

Responding to Novel and Targeted Multidrug-Resistant Organisms (MDROs): National and Local Perspectives

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Outline

- Identify novel and targeted MDROs and describe the public health concern
- Describe the main principles of MDRO response and prevention
- Demonstrate application of guidances through examples of MDRO outbreaks

• Novel MDRO

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- Examples:
 - original identification of *Candida auris*
 - original identification of the *mcr*-1 gene

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- Examples:
 - Carbapenemase-producing Enterobacterales (CP-CRE)
 - Carbapenemase-producing Pseudomonas spp. (CP-CRPA)
 - Carbapenemase-producing Acinetobacter baumannii (CP-CRAB)
 - Candida auris

• Varied MDRO epidemiology by state and rapid spread



Clinical C. auris isolates 2013 to 2021

•PMID: 36940442 DOI: 10.7326/M22-3469

Varied MDRO epidemiology by state and rapid spread



^{0 (}but >1 screening case) 1-10 11-50 51-100 101-500

Clinical *C. auris* isolates 2013 to 2021 •PMID: 36940442 DOI: <u>10.7326/M22-3469</u>





Clinical NDM-CRE isolates 2009 to 2022

Data are preliminary and subject to change. Data analyzed on 05/01/2023

- Highly resistant organisms
 - P. aeruginosa associated with the multistate eye drop outbreak
 - S to cefiderocol only

MIC (µg/ml) Results and Interpretation		
Drug	MIC (µg/ml)	INT
Amikacin	>64	R
Aztreonam	>32	R
Cefepime	>32	R
Cefiderocol	0.5	S
Ceftazidime	>128	R
Ceftazidime/avibactam ¹	>16	R
Ceftolozane/tazobactam ¹	>16	R
Ciprofloxacin	>8	R
Colistin ²	1	I.
Gentamicin	>16	R
Imipenem	16	R
Imipenem/relebactam ¹	8	R
Imipenem+chelators ³	2	
Levofloxacin	>8	R
Meropenem	>8	R
Piperacillin/tazobactam ¹	64	I.
Tobramycin	>16	R

S - I - R Interpretation (INT) derived from CLSI 2022 M100 S32

¹ Reflects MIC of first component

² Clinical and PK/PD data demonstrate colistin has limited clinical efficacy, even if an intermediate result is obtained. Alternative agents are strongly preferred. Colistin should be used in combination with one or more active antimicrobial agents. Consultation with an infectious disease specialist is recommended. ³ Screen for metallo-beta-lactamase production [Rasheed et al. Emerging Infectious Diseases. 2013. 19(6):870-878]

MDRO Response and Prevention

Containment

• Series of actions triggered in response to single case

• Whack one mole at a time

 Works well when targeted organisms are rare



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Prevalence of *Candida auris* and the total number of screening cases (new and known) among total facility census, identified on serial PPSs within all OC LTACHs and 6 vSNFs (A to F), by PPS number—OC, California, March to October 2019.

- Significant Spread Before Clinical Cases
 - Orange County:
 - 27 ACH, 3 adult LTACH, 14 vSNF
 - February 2019
 - 1st clinical *C. auris* case identified in LTACH patient
 - Initial PPS identified 44 cases at 6 vSNF and 3 LTACH facilities



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Interim Guidance for a Public Health Response to **Contain** Novel or Targeted Multidrug-resistant Organisms (MDROs)



Updated December 2022





Prevention strategies

- Publicly available in early 2023
- Informed by:
 - Published evidence on preventionfocused interventions
 - Mathematical modeling to estimate the relative population benefits for different bundles of prevention interventions

Public Health Strategies to **Prevent** the Spread of Novel and Targeted Multidrugresistant Organisms (MDROs)

Accessible Link: https://www.cdc.gov/hai/mdro-guides/prevention-strategy.html





Centers for Disease Control and Prevention National Center for Emerging a Zoonotic Infectious Diseases

Source: Public Health Strategies to Prevent the Spread of Novel and Targeted Multidrug-resistant Organisms (MDROs) (cdc.gov)

Past Examples of Successful Prevention Initiatives

- Siouxland: VRE prevention
 - Ostrowsky B, et al. Control of Vancomycin-Resistant Enterococcus in Health Care Facilities in a Region. N Engl J Med 2001; 344; 1427-33
- Israel: CRE prevention
 - Schwaber M, et al. Containment of a Country-wide Outbreak of Carbapenem-Resistant *Klebsiella pneumoniae* in Israeli Hospitals via a Nationally Implemented Intervention. Clinical Infectious Disease 2011; 52(7): 848-855

