

A mixed-method study to assess the knowledge-practice gap regarding hand hygiene among healthcare providers in a tertiary care hospital

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Abstract

Background and Aims: The burden of healthcare-associated infections (HAIs) is very high and compliance with infection control practices is poor in low and middle-income countries (LMICs). Hand hygiene (HH) being the most important measure to prevent HAIs, the present study was conducted to assess the gap in knowledge, perceptions, and practices of healthcare providers (HCPs) regarding HH and also to know the barriers in adherence to HH practices.

Material and Methods: This questionnaire-based cross-sectional study was carried out among 400 HCPs for 1 year. HH practices of HCPs were observed by a trained investigator followed by filling of the preformed proforma by HCPs. The quantitative data were analyzed using Epi info (Version 7) statistical software while qualitative analysis was done to generate themes.

Results: The compliance to HH was higher among nurses (78.3%) than consultants (49.5%) and residents (39.1%). Compliance was more in ICUs (71.4%) than wards (58.3%). Knowledge about HH was found to be 73.8% among consultants and 71.6% among residents, whereas HH opportunities availed by them were only 49.5% and 39.1%, respectively revealing a knowledge-practice gap. The main barriers to adherence to HH as perceived by HCPs were lack of awareness despite adequate knowledge, time constraints, heavy workload, and so on.

Conclusions: In our study, we found that despite adequate knowledge, consultants and residents showed lower compliance with HH practices as compared to nurses. Increasing awareness regarding HH guidelines through frequent sensitization sessions decreased workload, and strict surveillance may help in bridging the knowledge-practice gap.

Keywords: Hand hygiene, intensive care units, knowledge, perceptions, practices, wards

Introduction

Healthcare-associated infections (HAIs) are the infections that occur during patient care in hospitals or other healthcare facilities and are not present or incubating at the time of admission.^[1] The European Centre for Disease Prevention and Control estimated that more than 2.6 million new cases

of HAI occur every year in Europe, which has a cumulative burden higher than reported communicable diseases.^[2] The burden of HAIs is several-fold higher in low and middle-income than in high-income countries. HAIs affect 3.5% to 12% of hospitalized patients in developed countries and 5.7% to 19.1% in low and middle-income countries.^[3] World Health Organization (WHO) has identified HAIs as a major global health challenge and “Clean Care is Safer Care” program has

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put hand hygiene (HH) practices as a top measure to prevent HAIs. The hands of healthcare workers play a central role in transferring microorganisms and it has been observed that HH performance using alcohol-based hand-rub (ABHR) leads to a significant reduction in the bacterial counts present on hands.^[4,5] Studies have shown that despite the availability of protocols and knowledge about the importance of HH at various healthcare facilities, the compliance to HH is variable (3–80%).^[6-8] Hence, the present study was planned following a mixed-method approach incorporating both qualitative and quantitative analysis to assess the knowledge, perceptions, and practices of healthcare providers (HCPs) regarding HH, and to study the knowledge-practice gap if any and explore the barriers to adherence to HH.

Material and Methods

This study was a hospital-based cross-sectional study carried out in ICUs and wards of a tertiary care teaching hospital over a period of 1 year using mixed methods study design, after approval from the hospital ethics committee. The availability of sink with antimicrobial soap and water facility to bed ratio is 1:2 in ICUs and 1:10 in wards while ABHR is available at all patient beds.

Study participants

HCPs (consultants, residents, and nurses) working in the hospital inpatient areas and involved in direct patient care were included in the study after obtaining informed consent. HCPs, who refused to provide informed consent or were not willing to participate in the study, were excluded from the study. Training and sensitization of HCPs about infection prevention measures are regularly done as a part of a continuous quality improvement program in the hospital. The infection control nurses take surveillance rounds of ICUs, operation theatres, and wards and provide feedback to the hospital infection control committee and educate the HCPs in case any issue of noncompliance is noted. The minimum sample size required for the study was calculated using formula $n = Z^2 p (1-p) / d^2$. In an earlier study conducted in the same institute about 10 years back, the overall HH compliance among HCPs was 43.2%.^[9] Therefore, for getting the maximum sample size possible (to avoid any bias), the sample size was calculated using a prevalence of adherence to HH guidelines as 50%.^[10] Further to give equal representation to all categories of HCPs, the sub-samples were selected as per population proportion to sample size method i.e., 35 consultants, 71 residents, and 294 nurses were included in the study proportional to the total number of a particular category of HCPs employed in the institute. The selection of the subjects was done by purposive/judgmental sampling.

