

Back to basic: Bio-burden on hands of health care personnel in tertiary teaching hospital in Malaysia

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Abstract. Hands of Health Care Personnel (HCP) are one of the most common vehicles for the transmission of infection. Microorganisms can survive well on the hands of HCP for a certain duration. Therefore, the purpose of this study is to bring awareness to HCP that their hands can actually be contaminated with many microorganisms. These microbes on the hands of HCP can potentially infect their patients if they do not comply with the proper hand hygiene practice. This cross-sectional study was conducted at a randomly selected Intensive Care Unit (ICU) and general ward in a hospital. Twenty five HCP from each ward were randomly selected and their hands were imprinted on blood culture plates. Microorganism growth were quantified and identified. Data were analyzed and presented as descriptive analysis. One hundred blood agar plates were processed and analyzed. Majority (71%) of the samples had more than 50 colony-forming units (CFU) and only 17% of the samples had less than 25 CFU. Microorganisms identified include *Staphylococcus* spp., *Acinetobacter* spp., *Enterobacteriaceae*, *Pseudomonas* spp., *Moraxella*, *Delftiaacidovorans* and fungi. All isolated microorganisms were antibiotic sensitive strain. This study showed that the hands of HCP were contaminated with many microorganisms. Therefore, it is imperative that HCP must practice proper hand hygiene when taking care of their patients in the wards.

INTRODUCTION

Healthcare associated infections (HCAI) are associated with prolong hospitalization, morbidity and mortality. It also contributed to extra hospital budget. Every year, several billions spent in healthcare sector was solely for the management of HCAI cases. In 2001, one of the tertiary-care referral hospital in Malaysia spent 1.98 million Ringgit Malaysia only on antibiotics for treating HCAI (Hughes *et al.*, 2005).

Hands play a major role in the transmission of infection in healthcare institutions. The microflora that colonized the surface of hands can be divided into transient and resident microorganisms. The

transient microorganisms which colonize the superficial layers of the skin are less adherent and can be easily removed by proper hand washing. It includes the microorganisms such as *Staphylococcus aureus*, *Pseudomonas* spp., *Klebsiella* spp., and *Acinetobacter* spp. These microorganisms can be easily transmitted either by direct hand contact between human skin or through inanimate environment. These microorganisms can survive well on the hands of health care personnel (HCP) for a certain duration and it can cause cross contamination to the patients if HCP did not practice proper hand hygiene (Pittet *et al.*, 2006). The transient microorganism is frequently associated with hospital infections while the

resident microorganism rarely causes infection unless the skin is breached by a device such as a central venous catheter.

Infections with multi drug resistant organisms (MDRO) such as Extended Spectrum Beta Lactamase (ESBL) *Klebsiella pneumoniae*, ESBL *E. coli*, Carbapenem-resistant *Enterobacteriaceae* (CRE), and Methicillin-resistant *Staphylococcus aureus* (MRSA), are currently a big challenge not only to our healthcare setting but also globally. Effective hand hygiene was found to be effective in preventing or reducing the spread of these pathogens (Pittet *et al.*, 2000). Many studies have shown the relationship between hand hygiene practices and the reduction in HCAI rates (Pittet *et al.*, 2000; Zerr *et al.*, 2005; Ling & How, 2012). According to the annual report from the Ministry of Health Malaysia in 2012, the national HCAI rate reduced from 2.11% for March survey to 1.51% in September 2012 survey and at the same time hand hygiene compliance rate increased from 67.7% to 87.9% in 2012 (Infection Control Annual Report 2012).

Compliance with the practice of hand hygiene among healthcare worker is another challenge for infection control team. Globally, the compliance with the practice of hand hygiene still needs to be improved (Shekelle *et al.*, 2013). In our setting, HCP's compliance with the practice of hand hygiene was 65% to 70%, which is slightly lower compared to the national average hand hygiene compliance rate of 74% (Annual report ministry of health 2011).

