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Welcome to the IPC Tour 2024!

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Dr Jon Otter

Surface disinfectants in healthcare: when to use them and how to choose them and their contribution to AMR

Surface disinfectants in healthcare: when to use them, how to choose them, and their contribution to AMR

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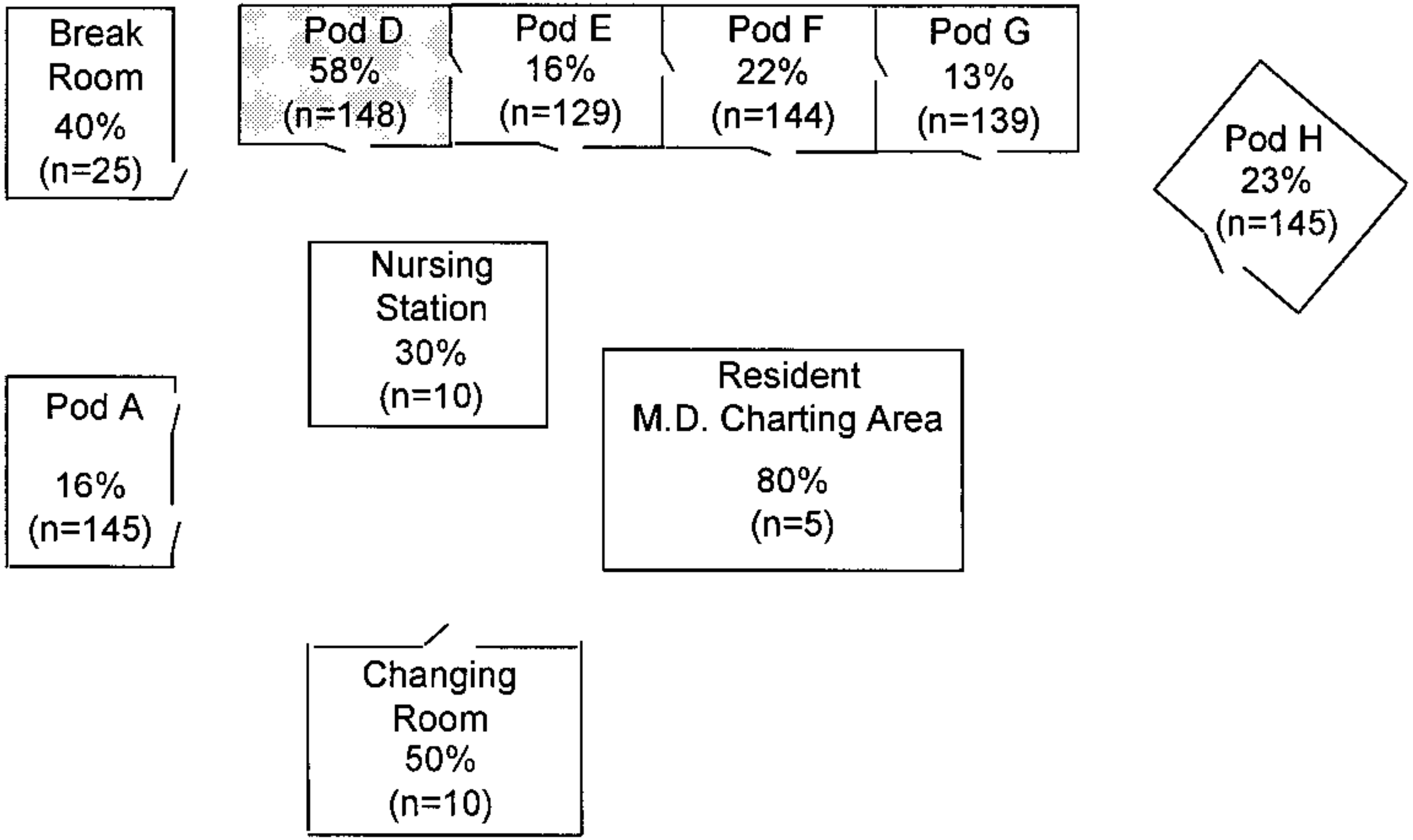
NHS
Guy's Hospital
Main Entrance and Urgent Care Centre
Guy's and St Thomas' NHS
St Thomas' Hospital
KING'S HEALTH PARTNERS

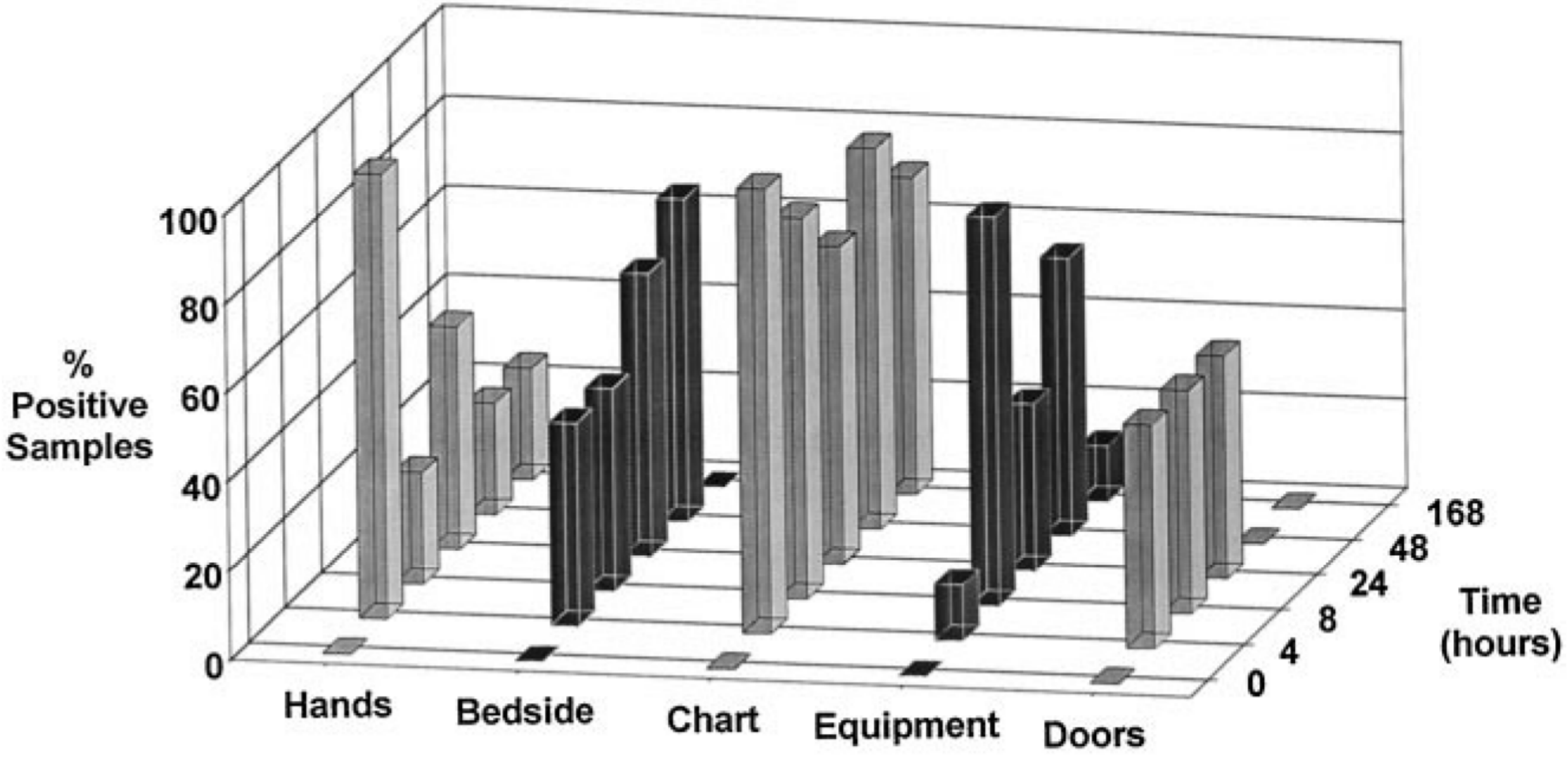

Welcome to
Royal Brompton
Hospital
Harefield Hospital

Transfer of a surrogate marker in a NICU

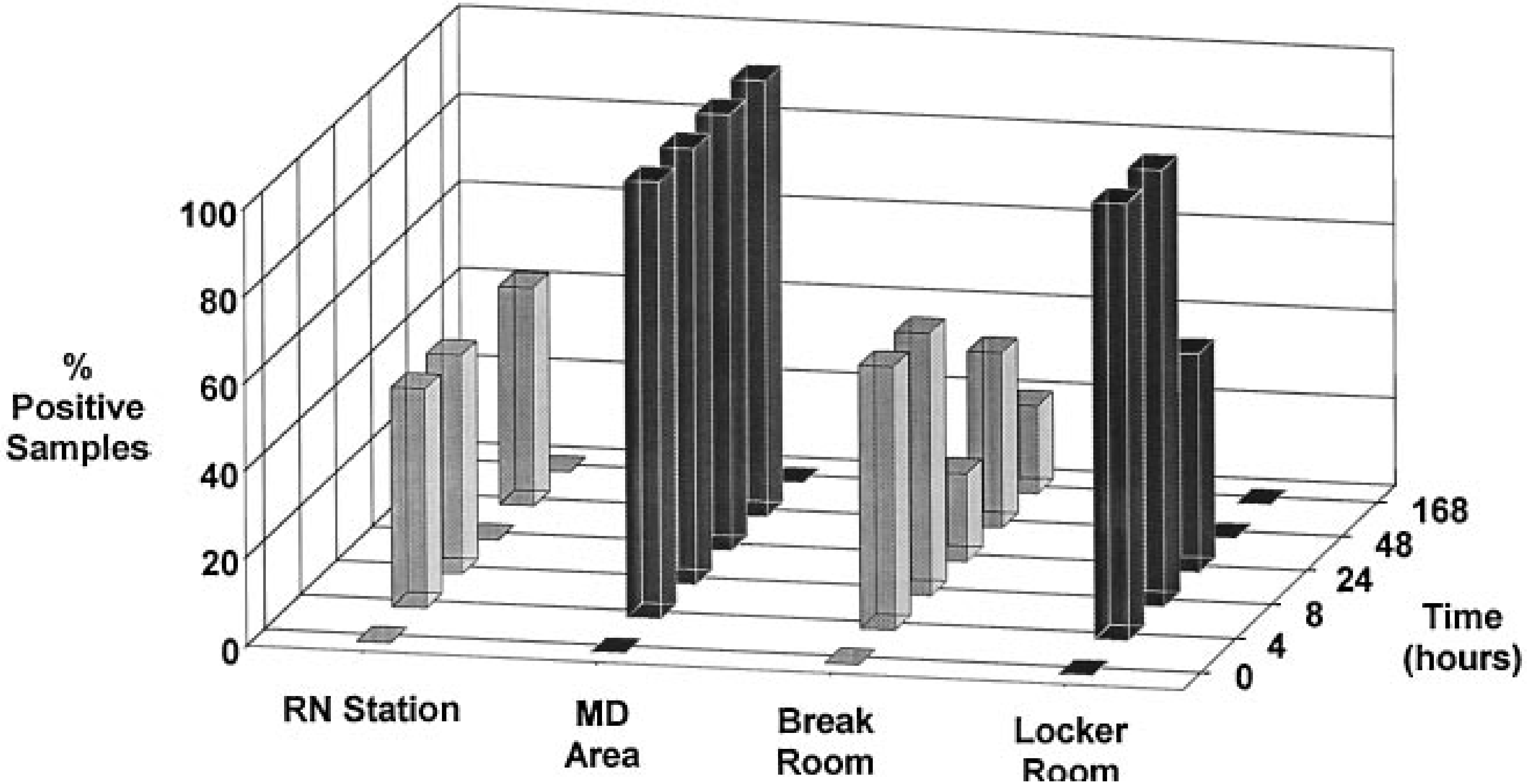


Oelberg *et al*. *Pediatrics* 2000;105:311-315.

Transfer over time: inoculated pod



Contamination over time by location



- Importance of surface contamination for HCAI and AMR
- Current approaches to cleaning and disinfection
- Surface disinfectant overview
- Possible contribution of surface disinfectants to AMR

Importance of surface contamination for HCAI and AMR

Current approaches to cleaning and disinfection

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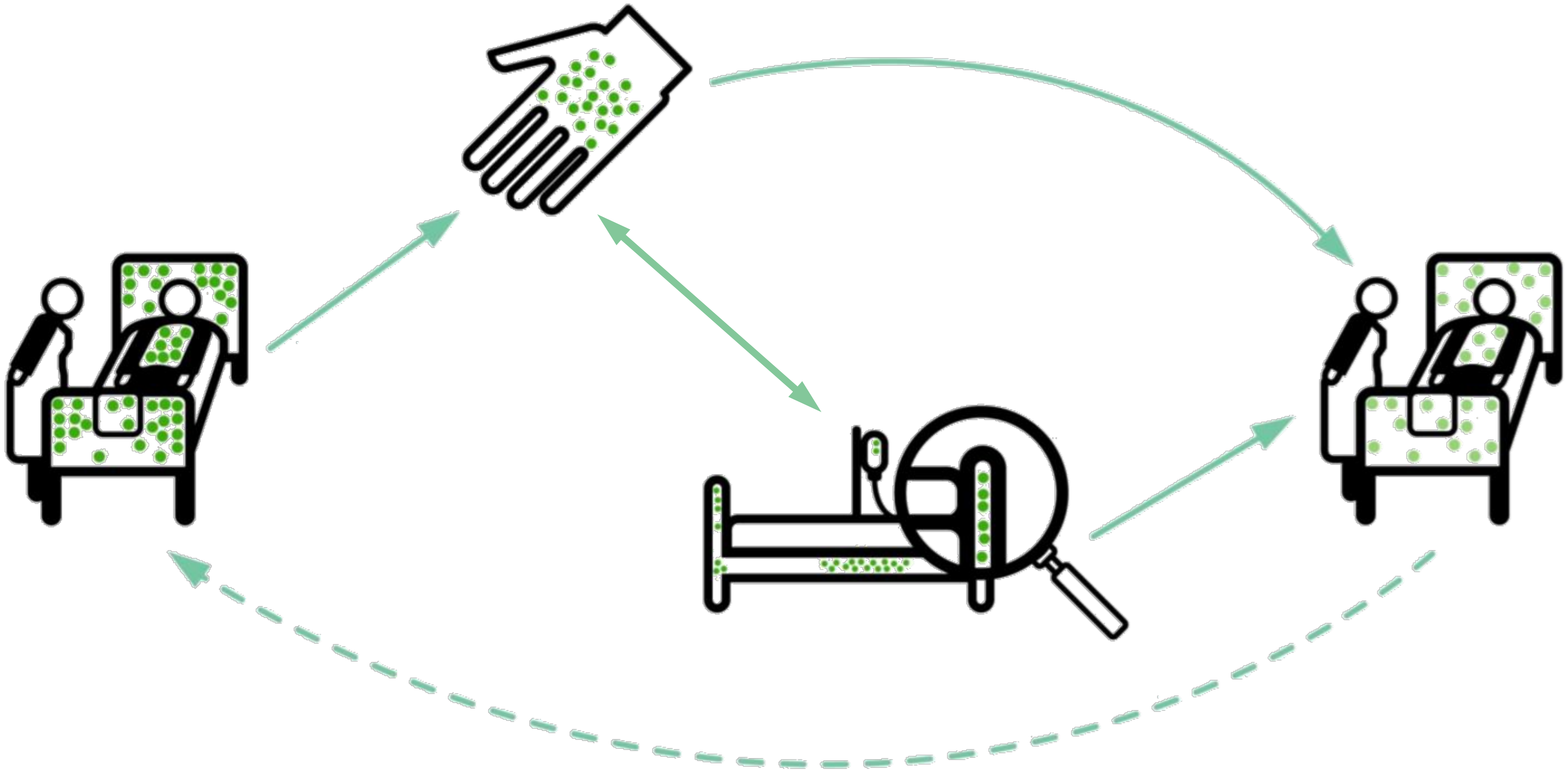
Transmission routes



Otter *et al. Infect Control Hosp Epidemiol* 2011;32:687-699.


86%
58%
93%
85%
59%
96%
French et al. J Hosp Infect 2004;57:31-37.

Surface <> Hand <> Patient

Pathogens can be transferred from surfaces to HCW hands without direct patient contact[1-2]

52% of 23 HCW acquired VRE on their hands[3]	Contact with patient **or** surface = ~10% risk of acquiring VRE[3]
45% of 50 HCW acquired MRSA on their hands[4]	**40%** of 50 HCW acquired MRSA on their hands[4]
50% of 30 HCW acquired *C. difficile* on their hands[5]	**50%** of 30 HCW acquired *C. difficile* on their hands[5]
Compliance with hand hygiene: **50%**[6]	Compliance with hand hygiene: **80%**[6]

1. Boyce *et al. Infect Control Hosp Epidemiol* 1997;18:622-627.
2. Bhalla *et al. Infect Cont Hosp Epidemiol* 2004;25:164-167.
3. Hayden *et al. Infect Control Hosp Epidemiol* 2008;29:149-154.
4. Stiefel *et al. Infect Control Hosp Epidemiol* 2011;32:185-187.
5. Guerrero *et al. Am J Infect Control* 2012;40:556-558.
6. Randle *et al. J Hosp Infect* 2010;76:252-255.

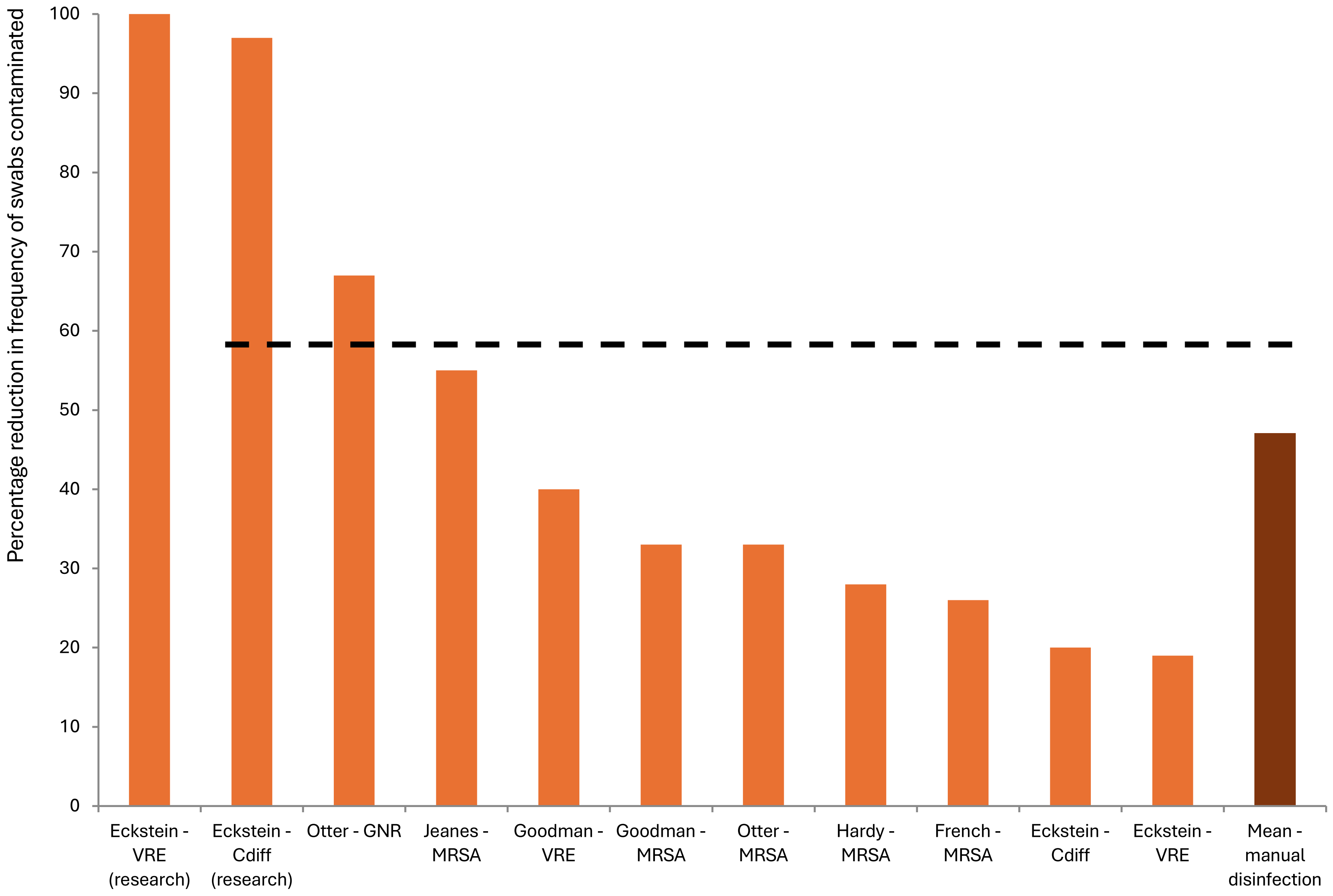
Surface survival

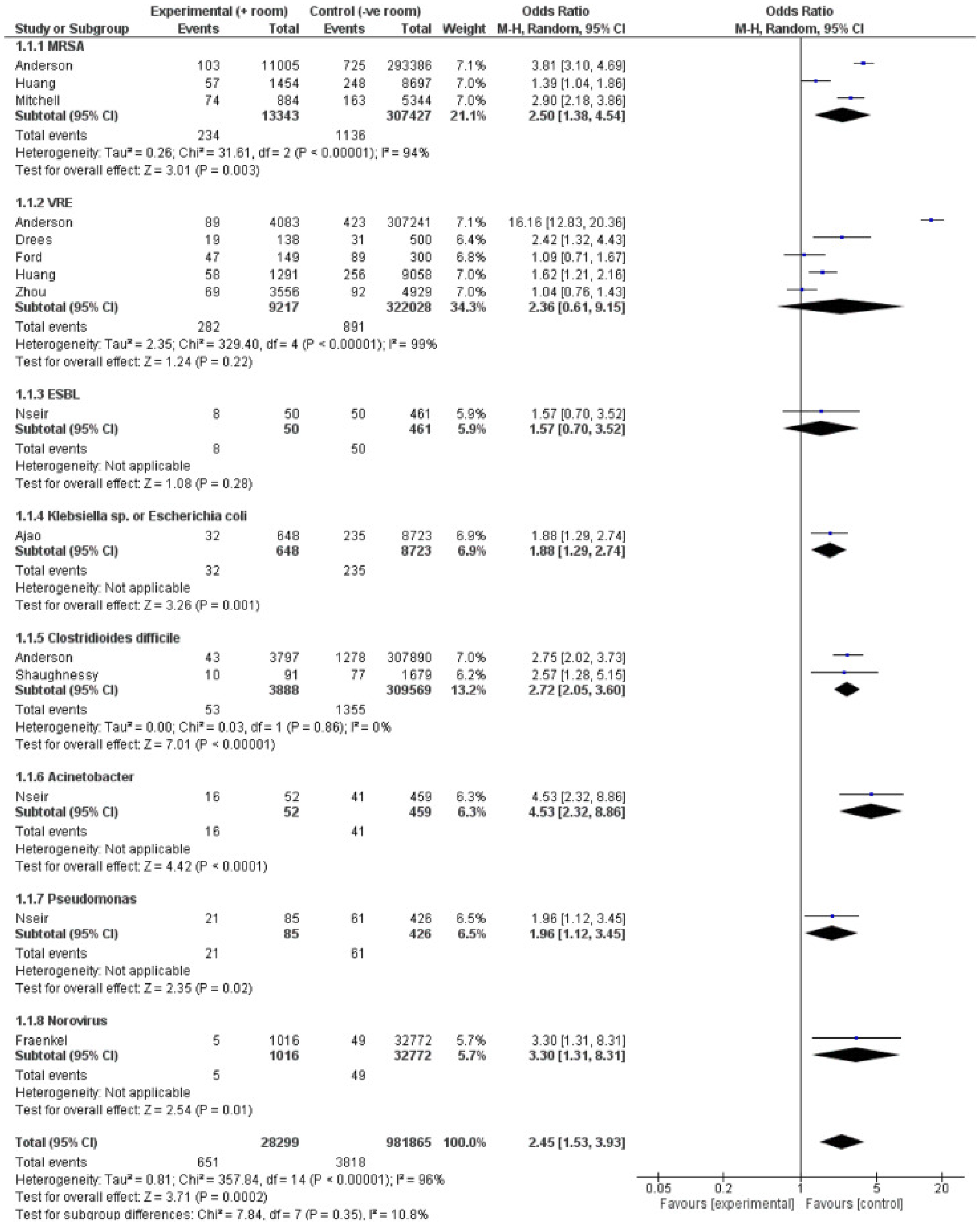
Organism	Survival time
Clostridium difficile (spores)	5 months
Acinetobacter spp.	3 days to 5 months
Enterococcus spp. including VRE	5 days – 4 years (!)[1]
Pseudomonas aeruginosa	6 hours – 16 months
Klebsiella spp.	2 hours to > 30 months
Staphylococcus aureus, inc. MRSA	7 days – 7 months
Norovirus (and feline calicivirus)	8 hours to > 2 weeks[2]
SARS Coronavirus	72 hours to >28 days[3]
Influenza	Hours to several days[4]

Adapted from Kramer *et al. BMC Infect Dis* 2006;6:130.

1. Wagenvoort et al. J Hosp Infect 2011;77:282-283.
2. Doultree *et al. J Hosp Infect* 1999;41:51-57.
3. Rabenau *et al. Med Microbiol Immunol* 2005;194:1-6.
4. Bean *et al. J Infect Dis* 1982;146:47-51.

Conventional terminal decontamination





The MDRO status of the prior room occupant influences acquisition risk

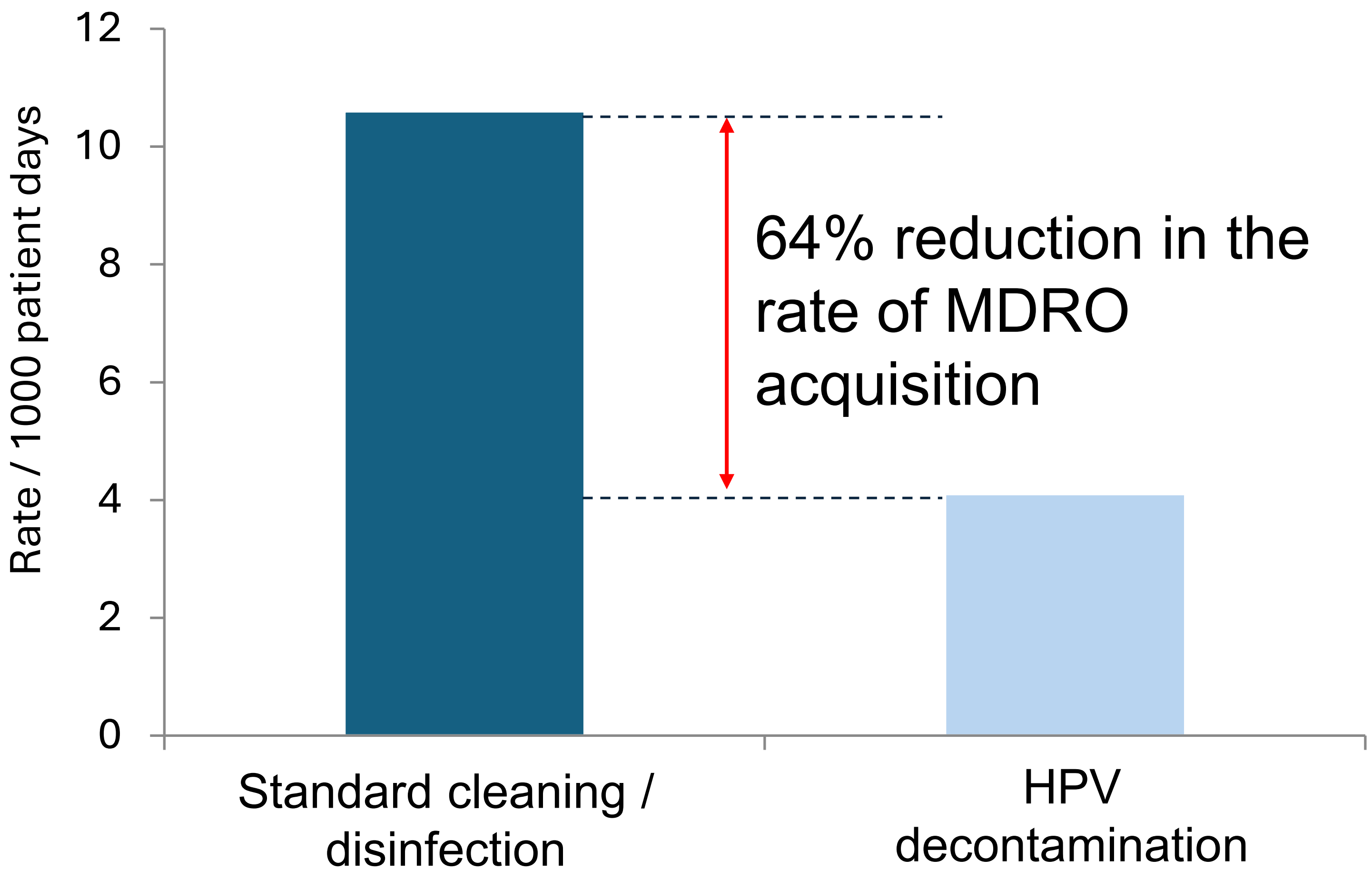
Meta-analysis of studies evaluating the risk of MDRO acquisition for the incoming occupant based on the status of the prior room occupant.

	OR	95% CI
Acinetobacter	4.5	2.3-8.9
Norovirus	3.3	1.3-8.3
C. difficile	2.7	2.0-3.6
MRSA	2.5	1.4-4.5
VRE	2.4	0.6-9.1
Pseudomonas	2.0	1.1-3.4
Klebsiella or *E. coli*	1.9	1.3-2.7
ESBL	1.6	0.7-3.5
Total	2.5	1.5-3.9

Mitchell et al. Infect Dis Health 2023.

