

# Carbapenem-Resistant *Klebsiella pneumoniae* Cluster in a Long-term Skilled Nursing Facility Highlights the Role of Local Public Health in Prevention and Control

Jennifer Sears, MPH<sup>1</sup>; Ami S. Patel, PhD, MPH<sup>1,2</sup>

<sup>1</sup>Philadelphia Department of Public Health, Division of Disease Control, Philadelphia, PA; <sup>2</sup>Centers for Disease Control and Prevention, Atlanta, GA

## Background



- Carbapenem-resistant Enterobacteriaceae (CRE) are gram negative bacteria, including *Klebsiella* and *E. coli*, which are resistant to  $\beta$ -lactams and carbapenems
- CRE often carry genes that make them resistant to other antimicrobials and “pan-resistant” strains have been reported
- *Klebsiella pneumoniae* carbapenemase (KPC) is the most common mechanism of resistance
- Resistance spreads easily between bacteria
- High mortality rates (40-50%)
- Reporting of CRE is voluntary in Philadelphia; however, reporting of disease outbreaks is mandatory
  - Prevalence data is not widely available
  - Survey data of Philadelphia acute and long-term care facilities found CRE to be common

## Cluster Detection

### Case Report:

- Reported to the Philadelphia Department of Public Health (PDPH) by Hospital A Infection Preventionist (IP) on October 16, 2012
- Initial report of 4 individuals admitted with CRE from Philadelphia Skilled Nursing Facility (SNF) A
- Hospital began to place all persons admitted from SNF A on contact precautions
  - Alerted other hospitals in system to do the same
  - No screening for CRE initiated; however, all patients admitted from SNFs screened for MRSA

### Facility Characteristics:

- Private skilled nursing facility under new ownership
- Single building with 3 floors (2 wings per floor)
  - No specialized units
- 180 beds
- 210 staff members
- Dedicated infection control nurse
  - Started position week prior to investigation

## Objectives

An investigation was conducted to:

- Identify CRE colonized patients
- Prevent further spread of CRE within the SNF
- Evaluate staff knowledge and educate about CRE and CRE prevention, including contact precautions

## Methods

### Initial Response:

- Visited SNF A to discuss infection control procedures and review charts
- Requested medical records from prior hospitalizations and spoke with IP at hospital A regarding CRE prevalence

### Second SNF A Visit:

- Facility conducted point prevalence survey of 3rd floor
  - Peri-rectal swabs collected by nurses
- PDPH conducted observational survey of infection control and hand hygiene throughout facility
- PDPH in-serviced all staff on infection control
  - PDPH administered survey to assess knowledge prior to in-service

### Case Definition:

- CRE positive isolate collected from SNF A residents:
  - During stay at SNF A
  - Within 48 hours of hospitalization OR
  - From clinical cultures taken within 1 week of hospitalization if symptoms were present upon admission

### Second Facility Involvement:

- Education of a second facility (SNF B) where a case patient was transferred
  - Notification and education after additional 2 CRE infected patients were detected by Hospital A at SNF B

### Lab Testing:

- Point prevalence testing completed at private lab and paid for by facility
  - Facility had to find lab capable of completing testing
- PDPH coordinated mechanism and pulsed-field gel electrophoresis (PFGE) testing at the Centers for Disease Control and Prevention (CDC) for isolates available at hospital A and positive isolates collected from point prevalence survey
  - 7 isolates were sent to CDC, including 1 isolate for a CRE infected patient from SNF B

### Survey Development and Administration:

- Pre-in-service survey determined knowledge of general infection control, including:
  - Standard precautions
  - Enhanced precautions
  - Bloodborne pathogens
- Given as a paper copy to all in-service attendees

### Follow-up:

- Second point prevalence survey conducted after additional symptomatic case patients detected
- Ongoing communication with facility regarding CRE surveillance

## Results

### Site Visit Observations:

- Facility was unaware of CRE upon initial notification
- Contact precautions were not observed during first visit
- Observational surveys detected inconsistent hand hygiene and use of contact precautions
- Surveys administered to staff at SNF A showed a deficit in infection control knowledge, specifically surrounding Infection control precautions for both administrators and Certified Nursing Assistants (Table 2)

### Case Patients:

- Total of 7 symptomatic case patients reported by Hospital A and 1 colonized case patient detected by point prevalence surveillance (Table 1)
- CRE positive patients were on all 3 floors of the facility
- Previous hospitalizations did not overlap for the initial 4 cases

### Lab Results:

- First point prevalence survey detected no CRE; however, did identify a carbapenem-insensitive isolate
- Second point prevalence survey detected one individual colonized with CRE
- Of the 7 isolates tested at CDC:
  - Isolates from 3 symptomatic case patients at SNF A were identical by PFGE to a patient from SNF B
  - Two additional case patients were related (>92%) by PFGE
  - One isolate was not CRE