WHO guidelines listed five components that need to be established to ensure compliance of hand hygiene practices (World Health Organization, 2009). One of the biggest challenges is to change the attitude of HCP. They must practice five components of hand hygiene practice during their duty in the wards. Continuous education is one of the essential components that need to be carried out to enhance hand hygiene compliance. HCP must understand that their 'clean looking' hands may contain many microorganisms that can potentially infect their patients if they do not carry out proper hand hygiene practices. The aim of this study is to determine the microorganism burden on the

hands of HCP with a view to create awareness among HCP on the importance of hand hygiene practices.

MATERIALS AND METHODS

Ethical Consideration

Permission to conduct the study during morning shift was obtained from the Sister and Head of Department with informed consent given by participating HCP. This study was approved by the Human Research Ethics Committee USM: USMKK/PPP/JEPeM [265.4.(1.4)]/Amend. (01).

Setting

This study was performed at the Hospital Universiti Sains Malaysia (USM). The hospital has 749 beds (696 beds in 29 general wards and 53 beds in 5 ICUs), serving a population of 2.58 million inhabitants (Population And Housing Census Malaysia, 2010). In 2012, there were 37,296 admissions to this hospital.

Study design

This cross-sectional study was carried out in January 2013. A simple random sampling method by using computer was used to select from a list of 34 wards. Ward 1 Mutiara and Ward 4 Utara were selected to represent ICU and general ward in Hospital USM.

Study procedures

During the morning shift from 8.30am till 11 am, 25 HCP comprising doctors, pharmacist, dietician, nurses and medical attendants from each selected ward were randomly selected according to random table. Their palms and fingertips were imprinted on a 140 mm Columbia horse blood agar plate (Oxoid, UK) by using imprint method regardless of their hand hygiene practice (Goh *et al.*, 1999). All the samples were immediately transferred to the laboratory for processing.

Microbiological samples and processing

Imprints from the right and left hand of the same HCP were considered as separate samples. The blood agar plates were then incubated at 35°C under aerobic condition for

24 hours. All microorganism growth on Day 2 were quantified based on colony-forming unit (CFU) as described by Goh *et al.* (1999). In this study, the CFU was modified into 3 categories, which are <25, 25-50, and >50 CFU.

Colonies of microorganisms were sub-inoculated on 90 mm Columbia horse blood agar and MacConkey agar plate (Oxoid, UK) in order to obtain pure culture. Pure culture was identified according to the standard sample processing methods (conventional biochemical test and VITEK 2 automated system) in microbiology laboratory. All microorganisms detected were further tested for antibiotic sensitivity using the disc diffusion test.

Statistical methods

Data were analyzed and presented as descriptive statistics.

RESULTS

Fifty HCP were included in this study and a total of 100 blood agar plates were obtained, processed and analyzed. Majority of the samples from ICU and Ward 4 Utara had more than 50 CFU, and less than one-fifth of the samples had less than 25 CFU (Table 1).

Among the 50 HCP, there were 29 doctors, 13 nurses, 4 hospital attendants, 2 pharmacists, 1 dietician and 1 medical assistant (Table 2).

Almost all (97%) of the samples had *Staphylococcus* strain. Six percent (6%) were *Staphylococcus aureus* and none of them were Methicillin-resistance strain. Nearly half of the samples had fungal, and it was the second most isolated microorganism after *Staphylococcus* spp. Other microorganisms detected include *Acinetobacter* spp., *Acinetobacter lwoffii*, *Enterobacter* spp., *Pantoea* spp., *Moraxella* group, *Klebsiella* spp., *Pseudomonas putida*, *Pseudomonas alcaligenes*, *Delftia acidovorans*, and *Serratia fonticola*. All of the microorganisms detected belonged to the antibiotic sensitive strain (Figure 1).

DISCUSSIONS

The hands of HCP are good vehicle for horizontal transmission of infection in hospital settings (Pittet *et al.*, 2000; Emmanuelle *et al.*, 2002). This study showed that their hands (Figure 2) contained microorganisms that can potentially infect other patients.

