

Nasal carriage of methicillin-resistant *Staphylococcus aureus* among healthcare undergraduates in Malaysia

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ABSTRACT

Staphylococcus aureus is a common component of skin flora of healthy adults. However, it can cause serious infections such as bloodstream infections, pneumonia, or bone and joint infections. Methicillin-resistant *Staphylococcus aureus* (MRSA) is known to cause hospital- (HA-MRSA) and community-acquired (CA-MRSA) infections worldwide. Asia is reported to have highest prevalence rates of HA-MRSA and CA-MRSA. As there were very less number of epidemiological studies being done in Malaysia, this study aimed to determine the prevalence of MRSA infection among the healthcare undergraduates who will be engaging with patients soon. We analyzed nasal swabs of students from a private medical institution in Klang Valley, Malaysia. Methicillin-resistance was accessed by sensitivity to the Oxacillin and Cefoxitin disks. In a total of 151 healthcare undergraduates, 117 of them were found positive for *Staphylococcus aureus*. Among the latter, 21 samples (13.9%) were resistant to Oxacillin and Cefoxitin. Our data shows significant high percentage of MRSA infection and therefore prevention strategies for MRSA need to be developed for the healthcare students before they engage with patients in clinic setting.

Keywords: MRSA, nasal swab, healthcare undergraduates, Oxacillin.

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INTRODUCTION

Staphylococcus aureus is a common constituent of the normal human body microflora including the moist squamous epithelium of the anterior nares (Ansari, 2016). Colonization of *Staphylococcus aureus* is usually not significantly associated with serious skin infection, but colonized individuals may develop an active infection more frequently than non-colonized individuals (Sollid and Furberg, 2014). The most significant site to screen for colonization of *S. aureus* is the anterior nasal compartment (Thomer and Schneewind, 2016). Cross-sectional surveys of healthy adult populations have reported *S. aureus* nasal carriage rates of approximately 27% (Wertheim and Melles, 2005). *S. aureus*, methicillin-resistant and vancomycin-intermediate and resistance are categorized by WHO as a 'HIGH' priority group for which new antibiotics are urgently needed (GENEVA, 2017). Resistant strains of *S. aureus* may cause various clinical situations varying from superficial infections to

serious life-threatening infections (Defres et al., 2009).

Methicillin-resistant *Staphylococcus aureus* (MRSA) is known to cause hospital- (HA-MRSA) and community-acquired (CA-MRSA) infections worldwide (Siddiqui and Koirala, 2018). A previous study showed that about 75% of MRSA cases reported as community associated MRSA (CA-MRSA) were isolated from normal healthy persons and as such, were no longer restricted to those who had chronic illness or frequent hospitalization (Muileboom et al., 2013). In Central and Northern Europe, approximately 10% of the colonizing *S. aureus* strains were MRSA (Warnke et al., 2014). According to a study carried out among medical students in Taiwan, the prevalence of MRSA was 2.2% (Chen and Chen, 2012). In Nepal, among 30 *S. aureus* nasal carriers, 8 were identified as carrying MRSA strains which gives a prevalence of 4% (Ansari, 2016). A study in Thailand shows 1% prevalence of MRSA among university

students (Kitti and Boonyonying, 2011), whereas in Malaysia, among 209 medical students recruited in a study, 10% of them were *S. aureus* carriers but none were MRSA (Ahmadi and Desa, 2012). Another study conducted in Malaysia showed *S. aureus* prevalence of 23.4% among the healthy adults and there was only one person colonized with MRSA among healthy adults (Choi and Yin, 2006).

This study aimed to determine the prevalence of MRSA infection among the healthcare undergraduates who will be engaging with patients soon.

METHOD

This is a descriptive cross-sectional study which was conducted from April 2018 to Sept 2018 at a private medical university in Malaysia. The non-probability convenience sampling method was utilized to enrol 151 healthcare undergraduate students on a voluntary basis. The volunteers comprised of both genders, healthy (without any signs and symptoms of redness, warmth, swelling, pain of the nose, fever, chills, sweating, cough, flu or just recovered from flu) who had not been prescribed antibiotics over the past week and were within the age range of 18 to 27 years. Nasal swabs of participants were collected and screened for the presence of *S. aureus*. All participants had signed the consent form before collection of nasal swabs to approve the use of their samples for research purposes only. The swab was withdrawn slowly and spread at one edge of Nutrient agar, Blood Agar and Mannitol Salt agar plates (Ford, 2008). An inoculation loop was used to streak the plates. The agars were kept at 37°C for 24 h in an incubator. After

one day, observations were recorded. Gram staining, catalase and coagulase tests were performed on each sample. A single isolated colony from Mannitol Salt Agar was used to inoculate the broth culture. The prepared broth cultures were kept in an incubator for 1 day (24 h) at 37°C (Payseur, nd). A sterilized swab was immersed in the prepared broth culture and padded dry at the wall of the test tubes before streaking onto Muller Hinton Agar. Methicillin-resistance was accessed by sensitivity to the Oxacillin and Cefoxitin disks (Oxoid Ltd, Basingstoke, England). Observations were recorded after 24 h of incubation.

