



# Carbapenem-Resistant Enterobacteriaceae (CRE) in Los Angeles County

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# Objectives

- Describe characteristics of CRE in Los Angeles County (LAC)
- Discuss the clinical and public health implications of CRE

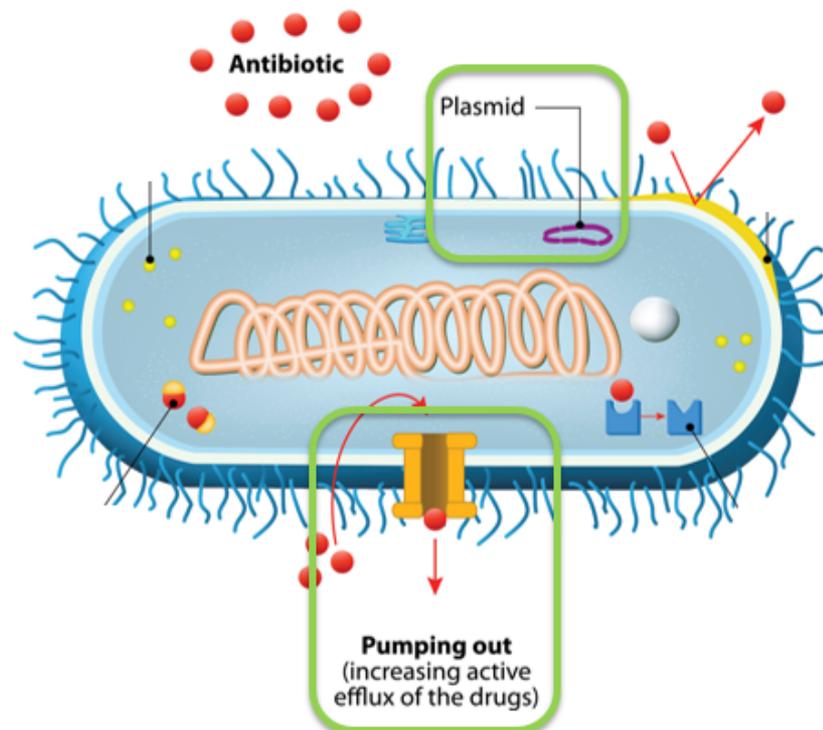
# What are Carbapenemase-Producing (CP) CRE?

**CP- CRE**

Enzyme (plasmid mediated)

**Non-CP- CRE**

Other mechanisms (i.e., mutations)



# Differences in Carbapenemase Characteristics

## KPC

- Mostly found in *K. pneumoniae* and *E. coli*
- Endemic in US, Greece, Italy, Israel, China, Brazil, Colombia, Argentina
- Inhibited by clavulanic acid, tazobactam, boronic acid, avibactam
- Additional resistance to penicillins, cephamycins, cephalosporins

## OXA

- Mostly found in *Acinetobacter*, *Pseudomonas*, Enterobacteriaceae
- Endemic in Japan, Taiwan, India, Balkan states, Greece
- Inhibited by metal chelators
- Additional resistance to penicillins, cephamycins, cephalosporins

## NDM, VIM, IMP

- Metallo-  $\beta$ -lactamases
- Mostly found in Enterobacteriaceae
- Endemic in Turkey, North Africa, Europe
- Inhibited by NaCl
- Additional resistance to penicillins, temocillin,  $\beta$ -lactamase inhibitor combinations



## LAC CRE Surveillance Strategy

- Request to voluntarily submit:
  - CR- *K. pneumoniae*, *E. coli*, and *Enterobacter spp.* isolates
  - Antimicrobial susceptibility testing (AST) results
- 33 clinical microbiology labs in LAC, representing:
  - 35 (38%) acute care hospitals (ACHs)
  - 2 (25%) long-term acute care hospitals (LTACHs)
  - 412 (~60%) long-term care facilities (LTCF)

## LAC Public Health Laboratory Methodology

- Matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) mass spectrometry for organism identification
- Nanosphere<sup>®</sup> Verigene BC-GN to detect carbapenemase genes
  - KPC
  - NDM
  - OXA
  - VIM
  - IMP

