Monitoring microbial surface loads, how is it done, what do we find?

Sam Watkin and Helen Rickard

Dr Lena Ciric

Dr Elaine Cloutman-Green

Martin Kiernan

What do we mean by it?

Monitoring the presence of microorganisms on environmental surfaces within the hospital setting

- **Why** should we do it?

- **When** should we do it?

- **How** do we do it?

- **Where** should we look?

- **What do we find** when we do look?

Why should you do it?

- Environmental surfaces play an **important role in the dissemination** of microorganisms$_1$

- Detect presence and movement of **clinically-relevant microorganisms** on environmental surfaces in the hospital setting

- Support existing **clinical surveillance**

- Allow for **targeted** infection prevention and control interventions

1. Chemaly RF, Simmons S, Dale C, Jr., Ghantoji SS, Rodriguez M, Gubb J, et al. The role of the healthcare environment in the spread of multidrug-resistant organisms: update on current best practices for containment. Ther Adv Infect Dis. 2014;2(3-4):79-90.

When would you do it?

Routine monitoring

- Regular sampling of environmental surfaces to determine microbial loading
- High-risk surfaces

Responsive monitoring

- In response to a clinical event (e.g. for outbreak monitoring or unexpected transmissions)
- Variety of relevant surfaces

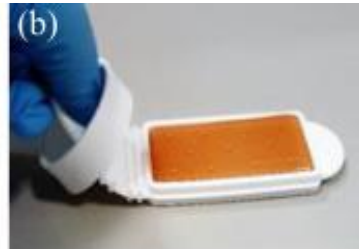# How would you do it?
Sample Collection
Depends on **downstream processing requirements**

Direct

- RODAC Plates
- Dipslides
- Petrifilms

Indirect

- Swabs
- Sponges
- Wipes

Figure adapted from: Rawlinson S, Ciric L, Cloutman-Green E. How to carry out microbiological sampling of healthcare environment surfaces? A review of current evidence. J Hosp Infect. 2019; 103(4): 363-74.

How would you do it?
Sample Processing

Depends on **type** of sample and **aim** of sampling

Culture based

- Selective vs non-selective media
- Species level identification
- Antibiotic resistance profiles
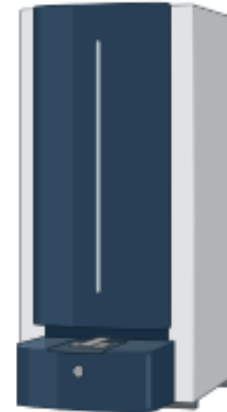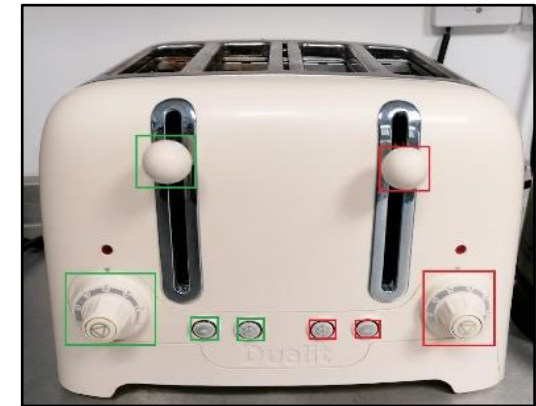
Molecular

- qPCR – specific target
- Sequencing

Where would you do it?

Important to consider a **range of sites** – not just the 'classic' high-risk environmental surfaces:

- Non-clinical areas
- Low-touch sites
- Communal touch sites
- Sinks and other water outlets

What do we find?
Communal Touch Surfaces

- 22 environmental samples were taken weekly over a **9 week period** in the bone marrow transplant unit at Great Ormond Street Hospital

