

A challenging *Burkholderia* outbreak investigation across multiple units at an academic medical center from June 2017 to February 2018

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BACKGROUND

- Most outbreak investigations involve short-term, geographically localized clusters or a point source of infection.
- *Burkholderia* outbreaks in the nosocomial setting are not an infrequent occurrence, and often originate from contaminated medications or medical products.
- We describe a prolonged *Burkholderia* outbreak at our institution not related to a point source of infection.

METHODS

- An investigation was conducted at a 738-bed tertiary care academic medical center in New York City.
- Epidemiological interventions included review of cases and surveillance of asymptomatic patients and the local environment. A case control study was also conducted examining hypothesized risk factors for acquisition (see [Poster 1257](#)).
- *Burkholderia* isolates were genotyped using pulsed field gel electrophoresis (PFGE) and *recA* gene sequencing. Initial isolates were also sent to a national reference laboratory for multilocus sequence typing (MLST).

RESULTS

- From 6/2017 - 2/2018, 32 patients on 12 distinct units (see Figure 1) had one or more positive cultures for outbreak strains of *Burkholderia*. 29/32 (91%) patients had positive respiratory cultures, most of which were clinical pneumonias while others represented asymptomatic colonization. 3/32 (9%) patients had bacteremia. 30-day mortality was 5/30 (17%).
- Molecular analysis revealed that the majority of *Burkholderia* cultures during this time period were due to transmission of two distinct isolates (see Table 1). *RecA* allele typing showed 100% concordance with PFGE results.
- Analysis of isolates by a reference laboratory revealed that both outbreak strains had not been previously described, and appeared to be unique to our institution.

	Affected patients	Species	PFGE pattern	<i>recA</i> allele	MLST designation
Outbreak strain 1	21	<i>Burkholderia cenocepacia</i>	A	365	1392
Outbreak strain 2	11	<i>Burkholderia cepacia</i>	C	53	Pending

