



The Royal
Melbourne Hospital

A Burkholderia cepacia cluster in an adult ICU.

A rapid response and resolution.

Liz Orr
Infection Prevention Manager
Melbourne Health

Liz.Orr2@mh.org.au

Conflict of interest

- I have nothing to declare

Background

- Royal Melbourne Hospital
 - RMH is Victoria's first hospital providing care and treatment since 1848
 - More than 7,000 staff employed
 - >500 beds
- Patient care
 - Accredited Level 1 Trauma Centre with 2,367 trauma patients treated, 576 helicopter landings and 80,000 admissions to our Emergency Department in 2018/19
 - RMH provides the fastest emergency stroke treatment in Australia - door to needle time treatment in 25 minutes

Intensive Care Unit (ICU)

- 4 pods
 - A Pod 12 beds
 - B pod 10 beds
 - C pod 10 beds
 - D Pod 10 beds (not used)
- Currently funded 29 beds across 3 pods (A, B and C)
- All nursing staff critical care certified (or working towards)
- Victorian designated centre for Viral Haemorrhagic Fever
- Provide ICU care to Peter MacCallum Cancer Centre
- Built in 2015/16

Introduction

- *Burkholderia cepacia* (*B. cepacia*) can cause outbreaks from contaminated fluids and other environmental sources
- Especially in immunocompromised patients such as cystic fibrosis patients and in ICU settings and has caused nosocomial outbreaks
- December 3rd 2018
 - An ICU patient with *B. cepacia* from sputum and bronchial washings was identified
- December 17th 2018
 - We were notified by the Micro Registrar of another 3 ICU patients with *B. cepacia* from a urine, wound swab and tracheal aspirate

Patient results

Patient	Date of isolate	Identification	Room number
LK	01/12/2018	<i>Burkholderia cepacia</i>	B2
DB	12/12/2018	<i>Burkholderia contaminans</i>	A2, A12
TJ	14/12/2018	<i>Burkholderia cenocepacia</i>	C1
LT	16/12/2018	<i>Burkholderia contaminans</i>	C6

Major Article

Outbreak of health care-associated *Burkholderia cenocepacia* bacteremia and infection attributed to contaminated sterile gel used for central line insertion under ultrasound guidance and other procedures



Ramon Z. Shaban PhD, PGDipPH&TM, GradCertInfCon, MEd, MCHPrac(Hons), BSc(Med), BN, RN, CICP-E, FACN, FFCENA ^{a,*}, Samuel Maloney MBBS, BMedSc(Hons), FRCPA ^b, John Gerrard MSc (Microbiology), MBBS, BSc(Med), DLSHTM, DTM&H (Lon), FRACP ^c, Peter Collignon MBBS, BMedSc, FRACP, FRCPA, FASM ^d, Deborah Macbeth PhD, RN, CICP-E ^e, Marilyn Cruickshank PhD, RN, CICP-E, FACN ^f, Anna Hume MBBS, BBiomedSc ^g, Amy V. Jennison PhD, BSc(Hons) ^h, Rikki M.A. Graham PhD, BSc(Hons) ^h, Haakon Bergh BSc, AssDip(MedSc) ⁱ, Heather L. Wilson PhD, MBBS, FRACP, FRCPA ^j, Petra Derrington MBBS, FRACP ^k

^a Infection Control Department, Division of Infectious Diseases and Immunology, Gold Coast Hospital and Health Service and Griffith University, Menzies Health Institute Queensland, Griffith University, Southport, Queensland, Australia

^b Infectious Diseases and Immunology, Gold Coast Hospital and Health Service, Pathology Queensland, Health Support Queensland, Department of Health, Queensland Government, Gold Coast University Hospital, Southport, Queensland, Australia

^c Infectious Diseases and Immunology, Gold Coast University Hospital, Gold Coast Hospital and Health Service, Southport, Queensland, Australia

^d ACT Pathology, The Canberra Hospital, Australian National University School of Medicine, Canberra, Australia

^e Infection Control Department, Infectious Diseases and Immunology, Gold Coast Hospital and Health Service, Southport, Queensland, Australia

^f Australasian College for Infection Prevention and Control, School of Nursing and Midwifery, Griffith University, Southport, Queensland, Australia

^g Medical Microbiology, Gold Coast Hospital and Health Service, Pathology Queensland, Health Support Queensland, Department of Health, Queensland Government, Southport, Queensland, Australia

^h Molecular Epidemiology, Public Health Microbiology, Forensic and Scientific Services, Health Support Queensland, Department of Health, Queensland Government, Southport, Queensland, Australia

ⁱ Central Microbiology, Molecular Bacteriology/Quality, Pathology Queensland, Health Support Queensland, Department of Health, Queensland Government, Southport, Queensland, Australia

