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Background

Understanding the transmission modes of methicillin-resistant *Staphylococcus aureus* (MRSA) in hospitals is crucial for effective prevention. While direct contact is likely the primary transmission route, the role of aerosolised MRSA in environmental contamination and patient-to-patient transmission is unknown.

Method

At Woodlands Health Campus, MRSA and non-MRSA cubicles are co-located within the same ward, separated by half-wall partitions with natural airflow (Figure 1).

This study encompasses three main components: active air sampling via SASS-3100 air sampler, passive air sampling via settle plates, and surface sampling (Figure 2).

505 environmental samples were collected from 30 MRSA-colonised patients over five sampling sessions (21 October- 18 November 2024), with an additional passive air sampling from non-MRSA patients.

Figure 1. (i) Ward setup with MRSA and non-MRSA cubicles located within the same wards, separated by half-wall partitions with natural airflow; (ii) Percentages of positive MRSA cultures captured by active air samplings in the cubicle (orange box)

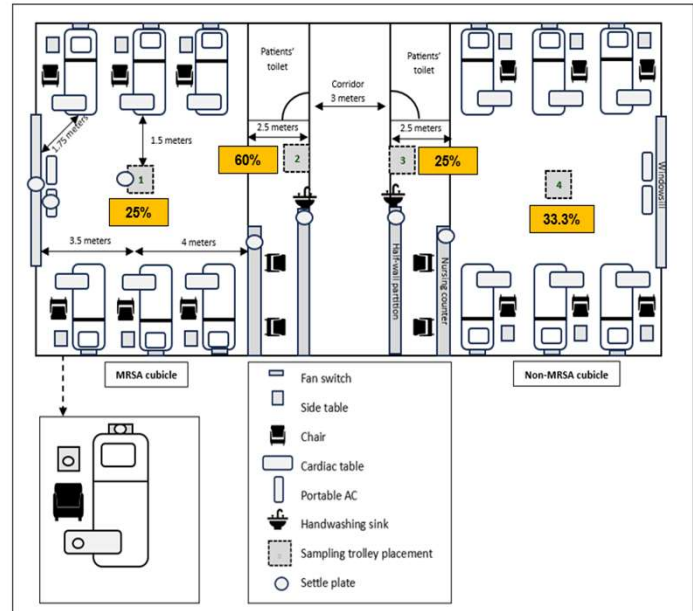


Figure 2. Study design with three main investigational components: air sampling (active and passive samplings), surface sampling, and whole genome sequencing (WGS) technology

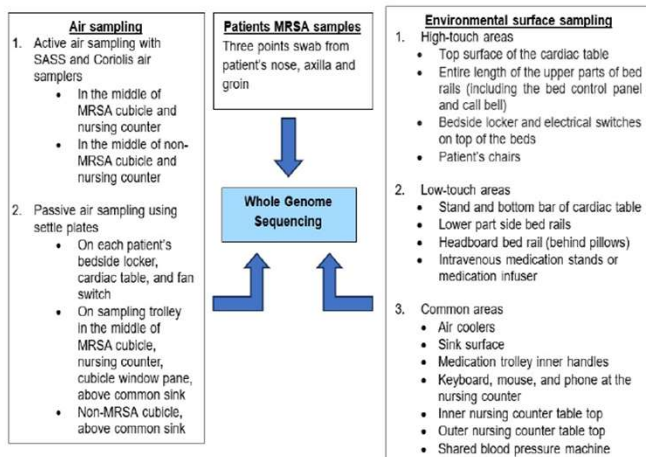


Table 1. Results of (i) Active air sampling using the SASS 3100 air sampler; (ii) Passive air sampling with settle plates; (iii) Environmental surface swabbing

(i) Active air sampling using the SASS 3100 air sampler				
Sample trolley placement	Growth on Brilliance™ agar	MRSA growth (samples)	Number of air sample collections (samples)	Positivity rate (%)
MRSA cubicle, middle of the room	Heavy	1	4	25%
MRSA cubicle, nursing counter	Heavy	3	5	60%
Non-MRSA cubicle, nursing counter	Heavy	1	4	25%
Non-MRSA cubicle, middle of the room	Heavy	1	3	33.3%
Total	-	6	16	37.5%

(ii) Passive air sampling with settle plates				
Placement of settler plates	Location of settle plates	Number of settle plates collected (plates)	Number of settle plates with MRSA growth (plates)	Positivity rate (%)
Patients' surroundings	MRSA patients' bedside locker	30	6	20%
	MRSA patients' cardiac table	30	7	23.3%
	MRSA patients' fan switch	30	5	16.7%
	Non-MRSA patients' bedside locker, cardiac table, fan switch (1 round of sampling)	18	0	0%
Common areas	MRSA cubicle, middle of the room	6	3	50%
	MRSA cubicle, windowsill	6	2	33.3%
	MRSA cubicle, nursing counter	6	0	0%
	MRSA cubicle, above the sink	5	2	40%
Non-MRSA cubicle, nursing counter	Non-MRSA cubicle, nursing counter	1	0	0%
	Non-MRSA cubicle, above sink	5	0	0%
Total	-	137	25	18.2%

Findings

- MRSA was cultured from active and passive air samples from various areas surrounding patients and from air samples from the opposite non-MRSA cubicle (Table 1).
- Sampling of high-touch surfaces revealed heavy MRSA growth on patient chairs and bed railings; moderate growth on railings and cardiac tables; and light growth on bedside lockers and light switches.
- No MRSA contamination was found in common areas on the sampling day. Findings are summarised in Table 1.
- Whole genome sequencing (WGS) analysis is ongoing.

Conclusion

MRSA was frequently cultured from air samples collected within MRSA cubicles (4/9, 44% positive) and potentially dispersed in the air to the opposite non-MRSA cubicles (2/7, 29% positive).

Whole genome sequencing to explore correlations of MRSA from patients and environments is ongoing. Further longitudinal study with larger sample size is needed to understand the role of aerosolised MRSA in healthcare-associated transmission.

Acknowledgement

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(iii) Environmental surface swabbing				
Site for environmental surface sampling		Heavy growth of MRSA (isolates)	Moderate growth of MRSA (isolates)	Light growth of MRSA (isolates)
MRSA cubicle, high-touch areas around patients	Cardiac table (top), including handle	1	4	4
	LEFT side length of upper part of bed rail, including bed control panel and call bell	1	5	1
	RIGHT side length of upper part of bed rail, including bed control panel and call bell	2	1	1
	Patient's Chair	5	6	1
MRSA cubicle, low-touch areas around patients	Bed side lockers and light switches on top of bed	2	1	3
	Stand and bottom bar of cardiac table	7	5	2
	Lower part side of bed rails	3	1	1
	Headboard bed rails	4	5	2
MRSA cubicle common/shared areas	Drip stand/ medication infuser (if applicable)	0	0	1
	Air cooler	0	0	1
	Sink surfaces	0	0	0
	Medication trolley inner handle	0	0	0
	Keyboard, mouse, and phone on the nursing counter	0	0	0
	Nursing counter table facing the patients' cubicle	0	0	0
	Nursing counter table facing the main corridor	0	0	0
	Shared blood pressure machine	0	0	0