

Impact of an Interventional Program on Improving Compliance of Hand Hygiene and Reducing Hospital-Acquired Infection in the Critical Care Unit

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Abstract

Introduction: This study aimed to determine the effect of a hand hygiene (HH) and awareness campaign on knowledge and compliance with HH practices among health-care workers working staff in the main intensive care units and also to evaluate the rates of hospital-acquired infection (HAI) before and after the intervention. **Methods:** A prospective, interventional, pre-post design was utilized and carried out in three phases: the first stage was a 1-month preintervention stage to develop the foundation of the compliance rate of handwashing; the second stage was the interventional handwashing campaign; the third stage was the postintervention stage to improve the compliance rate of handwashing. Two instruments were used in this study: the HH Knowledge Questionnaire developed by the World Health Organization to assess HH knowledge and the Handwashing Questionnaire developed to evaluate HH washing. **Results:** HH knowledge has been increased from preintervention (M = 11.84, standard deviation [SD] = 2.41) to postintervention (M = 18.80, SD = 2.93), and the effective compliance with HH practice was as low as 49% in June 2017 to 75% in February 2018. In addition, the HAI rate was dropped from 13.2% in June 2017 to 9% in February 2018. An inverse association was recognized between HH compliance and HAI rates. **Conclusions:** These results recommend that reasonable approaches can decrease the HAI rate of intensive care units. A nationwide handwashing interventional program can be employed in all hospitals.

Keywords: Handwashing, hospital infections, intensive care units, knowledge

INTRODUCTION

Hospital-acquired infections (HAIs) are a major health-care issue, leading to considerable increase in mortality and morbidity and resulting in financial burden. One of the best methods to prevent and control HAI is maintaining hand hygiene (HH) by washing hands with water and detergents and using alcohol-based hand sanitizers.^[1,2] It has been provided that transmission of pathogens can be reduced to a considerable extent by observing effective HH practices.^[1,3] The literature indicates that HH practices are still at a lower rate of compliance and requires sustainable efforts for further development.^[4,5]

Several health-care institutions, such as the World Health Organization (WHO), have proposed HH practices to all health-care workers (HCWs) as a means of preventing

infection.^[6,7] Despite the approved significance of HH in the health-care setting, researchers assert that it is quite a challenge to evaluate the extent of adherence to the respective HH practices.

Alcohol-based hand rub, which is part of HH practice, is playing a useful role in limiting infection transmission in health-care settings.^[8,9] However, the method is neglected by HCWs.^[10,11] Regardless of the fact that some of the previously

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How to cite this article: Gutierrez J, Alloubani A, Alzaatreh M, Mari M, Akhu-Zaheya L. Impact of an interventional program on improving compliance of hand hygiene and reducing hospital-acquired infection in the critical care unit. *J Global Infect Dis* 2021;13:80-4.

Received: 21 May 2020 **Revised:** 21 September 2020

Accepted: 16 October 2020 **Published:** 16 April 2021

Access this article online

Quick Response Code:



Website:
www.jgid.org

DOI:
10.4103/jgid.jgid_147_20

employed methods were revealed to be effective in enhancing the compliance rates,^[12] it is still required to attain a sustainable level of development.^[13]

The multidimensional HH is another approach to enhance HH compliance, thus controlling HAIs. International and national studies were conducted to examine the effect of the multidimensional HH approach that is the International Nosocomial Infection Control Consortium (INICC) on HH compliance in 19 different countries. This approach combines education, with reminders, continuous surveillance, performance feedback with the availability of supplies, and administrative support to achieve maximum outcome. The result indicates a significant improvement in HH compliance.^[14-17]

Most of the HH-related HAI studies have been conducted in developed countries.^[18] However, it has not been systematically studied in developing countries until the INICC started to evaluate and analyze the HAI rates with standardized methods.^[19]

This study aimed to determine the effect of a handwashing and awareness campaign on knowledge and compliance with HH practices among HCWs. Specifically, the study question was: What is the effect of HH campaign on HH knowledge, practice, and HAI?