Hydrogen peroxide vapour: clinical impact

30-month prospective cohort intervention study performed on 6 high-risk units (5 ICUs) including 8813 patients at Johns Hopkins Hospital.



Passaretti *et al. Clin Infect Dis* 2013;56:27-35.

Hospital cleaning and disinfection works

Key studies illustrating the impact of improved cleaning and disinfection

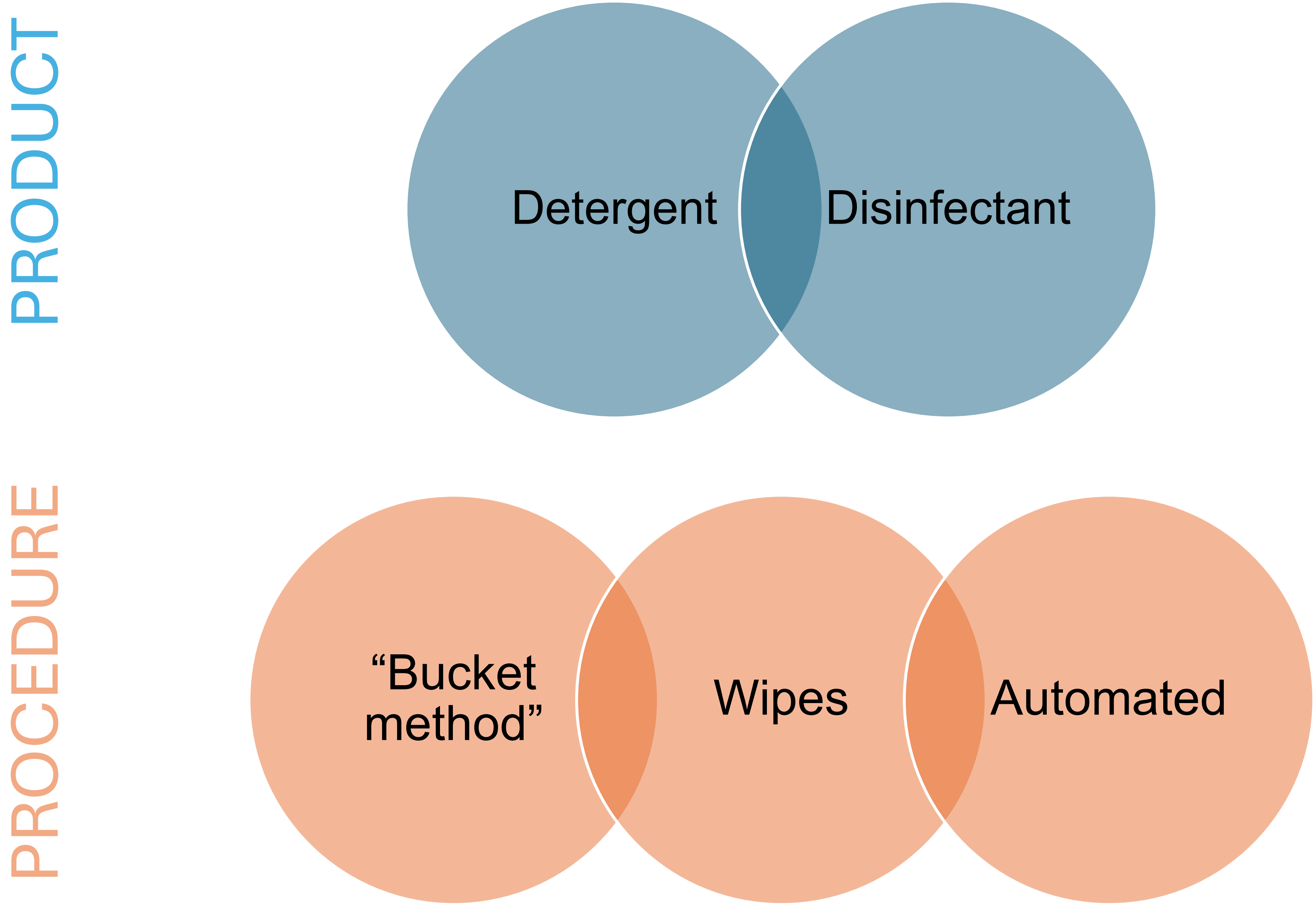
Author/year	Design	Result
Dancer et al. 2009	Cross-over study of extra ward cleaner	27% reduction in MRSA infection
Datta et al. 2011	Cohort intervention study of enhanced disinfection	Significant reduction in VRE acquisition from the prior room occupant
Anderson et al. 2017	Cluster RCT of UVC room disinfection	Significant reduction in MDRO acquisition from the prior room occupant
Mitchell et al. 2019	Cluster RCT of cleaning bundle	Improved rate of cleaning high touch items and reduced incidence of VRE
Dadon et al. 2023	Cross-over study of switching from chlorine "bucket" method to disinfectant wipes	Significant reduction in surface contamination, MDRO acquisition, and in-hospital mortality

Importance of surface contamination for HCAI and AMR

Current approaches to cleaning and disinfection

Surface disinfectant overview

Possible contribution of surface disinfectants to AMR


PRODUCT
Detergent
Disinfectant
PROCEDURE
"Bucket method"
Wipes
Automated

What is the protocol for surface cleaning and disinfection in your hospital?

- Combined cleaner/disinfectant for all cleaning and disinfection
- Routine detergent cleaning; cleaner/disinfectant when known infection risks
- Detergent cleaning only

English cleaning / disinfection recommendations

- Under *Standard Infection Control Precautions*, routine disinfection of the environment is not routinely recommended in the manual, aside from routine disinfection of sanitary fittings using chlorine.
- Under *Transmission Based Precautions*, disinfection of hospital surfaces during the stay of the patient and at the time of their transfer or discharge is recommended.
  - The manual makes a specific recommendation that chlorine should be used for daily and discharge surface disinfection.

Limitations of a “detergent only” approach

- Patients with unidentified infection risks
- Challenges of cleaning complex and intricate environment
- Dry surface biofilms
- Limited reduction in pre-post studies
- Evidence that they spread contamination around
- Emerging evidence of detergent-related surface damage
- Evidence that moving to routine disinfection reduces transmission risk

Kiernan et al. J Hosp Infect 2024 (accepted)

Limitations of a chlorine-based disinfectants

- Many are not sporicidal when tested correctly
- Inactivation when exposed to soiling
- Poor environmental profile
- Material compatibility
- Staff exposure
- Majority of patients on TBPs don’t require chlorine

Kiernan et al. J Hosp Infect 2024 (accepted)

Chlorine may not be as effective as you think..

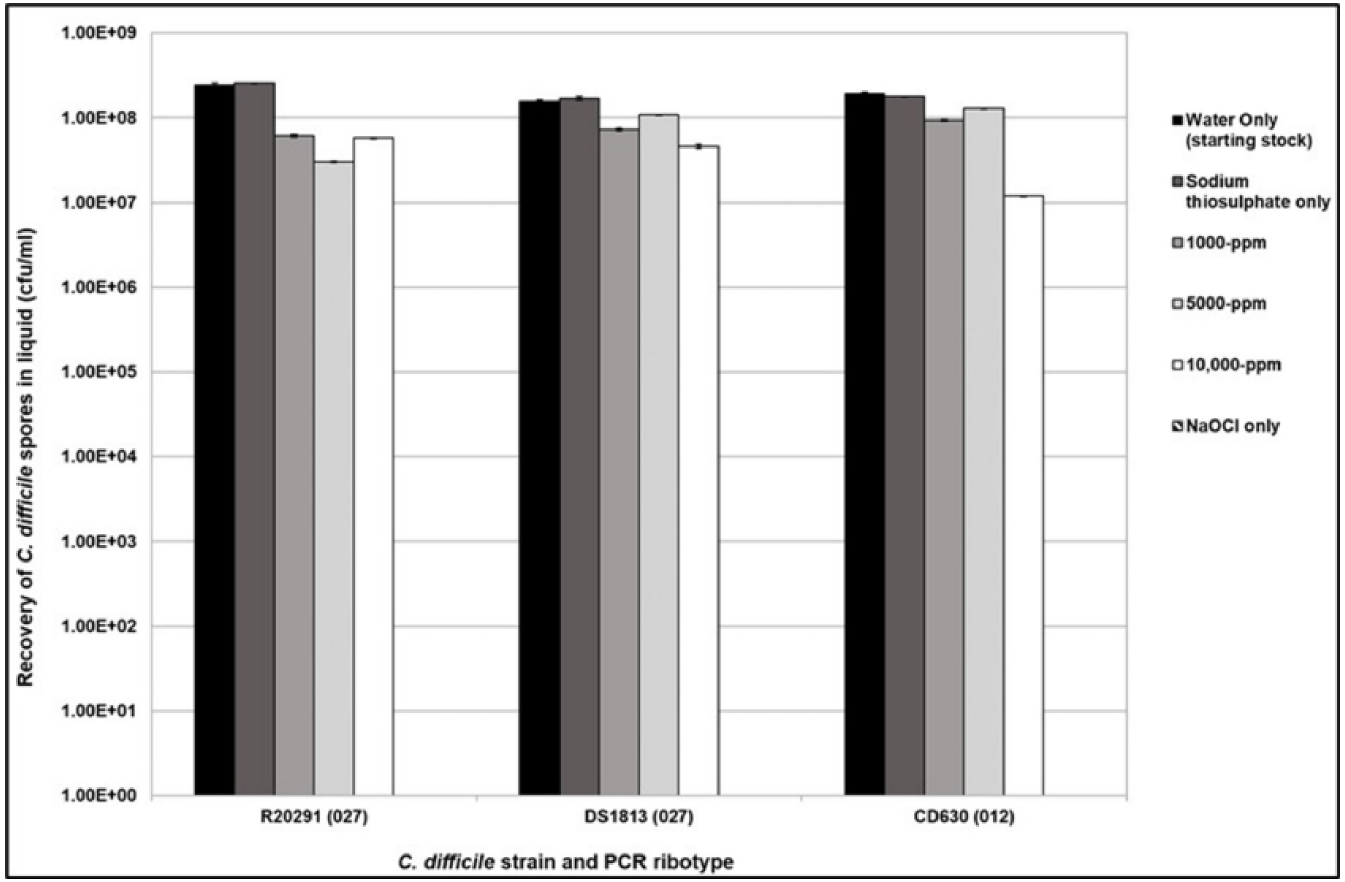
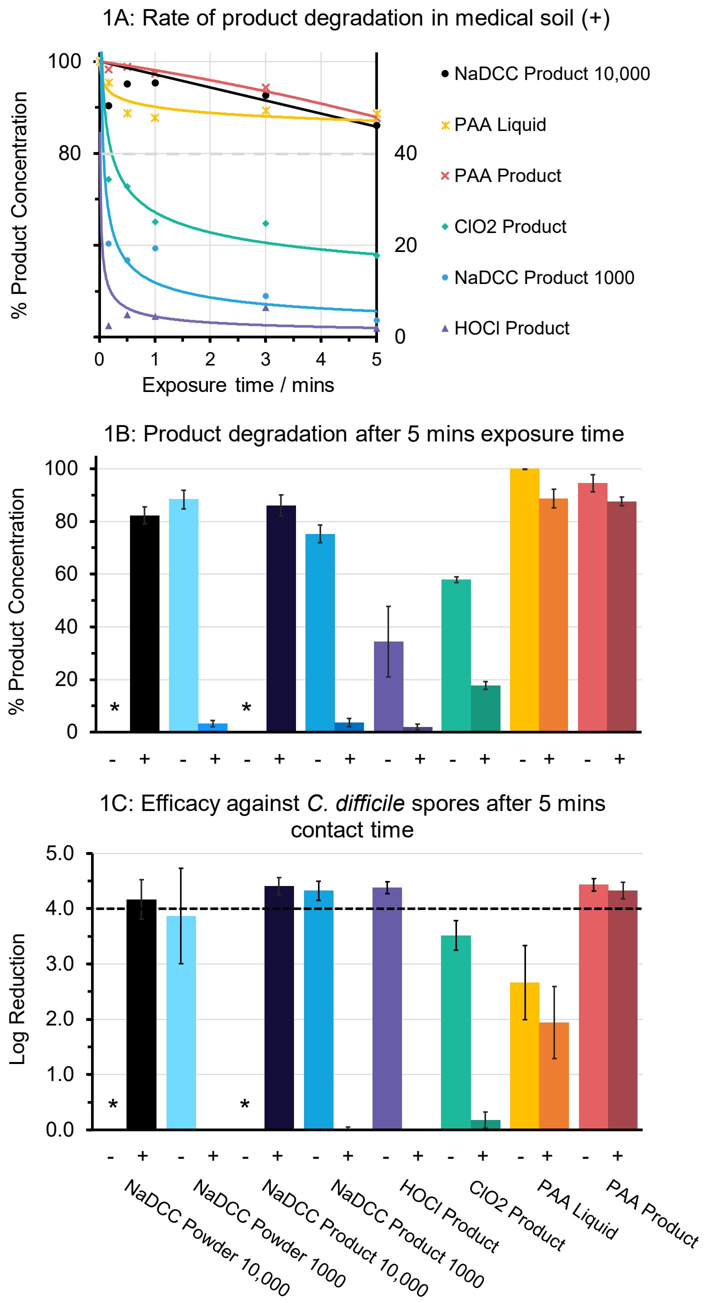


Fig. 1. Recovery of purified *C. difficile* spores following exposure to NaOCl at 1000, 5000 and 10 000 p.p.m. in liquid for 10 min. The spore inoculum was at 10^8 c.f.u. ml^{-1}. The inoculum was used as the positive control (water only) and was also suspended in sodium thiosulphate to ensure no cross-reactivity. Plots represent means±SEM (*n*=3).

Ahmed & Joshi. Microbiology 2023.

Impact of soiling



Brown et al. J Hosp Infect 2024 (accepted)

* = not tested

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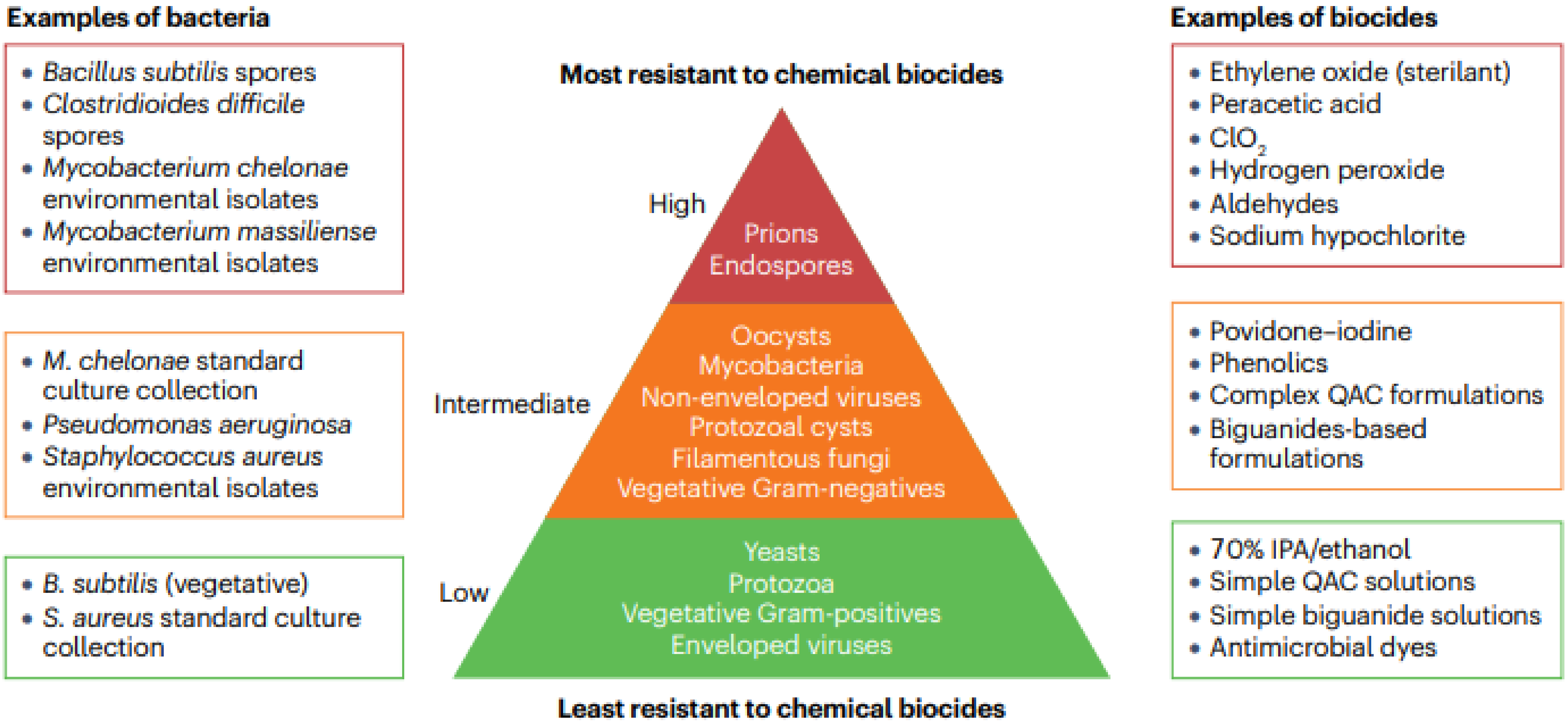
Types	Mechanism of action	Examples of chemistry	Application and areas of use
Highly reactive biocides — strong interactions through chemical or ionic binding			
Alkylating agents	Reacts with amino acids to form crosslinks and fix proteins	Glutaraldehyde, formaldehyde, ortho-phthalaldehyde	Disinfection of surfaces, materials, equipment Disinfection of materials and surfaces associated with the housing or transportation of animals
Oxidizing agents	Oxidation of macromolecules (proteins, lipids and nucleotides), while causing nonspecific damage to the cytoplasmic membrane	Sodium hypochlorite, peracetic acid, hydrogen peroxide, ethylene oxide	Disinfection of surfaces, materials, equipment Disinfection of materials and surfaces associated with the housing or transportation of animals Disinfection of drinking water
		Povidone–iodine	Disinfection of skin, scalps, surfaces, materials and equipment
Less-reactive biocides — weak physical interaction			
Cationics	Positively charged, hydrophilic region interacts with negatively charged cell surface. Hydrophobic region partitions into membrane, disrupting intermolecular bonds and leading to loss of intracellular contents	Quaternary ammonium compounds (for example, benzalkonium chloride)	Disinfection of skin and scalps Disinfection of surfaces, materials and equipment Incorporated in textiles, tissues, mask, producing treated articles with self-disinfecting properties
		Biguanides (for example, chlorhexidine, polyhexamethylene biguanide)	Antisepsis of skin and scalps Disinfection of surfaces, materials, equipment and swimming pools
		Diamines and amine oxides	Disinfection of surfaces, materials and equipment
Phenolics	Protonophore that targets the cytoplasmic membrane, causing loss of membrane potential. At low concentrations, triclosan inhibits fatty acid synthesis	Triclosan	Disinfection of surfaces, materials and equipment Incorporated in textiles, tissues, mask, producing treated articles with disinfecting properties
Alcohols	Permeabilization of the cytoplasmic membrane, denaturation of proteins and dehydration of exposed bacteria	Ethyl alcohol (ethanol) and isopropyl alcohol	Disinfection of skin and scalps Disinfection of surfaces, materials and equipment
Weak organic acids	Uncoupling of proton motive force; acidification of bacterial cytoplasm, leading to inhibition of enzyme activity and biosynthesis while exerting osmotic stress	Citric acid and benzoic acid	Disinfection of skin and scalps Disinfection of surfaces, materials and equipment
Metal ions	Redox active. Interacts with thiol groups and generates reactive oxygen species that damage macromolecules	Silver and copper	Antimicrobial surfaces, textiles and wound dressings
Antimicrobial dyes	Intercalation with DNA. Production of singlet oxygen (photosensitizers)	Methylene blue, toluidine blue and crystal violet	Wound dressings, photodynamic therapy (photosensitizers)

Maillard & Pascoe. Nature Rev Microbiol 2024.



Maillard & Pascoe. Nature Rev Microbiol 2024.

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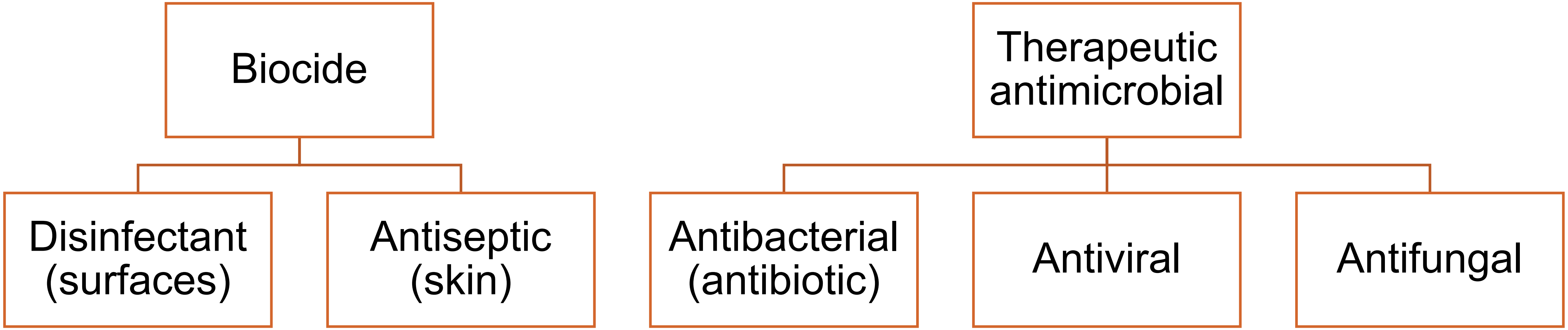

Biocide
Disinfectant (surfaces)
Antiseptic (skin)
Therapeutic antimicrobial
Antibacterial (antibiotic)
Antiviral
Antifungal

Biocides vs. therapeutic antimicrobials

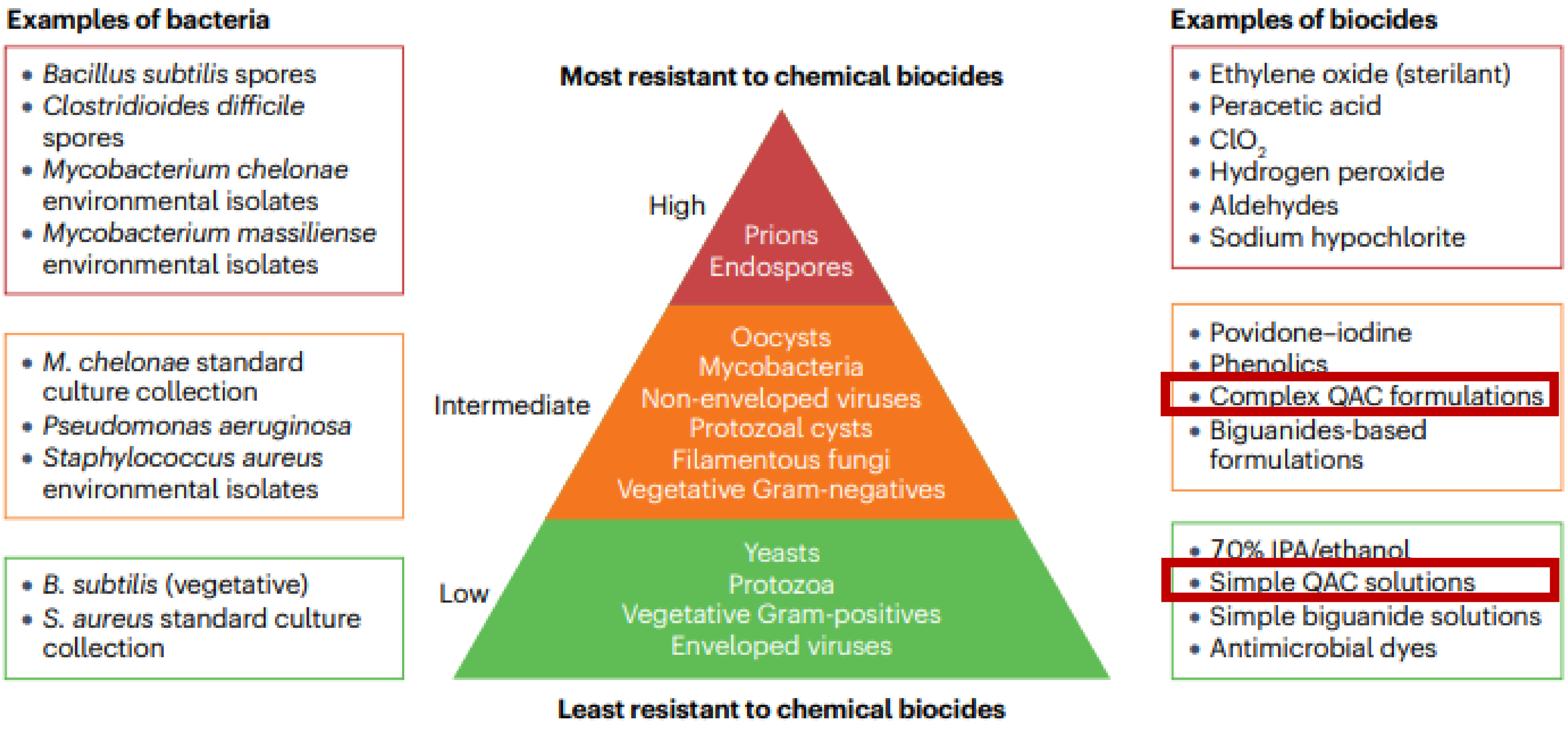
Feature	Biocide	Therapeutic antimicrobial
Mechanism of action	Multiple cellular targets	Single process or structure
“Resistance”	Tolerance or reduced susceptibility	Resistance halts therapy
Measurement of “resistance”	No agreed methodology or breakpoints	Defined methodology and breakpoints
Mechanism of “resistance”	Intrinsic or acquired	Intrinsic or acquired

Factors affecting biocide effectiveness

Biocide	Application	Microbe
• Type / mechanism of action • Concentration • Formulation	• Dilution • Delivery method • Contact time • Soiling • Surface type • Interactions	• Structure (e.g. spores) • Reduced susceptibility • Metabolic state (e.g. VNC) • Community (e.g. biofilm)

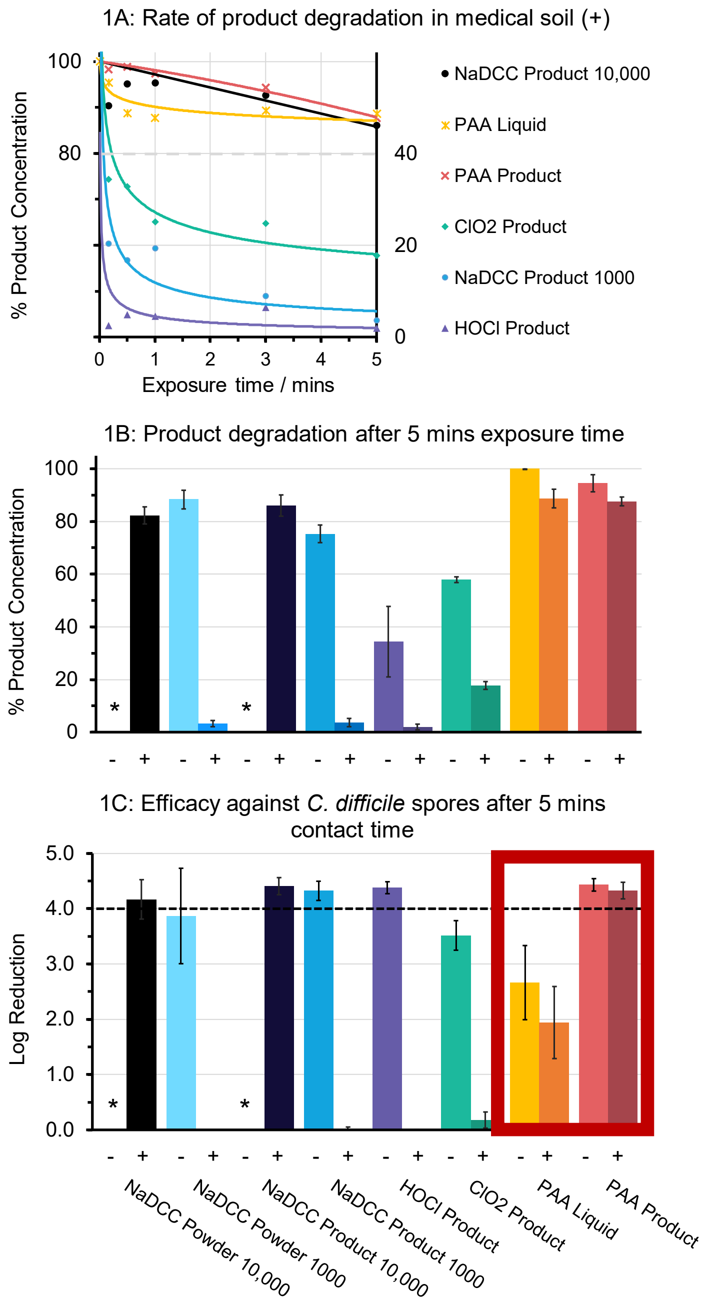
Maillard & Pascoe. Nature Rev Microbiol 2024.

The importance of formulation



Maillard & Pascoe. Nature Rev Microbiol 2024.

