

Evaluation of existing knowledge, attitude, perception and compliance of hand hygiene among health care workers in a Tertiary care centre in Uttarakhand

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ABSTRACT

Background and Aims: To evaluate existing knowledge, attitude and perception and compliance of hand hygiene activity among various healthcare workers in a tertiary care centre in Uttarakhand. **Methods:** A cross sectional study was done for a period of two months. WHO hand hygiene and compliance form with slight modification were used to study knowledge, attitude, perception and compliance (overt and covert) by direct observational technique. Statistical analysis was done using Microsoft Excel 2010 and IBM SPSS 23.0 version software. **Results:** A total of 220 participants were given questionnaire out of which 172 participated in study. 159 (92.4%) had already received training in HH in the past 3 years and were using alcohol based hand rub routinely. The overall correct knowledge score of various professional categories of HCW was good i.e. 71.6% Most of the healthcare workers knew the importance of adhering to this simple practice in prevention of healthcare associated infections. Most of them were aware of the conditions before or after when HH activity has to be performed. Poor compliance of hand hygiene was noted among healthcare workers on covert observation. For given hand hygiene opportunities the HH was started in 53.2% and 15.7% of overt and covert observations, respectively. However, HH compliance decreased drastically among HCW, which was 15.7% and 1.6% of overt and covert observations, respectively. **Interpretation and Conclusions:** The acceptance of the fact by most of the HCW that direct vigilance over this activity helped them performed better, suggested the demand of regular surveillance and several other promotional activities in the centre.

Keywords: Hand hygiene, Healthcare associated infections, Healthcare workers

Introduction

The provision of healthcare worldwide has always been associated with a potential range of safety problems to the patient. One of the most significant, current discussions in healthcare delivery in hospitals is healthcare associated infection (HCAI), also known as hospital acquired infection or nosocomial infection.^[1,2] Poor

adherence to hand hygiene practices is one of the most important cause of transmission of HCAI.^[3] Implementation of good hand hygiene practices is the simplest and most effective method to reduce the prevalence of health care-associated infections.^[4] Hand hygiene practices to a greater extent are influenced by health care worker's knowledge, attitude, perception and compliance. Improper hand hygiene practices not only result in increased burden on healthcare systems but also leads to emergence of drug resistant bacteria in community. Emergence of drug resistant bugs itself poses a great problem to primary

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care which the patient receives. This cross sectional study has been done in a tertiary care hospital in Uttarakhand to explore knowledge, attitude and practices of healthcare worker towards hand hygiene, total compliance and various barriers to hand hygiene so that preventive strategies can be undertaken to provide better patient care.

Methods

Study design

This is a descriptive cross-sectional study done for 2 months; August and September, 2018.

Assessment material

WHO (World Health Organization) hand hygiene questionnaire, with slight modifications was used.^[5] For compliance, WHO compliance form with slight modification was used.^[6]

Sample size

Convenient sampling was done and the sample size for study was calculated to be 200. A total of 220 participants were given questionnaire (10% extra in each category).

Study unit

Target population and participants for study were various health care professionals including MBBS and Nursing students, junior and senior residents, faculty and nursing officers. The participants who filled informed consent form were considered to be responders. Those responders who didn't return the questionnaire after two days' duration were considered lost to follow up.

Study protocol

The study was initiated after getting approval by Institute Ethical Committee. Stratified random sampling was done to choose the target population. Responders were assigned a code number and provided WHO hand hygiene-based questionnaire which were taken back within 2 days. For evaluation of compliance to HH in various areas of hospital, direct and indirect observation was done. Direct observation was performed overtly (by infection control team) and covertly (by trained observer not a part of infection control team). For a given HH opportunity, HH was considered compliant only if HCW used proper HH technique with adequate amount of HH material, appropriate duration and all steps done properly in correct order. Assessment of structural material availability for HH was done by directly checking the material availability on site on a single day during study period. After receiving all questionnaires and compliance forms, we arranged them as per coding sequence and responses were recorded after assigning scores for responses.