^j Microbiology and Antimicrobial Stewardship, Department of Infectious Diseases and Microbiology, Canberra Hospital and Health Services, Garran, Australian Capital Territory, Australia

^k Pathology Queensland, Health Support Queensland, Department of Health, Queensland Government, Southport, Queensland, Australia



Burkholderia cepacia pseudobacteraemia caused by environmentally contaminated commercial 0.5% chlorhexidine gluconate solution in neonatal intensive care units

S. Kim ^{a,*}, T.H. Um ^b, C.R. Cho ^{b,d}, S. Kim ^b, I.S. Park ^b, B. Oh ^d

^a University Ilsan Paik Hospital, Goyang, Republic of Korea

^b University Ilsan Paik Hospital, Goyang, Republic of Korea

^c University Ilsan Paik Hospital, Goyang, Republic of Korea

^d University Ilsan Paik Hospital, Goyang, Republic of Korea

^e University College of Medicine, Seoul, Republic of Korea

M M A R Y

Background: *Burkholderia cepacia* is intrinsically resistant to certain antiseptics. The authors noted a sudden increase in the frequency of isolation of *B. cepacia* from blood cultures in a neonatal intensive care unit (NICU) of a university-affiliated hospital.

To identify the source and intervene in the ongoing infections.

Methods: The cases were defined as patients with positive blood cultures for *B. cepacia* in the NICU between November 2014 and January 2015. Medical records were reviewed and healthcare workers were interviewed. Samples of suspected antiseptics, blood culture bottles, cotton balls, gauze and a needle used in the NICU were analysed microbiologically.

Findings: During the outbreak period, *B. cepacia* was identified in 25 blood cultures obtained from 21 patients. The clinical features of the patients were suggestive of pseudobacteraemia. Regarding environmental samples, *B. cepacia* was cultured from 0.5% chlorhexidine gluconate (CHG) solution products that had been used as a skin antiseptic for blood drawing in the NICU. The clinical *B. cepacia* isolate and two strains obtained from the 0.5% CHG exhibited identical pulsed-field gel electrophoresis patterns. After the CHG products were withdrawn, the outbreak was resolved.

Conclusions: The pseudobacteraemia cases were caused by contaminated 0.5% CHG produced by a single manufacturer. Stricter government regulation is needed to prevent contamination of disinfectants during manufacturing. In addition, microbial contamination of antiseptics and disinfectants should be suspected when a *B. cepacia* outbreak occurs in hospitalized patients.

Monday 17th December 2018 (Day 1)

- Notified ICU we have 4 patients with *B. cepacia* (don't need to isolate)
- Actions from the meeting:
 - Timeline of patient's admission to the hospital, to ICU and date of first *B. cepacia* specimen
 - Request for Molecular typing (whole genome sequencing) of available specimens
 - Infection Prevention will be alerted to future *B. cepacia* from any specimen, any ward
 - Head of Infection Prevention to check in with her infection control/diseases colleagues around Melbourne to establish if there has been an increase in *B. cepacia* at their respective hospital wards – nothing reported
- Next step is to await typing results before further action

Friday 21st December 2018 (Day 4)