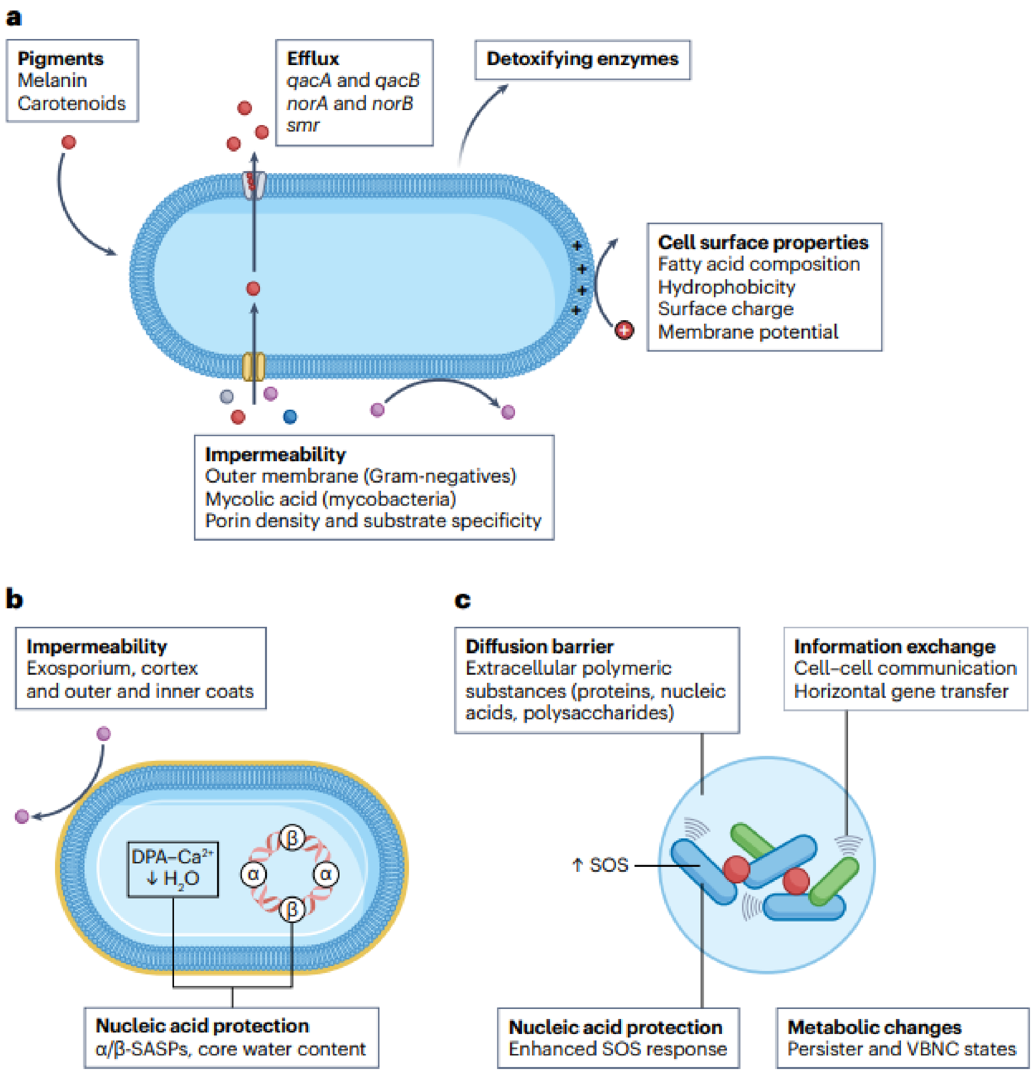
Importance of formulation



Brown et al. J Hosp Infect 2024 (accepted)

* = not tested

Intrinsic reduced susceptibility to biocides



Maillard & Pascoe. Nature Rev Microbiol 2024.

Acquired reduced susceptibility to biocides

General mechanism	Organism	Biocide (test concentration)	Change in biocide susceptibility	Antibiotic resistance	Specific mechanism	Ref.
Efflux	Mixed waterborne community	Copper (8–500 mg l^{-1})	NA (environmental isolates only)	Clarithromycin; tetracycline	CusA, CusB CusS, CutE	163
	Acinetobacter baumannii	Triclosan (128 mg l^{-1})	2–32-fold increase in MIC	Trimethoprim	FabI, AdeIJK	164
	Pseudomonas aeruginosa	BZC (12.5 mg l^{-1})	12-fold increase in MIC	Ampicillin; cefotaxime; ceftazidime	MexAB–OprM; MecCD–OprJ	165
	Campylobacter spp.	BZC; chlorhexidine; cetylpyridinium chloride	Twofold to fourfold increase in MIC	Erythromycin; ciprofloxacin	Not established (confirmed with efflux inhibitors)	166
	P. aeruginosa	Sodium hypochlorite (100 mg l^{-1})	Approximately 2.5-fold increase in MIC	Ampicillin; tetracycline; chloramphenicol kanamycin	MuxABC–OpmB[a]	134
Porins	*Mycobacterium chelonae*	Glutaraldehyde (0.2–2%)	>6 log_{10} survival of resistant strain in 2% glutaraldehyde	Rifampicin, vancomycin, clarithromycin, erythromycin	Msp	80
	Escherichia coli	Chlorophene (0.5–2.49 mM) Povidone-iodine (67–111 µg ml^{-1})	Increased growth in twofold to fivefold higher concentrations of biocide after 500 generations	Ampicillin; chloramphenicol; norfloxacin	OmpR; EnvZ	82
Metabolic changes	*E. coli*	Hydrogen peroxide (200 µM)	Increased growth in approximately twofold higher concentration after 500 generations	Ampicillin; chloramphenicol	RNA polymerase (*rpo*)	82
	Mycobacterium smegmatis	Triclosan (0.8–1.6 mg ml^{-1})	Fourfold to sixfold increase in MIC	Isoniazid	Lipid metabolism (InhA)	112
	Listeria monocytogenes	Triclosan (1–4 µg ml^{-1})	No change in MIC	Aminoglycosides	Heme metabolism (*hemH*, *hemA*)	111
Modifications of surface change	*P. aeruginosa*	BZC (50–1600 mg l^{-1})	7–25-fold increase in MIC	Polymyxin B	*pmrB*	67
Extracellular metal-binding protein	*Klebsiella pneumoniae*	Silver (≤64 µM)	NA (clinical isolates only); resistance to silver based on literature values	β-Lactams, fluoroquinolones, aminoglycosides (plasmid-encoded)	SilE	167

BZC, benzalkonium chloride; MIC, minimum inhibitory concentration; NA, not applicable. [a]Induction of SOS response and antioxidant enzymes also noted.

Maillard & Pascoe. Nature Rev Microbiol 2024.

Biocide and therapeutic antimicrobial cross-resistance

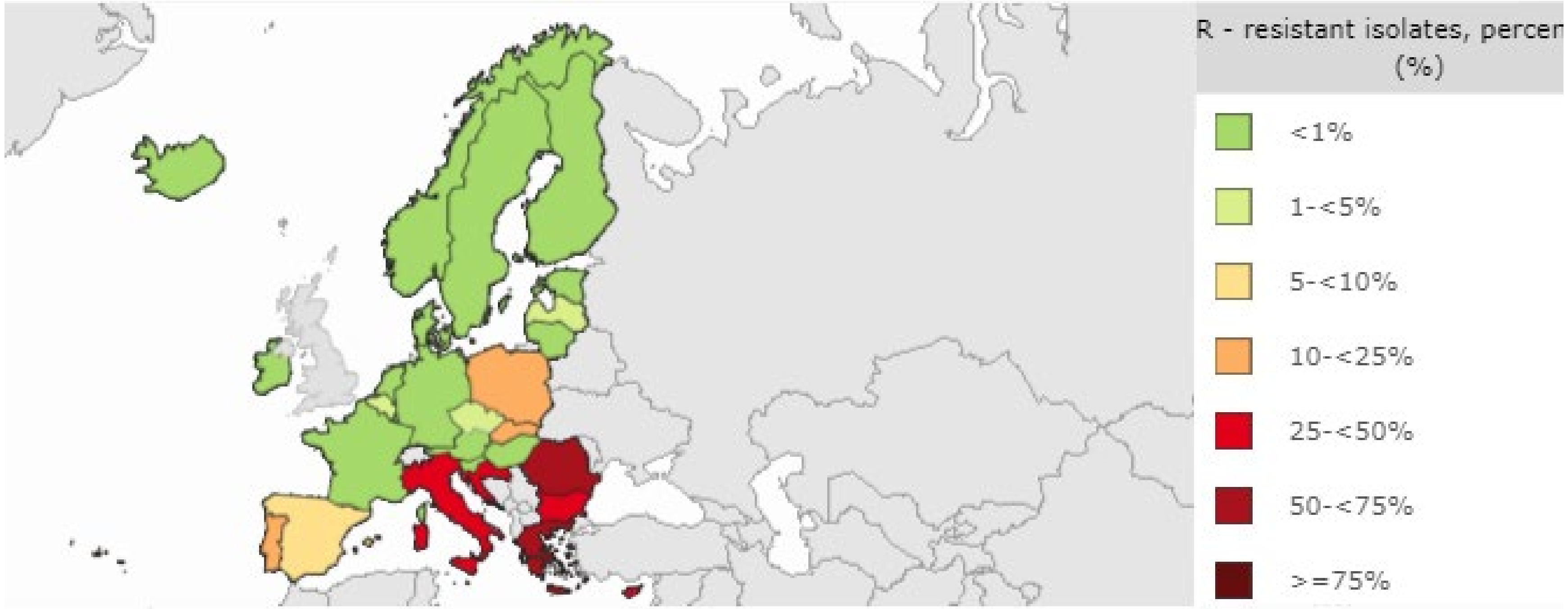
- Direct – shared mechanism for reduced susceptibility to biocides and resistance to therapeutic antimicrobials
- Indirect
  - Exposure to biocides can “switch on” AMR
  - Co-selection of resistance genes on the same mobile genetic element
- Cross-resistance to other biocides can occur
- Risk of cross-resistance varies by biocide
  - Oxidising agents less prone to cross-resistance
- Limited evidence of “real world” impact

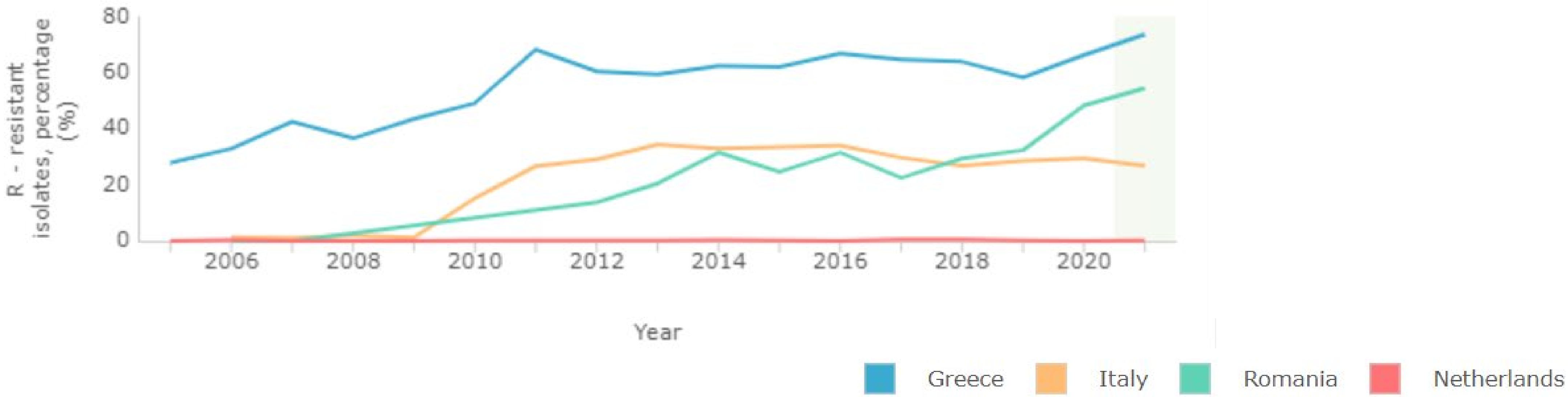
Why I'm not too worried about reduced susceptibility to biocides

Biocide reduced susceptibility	Therapeutic antimicrobial resistance (AMR)
Subtle and difficult to measure	Barn door
Few examples of clinically significant issues	We are running out
Have been using for decades without "failures"	New therapeutic antimicrobials don't last long
We can "formulate our way out"	Formulation isn't a way out

Why I'm really worried about resistance to therapeutic antimicrobials (aka AMR)

% invasive K. pneumoniae isolates resistant to carbapenems (CRE)





ECDC 2023.

Surface disinfectants in healthcare: when to use them, how to choose them, and their contribution to AMR

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Dr Kate Clezy

Candida auris

Candida auris

Kate Clezy, IPAC and HAI Team,
Clinical Excellence Commission,
NSW Health

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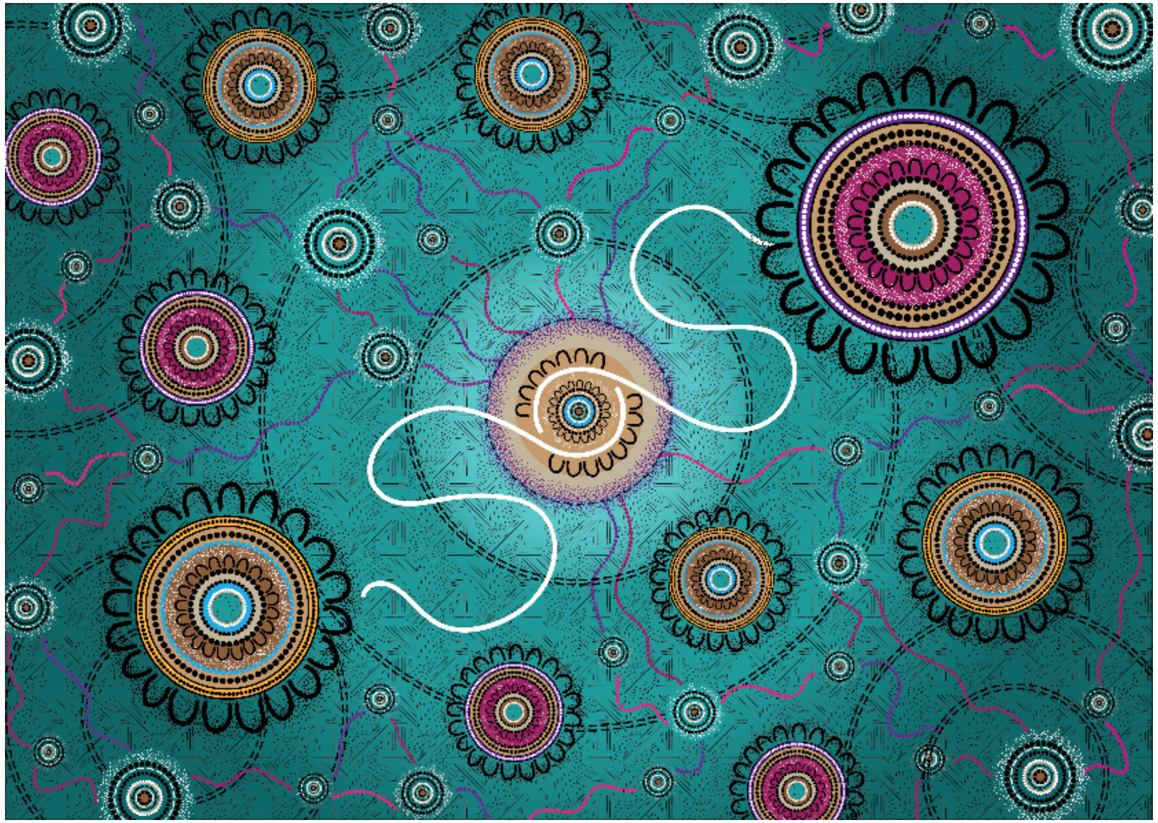
Acknowledgement of Country and Elders

Before we begin,

I would like to acknowledge the traditional owners of the land where we meet today.

I pay my respects to their Elders past and present.

It is upon their lands that we meet.



Candida auris

- Brief overview of *C auris*
- Review an outbreak
- Additional detail about *C auris*
- Infection Prevention and Control
- Summary and questions

C auris

- *C auris* is a yeast which was initially described as a novel candida species in 2009
- It is called "*auris*" as the first described isolate was from a patient's ear in a Japanese Hospital
- Almost all countries have reported *C auris*
- It is included in the ACSQHC Critical Antimicrobial Resistance list (CARAlert)

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C auris - Australia

Table 5.1: Critical antimicrobial resistances included in CARAlert in 2021 and 2022

Species	Critical antimicrobial resistance
Acinetobacter baumannii complex*	Carbapenemase-producing
*Candida auris**	Confirmed identification
Enterobacterales	Carbapenemase-producing and/or ribosomal methyltransferase-producing
	Transmissible colistin resistance*
Enterococcus species	Linezolid-resistant
Mycobacterium tuberculosis	Multidrug-resistant (resistant to at least rifampicin and isoniazid)
Neisseria gonorrhoeae	Ceftriaxone- and/or azithromycin-nonsusceptible
*Pseudomonas aeruginosa**	Carbapenemase-producing
Salmonella species	Ceftriaxone-nonsusceptible
Shigella species	Multidrug-resistant
Staphylococcus aureus†	Vancomycin-, linezolid- or daptomycin-nonsusceptible
Streptococcus pyogenes	Penicillin-reduced susceptibility

* Reported from July 2019
† For CARAlert, *S. aureus* includes *S. argenteus* and *S. schweitzeri*

https://www.safetyandquality.gov.au/sites/default/files/2023-11/aura_2023_fifth_australian_report_on_antimicrobial_use_and_resistance_in_human_health.pdf

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C auris - Australia

Nine cases reported for 2022

What's special about *C auris?*

- It is efficiently transmitted from person to person.
- It may be transmitted via fomites (such as medical equipment, surfaces)
- It is usually resistant to azoles, may also be resistant to amphotericin B and MDR isolates have been described
- It may form a biofilm that grows well in conditions that mimic a sweaty armpit

What's special about *C auris?*

- It may be difficult to identify in a laboratory
- It has been shown to be viable after two weeks on non-porous surfaces and identifiable up to 4 weeks
- Patients may have a long duration of colonisation
- In an outbreak in a LTCF in the US, environmental contamination load was widespread and correlated with colonisation load of the residents

What's not so special

- Colonisation can lead to infection (similar risks to other invasive candida with potential for poorer outcomes related to less available antifungal therapy). Risk of invasive infection is unclear but between 5 – 10%
- Risk of infection likely increased by presence of invasive devices (central line, intubation), use of broad-spectrum antimicrobials and possibly antifungal prophylaxis

C auris outbreak

Published October 3, 2018

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A *Candida auris* Outbreak and Its Control in an Intensive Care Setting

David W. Eyre, D.Phil., Anna E. Sheppard, Ph.D., Hilary Madder, F.A.N.Z.C.A., Ian Moir, Ruth Moroney, M.Sc., T. Phuong Quan, M.Sc., David Griffiths, B.Sc., Sophie George, M.Sc., Lisa Butcher, M.Sc., Marcus Morgan, M.Sc., Robert Newnham, Mary Sunderland, B.Sc., Tiphanie Clarke, B.A., Dona Foster, Ph.D., Peter Hoffman, B.Sc., Andrew M. Borman, Ph.D., Elizabeth M. Johnson, Ph.D., Ginny Moore, Ph.D., Colin S. Brown, F.R.C.Path., A. Sarah Walker, Ph.D., Tim E.A. Peto, F.R.C.P., Derrick W. Crook, F.R.C.Path., and Katie J.M. Jeffery, Ph.D.

https://www.nejm.org/doi/10.1056/NEJMoa1714373

C auris outbreak

June 2016

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1) Look back

Clinical Alert to U.S. Healthcare Facilities - June 2016

Print

This clinical alert has been updated. Please read the September 2017 *C. auris* Clinical Update with important information from investigations of U.S. cases of *C. auris* for clinicians, laboratorians, and public health officials.

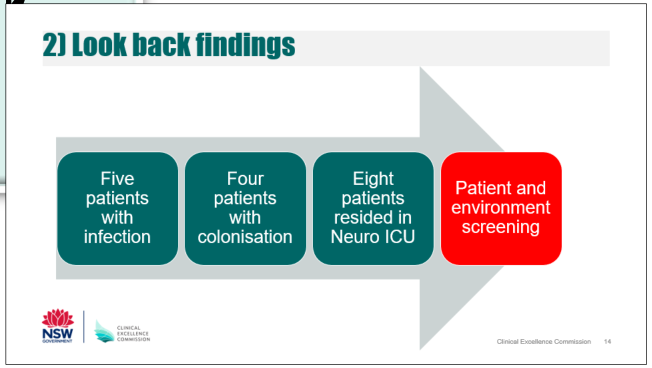
Global Emergence of Invasive Infections Caused by the Multidrug-Resistant Yeast *Candida auris*

Alerts from the United States and the United Kingdom triggered a look-back exercise

C auris outbreak

June 2016

October 2016



2) Look back findings

Five patients with infection

Four patients with colonisation

Eight patients resided in Neuro ICU

Patient and environment screening

3) Context: Neuroscience ICU

- 16 beds, with three single rooms (650 admissions annually)
- **Screening** as follows
    - On admission, weekly and discharge (increased to 3x weekly)
    - Swabs nose, axilla and groin. Tracheostomy, any wounds and urine.
    - Weekly screening in adjacent ward
- First and last isolates from each patient underwent **whole-genome sequencing**
- **Case-control study** (patients admitted to neurosciences who did NOT get colonised or infected)
- Environmental screening was based on information from the case-control study

4) Infection prevention and control

- Increased cleaning and disinfection
- Patient isolation
- Decluttering
- Reduced bedside equipment
- Removed fans and forced-air convection blankets
- Hand hygiene

5: Findings: Feb 2015 – August 2017

- Seventy patients infected (7) or colonised
- 66 had been in the ICU prior to colonisation (median 8.4 days); 3 had been in the ward, one was diagnosed in 2015
- Risk of infection/colonisation 6.8 x more likely (CI 2.96 – 15.63) with axillary temperature skin probes C auris was found on **axillary** temperature probes and a pulse oximeter

Skin-temperature probes

- The were **not** being cleaned according to manufacturer's instructions (using a quaternary ammonium compound wipe)
- Difficult to clean using disinfectant wipes due to design

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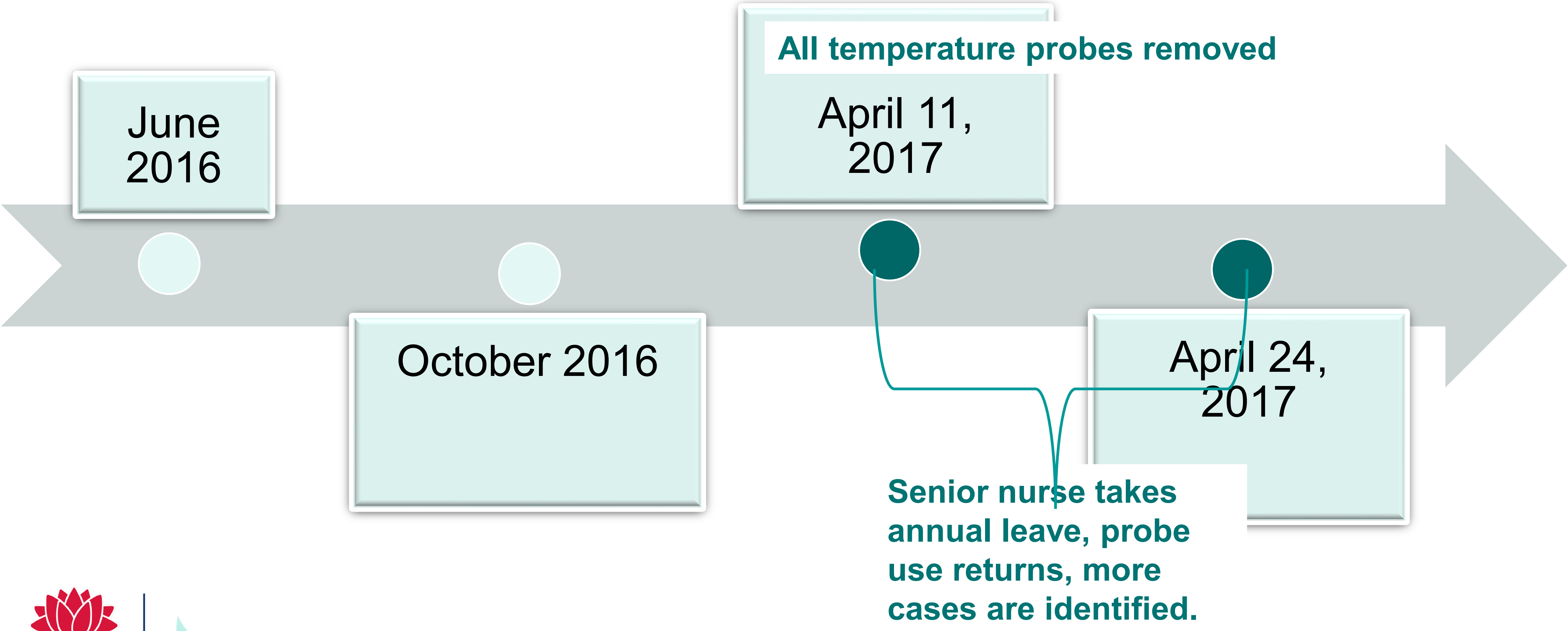
C auris outbreak



6: Action and conclusions

- Whole genome sequencing of patient and environmental isolates (mostly from probes) suggested wide-spread mixing of isolates from probes to patients
- All axillary probes were removed, which partially controlled the outbreak
- Additional measures added
- Patient devices likely to be the main source.

7: Lessons from this outbreak

- There is no substitution for observing when problem solving
- If you look, you will find
- Removal of items may be more complex than this appears (and we still rely on individuals to do the right thing)
- Cleaning needs to be according to manufacturer's guidelines
- A case control study can be highly effective in identifying likely contributors to a problem and allow targeting of testing and interventions

Infection Prevention and Control

NSW GOVERNMENT

CLINICAL EXCELLENCE COMMISSION

Infection prevention and control

- Screening
- Hand hygiene
- Transmission based precautions
- Isolation or cohorting
- Environmental cleaning and disinfection
- Alerts and communication

Environmental Cleaning

- Floors get contaminated with *C auris*
- Items such as call bells and BP cuffs sometimes fall onto the floor – potential transmission route
- Sporicidal disinfectants are effective against *C auris;* Peracetic acid also effective (only 1 product assessed)
- Quaternary ammonium compounds and hydrogen peroxide are less predictable
- Potentially the addition of UV-C enhances disinfection
- Comparing cloth v microfiber mops - no difference

Infection prevention and control

- As colonisation may persist for long periods, assume carriage is present if readmission occurs.
- No current protocols for decolonisation or clearance.
- Education of staff
- Education patients and their carers

Summary

- *Candida auris* is a pathogen of concern, although currently uncommon in Australia
- IPC strategies as per MROs are effective
- But very careful attention to cleaning the environment and shared patient equipment
- Action required if one case is identified

References

Prestel C et al. Candida auris Outbreak in a COVID-19 Specialty Care Unit - Florida, July-August 2020. MMWR Morb Mortal Wkly Rep. 2021 Jan 15

Eyre DW et al. A *Candida auris* outbreak and its control in an intensive care setting, *The New England Journal of Medicine*, 379(14):

Sexton DJ et al. Positive Correlation Between Candida auris Skin-Colonization Burden and Environmental Contamination at a Ventilator-Capable Skilled Nursing Facility in Chicago. Clin Infect Dis. 2021 Oct 5

Welsh RM et al. Survival, Persistence, and Isolation of the Emerging Multidrug-Resistant Pathogenic Yeast Candida auris on a Plastic Health Care Surface. J Clin Microbiol. 2017 Oct;55

Rutala WA et al. Inactivation and/or physical removal of Candida auris from floors by detergent cleaner, disinfectants, microfiber, and ultraviolet C light (UV-C). Infection Control & Hospital Epidemiology 2024;45(3)

Haq MF et al. Efficacy of 23 commonly used liquid disinfectants against Candida auris isolates from the 4 major clades. Infection Control & Hospital Epidemiology. 2024;45(1)

Thank you

gama healthcare | ACIPC Australasian College for Infection Prevention and Control

Morning Tea

gama healthcare | ACIPC Australasian College for Infection Prevention and Control

Prof Brett Mitchell (AM)

Latest research and updates from an Australian IPC research program

Latest research and updates from an Australian IPC research program

Prof Brett Mitchell (AM)
Central Coast Local Health District, Gosford Hospital, NSW.
Avondale University
Monash University
Hunter Medical Research Institute, NS

Disclosures

- Current recipient of NHMRC Investigator Grant
- Current recipient MRFF funding (HAPPEN study)
- No payment or fees related to this talk
- Work alongside a large number of collaborators in different countries
  - 50+ collaborators across on the talks presented today

Latest research and updates from an Australian IPC research program

Overview & results	Overview & some results	Overview	
IPC workforce	CLEEN study	CATION study	PhD students
Pathogen survival	HAPPEN study	HIPPS study	
		Accelerometer hand hygiene usage study	

Latest research and updates from an Australian IPC research program

Overview & results

- IPC workforce
- Pathogen survival

Overview & some results

- CLEEN study
- HAPPEN study

Overview

- CATION study
- PhD students
- HIPPS study
- Accelerometer hand hygiene usage study

Infection Prevention and Control Workforce

Purpose and methods

Purpose

In the Australian and NZ IPC workforce, wanted to understand:

