Longitudinal Environmental Surveillance of Microbial Contamination and Associated Antibiotic Resistance in a Podiatry Clinic

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INTRODUCTION

- The increasing and ongoing emergence of antimicrobial resistance (AMR) is well documented and presents a growing challenge to human health.
- Resistant organisms are known to contaminate the hospital environment (touch sites, sinks etc), particularly in the acute setting, where environmental contamination poses a risk for onward transmission.
- Transmission is increasingly being detected in other healthcare settings, but few studies have assessed the risk associated with podiatry clinics [1,2].
- Podiatrists routinely see patients with multi-morbidity, who often undergo multiple health encounters in different settings. Routine podiatric practice often includes higher risk interventions such as minor surgical procedures and wound care.

AIMS

- Carry out longitudinal environmental sampling of a newly opened, private community podiatry clinic in Southcentral England.
- Assess changes in the microbial population and associated resistance following increased clinic use.
- Identify clinical areas that represent an increased risk for fomite transmission.

Figure. 1 Podiatry treatment couch

METHODS

Figure 2: Environmental sampling was carried out over a 12-month period. Samples were taken prior to opening (post-deep clean), then monthly (months 1-3) and every three months thereafter (months 6, 9 and 12). On each occasion, surfaces (catergorised as touch (e.g. Fig 1) or elevated) were swabbed (n = 14) and waste trap water was taken from two handwash basins. Samples were cultured on selective and non-selective agar.

RESULTS

Summary

- 112 surface samples, were taken over the 12-month period. Surface samples were cultured onto blood agar (BA, total bacterial load) Colorex™ *S. aureus* agar (identification of staphylococci) and Sabouraud dextrose agar (culture of yeast and fungi). All staphylococci isolates were tested for antibiotic sensitivity to erythromycin and cefoxitin.
- 16 samples of waste trap water were collected and cultured for heterotrophic, coliform, and *Pseudomonas* spp. enumeration. Gram-negative isolates were tested for resistance to all major classes of antibiotics

Key findings

- The median number of bacteria recovered from elevated and touch sites was 370 cfu/swab (n=32) and 50 cfu/swab (n=80) respectively (Figure 3).
- Patient numbers increased over time as did the total bacterial load and staphylococci diversity (Figure 4, Figure 5). Of 138 staphylococci isolates 20% and 4% exhibited phenotypic resistance to erythromycin and cefoxitin respectively (Table 1). Resistant staphylococci were most commonly found on the curtain rail, drill cable and keyboard (Figure 7).
- *P. aeruginosa* and *C. freundii* were consistently recovered from both sinks. *Klebsiella oxytoca* was recovered sporadically. No resistance was detected.

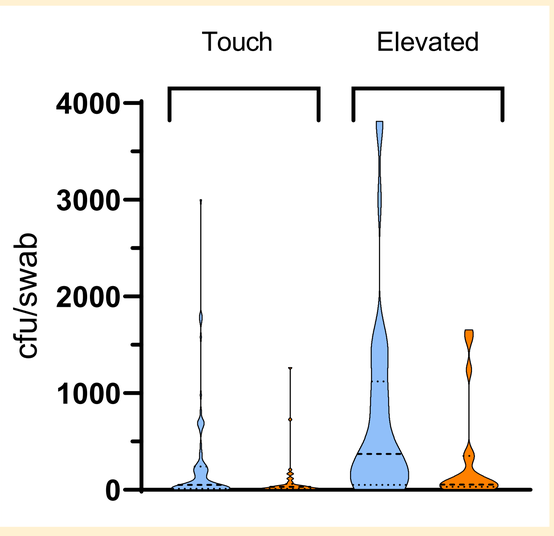

Figure. 3 Total number of bacteria (**Blue)** and staphylococci (**Orange)** recovered from touch and elevated sites..

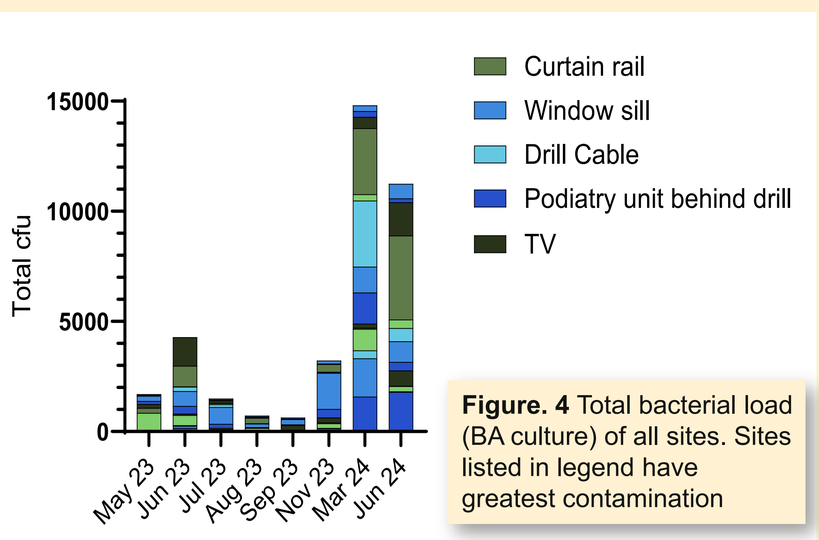

Figure. 4 Total bacterial load (BA culture) of all sites. Sites listed in legend have greatest contamination