**Table 1. Characteristics of case patients (N=8) at SNF A, Sept. 2012- Feb. 2013**

Case Characteristics	Cases n (%) or median (range)
Median Age (years)	74.5 (62-91)
Female	5 (63%)
Deceased	4 (50%)
Median time at SNF A	4 months (2 days - 9 years)
Incontinent	6 (75%)
<b>Resistance Mechanism</b>	
KPC	5 (63%)
Not Tested	3 (38%)
<b>Clinical Diagnosis</b>	
UTI	3 (38%)
UTI and Septicemia	2 (25%)
Pneumonia	2 (25%)
Colonized	1 (13%)
<b>Race</b>	
Black	5 (63%)
White	1 (13%)
Asian	1 (13%)
Other	1 (13%)

## Conclusion

- This outbreak was most likely sustained due to lack of knowledge and detection, highlighting the need for CRE education and challenges of contact precautions in the long-term setting
- The Local Health Department was an important partner in outbreak control
  - Facilitated communication, education, and laboratory testing
- PFGE, mechanism, and point prevalence testing assisted in characterizing cluster

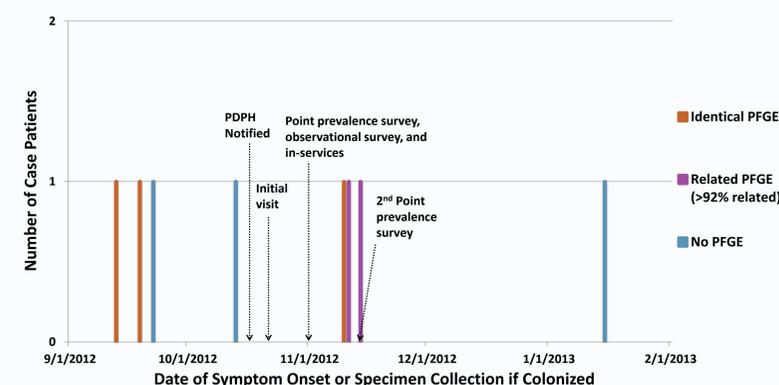
## Challenges

- Limited knowledge of CRE prevalence in Philadelphia prior to outbreak
- Facilities initially not aware of CRE cases despite faxed records from Hospital A
  - Required PDPH follow-up to ensure transfer facilities were aware of cases
- Difficulty finding a private lab to complete CRE surveillance testing
- Difficulty advising contact precautions for long-term residents
  - Based on continence and degree of nursing care

### Acknowledgements

- Thank you to PDPH staff who helped to complete the observational survey and chart review: Shadia BelHamdounia; Elizabeth Taggart; Amanda Driesse; Xiomara Lugo; Mercedes White; Timothy Amorim; Andrea Echeverri
- Thank you to the staff at SNF A and Hospital A
- Thank you for the continued support and guidance from Alex Kallen, MD, MPH, and Carolyn Gould, MD, MPH, from CDC's Division of Healthcare Quality and Promotion

**Figure 1. Philadelphia SNF A CRE Cluster Epi Curve, Sept. 2012 – Feb. 2013**



**Table 2. Results of pre-in-service infection control surveys administered to all SNF A Staff**

Question Topic	Role n (% correct)				
	LPN/RN (n=14)	Certified Nursing Assistant (n=25)	Administrator (n=8)	Other (n=13)	Unknown (n=20)
Understanding of standard precautions	8 (57%)	13 (52%)	3 (38%)	9 (69%)	10 (50%)
Proper PPE for droplet precautions	13 (93%)	9 (36%)	3 (38%)	7 (54%)	11 (55%)
Understanding of colonization	12 (86%)	13 (52%)	4 (50%)	10 (77%)	9 (45%)
Proper hand washing technique	11 (79%)	21 (84%)	6 (75%)	7 (54%)	17 (85%)
Precautions for norovirus	3 (21%)	4 (16%)	4 (50%)	4 (31%)	3 (15%)
Precautions for MDROs	12 (86%)	19 (76%)	4 (50%)	11 (85%)	12 (60%)
Glucometer cleaning	13 (93%)	20 (80%)	6 (75%)	9 (69%)	12 (60%)
Median Score	87%	73%	70%	87%	70%

## Recommendations for SNF

- Single rooms and contact precautions during care for all persons with history of CRE and need for assistance with activities of daily life (ADL)
- Modified contact precautions for patients that are continent and able to complete ADL on their own
- Patients need to be reminded to wash hands
- No need for continued cultures to determine if still colonized
- An inter-facility transfer form should be utilized

## Future Efforts

- PDPH has expanded HAI role to assist facilities with MDRO clusters and encourages voluntary reporting of CRE
- PDPH has created an MDRO advisory group to develop priority areas for the Philadelphia Healthcare community
- A fall symposium is planned to educate the healthcare community on CRE and antimicrobial stewardship and to promote communication

### References

- CDC. CRE Toolkit. <http://www.cdc.gov/hai/organisms/cre/cre-toolkit/index.html>. 2012.
- CDC. <http://www.cdc.gov/hai/organisms/cre/trackingCRE.html>. 2013

### Contact Information

Jennifer Sears, MPH, Email: [jennifer.sears@phila.gov](mailto:jennifer.sears@phila.gov)