- Levels of stress
- Resilience
- Personality traits
- Workforce views

Methods

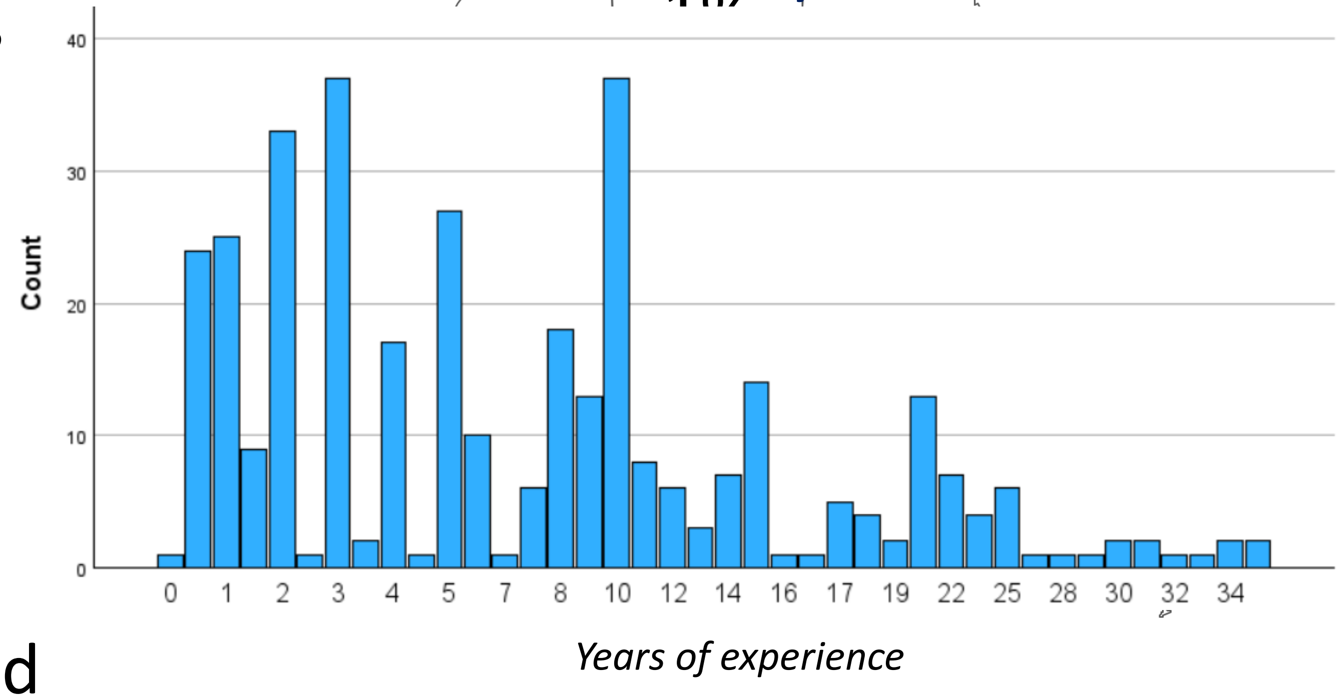
- Cross sectional anonymous online survey of ICPs
- Conducted in quarter two of 2023
- Used ACIPC list, social media and snowballing approach
- Brief resilience scale
- Work Stress Screener
- Big 5 personality test

Infection Prevention and Control Workforce

Overview

- 356 ICPs across Australia and New Zealand
- 58% worked in hospitals, 11% RACFs
- 34% leading an IPC team
- 75% public sector

Distribution of years worked



- 47% not credentialled, 23% advanced
- Years working in IPC = 6 (median), 8 mean

Infection Prevention and Control Workforce

Results: WoSS / Work Stress Screener

- 5 questions
- Possible score of 0 to 15
- High score = indication that there is malignant or harmful stress

- Mean score 4.3
  - 14% score of 0
  - 8% score >10
- Significantly higher levels of stress
  - Those <6 years IPC experience
- Significantly lower levels of stress
  - Masters or higher level degree

Infection Prevention and Control Workforce

Results: Resilience, Brief resilience score

- 6 questions

- 1.00–2.99 for low resilience
- 3.00–4.30 for normal resilience
- 4.31–5.00 for high resilience

- Mean score 3.3
  - 26% low resilience
  - 8% high resilience

- Significantly <u>higher</u> levels of resilience
  - ≥ 6 years IPC experience
  - Masters or higher level degree

- Significantly <u>lower</u> levels of resilience
  - Who are credentialed
  - < 45 years old

Infection Prevention and Control Workforce

Results: Personality traits (n=243)

- **Neuroticism**
  - Tendency for negative feelings
- **Extraversion**
  - Pronounced engagement with external world
- **Openness To Experience**
  - Imaginative, creative people from down-to-earth, conventional people
- **Agreeableness**
  - Cooperation and social harmony
- **Conscientiousness**
  - Control, regulate, and direct our impulses

- **Neuroticism**
  - Mean 70 (SD 15) - LOW
- **Extraversion**
  - Mean 79 (SD 11) - HIGH
- **Openness To Experience**
  - Mean 79 (SD 9) - HIGH
- **Agreeableness**
  - Mean 87 (SD 15) - HIGH
- **Conscientiousness**
  - Mean 87 (SD 15) - HIGH

Personality traits differed between age groups and those credentialed/not credentialed, little with IPC education

Infection Prevention and Control Workforce

Results: Workforce (n=343)

- **Will you leave the profession in the next three years?**
  - 20% Yes
    - 24% in the less 6 years experience category
    - 22% in <45 years old (16% ≥45 years)

- **Retire in next 10 years**
  - 31% Yes

IPC Workforce Take-homes

- Important to think about personalities in your own team
  - Mix?
  - Tailor your leadership style
  - Conscientiousness, biggest influencer in job performance - higher knowledge and conscientious to learn (Essentials of Organizational Behavior: 14th Edition)
  - Neuroticism propensity for burnout
- Reflect on your own personality – play to your strengths and understand others
- Need to look after those less experienced
- Study is not cause and effect

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Survival of pathogens in the environment

- Systematic search of literature
- 62 papers, in which the survival of 31 pathogens was undertaken in 572 tests.
- The studies spanned 1963 to 2023, in 14 countries

Journal of Hospital Infection 147 (2024) 25–31

Available online at www.sciencedirect.com

ELSEVIER

Journal of Hospital Infection

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

Healthcare Infection Society

Review

How long do nosocomial pathogens persist on inanimate surfaces? A scoping review

L. Porter[a,b,†], O. Sultan[a,b,†], B.G. Mitchell[c,d,e], A. Jenney[f], M. Kiernan[g], D.J. Brewster[h,i], P.L. Russo[a,b,c,*]

Table II
Range of survival by pathogen

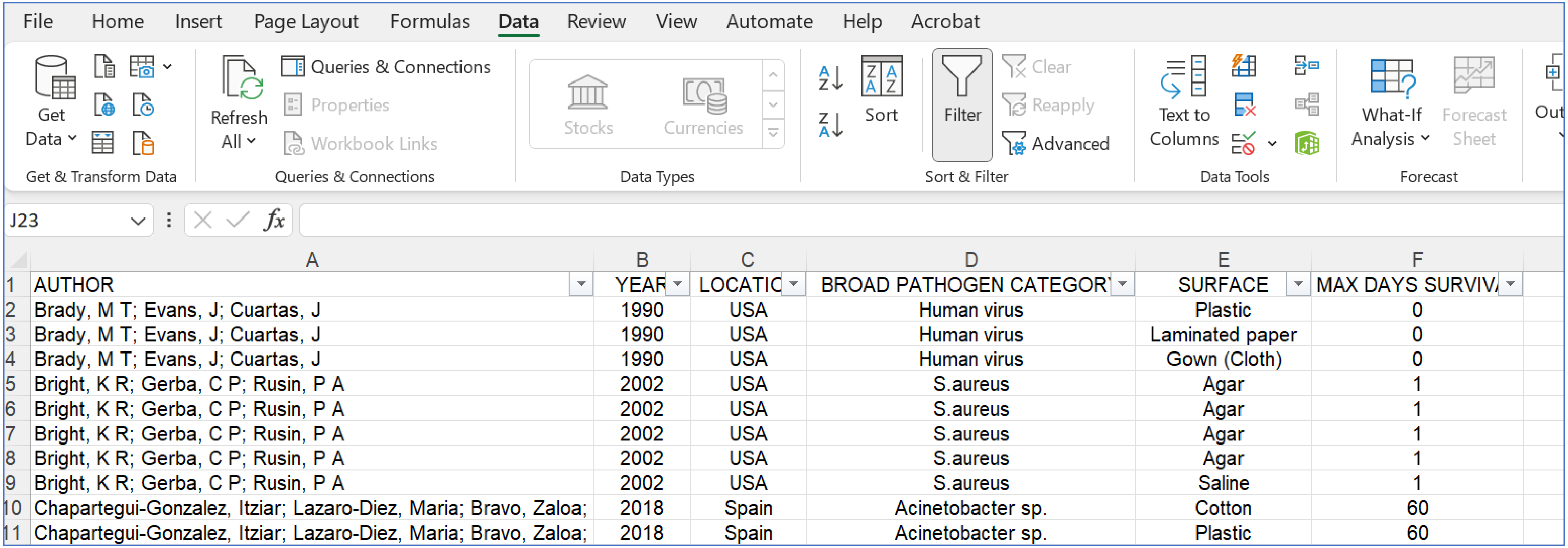
	Pathogen	Range of survival in days (unless otherwise indicated)
Gram positive	*Staphylococcus aureus*	<1 min to 318
	Clostridioides difficile	0.13–140
	Coagulase-negative *Staphylococcus*	<1 min to 28
	Micrococcus spp.	10–10
	Streptococcus mutans	0.13–0.2
	Bacillus spp.	1–28
	Enterococcus spp.	0.02–287
Gram negative	*Acinetobacter* spp.	0.04–90
	Burkholderia cepacia	0.13–8
	Citrobacter freundii	0.06–0.11
	Escherichia coli	<1 min to 56
	Klebsiella pneumoniae	0.57–600
	Proteus mirabilis	0.16–0.16
	Pseudomonas spp.	0.08–7
	Salmonella spp.	0.29–5
	Serratia spp.	0.29–20
	Stenotrophomonas maltophilia	0.29–1
	Haemophilus influenzae	1–1
Fungi	*Candida auris*	14–14
	Candida spp.	0.13–28
Virus	Animal virus	0.5–7
	Coronavirus	0.04–20
	Cytomegalovirus	<1 min to 0.01
	Human virus	<1 min to 12
	SARS-CoV	1–2

Survival time by surface type

Table III
Range of survival time by pathogen and surface

Surface	Pathogens of interest [c]	Range of survival in days (across studies)
Non-porous[a]	*Acinetobacter* spp.	0.29–60
	Clostridioides difficile	0.13–140
	Escherichia coli	0.25–11
	Klebsiella pneumoniae	2–2
	Pseudomonas spp.	0.21–7
	Staphylococcus aureus	0.04–60
Porous[b]	*Acinetobacter* spp.	1.5–90
	C. difficile	0.25–3
	E. coli	0.29–25
	K. pneumoniae	4–600
	Pseudomonas spp.	0.08–7
	S. aureus	1–168

Supplementary material: something useful?



	A	B	C	D	E	F
1	AUTHOR	YEAR	LOCATIC	BROAD PATHOGEN CATEGOR	SURFACE	MAX DAYS SURVIV
2	Brady, M T; Evans, J; Cuartas, J	1990	USA	Human virus	Plastic	0
3	Brady, M T; Evans, J; Cuartas, J	1990	USA	Human virus	Laminated paper	0
4	Brady, M T; Evans, J; Cuartas, J	1990	USA	Human virus	Gown (Cloth)	0
5	Bright, K R; Gerba, C P; Rusin, P A	2002	USA	S.aureus	Agar	1
6	Bright, K R; Gerba, C P; Rusin, P A	2002	USA	S.aureus	Agar	1
7	Bright, K R; Gerba, C P; Rusin, P A	2002	USA	S.aureus	Agar	1
8	Bright, K R; Gerba, C P; Rusin, P A	2002	USA	S.aureus	Agar	1
9	Bright, K R; Gerba, C P; Rusin, P A	2002	USA	S.aureus	Saline	1
10	Chapartegui-Gonzalez, Itziar; Lazaro-Diez, Maria; Bravo, Zaloa;	2018	Spain	Acinetobacter sp.	Cotton	60
11	Chapartegui-Gonzalez, Itziar; Lazaro-Diez, Maria; Bravo, Zaloa;	2018	Spain	Acinetobacter sp.	Plastic	60

Take-homes

- Pathogens survive for various period of time, depending on the pathogen and surface
- Some pathogens can survive for extended periods of time
- Survival in the environment can serve as a potential reservoir for ongoing transmission.

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		Accelerometer hand hygiene usage study	

The CLEANING AND ENHANCED DISINFECTION study

Brett Mitchell, Kate Browne, Georgia Matterson, Phil Russo, Nicole White, Andrew Stewardson, Allen Cheng, Maham Amin, Kirsty Graham, Jennie King, Martin Kiernan, Peta Tehan, David Brain, Maria Northcote.

CLEEN study
Cleaning of shared medical equipment

3 hours of **<u>additional dedicated</u>** cleaning of shared medical equipment per ward, per weekday

www.cleenstudy.com

CLEEN study

Study design

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Cluster 1 Wards 1&2	Control	Intervention	Intervention	Intervention	Intervention	Intervention
Cluster 2 Wards 3&4	Control	Control	Intervention	Intervention	Intervention	Intervention
Cluster 3 Wards 5&6	Control	Control	Control	Intervention	Intervention	Intervention
Cluster 4 Wards 7&8	Control	Control	Control	Control	Intervention	Intervention
Cluster 5 Wards 9&10	Control	Control	Control	Control	Control	Intervention

www.cleenstudy.com

CLEEN study: Different parts and outcomes

- **Effectiveness of additional cleaning on all HAIs**
  - Sub-analyses on All HAIs minus COVID-19; Pneumonia, surgical site, blood-stream and urinary traction infection combined
- **Improvements in the thoroughness of cleaning**
  - Florescent gel and UV
- **Cost effectiveness**
- **Time and motion**
  - How long does it take to clean individual pieces of shared medical equipment?
- **Cleaner interviews**
  - Cleaners’ experience of receiving feedback
- **Scenario modeling**

www.cleenstudy.com

CLEEN study: Different parts and outcomes

Effectiveness (RCT)

- Preliminary results presented at ECCMID later this month
- Journal publication submitted end month
- Presentation of results at IPS conference (Manchester, UK)

- Cost-effectiveness
  - Working on analysis currently
  - ? Presentation of results at ACIPC, in addition to effectiveness

- Cleaner interviews
  - Present some findings now
  - ? Presentation of results at ACIPC, in addition to above

- Time and motion study
  - Journal paper under review
  - Present some findings now
  - ? Presentation of results at ACIPC, in addition to above

- Scenario modeling
  - Paper to come
  - ? Presentation of results at ACIPC, in addition to above

CLEEN Study: Time and motion study

How much time is needed to effectively clean shared medical equipment?

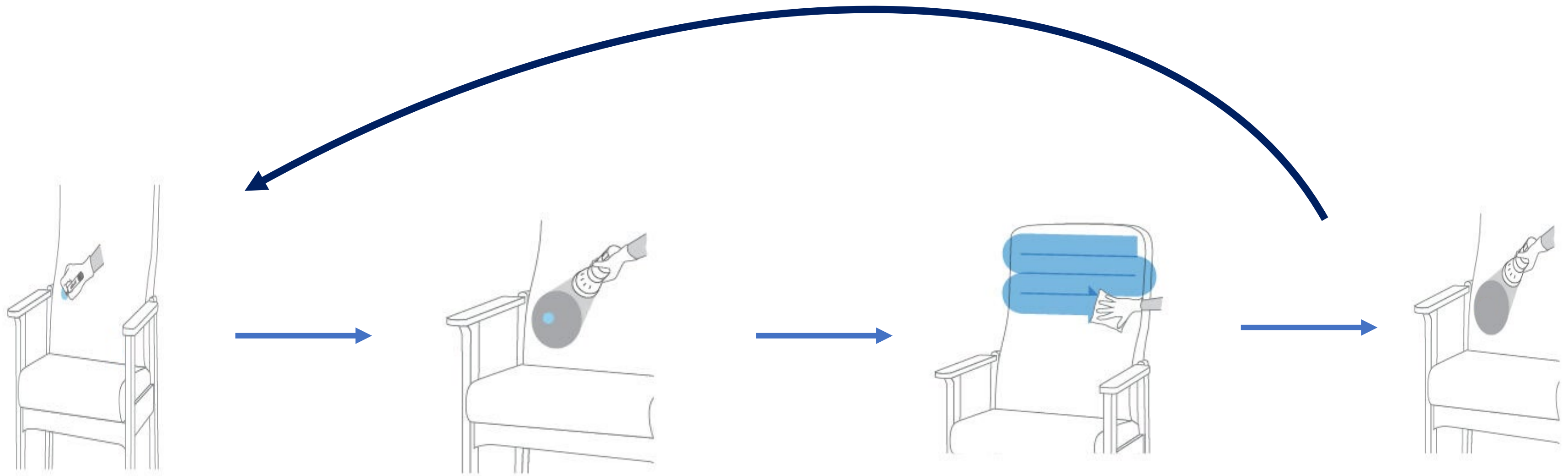
CLEEN study: Time and Motion - Why?

- How can we effectively plan cleaning programs and staff these accordingly?
- Allocating cleaning responsibility means time, especially for clinical staff
- Cost-effectiveness evaluations
- Plan future cleaning models

CLEEN study: Time and motion study

Methods

- Observational study, time and motion
- Participants received training on how to clean shared medical equipment
- UV dot placed, item cleaned, recorded how long.



www.cleenstudy.com

CLEEN study: Time and motion study

Results

Type of equipment	Mean time: effectively* clean (min:sec)	Min time (min:sec)	Max time (min:sec)
Blood glucose testing kit	0:50	0:27	1:10
Intravenous stand	1:20	0:40	2:01
Infusion pump	1:21	0:31	2:06
Blood pressure monitor	1:49	1:00	2:13
Patslide	2:17	1:38	3:00
Metal trolley	2:19	1:38	4:20
Wheelchair	2:29	1:21	3:38
Resuscitation trolley	2:29	2:01	3:50
Computer on wheels	2:43	1:46	4:00
Commode	2:58	2:18	4:20
Bladder scanner	3:16	2:09	5:01
Medication trolley	3:53	3:15	4:28

CLEEN study: Different parts

Effectiveness (RCT)

- Preliminary results presented at ECCMID later this month
- Journal publication submitted end month
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- Scenario modeling
  - Paper to come
  - ? Presentation of results at ACIPC, in addition to above

CLEEN study: Cleaners experience study

Method and results

Methods

- Describe their personal experiences of cleaning shared medical equipment and how they prefer to receive feedback about their work
- Semi-structured focus group

Results

- Regarding feedback the cleaners preferred method was verbal or through email (small groups or individually)
- Did not like the public displays of feedback.
- Furthermore, it was noted that cleaners valued demonstrations of cleaning processes as an additional feedback method

CLEEN study take homes:

Time and motion & Cleaner's perspectives

- It takes time to clean shared medical equipment, need to factor this into planning

- Consider the cleaner's perspectives on receiving feedback

- Main results on effectiveness and cost-effectiveness to come

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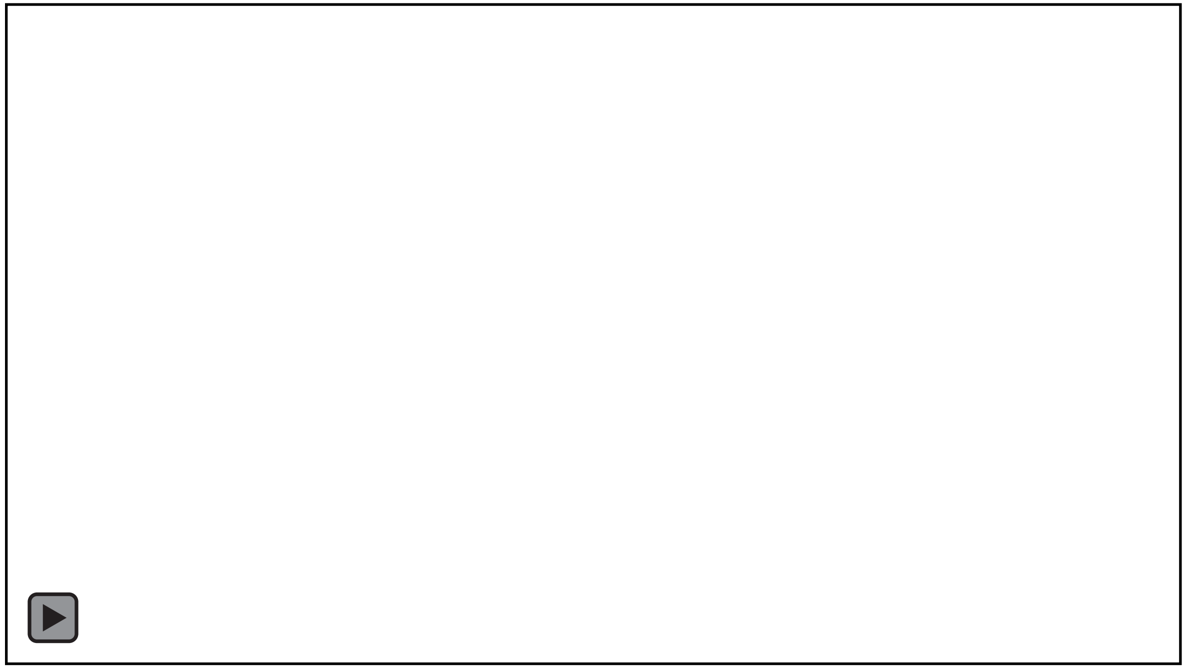
Hospital Acquired Pneumonia PrEveNtion (The HAPPEN study)

- Multi-centre RCT
- Effect of improving the quality and quantity of oral care on the incidence of HAP
- Cost-effectiveness
- Patient experience of HAP
- Attributable LOS in hospital



www.happenstudy.com

HAPPEN study: The team

Chief Investigators

- Professor Brett Mitchell
- Dr Nicole White
- Professor Allen Cheng
- Professor Helen Rawson
- Professor Phil Russo
- Professor Rhonda Wilson
- Professor Jenny Sim
- A/Professor Andrew Stewardson
- Dr Sonja Dawson
- Dr Julee McDonagh
- Dr Auxilla Madhuvu

Associate Investigators

- Liz Orr
- Jayne O'Connor
- A/Prof Caroline Marshall
- A/Prof Doug Johnson
- Professor Patricia Stone
- Professor Nick Graves
- Professor Maria Northcote
- Professor Janet Wallace

- Dr Peta Tehan
- Dr Kate Browne
- Georgia Matterson

Partners

Australian College of Nursing

Sigma Global Nursing Excellence

Clinical Excellence Commission

ACIPC Australasian College for Infection Prevention and Control

Cabrini

NSW Government Health Mid North Coast Local Health District

NSW Government Health Central Coast Local Health District

Consumers

www.happenstudy.com

HAPPEN study overview

Completed

Starts ~ June 2024

2025-2026

www.happenstudy.com

HAPPEN: Oral care and HAP survey

Methods

- A national survey of Australian Nurses in 2023 (RN or EN).
- Paper currently under review
- Describe current practices, barriers and facilitators, knowledge and educational preferences of registered nurses performing oral health care in the Australian hospital setting, with a focus on the prevention of HAP
- 179 participants

HAPPEN: Oral care and HAP survey

Results (preliminary)

Oral care priorities, training and practice

- 82% agreed that oral care is important, 66% feel oral cavity hard to clean

Perceptions of pneumonia (HAP) risk and prevention strategies

- Of all HAIs, participants ranked pneumonia as third in terms of frequency

Topic	Not important (%)	Slightly important (%)	Moderately important (%)	Very important (%)
Hand hygiene	3 (2)	23 (15)	40 (26)	**90 (58)**
Patient Mobilisation	3 (2)	19 (12)	49 (31)	**85 (55)**
Environmental Cleanliness	8 (5)	24 (15)	43 (28)	**81 (52)**
Correct use of PPE	9 (6)	28 (18)	40 (26)	**79 (51)**
Dysphagia management	3 (2)	20 (13)	56 (36)	**77 (49)**
Oral Care	7 (5)	31 (20)	47 (30)	**71 (45)**

HAPPEN: Oral care and HAP survey

Results (preliminary)

Barriers

- Uncooperative patient (n=91, 43%), inadequate staffing (n=84, 40%) and a lack of oral toilet requisite (n=63, 30%)
- Better supplies (66%)
- Insufficient time (20%)

Education and support

- In-services most popular (30%), then website
- Patient reminders (77%)
- High-quality toothbrushes
- Games and apps least favoured

Publication under review

HAPPEN: Oral care and HAP focus groups

Methods & results (preliminary)

- Three focus groups with nurses across the country
- Paper currently under development

<u>**Themes**</u>

- **The nurses role**
- **Challenges**
  - Time, lack of resources, education
- **Empowering patients**
  - Education
- **Prompts**
  - Patient prompts and innovation

And it's only later that I started to realise that there was a link between oral hygiene and respiratory health, and it's a fairly strong link. Um, and it — and it's interesting that when I mention it to nurses who were quite experienced, they — they're quite surprised by this.

Equipment isn't readily available for patients to do it themselves, which leads me into the expectation is on the patients and therefore the patients aren't getting either prompted or don't know why they're doing it

Publication in development

HAPPEN study: Our intervention

- **Dedicated research nurse**
  - Education patients and staff on the ward, working with them [Education, in-service, engaging patients]
  - Assist in providing oral care [Time resource]

- **Products**
  - Good quality toothbrush [Product, Patient prompt]
  - Three-sided toothbrush and toothpaste [Product]

- **Education**
  - Website, training material, short videos and more [Education, engagement]
  - Separate patient and clinician focussed

HAPPEN study overview

Completed

Starts ~ June 2024

2025-2026

www.happenstudy.com

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CATION study

- Investigate the role of chlorhexidine for cleaning meatal area for reducing UTIs in patients that self-catheterise in the community
- Double blind, placebo, cross-over RCT
- Saline Vs 0.1% chlorhexidine
- Recruitment underway
- Results late 2025

Chlorhexidine for meatal cleaning in reducing catheter-associated urinary tract infections: a multicentre stepped-wedge randomised controlled trial

Oyebola Fasugba, Allen C Cheng, Victoria Gregory, Nicholas Graves, Jane Koerner, Peter Collignon, Anne Gardner, Brett G Mitchell

Summary

Background Evidence for the benefits of antiseptic meatal cleaning in reducing catheter-associated urinary tract infection (UTI) is inconclusive. We assessed the efficacy of 0·1% chlorhexidine solution compared with normal saline for meatal cleaning before urinary catheter insertion in reducing the incidence of catheter-associated asymptomatic bacteriuria and UTI

Lancet Infect Dis 2019; 19: 611–19

Published Online April 12, 2019

Open access Original research

BMJ Open

Effectiveness of meatal cleaning in the prevention of catheter-associated urinary tract infections and bacteriuria: an updated systematic review and meta-analysis

Brett Mitchell [1], Cassie Curryer [1], Elizabeth Holliday [2], Claire M Rickard [3,4,5], Oyebola Fasugba [6]

To cite: Mitchell B, Curryer C, Holliday E, *et al.* Effectiveness of meatal cleaning in the prevention of catheter-associated urinary tract infections and bacteriuria: an updated systematic review and meta-analysis. *BMJ Open* 2021;**11**:e046817. doi:10.1136/bmjopen-2020-046817

ABSTRACT

Objective A systematic review on meatal cleaning prior to urinary catheterisation and post catheterisation and reduces the risk catheter-associated urinary tract infections (CAUTIs) and bacteriuria was published in 2017, with further studies undertaken since this time. The objective of this paper is to present an updated systematic review on the effectiveness of antiseptic cleaning of the meatal area for the prevention of CAUTIs and bacteriuria in patients who receive a urinary

Strengths and limitations of this study

- A summary of the latest evidence on the role of antiseptics in reducing catheter-associated urinary tract infections.
- Subgroup analysis to explore effects using different antiseptics.
- Heterogeneity of population groups is a limitation.

