Original Article

Effectiveness of Standard Hand Hygiene Procedure versus Use of Hand Rub in Reducing Transient Bacterial Colony from Hands of Health Professionals Working in Critical Care Units: Quasi-Experimental Study

Betcy Pappachan, Anil Sharma[1], Anil Kumar Patidar[2]

MSc Nursing Students Department of Nursing, [1]Principal, Department of Nursing, [2]Assistant Professor, Department of Nursing, MTIN, CHARUSAT, Charotar University of Science and Technology (CHARUSAT), CHARUSAT Campus, Changa, India

Abstract

Introduction: Hand sanitation is the key measure suggested to counteract and control the spread of pathogens within the hospital setup to safeguard the patients and health professionals from disease. The purpose of this research is to see the effect of two different hand hygiene measures (soap-water, hand rub) on the level of bacterial colony among healthcare personnel's hands. **Materials and Methods:** A total of 44 health care workers were equally divided into two groups using nonprobability convenient sampling technique from various critical care units and approach utilized was quasi-experimental design. Using Pretest posttest design 88 culture swabs were obtained from the hands of participants before and after handwashing with soap and water and hand rub respectively and sent to microbiology laboratory for further testing for the presence of transient bacterial colonies. **Results:** Paired *t*-test was used to compare between the two groups. It showed that the mean difference of hand rub group is greater than that of soap and water group (27.9 > 5.7). Paired *t*-test value is 2.3 and $P = 0.028$ ($P < 0.05$). Hence, it was considered statistically significant. Moreover, Fischer's exact test was used to find out the association between pre-interventional bacterial count with selected demographic variable ($P > 0.05$). Hence, it was considered statistically insignificant. **Conclusions:** Hand hygiene with hand rub is more effective than handwashing with soap and water in transient bacterial colony reduction from hands of health care personnel.

Keywords: Bacterial flora, hand hygiene, hand rub, soap and water

Introduction

Nosocomial infection is one of the major reasons for illness and death rate in hospitalized patients.[1] The prime cause of healthcare-associated infections in the hospital setting are the hands of health care personnel who carries various drug-resistant pathogens, which unless decontaminated will worsen the condition and lead to fatal problems.[2]

Human skin is generally inhabited with various pathogens at different body parts. Moreover, the total microbial count ranges around 3.9×10^4 to 4.6×10^6 CFUs/cm^2. In 1938, pathogens obtained from the hands were broadly classified into two, resident and transient flora. Resident flora is the microbes residing under the skin whereas transient flora is the microbes seen to get collected over the superficial layers of the skin. Transmission of these is either by direct contamination or in contact with patients or dirty surfaces. These transient pathogens are responsible for the majority of nosocomial infections in hospitals which leads to fatal problems.[3] Among them, Methicillin-resistant *Staphylococcus aureus*, Vancomycin-resistant Enterococcus, C. difficile, norovirus, etc., are most prevailing.[4]

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Address for correspondence: Mr. Anil Kumar Patidar, Department of Nursing, MTIN, CHARUSAT, Charotar University of Science and Technology (CHARUSAT), CHARUSAT Campus, Changa - 388 421, India.
E-mail: anilpatidar.nur@charusat.ac.in

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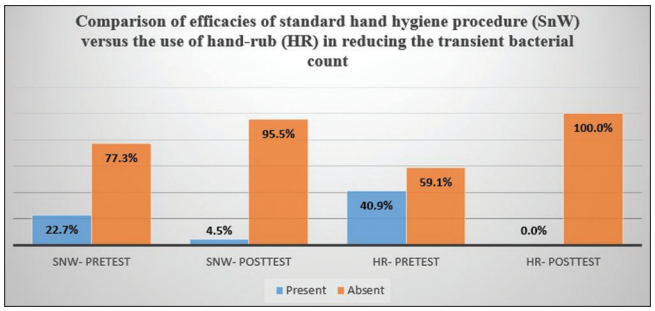

Figure 1: Bar graph showing comparison of pretest posttest bacterial colony count after soap and water and hand rub use

According to the report of the Centre for Disease Control cleaning hands is considered as the optimum method for infection prevention. Although various studies revealed only in 50% of occasions hospital staff used to clean their hands.[5] Various Researches depict that hand sanitation if performed at the most significant time can aid to patient safety and infection control. In addition to that disparities still remain in following the 5 moments of hand hygiene stated by WHO.[6]

In the Indian scenario, similar to other developing nations, less priority is given for the nosocomial infection control. Moreover, the relative causes for this is inadequacy of hospital building facility, skilled human resources, monitoring system, staff shortage, unsanitary conditions, poor social status, unaccredited healthcare setting, and noncompliance of health care personnel toward infection control policy.[7]

Objectives

- To assess the preinterventional and postinterventional effectiveness of handwashing using soap-water on transient bacterial colony count
- To assess the preinterventional and postinterventional effectiveness of alcohol-based hand rub on transient bacterial colony count
- To compare the pretest and posttest results of handwashing using soap and water as well as hand rub on transient bacterial colony count
- To determine the association between preinterventional bacterial count with selected demographic variable.

