

High Prevalence of Methicillin-Resistant *Staphylococcus aureus* Nasal Colonization among Thai Medical Students

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Objective: To assess the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) colonization in medical students. Medical students are healthcare providers who are in close contact with patients and are at risk of transmitting MRSA to patients. However, there is little information regarding MRSA colonization among medical students.

Materials and Methods: The authors collected nasal swabs from 326 medical students, both pre-clinical and clinical students, to screen for MRSA using both culture-based and molecular techniques. Prevalence of *S. aureus* and MRSA colonization was compared between pre-clinical and clinical students in a cross-sectional study and among clinical students in an 8-month prospective study.

Results: *S. aureus* nasal colonization was found in 27.61% of medical students, 7.36% of them had MRSA colonization and there was no difference between pre-clinical and clinical students ($p=0.206$). Longer exposure to the clinical environment among clinical students did not increase the rate of MRSA colonization ($p=0.588$). The authors also reported a discrepancy in MRSA detection rate between direct culture and polymerase chain reaction (PCR) method.

Conclusion: Detection of MRSA colonization should be done using PCR method. MRSA colonization rate in medical students was higher than in the normal population.

Keywords: *Staphylococcus aureus*, MRSA, Nasal colonization, Medical student, Thailand

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Methicillin-resistant *Staphylococcus aureus* (MRSA) is a major cause of nosocomial infection⁽¹⁾. It is easily transmitted via direct contact with patients or carriers⁽²⁾. One factor contributing to MRSA colonization is recent exposure to antibacterial agents⁽³⁾. Healthcare personnel work in antibacterial-rich environments and are at increased risk of acquiring MRSA colonization⁽⁴⁾. They can easily transmit MRSA to patients and cause outbreaks^(1,4,5). Medical students are often in close contact with patients but may be neglected when implementing infection control measures for healthcare employees. They are another source of contamination, but little is

known about MRSA colonization among Thai medical students. The present study aimed to survey the prevalence of MRSA nasal colonization among Thai medical students and compared between pre-clinical and clinical students. The author further determined whether longer exposure to clinical environments would affect colonization status in clinical students. In addition, the authors compared MRSA detection by the culture-based and molecular method.

Materials and Methods

Study design and population

The present study was conducted between 2014 and 2015 at the Faculty of Medicine Siriraj Hospital, Mahidol University, the largest university hospital in Thailand. Details of the study were explained to participants and informed consents were obtained. All medical students giving consents were included in the study with no exclusion.

The study consisted of two parts, a cross-sectional study, and a prospective cohort study. In the cross-

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sectional study, 326 students were divided into pre-clinical students (n = 135) and clinical students (n = 191). In the prospective cohort study, the authors compared the prevalence of MRSA colonization among 51 clinical students before and after an 8-month period of clinical exposure when they had made most rotations in-patient wards. After informed consent was given, samples from both anterior nostrils of each volunteer student were collected.

Sample collection and MRSA detection

Nasal samples were collected using two sets of swabs to detect MRSA by culture-based and molecular methods. For the culture method, *S. aureus* colonies were identified according to the conventional microbiological methods. All *S. aureus* isolates were determined to be MRSA (i.e., resistant to oxacillin) by disk diffusion method according to the CLSI guideline⁽⁶⁾. For the molecular method, MRSA was detected directly from the sample by polymerase chain reaction (PCR) using BD MAX™ StaphSR kit according to the manufacturer's protocol. The student was classified as MRSA carrier if MRSA was detected by either method.

Statistical analysis

Statistical analysis in the present study was done using the SPSS version 19.0.1. The primary objective was to compare between two groups of medical students. The comparison was done using the Chi-square test. During the study, the authors found a discrepancy between two detection method and we compared the two methods using the Chi-square test. Significance was determined if p-value was lower than 0.05.

Ethical approval

The present study was ethically approved by the Siriraj Institutional Review Board (approval No. 491/2556 (EC4)).

Results

Prevalence of *S. aureus* and MRSA colonization among medical students

Prevalence of *S. aureus* colonization among medical student was 27.6% with no significant difference between pre-clinical and clinical students (24.44% and 30.08%, respectively, p=0.283). Prevalence of MRSA colonization among medical students is shown in Table 1. There was also no significant difference between the two groups of medical students (5.19% and 8.90%, respectively, p=0.206). None of MRSA

Table 1. Prevalence of MRSA colonization among Thai medical students

Medical student	n	% MRSA	
		Conventional method	Molecular method
Overall	326	0	7.36
Preclinical students	135	0	5.19
Clinical students	191	0	8.90

MRSA=methicillin-resistant *Staphylococcus aureus*

was detected by a conventional method and its discrepancy from molecular method was statistically significant (p<0.001).

