Abstract # 1251

Contaminated Sinks May be an Environmental Source for Serial Transmission of Carbapenem-Resistant *Enterobacteriaceae* (CRE) to ICU Patients

sarah.stamps@duke.edu
DUMC Box 102359
Room 171 Hanes House
Durham, NC 27710
Phone: (919) 681-9013

iphe DUKE INFECTION PREVENTION AND HOSPITAL EPIDEMIOLOGY

Sarah Lewis[1,2,3], Jessica Seidelman[1,3], Kirk Huslage[2,3], Charlene Carriker[2,3], Amy Hnat[2,3], Erica Lobaugh-Jin[2,3], Chris Sova[2,3], Bonnie Taylor[2,3], Nancy Strittholt[2,3], Sheila Vereen[2,3], Robert Willis[2,3], Christy Campbell[2,3], Rachel Addison[3], Kevin Hazen[4], Amy Mathers[5], Kasi Vegesana[5], Joanne Carroll[5], Shireen Kotay[5], Art Baker[1,3], Daniel Sexton[1,3], Deverick Anderson[1,3], Becky Smith[1, 2,3]

1-Division of Infectious Diseases, Duke University School of Medicine, Durham, NC 2-Infection Prevention and Hospital Epidemiology, Duke University Hospital, Durham, NC 3-Duke Center for Antimicrobial Stewardship and Infection Prevention, Durham, NC 4-Clinical Microbiology Laboratory, Duke University School of Medicine, Durham, NC 5-Division of Infectious Diseases, University of Virginia School of Medicine, Charlottesville, VA

Duke Center for Antimicrobial Stewardship and Infection Prevention

Abstract

Background: We performed an investigation after noting an increase in hospital-onset (HO) KPC-producing *Enterobacteriaceae* (KPC-E) infections in patients admitted to a tertiary referral hospital in North Carolina.

Methods: We defined pre-outbreak (1/1/17-6/30/17), outbreak (7/1/17-10/31/17), and post-outbreak (11/1/17-7/31/18) phases. A clinical case was defined as any positive clinical culture for KPC-E. HO was defined as a positive clinical or surveillance culture collected on hospital day ≥ 3. Patients were mapped in space and time to inform targeted environmental sampling. Whole genome sequencing (WGS) was performed on selected KPC *K. pneumoniae* environmental and patient isolates to determine relatedness.

In October 2017, a CRE prevention bundle was implemented that included daily communication of CRE patient movement, increased audits/feedback of HCW compliance with hand hygiene, enhanced cleaning and disinfection in CRE rooms and high-risk units with bleach and UVC disinfection, and weekly rectal surveillance screens in 4 adult ICUs.

Results: 0.67 clinical cases of KPC-E per month were observed during the pre-outbreak period compared to 3.75 clinical cases of KPC-E per month during the outbreak period. Kp was the most common species (Figure 1). Mapping of patients revealed probable direct and indirect transmission between patients in multiple hospital units (Figure 2). 3 patients who were non-sequentially admitted to the same ICU room over a 12-week span acquired KPC Kp (Figure 2). Environmental cultures from the in-room sink drain and P-trap grew KPC Kp that was related to the patient isolates by WGS; the sink was removed. Although no additional clinical cases of KPC-E occurred after full implementation of the bundle and sink removal, we continued to observe acquisition of KPC-E rectal colonization in all 4 ICUs (Figure 3).

Conclusion: We describe a multi-species outbreak of KPC-E that was mitigated through evidence-based CRE control measures and removal of a colonized sink. However, ongoing low-level presumed transmission of KPC points to persistent environmental sources. Additional study is needed to understand the prevalence of CRE in hospital sinks, factors that drive drain colonization, and contribution of CRE in a sink to nosocomial transmission.