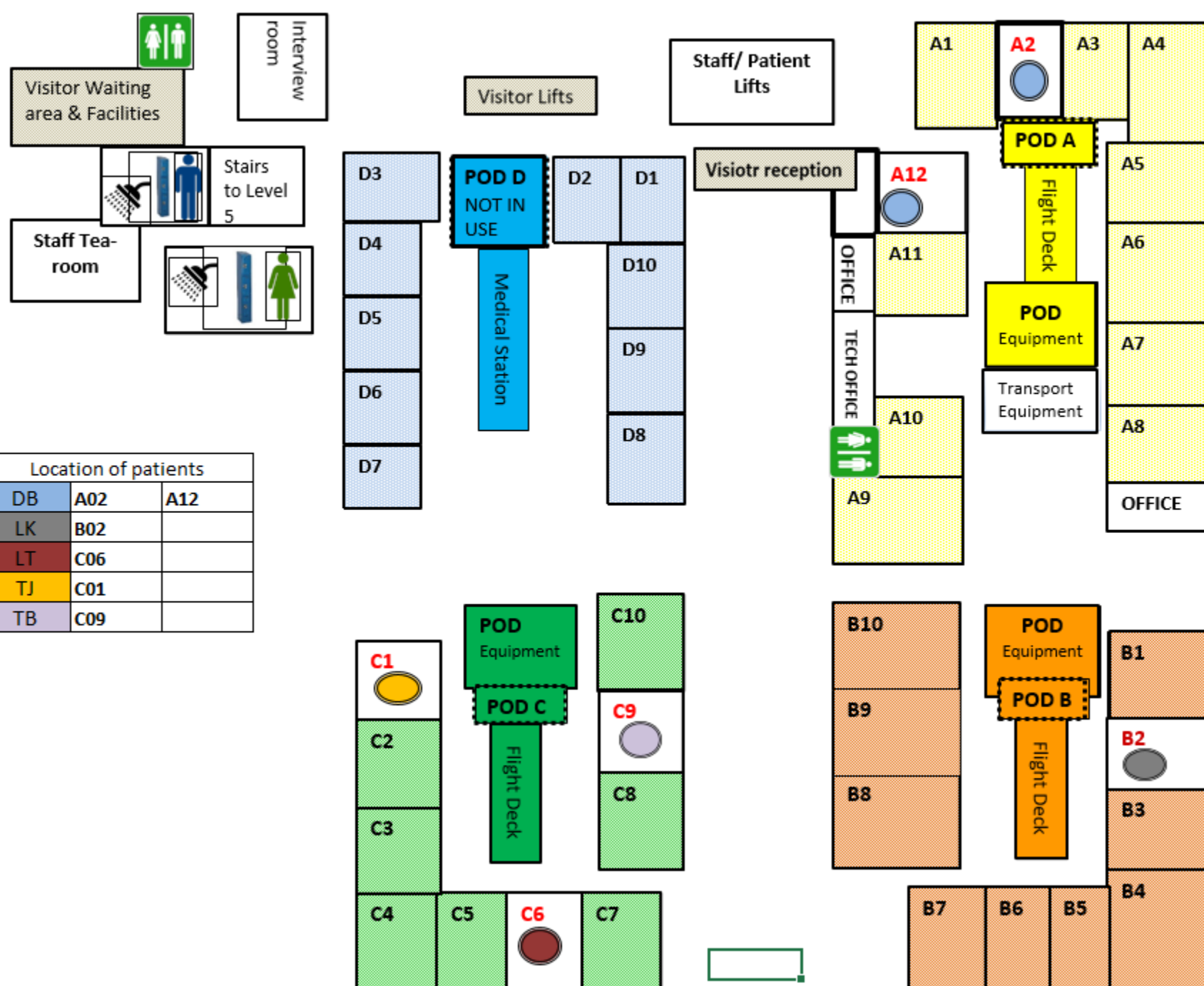
- Another patient with *B. cepacia* detected – in blood culture
- Total of 5 patients
- Collected 25 environmental fluid samples from ICU
 - Included chlorhexidine mouth wash, hand wash, ABHR, ultrasound gel, fluid from sterile humidification circuits, eye drops, molicare body lotion and peppermint lip cream in the affected patient rooms
- Arranged for the 4 available patient isolates to be send to Microbiological Diagnostic Unit Public Health Laboratory (MDU) for multilocus sequence typing (MLST) typing
- Arranged for water to be collected from taps on Monday 24th December 2018 - outsourced

Monday 24th December 2018 (Day 8)

- Water specimens collected from rooms where positive patients have been including swabs from the aerators and faucets

Patient	Date of isolate	Identification	Room number
LK	01/12/2018	<i>Burkholderia cepacia</i>	B2
DB	12/12/2018	<i>Burkholderia contaminans</i>	A2, A12
TJ	14/12/2018	<i>Burkholderia cenocepacia</i>	C1
LT	16/12/2018	<i>Burkholderia contaminans</i>	C6
TB	19/12/2019	<i>Burkholderia lata</i>	C9

Location of patients		
DB	A02	A12
LK	B02	
LT	C06	
TJ	C01	
TB	C09	



Monday 24th December 2018 (Day 8)

- We had preliminary report that the 4 patient isolates typed were different
- Suggests no patient to patient transmission (at least initially) and also makes a single contaminated fluid source unlikely (although could possibly be multi-type contamination, much less likely)
- Preliminary results from the environmental samples expected 27th December 2018

Thursday 27th December 2018 (Day 11)

- Of the 25 environmental samples sent – all negative
- Look back for any *B. cepacia* isolates for the last 2 years
 - 3 patients in 2 years in ICU

Environmental sample	<i>Burkholderia cepacia</i> complex
Lip ointment	Not isolated
Molicare skin protection foam	Not isolated
Chlorhexidine hand wash	Not isolated
Rivacol mouthwash	Not isolated
Humidification sterile water	Not isolated
2% chlorhexidine 70% isopropyl alcohol tinted red	Not isolated
Polytears	Not isolated
Purell 70% alcohol hand sanitiser foam	Not isolated
Gojo foam hand wash	Not isolated
Aquasonic ultrasound gel	Not isolated
Atris ultrasound gel	Not isolated

Monday 31st December 2018 (Day 15)

