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Prior room occupancy increases risk of methicillin-resistant *Staphylococcus aureus* acquisition

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Abstract. ***Background*:** In Australia, little is known about the risk of acquiring methicillin-resistant *Staphylococcus aureus* (MRSA) from prior room occupants. The aims of the study are to understand the risk of MRSA acquisition from prior room occupants and to further extend the existing knowledge-base on the role of discharge cleaning in hospitals.

***Methods*:** A non-concurrent cohort study was undertaken in five wards at a 250-bed general hospital in Tasmania, Australia. All admitted patients were screened for MRSA. Weekly screenings for all patients who remained in hospital were undertaken. New MRSA acquisitions were identified. The exposed group were patients whose immediate prior room occupant had MRSA, while the unexposed prior room occupant did not have MRSA.

***Results*:** 6228 patients were at risk of acquiring MRSA, with 237 new MRSA acquisitions equating to an acquisition rate of 3.8% for each at-risk patient admission. The unadjusted odds ratio for acquiring MRSA when the prior room occupant had MRSA was 2.9 (95% CI 2.2–3.9). Using logistic regression, exposure to a prior occupant harbouring MRSA remained a significant predictor of subsequent acquisition, after controlling for variables, OR 2.7 (95% CI 2.0–3.6).

***Conclusion*:** Admission to a room previously occupied by a person with MRSA increased the odds of acquisition for the subsequent patient, independent of other risk factors. It demonstrates the necessity of having effective discharge cleaning practices in place. We believe increased attention to discharge room cleaning in hospitals is required and the reconsideration of additional recommendations for discharge cleaning.

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Background

Internationally, major safety and quality efforts are being made to reduce the harms and risks associated with healthcare-associated infections (HAIs). There are many processes that can be established to reduce the risk of organism transmission in healthcare settings.[1] These include: adequate levels of hand hygiene compliance, correct application of personal protective equipment, appropriate intravascular device management and optimal levels of environmental cleanliness. Methicillin-resistant *Staphylococcus aureus* (MRSA) is one of the organisms that is commonly associated with HAIs, and is linked to morbidity and mortality in hospitalised patients.[2,3]

To understand how the environment plays a part in the occurrence of infections, it is important to think beyond the end-point of the infected patient. For example, persons colonised with microorganisms can contaminate a healthcare environment. These microorganisms can subsequently be transferred to other sites, most commonly by the hands of healthcare workers, patients and visitors.[4] Microorganisms acquired from these sites may then be responsible for infection in other patients. Similarly, infection may occur many months following contamination and subsequent colonisation, often after the patient has been discharged from hospital.[5] In the past, the roles of inanimate objects in hospital environments (e.g. surfaces and equipment) in the spread of HAIs were regarded as controversial.[6] However, a large body of evidence now supports the notion that the environment plays a part in microorganism transmission and subsequent infection.[7–9] Several studies have demonstrated that the persistence of microorganisms in the environment leads to an increased risk

Implications

- In Australia, little is known about the risk of acquiring methicillin-resistant *Staphylococcus aureus* from prior room occupants.
- Admission to a room previously occupied by a person with methicillin-resistant *Staphylococcus aureus* increases the odds of acquisition for the subsequent patient.
- Increased attention to discharge room cleaning in hospitals is required and the reconsideration of additional recommendations for discharge cleaning.

of acquiring an infection for a patient who is admitted to a room that was previously occupied by a patient colonised or infected with a particular organism.[8,10,11] These studies, alongside those on the known role of colonisation pressure, demonstrate the potentially important role that the environment plays in infection transmission and prevention.

In Australia, little is known about the risk of acquiring MRSA from prior room occupants. This study explores the risks of MRSA acquisition resulting from prior room occupancy to demonstrate the potential role that the environment plays in organism transmission and infection. The specific aims of the study are to understand the risk of MRSA acquisition from prior room occupants and to further extend the existing knowledge base on the role of discharge cleaning in hospitals.

Methods

Study design

A non-concurrent cohort study was carried out between 1 January 2011 and 31 December 2012.

Setting and sample

The study was undertaken in five wards at a 250-bed general hospital in Tasmania. All patients admitted to these wards were included in the study. The five wards under surveillance were medical and surgical wards, as well as one medical admissions unit. These wards consisted of shared rooms and a small number of single rooms. All persons admitted to the wards were screened for MRSA, regardless of risk factors. The MRSA screens consisted of nose, throat and perineum swabs, using pre-moistened swabs with sterile saline (0.9%). Weekly screenings for all patients who remained in hospital were also undertaken. The microbiology laboratory performing the testing for the study was an accredited laboratory (National Association of Testing Authorities). Brilliance chromogenic agar (Oxoid, Adelaide, South Australia, Australia) was directly inoculated from the screening swabs. Plates were allowed to warm to room temperature before inoculation and incubation, for a minimum of 20 h at 37°C.

The hospital's policy was to instigate contact precautions for any person known to have MRSA colonisation or infection. Persons with a history of MRSA were placed under contact precautions upon admission and housed in single rooms (whenever possible), until the results of the admission screenings were obtained. Compliance with admission screening procedures was monitored by infection control staff throughout the study period, with wards consistently achieving 80% policy compliance or higher.

Data collection and definitions

For all participants in the cohort, data were collected from two sources: the clinical coding department and the infection control department. The infection control department provided data on all persons who newly acquired MRSA during the study period. New MRSA acquisitions were defined as instances in which MRSA was identified in any clinical specimen or weekly patient screen obtained 48 h or more after admission, in patients with no known previous history of MRSA and with negative MRSA admission screen results. If a patient did not have an admission screen undertaken, they were assumed not to have MRSA, unless they had a previous history of MRSA. The data provided by the infection control department were the patient's hospital number, the date of MRSA acquisition (specimen collection date) and the ward and bed number of the patient.

The clinical coding department provided data on all patients admitted to the wards who were under observation. The data provided were admission and discharge dates, patients' hospital numbers, dates of birth, sex, diagnosis-related groups (DRG), International Classification of Diseases (ICD) codes (Australian, 10th Edition), patient locations during each admission (ward and room number) and patient's history of MRSA (alert status on an electronic system). In the 11 years before the commencement of this study, all patients at the hospital (in-patient and outpatients) who had been identified as having MRSA had electronic alerts placed on their medical records, using an electronic patient information system. The alerts could only be removed by the infection control unit once the patient had three consecutive negative MRSA screens.

A Charlson co-morbidity index score was calculated for each person by using ICD coding data, as is consistent with previously published literature.[12]

Data analysis

The cohort was divided into two groups: exposed and non-exposed. The exposed group consisted of persons whose immediate prior room occupant had MRSA, whilst the unexposed group included persons whose immediate prior room occupant did not have MRSA. No differentiation was made between single and shared rooms. Patients known to be colonised (on admission or subsequently) were housed in single rooms or were cohorted together in shared bays. Data provided by the infection control department and clinical coding were merged into one Excel database for data cleaning, before being exported into SPSS 21.0, in which analysis was undertaken.