Use of a Rapid Molecular Test to Detect *Staphylococcus aureus* Environmental Contamination During an Outbreak

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Background

•Environmental contamination can contribute to the spread of organisms in outbreaks. Environmental microbiological sampling for target organisms can be of value as it may support hypotheses in relation to modes of transmission and therefore enable more targeted infection prevention and control measures. It can also be used as a monitoring measure to determine the success of environmental cleaning methods. Microbiological culture methods may differ between organisations, have low sensitivity, and can take several days. For these reasons, molecular testing has recently been studied as a possible alternative method for environmental microbiological sampling in outbreaks involving carbapenamase producing organisms (CPO) and vancomycin-resistant enterococci (VRE).[1,2]

Objective

• To compare detection rates for Borderline Oxacillin Resistant *Staphylococcus aureus* (BORSA) from environmental samples using a commercially available rapid molecular diagnostic test with the results obtained using other methods.

Methods

- An outbreak of Borderline Oxacillin Resistant *Staphylococcus aureus* (BORSA) on a Dermatology Unit was confirmed using spa typing performed by the Scottish National MRSA Reference Laboratory (t10939) and also confirmed using whole genome sequencing carried out by the Infection Group, University of St Andrews.
- Outbreak investigations identified possible epidemiological links between dermatology inpatient (ward) and outpatient clinical areas including phototherapy where the majority of patients had skin conditions with a high risk of skin scale shedding.
- Enhanced environmental cleaning was instigated with Actichlor Plus throughout the inpatient and outpatient clinical areas with additional mid-day cleans in outpatient areas and an additional clean at the end of the day in the inpatient (ward) clinical area.
- Following enhanced environmental cleaning, 10 macroscopically clean hand touch sites were sampled using different methods.
- The results obtained using a commercially available rapid molecular diagnostic test (Cepheid GeneXpert® MRSA/SA BC Assay, Cepheid, Sunnyvale, CA, USA) were then compared to 2 microbiological culture techniques (swab and sponge) using methods as previously described. [1] MALDI-TOF (Bruker Diagnostics, Germany) was used for organism identification and Vitek 2 (bioMérieux, Marcy L'Etoile, France) for antibiotic susceptibility testing.

Results

Table 1. Culture and PCR Results of Environmental sites

	Swab	Sponge	
Surface Tested	**Culture result**	**Culture result**	**PCR result for *S. aureus***
Dressing trolley	No growth	No growth	Negative
Shower head	*S. aureus* t8898	*S. haemolyticus*	Positive
Mattress Cover	*S. capitis*	*S.hominis*	Negative
Dustpan	*S. aureus* t002	*S.aureus* t10939	Positive
Patient chair	*S.aureus* t10939 *S. epidermidis*	*S. aureus* t10939	Positive
Tympanic probe	*S.aureus* t127 Diptheroid	*S. aureus* t127	Positive
Floor	*S. capitis*	Heavily mixed however no *S.aureus* identified	Positive
Bathroom seat	No growth	No growth	Negative
Bath tap	No growth	*S.aureus* t10939	Positive
Plug hole	No growth	*S. aureus* t127	Positive

Conclusions

•The Cepheid GeneXpert® MRSA/SA BC Assay was positive for all sites found to be positive by either other method but gave a positive result from the floor which was negative by either other method. There are several possible reasons for this observed discrepancy: different sensitivities of the different methods; a false positive result for the floor sample (however, the floor had, at a previous time cultured positive for *S. aureus*); the detection of non-culturable bacteria (whether viable or non-viable) by the molecular based rapid method (possibly the detection of organisms that may have been damaged or killed by environmental cleaning).

•Reducing the environmental burden of organisms in an environment where there is heavy skin scale shedding was challenging despite enhanced environmental cleaning together with improvements in practices, antimicrobial prescribing and patient screening and decolonisation. We found that Cepheid MRSA/SA BC Assay was a useful tool for indicating environmental contamination by *S. aureus*.

References

1.)Garvey Mi, Bradley CW, Casey Al. Using a carbapenemase-producing organism polymerase chain reaction to rapidly determine the efficacy of terminal room disinfection. *J Hosp Infect* 2017; 95:329-330

2.) Garvey MI, Bradley CW, Casey A, Clewer V, Holden E. Using a *vanA* polymerase chain reaction to detect environmental contamination during a vancomycin-resistant enterococci outbreak. *J Hosp Infect* 2017;97:419-421