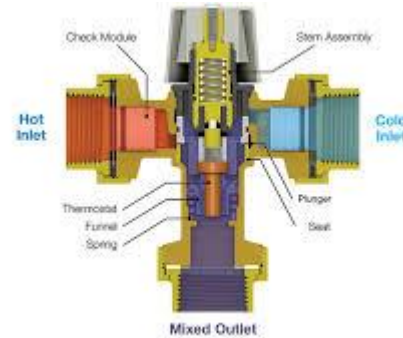
- 18 water, faucet and aerator swab results back
- 7 results positive in 3 rooms

Room	Identification	Specimen
C9	<i>Burkholderia lata</i>	Warm water
C9	<i>Burkholderia lata</i>	Faucet
C9	<i>Burkholderia lata</i>	Aerator
B2	<i>Burkholderia cepacia</i>	Warm water
B2	<i>Burkholderia cepacia</i>	Faucet
C6	<i>Burkholderia contaminans</i>	Faucet
C6	<i>Burkholderia contaminans</i>	Aerator

- Moved the patient out of B2 – others known positive so remained

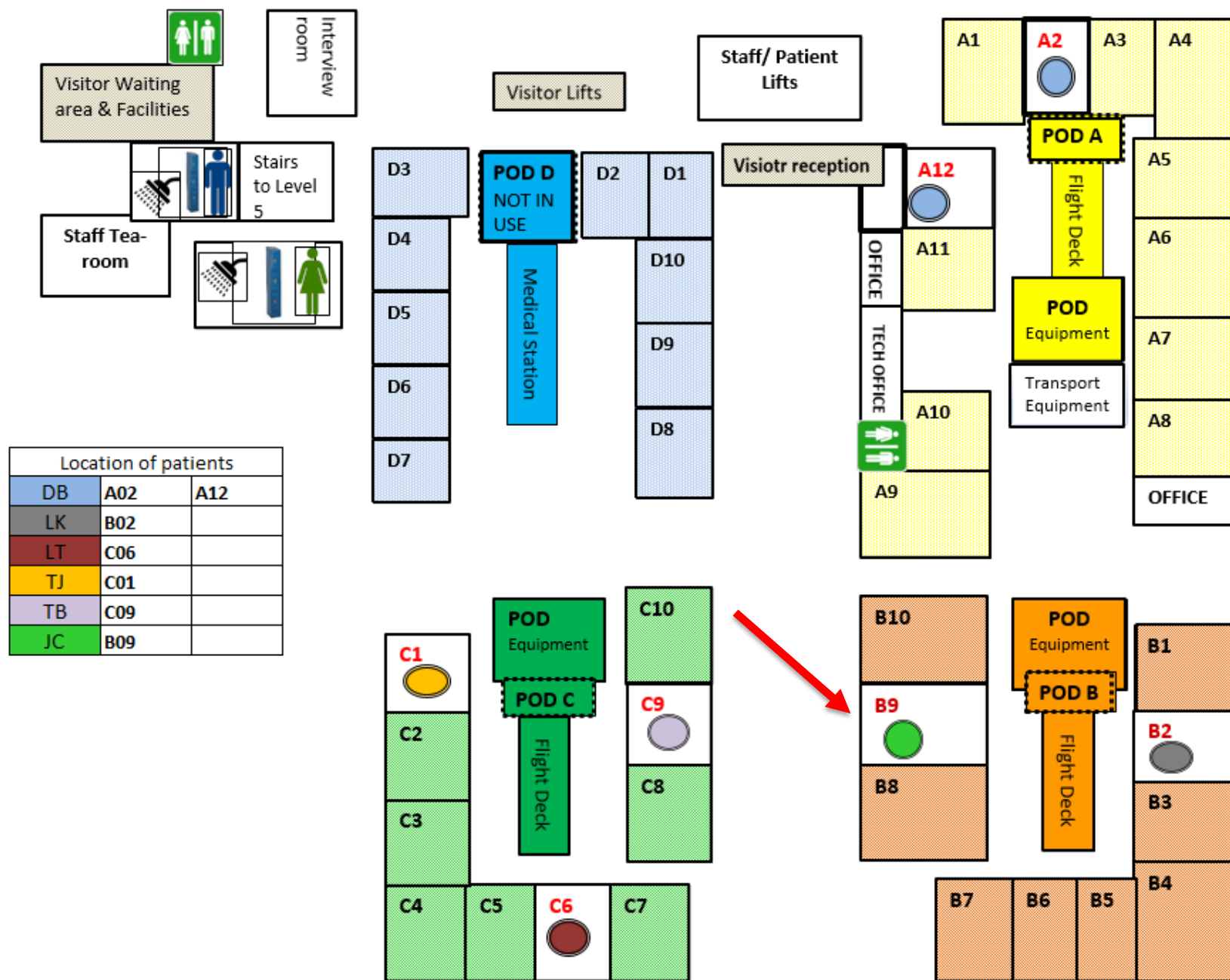
Monday 31st December 2018 (Day 15)