Definitions and standard HH procedure

HH products approved for effective HH were alcohol-based hand rub, chlorhexidine-based hand rub, or antimicrobial soap.

Hand washing, defined as washing hands for at least 40 s with antimicrobial soap and water and hand-rubbing as applying a palmful (3–5 mL) of antiseptic hand rub for 20–30 s, following WHO recommended 6 steps of handwashing, were the standard HH procedures that were assessed for estimating compliance in the study participants.^[11,12] The incomplete HH technique (concerning timing and technique) was considered as noncompliance. Five moments of HH (i.e., before touching a patient, before clean/aseptic procedure, after body fluid exposure/risk, after touching a patient, and after touching patient surroundings) were taken as the indication of HH during patient care. Opportunities for HH were defined as moments during healthcare activities when HH is necessary to interrupt germ transmission by hands. Each opportunity should be followed by HH. The questionnaire was based on HAIs prevention guidelines provided by the World Health Organization (WHO) and the Center for Disease Control (CDC).^[13] The questionnaire was validated by doing a pilot study and also by sharing the questionnaire with subject experts and incorporating appropriate changes in the final version accordingly. Information about the demographic profile, practices, knowledge, and perceptions regarding HH was also collected.

Data collection and statistical analysis

The HH practices of HCPs were observed by the trained investigator while the HCPs were dealing with and taking care of the patients. Practices of HCPs were observed individually and care was taken to ensure that the HCPs were not aware that they were being observed. Observation of practices was done during all shifts of the day (i.e., morning, evening, and night) to obtain a balanced distribution of the observations. After observation of HH practices of HCPs by the investigator, the proforma containing demographic data, a questionnaire about knowledge and perception was filled by the HCP and handed over to the investigator. For the questions on knowledge, the correct answer was awarded 1 mark and the wrong answer was awarded 0 marks and accordingly the excel sheet was prepared. The analysis of the data was done using a mixed-methods approach which refers to a methodology of research that uses the mixing of quantitative and qualitative data within a single investigation. This integration permits synergistic utilization of data than separate quantitative and qualitative data collection and analysis.^[14] The quantitative data generated were analyzed using Epi info (Version 7) statistical software by calculating proportions, percentages, and Chi-square tests. A *P* value of ≤ 0.05 was taken as significant.

The qualitative analysis was conducted by coding the response to the open-ended questions to bring out important suggestions and themes about barriers perceived by HCPs in adhering to HH guidelines.

Results

During the study, 400 HCPs were observed comprising of 35 consultants, 71 residents, and 294 nurses. The distribution of HCPs as per place of observation is shown in Table 1. Distribution of study participants concerning age and gender is shown in Figures 1 and 2. The minimum age of HCP was 22 years and a maximum of 58 years. Approximately 70% of HCPs belonged to the age group of 21–30 years. Most of the HCPs were females (82.8%) probably due to nurses forming 73.5% of study participants.

Practices regarding HH

The availability of either soap and water or hand rub was 100% in ICUs and 92.8% in wards. A total of 1959 (184 from consultants, 394 from residents and 1381 from nurses) HH opportunities were created out of which 1327 opportunities were availed. The overall compliance came out to be 67.7% [Table 2]. It was found to be highest among nurses (78.3%), followed by consultants (49.5%) and lowest in residents (39.1%) and the relationship was statistically highly significant. Total opportunities of HH during the period of observation were 1410 in ICU and 549 in wards as shown in Figure 3. Opportunities availed by the participants were 1007 in ICUs and 320 in wards by HCPs. Compliance with HH was seen more in ICUs (71.4%) than in wards (58.3%) as shown in Table 3 and the difference was statistically significant (P -value = 0.012). Most of the HCPs (93.0%) used ABHR for HH.