The prospect of the study is significant since it was the first study in the northwest region of Saudi Arabia. In the current study, most of the strategies recommended by the WHO are combined, wherein each strategy works on HH compliance and HAI independently within varying degrees. Furthermore, the effectiveness of a multimodal program that does not include all strategies included in INICC multidimensional HH approach is unclear,^[15] and therefore, further implementation is needed.

METHODS

Study design

A prospective, interventional, pre–post design was utilized using one group pretest–posttest. Pre–post design is presented to understand and determine the effects of selected interventions.^[17]

Setting and participants

The study was conducted between June 2017 and February 2018 in the main intensive care unit (MICU), pediatric ICU (PICU), neonatal ICU (NICU), and coronary care unit (CCU) at one of the largest government hospital in Tabuk, Saudi Arabia. This hospital is a 445-bed tertiary hospital that contains a 22-bed PICU, 20-bed MICU, 16-bed NICU, and 3-bed CCU.

The managers and assistants were approached to evaluate the inclusion criteria. The inclusion criteria for HCWs should be worked in one of the selected units in the hospital with 24-h accountability and responsibility for operational processes, held a Bachelor or Master of Science degree, and were able to sign the consent form to participate in this study.

Ethical considerations

This study has been reviewed and permitted by the Institutional Review Board, with the ethical approval number: UT-54-1-2018. Moreover, ethical approval for this study was obtained by the training and scholarship center of the health of the approached hospital. The researchers assured the participants that the information was confidential. No personal data would be shared, and it would be used only for research purposes, while maintaining their anonymity. Furthermore, the researchers confirmed that the outcomes of the study would aid in recognizing the actual reasons behind the unsuitable handwashing practice and knowledge.

Measurements/instruments

An electronic questionnaire was constructed using the Google Drive website in which the participants used an electronic device (iPad) to answer the questionnaires. The questionnaire used in this study was composed of three parts: demographic sheet, HH Knowledge Questionnaire developed by the WHO^[20] to assess HH knowledge, and Handwashing Questionnaire developed by Alloubani *et al.*^[21] to assess the HH practice.

The demographic information included gender, age, experience, profession, departments, and education. The HH Knowledge Questionnaire consisted of 25 questions and addressed different factors related to HH knowledge. The correct answer was given one point. The total score ranged from 0 to 25. Scores ≤ 12 were considered poor, scores between 13 and 18 were considered moderate, and scores of ≥ 18 were considered high.

The Handwashing Questionnaire consists of eight questions to assess self-reported HH practice level. Each item was rated using a 5-point Likert scale. The total score ranges from 8 to 40, scores >20 were considered low, 20–30 was considered moderate, and <30 was considered a high level of HH practice.

Procedures

The study was conducted over three stages:

Preintervention

The first stage was a 1-month preintervention stage in June 2017 to develop the foundation of compliance rate of handwashing. The handwash observers were trained on the procedure, and they were monitored by the principal investigator daily. The questionnaire was administered to the participants preintervention in June 2017.

Intervention

The second stage was the interventional handwashing campaign carried between July 2017 and January 2018 as a part of the provincial educational program about HH practice improvement among HCWs.

The campaign's steps involve:

- Facilitating: Lectures to educate HCWs about the importance of HH and the fundamental HAI concepts
- Posters: In the workplace explaining the five steps for HH practice demonstrating the correct use of alcohol-based solutions and handwashing techniques

- Leaflets: Describing the proper way to carry out HH
- Messages (SMS): To notify the nurses and other HCWs regarding the importance of HH. The previous steps were aimed at training and spreading alertness among HCWs.^[16] In addition, alcohol-based disinfectants were put inside and outside all rooms in the hospital, at the bedsides of the patients' room, and in other visible and suitable sites.

Two hundred hours of observation for the HCWs were conducted directly using an observation record form. The observation was distributed equally into two stages. The first stage took place in June 2017 and the second started in February 2018.

The WHO guidelines were utilized to define the opportunities of handwashing and classify them into five groups:^[16] (1) pre the patient interaction, (2) before any task with aseptic, (3) post contact to bodily fluids, (4) post patient interaction and (5) post connection with surrounding of the patients. The observation locations were scheduled early, and observations were carried out in a daily manner at prespecified 1 h for each department during the morning shift.