- Advised Engineering of results
- Conduct thermal disinfection of all ICU sinks, faucets, aerators and thermostatic mixing valves (TMVs) to commence Wednesday 2nd January 2019



Wednesday 2nd January 2019 (Day 17)

- Thermal disinfection commenced
- Plumber worked his way through ICU (Expected to take a week)
- Priority given to those rooms affected
- Patients were not moved out during this process
- Took approx. 30 minutes per sink
- Once finished sink area was cleaned by the ICU cleaner
- Notified of a new patient isolate in B9 – patient initials JC
- Notified DHHS and Safer Care Victoria as per Deputy CEO request
- ICU concerned with using water for NG feeds and patient consumption



Thursday 3rd January 2019 (Day 18)

- Following thermal disinfection we resampled the same water, faucet and aerator outlets from 24th Dec and added on newly detected patient room B9
- Ongoing thermal disinfection of the remaining ICU rooms
- I went camping...



Wednesday 9th January 2019 (Day 24)

- MLST results available for the water, faucet and aerator samples collected on 24th December 2018

Room	Identification	Specimen	MLST type
C9	<i>Burkholderia lata</i>	Warm water	98
C9	<i>Burkholderia lata</i>	Faucet	98
C9	<i>Burkholderia lata</i>	Aerator	98
B2	<i>Burkholderia cepacia</i>	Warm water	Novel
B2	<i>Burkholderia cepacia</i>	Faucet	Novel
C6	<i>Burkholderia contaminans</i>	Faucet	482
C6	<i>Burkholderia contaminans</i>	Aerator	482

- Hypothesis
 - 3 rooms that have positive results are not related to each other

Thursday 10th January 2019 (Day 25)

- Testing results for the repeat water, faucet and aerator collected post thermal disinfection collected on 3rd January 2019 were back
- Reopened B2
- Chlorine levels in ICU potable water were undetectable

Room	Result
A2	Not isolated
A12	Not isolated
B2	Not isolated
C1	Not isolated
C6	Not isolated
C9	Not isolated
B9	Not isolated

Patients					
DB	A2				
LK	B2				
TJ	Ward				
LT	C6				
TB	C9				
JC					
Period					
22 November 2018					
1 December 2018					
12 December 2018					
14 December 2018					
16 December 2018					
19 December 2018					
21 December 2018					
24 December 2018	Water Samples Collected				
25 December 2018					
29 December 2018					
31 December 2018	Water Sample results back				
PUBLIC HOLIDAY 01/01/2019					
2 January 2019	Heat disinfection performed				
3 January 2019	Repeat water samples collected				
4 January 2019					
10 January 2019	Repeat Test Results back				

Friday 11th January 2019 (Day 26)

- MLST results for positive patient isolates and water, faucet and aerators were compared
- Key finding:
 - there are patients with *Burkholderia* isolates that share the same MLST as some water/aerator/faucet isolates
 - the best way to assess whether these are related within ST groups is additional phylogenetic analysis
- Chlorine levels
 - Meet with engineering to discuss options

MLST results

Isolate	Identification	Specimen	MLST Type
TB	<i>Burkholderia lata</i>	Blood culture	98
C9	<i>Burkholderia lata</i>	Warm water	98
C9	<i>Burkholderia lata</i>	Faucet	98
C9	<i>Burkholderia lata</i>	Aerator	98
LK	Not typed (discarded)		
B2	<i>Burkholderia cepacia</i>	Warm water	Novel
B2	<i>Burkholderia cepacia</i>	Faucet	Novel
LT	<i>Burkholderia contaminans</i>	Tracheal aspirate	482
C6	<i>Burkholderia contaminans</i>	Sputum	482
C6	<i>Burkholderia contaminans</i>	Faucet	482
C6	<i>Burkholderia contaminans</i>	Aerator	482
JC	<i>Burkholderia cenocepacia</i>	Tracheal aspirate	Novel
DB	<i>Burkholderia contaminans</i>	Wound swab	102
TJ	<i>Burkholderia cenocepacia</i>	Urine	Novel