Statistical analysis

Data was entered and analyzed using Microsoft excel 2010 and IBM SPSS 23.0 version software. Continuous data was

expressed as mean \pm standard deviation, range or as median with interquartile range as appropriate. Normality of quantitative data was checked by measures of Kolmogorov Smirnov test. For normally distributed data t-test/ANOVA was used and for skewed continuous variables Mann-Whitney U-test/Kruskal Wallis H test was used. Discrete categorical data was presented as n (%). For categorical data, gender and outcome comparisons were made by Pearson χ^2 test or Fisher's exact test. All statistical tests were two-sided and performed at a significance level of $\alpha < 0.05$.

Results

A total of 220 participants were given questionnaire (10% extra in each category). Out of 55 questionnaires given to 50 faculty members, 22 (40%) returned the questionnaire. For all other groups, 100% returned the questionnaire. The first 25 responders (among SR, JR, MBBS students and BSc nursing students each) and first 50 nursing officers were chosen for evaluation. Out of 172, 159 (92.4%) had revealed that they had already received training in HH in past 3 years and were using alcohol based hand rub routinely.

Knowledge study

The overall correct knowledge score of various professional categories of HCW was good i.e. 71.6 (± 6.9) % [Table 1]. HCW were aware of the fact that contaminated hands can cross transmit germs between patients. Most of them knew the conditions before and after where hand hygiene practices are required. Majority were knowing that HR take less time than HW. HCW knew the harmful effects of wearing jewellery and other equipment like artificial nails while providing patient care. The knowledge of HCWS regarding hand hygiene practices with gloves was not good. Most of them were unaware that hand hygiene has to be done even with the use of gloves whenever there is an indication. Also very few of them were knowing that hand hygiene has to be done after moment 5 i.e. after touching the patient's surroundings.

Perception study

Most of the health care workers were of the opinion that their mentor or seniors hand hygiene practices have impact on their performance and availability of hand hygiene material has positive impact on their HH activity. Posters, regular training and resource material availability at point of care helps in positive reinforcement of these activities [Table 2].

Perception study

Most of the health care workers were of the opinion that alcohol based hand rub has made it easier to perform hand hygiene and the awareness of the fact that they are being observed for hand hygiene activities made them did the activity more frequently [Table 3].

Attitude study

Most of them agreed that adherence to hand hygiene practices should be done all the time but they also agreed that sometimes

Table 1: Comparison of correct knowledge of Hand hygiene practices among different categories of Health care workers