Table 1. Molecular typing of *Burkholderia* species outbreak strains

RESULTS

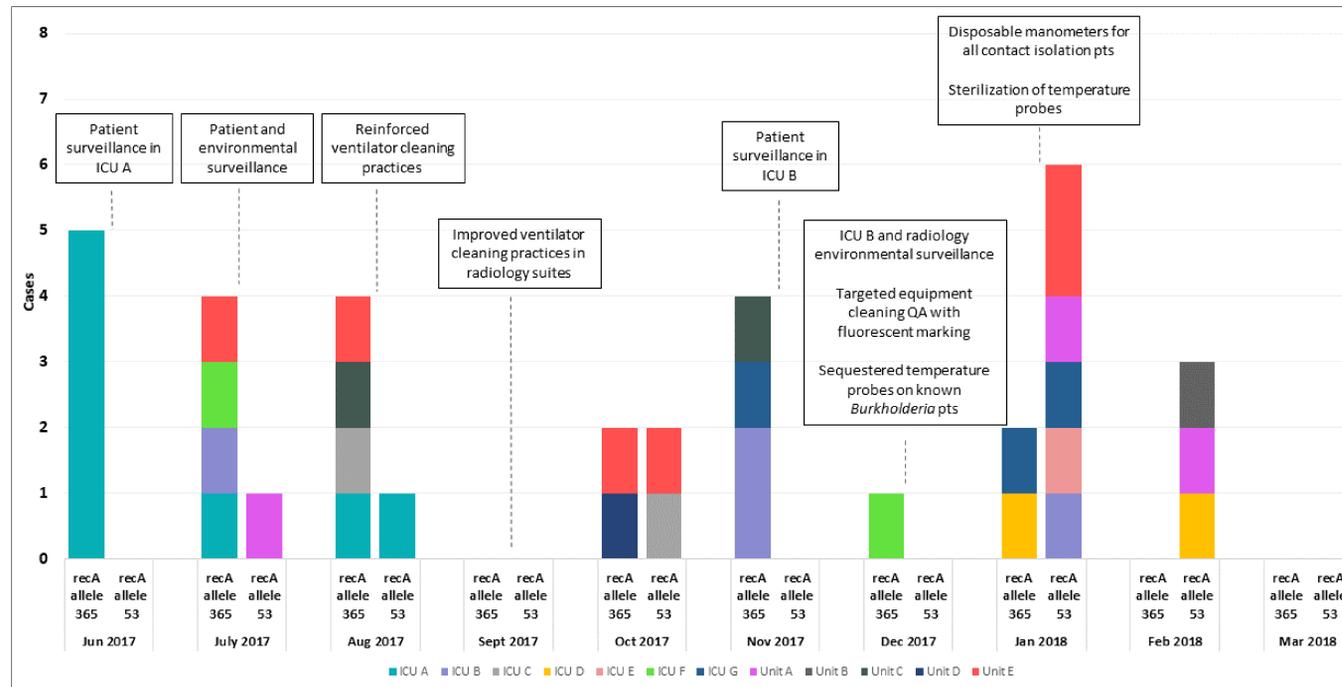


Figure 1. Incident Cases of *Burkholderia* spp. from June 2017 to Feb 2018 by unit and *recA* allele along with epidemiological interventions

- Initial epidemiological investigation revealed clustering of patients in nearby rooms within ICU A. Active surveillance of patients boarding in ICU A by tracheal aspirate (ventilated patients) or throat culture (non-ventilated patients) did not reveal additional cases (n=19). Environmental cultures of 2/9 sinks in ICU A were positive for *Burkholderia*; however subsequent molecular analysis revealed that these *Burkholderia* isolates were not related to the outbreak strain. The remainder of environmental cultures were negative (n = 49, see Table 2 for a listing of all environmental cultures performed).
- Initial epidemiological interventions:
 - Contact isolation for patients with positive cultures for *Burkholderia*
 - Increased hand hygiene observations in ICU A by Infection Prevention Liaisons
 - Enhanced cleaning of patient rooms and common spaces by Environmental Services
- Secondary epidemiological interventions:
 - Over the following months, additional *Burkholderia* cases were detected on a wide variety of units. A case control study was undertaken that examined risk factors for acquisition of *recA* allele 365 (see [Poster 1257 for full details](#)). Invasive mechanical ventilation was found to be highly associated with case status (OR 10.5; 95% CI: 1.91, ∞). No point source, such as the receipt of particular aerosolized medications or a particular scope, was found to be associated with case status.
 - Recently implicated medication lots linked to *Burkholderia* outbreaks at other institutions such as docusate and cleaning foam were not found to be in use at our facility.
 - Additional patient (n= 23) and environmental (n=47) surveillance cultures were performed in ICU B, Unit E, and radiology suites, which revealed no additional cases nor environmental reservoirs.

- Ventilator cleaning practices were then investigated. Routine cleaning of ventilators after patient use was reinforced with respiratory staff.
- The following epidemiologic interventions were made to minimize the potential for transmission of *Burkholderia* between patients:
 - Ensuring a sterilization process for ventilator temperature probes, which are used in heated humidification
 - Using disposable manometers on contact isolation patients
 - Reinforcing the cleaning of ventilators that reside outside of patient rooms, including those in radiology suites, after each use
- Incident cases subsided over the following months, though are still intermittently seen.

ICU ventilators (n=2)	ICU ice machine (n=2)
ICU sinks (n=15)	ECMO machine (n=2)
Ultrasound/echocardiogram gel (n=2)	Portable glucometers (n=1)
Portable bronchoscopy cart (n=3)	ICU ultrasound (n=2)
Ventilator residing in radiology suite (n=2)	IV contrast injector (n=4)
CT scanner controls (n=2)	EKG machines (n=1)
“Wireless on Wheels” mobile PC (n=1)	Nursing station surfaces (n=1)
Temperature probes (n=10)	Central line storage cart (n=1)

Table 2. Environmental/equipment surfaces cultured during outbreak investigation

CONCLUSIONS

- The use of novel molecular techniques, such as *recA* allele typing, allowed for rapid detection of outbreak strains without having to await PFGE results, and greatly expedited epidemiological investigation.
- Despite initial efforts targeting transmission within a particular unit, ongoing transmission of *Burkholderia* outbreak strains was seen for a number of months in many units after the initial outbreak was detected.
- A case control study was invaluable in focusing the efforts of Infection Prevention and Control to assess mechanical ventilation practices.
- A complete evaluation of practices surrounding the use of invasive mechanical ventilation revealed multiple opportunities for improvement and standardization of practice. While no single intervention likely explains the subsidence of the *Burkholderia* outbreak, the investigation led to substantial change in both the routine and terminal cleaning of mechanical ventilators across the hospital.

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