Original Research Article

Progress in Microbes and Molecular Biology

HH PUBLISHER

Methicillin-resistant *Staphylococcus aureus* (MRSA) on dispensing counters of community pharmacies in Klang Valley

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Abstract: *Staphylococcus aureus* has been causing contamination and infection in the hospital and community settings. Methicillin-resistant *Staphylococcus aureus* (MRSA) was first discovered in the 1960s and epidemics of MRSA were reported soon after the usage of methicillin. The incidence rate of MRSA infections has been increasing for the past 50 years, and community-associated infection may be slowly replacing hospital-associated MRSA strains. This study aimed to investigate the prevalence of MRSA on the dispensing counters of community pharmacies under different settings - community pharmacies in shopping malls and high streets in Klang Valley. With verbal consent, swab samples were collected from dispensing counters of 23 community pharmacies using sterile cotton buds moistened with sterile sodium chloride (NaCl) solution. Samples were spread on nutrient agars and *Brilliance* MRSA 2 selection agars and incubated at 37ºC. The numbers of colony were documented and statistically analysed using Microsoft Excel and Statistical Package for the Social Sciences (SPSS) Statistics. The results showed that the prevalence of MRSA on the dispensing counters was 22% (5 out of 23), and the difference in MRSA contamination between community pharmacies in shopping mall and high street setting was insignificant ($p > 0.05$). This study serves as the pioneer study of its kind in Klang Valley. All healthcare professionals and individuals are strongly advised to practise a good level of hygiene to avoid MRSA cross contamination.

Keywords: MRSA; pharmacy; dispensing counter; cross-contamination; Klang Valley

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Received: 10th April 2020
Accepted: 12th May 2020
Published Online: 18th May 2020

Citation: Chow Y-L and Tham H-W. Methicillin-resistant *Staphylococcus aureus* (MRSA) on dispensing counters of community pharmacies in Klang Valley. Prog Microbes Mol Biol 2020; 3(1): a0000084. https://doi.org/10.3687/pmmb.a0000084

Introduction

Asia has one of the highest incidence rates of MRSA infections in the world[1- 3]. Besides MRSA, vancomycin-intermediate *S. aureus* (VISA) strains and vancomycin-resistant *S. aureus* (VRSA) strains are also reported in several Asia countries[4]. From 1986 to 2007, the prevalence rate of MRSA infections in Malaysia has increased from 17% to 44.1%[5]. On average, MRSA patients in intensive care units are hospitalised three times longer and have five times greater risk of death compared to other patients in the intensive care units[6]. In addition, there have been reports in which patients infected with MRSA have a mortality rate of 34% within 30 days compared to 27% in patients infected with non-antibiotic resistant *S. aureus*[7]. Researchers have been working persistently to search for potential compounds to inhibit MRSA, while some studies exhibited good potential but further works are needed before these discoveries could be developed as marketable drugs[8–11].

Hospital-associated MRSA (HA-MRSA) and community-associated MRSA (CA-MRSA) differ in terms of their molecular and clinical epidemiology. HA-MRSA infection is linked to serious, invasive diseases, such as skin and soft tissue infections (SSTIs), pneumonia and bloodstream infection (BSI) in hospitalised patients[12]. On the other hand, CA-MRSA infection may slowly replace HA-MRSA[13] with cross contamination between hospital and community settings[14,15]. CA-MRSA is defined as MRSA infection which happens without any recent hospital exposure, and is usually associated with SSTIs in healthy, young individuals[16]. In addition, uncommon cases of skin infections, for instance, necrotizing fasciitis has been reported to be associated with CA-MRSA[17]. Furthermore, CA-MRSA strains also cause other invasive infections; for example, urinary tract infections, osteomyelitis, bacteremia, pneumonia and septic shock. However, each of these infections only accounts for less than 4% of all CA-MRSA infections[18]. With the statistics and adverse effects of MRSA discussed above, this study aims to

study the prevalence of MRSA in selected community pharmacies in Klang Valley, Malaysia. Dispensing counters of these pharmacies will be the study site of this project.