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HIPPS study

- Led by A/Professor Andrew Stewardson
- Establish the prevalence of healthcare-associated infections (HAIs) among adult patients in acute care hospitals in the Philippines
- 23 Level 1, 2 and 3 hospitals in the Philippines
- WHO and DoH Philippines funded
- Data collection coming mid-year

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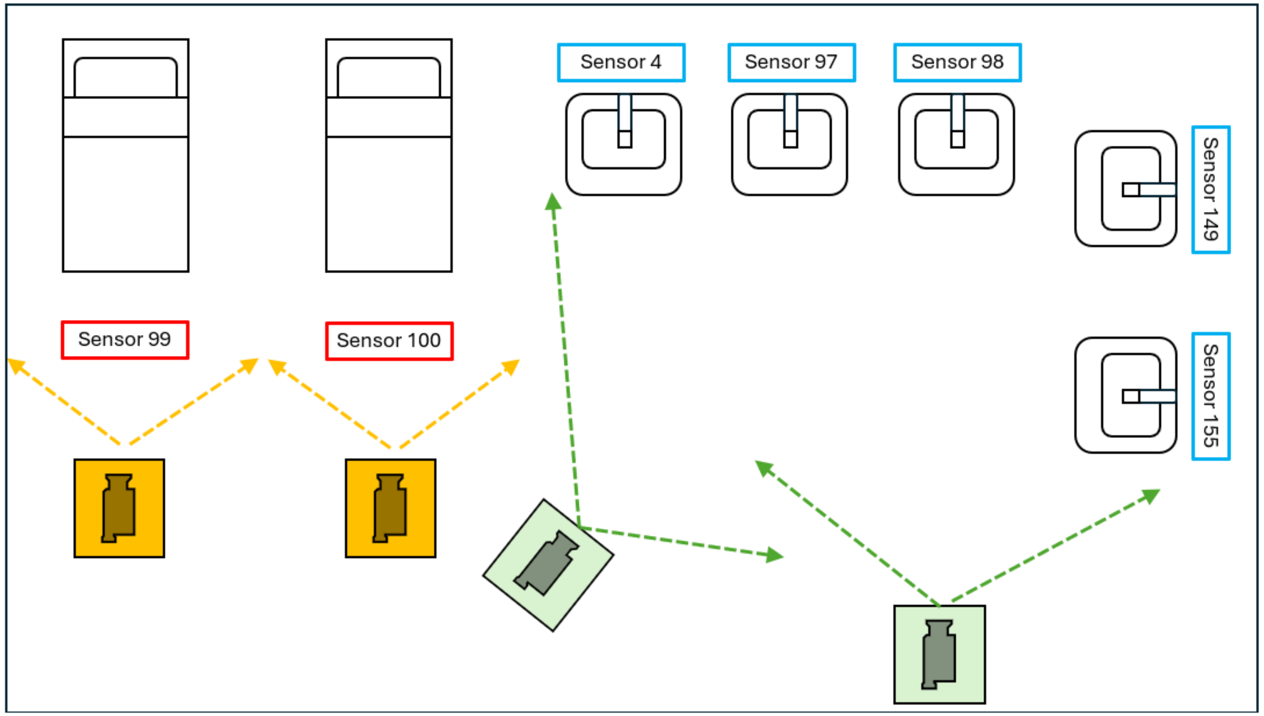
		Accelerometer hand hygiene usage study	

Hand hygiene sensor technology

- Real-time data collection of hand hygiene usage
- Accelerometer placed in each ABHR and soap-dispenser
- Real-time data could be used to identify historical trends and help facilitate targeted early interventions
- Identify empty ABHR and soap dispensers
- Tested this in a simulation ward with 5000+ observations and nursing activities



Publication in development

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Selection of PhD student work

Air purifier study

- Bismi Thottiyil Sultanmuhammed Abdul
- Effect of in-room air purification on the incidence of ARI
- Multi-centre, double-blind cross-over RCT

Drivers of multi-resistant organism (MRO) acquisition and transmission

- Dr Sarah Browning
- Antibiotic thresholds, gloves and gowns and clinical handwashing basins

Aseptic technique

- Hannah Kent
- Improving education and understanding of aseptic technique

HAP epidemiology & impact

- Michelle Chalker
- Incidence, mortality and attributable LOS associated with HAP

Pressure injury prevention

- Hayley Ryan
- Impact of a barrier wipes on pressure injury in aged care residents
- Multi-centre, single-blinded, parallel RCT

HAI Textbook

- The first Australian text to address the challenges posed by infectious diseases and healthcare-associated infections
- 76 authors
- 25 peer reviewers

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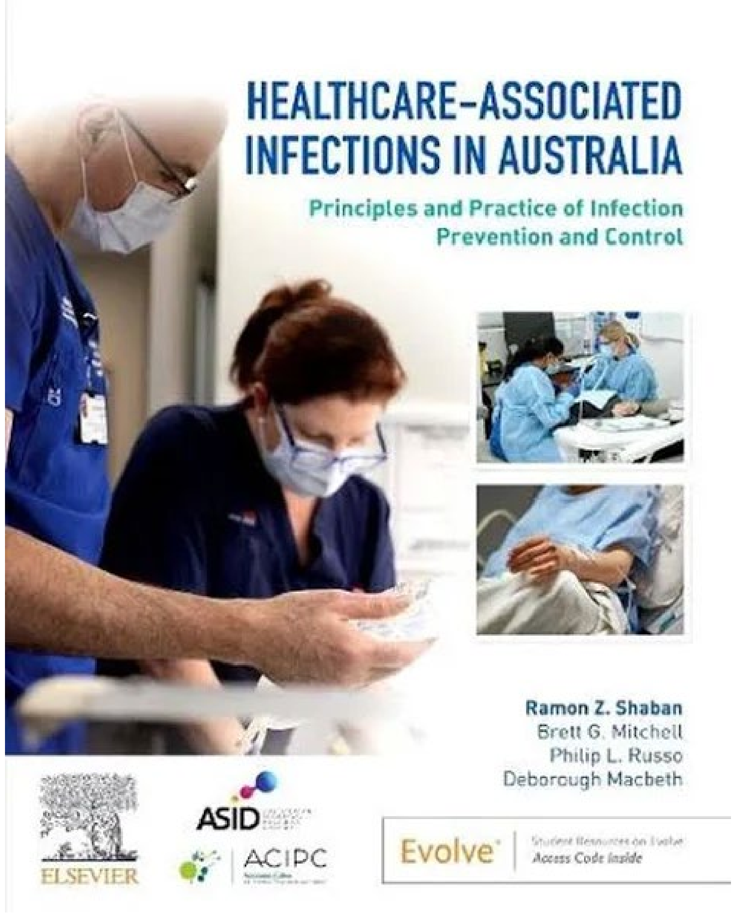
* 25% discount offer exclusively for ACIPC members. ACIPC members will receive the 25% discount code via email.



Latest research and updates from an Australian IPC research program

CLEEN (cleaning) study: **cleanstudy.com**

HAPPEN (pneumonia) study: **happenstudy.com**

CATION (UTI) study: **utipreventioncom.wordpress.com/**

Infection Control Matters podcast: **infectioncontrolmatters.com**

HAI text:

Prof Brett Mitchell (AM)
brett.Mitchell@avondale.edu.au

gama healthcare | ACIPC Australasian College for Infection Prevention and Control

Kathy Dempsey

Sustainability and Infection Prevention and Control

Sustainability and Infection Prevention and Control

Kathy Dempsey RN, DippApSc, BSc (Nursing), MNSc (Infection Control & Hospital Epidemiology)
SHEA/CDC Cert Infection Control, Cert Med Micro, DipLdrshp&Mgt.CICP-E; Future Leaders of Healthcare DrPH Candidate

NSW Chief ICP & HAI Advisor | IPAC COVID-19 Response Clinical Lead | Clinical Excellence Commission
Infection Prevention and Control Practitioner (CICPE).

NSW GOVERNMENT | CLINICAL EXCELLENCE COMMISSION

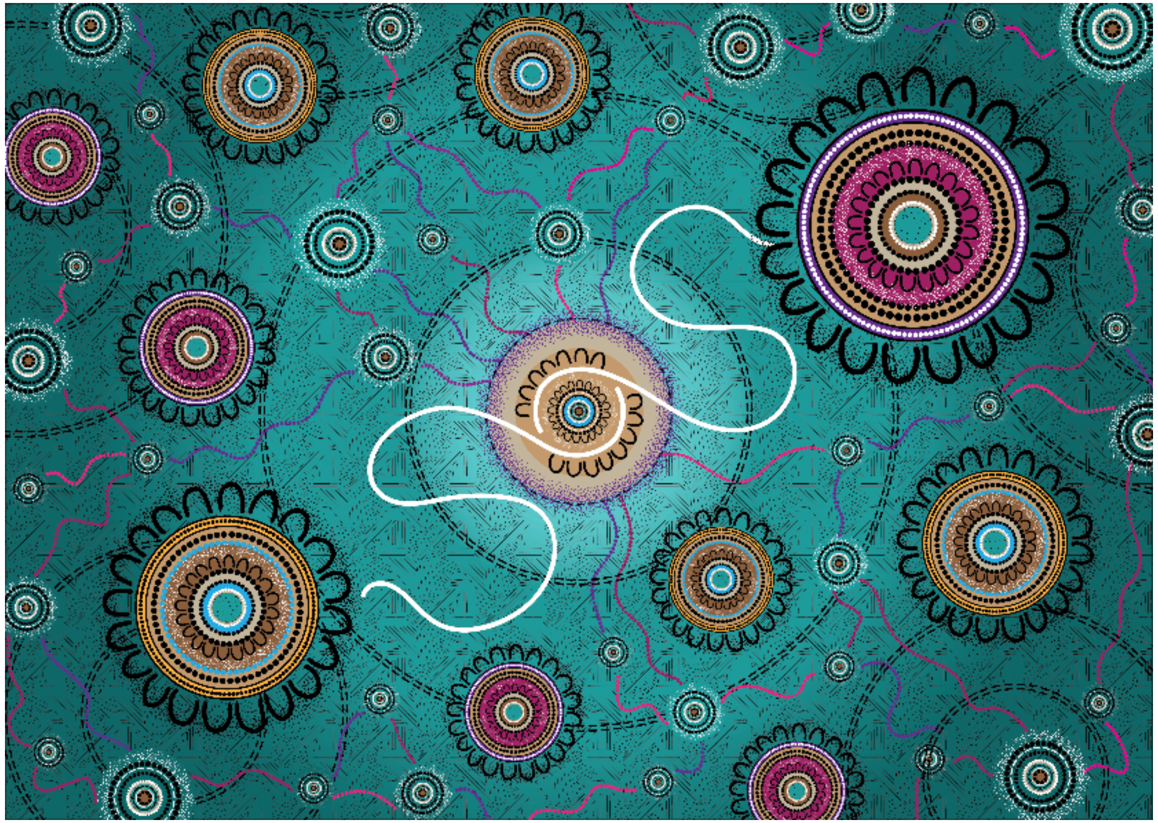
Acknowledgement of Country and Elders

Before we begin,

I would like to acknowledge the traditional owners of the land where we meet today.

I pay my respects to their Elders past and present.

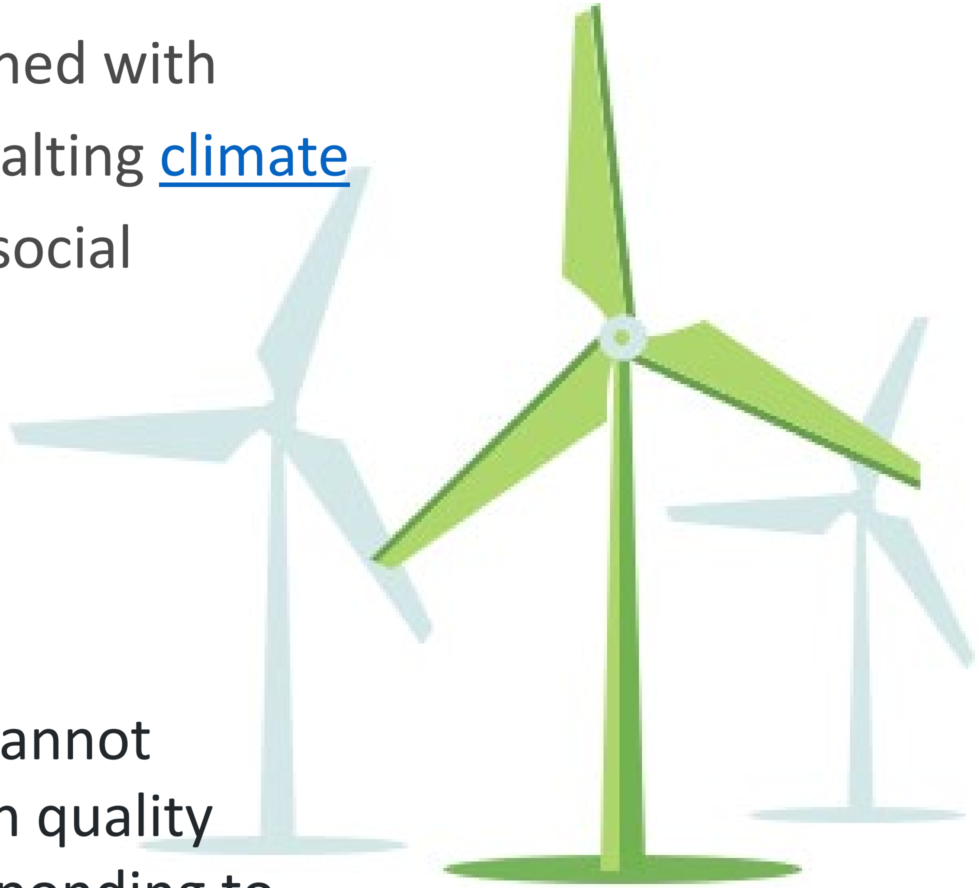
It is upon their lands that we meet.



What is Sustainability

Sustainability is concerned with protecting the planet, halting [climate change] and promoting social development

Health recognises we cannot continue to deliver high quality healthcare without responding to climate risk now.



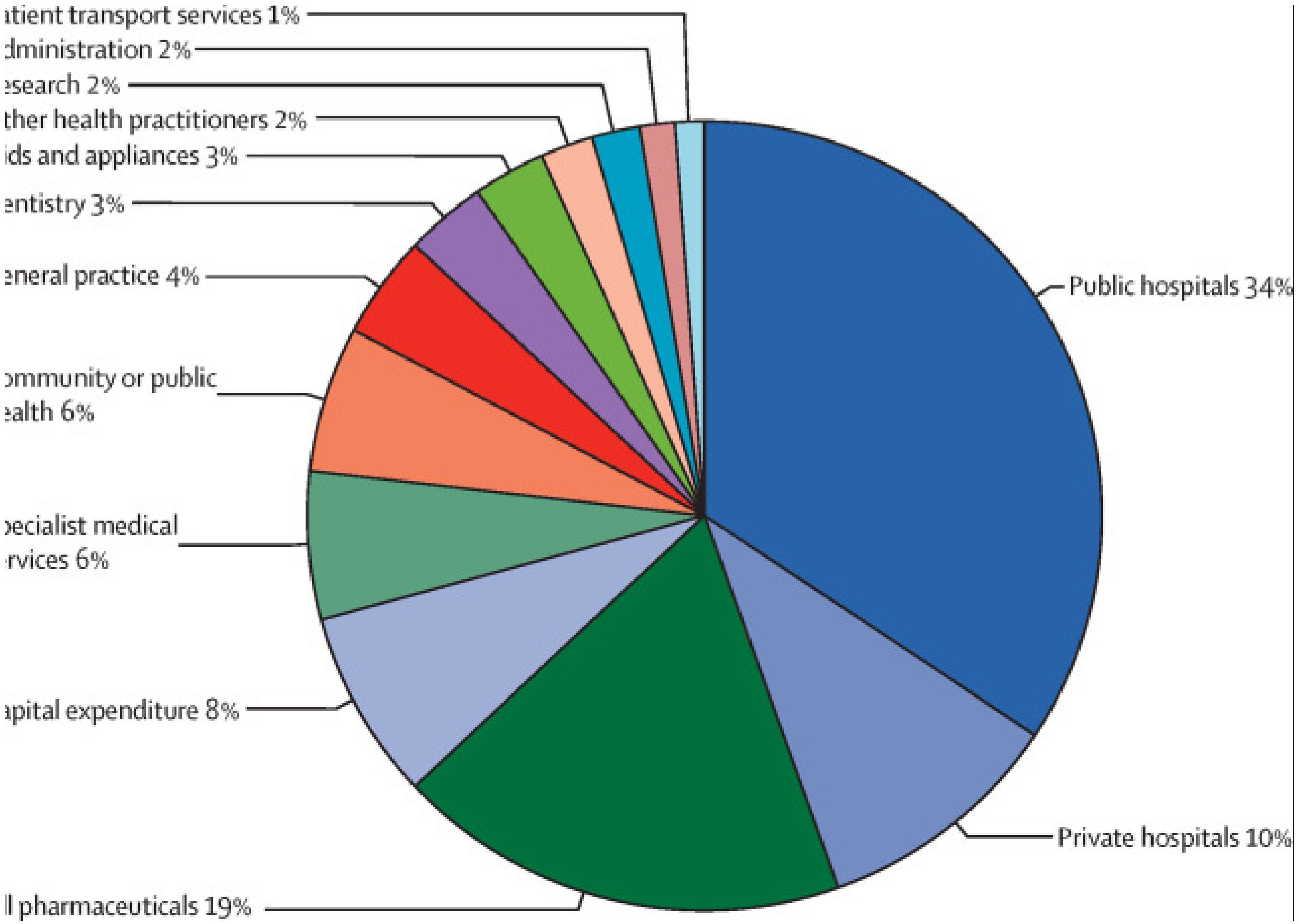
https://www.health.nsw.gov.au/netzero/Pages/default.aspx

Australian Healthcare Carbon Emission

Aus HC
- 7% total Carbon E

GLOBAL
- 4.4% of greenhouse gas emissions
- Energy, Waste,H2O,

AREAS
- Transport, Procurement
- Infrastructure- clinical care; supply chain; devices
- Pharmaceuticals; equipment, Anaesthetic gases, inhalers



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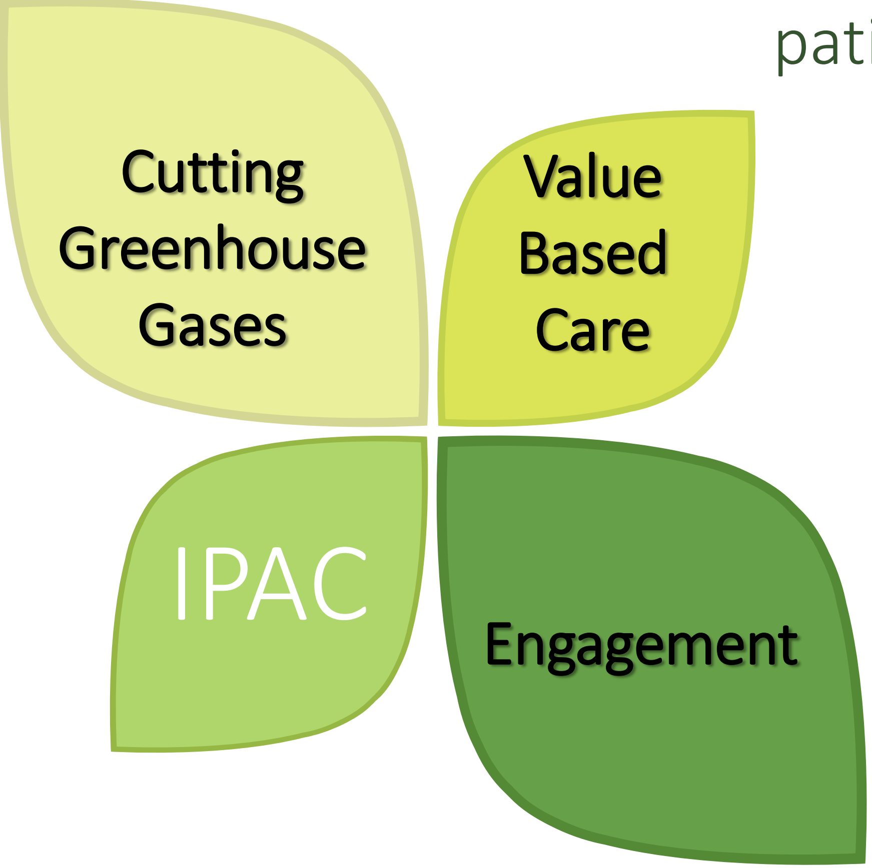
Climate Change and Health

- Heat-related illnesses
- Accidental injury
- Lung and Heart Health
- Mental Health and emotional wellbeing
- Food-and water-borne diseases
- Mosquito-borne diseases
- Poor nutrition
- Allergies

Net Zero

Net zero means cutting greenhouse gas emissions to as close to zero as possible, with any remaining emissions re-absorbed from the atmosphere, by oceans and forests for instance.



Delivering outcomes and experiences that matter to patients and the community.

Quality and safe sustainable care

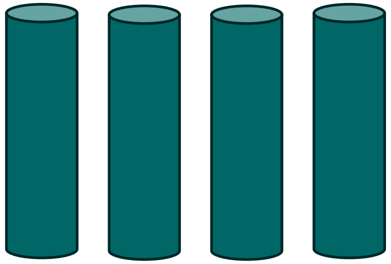
engagement from patients, the community, clinicians and organisations

IPAC Not Sustainability at any cost

A life cycle approach

A measured and considered approach

A broad approach



Keep people healthy, well and independent

Minimise low-value and harmful care

Decarbonise high-value care

Our planet, our health

NSW GOVERNMENT | CLINICAL EXCELLENCE COMMISSION

NSW State Health Plan

Future Health: Guiding the next decade of health care in NSW 2022-2032.

NSW Health vision is to lead a modern, low carbon, low waste, climate resilient health system by focusing on quality, value, innovation and equity

Strategic outcomes	
01	Patients and carers have positive experiences and outcomes that matter
02	Safe care is delivered across all settings
03	People are healthy and well
04	Our staff are engaged and well supported
05	Research and innovation, and digital advances inform service delivery
06	The health system is managed sustainably

NSW GOVERNMENT | CLINICAL EXCELLENCE COMMISSION

Net zero clinical programs

Net zero clinical programs

Getting to a net zero health system will require changes and innovations across every service and every specialty. NSW Health's net zero programs will support, connect and inspire our staff to rethink and reimagine their service, with a net zero lens.

Meet the NSW Health Net Zero Leads who are leading and coordinating this work.

See what is happening and find key resources in your area.

Allied health

Find out how allied health professionals can contribute to a net zero health service.

Anaesthetics

Anaesthetic gases are 5% of a hospital's carbon footprint.

Emergency

We need to improve environmental sustainability within emergency departments.

Intensive care

Clinicians have an important role to play in decarbonising our health system.

Pathology

Pathology testing, together with imaging, contributes 9% of healthcare's carbon footprint.

Respiratory

Metered dose inhalers are 3% of healthcare's carbon footprint,

Surgery

Theatres currently produce 30% of a hospital's waste.

Mental health

The effects of climate change can seriously harm mental health.

Medical imaging

Find out how to reduce carbon emissions from diagnostic imaging.

Nursing and midwifery

Nurses and midwives are critical in our transition to net zero.

Pharmacy

Pharmaceuticals are 19% of the Australian health system's carbon footprint.

Where is Infection prevention and control???

NSW GOVERNMENT | CLINICAL EXCELLENCE COMMISSION

NSW Health IPAC PD2023_025

Implementation of PPE must
consider environmental impact and sustainability in addition to
safety requirements.

NSW Health Organisations are required to consider environmental sustainability with a balanced approach to decisions related to the implementation of single use or single patient use items versus reusable items

NSW SUSTAINABILITY ROADMAP

Climate Risk and Net Zero

ANAESTHETIC RESOURCES

GASES

Reusable vs Disposable Devices: IPAC or Planetary Health

The microbiological and sustainability effects of washing anaesthesia breathing circuits less frequently 2014

CENTRE *for* SUSTAINABLE HEALTHCARE

inspire • empower • transform

SUSTAINABLE VALUE = OUTCOME FOR PATIENTS AND POPULATION + Patient safety & quality / ENVIRONMENTAL + SOCIAL + FINANCIAL IMPACTS (THE 'TRIPLE BOTTOM LINE')

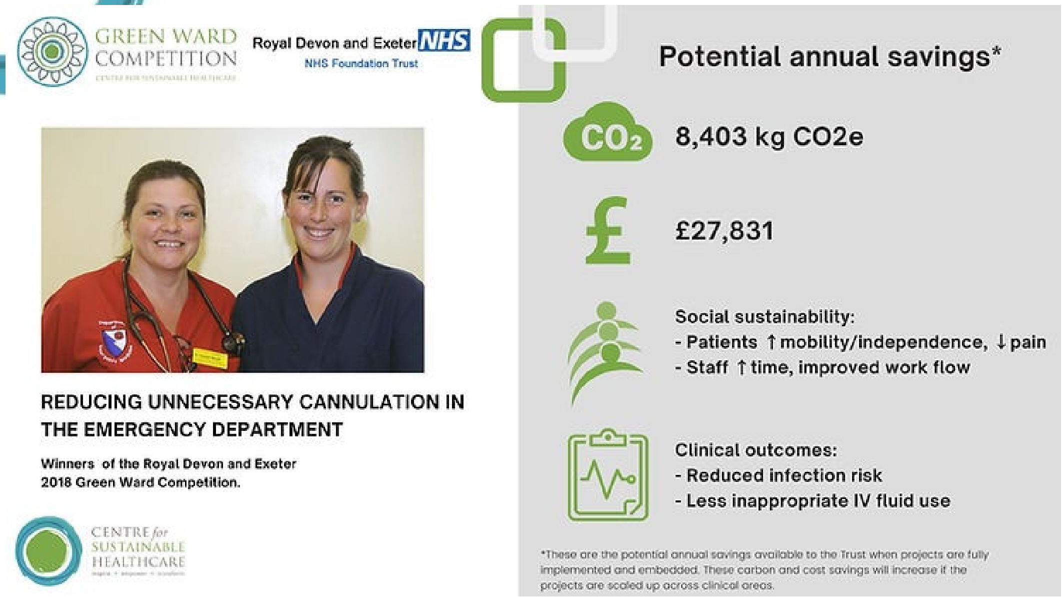
https://sustainablehealthcare.org.uk/who-we-are/csh-story

INSPIRE → EMPOWER → TRANSFORM

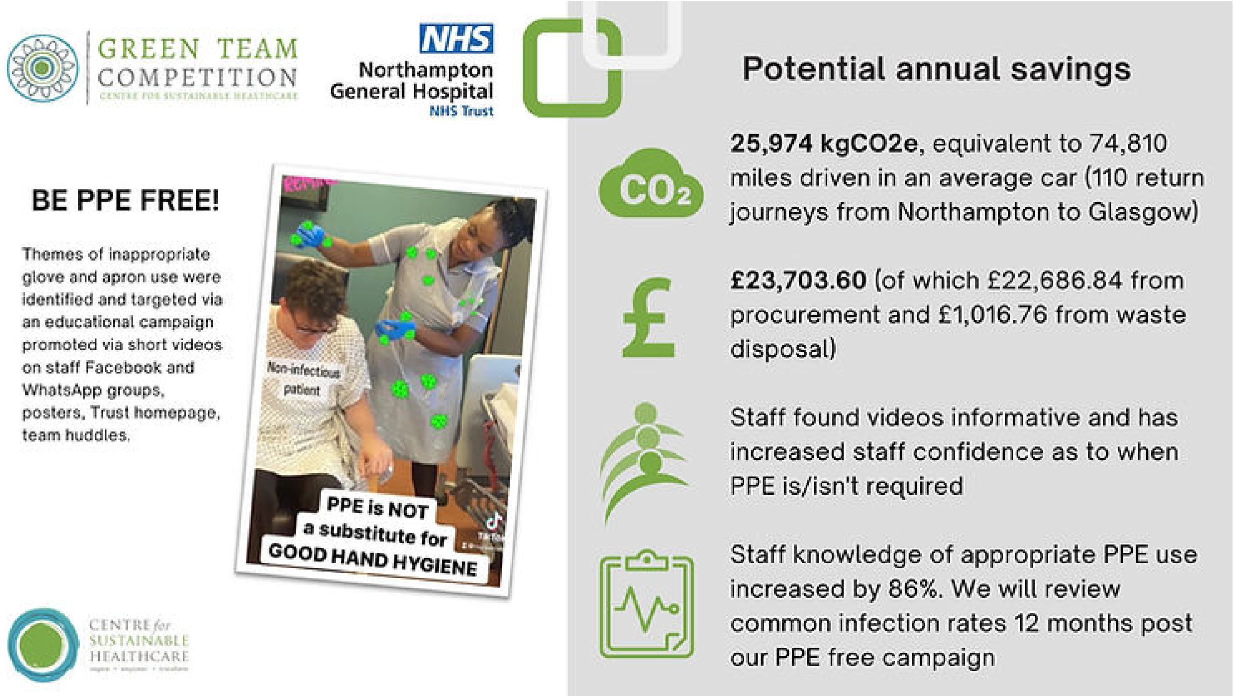
CENTRE for SUSTAINABLE HEALTHCARE

Mortimer, F. The Sustainable Physician. Clin Med 10(2). April 1, 2010. D110-111.

Sustainability in Quality Improvement (SusQI)



https://www.susqi.org/case-studies



IPAC – appropriate indication for IVAD

- IPAC – risk assess

NHS England Delivering a net zero NHS

To deliver the world's first net zero health service and respond to climate change, improving health now and for future generations.

Great Ormond Street Hospital – reducing single use plastics

Used to use 11 million nonsterile gloves a year

Reduced by 3.7 million nonsterile gloves

Language??

https://www.england.nhs.uk/greenernhs/

Letting go of nonsterile gloves!

Global Green and Healthy Hospitals

1900 Members in over 80 countries

- LEADERSHIP
- CHEMICALS
- WASTE
- ENERGY
- WATER
- TRANSPORTATION
- FOOD
- PHARMACEUTICALS
- BUILDINGS
- PURCHASING

https://greenhospitals.org/

LEADERSHIP

Prioritize environmental health

CHEMICALS

Substitute harmful chemicals with safer alternatives

WASTE

Reduce, treat and safely dispose of healthcare waste

ENERGY

Implement energy efficiency and clean, renewable energy generation

WATER

Reduce hospital water consumption and supply potable water

TRANSPORTATION

Improve transportation strategies for patients and staff

FOOD

Purchase and serve sustainably grown, healthy food

PHARMACEUTICALS

Safely manage and dispose of pharmaceuticals

BUILDINGS

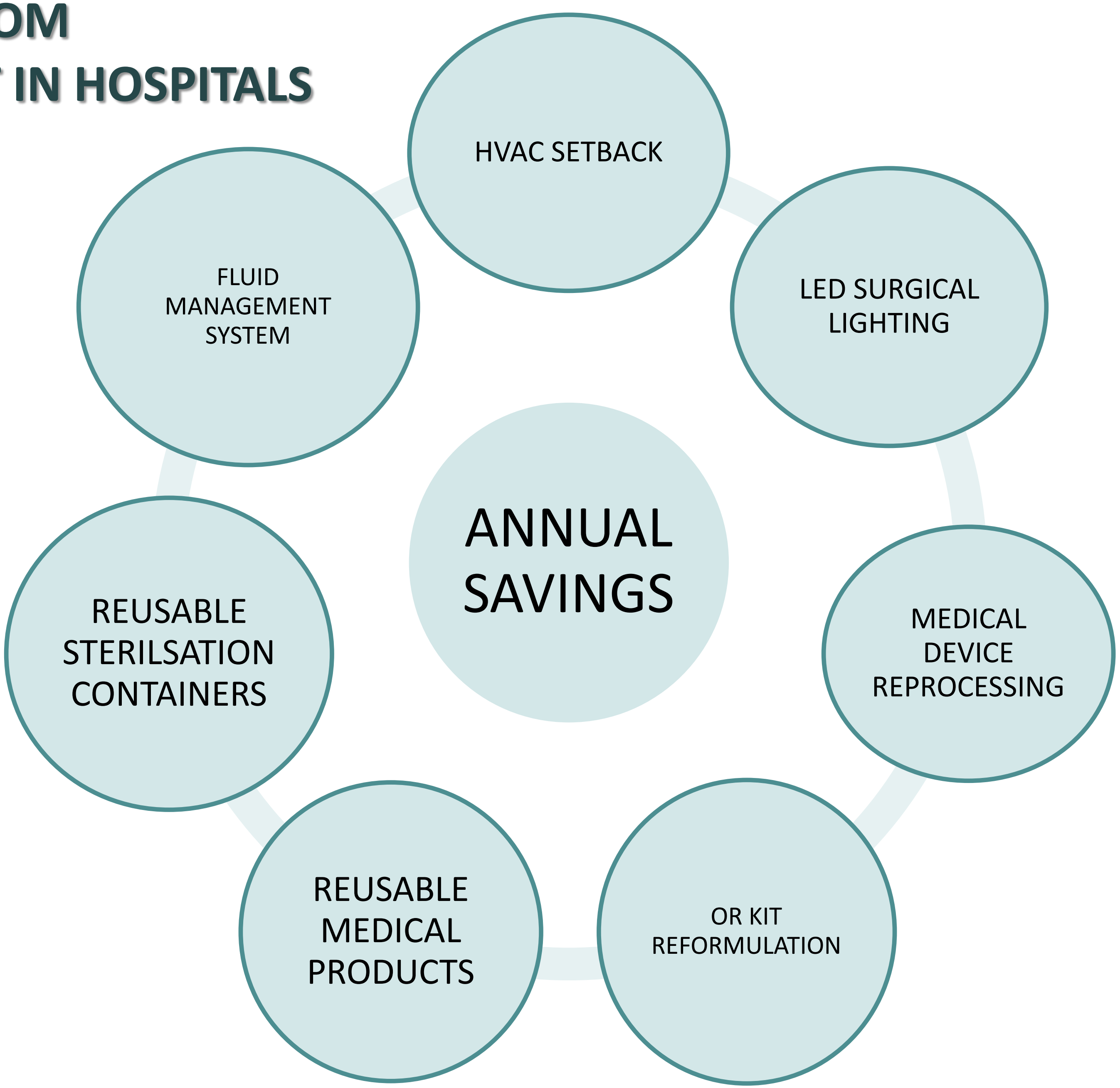
Support green and healthy hospital design and construction

PURCHASING

Buy safer and more sustainable products and materials

https://greenhospitals.org/goals

POTENTIAL COST SAVINGS FROM SUSTAINABLE PROCUREMENT IN HOSPITALS (PRACTICE GREENHEALTH)



https://greenhospitals.org/sites/default/files/2022-09/Sustainable%20Procurement%20Guide.pdf

Balancing Sustainability and Infection Control

Adapted from information from: https://libguides.anzca.edu.au/enviro/
Speaker: Renae McBrien

- Anaesthetists apparently the voice and founding body of sustainability

- Build through a plan – build governance

GLOBAL GREEN and HEALTHY HOSPITALS

Global Green Health Hospital Targets

7kg per OBD general waste

3kg per OBD clinical waste

2 kg per OBD recycling

CLINICAL EXCELLENCE COMMISSION

Hospital waste – regulated and confusing

Apparently, we don’t educate our HW

IPAC - Years of trying to educate (2015)

HETI- My Health Learning Waste Management

IMPROVE!