RESULTS

A total of 151 undergraduate students were screened for the presence of *S. aureus* from their nasal swab specimens. A total of 117 of them were found positive for *S. aureus* (Table 1). Among the latter, 21 samples were resistant to Oxacillin and Cefoxitin. Female participants had a higher percentage of nasal carriage of *S. aureus* (86, 80.4%) compared to male participants (31, 70.5%) (Table 1). Participants of the Malay ethnic group had the highest percentage of nasal carriage (37, 82.2%), followed by Indians (17, 81.0%), others (12, 75.0%) and Chinese (51, 73.9%). Nine MRSA isolates were found among male students (20.5%), whereas 23 MRSA isolates were isolated from the females (21.5%). The percentage of MRSA isolates was highest among the Chinese ethnic group (26.1%) followed by Indians (23.8%), others (18.8%) and Malays (13.3%).

Table 1. Distribution of *Staphylococcus aureus* and MRSA among undergraduates.

		No.	<i>Staphylococcus aureus</i>	MRSA
Gender	Male	44	31 (70.5)	9 (20.5)
	Female	107	86 (80.4)	23 (21.5)
Ethnicity	Malay	45	37 (82.2)	6 (13.3)
	Chinese	69	51 (73.9)	18 (26.1)
	Indian	21	17 (81.0)	5 (23.8)
	Others	16	12 (75.0)	3 (18.8)
Total		151	117 (77.4)	32 (21.2)

Numbers in parentheses are percentages.

DISCUSSION

This study mainly showed the high prevalence of *S. aureus* and MRSA nasal carriage among healthcare undergraduate students. The high prevalence could be due to exposure to the hospital environment whereby students have visits or classes at hospitals and clinics. Thus, they are more likely to have a higher risk of exposure to MRSA. Similar study in a dental college and hospital of Bengaluru showed the presence of MRSA among 25 undergraduates (12.50%). This finding

suggests that MRSA colonization is common among students but higher in postgraduate students as compared to undergraduates (Hema et al., 2017). Longer clinical hours spent among postgraduates could explain this. However we did not include postgraduate students in our study. Risk of MRSA usually increases with activities or places that involve crowding, skin-to-skin contact and shared equipment or supplies. The population that possesses high risk includes athletes and kids in daycare centers. People of extreme age and healthcare personnel are also more likely to be colonised

with MRSA upon contact.

A previous study conducted in Switzerland showed that males had higher risk of MRSA colonisation as compared to females (Garoy et al., 2019). Another study conducted in Malaysia showed that the Indian population had a higher incidence of MRSA colonisation (Ghaznavi-Rad et al., 2010). However we were not able to find a significant association among ethnicity and gender with MRSA infection in our study ($p > 0.05$). Therefore, sample size has to be increased to better represent the overall undergraduate population to improve the accuracy of our findings. The study was conducted based on voluntary participation. As such, samples obtained did not encompass the entire undergraduate population. Instead, participants were selected based on their availability and willingness to participate. MRSA has the potential to cause serious skin, surgical wound, bloodstream, lung, heart, bone, joint and urinary tract infections. In serious conditions, it can cause sepsis and death. MRSA found among healthcare workers has the potential risk of easy spread to patients. Awareness on the spread of MRSA infection among undergraduate students must be created via various channels. Students must be inducted on proper hand washing techniques, besides practicing it all the time, especially when engaging with patients. Resident's doctors are highly recommended to optimize gown and gloves use for all interactions that may involve contact with the patients. In the hospital, people who are infected or colonized with MRSA often practice contact precautions as a measure to prevent the spread of MRSA. These carriers could be treated for decolonization of MRSA with local application of mupirocin topical ointment. Strict hand hygiene procedures are to be followed and contaminated surfaces should be properly disinfected. Besides, routine screening of nasal swab among the care givers for MRSA is also highly recommended. The data show prevention strategies for MRSA need to be developed for the community as well as in the clinical setting.

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