

# Effectiveness Hand Washing and Hand Rub Method in Reducing Total Bacteria Colony from Nurses in Medan

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## Abstract

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**Keywords:** Handwashing; Handrub; Total bacteria colony

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**BACKGROUND:** Hospital-acquired infection (HAI) is a major problem for the patient's health care and may impact the duration of treatment. Hand hygiene is a simple procedure but giving good prevention usually done among nurses at the hospital.

**AIM:** Objective of the study is to determine the effectivity of handwashing method compared to hand rub to eliminate microorganisms on nurse's hands at Sumatera Utara University Hospital. This is an experimental analytic study using random sampling technique.

**METHODS:** There were 16 nurses enrolled in this study. There were 2 groups involved; the first group using handwashing with soap and the other one using hand rub. The swabs were taken from each hand from both groups before and after washing their hands. Moreover, the swabs directly sent to Microbiology Laboratory of Sumatera Utara University to identify bacteria which colonise the hand.

**RESULTS:** There were no significant differences between using handwashing method compared to hand rub in reducing total bacterial colony on hands ( $p = 0.088$ ). The average of total colony decreased by using handwashing method is 59.5%, and by using a hand, rub is 47.2%.

**CONCLUSION:** Hand hygiene method using alcohol-based hand rub liquid has been recommended by WHO and can replace hand washing method in a particular situation.

## Introduction

A hospital-acquired infection (HAI) is a major problem for patients health care and may impact the duration of treatment even increasing the risk of mortality. Prevalence of HAIs in low-income and medium countries ranged from 5.7-19.1%, while the prevalence in high-income countries ranged between 3.5 – 12%. In Indonesia which is part of the middle-income countries, HAI prevalence reached up to 7.1% [1]. Organisms that cause nosocomial infection are most commonly transmitted by the hands of physicians, nurses, physiotherapists, and other hospital personnel. Hand hygiene has often been singled out as the most important procedure in

preventing nosocomial infection [2]. Hand hygiene is a simple procedure but giving good prevention usually done among nurses at the hospital. Sari study showed that using two types of hand rub from WHO which first formulation contains glycerol and ethanol, hydrogen peroxide.

In contrast, the second formulation consists of isopropyl alcohol, glycerol, and hydrogen peroxide, on the subject's hands before, after, and the average decline in the number of germs. Based on Total Plate Count showed bacterial colony difference before and after hand washing using hand rub WHO formula. The decline in several germs after using the hand rubs WHO formula is higher compared to the average decline in several germs after hand washing using a commercial hand rub [3].

## Material and Methods

### Study design

This is an experimental analytic study with pre-test – post-test design. Aim of the study is to measure the effectiveness of hand washing with soap and hand rub methods to eliminate microorganisms on nurse's hands at Universitas Sumatera Utara Hospital (USU-Hospital). This study has been done from October to November 2016. Moreover, Health Research Ethics Commission (KEPK) Faculty of Medicine, Universitas Sumatera Utara has approved the study protocol.

### Subjects

These subjects were chosen by random sampling technique and who meets the inclusion criteria. The criteria include were the nurse's skin were intact and has not done hand-washing or using hand rub at least 4 hours before sample collection. There were 16 nurses enrolled in this study. Firstly, all of them using handwashing with soap for hand hygiene. After a week, all of them using hand rub for hand hygiene. The swabs were taken from each hand from both groups before and after washing their hands. Moreover, the swabs directly sent to the Microbiology Laboratory of Universitas Sumatera Utara.

### Procedure

There were 16 nurses involved in this study with 2 different methods. Firstly, the nurses used handwashing with soap, and after a week, those nurses using hand rub. Both hands were swabbed before and after doing the method. After swabbing, the swabs directly sent to Microbiology Laboratory of Sumatera Utara University to identify bacteria which colonise the hand and to count the colony of the bacteria.

### Statistical analysis

The effectiveness of the use of handwashing with soap and hand rub is defined as the reduction of the number of mean colonies on the samples before and after the action. The average obtained then compared with paired t-test.

## Results

### Hand wash with soap method

According to the results, before handwashing

with soap, swab collected was obtained several bacteria named *Bacillus subtilis* 4 samples (20%), *Staphylococcus epidermidis* 9 samples (45%) and coagulase-negative *Staphylococcus* 7 samples (35%).

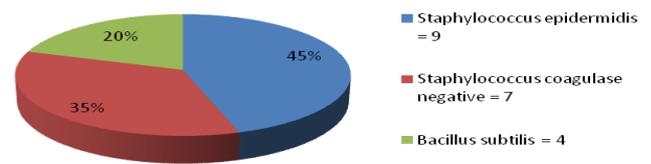


Figure 1: Bacteria found before handwashing with soap

After handwashing with soap *Bacillus subtilis* was not found moreover, bacteria still exist were *Staphylococcus epidermidis* 9 samples (56.25%) and coagulase-negative *Staphylococcus* 7 samples (43.75%) (Figure 1, and Figure 2).

