

Michigan Department of Health and Human Services Bureau of Laboratories  
Confirmatory Testing for Carbapenem-Resistant *Enterobacterales*(CRE),  
*Pseudomonas aeruginosa* (CRPA), and *Acinetobacter baumannii* (CRAB)

## Overview

### Clinical Laboratory:

1. Detect possible carbapenem resistance in isolates of *Enterobacterales*, *Pseudomonas aeruginosa*, and *Acinetobacter baumannii* using current recommendations from CLSI to the extent possible. (See below for specific guidance)
2. Send suspect isolates to MDHHS laboratory in Lansing for confirmation  
(when a particular resistance mechanism is confirmed in your facility, it may not be necessary to send all subsequent isolates)

### MDHHS:

1. Confirm organism is *Enterobacterales*, *Pseudomonas aeruginosa*, or *Acinetobacter baumannii* (Identification, pure culture)
2. Perform **Modified Carbapenem Inactivation Method (mCIM)** (*Enterobacterales* or *Pseudomonas aeruginosa* only)
3. If isolate is mCIM positive or *Acinetobacter baumannii*: perform PCR testing for **KPC gene** (*bla<sub>KPC</sub>*), **NDM-1 gene** (*bla<sub>NDM-1</sub>*), **OXA-48 like gene** (*bla<sub>OXA-48 like</sub>*), **VIM gene** (*bla<sub>VIM</sub>*), and **IMP gene** (*bla<sub>IMP</sub>*)
4. Isolates of *Acinetobacter baumannii* may also be tested for **OXA-23 gene** (*bla<sub>OXA-23</sub>*), **OXA-24/40 gene** (*bla<sub>OXA-24/40</sub>*), and **OXA-58 gene** (*bla<sub>OXA-50</sub>*) upon Epidemiology request.
5. Perform **MIC** testing for the following antimicrobial agents using the CLSI reference microbroth dilution method, and interpret using newest CLSI breakpoints: amikacin, aztreonam, cefepime, cefotaxime, ceftazidime, ciprofloxacin, doripenem, doxycycline, ertapenem, gentamicin, imipenem, levofloxacin, meropenem, minocycline, piperacillin tazobactam, ticarcillin-clavulanic acid, tigecycline, tobramycin, and trimethoprim-sulfamethoxazole.
6. Report to submitter
7. Share results with state Healthcare-Associated Infections (HAI) coordinator (Brenda Brennan) and SHARP\* Unit in MDHHS Bureau of Epidemiology, and AR Lab Network (CDC)

\*Surveillance for Healthcare-Associated and Resistant Pathogens

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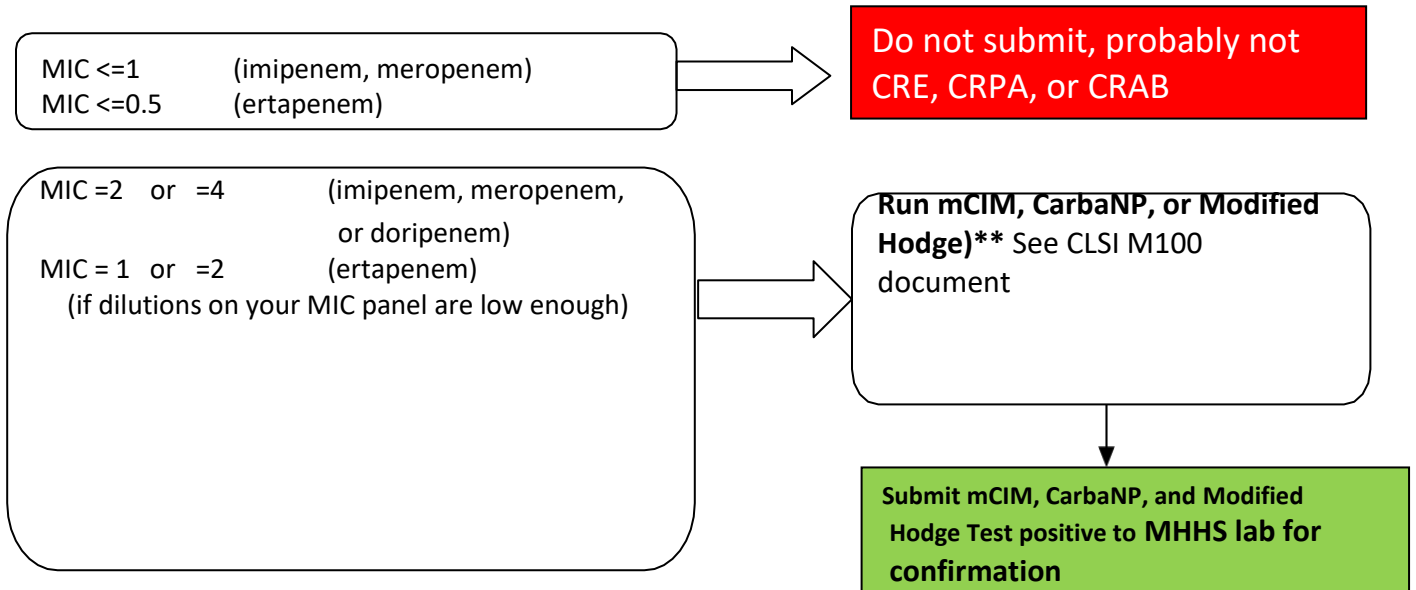
**Criteria for Isolates if laboratory is using “newer” (2012-2020) CLSI breakpoints:**

