Burkholderia in ICU - A combined epidemiologic, genomic and engineering investigation

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No disclosures or conflicts of interest

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Burkholderia species

- Gram negative bacilli
- Generally low virulence
- Environmental – soil, water, plants food
- *Burkholderia cepacia* complex (BCC)
  - 24 different species
  - an opportunistic human pathogen – pneumonia, BSI

Transmission of Burkholderia

- Person-to-person
- Via contaminated solutions
- From contaminated environment and fomites
- From contaminated water sources
  - Splashes from sinks implicated

Open Forum Infectious Diseases

MAJOR ARTICLE

Combined Clinical, Epidemiological, and Genome-Based Analysis Identified a Nationwide Outbreak of *Burkholderia cepacia* Complex Infections Caused by Contaminated Mouthwash Solutions

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Suspicious outbreak of ventilator-associated pneumonia caused by *Burkholderia cepacia* in a surgical intensive care unit

LiPing Guo MD [a], Gang Li MD [b], Jian Wang MSNurs [b], Xia Zhao MSNurs [a], Shupeng Wang MD [b], Li Zhai MSNurs [b], Hongbin Jia MLT [c], Bin Cao MD [a,d,*]

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Epidemiological investigation and successful management of a *Burkholderia cepacia* outbreak in a neurotrauma intensive care unit

Neha Rastogi[a], Surbhi Khurana[b], Balaji Veeraraghavan[c], Francis Yesurajan Inbanathan[c], Suresh Kumar Rajamani Sekar[c], Deepak Gupta[d], Keshav Goyal[c], Ashish Bindra[e], Navdeep Sokhal[e], Ashutosh Panda[f], Rajesh Malhotra[g], Purva Mathur[b,*]

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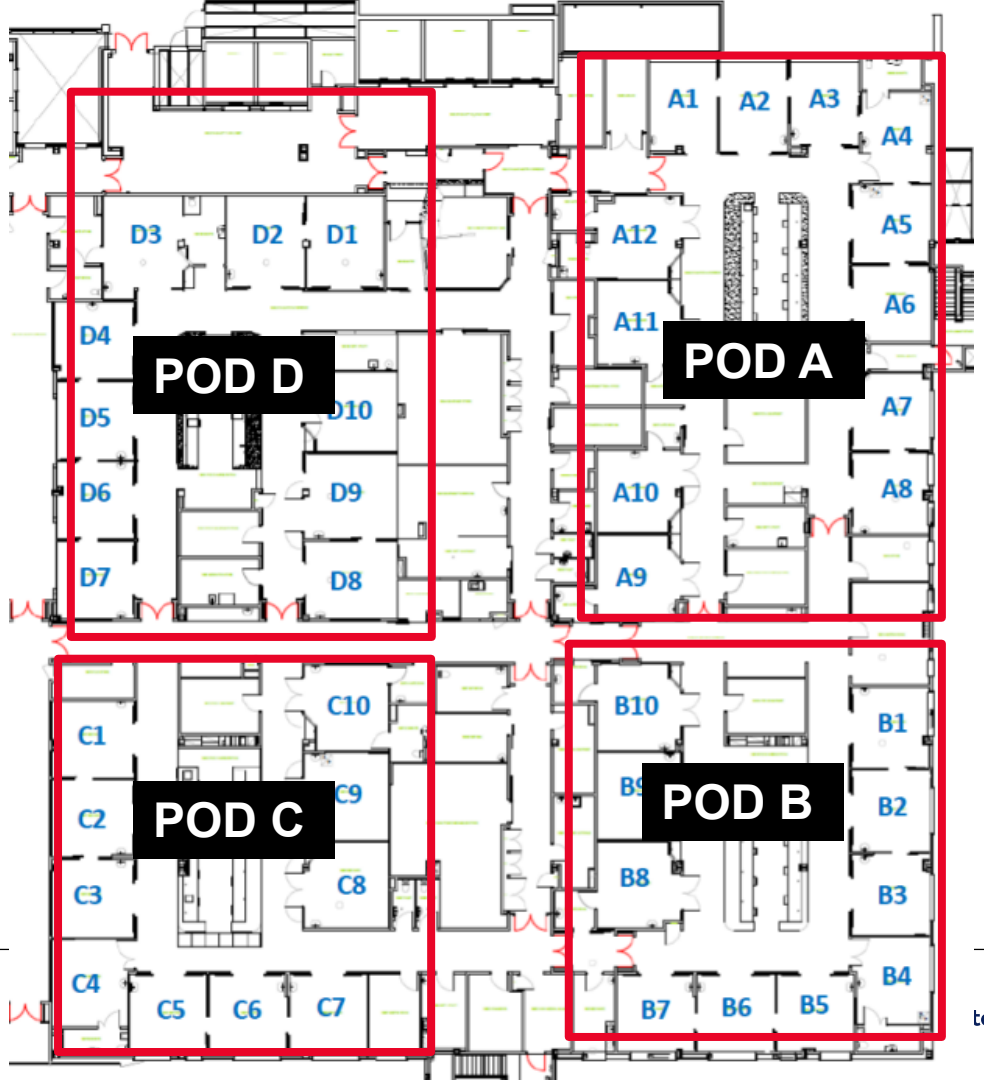
Royal Melbourne Hospital