The participants were observed closely to assess their compliance with handwashing. The observations were carried out for two patients at one time and directly during patient care. The staff did not have any information about the times of the observation.

Postintervention

The third stage was the postintervention stage in February 2018 to assess the improvement in handwashing compliance rates. The questionnaire was administered postintervention again in February 2018.

The compliance rate of handwashing by the HCWs' was obtained by dividing the total number of handwashing actions using soap and water or hand sanitizing by the total opportunities number, then multiplying by 100. where the handwashing actions performance represented by the actual number of handwashing that were conducted by the HCWs' through their tasks and within the manner of organized care, while the opportunities number represented by the indications for handwashing during the care procedure when handwashing should be achieved.^[16]

Data analysis

Data were analyzed utilizing the Statistical Package for Social Sciences (SPSS) for Windows, Version 21.0. Armonk, NY: IBM Corp. Descriptive statistics were used to describe the study variables and independent sample *t*-test and correlation Pearson with a 95% confidence level.

RESULTS

Participants' Sociodemographic

A total of 300 HCWs were approached; 220 were participated in the study at all phases with a response rate of 73.3%,

including 164 nurses, 41 physicians, 11 radiology technicians, 2 physiotherapists, and 2 lab technicians. One-third of the participants were male (65, 29.5%). Moreover, the majority of the participants (152, 59.1%) were between 20 and 30 years old, and 136 (61.8%) participants had <5 years of experience. Nurses had the largest percentage of participants (164, 74.5%), followed by medical doctors (41, 18.5%). The detailed demographic data of the study participants are shown in Table 1.

Knowledge and practice about hand hygiene questionnaire

A significant difference ($t = -4.40, P > 0.001$) was observed between the pre ($M = 24.33$; standard deviation [SD] = 3.31) and post ($M = 32$; SD = 3.91) HH practice scores; this finding indicates that there is an improvement in practicing HH regularly during the shift. Whereas the knowledge has been increased from preintervention ($M = 11.84, SD = 2.41$) to postintervention ($M = 18.80, SD = 2.93$), and it was significant ($t = -8.39, P < 0.001$) [Table 2].

Hand hygiene (observation of pre- and post-intervention)

Table 3 displays an observation of 1355 opportunities of participants' handwashing through the study stages. The HH action compliance was assessed using observation for the participants during patients' care. The overall HH preintervention compliance rate was 49%, while it was 75% postintervention.

Health-care-associated infection rate

The average health-care-associated infection rate for 3 months preintervention was 13.2, as reported by the infection

Table 1: Participants' demographics

Variable	Frequency (%)
Gender	
Male	65 (29.5)
Female	155 (70.5)
Age (years)	
20- 30	152 (69.1)
31- 40	38 (17.3)
<40	30 (13.6)
Experience (years)	
>5	136 (61.8)
6- 10	34 (15.5)
<10	50 (22.7)
Profession	
MD	41 (18.5)
Nurses	164 (74.5)
Radiologist	11 (5)
Lab technician	2 (1)
Physiotherapist	2 (1)
Departments	
Medical ICU	116 (52.7)
Pediatric ICU	37 (16.8)
Neonatal ICU	41 (18.7)
CCU	26 (11.8)

ICU: Intensive care units, CCU: Coronary care unit, MD: Doctor of medicine

control unit. After implementing the program, the average of health-care-associated infection decreased to 9% 3 months after the intervention.

Relationship between hand hygiene knowledge and practice

This section presents a summary of the associations between knowledge, practice, and HH compliance postintervention. Table 4 displays the correlation matrix among these three variables using a Pearson product-moment correlation.

A significant positive relationship was found between the overall score for knowledge and practice with HH compliance postintervention ($r = 0.49$ and $r = 0.28$, respectively, $P < 0.001$). In addition, a positive correlation was observed between knowledge and practice ($r = 0.61$, $P < 0.001$). This finding indicates that increasing the level of knowledge improved HH practice. In addition, the HH compliance increases when the knowledge increases.