Question	Faculty n (%) n=22	Senior Resident n (%) n=25	Junior Resident n (%) n=25	Nursing officer n (%) n=50	MBBS student n (%) n=25	BSc Nursing student n (%) n=25	P
Main route of cross-transmission of germs between patients are contaminated hands	21 (95.5)	20 (80)	16 (64)	38 (76)	16 (64)	22 (88)	0.05
Most frequent source of germs in HAI	7 (31.8)	12 (48)	13 (52)	26 (52)	11 (44)	3 (12)	0.02
HH prevents germ transmission to patient:							
Before touching patient	22 (100)	25 (100)	25 (100)	48 (96)	25 (100)	25 (100)	0.42
Immediately after body fluid exposure	4 (18.2)	4 (16)	4 (16)	2 (4)	5 (20)	1 (4)	0.17
After exposure to immediate surroundings of patient	5 (22.7)	6 (24)	6 (24)	8 (18)	5 (20)	2 (8)	0.7
Immediately before clean/aseptic procedure	22 (100)	22 (88)	20 (80)	44 (88)	24 (96)	24 (96)	0.16
After touching a patient	22 (100)	25 (100)	24 (96)	49 (48)	23 (92)	25 (100)	0.35
Immediately after body fluid exposure	21 (95.5)	24 (96)	25 (100)	50 (100)	23 (92)	24 (96)	0.42
HH prevents germ transmission to HCW:							
Immediately before clean/aseptic procedure	6 (27.3)	7 (28)	6 (24)	4 (8)	9 (36)	3 (12)	0.05
After exposure to the immediate surroundings of Patient	20 (90.9)	23 (92)	21 (84)	47 (94)	22 (88)	25 (100)	0.4
HR more rapid than HW for hand cleaning	17 (77.3)	22 (88)	25 (100)	46 (92)	25 (100)	25 (100)	0.01
HR more effective against germs than HW	8 (36.4)	10 (40)	5 (20)	20 (40)	10 (40)	3 (12)	0.1
HR and HW to be performed in sequence	10 (45.5)	9 (36)	15 (60)	22 (44)	15 (60)	10 (40)	0.38
Minimal time needed for HR to kill most germs (20 sec)	13 (59.1)	19 (76)	18 (72)	32 (64)	19 (76)	18 (72)	0.71
HH required:							
Before palpation of abdomen	22 (100)	25 (100)	24 (96)	50 (100)	25 (100)	24 (96)	0.42
Before giving injection	22 (100)	25 (100)	25 (100)	50 (100)	25 (100)	24 (96)	0.32
After emptying bedpan	19 (86.4)	15 (60)	19 (76)	36 (72)	19 (76)	22 (88)	0.21
After removing examination gloves	14 (63.6)	15 (60)	13 (52)	20 (40)	11 (44)	7 (28)	0.11
After making patient's bed	11 (50)	15 (60)	12 (48)	24 (48)	13 (52)	6 (24)	0.2
After visible exposure to blood	22 (100)	22 (88)	21 (84)	40 (80)	23 (92)	24 (96)	0.13
Likelihood of colonisation of hands with germs is increased							
Wearing jewellery	22 (100)	23 (92)	23 (92)	50 (100)	25 (100)	21 (84)	0.02
Damaged skin	22 (100)	24 (96)	23 (92)	50 (100)	22 (88)	25 (100)	0.06
Artificial fingernails	22 (100)	22 (88)	19 (76)	47 (94)	25 (100)	24 (96)	0.01
Regular use of a hand	13 (59.1)	12 (48)	20 (80)	23 (46)	15 (60)	11 (44)	0.07

HH-Hand hygiene, HAI-Health care associated infection, HCW-Health care worker, HR-Hand rub alcohol based, HW-Hand wash with soap and water

they have more important things to do than hand hygiene when it comes to patient care and emergency situations made hand hygiene difficult at times. They also agreed that if they omit hand hygiene practices they felt bad about it and even if others omit it they felt frustrated [Table 4].

Compliance study

Total 3165 opportunities for HH were observed during these 2 months' period. 1877 (59.3%) and 1288 (40.7%) were overt and covert observations, respectively. For given HH opportunities observed the HH was started (mean \pm 2 SD) in 53.2 (\pm 13) % and 15.7 (\pm 4.7) % of overt and covert observations, respectively. However, HH compliance decreased drastically among HCW which was 15.7 (\pm 5.9) % and 1.6 (\pm 1.3) % of overt and covert observations, respectively [Table 5].

Discussion

Health care associated infections affect hundreds of millions of patients worldwide every year and lead to increased morbidity and mortality to patients. HH is the most important effective and simplest measure to prevent HAI. HCW hands act as vehicle for transmission of pathogens from one patient to another

due to improper HH.^[5] Several studies have shown that good HH practices can prevent up to 15-30% of total HAI.^[7,8] The importance of adhering to this practice increases manifolds for HCW working in surgical wards and ICU, where the chances of infection spread are much higher.^[9]

In some studies, the levels of knowledge, perception and attitude amongst nursing staff was better than doctors, but in some doctors were on better side.^[10-18] Various studies revealed that adherence to hand hygiene practices remains low despite of good amount of knowledge.^[6,10] Marked reductions in HAI rate has been seen in many studies after implementation of various programs and continuous education of HCW for improvement of HH practices and compliance^[19,20] WHO has laid down several guidelines for ensuring the safety of patients in health care settings among which hand hygiene practices are the most important one.^[21]

Majority of HCW in our study admitted (92.4%) that they had received training in HH and agreed that they use HR in routine practice. Similar observations were found in a study by Aledideilah R, et al.,^[22] while in another study carried out by Kudavidnange B, et al. on ICU staff very few staff was aware of

Table 2: Perception of different approaches for improving HH practices among different categories of HCW using Likert scale