- Samples were cultured on **Columbia blood agar**

- Aerobic colony counts per 100cm^2 were established and species were identified by **MALDI-ToF Mass Spectrometry**
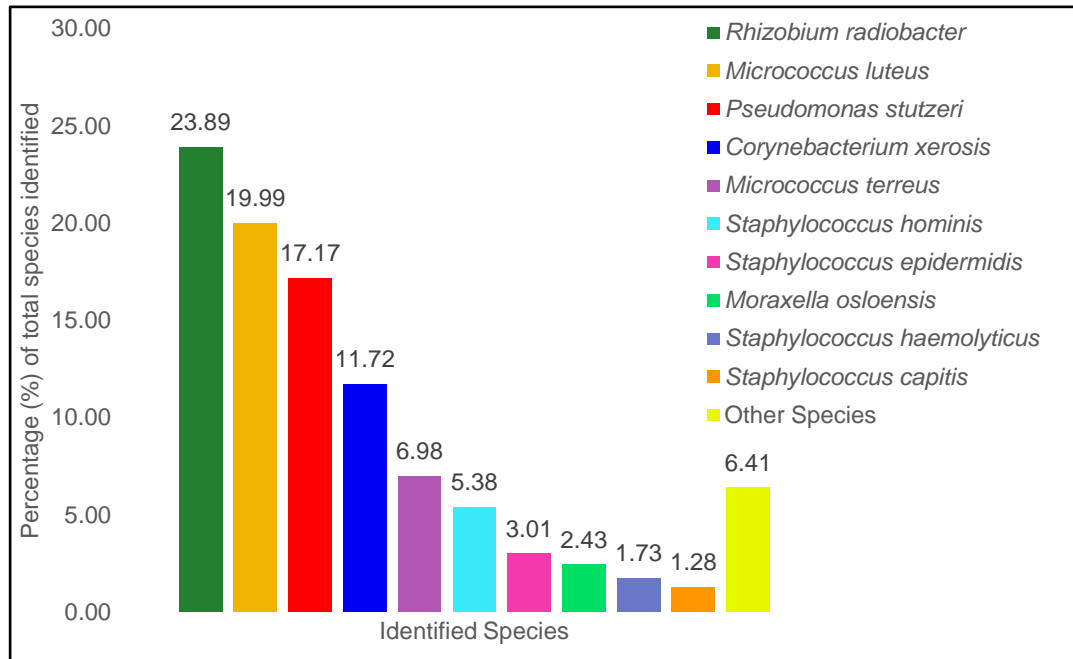

Proportions of all identified species. A total of 42 distinct species were identified. Only species comprising a percentage of the total organisms identified of over 1% are shown.
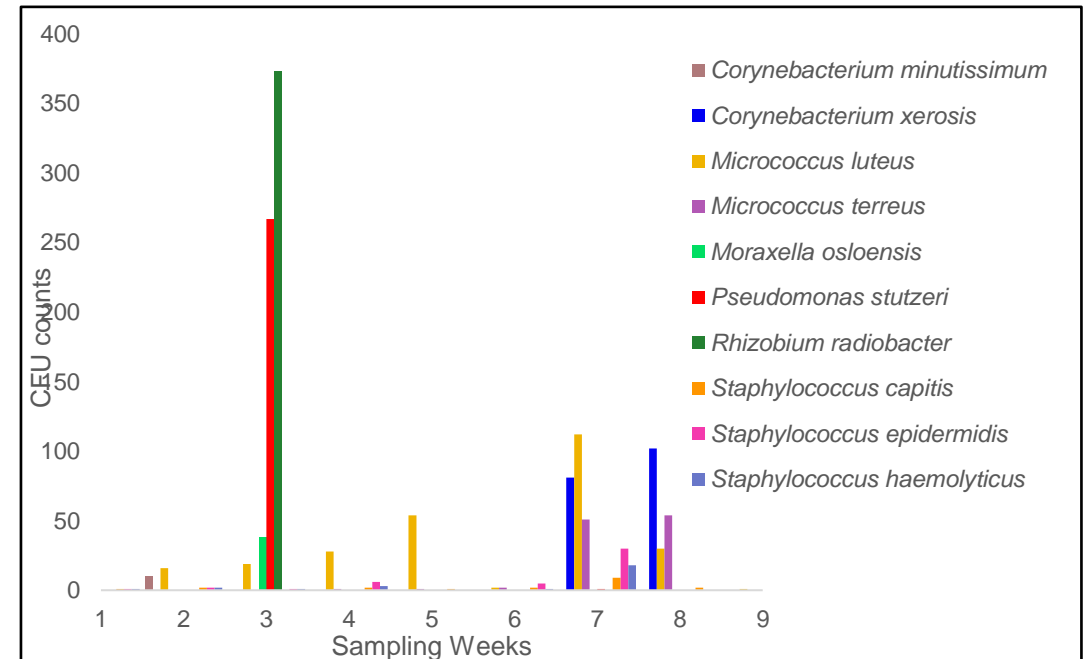
Distribution of frequently recovered species across the duration of the sampling study. Counts of frequently identified species are plotted against the sampling weeks they were recovered on. Species identified ≥10 times are included.