It is noteworthy that, in our observation during sample collection process, the compliance with the practice of hand hygiene is in need of improvement despite the availability of hand rubs and hand hygiene facilities. Several excuses such as skin irritation from wearing gloves, forgetfulness and busy work schedules were given. Similar reasons were also given by responder in other study (Dubbert *et al.*, 1990). This could be one of the factors that contributed to the excessive microorganism burden (>50 CFU) in a majority of the samples.

Table 1. Colony-forming units detected on blood culture plates in 4 Utara (general ward) and 1 Mutiara (ICU)

Colony Forming Unit (CFU)	4 Utara n (%)	1 Mutiara n (%)	Total n (%)
>50	34 (68.0)	37 (74.0)	71 (71.0)
25 – 50	5 (10.0)	7 (14.0)	12 (12.0)
<25	11 (22.0)	6 (12.0)	17 (17.0)

Table 2. Distribution of hand-print sampling from different HCP groups

	1 Mutiara	4 Utara
Doctor	13	16
Nurse	7	6
Hospital attendant	1	3
Pharmacist	2	0
Dietician	1	0
Medical attendant	1	0
Total	25	25

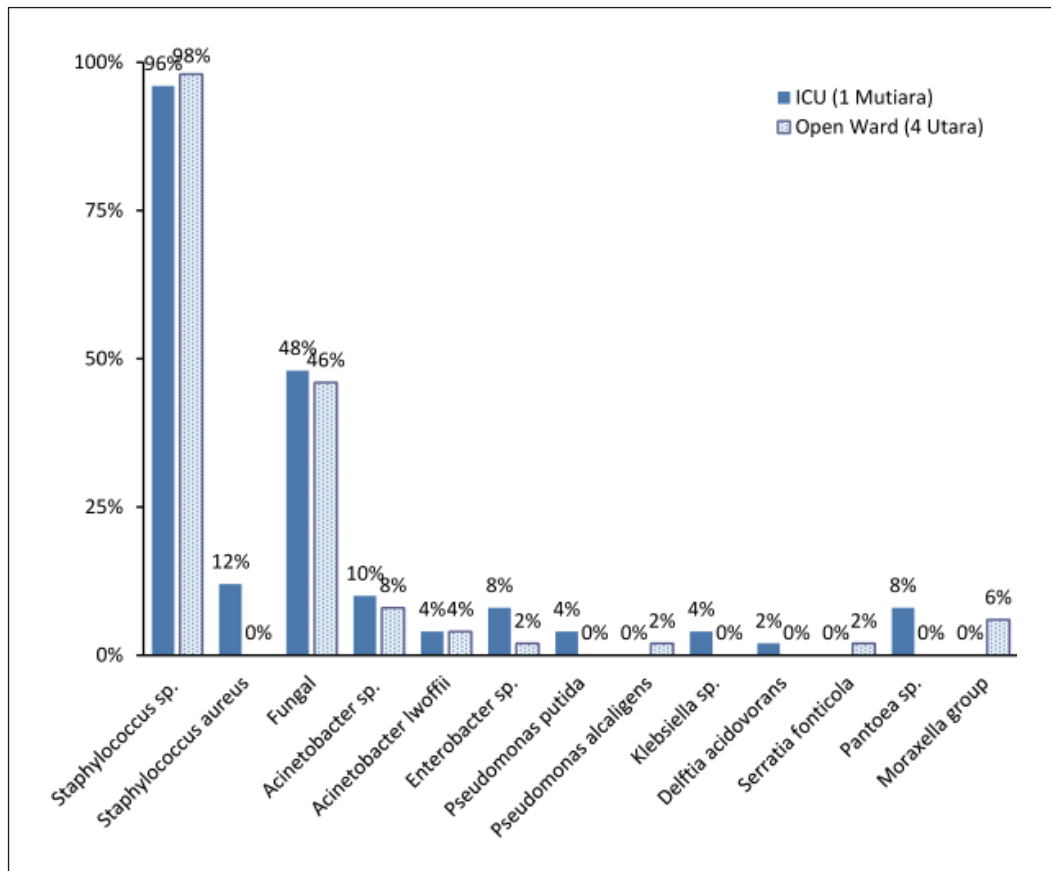


Figure 1. Types of microorganism isolated from the hands of HCP

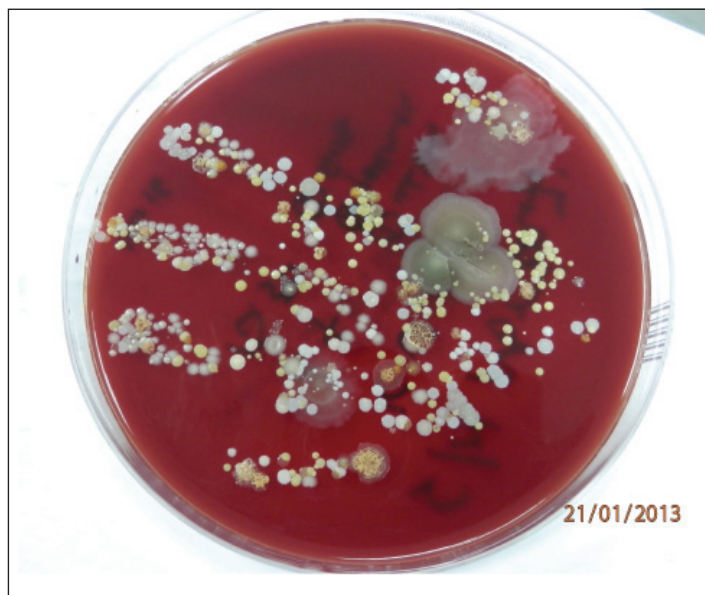


Figure 2. Different types of colonies grew on 140 mm Columbia horse blood plate after incubated for 24 hours

Our study found that 74% of the hands of HCP in ICU had more than 50 CFU. This finding is comparable to the one previously reported at the National University Hospital of Singapore (76.6%) (Goh *et al.*, 1999). We found that *Staphylococcus* sp. was the most common among the microorganisms isolated (97%). This was comparatively higher than that reported in a study conducted in Turkey (30.1%) (Eksi *et al.*, 2010). Gram negative bacteria detected in ICU (n=20) was more than that in the general ward 4Utara (n=12). This could be due to the different types of patients in these two wards. Patients admitted to ICU are usually more seriously ill and are exposed to multiple antibiotic treatments as compared to patients in the general wards. The degree of bacteria contamination in ICU is also higher as compared to general wards. A study done in Taipei Medical University Hospital (Teng *et al.