Primary Objective

To understand and mitigate transmission of KPC-producing *Enterobacteriaceae* (CPE) at a 957-bed tertiary care hospital using standard epidemiologic methods

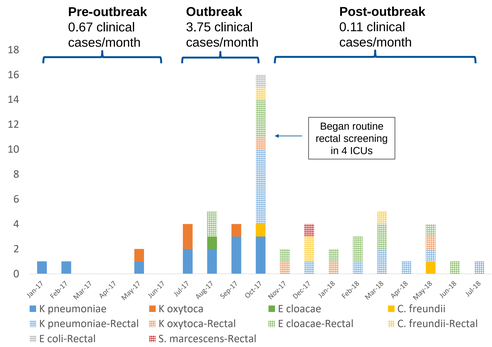
Definitions

- Outbreak periods
  - Pre-outbreak: 1/1/2017-6/30/2017
  - Outbreak: 7/1/2017-10/31/2017
  - Post-outbreak: 11/1/2017-7/31/2017
- Clinical case: Any positive clinical culture for KPC-producing *Enterobacteriaceae*
- Rectal surveillance case: A positive rectal screening culture for KPC-producing *Enterobacteriaceae*
- Hospital-onset (HO): Positive clinical or surveillance culture obtained on hospital day 3 or later

CRE Prevention Bundle Elements	Date
Daily communication of CRE patient movement	August 2017
Increased audits/feedback of HCW compliance with hand hygiene and PPE compliance	August 2017
Enhanced cleaning and disinfection in rooms of patients with CRE and high-risk units using bleach and UV-C light	August 2017
Patient, family, and staff education regarding hand hygiene and PPE compliance	August 2017
Weekly rectal surveillance screens in 4 adult ICUs	October 2017

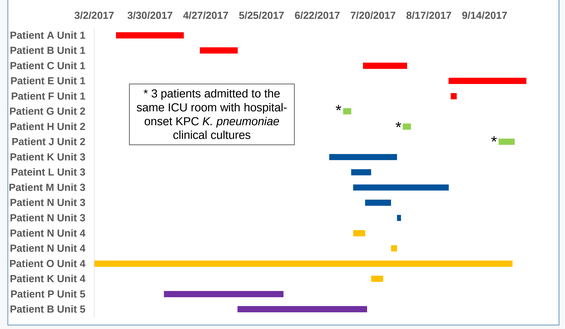
Results

Figure 1. Multi-species outbreak of hospital-onset KPC-Producing *Enterobacteriaceae*



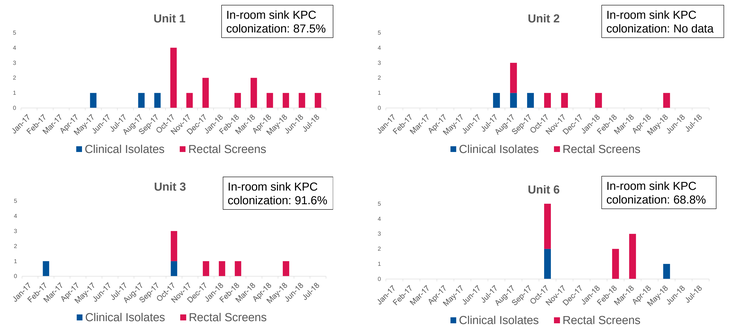
- Mapping of patients in time and space revealed probable direct and indirect transmission between patients in multiple hospital units (Figure 2)

Figure 2. Overlap of patients with KPC Clinical Isolates in Time and Space



- Targeted environmental sampling was performed in the room in Unit 2 with multiple patient acquisitions of KPC *K pneumoniae* and revealed KPC-colonization of in-room sink drain and P-trap of ICU room.
- Additional point-prevalence sampling of in-room sinks in 3 units confirmed a high burden of in-room sink drain colonization.

Figure 3. Sub-clinical transmission of KPC-Producing Enterobacteriaceae in 4 Adult ICUs



Conclusions

- We mitigated a multi-species outbreak of KPC-producing *Enterobacteriaceae* through implementation of evidence-based CRE control measures
- Ongoing positive rectal surveillance screens demonstrate that sub-clinical transmission continues in high-risk units despite implementation of control measures
- The high rate of in-room sink KPC colonization in 3 units implicates sinks as potential environmental reservoirs of CRE
- Additional study is needed to understand the prevalence of CRE in hospital sinks, factors that drive drain colonization, and contribution of CRE in sink drains to hospital transmission of CRE

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