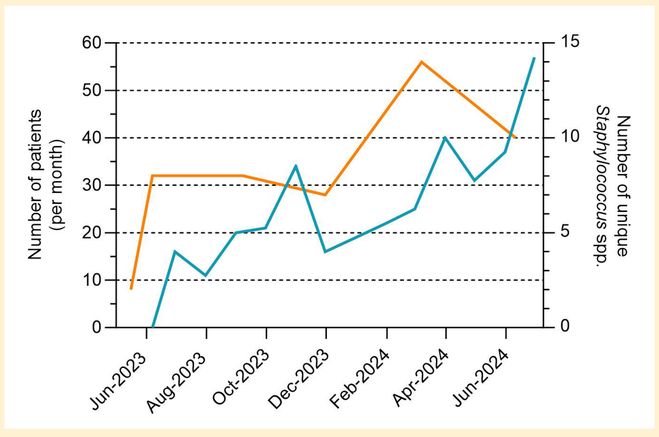

Figure. 5 The number of unique *Staphylococcus* spp. detected on environmental surfaces (orange line) and the number of patients treated in the preceding month (blue line) increased over time.

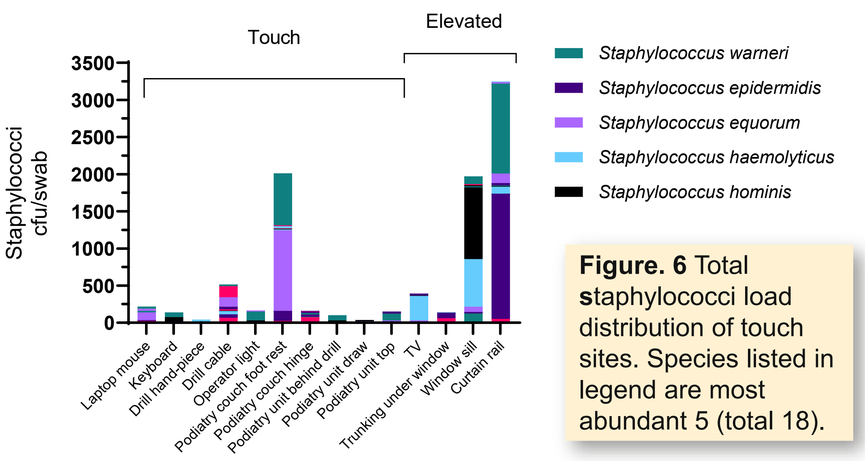

Figure. 6 Total staphylococci load distribution of touch sites. Species listed in legend are most abundant 5 (total 18).

	Number of isolates	Resistant to Erythromycin	Resistant to Cefoxitin	Resistant to E & FOX
S. borealis	1	1	0	0
S. capitis	14	1	0	0
S. cohnii	2	0	0	1
S. epidermidis	25	5	0	1
S. haemolyticus	11	2	0	1
S. hominis	17	8	1	0
S. pasteuri	13	0	0	0
S. saprophyticus	10	2	0	1
S. ureilyticus	7	4	1	0
S. warneri	17	1	0	0

Table. 1 Antibiotic resistance of *Staphylococcus* spp. to erythromycin (E) and cefoxitin (FOX). Only resistant species are shown.

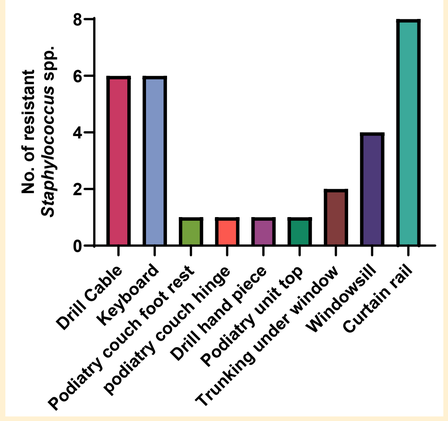

Figure. 7 Frequency of resistant staphylococci (to erythromycin and/or cefoxitin) detected at each sampling site. Only positive sites are shown.

DISCUSSION

- The number of bacteria recovered from the podiatry clinic and the diversity of the staphylococci isolated increased over time, likely reflecting the increased number of patients attending the clinic (Figure 5).
- Environmental surfaces were designated ‘touch’ if they were likely to be interacted with by patients or clinicians (computer keyboard, podiatry tools, couch) or ‘elevated’, which if contaminated would suggest airborne dispersal of bacteria.
- Elevated sites are unlikely to be routinely cleaned and were contaminated with the highest number of bacteria. Patients and staff are unlikely to directly interact with these surfaces and the risk of fomite transmission can be considered low. However, these surfaces (e.g. curtain rail) did harbour staphylococci resistant to commonly prescribed antibiotics implying airborne dispersal from around the couch space (Figure 7).
- The couch foot rest, although not the most heavily contaminated touch site (Figure 4), harboured the highest number of staphylococci (Figure 6) although very few isolates exhibited phenotypic resistance (Figure 7). Comparatively fewer staphylococci were recovered from the staff keyboard. However, resistance was detected more frequently, perhaps reflecting inadequate hand hygiene or glove use between patients.
- The coiled drill cable was often heavily contaminated and harboured a diversity of staphylococci (Figure 6) many of which were resistant to erythromycin and/or cefoxitin (Figure 7).
- Podiatry patients readily contaminate their immediate environment, particularly the podiatry couch. AMR organisms can persist within the clinic especially on surfaces that are difficult to clean (e.g. drill cables) and/or be transferred to staff contact sites (e.g. computer keyboards) through inadequate hand hygiene or inappropriate glove use.

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