Material and Methods

Agar Preparation and Procurement

Nutrient agars (Oxoid) were prepared according to the manufacturer's instructions. *Brilliance* MRSA 2 pre-made agar plates were purchased from Thermo Fisher Scientific and stored in dark at 4°C until used.

Study Sites

Twenty-three (23) community pharmacies were randomly identified for sample collection in Klang Valley. All pharmacies were either located in shopping complexes, or at high-street setting.

Sample Inoculation

All samples collected were inoculated onto nutrient agars and *Brilliance* MRSA 2 agars and incubated at 37°C for 12-16 hours. The numbers of visible colony were documented and data were analyzed. The results were presented in colonies forming unit per mL (CFU/mL). All procedures were conducted under aseptic conditions.

Ethical Clearance

This study was conducted under the approval of SEGi Ethics Committee, with ethics approval number of SEGi/RIMC/FOP/28/2018.

Results

Study Sites

Figure 1 indicates the pharmacies visited over the course of the sample collection period in this study. The blue pointers indicate the absence of MRSA and the red pointers indicate the presence of MRSA. In Kuala Lumpur city, three community pharmacies were found to have MRSA on their dispensing counters. Meanwhile, in Damansara and Petaling Jaya area, one community pharmacy in each area was found to have MRSA on the dispensing counter.

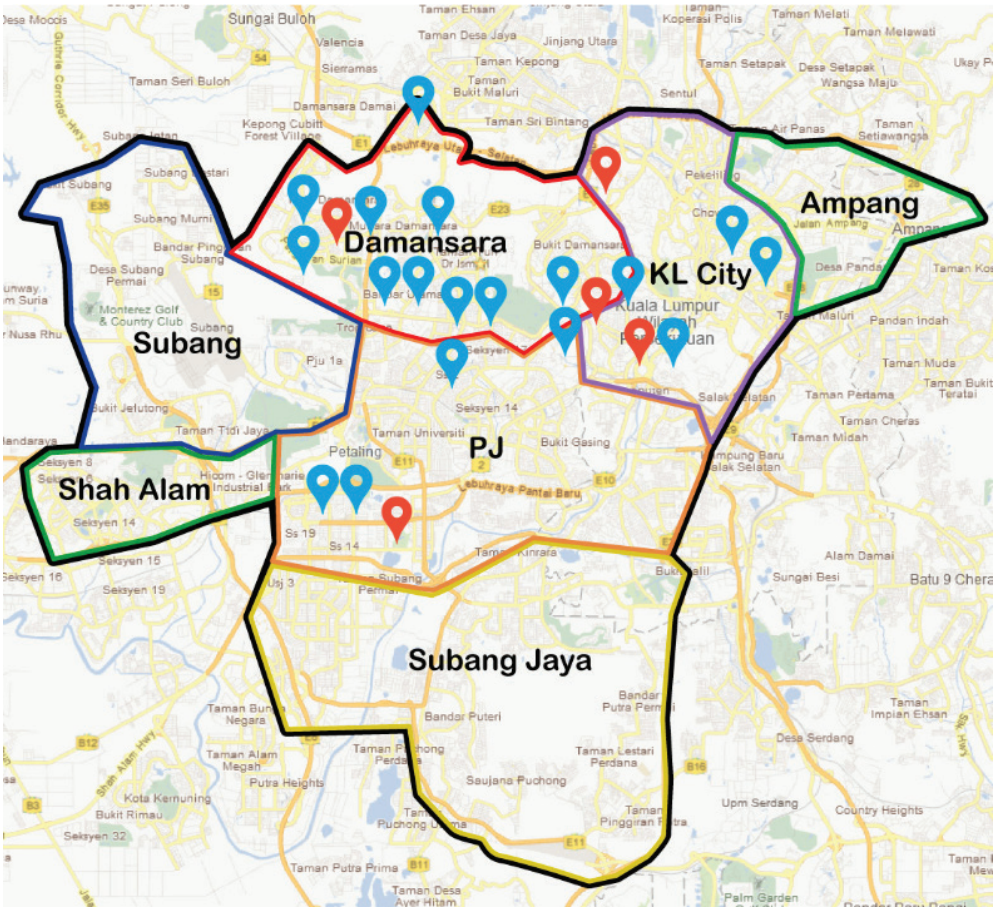

Figure 1. Selected community pharmacists for this study. (Blue pointers) Community pharmacies without MRSA detected on dispensing counter; (Red pointers) Community pharmacies with MRSA detected on dispensing counter.