Table 1: Distribution of healthcare providers concerning the place of observation (n=400)

Place of observation	ICU	Wards
Consultant (n=35)	21 (5.3%)	14 (3.5%)
Resident (n=71)	39 (9.7%)	32 (8.0%)
Nurse (n=294)	228 (57.0%)	66 (16.5%)

Table 2: Compliance to hand hygiene among healthcare providers

Healthcare provider	No. of opportunities available	No. of opportunities availed	Compliance (%)
Consultant	184	91	49.5
Resident	394	154	39.1
Nurse	1381	1082	78.3
Total	1959	1327	67.7

$\chi^2=53.28$; $df=2$; $P<0.001$; Highly significant

Knowledge regarding HH

Formal training in HH was received by 92.2% HCPs in the last 3 years. Overall knowledge regarding HH among the HCPs was found to be 73.8% in consultants, 71.6% in residents, and 69.4% in nurses [Table 4]. Out of 400 HCPs in the present study, 385 (96.3%) knew all steps of HH. Knowledge about the fact that HH is the single most important measure for preventing HAIs was present in 97.1% consultants, 83.1% residents, and 80.9% nurses. Almost half of the consultants, 66.1% of residents and 60.2% of nurses were unaware of the most frequent source of germs responsible for HAIs. More than half of the residents and around 70% of the nurses did not know the HH action (step) that prevents transmission of germs to the HCP. Knowledge about the minimal time of HH needed for ABHR to kill most germs was seen in 51.4%,

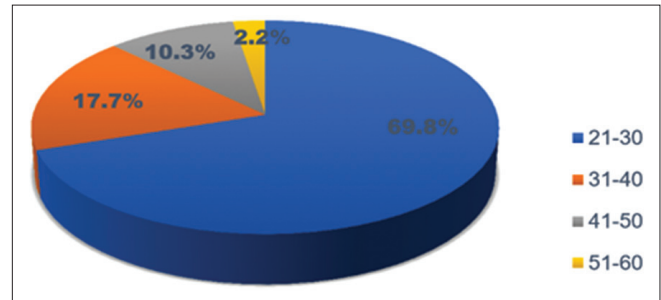


Figure 1: Distribution of healthcare providers concerning age (years)

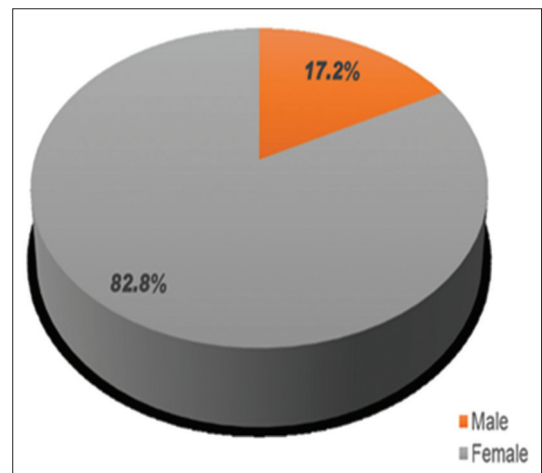


Figure 2: Distribution of healthcare providers as per gender

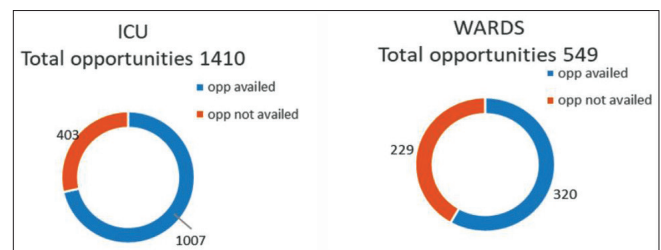


Figure 3: Compliance to hand hygiene as per the place of observation

43.6%, and 58.5% consultants, residents, and nurses, respectively [Table 4].

Perceptions regarding HH

Most of the HCPs (96.0%) perceived that compliance to HH recommendations was easy and 97.8% of them also perceived that they knew all the six steps of HH. Participants were asked about their perception about various barriers to adherence to effective HH in an open-ended question and from the responses, themes were generated [Table 5]. Lack of knowledge and awareness, heavy workload, shortage of time, ignorance, and negative attitude of HCPs were identified as barriers to adhering to effective HH.

Some of the verbatim responses by the HCPs are mentioned below.

- *There is a lack of time to follow every infection prevention guideline every time. How many times can I wash hands while caring for so many patients?* (Ward nurse)
- *Senior consultants may not be approachable due to their seniority and position even if they are not following the hand hygiene and they do not set a good example.* (ICU Nurse)

Table 3: Compliance to hand hygiene as per the place of observation

Place of observation	No. of opportunities available (n=1959)	No. of opportunities availed	Compliance (%)
ICUs	1410	1007	71.4
Wards	549	320	58.3