Send any carbapenem I or R isolates to MDHHS

(when a particular resistance mechanism is confirmed in your facility, it may not be necessary to send all subsequent isolates)

**Criteria for Isolates if laboratory is using “older” (2010) CLSI breakpoints:**

1. Look at instrument results for *Enterobacteriales Pseudomonas aeruginosa*, and *Acinetobacter baumannii*).
2. If carbapenem I or R, submit to MDHHS lab for confirmatory testing
3. If carbapenem = S, look at numerical MIC value(s):



\*\*If your laboratory is not performing mCIM, we encourage you to do so.

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**What to Submit?**

1. Pure culture of any species of *Enterobacteriales*\* that fits criteria above

- |                               |                                |
|-------------------------------|--------------------------------|
| <i>E coli</i>                 | <i>Serratia</i>                |
| <i>Klebsiella</i>             | <i>Proteus</i>                 |
| <i>Enterobacter</i>           | <i>Providencia</i>             |
| <i>Citrobacter</i>            | <i>Morganella</i>              |
| <i>Raoultella</i>             | <i>etc.</i>                    |
| <i>Pseudomonas aeruginosa</i> | <i>Acinetobacter baumannii</i> |

\*Please email or call Carrie Anglewicz or Kelly Jones if you're not sure: [anglewicz@michigan.gov](mailto:anglewicz@michigan.gov) 517-335-9654 or [jonesk42@michigan.gov](mailto:jonesk42@michigan.gov) 517-335-9638

2. Include copy of your instrument susceptibility printout

**How to Submit?**

- Agar *slants* only, no agar plates will be accepted
- Please include copy of your ID and AST results (e.g., printout from automated instrument)
- Also include mCIM, CarbaNP, or MHT result, if performed
- Select Antimicrobial Resistance Confirmation on MDHHS requisition (Form DCH0583):
- 