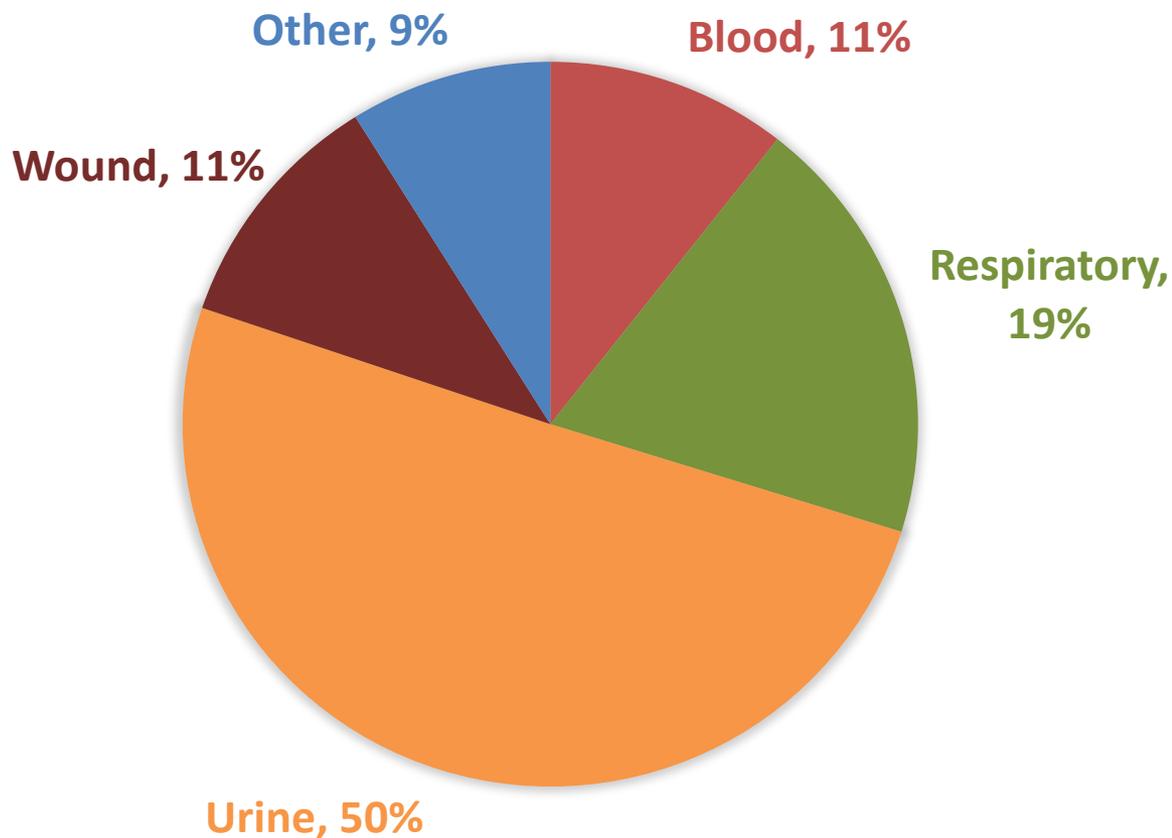




## LAC Results

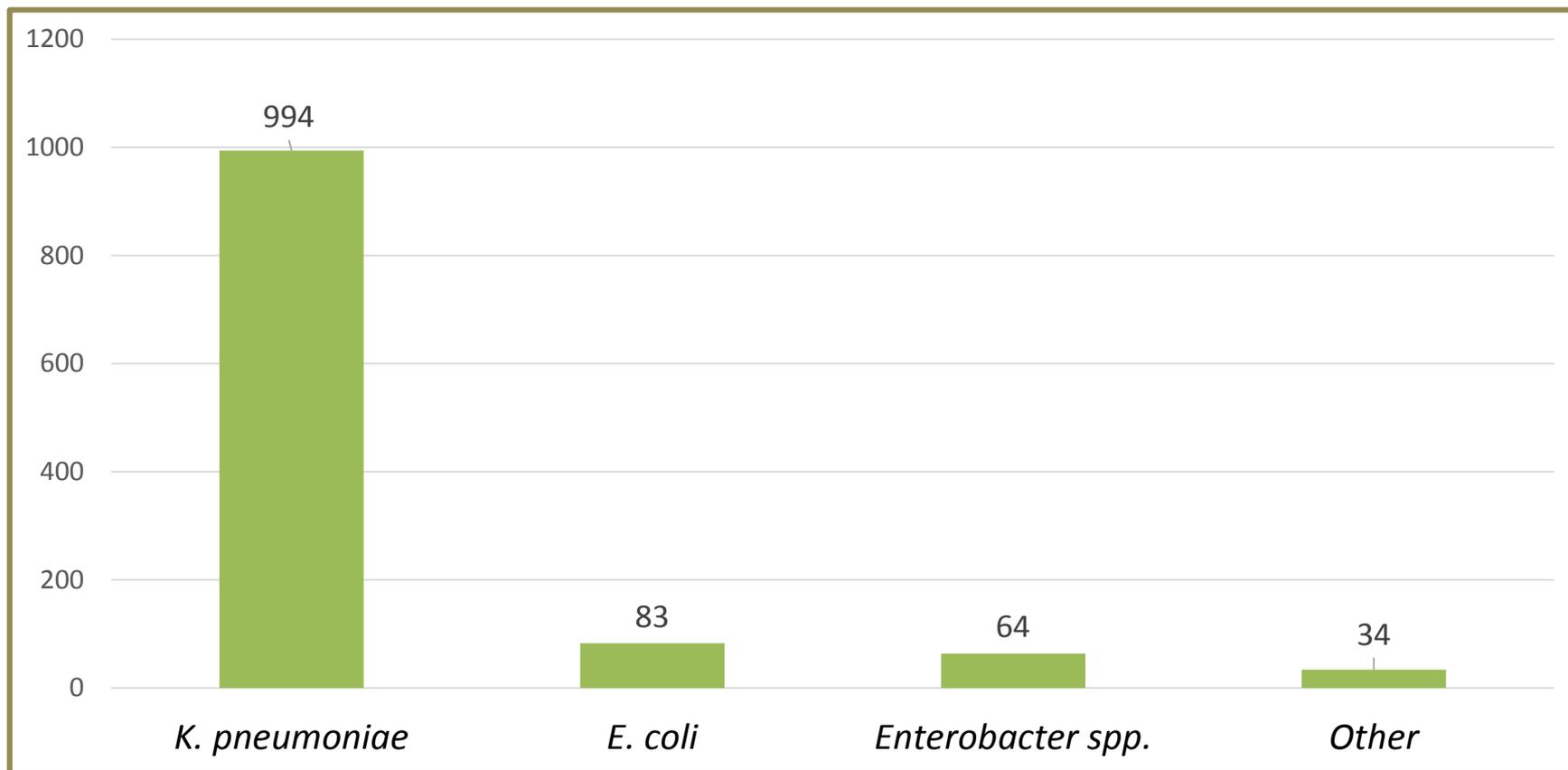
- PHL tested 1,175 CRE isolates between Jan. 2015 to May 2018
  - 75% from acute care settings
  - 25% from long-term care settings
- AST data from submitting labs available for 661 isolates between Jan. 2015 to Apr. 2017
  - 83% used automated AST system

# CRE Specimen Sources



N= 1,175

# CRE Organisms Identified



N= 1,175

# Genomic Epidemiology

- 973 (**83%**) were CP-CRE (compared to **34%** in US (CDC))
  - 96.1% KPC
  - 2.2% OXA
  - 1.3% NDM
  - 0.3% VIM
  - 0.1% IMP
- 2.3% had two genes identified
- 15% were non-CP-CRE

## Susceptibilities for Select Adjunctive Agents

Antibiotic	CP- CRE		Non-CP- CRE	
	n	%S	n	%S
Ciprofloxacin	461	0.9	35	37.5
Amikacin	465	37.6	34	70.6
Gentamicin	451	57.6	45	80
Tobramycin	407	16.1	34	73.5
Colistin	128	60.1	22	63.6
Tigecycline	107	77.5	12	58.3



## Conclusions

- A large proportion of CRE in LAC produce a carbapenemase
- KPC is the predominant carbapenemase in LAC, but non-KPC mechanisms are present
- CP-CRE are highly resistant to adjunctive agents for CRE infections

# Recommendations

- Obtain access to genetic resistance mechanism testing in order to rapidly identify CP- CRE
- Ensure inter-facility communication to prevent regional spread



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**Questions?**

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