Prospective monitoring of MRSA colonization after exposure to the clinical environment

Effect of clinical exposure on the prevalence of MRSA colonization among 51 clinical students was determined in an 8-month prospective study. After the first collection, medical students were rotated to various clinical services. The results showed that the prevalence of MRSA colonization among clinical students were insignificantly decreased after an 8-month period (8.22% versus 5.88%; p=0.588).

Discussion

MRSA infection is a critical issue for infection control. Although MRSA colonization in patients has been well documented as an important risk factor for subsequent MRSA infection, colonization in healthcare personnel is less known. The authors hypothesized that exposure to the antibiotic-rich environment is a risk factor for colonization of MRSA. In the present study, the authors used pre-clinical students as a control group because their clinical exposure was limited compared to clinical students. However, there was no difference in MRSA carrier rate between these two groups. Two studies from different countries also demonstrated indifferent colonization rate between pre-clinical and clinical students^(7,8) (Table 2).

Nevertheless, the overall MRSA colonization rate in the present study was higher than a previous study in non-medical students (7.36% versus 1.00%)⁽⁹⁾. Another study in Oman also reported high MRSA colonization rate in pre-clinical students⁽¹⁰⁾. This finding suggests that medical students may acquire MRSA during their early year, even before their clinical exposure. Two possible explanation can account for this finding, pre-clinical students may

Table 2. Comparison of MRSA colonization rate between preclinical and clinical students

Region	MRSA colonization rate		p-value	Reference
	Preclinical students	Clinical students		
Taiwan	2.4%	1.9%	0.54	(7)
Oman	11.4%	20.8%	>0.05	(8)
Thailand	5.19%	8.90%	0.206	This study

MRSA=methicillin-resistant *Staphylococcus aureus*

acquire MRSA from clinical students as they interact during student's activities, or MRSA is not confined in hospital wards, but also spreads to other parts of the hospital reachable by pre-clinical students.

Interestingly, the authors did not detect any MRSA by direct culture method in contrast to a high MRSA detection rate by direct PCR method. A previous study at another Thai hospital showed that there was no MRSA colonization in medical students by direct culture method⁽¹¹⁾. Many previous studies from different regions of the world, including a study in Thailand, consistently reported a low rate of MRSA colonization by direct culture method^(3,7,11-14). Other studies also reported cases of PCR-positive, culture-negative MRSA carriers and suggested that the PCR-based method is required for active surveillance of MRSA colonization^(15,16). Furthermore, the PCR-based method usually provides results 24 to 48 hours before the conventional culture method.

In the prospective study, there was no significant change in MRSA colonization over an 8-month period of clinical exposure (p=0.588). Although this interval may be too short to change colonization status, it is possible that the prevalence of MRSA colonization among clinical students had already reached a high rate since being pre-clinical students. To further explain these findings, a longer prospective cohort may be useful to identify whether MRSA colonization is time-dependent. In addition, MRSA colonization among clinical students after 8-month clinical exposure was slightly lower than at the beginning. Despite statistical insignificance, some students may have transient colonization i.e., they acquired MRSA only for a short period and eventually removed it by themselves with no required action⁽⁴⁾.

The major aim of the present study was to find the true prevalence of MRSA colonization and to evaluate the different methods used in detecting MRSA colonization. However, the rate of MRSA transmission from MRSA-positive students to patients was not

included in a scope of the study. The transmission of MRSA from a colonized healthcare worker to patients has been shown in a previous study⁽⁵⁾. In that study, decolonization of the carriers resulted in the resolution of MRSA outbreak in the hospital, signifying the role of MRSA colonization and the transmission of the disease. In the current scenario, a decolonization intervention and a follow-up study are needed to evaluate the impact of MRSA colonization in medical students and the rate of MRSA infection in the hospital.

Conclusion

In conclusion, the authors reported a high rate of MRSA colonization among Thai medical students. Screening for MRSA colonization would be more efficient using the molecular method. Although there is currently no recommendation to eliminate MRSA colonization in healthcare personnel, a high rate of MRSA colonization should be of concern for possible hospital dissemination. Further studies for various groups of healthcare providers is warranted to determine whether precaution measures for those with MRSA colonization are necessary.

