

What's Lurking Around the Corner: Identifying Novel CRE Resistance Mechanisms in the Los Angeles County Healthcare Community, 2015



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Introduction

Disease Burden

- Laboratory-based surveillance conducted from 2010-12 identified Los Angeles County (LAC) as a carbapenem-resistant *Enterobacteriaceae* (CRE) high incidence area¹

Current Surveillance

- Voluntary CRE surveillance projects initiated January 2015 by the LAC Department of Public Health (DPH) and Public Health Laboratory (PHL)
- Part one: reporting of CRE via LabID in NHSN
- Part two: clinical microbiology laboratory (CML) surveillance for identification of resistance mechanisms in *K. pneumoniae*, *E. coli*, and *Enterobacter spp.* isolates resistant to carbapenems

Situational awareness

- Information gained from enhanced surveillance projects will be used to define the extent of antibiotic resistance in *Enterobacteriaceae* in LAC and target prevention efforts

Aims

- Characterize the epidemiology of CRE resistance mechanisms circulating in the LAC healthcare community
- Detect emergence of non-KPC resistance in *Enterobacteriaceae*

Methods

Participation Requirements

- All 99 LAC hospital CMLs and regional reference labs invited to participate
- CMLs completed enrollment form indicating their method of susceptibility testing for CRE
- Susceptibility report submitted with isolates

PHL Testing Methodology

- Streaked for isolation and confirmation of organism via MALDI-TOF
- Modified Nanosphere BC-GN assay used to identify KPC, NDM, OXA, IMP, VIM, and CTX-M resistance genes

Facility Characteristic

- For hospital-based CMLs, facility characteristics were analyzed in conjunction with PHL results
- Included average daily census (ADC), teaching vs non-teaching, NHSN CRE data if available

Results

Table 1. Submitting Laboratory and Facility Characteristics

	No. (%)
Total labs enrolled	31
Acute care hospital	
• Teaching	10 ^a (32)
• Non-teaching	17 (55)
Long term acute care	2 (6.5)
Regional laboratory	3 (9.7)
• Hospital based	2 ^b
• Long term care	1
Use new CLSI breakpoints	21 (68)
Perform MHT	16 (52)

^aOne regional lab serves a network of teaching hospitals.

Fig. 2 Age Range and Sex of CRE Positive Patients

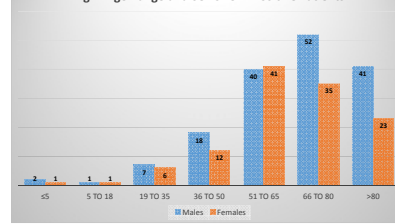


Fig. 4 Resistance Mechanism by Non-Sterile Specimen Source (n=234)

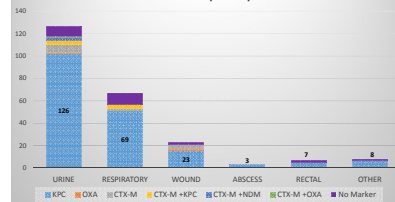


Fig. 1 Method of Susceptibility Testing for CRE

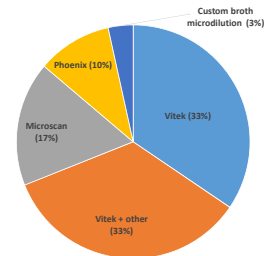


Fig. 3 Non-KPC Resistance Mechanism by Organism Type (n=44)

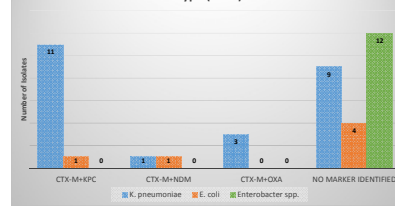


Fig. 5 Resistance Mechanism by Sterile Specimen Source (n=44)

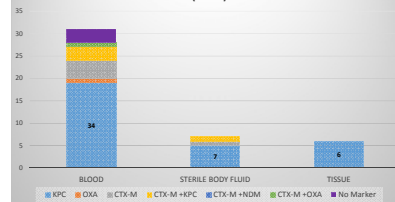


Table 2. Resistance Mechanism Detected by Nanosphere

Organisms	KPC	VIM	IMP	OXA	NDM	CTX-M	CTX-M +KPC	CTX-M +NDM	CTX-M +OXA	No Marker	No Organism Detected	Total
<i>K. pneumoniae</i>	198	0	0	2	0	8	11	1	3	9	0	231
<i>K. oxytoca</i>	1	0	0	0	0	0	0	0	0	0	0	1
<i>E. coli</i>	6	0	0	0	0	8	1	1	0	4	0	20
<i>Enterobacter spp</i>	2	0	0	0	0	1	0	0	0	12	0	15
<i>Citrobacter spp</i>	5	0	0	0	0	0	0	0	0	0	0	5
<i>Proteus spp</i>	1	0	0	0	0	0	0	0	0	0	0	1
<i>P. aeruginosa</i>	0	0	0	0	0	1	0	0	0	2	0	3
<i>Acinetobacter spp</i>	1	0	0	1	0	0	0	0	0	0	0	2
Negative	0	0	0	0	0	0	0	0	0	0	5	5
TOTALS	214	0	0	3	0	18	12	2	3	27	5	283

Results

- A total of 31 labs enrolled representing 40 hospitals, 3 LTACs, 1 regional lab for SNFs (Table 1)
- Majority (82%) of isolates submitted were *K. pneumoniae*
- Urine accounted for 44.5% of all specimens submitted (Fig. 4)
- KPC (226, 80%) most frequently identified carbapenemase (Table 2)
- Ten laboratories reported 17 ESBL and CR isolates; 47% (8) reported from community hospitals (CH)
- Non-sterile specimens accounted for 70% (24) of isolates that had an ESBL detected, with or without a carbapenemase, and all isolates in which a resistance mechanism was not detected.

Limitations & Conclusion

- Counts represent isolates not patients; future work includes de-duplication of isolates and generating countywide CRE antibiogram
- While KPC continues to be the predominantly circulating carbapenemase, the decrease from a previously identified 94% prevalence signals the emergence of other resistance mechanisms
- As compared to CDC Emerging Infections Program surveillance, which detected only KPC in their isolates, LAC has identified more variation in isolates tested

Future Activities

- Develop CRE response algorithm for when non-KPC resistance markers are identified
- Increase and diversify CMLs enrolled in surveillance – include more non-acute care setting laboratories
- Whole genome sequencing and confirmation of susceptibility at PHL to be done on subset of isolates without resistant mechanism identification
- Conduct analysis of colistin resistance from submitting CML susceptibility reports; PCR testing for mcr-1 on subset of isolates at PHL when primers completed

Acknowledgements

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