MLST alleles

Isolate	Identification	Specimen	MLST Type	MLST alleles
TB	<i>Burkholderia lata</i>	Blood culture	98	atpD(61);gltB(84);gyrB(82);recA(65);lepA(43);phaC(55);trpB(77)
C9	<i>Burkholderia lata</i>	Warm water	98	atpD(61);gltB(84);gyrB(82);recA(65);lepA(43);phaC(55);trpB(77)
C9	<i>Burkholderia lata</i>	Faucet	98	atpD(61);gltB(84);gyrB(82);recA(65);lepA(43);phaC(55);trpB(77)
C9	<i>Burkholderia lata</i>	Aerator	98	atpD(61);gltB(84);gyrB(82);recA(65);lepA(43);phaC(55);trpB(77)
LK	Not typed			
B2	<i>Burkholderia cepacia</i>	Warm water	Novel	atpD(91);gltB(336);gyrB(-);recA(53);lepA(3);phaC(62);trpB(-)
B2	<i>Burkholderia cepacia</i>	Faucet	Novel	atpD(91);gltB(336);gyrB(-);recA(53);lepA(3);phaC(62);trpB(-)
		Tracheal aspirate		
LT	<i>Burkholderia contaminans</i>	Sputum	482	atpD(151);gltB(192);gyrB(245);recA(152);lepA(158);phaC(173);trpB(151)
C6	<i>Burkholderia contaminans</i>	Faucet	482	atpD(151);gltB(192);gyrB(245);recA(152);lepA(158);phaC(173);trpB(151)
C6	<i>Burkholderia contaminans</i>	Aerator	482	atpD(151);gltB(192);gyrB(245);recA(152);lepA(158);phaC(173);trpB(151)
JC	<i>Burkholderia cenocepacia</i>	Tracheal aspirate	Novel	atpD(107);gltB(155);gyrB(343);recA(67);lepA(-);phaC(41);trpB(252)
DB	<i>Burkholderia contaminans</i>	Wound swab	102	atpD(64);gltB(80);gyrB(76);recA(89);lepA(105);phaC(97);trpB(70)
TJ	<i>Burkholderia cenocepacia</i>	Urine	Novel	atpD(131);gltB(11);gyrB(-);recA(14);lepA(11);phaC(6);trpB(79)

MLST alleles

Isolate	Identification	Specimen	MLST Type	MLST alleles	
TB	<i>Burkholderia lata</i>	Blood culture	98	atpD(61);gltB(84);gyrB(82);recA(65);lepA(43);phaC(55);trpB(77)	Identical
C9	<i>Burkholderia lata</i>	Warm water	98	atpD(61);gltB(84);gyrB(82);recA(65);lepA(43);phaC(55);trpB(77)	
C9	<i>Burkholderia lata</i>	Faucet	98	atpD(61);gltB(84);gyrB(82);recA(65);lepA(43);phaC(55);trpB(77)	
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		Tracheal aspirate			
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C6	<i>Burkholderia contaminans</i>	Faucet	482	atpD(151);gltB(192);gyrB(245);recA(152);lepA(158);phaC(173);trpB(151)
C6	<i>Burkholderia contaminans</i>	Aerator	482	atpD(151);gltB(192);gyrB(245);recA(152);lepA(158);phaC(173);trpB(151)
JC	<i>Burkholderia cenocepacia</i>	Tracheal aspirate	Novel	atpD(107);gltB(155);gyrB(343);recA(67);lepA(-);phaC(41);trpB(252)
DB	<i>Burkholderia contaminans</i>	Wound swab	102	atpD(64);gltB(80);gyrB(76);recA(89);lepA(105);phaC(97);trpB(70)
TJ	<i>Burkholderia cenocepacia</i>	Urine	Novel	atpD(131);gltB(11);gyrB(-);recA(14);lepA(11);phaC(6);trpB(79)

Different

Friday 18th January 2019 (Day 33)

Discussion/Considerations

- Only rooms with affected patients were tested – what about the others?
- It is not clear at what point the water has become contaminated
- There have been very few isolates in ICU previously and in other wards in the hospital, suggesting a more distal source although we have not tested other wards
- Samples were only tested for *Burkholderia cepacia*, so we don't know if there are any other organisms in the water
- However, whatever treatment we apply to the water should be effective for other organisms as well

Friday 18th January 2019 (Day 33)

- It is possible that the taps may have become contaminated by water splashing up from the drain, but less likely
- Testing of water in rooms A2, B3, C2, D4 has revealed undetectable levels of chlorine in the tap water
- How the organisms were transmitted from the tap to the patients is not clear, but could include splashing of equipment in proximity to the sink and transfer to patient directly or via hands, administration of tap water to patients via enteral feeds, contamination during bathing of patients with tap water
- Studies have shown associations between contaminated taps/water and use of aerators, TMVs and sensor taps, all of which have mechanisms that can become contaminated and which are not easy to clean
- Our ICU has all 3 of these in the taps

Friday 18th January 2019 (Day 33)

Actions:

- Engineering to investigate options for continuous disinfection of water in the B block floors 4-8, which have a TMV system
- Options are low dose chlorine (which is effective, but may damage pipes) and copper-silver ionisation (which is also effective and does not damage pipes)
- Re-swab taps/aerators/water after institution of new system
- Monitor for new cases

Chlorination

- Introduced low dose chlorination of the potable water in the ICU B block – this also covers our Haematology/Oncology ward located directly above
- Commissioned 16th April 2019
- Aiming for levels between 0.5 – 1.5mg/L
- HCC testing done in ICU 5th February – all within specification

What's next?