What is already known on this topic?

There is no difference in the prevalence of MRSA colonization between medical students in pre-clinical and clinical years. However, it was previously believed that the prevalence of MRSA colonization among medical students is low.

What this study adds?

Culture method is not sensitive enough in detecting MRSA colonization. By using molecular method (PCR), the authors discovered that the prevalence of MRSA colonization in medical students is higher than previously believed.

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Conflicts of interest

The authors declare no conflict of interest.

References

1. Seibert DJ, Speroni KG, Oh KM, DeVoe MC,

- Jacobsen KH. Knowledge, perceptions, and practices of methicillin-resistant *Staphylococcus aureus* transmission prevention among health care workers in acute-care settings. *Am J Infect Control* 2014;42:254-9.
2. Banning M. Transmission and epidemiology of MRSA: current perspectives. *Br J Nurs* 2005;14:548-51, 554.
 3. Ma XX, Sun DD, Wang S, Wang ML, Li M, Shang H, et al. Nasal carriage of methicillin-resistant *Staphylococcus aureus* among pre-clinical medical students: epidemiologic and molecular characteristics of methicillin-resistant *S. aureus* clones. *Diagn Microbiol Infect Dis* 2011;70:22-30.
 4. Dulon M, Peters C, Schablon A, Nienhaus A. MRSA carriage among healthcare workers in non-outbreak settings in Europe and the United States: a systematic review. *BMC Infect Dis* 2014;14:363.
 5. Scheithauer S, Trepels-Kottek S, Hafner H, Keller D, Ittel T, Wagner N, et al. Healthcare worker-related MRSA cluster in a German neonatology level III ICU: a true European story. *Int J Hyg Environ Health* 2014;217:307-11.
 6. Clinical and Laboratory Standards Institute (CLSI). Performance standards for antimicrobial susceptibility testing (CLSI Supplement M100). 27th ed. Wayne, PA: CLSI; 2017.
 7. Chen CS, Chen CY, Huang YC. Nasal carriage rate and molecular epidemiology of methicillin-resistant *Staphylococcus aureus* among medical students at a Taiwanese university. *Int J Infect Dis* 2012;16:e799-803.
 8. Pathare NA, Asogan H, Tejani S, Al Mahruqi G, Al Fakhri S, Zafarulla R, et al. Prevalence of methicillin resistant *Staphylococcus aureus* [MRSA] colonization or carriage among health-care workers. *J Infect Public Health* 2016;9:571-6.
 9. Kitti T, Boonyonying K, Sitthisak S. Prevalence of methicillin-resistant *Staphylococcus aureus* among university students in Thailand. *Southeast Asian J Trop Med Public Health* 2011;42:1498-504.
 10. Orlin I, Rokney A, Onn A, Glikman D, Peretz A. Hospital clones of methicillin-resistant *Staphylococcus aureus* are carried by medical students even before healthcare exposure. *Antimicrob Resist Infect Control* 2017;6:15.
 11. Treeririchod A, Hantagool S, Prommalikit O. Nasal carriage and antimicrobial susceptibility of *Staphylococcus aureus* among medical students at the HRH Princess Maha Chakri Sirindhorn Medical Center, Thailand: a follow-up study. *J Infect Public Health* 2014;7:205-9.
 12. Abroo S, Hosseini JN, Sharifi Y. Methicillin-resistant *Staphylococcus aureus* nasal carriage between healthy students of medical and nonmedical universities. *Am J Infect Control* 2017;45:709-12.
 13. Bettin A, Causil C, Reyes N. Molecular identification and antimicrobial susceptibility of *Staphylococcus aureus* nasal isolates from medical students in Cartagena, Colombia. *Braz J Infect Dis* 2012;16:329-34.
 14. Carmona-Torre F, Torrellas B, Rua M, Yuste JR, Del Pozo JL. *Staphylococcus aureus* nasal carriage among medical students. *Lancet Infect Dis* 2017;17:477-8.
 15. Seki M, Takahashi H, Yamamoto N, Hamaguchi S, Ojima M, Hirose T, et al. Polymerase chain reaction-based active surveillance of MRSA in emergency department patients. *Infect Drug Resist* 2015;8:113-8.
 16. Silbert S, Kubasek C, Galambo F, Vendrone E, Widen R. Evaluation of BD Max StaphSR and BD Max MRSAXT Assays using ESwab-collected specimens. *J Clin Microbiol* 2015;53:2525-9.