What do we find?
Communal Touch Surfaces
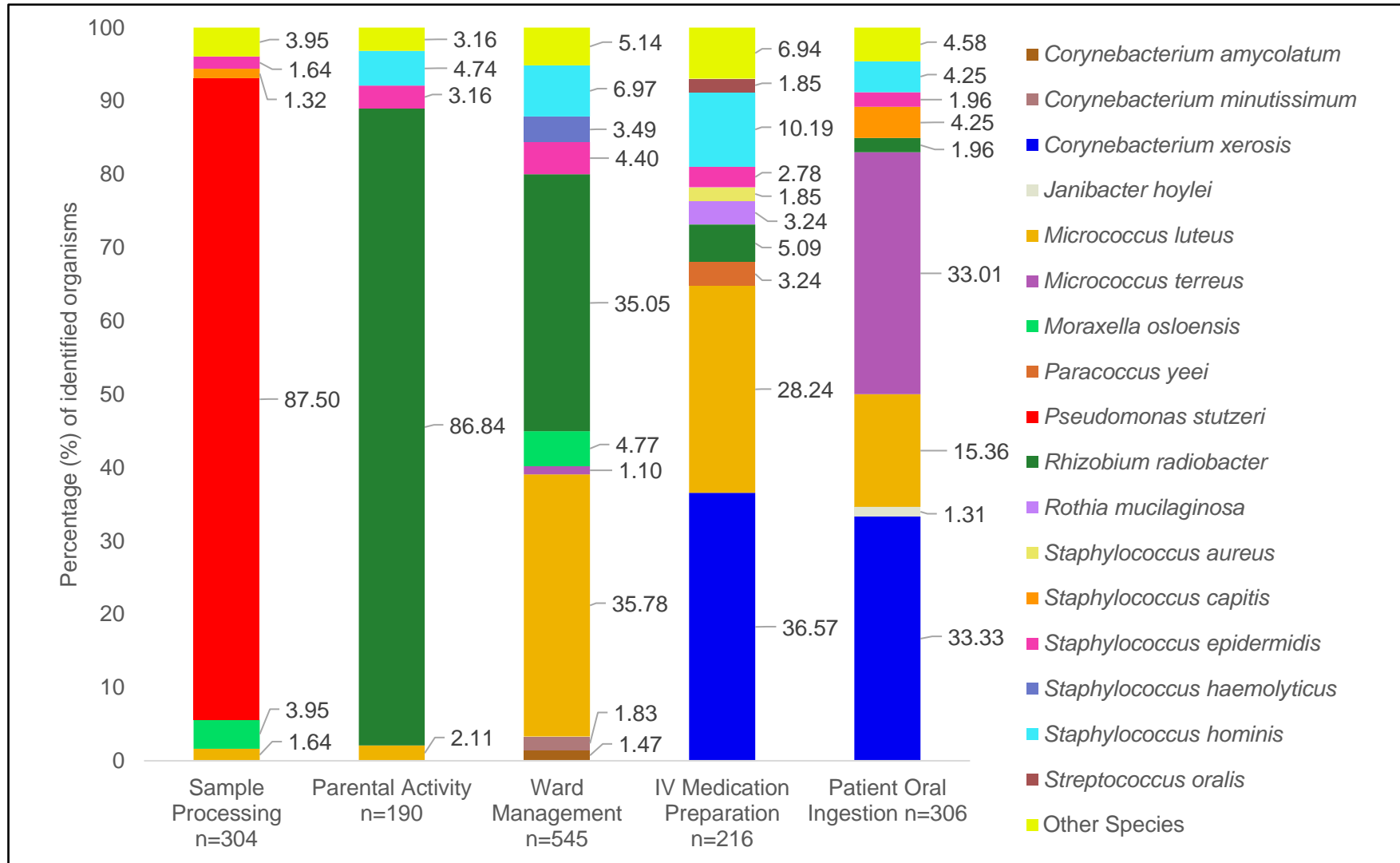
Distribution of identified organisms on sample sites grouped by activity. Sample sites are grouped by activity. All species which comprise ≥1.00% of the total organisms present are displayed. Species which comprise ≤1.00% are grouped as "Other Species".

What do we find?
Sink Surfaces

Why look at sink surfaces?

