Utilization of the Modified Carbapenem Inactivation Method (mCIM) to Screen for Carbapenemase-Producing Enterobacterales, Nebraska 2023

E. McCutchen, B. Ayers, A. Bartling, S. McGill, A. Roden, P. Iwen, Nebraska Public Health Laboratory
Department of Pathology, Microbiology & Immunology; University of Nebraska Medical Center, Omaha, NE 68198

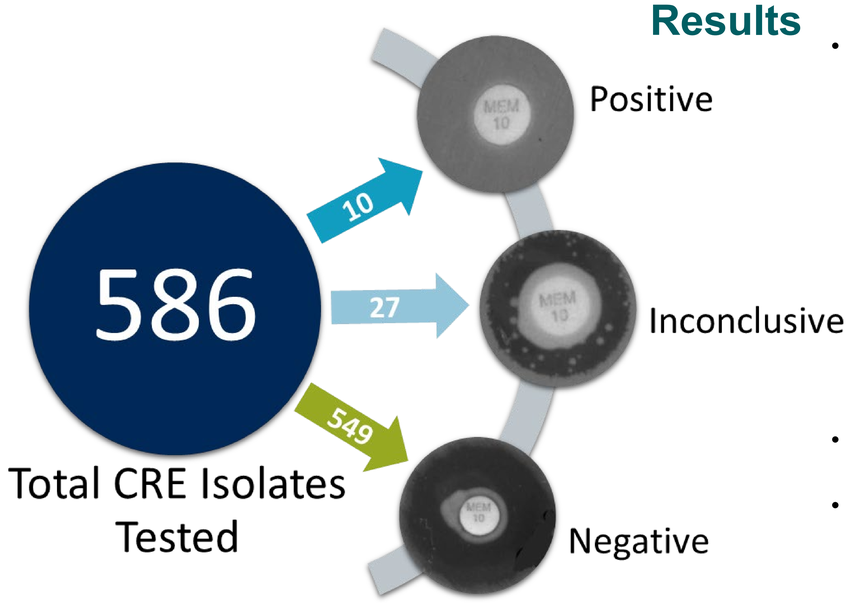
Introduction

The CDC recently described carbapenemase-producing Enterobacterales (CPE) as urgent antimicrobial resistant threats in the U.S. and expressed that aggressive action is needed to reduce the spread of these high-risk pathogens. Public health laboratories participating in the CDC Antimicrobial Resistance Laboratory Network (ARLN) provide a service to their jurisdictions to help monitor for these pathogens.

Objective/Purpose

This report describes the results of using the modified carbapenem inactivation method (mCIM) at the Nebraska Public Health Laboratory (NPHL) as a cost-effective, rapid, and reliable method to screen carbapenem-resistant Enterobacterales (CRE) for carbapenemase production.

Results

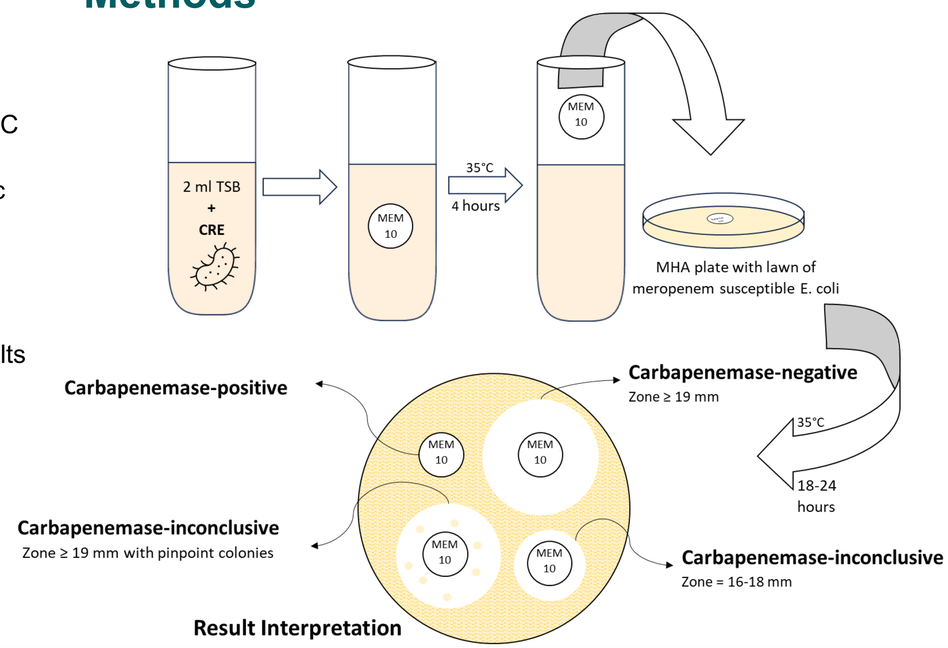


Carbapenemase results following mCIM screening.

- 37 isolates were inconclusive or positive following mCIM screening
  - Five were positive by the CARBAR assay and confirmed via WGS
    - 2: OXA-48-like
    - 3: KPC
  - Also following WGS, the remaining 32 isolates were shown to contain an assortment of less common beta-lactamase-producing genes such as:
    - *bla*MIR
    - *bla*ACT
    - *bla*SHV
- None of the isolates were found to be related following SNP analysis
- Prior to the implementation of mCIM as a screening tool, all 586 CRE isolates received would have undergone testing with the CARBAR RT-PCR assay, resulting in a savings over $22k in reagent costs with the utilization of this phenotypic testing method.

Methods

- CRE Isolates Tested:
  - Submitted to the NPHL from clinical laboratories throughout Nebraska
  - Intermediate (MIC 2-4 µg/ml) or resistant (MIC ≥8 µg/ml) to ertapenem or imipenem with varying results for meropenem by phenotypic methods
- mCIM assay was performed according to CLSI (Clinical and Laboratory Standards Institute)
  - ~$7/isolate
- Isolates with inconclusive or positive mCIM results were further tested by:
  1. Cepheid Xpert® Carba-R assay (CARBAR)
     - ~$42/isolate
  2. Whole genome sequencing (WGS) using the Clear Labs Clear Dx Microbial Surveillance WGS Reagent Kit v2.0 on the Clear Dx instrument
     - ~$200/isolate



Conclusion

Utilization of mCIM for screening of CRE allows the NPHL to use a simple, cost-effective, and rapid test method. This provides an alternative approach to screen for carbapenemase production which supports focused epidemiological investigations. mCIM screening ultimately saves time and resources for both public health laboratorians and epidemiologists.

References

- CLSI. *Performance Standards for Antimicrobial Susceptibility Testing.* 34th ed. CLSI supplement M100. Clinical and Laboratory Standards Institute; 2024. https://guides.library.cornell.edu/poster
- Hagey JV, Vlachos N, Kent AG, Diaz M, Halpin AL. (2023). CDCgov/phoenix: v2.0.0 (v2.0.0). Zenodo. https://doi.org/10.5281/zenodo.8147510