*, 2008) on bacteria contamination on patients' medical charts found that 90% of the charts in surgical ICU were contaminated with potentially pathogenic or pathogenic bacteria, as compared to 72.2% of those in surgical ward.

From our study, we found that virulent microorganisms such as *Klebsiella* spp, *Acinetobacter* spp. and *Staphylococcus* spp. can easily contaminate our HCPs' hands. These microorganisms are opportunistic pathogens that can infect patients during their hospital stay and may lead to serious outcomes such as pneumonia, urinary tract infection and septicemia (Eksi *et al.*, 2010). The possibilities of these microorganisms causing an outbreak should not be taken lightly.

Our results clearly showed that the hands of HCP were contaminated with many microorganisms, and hands are the ideal vehicle for cross contamination between patients and the wards (Pittet *et al.*, 2000; Emmanuelle *et al.*, 2002). Therefore, carrying out the practice of five components of hand hygiene is mandatory when taking care of patient.

Appropriate knowledge is essential to instill the correct attitude among HCP to prevent infection and to improve the hand hygiene practice and compliance. Therefore, we recommend that continuous education on

proper hand hygiene practices should be carried out to increase awareness among HCP so as to ensure that they practice the correct hand hygiene technique.

Limitation Of The Study

The microorganism burden were assessed by taking the agar hand imprint instead of glove juice technique, which may be more effective in detecting the whole microorganism burden on hands (Larson *et al.*, 2001).

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