Prevalence of Total Microorganism and MRSA Counts

Based on the graph in Figure 2, different levels of microorganism prevalence were detected on all 23 dispensing counters of community pharmacies. MRSA was detected on five dispensing counters out of 23 community pharmacies in Klang Valley.

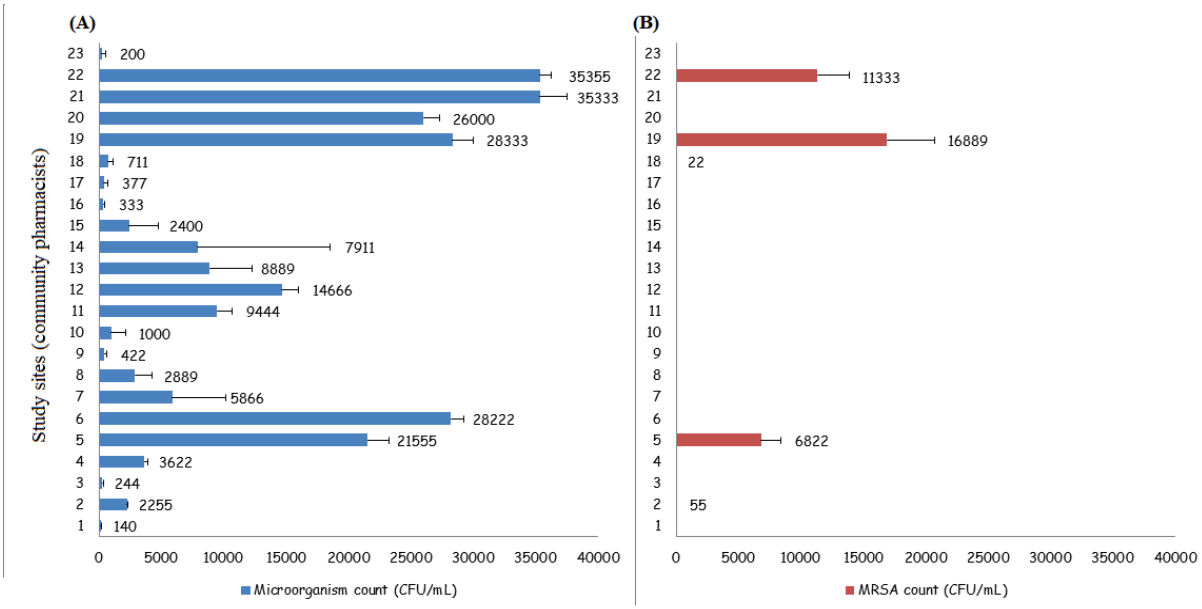

Figure 2. Microorganism count on 25 cm^2 of dispensing counters of selected community pharmacies. (A) Total microorganism count on nutrient agars; (B) Total MRSA count on *Brilliance* MRSA 2 agars.

MRSA Contamination between Community Pharmacies in Shopping Mall and High Street Settings

Figure 3 shows MRSA was detected on two dispensing counters of community pharmacies in high street. Three dispensing counters of community pharmacies in shopping mall setting were detected with MRSA.

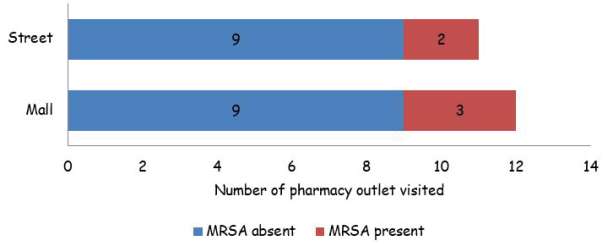

Figure 3. No significant difference in MRSA contamination between community pharmacies in shopping mall and high street settings.

