris* often colonizes the respiratory and urinary tracts, yeast or *Candida* species from non-sterile sites can also be submitted for rule-out of *C. auris* |
| Vancomycin-resistant *Staphylococcus aureus* (VRSA) | • Statewide within 24 hours (immediately notifiable)<br>• Suspected VRSA isolates should be verified through repeat testing to confirm vancomycin-resistance (MIC >or =16 ug/mL)<br>• Suspected VRSA isolates will be referred to the CDC for confirmation |

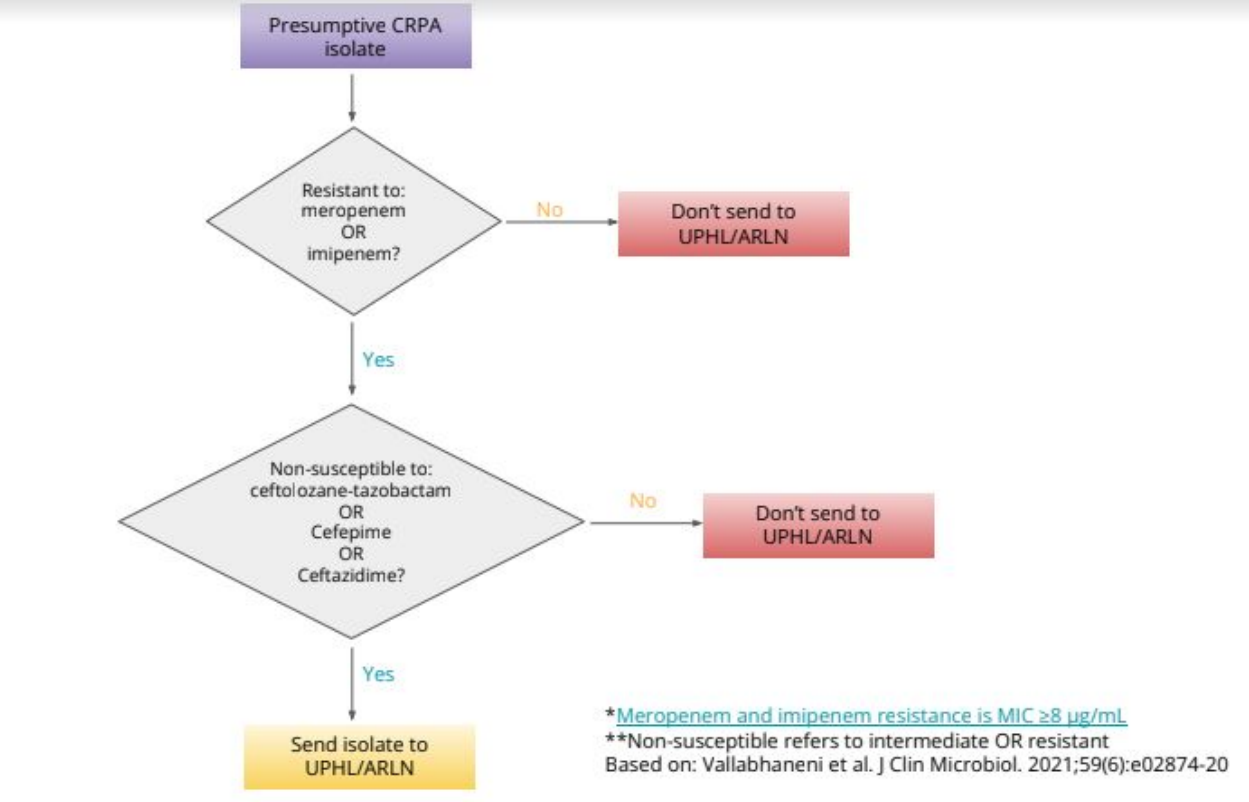
* Please note: There have been some naming changes to species of the genus *Enterobacter*. One species of Enterobacter—namely *aerogenes*—has been moved to the genus *Klebsiella* and is now more commonly known as *Klebsiella aerogenes.*

# Reporting and isolate submission requirements (cont.)

Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) resistance to imipenem or meropenem in conjunction with non-susceptibility to either cefepime, ceftazidime or ceftolozane-tazobactam has been shown to be an effective predictor (83-100% sensitivity) of carbapenemase production in *Pseudomonas aeruginosa* (Vallabhaneni et al. J Clin Microbiol. 2021;59(6):e02874-20).

Use the CRPA-CDC algorithm below before submitting any CRPA for further characterization. Specimens that fall under the "Don't send to UPHL/ARLN" will be canceled.

## CDC algorithm to rule out CRPA isolate submissions to UPHL/AR Lab Network



Section 10

# Updates from the Healthcare-Associated Infections and Antimicrobial Resistance (HAI/AR) program

The DHHS HAI/AR program has received additional support from the Strengthening HAI/AR program (SHARP) capacity grant. This grant supports various non-COVID activities such as antimicrobial stewardship, National Healthcare Safety Network (NHSN) expertise, and non-MDRO outbreaks.

We are grateful for your continued commitment to quality laboratory practices and patient care, and your cooperation in making sure reporting and isolate submissions are consistent with Utah's Communicable Disease Rule.

Together, we can prevent transmission and enhance containment of MDROs in Utah. Contact the HAI/AR program at hai@utah.gov or UPHL at ARLNUtah@utah.gov for more information.