- **Unique** environment

- Mechanism of **dispersal**

- **Complex** environment to sample

Aim: Determine the effect patients have on the sink microbiota, and to characterise the sink *Pseudomonas* population in terms of drug resistance and presence of virulence factors

What do we find?
Sink Surfaces

- **Non-outbreak** situation

- **Post-operative** and **Respiratory** wards

- **Flocked swabs** with charcoal transport media

- Sink surface and plug hole

- Plated onto **chromogenic agar**

- Identified by **MALDI-ToF MS**

Examples of sinks sampled in this study

What do we find?
Sink Surfaces

Differences after patients

- **Increased amounts** and diversity after patients arrive on both wards
- Move from water and environmental organisms to **human commensals**

Differences between wards

- *Pseudomonas* spp. most common after patients introduced in Respiratory ward
- *Enterobacter* spp. most common in Post-operative ward
- *P. aeruginosa* increases after patients arrive in the Respiratory but not Post-operative ward
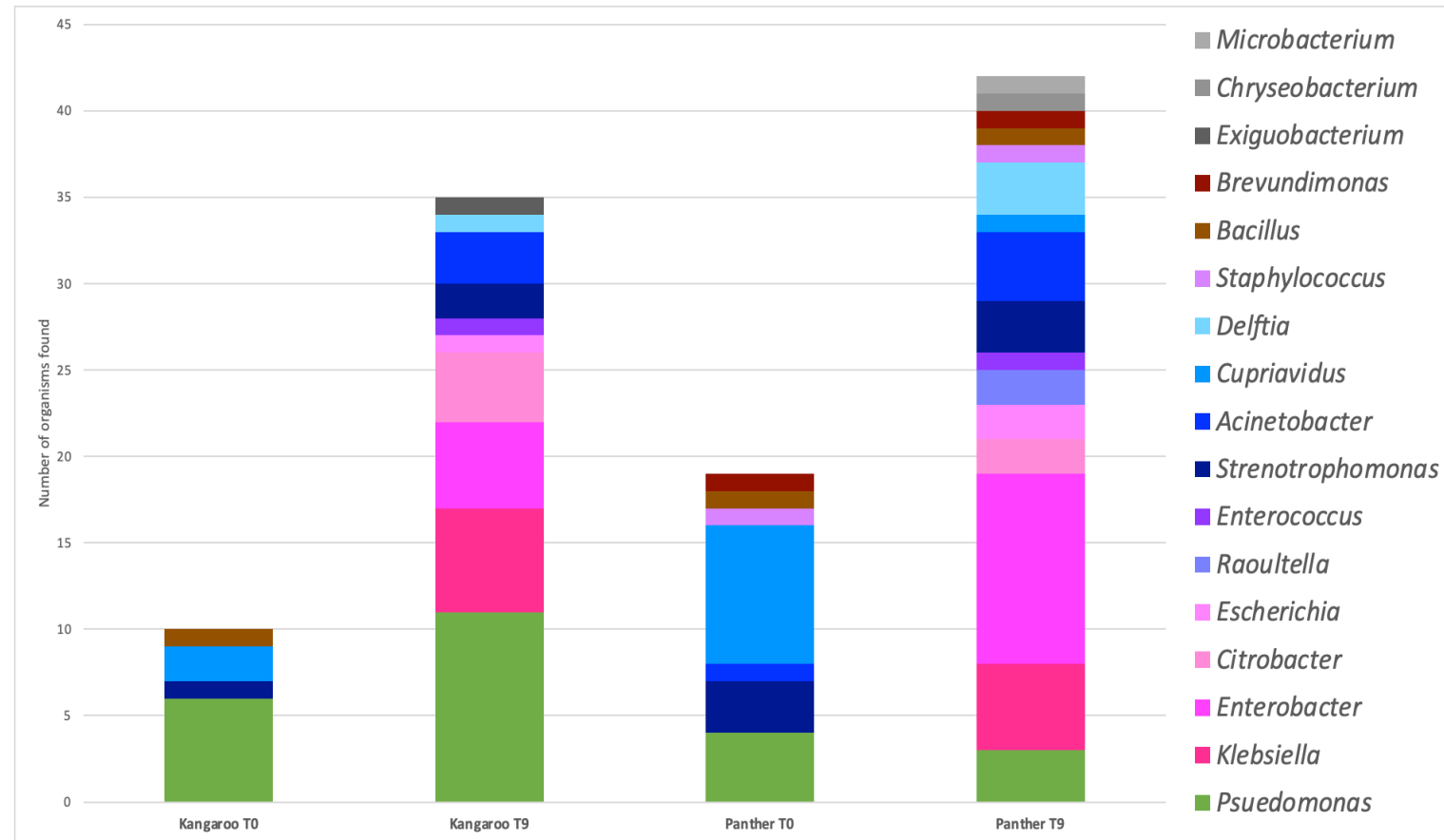
Organisms recovered from sinks in Respiratory and Post-operative wards before and after wards open to patients.

Acknowledgements