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- 5) Improve communication

Modeling to Inform Prevention

- Updated established deterministic compartmental regional CRE transmission model
- Modeled the effect of placing colonized individuals under transmission-based precautions

Modeling to Inform Prevention

- Assessed relative intervention impact
 - Detection and tracking
 - PPSs, Admissions screening, and interfacility communication
 - Enhanced IPC
 - Improvement in IPC for infected individuals
- Implemented in different facility types
- At different points in an epidemic

Reduction in MDRO Prevalence After 10 years



Caption: Infection prevention and control (IPC) effectiveness by facilities based on the reduction in intrafacility transmissibility in Long-Term Acute Care Hospitals (LTACHs) and Ventilator-Capable Skilled Nursing Facilities (vSNFs) A: 50% in LTACHs. 25% in vSNFs B: 50% in LTACHs, 35% in vSNFs

C: 70% in LTACHS, 35% in vSNFs D: 70% in LTACHS, 50% in vSNFs



Years since importation

- Intended to reduce transmission of MDROs at all stages of spread
 - Ideally includes multiple targeted MDROs in a region
- State, local, and territorial health departments work with healthcare facilities to:
 - Provide education
 - Improve infection control practices
 - Detect colonized patients
 - Facilitate inter-facility communication

Public Health Strategies to **Prevent** the Spread of Novel and Targeted Multidrugresistant Organisms (MDROs)

Accessible Link: https://www.cdc.gov/hai/mdro-guides/prevention-strategy.html



- Response (Containment) strategies updated December 2022
 - Initial response to new identifications of novel and targeted MDROs

Interim Guidance for a Public Health Response to **Contain** Novel or Targeted Multidrug-resistant Organisms (MDROs)



Updated December 2022



Centers for Disease Control and Prevention National Center for Emerging and Zoonotic Infectious Diseases

Source: Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms (MDROs): Updated December 2022 (cdc.gov)

Figure 1. Relationship between epidemic stages, response tiers, containment response, and prevention activities for novel or targeted MDROs.



Organism or resistant mechanism that have

*Never (or very rarely) been identified in the United States and for which experience is extremely limited are Tier 1.

[^]Never (or very rarely) been identified in a public health jurisdisction but are more common in other parts of the U.S. are Tier 2.

Endemic MDROs in a region and have been targeted by public health for their clinical Tier 4 significance and potential to rapidly spread **Non-endemic** MDROs targeted by Tier 3 facility/region for epidemiologic importance MDROs identified in healthcare settings, but not regularly Majority of CPO & identified in the region; Tier 2 Candida auris and organisms for which no current Responses treatment exists Novel mechanisms that have never (or very rarely) been Tier 1 identified in the United States and for which experience is extremely limited

Tier 1	Novel resistance mechanisms
Tier 2	 Pan-nonsusceptible organisms KPC+ <i>Pseudomonas aeruginosa</i> KPC+ <i>Acinetobacter baumannii</i> Most gram-negative organisms with at least one of the following genes: NDM, VIM, IMP, or OXA-48-like
Tier 3	 OXA-23-like, OXA-58-like, or OXA-24/40-like Acinetobacter baumannii KPC+ Enterobacterales



Tennessee C. auris Re-tier

- Tier 3 Status: Areas with advanced spread
 - West Region
 - Mid-Cumberland Region
 - Montgomery County only
 - Southeast Region





Tennessee *C. auris* **Re-tier**

- Tier 2 Status: Areas with limited to moderate spread
 - Mid-Cumberland Region (except Montgomery County)
 - Upper Cumberland
 - South Central
 - East/Knox
 - Northeast/Sullivan





MDRO outbreak data

HAI/AR Program Performance Measures Analysis for Novel MDRO (nMDRO) Responses—08/2019—07/2021

Inclusion criteria:



Data are preliminary and subject to change.

Data Analysis

- Limited to "traditional" (non-regional) responses
- Calculated the proportion of responses by healthcare setting and organism (i.e., CRAB, CRE, CRPA, *Candida auris*):
 - Proportion of nMDRO responses with at least one positive colonization screen
 - Colonization screening positivity

nMDRO Responses



> One-third of Responses Had Positive Colonization Screen



■ ACH ■ LTACH ■ vSNF ■ SNF ■ All Settings

8% of Response Screens were Positive

■ ACH ■ LTACH ■ vSNF ■ SNF ■ All Settings



Rankin et al. SHEA Spring Conference 2023

Thank you

For more information, contact CDC 1-800-CDC-INFO (232-4636) TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