INSTRUCTIONS FOR COMPLETION: Complete reverse side of form for corresponding numbers in parentheses and in bold.			
<b>INDICATE SPECIMEN SOURCE</b>	<b>SEROLOGY</b>	<b>MICROBIOLOGY</b>	<b>TESTS THAT REQUIRE MDHHS APPROVAL</b>
<input type="checkbox"/> AMNIOTIC FLUID <input type="checkbox"/> BRONCHIAL <input type="checkbox"/> CERVIKX <input type="checkbox"/> CSF <input type="checkbox"/> GASTRIC <input type="checkbox"/> NASOPHARYNGEAL <input type="checkbox"/> ORAL MUCCOSAL TRANSDUATE <input type="checkbox"/> PLASMA <input type="checkbox"/> SERUM <input type="checkbox"/> STOOL <input type="checkbox"/> SPUTUM <input type="checkbox"/> THROAT <input type="checkbox"/> URETHRA <input type="checkbox"/> URINE <input type="checkbox"/> WHOLE BLOOD <input type="checkbox"/> FOOD-Specify: <input type="checkbox"/> OTHER-Specify:	SERUM STATUS - if Applicable <input type="checkbox"/> ACUTE <input type="checkbox"/> CONVALESCENT <input type="checkbox"/> ARBOVIRUS ENCEP PANEL (igm) May-Oct includes: Eastern Equine, California, IL Louis and West Nile CSF Only <input type="checkbox"/> BRUCELLA SEROLOGY <input type="checkbox"/> FUNGAL SEROLOGY COMPLEMENT FIX <input type="checkbox"/> FUNGAL IMMUNODIFFUSION <input type="checkbox"/> FRANCISELLA SEROLOGY <input type="checkbox"/> LEGIONELLA - HA <input type="checkbox"/> LYME DISEASE- EIA (4) <input type="checkbox"/> MEASLES IqG <input type="checkbox"/> MUMPS IqG <input type="checkbox"/> RABIES AB SEROLOGY (3) <input type="checkbox"/> RUBELLA IqG <input type="checkbox"/> TETANUS TOXIN EIA <input type="checkbox"/> VARICELLA ZOSTER IqG	<input type="checkbox"/> AEROBIC ISOLATE ID (5) <input checked="" type="checkbox"/> <b>ANTIMICROBIAL RESISTANCE CONF. (6)</b> <input type="checkbox"/> AFB SLIDE/CULTURE-CLINICAL SPECIMEN <input type="checkbox"/> AFB IDENTIFICATION-ISOLATE ID <input type="checkbox"/> ENTERIC BACTERIAL CULTURE <input type="checkbox"/> FOODBORNE ILLNESS-ISOL or Food (8) <input type="checkbox"/> FUNGAL IDENTIFICATION-ISOLATE ID <input type="checkbox"/> LEGIONELLA CULTURE <input type="checkbox"/> NEISSERIA GONORRHOEAE - ISOLATION <input type="checkbox"/> NEISSERIA - REFERRED CULTURE <input type="checkbox"/> PARASITOLOGY - BLOOD <input type="checkbox"/> PARASITOLOGY - STOOL <input type="checkbox"/> PARASITOLOGY - WORM <input type="checkbox"/> PERTUSSIS PCR <input type="checkbox"/> SALMONELLA SEROTYPING - HUMAN <input type="checkbox"/> SHIGELLA SEROTYPING <input type="checkbox"/> E. COLI SHIGA-TOXIN PRODUCER (STEC) <b>VIROLOGY</b> <input type="checkbox"/> ENTEROVIRUS PCR (6) <input type="checkbox"/> RESPIRATORY PCR PANEL <input type="checkbox"/> INFLUENZA (PCR/CULTURE) (7) PATIENT STATUS (Influenza) <input type="checkbox"/> OUTPATIENT <input type="checkbox"/> INPATIENT <input type="checkbox"/> UNKNOWN <input type="checkbox"/> VIRAL CULTURE	<b>EMERGING ARBOVIRUS PANEL</b> <input type="checkbox"/> PCR <input type="checkbox"/> SEROLOGY <input type="checkbox"/> AFB NUCLEIC ACID AMPLIFICATION <input type="checkbox"/> BACTERIAL TYPING-PCR (8) <input type="checkbox"/> BOTULISM TOXIN <input type="checkbox"/> MUMPS - PCR <input type="checkbox"/> MEASLES IqM <input type="checkbox"/> NOROVIRUS PCR (6) <input type="checkbox"/> PERTUSSIS CULTURE <input type="checkbox"/> RUBELLA IqM (1) <input type="checkbox"/> SALMONELLA SEROTYPING NON-HU <input type="checkbox"/> TOXIC SHOCK TESTING <input type="checkbox"/> OTHER _____ <b>OTHER</b> <input type="checkbox"/> AUTOCLAVE TEST STRIPS <input type="checkbox"/> LEGIONELLA - DFA <input type="checkbox"/> LYME DISEASE - DFA (1ck) <b>HEPATITIS TESTING</b> <input type="checkbox"/> HEPATITIS C ANTIBODY (1) <input type="checkbox"/> HEPATITIS B SURFACE ANTIGEN (HBsAg) (1) <input type="checkbox"/> HEPATITIS B ANTIBODY (Anti-HBsAg) <input type="checkbox"/> HEPATITIS A ANTIBODY (IgM) (1)
<b>HIV TESTING</b>	<b>SYPHILIS TESTING</b>		
<input type="checkbox"/> HIV Ag/Ab - Serum (1) <input type="checkbox"/> HIV Ag/Ab-Oral Mucosal Transudate (1) <input type="checkbox"/> CD4/CDS (EDTA whole blood) (1) <input type="checkbox"/> HIV-1 VIRAL LOAD (EDTA plasma) (1) <input type="checkbox"/> HIV-1 GENOTYPING (EDTA plasma) (1)	<input type="checkbox"/> SYPHILIS PANEL (1) <input type="checkbox"/> SYPHILIS TP-PA (ONLY) (1) <input type="checkbox"/> SYPHILIS VDRL - CSF Only (1) <input type="checkbox"/> SYPHILIS DFA (1,2) <input type="checkbox"/> SYPHILIS IqM WESTERN BLOT* (1)		

6. Follow regulations for shipping Infectious Substances, category B (UN 3373) and transport to Lansing laboratory (hospital courier, US Mail, or FedEx)

Shipping address:

Michigan Department of Health and Human Services Bureau of Laboratories  
 3350 North Martin Luther King Jr. Blvd.  
 Building 44 Room 155  
 P.O. Box 30035  
 Lansing, Michigan 48909