Materials and Methods

This study involves,

Approach

Quantitative approach.

Design

Quasi-experimental, pretest posttest design.

Setting

Central Gujarat hospitals.

Sample

Health care workers in Critical Care Unit (CCU).

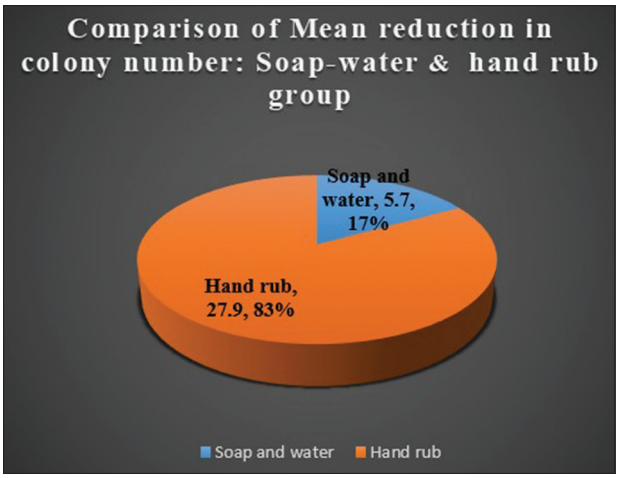

Figure 2: Pie chart showing mean reduction in bacterial colony count after soap and water and hand rub use

Sample size

Forty-four.

Study duration

Two months (June–July 2020).

This quasi-experimentation was done using pretest posttest design on health care personnel working in critical care units of Hospitals in Central Gujarat. The participants were divided into two groups on the basis of nonprobability convenient sampling technique. The sample size was estimated using power analysis $Z_{1-\beta,}$ Keeping Alpha error 5% and Power $(1_{-\beta})$ to be 80%. A total of 44 samples were included in the study (22 each in both experimental groups).

Before starting this study, proper ethical approval with permission was obtained from the institutional ethics committee under protocol number-CHA/IEC/ADM/20/07/599.07.

Participants were clearly informed about the basic aim of research. A written informed and voluntary participation consent was obtained from each study participant before this study ensuring confidentiality of their information. A prevalidated questionnaire as well as a procedure checklist regarding handwashing with soap water and hand rub was utilized. The tools were divided into two sections, one containing questions related to demographic variable. Second section was further classified into two consisting of procedure checklist of both the methods. Data were coded and then entered into excel sheets. Data were compiled, followed by analysis using descriptive and inferential statistics. And were presented as frequency and percentages.

Procedure

Preintervention culture swabs from the hands of samples will be first collected. After doing one patient care, treatment (1. washing hands with soap and water 2. hand rub) is administered simultaneously to each group. And during intervention, the steps of handwashing will be assessed using

Table 1: Efficacy of experimental group 1 on transient bacterial colony count on hands of health care worker's working in critical care units

Bacterial flora on hands	Soap and water (experimental 1), frequency (%)	
	Pretest	Posttest
Present	5 (22.7)	1 (4.5)
Absent	17 (77.3)	21 (95.5)

Table 2: Efficacy of experimental group 2 on transient bacterial colony count on hands of health care worker's working in critical care units

Bacterial flora on hands	Hand rub (experimental 2), frequency (%)	
	Pretest	Posttest
Present	9 (40.9)	0
Absent	13 (59.1)	22 (100.0)

Table 3: Comparison of the results of experimental Group 1 and 2 in decreasing the transient bacterial colony from hands of healthcare workers working in critical care units (*n*=22, 22)

Bacterial flora on hands	Frequency (%)			
	Soap and water		Hand rub	
	Pretest	Posttest	Pretest	Posttest
Present	5 (22.7)	1 (4.5)	9 (40.9)	0
Absent	17 (77.3)	21 (95.5)	13 (59.1)	22 (100.0)

Table 4: Two-sample *t*-test for comparing efficacy of experimental Group 1 and 2 in removing the transient bacterial colony from hands of health care worker's working in critical care units

Group	Mean	SD	*T*	df	*P*
Soap and water (experimental 1)	5.7	11.2	2.3	42	0.028
Hand rub (experimental 2)	27.9	44.5			