Table 1 shows that the nature of community pharmacy settings (shopping mall or high street) did not significantly correlate with the presence of MRSA contamination on dispensing counter ($P > 0.05$).

Table 1. Independent T-test on difference in MRSA contamination between community pharmacies in shopping mall and high street settings.

		t-test for Equality of Means
		Sig. (2-tailed)
Location	Equal variances assumed	.708

Discussion

A comparable study was conducted at Yamaguchi University Hospital, Japan in 2013. The study assessed the presence of MRSA contamination on the surfaces of bed side rails, overbed tables and curtains in the rooms of 24 inpatients that were infected with MRSA infections. The prevalence of MRSA contamination on the surfaces of bed side rails and overbed tables was 31.6% (6 out of 19) and 25% (6 out of 24) respectively. The total number of bedside rails examined was 19 instead of 24 because 5 of the patients were using beds without side rails. However, there was an absence of MRSA contamination on the surfaces of all 24 curtain samples[19].

Three other similar studies that evaluated the prevalence of MRSA contamination on the surfaces of curtains have presented different results. The prevalence of MRSA contamination was reported to be 28% (14 out of 50)[20], 15.5% (31 out of 200)[21], and 92% (12 of 13 samples)[22]. The method used for MRSA detection may have been different for each study to which it leads to differences in results. Therefore, further studies are needed to answer the inconsistencies in these results.

In this study, the prevalence of MRSA on the dispensing counters of community pharmacies in Klang Valley was found to be 22% (5 out of 23). The number might be worrying since community pharmacies are easily accessible by the public. Although the data collected could be improved, the cleanliness of dispensing counters should be prioritized since patients normally receive their medications from pharmacists over the dispensing counters. As a result, the transmission of MRSA to other healthy populations might occur through the platform of dispensing counters.

In addition, we also found that the occurrence of MRSA contamination between different community pharmacy settings (shopping mall or high street) was not statistically significant. The location of pharmacies whether in a shopping mall or at high street, did not significantly reflect the hygiene of the dispensing counter. We would like to highlight other factors that may affect the cleanliness of pharmacy, for instance, the responsibility of pharmacist and staff members. In addition, increasing awareness of public to consult community pharmacists might also lead to cross

contamination of antibiotic-resistant microorganism[23], with several research studies reported evidence of microorganism transmissions between environmental surfaces and patients[24].

Based on the Good Dispensing Practices by World Health Organization (WHO), a clean, organized and safe working environment provides a basis for good practice. Dispensing environments of a community pharmacy should be clean, hygienic and uncontaminated since most of the pharmaceutical products are for internal use. The dispensing environment of a community pharmacy includes work surfaces, staff members, physical surroundings, shelves, counters and so on. In addition, staff members should maintain good personal hygiene and wear clean clothing if they are involved in dispensing. The staff members should also avoid skin contact with pharmaceutical products during dispensing to prevent any contamination. Maintaining a clean working environment in the community pharmacy requires daily cleaning of floors and working surfaces, daily removal of waste and a regular routine of shelves cleaning. It is also essential to clean the equipment used after handling any pharmaceutical products[25].

Private healthcare sector such as community pharmacy is in growing need in developing countries. These pharmacies are always the primary source of healthcare for the public due to convenience, close in proximity, reasonable price, responsiveness and flexibility in operating hours[26]. Therefore, community pharmacy should be kept at good level of hygiene to prevent cross contamination of multidrug-resistant microorganism.

Conclusion

MRSA contamination has been detected on dispensing counters of community pharmacies in Klang Valley. The prevalence of MRSA on the dispensing counters was 22% (5 out of 23). In addition, this study also showed that the presence of MRSA contamination was independent from the location and setting of community pharmacies.

Authors Contribution

The research and manuscript writing were performed by Y-LC. H-WT founded the research project.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Acknowledgement

Authors would like to acknowledge Faculty of Pharmacy, SEGi University for supporting the research project through University Research Fund.

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