- 550 bed tertiary healthcare providers in Melbourne, Australia
- Provides a comprehensive range of specialist healthcare including haematology, BMT and renal transplant patients
- One of two level 1 Trauma Centres in Victoria

RMH ICU

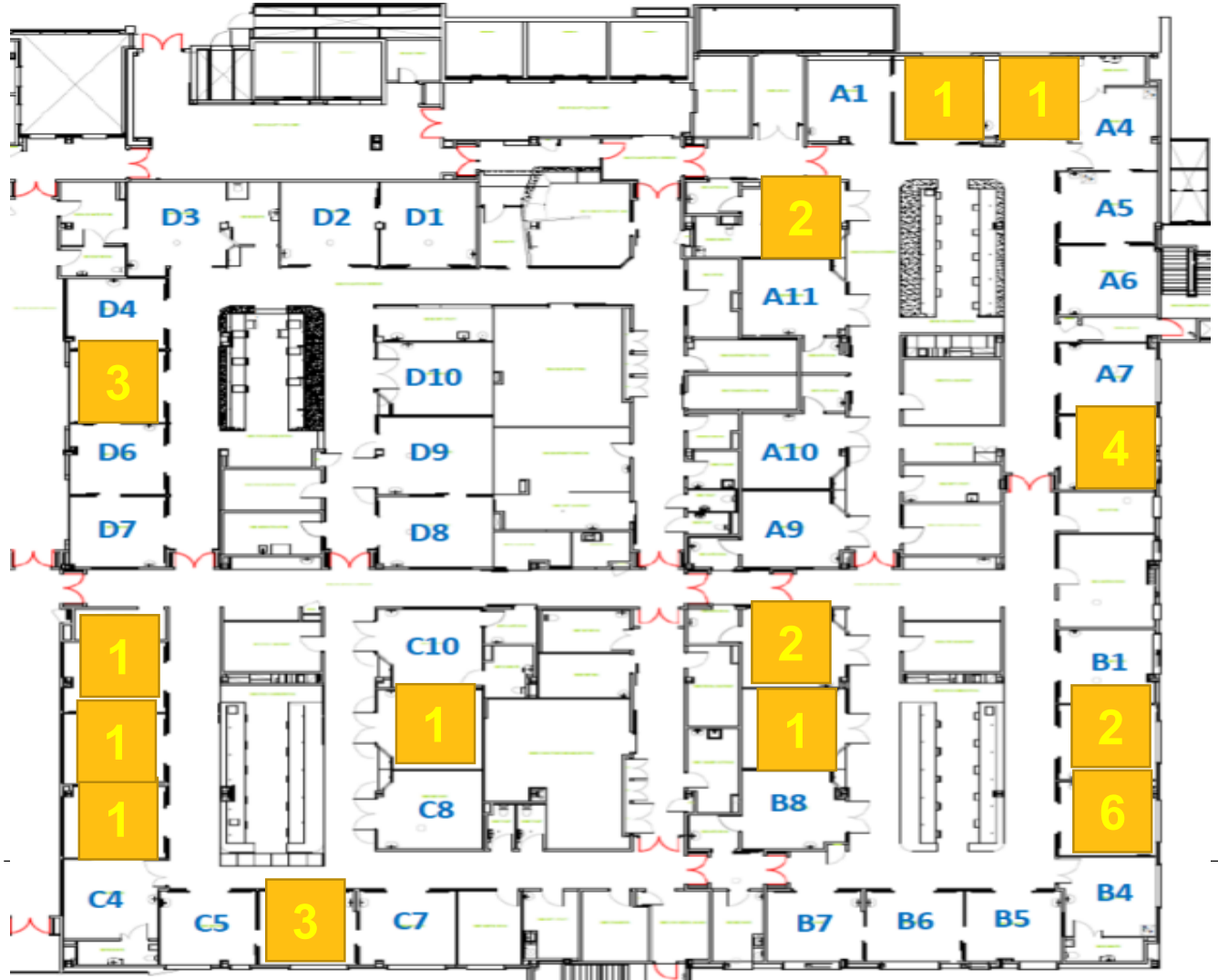
- New tertiary level ICU – opened 2016 (Ward 6B)
- 42 single beds in 4 PODS
  - Each with clinical hand basin
- 3000 patients admitted annually