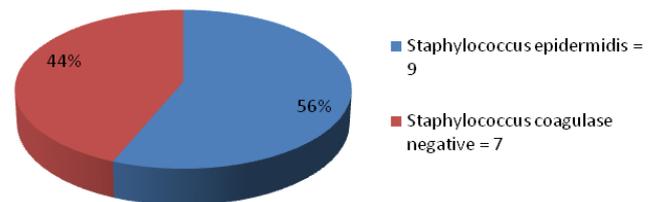


Figure 2: Bacteria found after handwashing with soap

### Hand rub method

Based on the results of the study before using hand rub, bacteria found were *Staphylococcus epidermidis* 10 samples (47.62%), *Staphylococcus coagulase-negative* 6 samples (28.75%), *Bacillus subtilis* 2 samples (9.52%), *Klebsiella oxytoca* 2 samples (9.52%) and *Escherichia coli* 1 sample (4.76%). After using handrub, *Klebsiella oxytoca* and *E. coli* was not found but the other bacteria still exist.

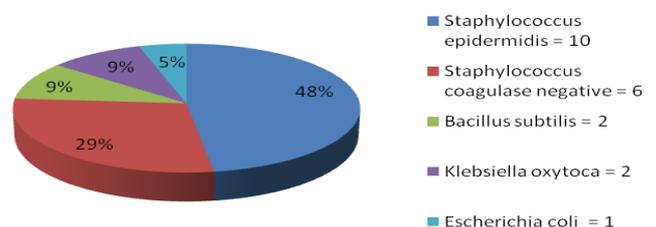


Figure 3: Bacteria found before using hand rub

There were *Staphylococcus epidermidis* on 10 samples (55.55%), *Staphylococcus coagulase negative* 6 samples (33.33%) and *Bacillus subtilis* 2 samples (11.12%) (Figure 3, and Figure 4).

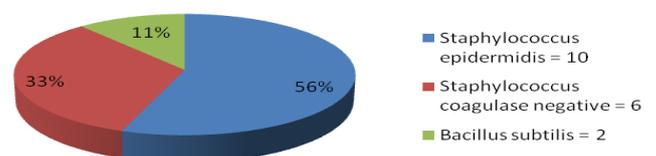


Figure 4: Bacteria found after using hand rub

**Total plate count bacteria from hand wash with soap**

It was found that the bacteria colony count reduced after handwashing with soap. Figure 6 described the total plate count (TPC) bacteria (CFU/ml) from each sample in a petri dish both before and after handwashing with soap. It was found that the average number of reduced colonies is 59.55%

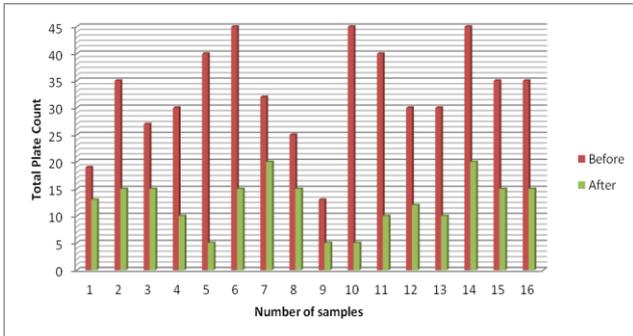


Figure 5: Reduced TPC after handwashing with soap

**Total plate count bacteria from using hand rub**

The same result showed when using hand rub. It was found that the bacteria colony count reduced after using hand rub. Figure 7 described the total plate count bacteria (CFU/ml) from each sample in a petri dish both before and after using hand rub. It was found that the average number of reduced colonies is 47.2%.

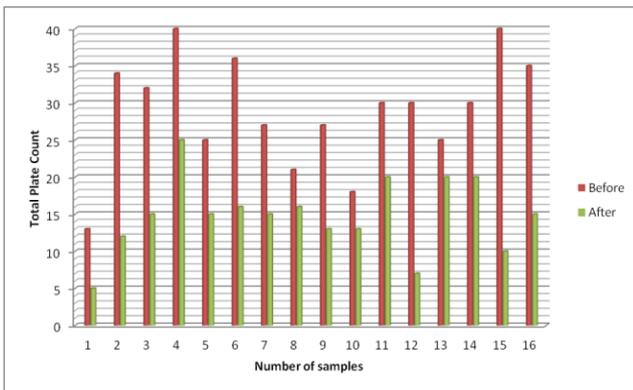


Figure 6: Reduced TPC after using hand rub

**Effectiveness reduced TPC after hand wash with soap and using hand rub**

The effectiveness of using soap or hand rub is defined as the reduction of the number of mean colonies on the samples before and after the method done. The value obtained when compared with the paired t-test. Paired t-test results showed that  $p = 0.088$ . However, the value of  $p > 0.05$  indicates that there is no significant difference between handwashing with soap and hand rub usage in reducing the number of bacteria colonies on the

hands of nurses. The average reduction number of bacteria was higher on washing hand with soap which is up to 12.35%.