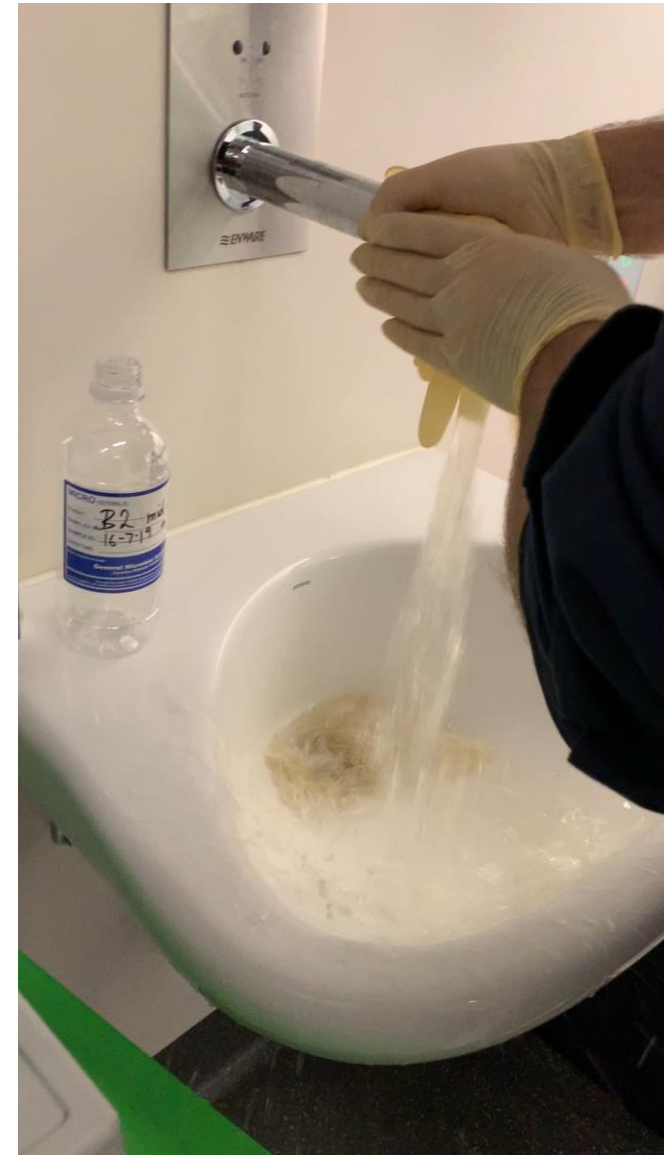
- Ongoing monitoring in ICNet – alert set up for notification
- No further cases until... I submitted this abstract on Friday 28th June 2019
- New ICU patient isolate for *B. cepacia* detected in bronchial fluid collected 30th June 2019...

Déjà vu



Tuesday 2nd July 2019 (Day 2)

- Patient was in ICU bed A8
 - Different room from previous cases
- Met with ICU
- Send patient isolate to MDU for MLST typing
- Send water, faucet and aerator samples of A8 to MDU for *Burkholderia* testing



Tuesday 9th July 2019 (Day 7)