Burkholderia in ICU 2017 - 2022

- Burkholderia isolated from 29 patients
- Mostly sporadic cases
- Cluster in Dec 2018
- Patients are mostly colonised rather than infected

 ACIPC 2019: A Burkholderia cepacia cluster in an adult ICU. A rapid response and resolution. Liz Orr



2017-22
Number of times Burkholderia isolated from patients in ICU POD /rooms

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Positive cases – characteristics 2017-22

Patient characteristic	n (%) n=29
Gender	
Male	19 (65)
Female	10 (35)
Age, years (median, range)	50 (17, 86)
Hospital length of stay, days (median, range)	29 (2, 136)
ICU length of stay, days (median, range)	13 (2, 135)
Days between admission and positive test (median, range)	10.4 (41, 42.8)
Days between ICU admission and positive test (median, range)	10.2 (0.3, 42.8)

Patient samples 2017-22

Sample Type	Samples, n (%) n=29
Blood	2 (6.9)
BAL/Sputum/TA	21 (72.0)
Swab	3 (10.3)
Tissue	1 (3.4)
Urine	2 (6.9)
ICU crossover*	13 (45%)
Pod crossover^	3 (10%)

*Admission in ICU bed at same time as another Burkholderia positive patient
^Admission in ICU pod at same time as another Burkholderia positive patient

Actions upon detection of Burkholderia isolate

- Contact trace index/close bed to new admissions
- Microbiological testing and subtyping of water samples and faucet swabs in rooms of affected patients
- Subtyping of isolates using whole genome sequencing
- Thermal disinfection of the affected tap with repeat sampling prior to allowing new patient into room
- Aerators in all taps changed regularly

Environmental & patient samples 2017-2022

	Patient samples, n (%) (n = 29)	Environmental samples, n (%) (n = 275)
Isolated	**29**	**37 (13)**
Burkholderia cepacia	13 (45)	15 (40)
Burkholderia contaminans	7 (24)	19 (51)
Burkholderia lata	1 (3)	3 (8)
Burkholderia ambifaria	1 (3)	-
Burkholderia gladioli	5 (17)	-
Burkholderia pseudomallei	1 (3)	-
Burkholderia xenovorans	1 (3)	-
MLST analysis	**14 (48)**	**36 (97)**