Top things in our Bins – Using IPAC to mitigate

1. Expired consumables
2. Plastic Gloves and Gowns
3. Plastic medical trays
4. Plastic wipes and buckets
5. Plastic Bags
6. Plastic packaging – soft plastic

Promote partnerships – to build and scale for appropriate use for Healthcare

Promote Internal partnerships – community swap: Free shelving Unit

Free Moving Boxes

Recycle clear sterilised plastic

Soft plastic recycling stream

Theatre/ Clinical Metal Recycling

Donating Crutches overseas

No matter what, with all things sent to IPAC for their endorsement and approval

IPAC

Expired Consumables	Medical Market day
Plastic Bags	Removal – replace with reusable buckets
Plastic Wipes & Buckets	Remove access if don't need / reuse
Plastic Gloves & Gowns	Removal of gowns and gloves from bedside
Plastic Medical Trays	Clean the green

Swap Meet

Painters using

Unnecessary PPE

Good (BUSINESS) common sense back into HC

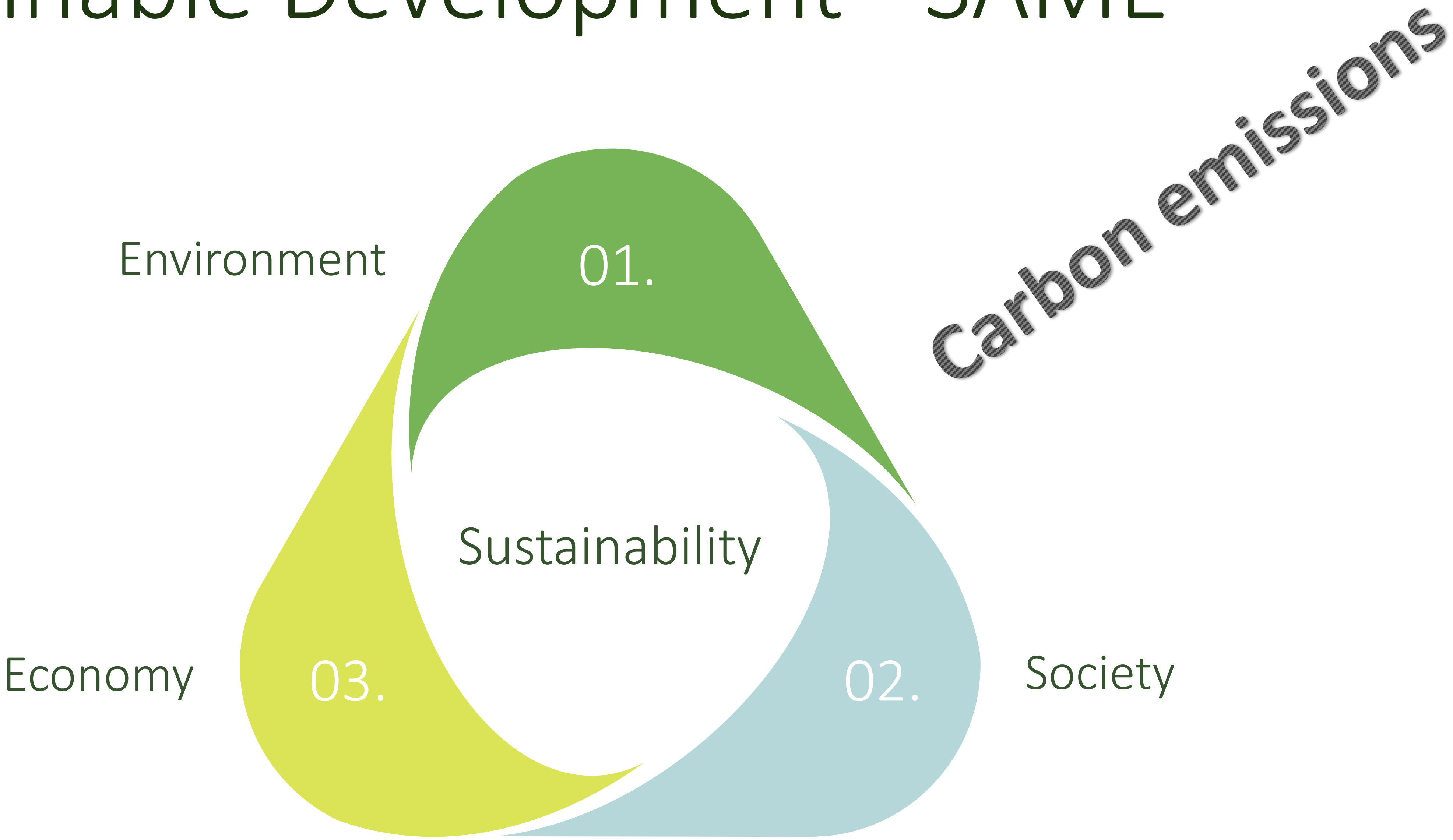
Good Business

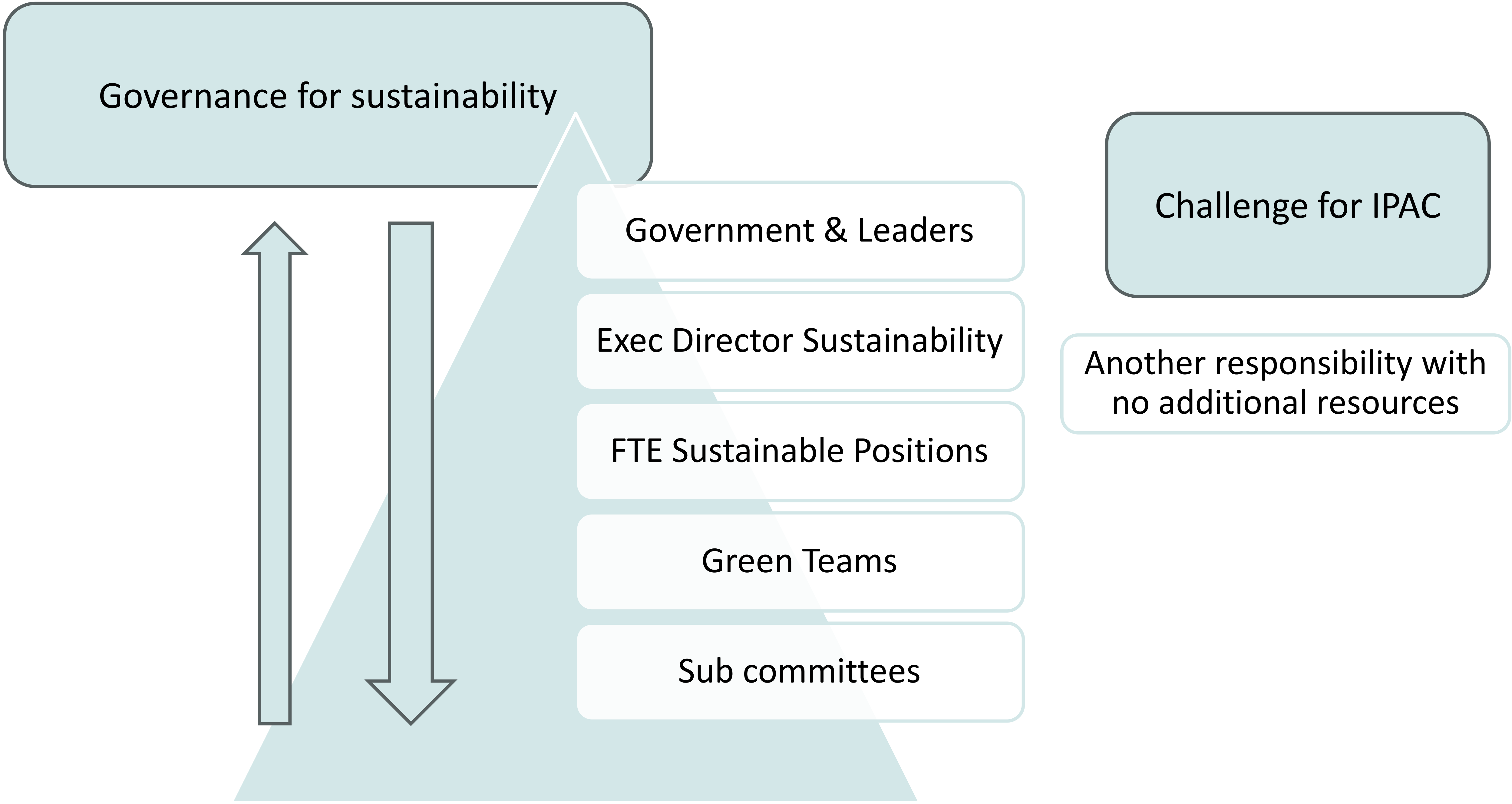
Common Sense is not so common

NOT IPAC Guidelines rather interpretation and operationalising of guidelines

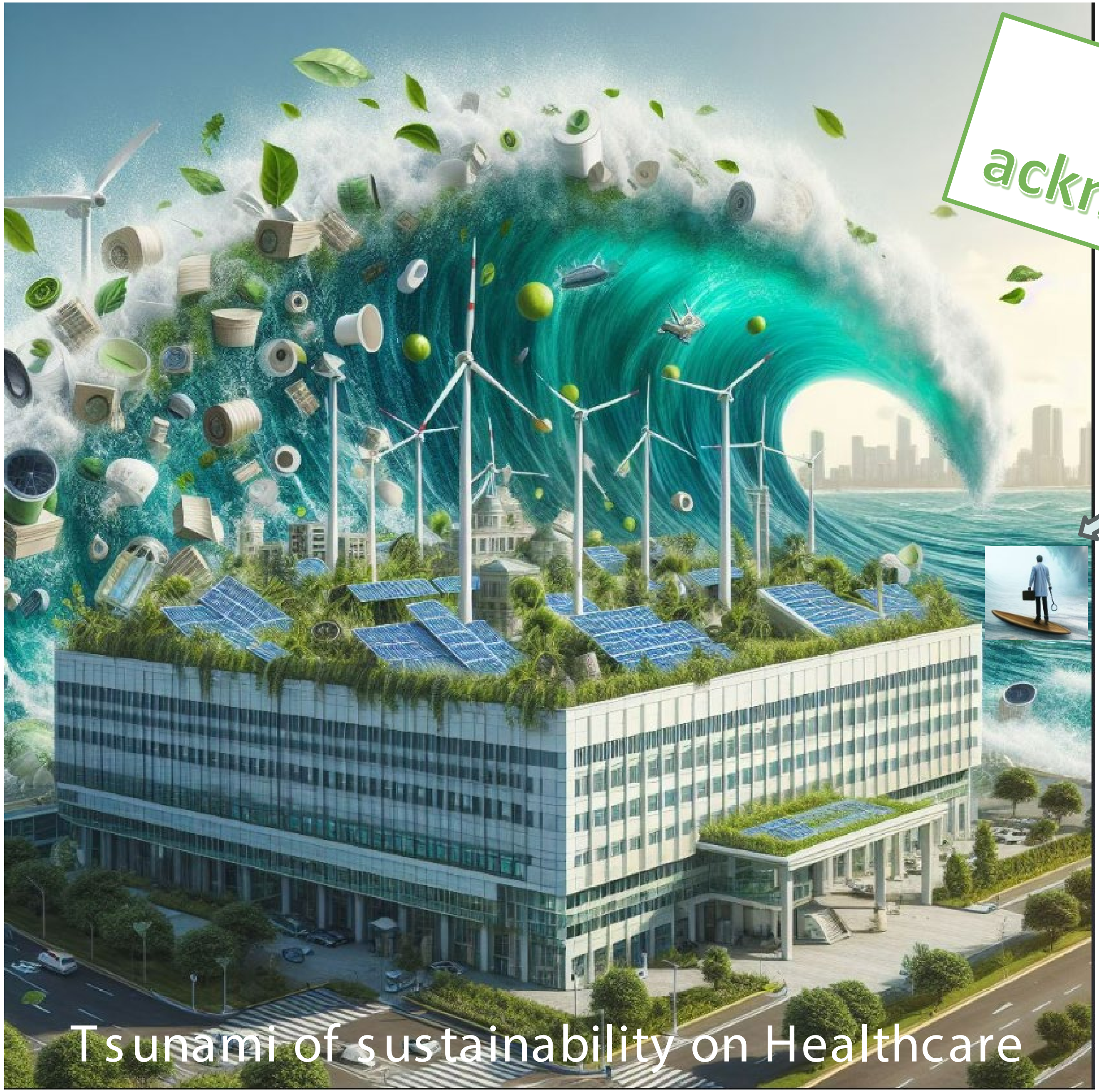
IPAC CAN HELP LEAD THAT BUSINESS WITH COMMON SENSE RISK MANAGEMENT

Sustainable Development - SAME





Governance for sustainability
Government & Leaders
Exec Director Sustainability
FTE Sustainable Positions
Green Teams
Sub committees
Challenge for IPAC
Another responsibility with no additional resources



IF IPAC can lead – we need acknowledgement and resourcing

ICP

Generated with AI · 6 April 2024 at 5:15 pm

Scrub or Rub

https://libguides.anzca.edu.au/enviro/
Speaker: Justin Hii

© Kathy Dempsey

Environmental benefits of ABHR

- Need environmental benefits, Clinical benefits and cost benefits

IPAC supported

– NSW pre-2020
– LHDs 2016
– HHA and NHHI

Infection control: principles and regulations

https://libguides.anzca.edu.au/enviro/
Speaker: David New

We want to be green too!

Logic behind IPAC

- Sterilisation
- Disinfection
- Cleaning

Spalding Classification
- Critical
- Semi-critical
- Non-critical

ACSQHC – STD 3
AS 5369 – RISK Mx Approach
TGA

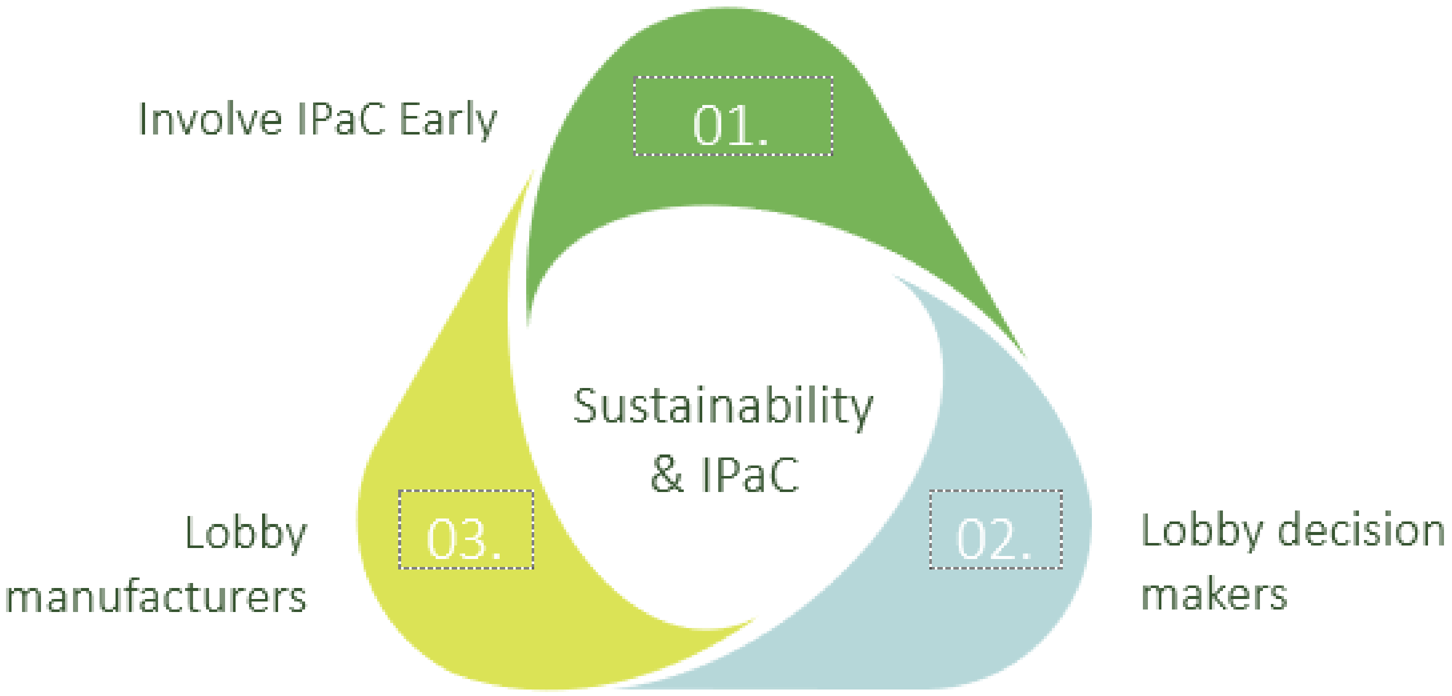
REGULATIONS, CAPACITY, INTEGRITY

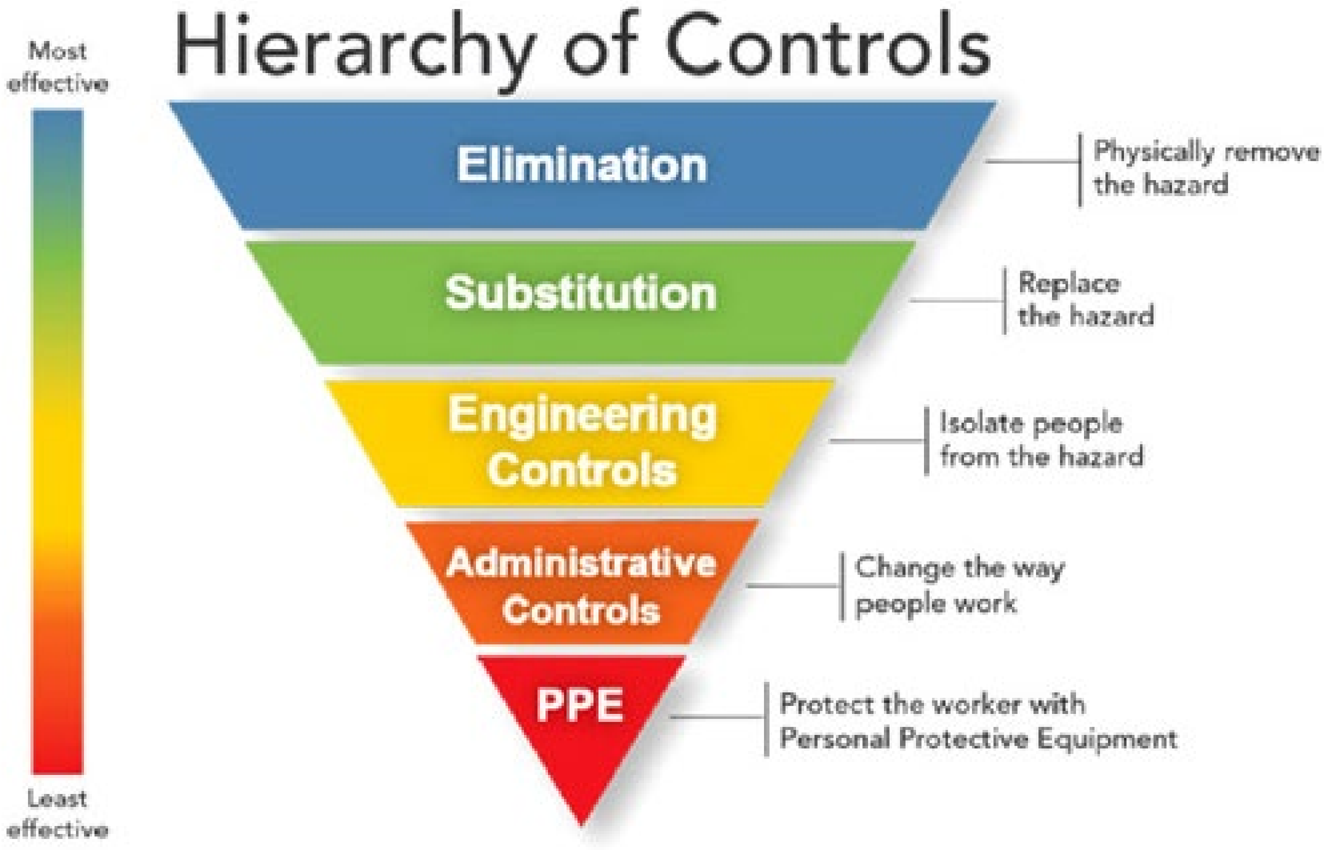
MANUFACTURERS

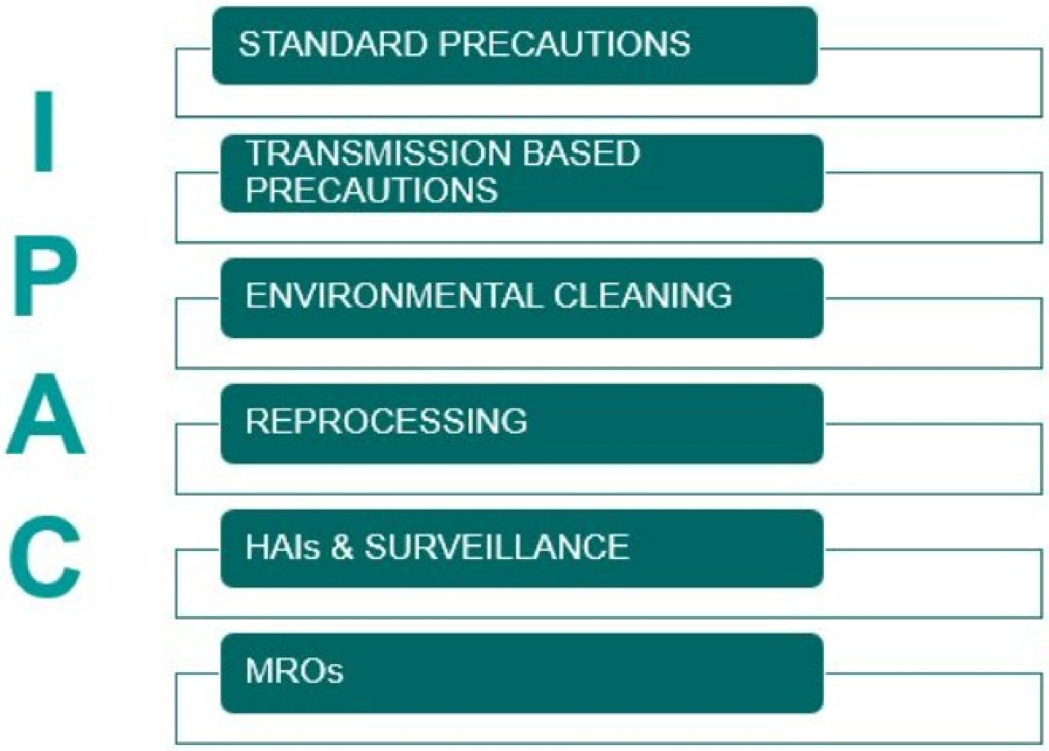
PPE

Risk assessment

https://libguides.anzca.edu.au/enviro/
Speaker: David New



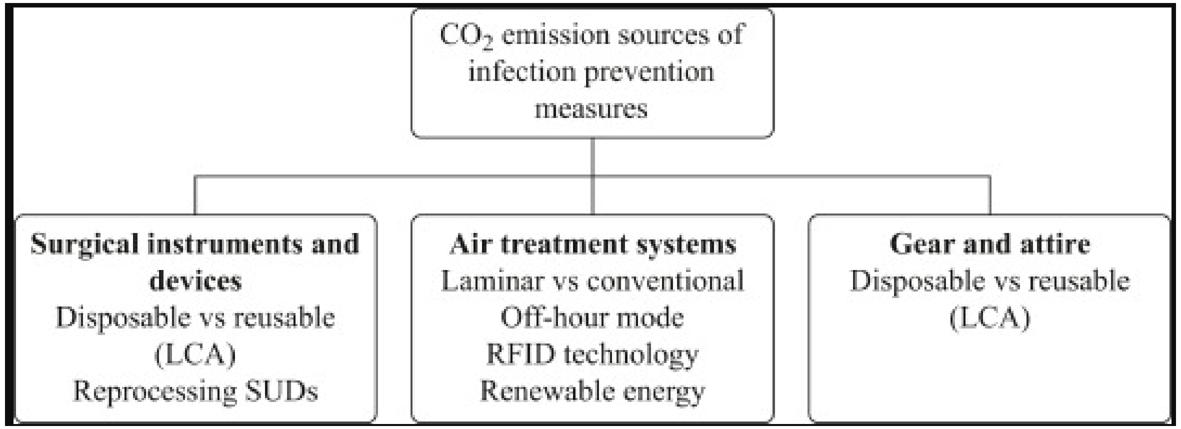




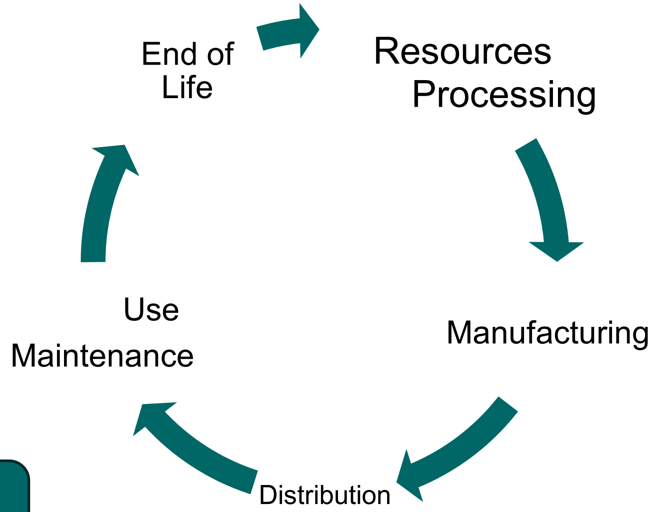
Personal protective equipment (PPE): PPE is the least effective method for protecting workers from hazards. PPE includes masks, gloves, or other protective equipment to reduce exposure. PPE should be used in addition to other methods or if there are no other effective ways to control the hazard. This intervention relies on worker behavior change and should be the last line of defense.