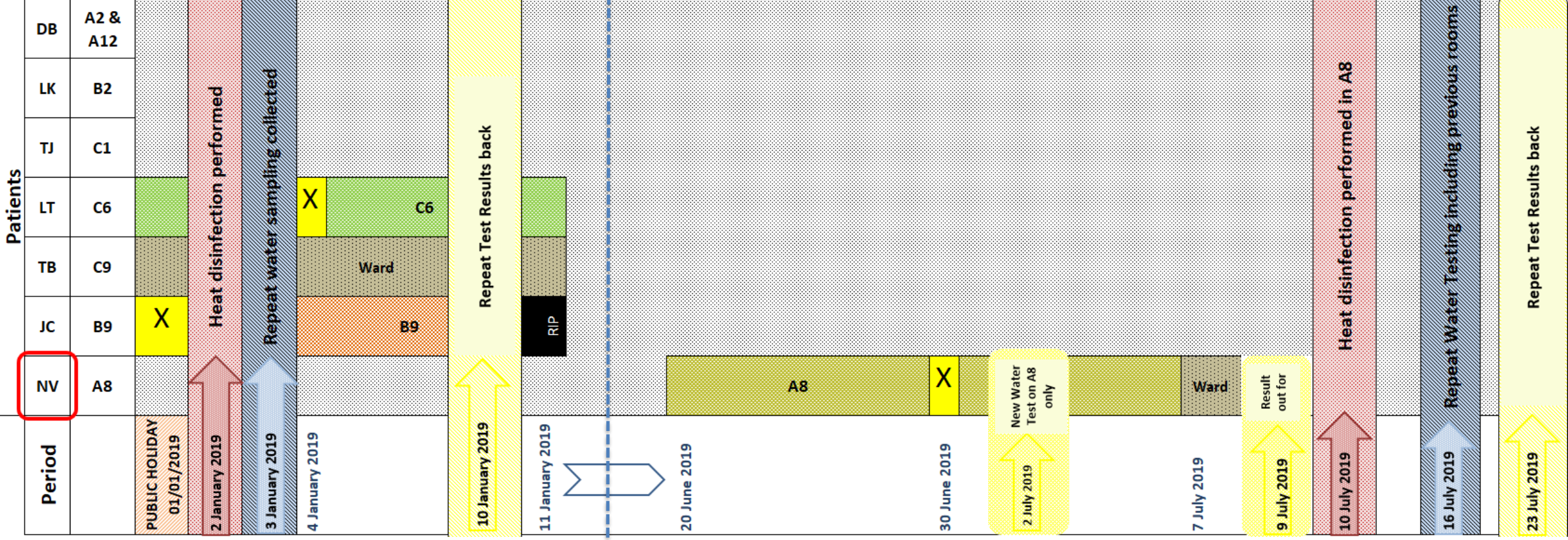
- Results positive for *B. cepacia*

Room	Identification	Specimen
A8	<i>Burkholderia cepacia</i> complex	Faucet 1st flush
A8	<i>Burkholderia cepacia</i> complex	Aerator
A8	<i>Burkholderia cepacia</i> complex	Faucet

- Heat disinfect A8 ASAP and close the bed
- Resample A8 following heat disinfection as previous conducted
- Sample the rooms previously tested in Dec 2018 plus a few random samples across the 4 pods
- Send positive water/aerator/tap samples to MDU for MLST
- Set up meeting for next week to discuss ongoing water treatment, aerator cleaning/replacement and review results from all the testing including chlorination report

Results post thermal disinfection (Day 21)

Room	Result
A8	Not isolated
A2	Not isolated
A12	Not isolated
B2	Not isolated
C9	Not isolated
C1	Not isolated
C6	Not isolated
D10	Not isolated



Results for MLST typing (Day 24)

Isolate	Identification	Specimen	MLST type
A8	<i>Burkholderia cepacia complex</i>	Faucet 1st flush	482
A8	<i>Burkholderia cepacia complex</i>	Aerator	482
A8	<i>Burkholderia cepacia complex</i>	Faucet	482
NV	<i>Burkholderia contaminans</i>	Bronchial fluid	482

Correlation from December cluster

Patient	Room	Identification	Specimen	MLST Type	MLST alleles
LT	C6	<i>Burkholderia contaminans</i>	Tracheal aspirate Sputum	482	atpD(151);gltB(192);gyrB(245);recA(152);lepA(158);phaC(173);trpB(151)
	C6	<i>Burkholderia contaminans</i>	Faucet	482	atpD(151);gltB(192);gyrB(245);recA(152);lepA(158);phaC(173);trpB(151)
	C6	<i>Burkholderia contaminans</i>	Aerator	482	atpD(151);gltB(192);gyrB(245);recA(152);lepA(158);phaC(173);trpB(151)
NV	A8	<i>Burkholderia contaminans</i>	Bronchial fluid	482	??
	A8	<i>Burkholderia cepacia complex</i>	Faucet 1st flush	482	
	A8	<i>Burkholderia cepacia complex</i>	Aerator	482	
	A8	<i>Burkholderia cepacia complex</i>	Faucet	482	

- NV patient isolate is more closely related to the A8 water isolates than the December isolates from LT and C6 water samples
- No further patient isolates identified to date

Summary and key learnings

- Environmental and water/faucet/aerator sampling important
- Thermal disinfection successful
- Retest post disinfection
- Phylogenetic analysis – able to establish patient and room relationship
- Key stakeholder involvement – ICU, Engineering, Microbiology, Executives and Reference Laboratory
- Alert systems in place
- New chlorination system – ongoing monitoring
- Rapid response and resolution

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- ¹*Melbourne Health, Parkville, Australia,*
²*University of Melbourne, Parkville, Australia,*
³*Microbiological Diagnostic Unit Public Health Laboratory, Parkville, Australia,*
⁴*AquaKlar Analytical Services, Thornbury, Australia*