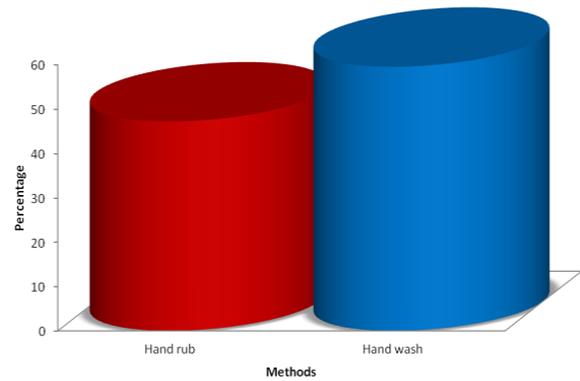


Figure 7: Comparison of reduced TPC from 2 methods

**Discussion**

The bacteria found on nurse's hands at USU hospital were *Staphylococcus epidermidis*, *Staphylococcus aureus* coagulase-negative, *Bacillus subtilis*, *Klebsiella oxytoca*, and *Escherichia coli*. This result was different from bacteria type obtained by Anwar Musadad and Agustina Lubis study which is 12.9% *Staphylococcus Albus*, 3.2% *Escherichia coli* and 6.4% *Pseudomonas sp.* [4]. The difference happened most probably due to the location of the medical officer and paramedic workplace are not the same as the previous study, so that the bacteria found may also different.

The hand is normally colonised by resident and transient bacterial flora, depending on the part of the skin where they colonised. Resident flora, the harmless bacteria is more difficult to destroy. (For example *Staphylococcus epidermidis* and *Staphylococcus aureus* coagulase-negative). Transient flora more often at risk of incurring diseases and more easily destroyed. (For example *Staphylococcus aureus*, *Bacillus subtilis*). Nurses' hands could be contaminated with both types of flora at the time of contact with patients. Moreover, it may be contaminated from the patient's environment. The amount of flora also increased along with the length of the duration of the activity [5].

Using hand rub recommended by WHO due to practical use and education promoted on the function of hygiene in replacing soap. The content on the hand rub used in this research is 70% ethyl alcohol and soap used is 0.175% chloroxylenol and 0.3% salicylic acid. The alcohol effect was bactericidal against gram-positive and gram-negative bacteria, *M. tuberculosis*, some types of fungus and non-enveloped viruses. Alcohol works on the bacteria by protein and cytoplasm membranes denaturation.

Finally, alcohol destroys the work by denaturation on the cell membrane [6].

The results showed that washing hands with soap (59.55%) or using hand rub (47.2%) had a significant difference between before and after doing hand hygiene ( $p = 0.001$ ). These results are by research by Sari[3]. Whom found the significant difference after hand washing using soap ( $p = 0.002$ ) and after using hand rub ( $p = 0.001$ ). The same result also found by Mona [7]. Whom found the significant difference after washing 30 hands using soap ( $p = 0.01-0.03$ ) and after using hand rub ( $p = 0.002$ ).

However, in this study, washing hand with soap has an average reduction in total plate count of bacteria colony (59.55%) higher than using hand rub (47.2%). This result is contrary to Abaza et al., [5] who found the result of handwashing using alcohol-based hand rub is much more efficient than hand washing using soap. Abaza compared 4 products alcohol-based hand rubs with an efficiency of 99%, 97%, 77% and 87% while the soap only shows the efficiency of 30%. Similar to Abaza, Amy et al., [8]. Found where a total of 204 samples showed that hand rub is more efficient than handwashing with soap and have a meaningful difference ( $p = 0.01$ ). Hand hygiene method using alcohol-based hand rub liquid has been recommended by WHO and can replace handwashing with soap method in a particular situation. It suggests that hand hygiene method using hand rub liquid could be chosen in hand hygiene method [6].

In conclusion, there was no significant difference between handwashing with soap and using hand rub in reducing bacteria which colonised the nurse's hand in this study ( $p = 0,088$ ). The average of total colony decreased by using handwashing with soap method is higher (59.5%) than using hand rub (47.2%).

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