Single-use vs reusable, and its impact

Bolten *et al* 2022-The carbon footprint of the operating room related to infection prevention measures: a scoping review



Evidence suggests that the use of disposable items instead of reusable items generally increases the carbon footprint, **<u>depending on sources of electricity</u>**



LCA – Lifecycle assessment

Novel Technologies and "magic" solutions in the name of sustainability

Glove Use – improving HH

Electrolysed Water

Biocide

Reusable sterile surgical gowns

Laundry and energy

Launder 100 times

Anaesthetic Trays

- Noncritical if just carrying items
- Critical if holding sterile pieces

Steam sterilisation's energy and water footprint

McGain *et al* 2017 VIC Australia study over 304 days

2173 active cycles, 1343 standard (134°C) cycles that had an average load mass of 21.2kg, with 32% of cycles <15kg

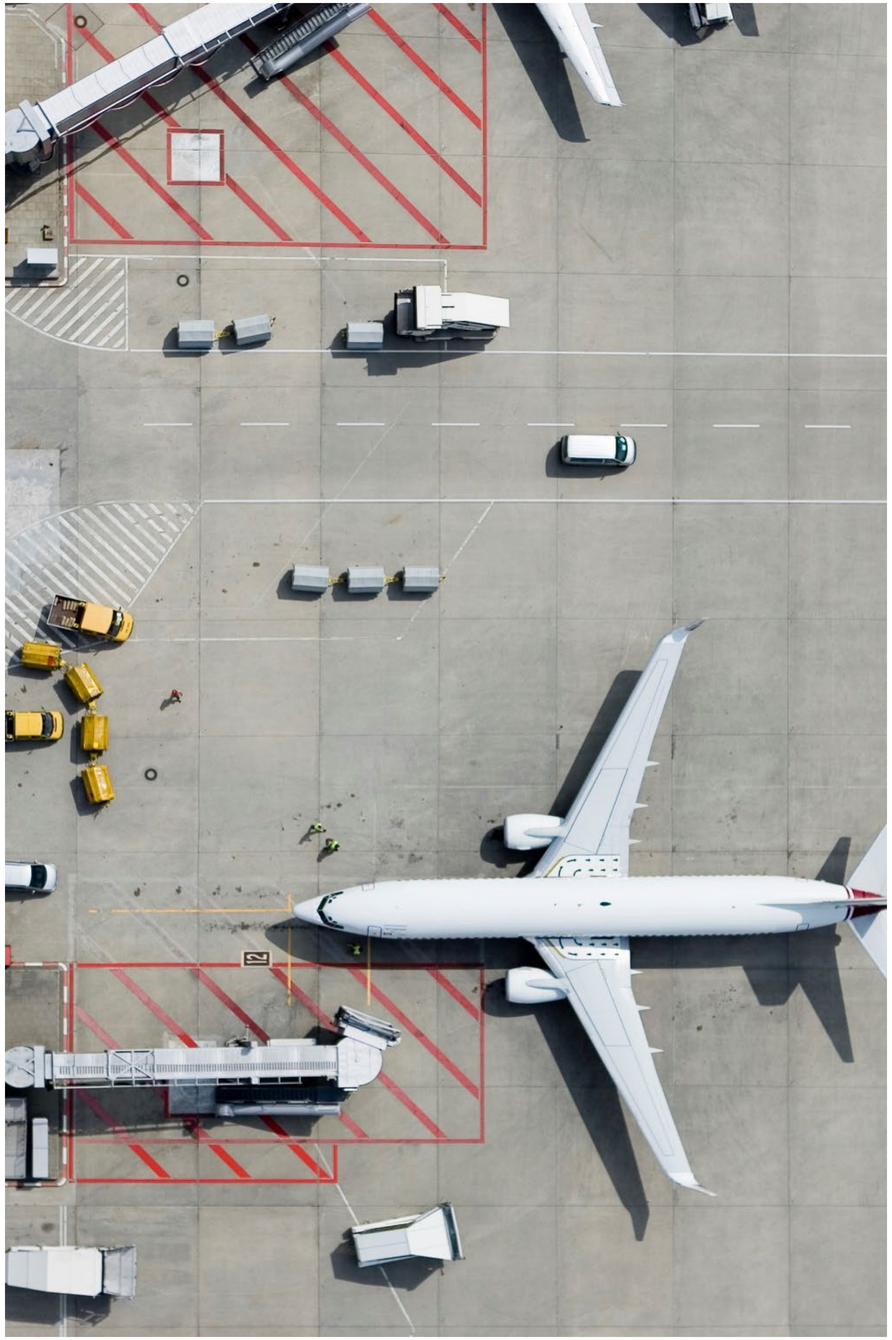
Electricity used for active cycles was 32,652kWh

Water used was 1243495L

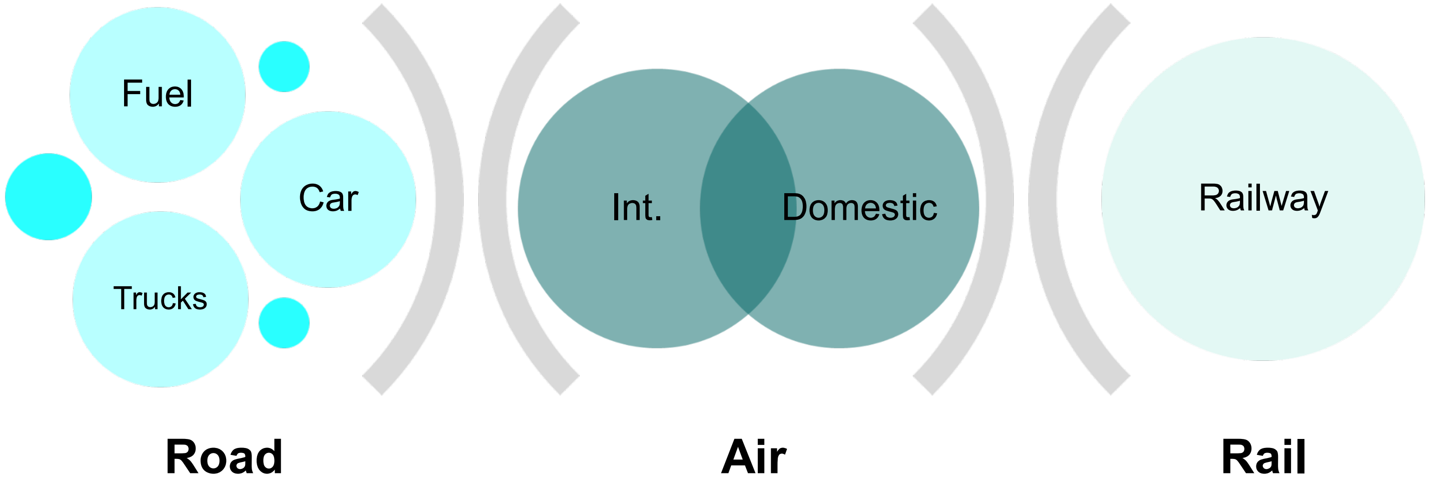
Standby used 21457kWh

Water 329200L

Considerable electricity and water use occurred during standby, load mass was only moderately predictive of electricity consumption and light loads were common yet inefficient.



Transportation



BARRIERS

PEOPLE IN CHARGE WITHOUT ALL THE EVIDENCE!

OR

SUSTAINABILITY WITHOUT COMPLETE LIFE CYCLE & PATIENT SAFETY EVIDENCE!

OR

IPaC the gatekeepers of quality and safety
Translation to - IMPLEMENTATION & OPERATIONALISATION
LIFE CYCLE Considerations

IPaC © Kathy Dempsey

Expectation vs reality

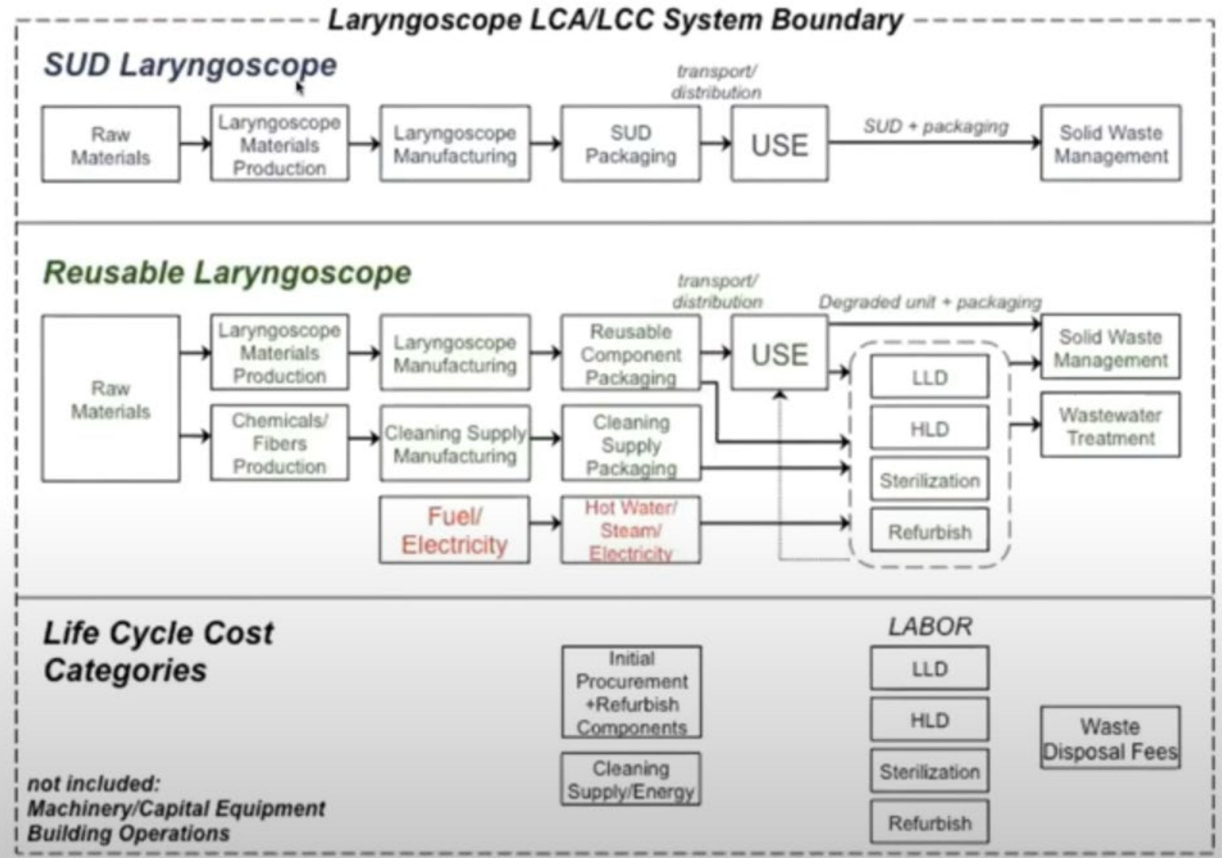
Glove off project- Use gloves in situations involving possible contact with blood or body fluids, mucous membranes, non-intact skin (standard precautions)

Natural vs mechanical ventilation - COVID-19, Influenza, ARI in general, TB, measles, Chickenpox etc

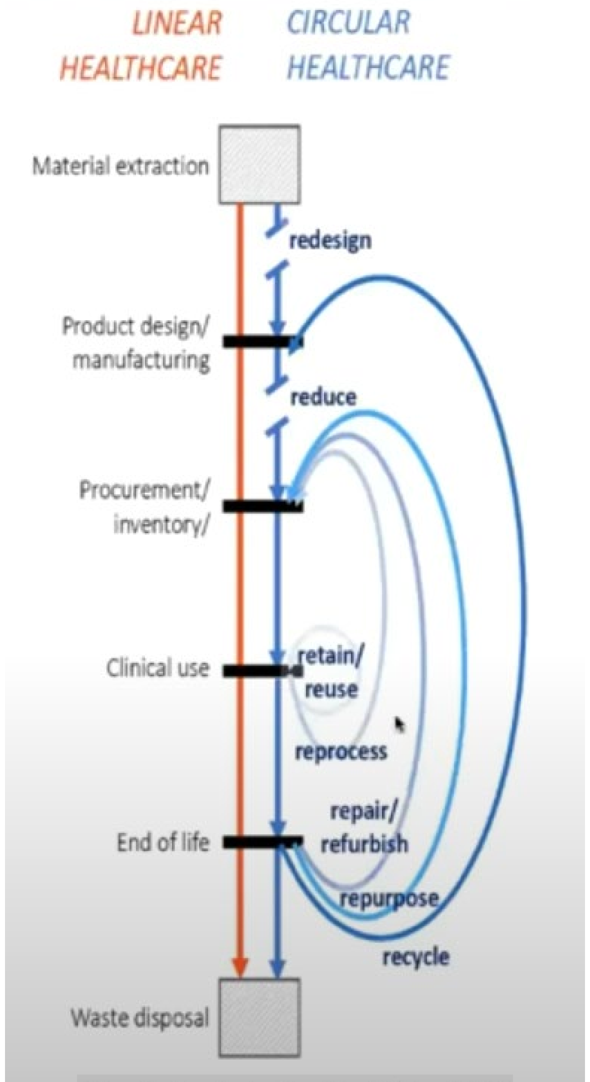
Single use vs reusable – Cost of cleaning, disinfection, sterilization (water, electricity, wrapping material, consumable e.g., indicator tape, dust cover, PPE, chemicals, storage space, human resource, transportation (fuel, time, human resource)

Healthcare Acquired Infections (HAIs)

MYTH – IPaC DRIVING SUD



Sherman, Raibley, Eckelman, *A&A* 2018



MacNeill, et al., Health Affairs 2020

Reusable v's disposable

Not the defacto answer for ALL our needs

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Sustainable IPAC: Our challenges

- Risk of healthcare associated infection
- Emerging pathogens and antimicrobial resistance
- Funding and resourcing
- Staffing challenges
- Access to medical supplies and equipment
- Infection prevention process and systems (not every facility is the same e.g. rural vs metro)
- Our standards, policies and obligations towards the provision of safe and quality healthcare
- Protecting our workforce

References

RACP Climate Change and Australia's Healthcare Systems

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Future Health: Guiding the next decade of health care in NSW 2022-2032

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Keil, M., Viere, T., Helms, K., & Rogowski, W. (2023). The impact of switching from single-use to reusable healthcare products: a transparency checklist and systematic review of life-cycle assessments. European journal of public health, 33(1), 56–63. https://doi.org/10.1093/eurpub/ckac174

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https://www.england.nhs.uk/greenernhs/whats-already-happening/great-ormond-street-hospital-reducing-single-use-plastics-case-study/

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PPT Template : PresentationDeck.com **[Order #9556] (April 5, 2024)**

gama healthcare | ACIPC Australasian College for Infection Prevention and Control

a greener path to safe patient care

Scan the QR code to learn more about GAMA Healthcare's sustainability journey and IPC solutions.

gama healthcare | ACIPC Australasian College for Infection Prevention and Control

Lunch

gama healthcare | ACIPC Australasian College for Infection Prevention and Control

Dr Jon Otter

What's next for IPC? Winter 2024 and beyond

What's next for IPC? Winter 2024 and beyond: setting priorities and scanning the horizon

Jon Otter PhD FRCPath
Director of Infection Prevention and Control & Consultant Clinical Scientist
Guy's and St Thomas' NHS Foundation Trust / Imperial College London
@jonotter
j.otter@imperial.ac.uk
Blog: www.reflectionsIPC.com
Slides: www.jonotter.net

Priorities

What’s hot in IPC

Promoting antimicrobial stewardship

Embedding digital systems to enhance our clinical services

Preventing Gram-negative bloodstream infection

Preventing SSI

Preventing the transmission of SARS-CoV-2 in our hospitals

Promoting antimicrobial stewardship

Embedding digital systems to enhance our clinical services

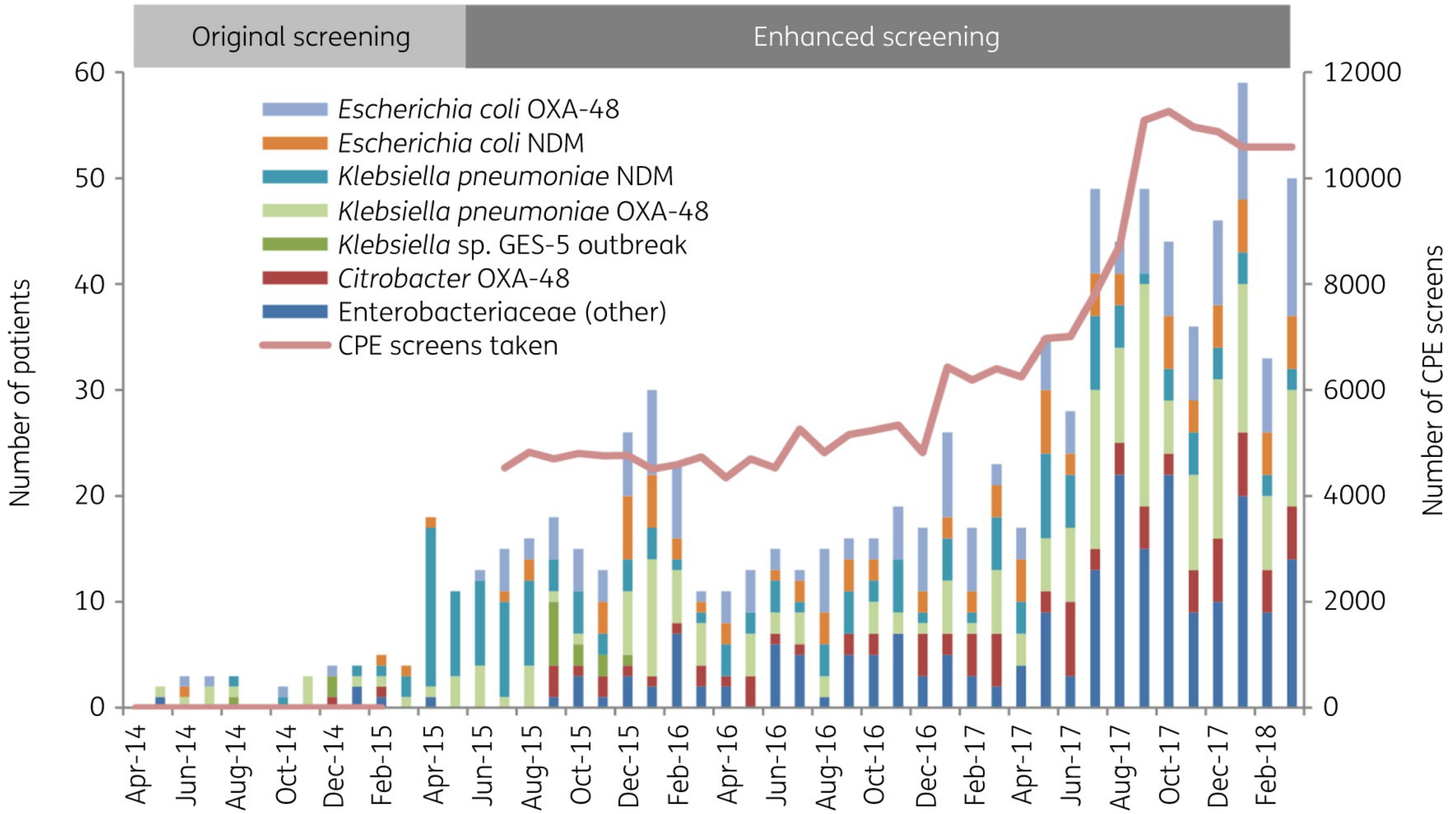
Preventing Gram-negative bloodstream infection

Preventing SSI

Preventing the transmission of SARS-CoV-2 in our hospitals

CPE: seek and ye shall find?

Overall trend in CPE detected at Imperial, by bacterial species and mechanisms, deduplicated by patient



Otter et al. J Antimicrob Chemother 2020.

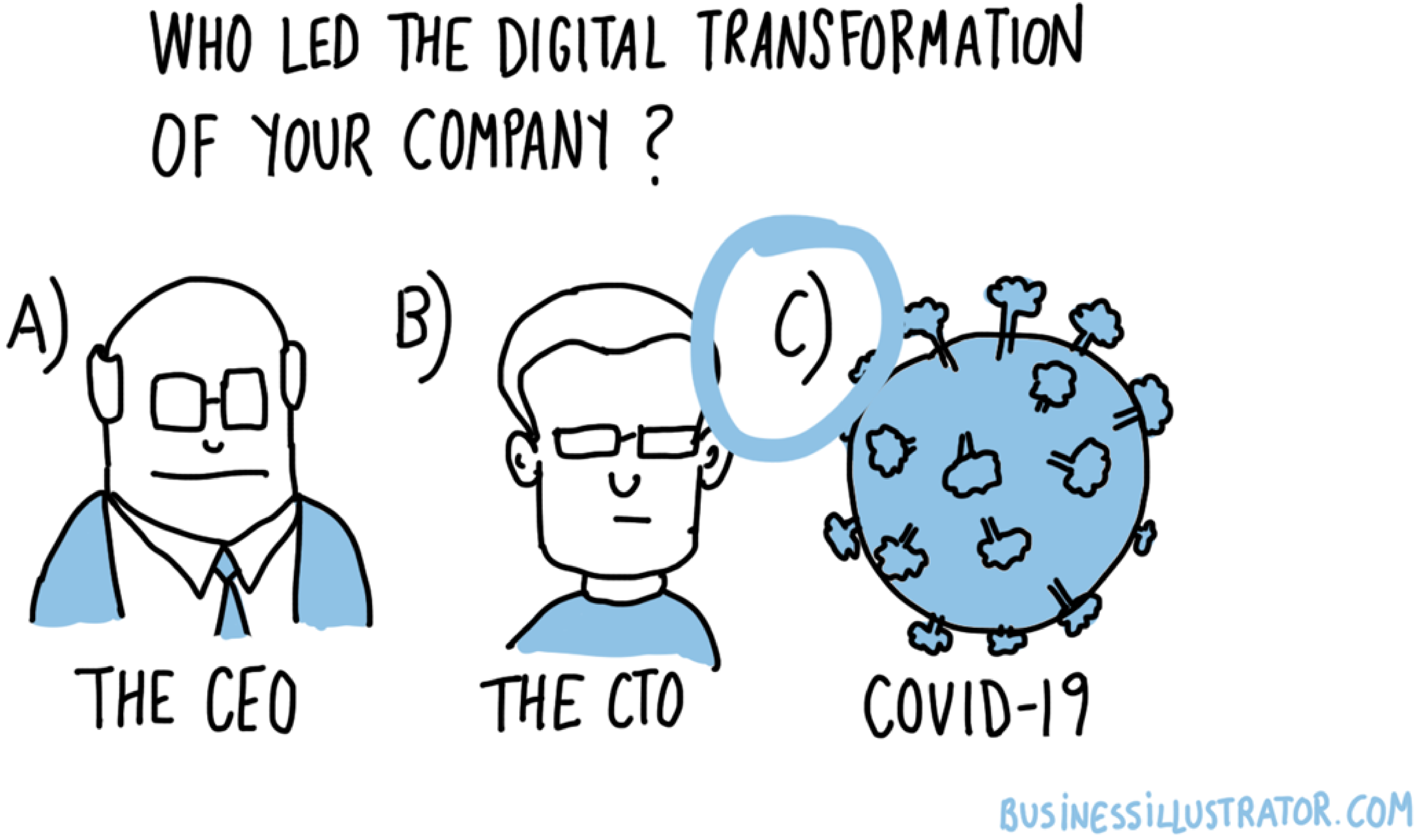
Promoting antimicrobial stewardship

Embedding digital systems to enhance our clinical services

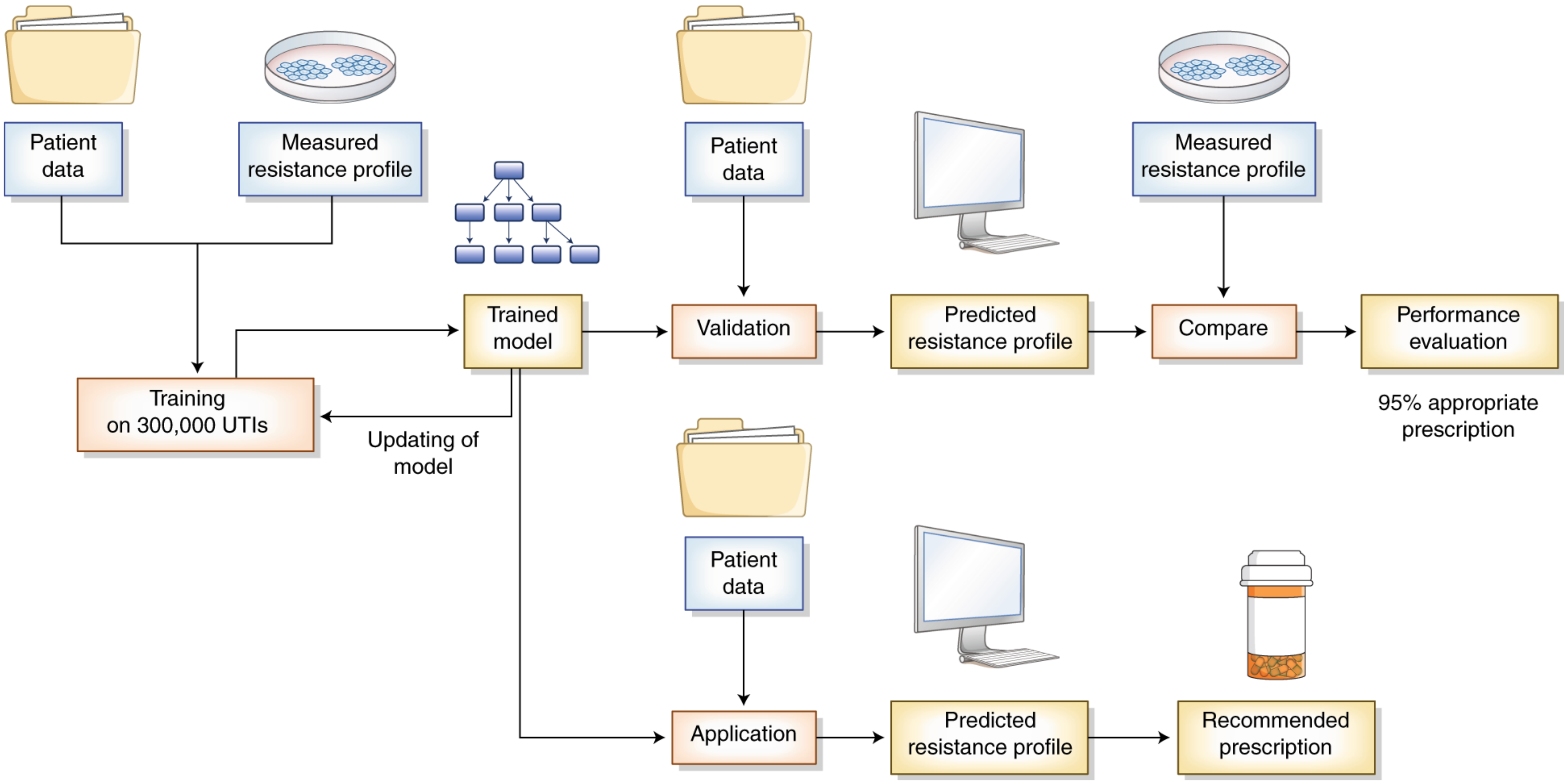
Preventing Gram-negative bloodstream infection

Preventing SSI

Preventing the transmission of SARS-CoV-2 in our hospitals


WHO LED THE DIGITAL TRANSFORMATION OF YOUR COMPANY ?
A)
THE CEO
B)
THE CTO
C)
COVID-19
BUSINESSILLUSTRATOR.COM

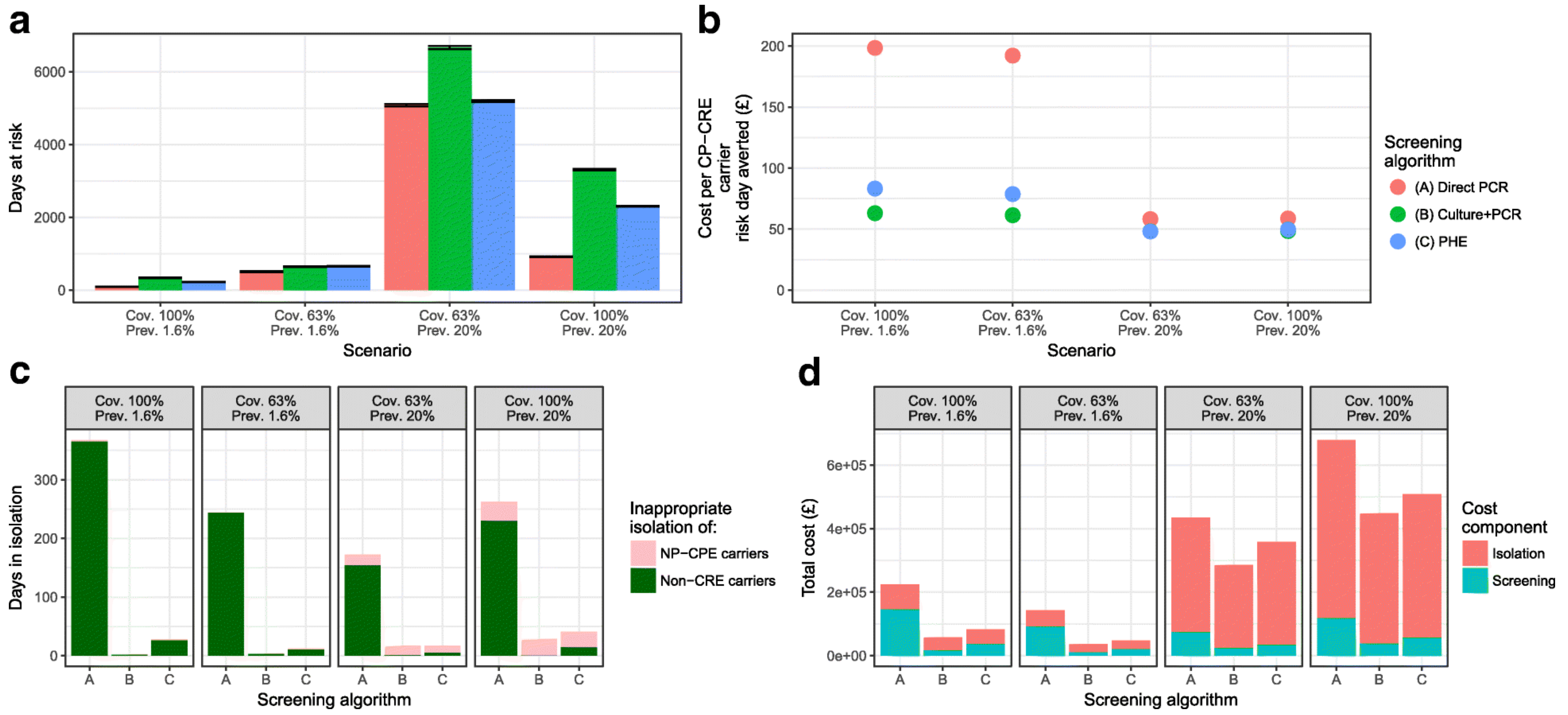
Machine learning / AI: antimicrobial prescribing decision support



Didelot et al. Nature Medicine 2019.