$\chi^2=6.218$; $df=1$; $P=0.012$; Significant

Table 4: Knowledge regarding hand hygiene among healthcare providers

Questions	Healthcare providers					
	Consultants (n=35)		Residents (n=71)		Nurses (n=294)	
	Correct	Incorrect	Correct	Incorrect	Correct	Incorrect
A single most important measure for preventing HAI is?	34	1	59	12	238	56
The main route of cross-transmission of potentially harmful germs between patients in a healthcare facility?	28	7	61	10	246	48
Most frequent sources of germs responsible for healthcare-associated infections?	17	18	47	24	177	117
According to WHO, how many steps of hand washing do you know?	30	5	65	6	290	4
Hand hygiene action that prevents transmission of germs to the healthcare provider?	33	2	30	41	89	205
Minimal time of hand hygiene needed for alcohol-based hand rub to kill most germs on your hands?	18	17	31	40	172	122
Which type of hand hygiene method is required in the following situations?*	145	65	311	115	1184	580
What should be avoided, as associated with an increased likelihood of colonization of hands with harmful germs?*	108	32	209	75	867	309
Total	413 (73.8%)	147 (26.2%)	813 (71.6%)	323 (28.4%)	3263 (69.4%)	1441 (30.6%)
	560		1136		4704	

*Multiple responses to the question

- *The hand rub makes my hands rough and I have to use the moisturizer again and again, so I avoid using the soap or hand rub.* (Ward nurse)
- *Though I want to use hand rub but it is not possible to use it every time, so I often use sterile gloves for 2–3 actions and then wash hands.* (ICU nurse)
- *In OPD where I see around 80–100 patients, it is impossible to use it every time.* (Physician)
- *Before going to O.T, I quickly see many patients so sometimes I forget to use hand rub.* (Surgeon)

Suggestions given by HCPs to improve the adherence to HH and infection prevention practices in the hospital included regular sensitization and training sessions (85.5%) and decreased workload of HCPs (84.2%), effective surveillance, and feedback (73%) as some of the top strategies. Emphasis on practicing all aseptic precautions, incentives, and disincentives improved communication among all HCPs, maintaining staff to patient ratio were also suggested by study participants as some of the strategies to improve adherence to HH.

Discussion

HAIs represent a significant threat to patient safety, affecting hundreds of millions of individuals worldwide.^[4] HAIs result in increased mortality and morbidity, greater length of stay, and higher healthcare costs.^[15] Proper handwashing remains one of the most important measures for preventing the spread of pathogens in hospitals since Semmelweis recommended hand

Table 5: Main barriers in adhering to effective hand hygiene (n=400)

Themes generated	Percentage
Lack of knowledge and awareness	75.3
Heavy workload	72.0
Shortage of time to adhere to the guidelines	69.6
Ignorance and negative attitude of the healthcare providers	53.0
Resistance to changing habits	51.6
Understaffing	37.4
Poor quality of the soap for hand washing and less availability of hand-rub	26.9
Lack of surveillance and feedback assessment	9.7

disinfection with a solution of chlorinated water over normal hand washing.^[16] HH is still considered one of the easiest but least adhered practice of infection control in health settings. In the present study, we used a mixed-method approach to study the knowledge, practices, and perceptions of HCPs regarding HH.^[17-19] Compliance was found highest among nurses i.e., 78.3%, whereas compliance was low among consultants (49.5%) and residents (39.1%). It was also noted that though formal training in HH was received by 92.2% HCPs in the last 3 years, yet overall compliance to HH was low (67.7%) in our study which is a cause for great concern. Compliance was even less than 50% in consultants and residents despite repeated sensitization drives and all the protocols being in place. Our findings were found to be in concordance with a study from south India which reported that compliance to HH was highest among staff nurses (81.1%) and relatively less among junior residents (30.9%).^[20] Higher handwashing adherence rates in nurses (52%) in comparison to physicians (23%) were also noted in a study by Pittet *et al.*^[21]

In another study conducted approximately 10 years back in the same hospital as the present study, it was observed that compliance to HH was higher in physicians (56.3%) as compared to nurses (41.3%) and residents (40.0%).^[9] Comparing the two studies, we can see that compliance among nurses showed improvement from 41.3% to 78.3% in our institution which reflects the importance of improvement in training as well as constant surveillance. Disheartening is the fact that compliance among physicians decreased from 56.3% to 49.5% and that among residents showed no improvement (40.0% vs 39.1%). Though the study group and sample distribution in these two studies are not the same, still it gives us a fair idea that there is a lot of scope for improvement and stringent surveillance measures need to be followed.