Multilocus Sequence Typing 2017-2022

MLST	Patient samples, n (%)	Environmental samples, n (%)
482	7 (50)	13 (36)
98	1 (7)	3 (8)
Novel	5 (17)	17 (47)
Not Determined	1 (7)	3(8)
TOTAL	**14**	**36**

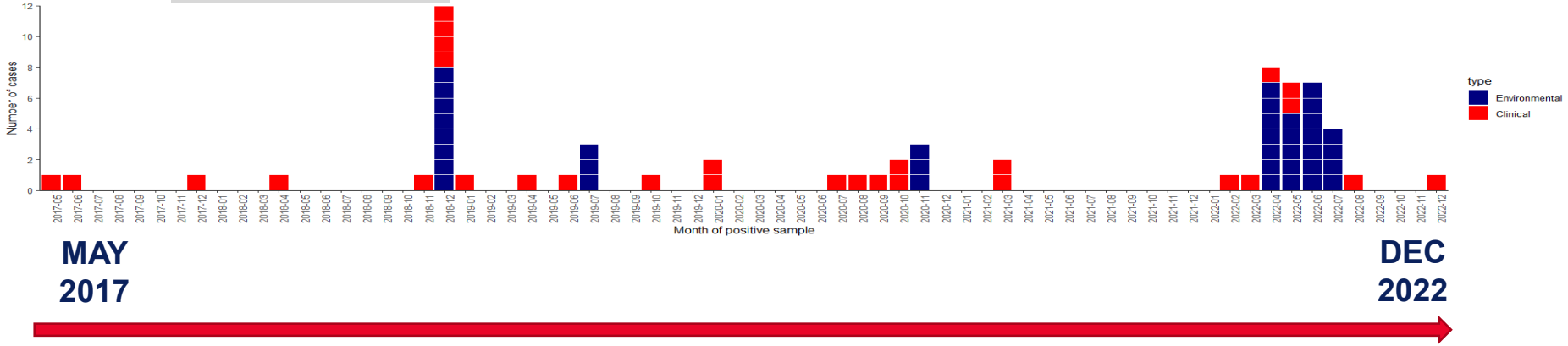
Epidemiologic curve of patient and environmental Burkholderia positive samples, collected between April 2017 and December 2022

2018
B. contaminans ST 482

2019/2020
B. contaminans ST 482
B. cepacia ST novel

2022
B. contaminans ST 482

2018 *B.lata ST98*



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Hot water system in ICU

- RMH ICU has thermostatic mixing valves to mix hot and cold water
- Chlorine in water measured in response to Burkholderia isolations
- Acceptable levels at the entry to ICU
- Non detectable levels at the southern end
- Low water usage in ICU means deterioration of chlorine by the time it gets to far end rooms
  - ➢ Monthly flushing program introduced

Chlorination flushing

- Due to ongoing isolation of Burkholderia and detection of low chlorine levels, additional chlorine added to the cold water system
- Chlorine levels – a fine balance between too much (causes corrosion in pipes, raises concentration in other wards which don't need a higher concentration and raises pH which may need correction)
- May need to increase frequency of pipe flushing

Summary of situation

- Intermittent isolation of Burkholderia from:
  - patients in ICU
  - Taps and water tested in ICU around the time of patient isolates
- Suggests presence of biofilm in taps intermittently releasing organisms
- Intermittent hot water flushing helps the problem but cannot get rid of biofilm
- Chlorine levels in water at point of care low or non-existent – may be contributing factor
- Lack of guidelines or recommendations

Current plan

- Continue with monthly pipe flushes and thermal flushing of patient rooms
- Thermally disinfect affected rooms at the time of patient isolates
- Consider waterless care for patients
  - Has been used in some ICUs overseas and has decreased Gram negative infections

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Thank you

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