

Carbapenemase-producing Carbapenem-resistant Organism Colonization Screening Surveys — Maryland, April 2017–April 2018

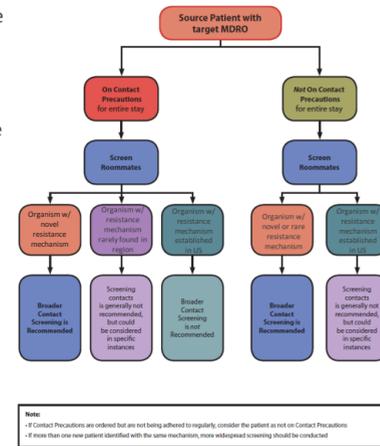
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BACKGROUND

- In 2013, Centers for Disease Control and Prevention (CDC) named carbapenem-resistant Enterobacteriaceae (CRE) one of the top three urgent drug-resistant threats in the United States
- In response, Maryland Department of Health (MDH) began conducting statewide surveillance for CRE in 2013
- As an Emerging Infections Program (EIP) site, MDH also participates in CDC's Multi-site Gram-negative Surveillance Initiative (MuGSI), collecting data about and isolates from other carbapenem-resistant organisms (CROs), including:
 - Carbapenem-resistant *Acinetobacter baumannii* (CRAB)
 - Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)
- MDH Laboratories Administration performs mechanism testing on all CROs identified in MD residents for carbapenemase production using a CDC-developed real time polymerase chain reaction (rtPCR) assay
- In April 2017, MDH began implementing CDC's containment strategy for confirmed cases of carbapenemase-producing carbapenem-resistant organisms (CP-CROs) to identify and stop potential transmission, including:
 - Performing CP-CRO colonization screening surveys (CSSs) of healthcare contacts of confirmed CP-CRO cases (Figure 1)
 - Assessing the quality and consistency of infection control in healthcare facilities where cases are identified

Figure 1: Approach to screening healthcare contacts following identification of novel or targeted multidrug-resistant organisms



METHODS

- Epidemiological investigations of confirmed CP-CRO cases were routinely conducted by MDH epidemiologists, in accordance with CDC's *Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms (MDROs)*
- When epidemiologically linked contacts of CP-CRO cases were identified in healthcare facilities, rectal swabs were collected for CP-CRO colonization screening at MDH Laboratories Administration
- On each swab, MDH Laboratories Administration performed the Cepheid Xpert® Carba-R assay to detect five carbapenemases:
 - Klebsiella pneumoniae* carbapenemase (KPC)
 - New Delhi metallo-β-lactamase (NDM)
 - Verona integron encoded metallo-β-lactamase (VIM)
 - Imipenemase (IMP)
 - Oxacillinase-48-like carbapenemase (OXA-48)
- Identification of CP-CROs in contacts sometimes resulted in additional CSSs to ensure complete case detection
- Non-KPC cases were combined for analysis



Dr. Niketa Jani preparing specimen for Cepheid Xpert® Carba-R testing

RESULTS

- During April 1, 2017–April 1, 2018, MDH received reports of 278 incident cases of confirmed CP-CROs
 - 16 (6%) cases were confirmed to express non-KPC carbapenemases by mechanism testing
 - 7 (3%) cases resulted in CSSs of possibly exposed healthcare contacts to identify potential CP-CRO transmission, including one rare case of KPC-*Acinetobacter* (Table 1)
 - In first-round CSSs, 132 healthcare contacts were screened for CP-CROs
 - Of 132 screened contacts, 13 (10%) were positive for additional CP-CROs, all of which had KPC
 - Post-acute care facilities were the most common sites of CSSs
 - Of the 13 contacts identified as having CP-CROs, 12 (92%) resided in post-acute care facilities, all on ventilator units at skilled nursing facilities (vSNFs)

- During one first-round CSS, 64% of screened contacts were positive for KPC, which had not been identified in the index case (Case No. 5 in Table 1)
 - Admission screening for CP-CROs initiated at this vSNF
 - Serial follow-up CSSs performed every 3-4 weeks
 - Total 72 unique patients screened via admission screening and serial CSSs (Table 2)
 - 38 (53%) tested positive for KPC on at least one test; 32 (89%) of these not previously known to be KPC-positive
 - 5/72 (7%) converted from negative on initial testing to positive on subsequent testing
 - Positive patients cohorted and placed on appropriate contact precautions
 - Staff cohorted to provide care only for KPC+ or only KPC- patients
 - On-site infection prevention (IP) assessment conducted
 - Staff re-trained in IP techniques, including hand hygiene, environmental cleaning, and use of personal protective equipment

CONCLUSIONS

- Identification of CP-CROs that express non-KPC carbapenemases was rare in Maryland during April 2017–April 2018
- Transmission of non-KPC carbapenemases from index patients to healthcare contacts was not identified
- Identification of patients in one vSNF who initially tested negative for KPC but later tested positive suggested likely intrafacility transmission of KPC from other positive patients
- CSSs identified previously unrecognized cases of KPC, most commonly in vSNFs, and resulted in important IP interventions

REFERENCES

- CDC. Antibiotic/Antimicrobial Resistance: Biggest Threats. https://www.cdc.gov/drugresistance/biggest_threats.html
- CDC. Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms (MDROs). <https://www.cdc.gov/hai/outbreaks/docs/Health-Response-Contain-MDRO.pdf>



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Table 1. First-round colonization screening survey characteristics and results, n = 7

Case No.	Index Organism	Index Carbapenemase Detected	Facility Type Screened*	No. first-round contacts screened	Results from screened contacts	
					No. KPC+	No. non-KPC+
1	<i>K. pneumoniae</i>	NDM	NH	11	0	0
2	<i>K. pneumoniae</i>	NDM/OXA-48	ACH	12	0	0
3	<i>K. pneumoniae</i>	KPC/VIM	vSNF	35	5	0
4	<i>A. baumannii</i>	KPC	ACH	31	1	0
5	<i>P. aeruginosa</i>	VIM	vSNF	11	7	0
6	<i>E. coli</i>	OXA-48	SNF	7	0	0
7	<i>E. coli</i>	NDM	SNF	25	0	0

*NH = nursing home; vSNF = ventilator unit in skilled nursing facility; ACH = acute care hospital

Table 2. Summary of serial colonization screening results for vSNF with high burden of KPC found on first-round CSS, n = 72

Patient KPC screening results	No.	%
Only tested negative	32	44
Only tested positive	28	39
Converted from negative to positive	5	7
Converted from positive to negative	4	6
Converted positive to negative to positive	1	1
Failed/Rejected	2	3
Total	72	100