In operation theatres as well as in ICUs, a lot of HH opportunities are available and it has been seen that in these areas compliance of HCPs to HH is poor. This was

highlighted in another study where an average of 149 HH opportunities per hour of anesthesia time was observed. The authors reported that the mean HH compliance rates were 2.9% and the rates were lowest during induction (3.2%) and emergence from anesthesia (4.1%). The top five articles that showed bacterial contamination in their study were a patient bed, anesthesia cart handle, anesthesia chair, and right monitor screen button.^[22]

It was also observed in the present study that compliance with HH was better in ICUs than in wards. It is possible that as ICUs have sicker patients, so the HCPs are more careful about complying with HH measures in ICUs. Overall knowledge regarding HH among the HCPs was found to be 73.8% in consultants, 71.6% in residents and 69.4% in nurses and 385 (96.3%) HCPs in the present study knew all steps of HH, whereas compliance to HH was 49.5%, 39.1%, and 78.3% among consultants, residents, and nurses respectively. So, there was a clear knowledge and practice gap observed in the study participants. In the present study, knowledge, that HH is the most important measure for preventing HAIs was seen in 97.1% consultants and 80.9% nurses whereas, in another study, 73% of doctors and 91% of nurses knew about the same.^[23] Almost half of the consultants were unaware of the most frequent source of germs responsible for HAIs and more than half of the residents and approximately 70% of the nurses did not know about the HH action that prevents transmission of germs to the HCP. This finding contrasts with the findings reported by Maheshwari *et al.* who reported that 100% of nurses and 95% of residents were aware that the most appropriate timing for performing HH actions that prevent transmission of germs to the healthcare worker was after touching a patient.^[24] Hence, it is evident that there is a continuing need for regular education, sensitization, and updating all the HCPs regarding HH recommendations, especially the newly appointed HCPs to cover the lapses in knowledge and practices.

Analysis of the perceptions of HCPs regarding HH in the present study showed that the majority of them perceived that compliance to HH recommendations was easy (96.0%) and that they knew the six steps of HH (97.8%). Thus, it becomes clear that HCPs were aware of the HH guidelines as well as about when to bring them to practice but this was not being reflected in their actual practice. The main barriers in adhering to HH in our study as perceived by study participants were lack of knowledge and awareness, heavy workload, shortage of time, ignorance and negative attitude of HCPs, resistance to changing habits and understaffing, etc., Some suggestions listed by HCPs were regular sensitization and training sessions, decreased workload of HCPs, effective surveillance and feedback, incentives and disincentives,

and improved communication among all HCPs. Another study also enumerated suggestions such as healthcare facilities should have the necessary infrastructure, staff education, and training especially for the newly arrived staff for improving adherence to HH.^[25] In a systematic review, the authors observed that a combination of administrative support, education and training, reminders, surveillance, and performance feedback raised the compliance from a baseline of 51.5% to a record of 80.1%.^[26]

In today's scenario where HAIs, bacterial, fungal as well as viral infections (newer one being COVID-19) are rampant and mostly spread by cross-infection from HCP's hands, the importance of HH needs to be adequately stressed on. In our study, despite having good knowledge about HH, the compliance to HH is still dismal in HCPs both in intensive care units and wards. This may be a little ironical, but we all know that "knowledge is of no value unless you put it into practice" (Anton Chekov) at the right place, at the right time. Therefore, we must continue good practices with the aim of improvement of HH compliance including education and sensitization of the HCPs involving not only nurses but also consultants, residents, and interns. Moreover, we must ensure an adequate supply of ABHR or other agents and the HCPs should be kept motivated with incentives and appreciation. The role of good surveillance by the infection control team is as important as is communicating the monthly feedback to the HCPs. Results of the present study and the suggestions inferred were conveyed to the hospital administration and infection control team and necessary changes were made in hospital policies.

Limitations: Despite the best efforts, there are certain limitations in the present study. While filling the proforma about compliance by the investigator, a conscious improvement in compliance due to awareness of being observed could not be ruled out. HCPs had different job profiles, variable workload and working hours, and the variable HH opportunities might have some impact over the compliance to HH. In the present scope of the study, we did not include certain areas such as operation theatres, dialysis units, and the emergency departments.

Conclusion

HH is the single most important measure for preventing HAIs. All HCPs should know about HH and its importance. There should be conscious efforts to improve HH compliance in HCPs especially among residents and consultants and bridge the knowledge practice gap. Regular sensitization and surveillance of HH practices should be done by the infection control team and timely feedback should also be shared with all concerned to improve outcome.

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Conflicts of interest

There are no conflicts of interest.

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