Modelling

Fast and expensive (PCR) or cheap and slow (culture)? A mathematical modelling study to explore screening for carbapenem resistance in UK hospitals



Knight BMC Medicine 2018.

Promoting antimicrobial stewardship

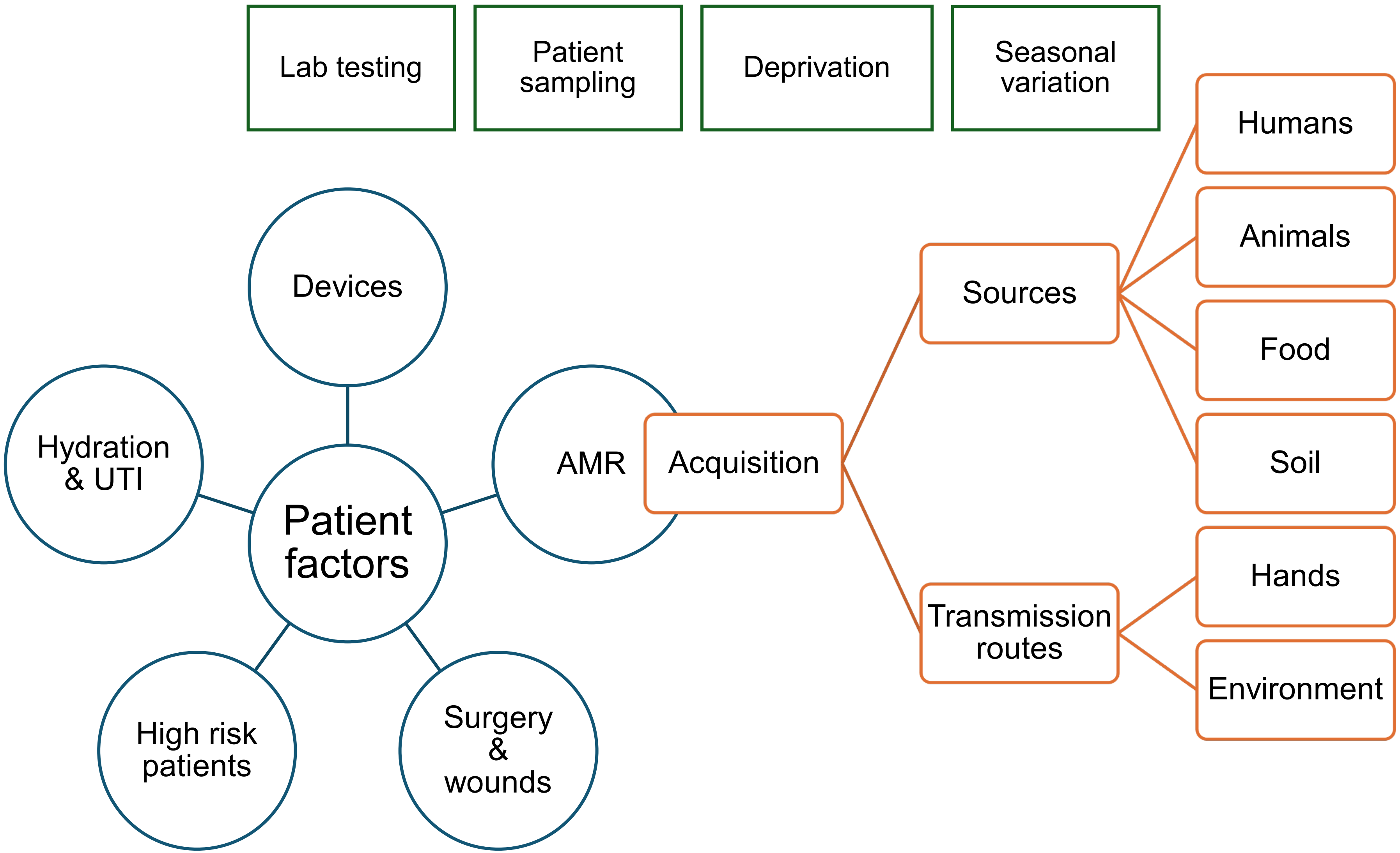
Embedding digital systems to enhance our clinical services

Preventing Gram-negative bloodstream infection

Preventing SSI

Preventing the transmission of SARS-CoV-2 in our hospitals

Drivers of Gram-negative BSI



Promoting antimicrobial stewardship

Embedding digital systems to enhance our clinical services

Preventing Gram-negative bloodstream infection

Preventing SSI

Preventing the transmission of SARS-CoV-2 in our hospitals

Patient experience

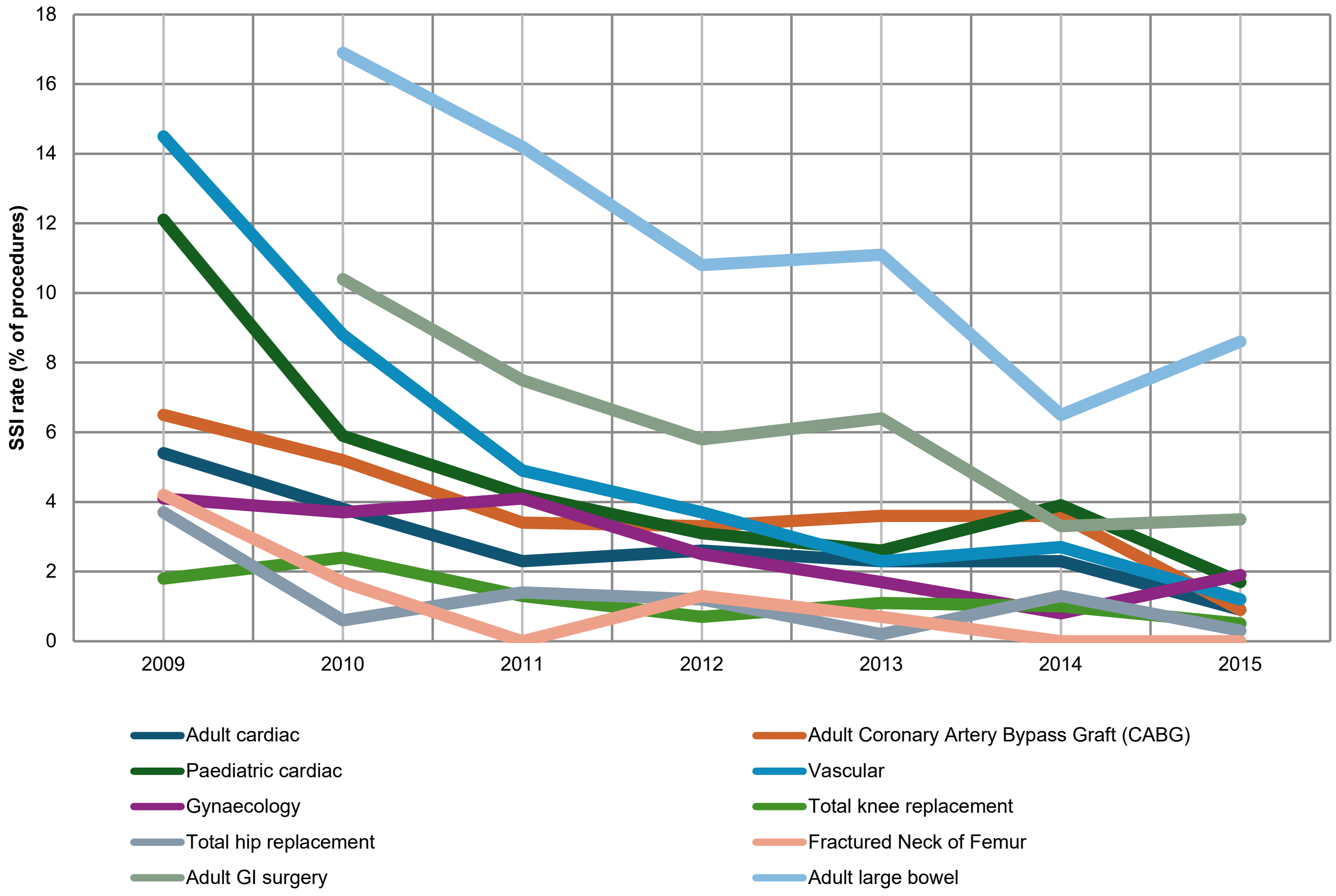
17 patients who had suffered an SSI were enrolled into a semi-structured interview

‘I was crying, I was just not well at all. I couldn’t keep a drink down. The GP came and said what do you expect, you’ve had major surgery. I started to think I was going mad, perhaps you are supposed to feel like this. My husband was at his wits end, he didn’t know what to do. He called the NHS helpline and they said to buy some anti-sickness tablets from the chemist but they didn’t work. He rang the hospital and they weren’t very helpful, he rang the ward and they said she has been discharged so there is nothing we can do. Then after three or four days I was getting terrific pains in my stomach and I felt like I had wet myself, there was a lot of blood just gushing out of me.’

Tanner et al. J Infect Prevent 2012

SSI prevention: a success story

SSI surveillance at GSTT began to be enhanced in January 2009. The Trust now performs SSI surveillance in 12 surgical specialties. Assuming that the latest and lowest rate of SSI was achievable from the start of the programme, the reductions achieved suggest that 774 SSIs have been prevented. Assuming each SSI costs £5,239, this has resulted in savings of £4,056,443 over 6 years.



Unpublished data, with permission from GSTT.

Promoting antimicrobial stewardship

Embedding digital systems to enhance our clinical services

Preventing Gram-negative bloodstream infection

Preventing SSI

Preventing the transmission of SARS-CoV-2 in our hospitals

PPE	Transmission routes	Testing and laboratory factors	Vaccination
Organizational transformation	Guidelines and policy development	Regulatory framework	Outbreaks
Non-COVID pathogens	Antimicrobial stewardship	Digital transformation	Applied research

Promoting antimicrobial stewardship

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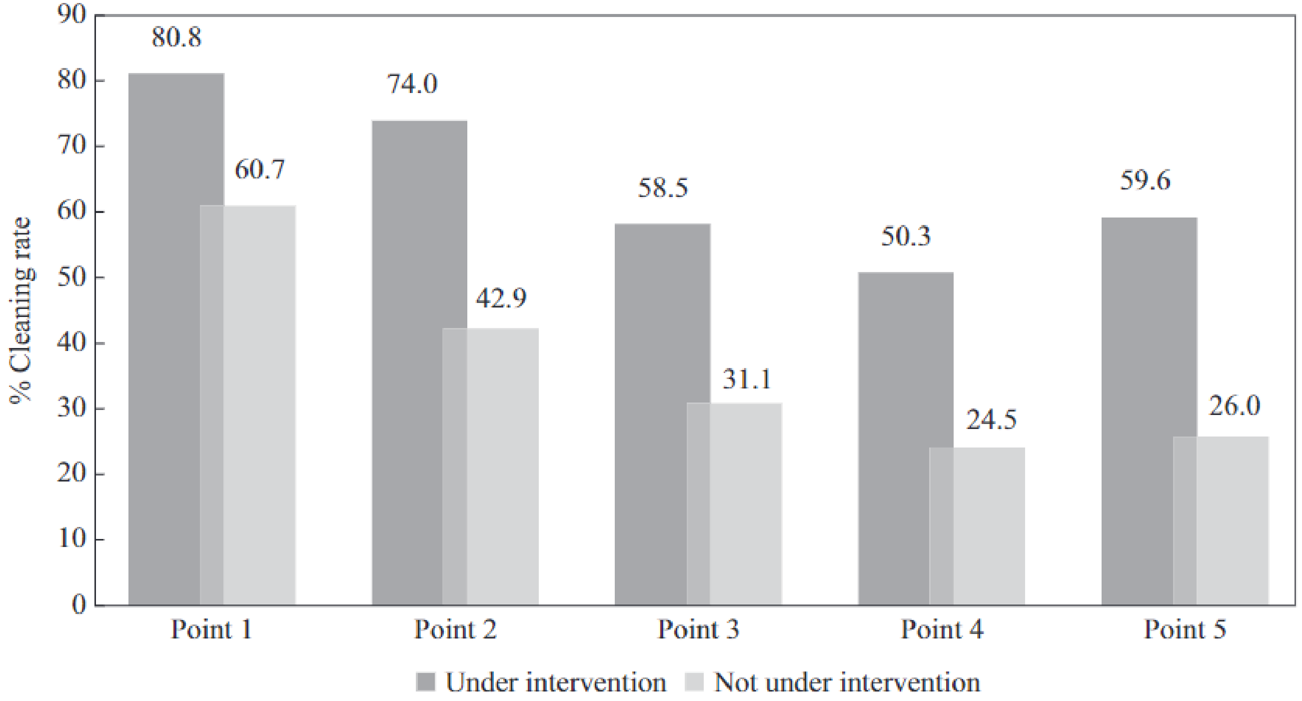
Priorities

What’s hot in IPC

More effective surface disinfection improves patient outcomes

- Prospective intervention cluster cross-over study in Israel.
- Performed over 15 months, including 7,725 patients.
- Intervention was a switch from "bucket-based" chlorine disinfection to routine use of QAC-based wipes.



Outcome	Effect (95% CI)	*P*-value
CLABSI/CAUTI[a]		
IRR	1.6 (0.7, 3.5)	0.3
IRD	12.2/100,000 person-days (−9.7, 34.2)	0.3
CLABSI[a]		
IRR	2.0 (0.5, 8.0)	0.3
IRD	5.2/10,000 person-days (−5.4, 15.7)	0.3
CAUTI[b]		
IRR	1.4 (0.8, 2.4)	0.2
IRD	6.7/10,000 person-days (−4.2, 17.7)	0.2
MDRO contamination[c]		
OR	0.7 (0.5, 1.0)	0.06
Predicted probability difference	−7.0% (−13.6%, −0.5%)	0.04
MDRO acquisition[d]		
HR	0.4 (0.2, 1.0)	0.04
Risk difference	−7.6% (−7.7%, −7.4%)	NA
In-hospital mortality[e]		
IRR	0.8 (0.7–1.0)	0.03
IRD	−19.8/10,000 person-days (−37.9, −1.6)	NA

Dadon et al. J Hosp Infect 2023.

“Gonna take you right in to the sink splash zone” (duh duh duh)

Category	Examples	Prevalence
A	Vascular access equipment	65%
Bi	Ventilator equipment	18%
Bii	Respiratory equipment	27%
C	Haemofiltration / dialysis	12%
D	Personal care items	68%
E	Nutrition / enteral care	33%
F	Alcohol gel / PPE	57%
G	Housekeeping / cleaning	5%
H	Patient skin contact items	43%
I	Medicines / infusion pumps	32%
J	Negatinve pressure wound care	5%
K	Patients with IV devices	12%
L	Patinets with urinary catheters	18%
M	Invasive monitoring equipment	5%
N	Patinet admission packs	5%

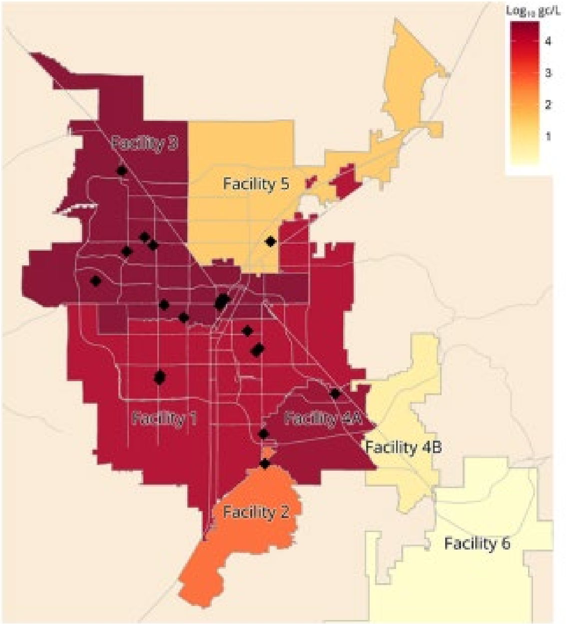
The sink splash zone. Panel A: after running the tap. Panel B: after hand hygiene. Panel C: equipment in the sink splash zone.

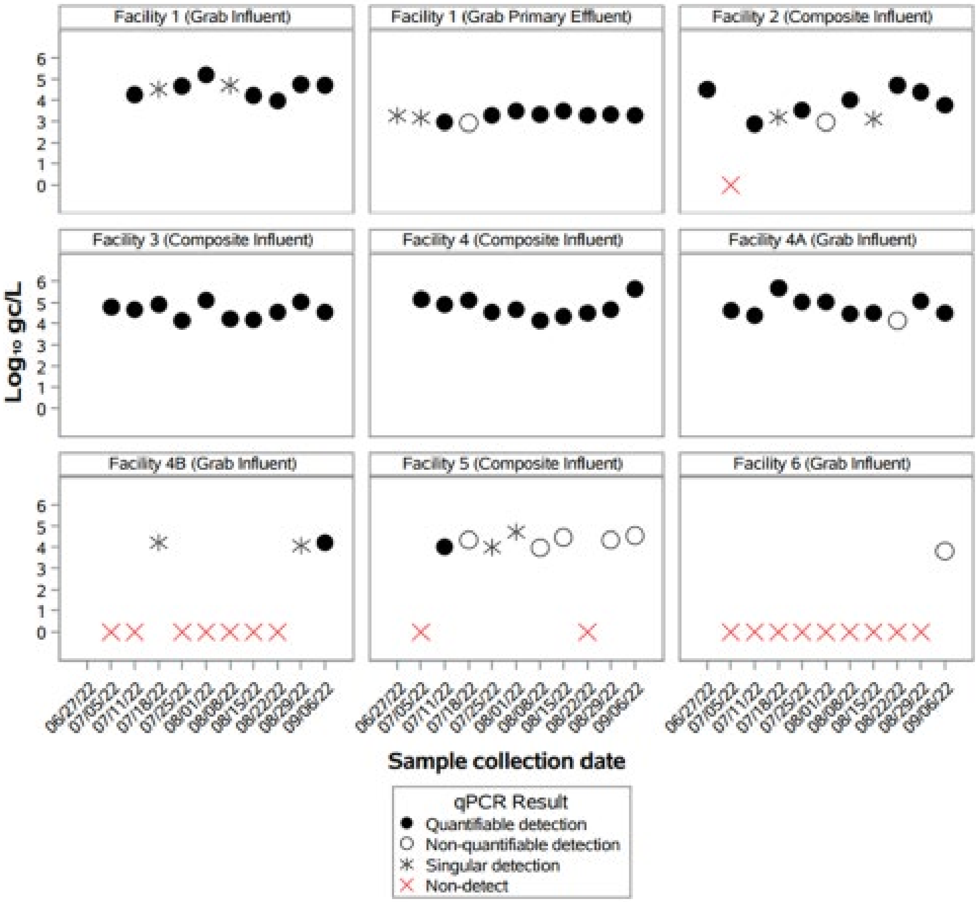
G

Candida auris: coming to a hospital near you…(& wastewater surveillance is pretty cool)

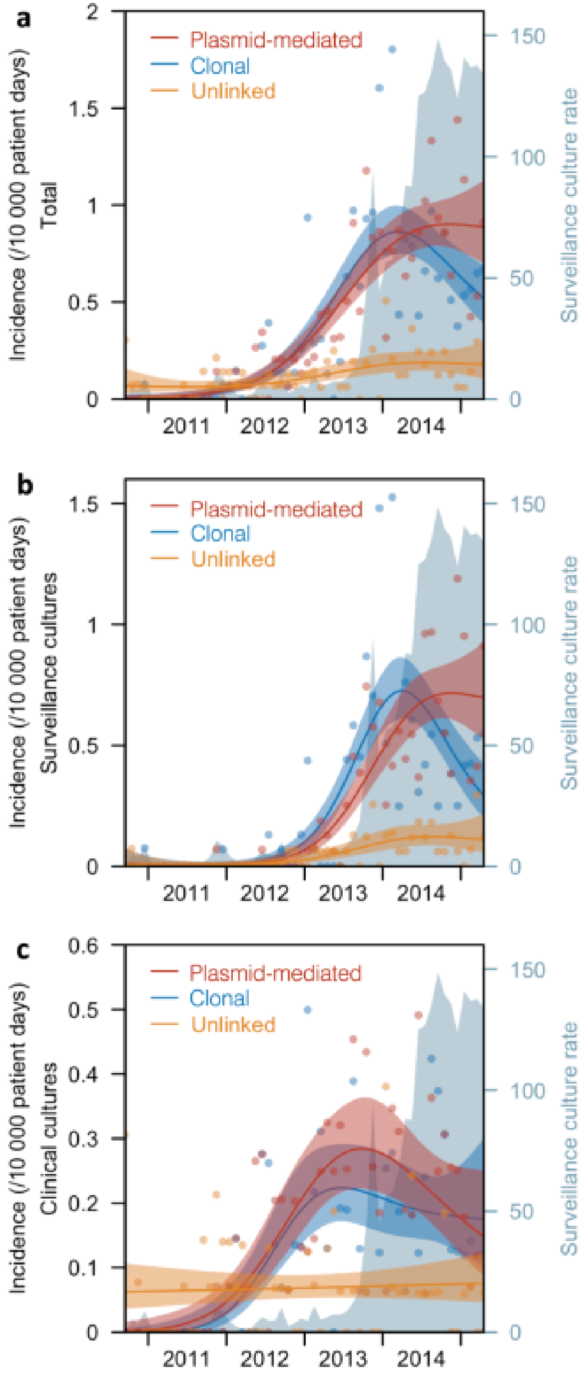
Positive detection 72 of 91 samples (79%); higher detection frequencies in sewersheds serving healthcare facilities involved in the outbreak (94 vs 20% sample positivity)

facility/sewershed	number of state-licensed healthcare facilities, Las Vegas metropolitan area[a]: hospitals[b]	skilled nursing facilities	number of hospitals or skilled nursing facilities with reported *auris* clinical or colonization cas
1	17	12	7
2	4	2	2
3	13	17	11
4A	2	3	1
4B	0	1	0
5	2	2	1
6	1[c]	2	0
total	39	39	22





Barber et al. Env Sci Tech 2023.



Horizontal plasmid transfer is a key driver of CPE transmission

Genomic analysis of 1312 CPEs submitted to government ref lab in Singapore between 2010 and 2015.

Significant risk factors for clonal spread of CPE:

- direct or indirect ward-level contact;
- direct or indirect hospital-level contact;
- bacterial species (*Klebsiella* and *Enterobacter* a higher risk of spread than *E. coli;*
- carbapenemase type (NDM and OXA-type a higher risk of spread than KPC)

Significant risk factors for plasmid-mediated spread of CPE:

- **none**

Marimuthu et al. Nat Comm 2022.

Water-free care demands our attention

Retrospective cohort study including 552 German ICUs, comparing HCAI prevalence in patients cared for in rooms with or without sinks.

Parameter	Category	aIRR	95% CI	*P*-value (type III)
Presence of sink in patient room	Sink group	1.21	(1.01–1.45)	0.039
	No-sink group	1=reference		
Type of ICU	Interdisciplinary in hospital <400 beds	1.001	(0.83–1.21)	0.004
	Interdisciplinary in hospital ≥400 beds	1.278	(1.04–1.57)	
	General surgical	1.255	(1.00–1.59)	
	Special surgical (neurosurgical, cardiovascular)	1.335	(1.00–1.78)	
	Paediatric	2.133	(1.14–4.01)	
	Weaning	0.952	(0.60–1.53)	
	Others	2.11	(1.44–3.10)	
	Medical/neurological	1=reference		
Length of stay (days)	Risk increase per day	1.01	(1.00–1.02)	0.016
Invasive ventilation use	Risk increase per 1%	1.009	(1.00–1.01)	0.001
Urinary tract catheter use	Risk increase per 1%	1.014	(1.01–1.02)	<0.001

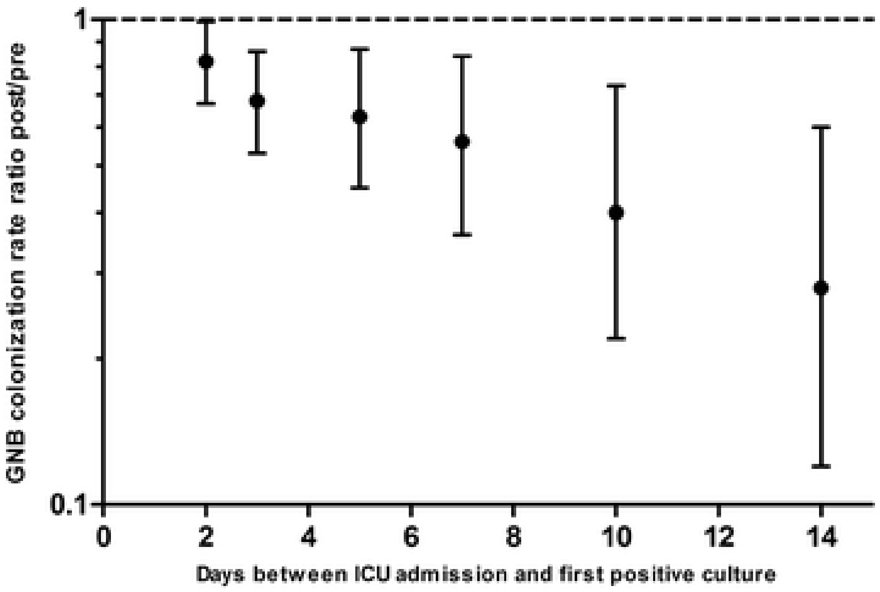
CI, confidence interval.

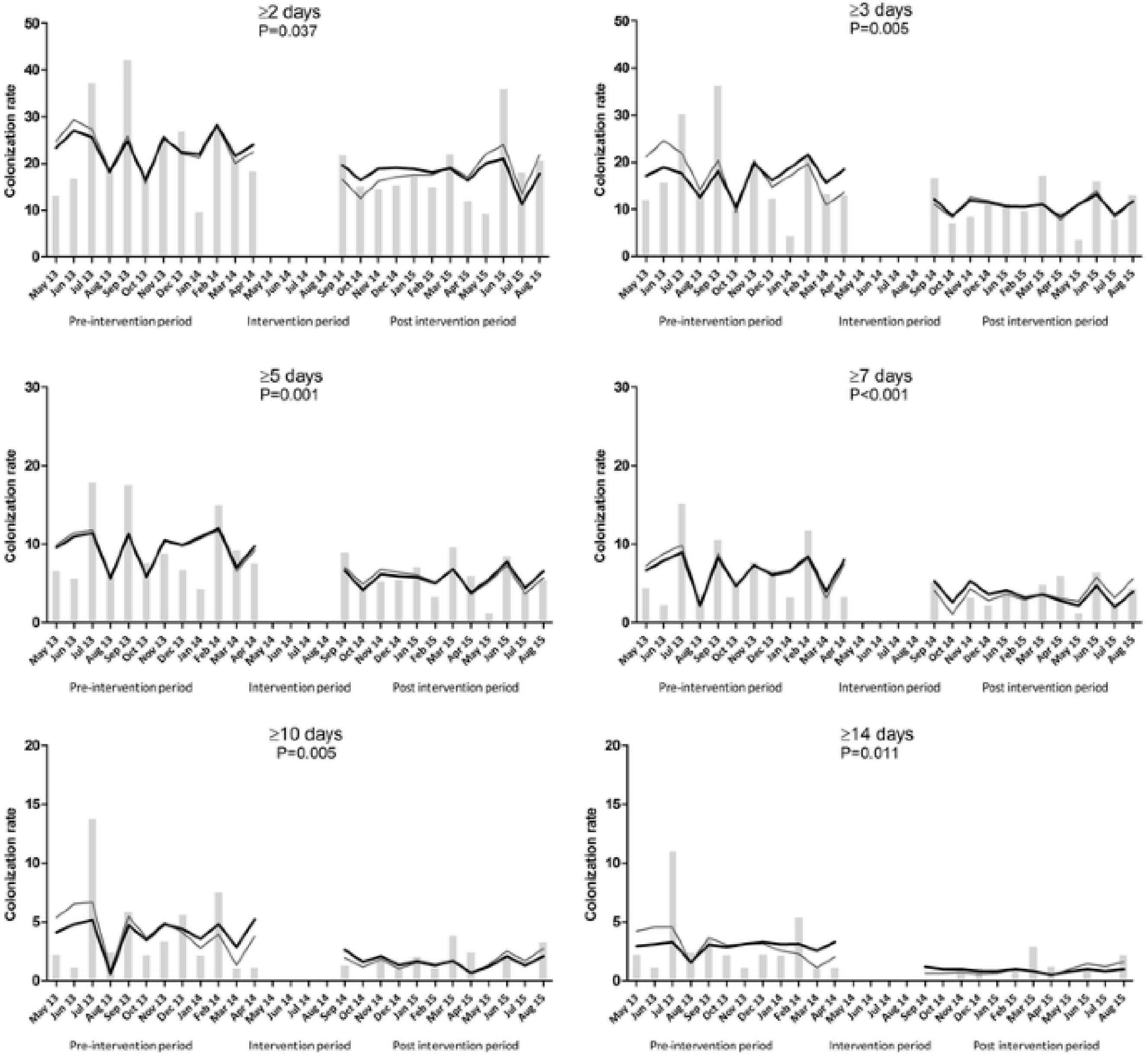
Multivariable analyses identified sinks as a risk factor for BSIs and UTIs

Fucini et al. J Hosp Infect 2023.

Water free critical care

Overall rate of Gram-negative rod colonisation rate: were 26.3 GNB/1000 ICU admission days pre-intervention and 21.6 during the intervention (rate ratio 0.82; 95%CI 0.67–0.99; P = 0.02).





Hopman et al. Antimicrobial Resistance & Infection Control 2017;6:59

What's next for IPC? Winter 2024 and beyond: setting priorities and scanning the horizon

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STAY A STEP AHEAD

of winter infections

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Scan the QR code to register for the IPC webinar "**Winter Preparedness & the Hidden Threats**".

23rd April 2024 at 7pm AEST

gama healthcare | ACIPC Australasian College for Infection Prevention and Control

Panel Discussion

STAY A STEP AHEAD

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Thank you for attending the **IPC Tour 2024!**

Scan the QR code to download winter campaign resources.