SD: Standard deviation

checklists handwashing with soap and water and hand rub of both the experimental groups simultaneously. Thereafter, postintervention swabs are collected from the hands of health care personnel (samples). These Pre- and post swabs, are then send for microbiological testing to the laboratory. In the laboratory, streaking procedure is done (i.e., with the swabs streaks are made on the chocolate agar and nutrient agar) then incubated for 24 h to see the growth of bacteria. If no growth seen, again incubated for the next 24 h. Incubation is done at 37°C–38°C in an incubator. Then, if colonies are seen on the plate, staining of these colonies are done using gram stain method. And observed under microscope for ruling out the organisms. At the end of hand hygiene, swabs culture reports show the results of number of bacterial colony isolated and the specific bacteria.

Results

It states that in soap and water group, out of 22 samples in pretest, 5 (22.7%) of the healthcare personnel's had bacterial flora on hands, whereas in posttest 1 (4.5%) of the healthcare personnel had bacterial flora on hands [Table 1]. This indicates that hand washing using soap-water does not remarkably reduce the colony number.

In hand rub group, in pretest, 40.9% of the healthcare personnel working in critical care units had bacterial flora on hands. In posttest, none of the healthcare personnel had bacterial flora on hands. This indicates that the hand rub remarkably reduces the bacterial count [Table 2].

In Exp. Group 1, in pretest, 5 (22.7%) of the healthcare personnel in CCU had bacterial colony on hands whereas in posttest, 1 (4.5%) showed the presence of colony. This indicates that washing hands with soap with water remarkably reduces the colony number.

In Exp. Group 2, in pretest, 9 (40.9%) of the participants showed bacterial colony [Figure 1]. In posttest, no bacteria was seen. This indicates that the hand rub completely removed the bacterial flora. This shows that in the hand rub group, bacterial flora has remarkably reduced as compared to that in soap and water group [Table 3 and Figure 1].

Two sample *t*-test was used to compare the efficacy of standard handwashing procedure versus the hand rub in reducing the transient bacterial counts. Mean reduction in bacterial colony count in exp. Group 1 and 2 was 5.7 and 27.9 respectively [Figure 2]. "T"-value for this test was 2.3. The *P* value corresponding was <(0.05), hence the rejection of null hypothesis occurs. Hand rub was considerably efficient in reducing the bacterial colonies from hands of healthcare personnel working at CCU [Table 4].

It states that as the *P* values represented are larger than (0.05) neither of the demographic variables showed any considerable association with the bacterial flora on the hands of health care professional working in CCU [Table 5].

Discussion

A quasi-experimental study conducted to compare two different hand hygiene measures. Findings revealed that hand rub was more effective in removing bacterial colonies from hands in comparison to handwashing with soap and water. This result was different from by Tetty Aman Nasution *et al*., study which is washing hand with soap has an average reduction in total plate count of bacteria colony (59.55%) higher than using hand rub (47.2%).[8] *S. aureus* was the commonly seen bacteria on hands of health professionals. This study was limited due to the time constraints and setting. This same kind of research can be done with a larger sample size and with utilization of wider settings. This research can add up for the hand hygiene researches, especially during this current pandemic situation.

Table 5: Association of preinterventional bacterial count with demographic variable was done using Fisher's exact test

Demographic variable	Transient bacterial flora on hands		*P*
	Absent	Present	
Age (years)			
18-25	10	5	0.629
25-35	18	7	
>35	2	2	
Education			
Secondary and/or higher secondary education	3	3	0.364
Graduation and/or above	27	11	
Qualification			
Doctor	7	3	0.572
Staff nurse	20	8	
Patient care assistant	3	3	
Year of experience (years)			
<1	5	6	0.132
1-5	25	8	
Preferred hand hygiene			
Soap and water	17	5	0.332
Hand rub	13	9	

Limitations of the study

This study has limitations. This research was limited to 44 health care personnel's working in CCU. This study can be carried out on health care worker of other hospital and due to the pandemic situation accessibility to hospitals were also limited. The extraneous variables could not be controlled by the investigator.

Conclusions

Nursing professionals are the core of any healthcare team, who play a prime role in promoting and maintaining the health, the present study focuses on evaluating the effectiveness of different hand hygiene measures. After detailed analysis, this study brought out the following conclusions, paired *t*-test showed that average reduction in bacterial flora in soap and water group was 5.7 which was 27.9 for hand rub group. *T*-value for this test was 2.3 with df = 42. Equivalent $P < 0.05$, hence the null hypothesis is rejected.

Hence hand rub was significantly found to be more effective in reducing the bacterial flora on hands of health care personnel working in critical care units in this study.

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Conflicts of interest

There are no conflicts of interest.

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