DISCUSSION

This study aimed to explore the effectiveness of a hand hygiene program to the compliance of HCWs on the HH practices and HAI in the largest governmental hospital in Tabuk City. The results of the current study revealed the HCWs in the critical care unit possess a moderate level of knowledge-related hygiene preintervention. This result is in agreement with the

results reported by Zakeri *et al.*^[22] who reported a moderate level of knowledge among HCWs in the ICU. This result augments the need of the current study and similar studies, as the educational program is very helpful in HH knowledge and acquisition, which was ultimately reflected in HCW practice, which is also congruent with Suchitra and Lakshmi.^[23] A contradictory conclusion was drawn from another study, which implies that the level of knowledge was lower among HCWs who received education.^[22]

Further, the results showed a suboptimal level of HH self-reporting practice in the preintervention phase, it is an expected result based on the level of knowledge about HH, given that the level of knowledge and practice is highly correlated. Our findings revealed that HH practice self-reporting and observed compliance rate were in agreement. The compliance rate was below average. This was congruent with a previous study of the HH compliance rate who had reported a low compliance rate.^[24] In the current study, after implementing the interventional program, the self-reporting of HH practice and compliance rate have improved, which is congruent with a previous study which implies that the implementation of the educational intervention program was successful in improving HH practice and compliance.^[25]

In this study, monthly surveillance monitoring for HAI in critical care units showed that there is a decrease in overall HAI; the same conclusion was reported in previous studies, which revealed a decrease in the incidence of HAI rate after implementing an educational program.^[21,26] Furthermore, our result indicates that there is a significant relationship between knowledge and practice. This is consistent with the findings of a study conducted by Nasirudeen,^[26] which indicates that HH knowledge influences practice.

Limitations

The study results and its generalization should be taken with consideration for some limitations. Using the interventional design is practical; however, it has some limitations. Using one group, there is a possibility of rival hypotheses which would compete with the intervention as an explanation for the results. Although the participants were not informed about the time of observation, there is still the possibility of the Hawthorne effect in relation to handwashing that is equated with by increasing the frequency and the compliance of handwashing that will be undertaken by HCWs. Moreover, convenience sampling, although more practical, affects the generalizability of the study. In addition, this study was conducted only in one hospital as it the only major civilian hospital with intensive care units.

CONCLUSION

This study displayed the effectiveness of HH and awareness campaign which includes educational lectures and posters for enhancing compliance with HH practice in the critical care units. Improving HH practice among the HCWs is important to shed light on for better quality of care.

Table 2: Means, standard deviations, and t-test analysis for the knowledge and practice about hand hygiene questionnaire

	Preintervention		Postintervention		T	P
	Mean	SD	Mean	SD		
Knowledge	11.84	2.41	18.80	2.93	-8.39	>001
Practice	24.33	3.31	32	3.91	-4.40	>001

SD: Standard deviation

Table 3: Hand hygiene compliance (observation of pre- and post-interventions)

Stage	Opportunity	Action	Compliance rate (%)
Preintervention	714	350	49
Postintervention	641	480	75

Table 4: Relationship between hand hygiene knowledge, practice, and interventions

	HH compliance postintervention	Knowledge
Knowledge		
R	0.49	1
P	<0.001	
Practice		
R	0.28	0.61
P	<0.001	<0.001

HH: Hand hygiene

Further, longitudinal interventional studies are required to sustain the improvements in the HH compliance rate to decrease the HAI rates. Moreover, to maintain this level of improvement, proper education, periodical assessment, and training regarding HH practices for all HCWs are needed.

Acknowledgment

We would like to thank Manar Saleh (University of Houston; Teacher, Houston Independent School District) for her valuable assistance and support in editing and revising this manuscript.

Research quality and ethics statement

This study was approved by the Institutional Review Board / Ethics Committee approval number [UT-54-1-2018]. The authors followed applicable EQUATOR Network (<http://www.equator-network.org/>) guidelines during the conduct of this research project.

Financial support and sponsorship

The authors would like to acknowledge the financial support for this work, from Deanship of Scientific Research (DSR), the University of Tabuk, Tabuk, Saudi Arabia, under grant no. S-1438 -0212.

Conflicts of interest

There are no conflicts of interest.

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