Perception Item point	Faculty		Senior Resident		Junior Resident		Nursing officer		MBBS student		BSc Nursing Student		P
	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	
Leaders and Senior Managers should supported and promoted HH	5.8 (±1.3)	6 (5, 7)	5.6 (±1.4)	6 (5, 7)	6 (±1.2)	6 (6, 7)	6.3 (±0.7)	6 (6, 7)	6.6 (±1.2)	7 (7, 7)	0.04	0.003	
Alcohol-based HR available at each point of care	6.2 (±1.3)	7 (5, 7)	5.9 (±1.3)	6 (5, 7)	6.5 (±0.7)	7 (6, 7)	6.2 (±1.0)	6 (5, 7)	6.2 (±1.4)	7 (6, 7)	0.36	0.37	
Posters on HH displayed at point of care as reminder	6.2 (±1.2)	7 (6, 7)	6 (±1.8)	6 (4, 7)	6.2 (±1.1)	7 (5.5, 7)	6.3 (±0.8)	6 (6, 7)	6.3 (±1.0)	7 (6, 7)	0.6	0.29	
Received education on hand hygiene	6.3 (±1.1)	7 (5, 7)	6.3 (±1.1)	7 (6, 7)	6.4 (±0.8)	7 (6, 7)	6.3 (±1)	7 (6, 7)	6.2 (±1.2)	7 (6, 7)	0.11	0.59	
Clear and simple instructions made visible	6.4 (±1)	7 (5.75, 7)	6.4 (±1)	7 (6, 7)	6.7 (±0.7)	7 (6, 7)	6.3 (±0.9)	6 (6, 7)	6.3 (±1.6)	6 (5, 7)	0.08	0.18	
Regular feedback of HCW on their hand hygiene performance	6.7 (±0.8)	7 (7, 7)	5.8 (±1.4)	6 (5, 7)	6 (±1.2)	6 (6, 7)	5.1 (±1.5)	5 (4, 6)	4.7 (±1.6)	5 (4, 6)	0.00	0.00	
HCW always performed HH as recommended	6.6 (±0.5)	7 (6, 7)	6.2 (±0.7)	6 (6, 7)	6.2 (±0.8)	6 (6, 7)	6.2 (±1.3)	7 (6, 7)	5.7 (±1.6)	6 (4, 7)	0.07	0.2	
Patients invited to remind HCW to perform hand hygiene	6.3 (±1.5)	7 (6, 7)	4.7 (±2.1)	5 (2.5, 6.5)	5 (±2.2)	6 (2.5, 7)	4.6 (±2.2)	5 (2.5, 6)	4.8 (±2)	5 (3, 6.5)	0.03	0.06	

IQR=Interquartile range (25-75), Likert scale: 1 (not effective) to 7 (very effective)

Table 3: Perception towards other issues of HH practices among different categories of HCW using Likert scale

S. no.	Perception item point	Faculty		Senior Resident		Junior Resident		Nursing officer		MBBS student		BSc Nursing Student		P
		Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	
1	Impact of HAI on patient's clinical outcome	3.3 (±0.5)	3 (3, 4)	3.3 (±0.6)	3 (3, 4)	3.4 (±0.5)	3 (3, 4)	3 (±0.7)	3 (3, 3)	3 (±0.2)	3 (3, 3)	3.4 (±0.7)	4 (3, 4)	0.01
2	Effectiveness of HH in preventing HAI	3.9 (±0.4)	4 (4, 4)	3.6 (±0.6)	4 (3, 4)	3.4 (±0.5)	3 (3, 4)	3.5 (±0.6)	3.5 (3, 4)	3.5 (±0.5)	4 (3, 4)	3.6 (±0.6)	4 (3, 4)	0.09
3	Among all patient safety issues, how important was hand hygiene at our institution	3.6 (±0.7)	4 (3, 4)	3.4 (±0.9)	4 (3, 4)	3.4 (±0.7)	3 (3, 4)	3.4 (±0.6)	3 (3, 4)	3.1 (±0.9)	3 (2, 4)	3 (±0.7)	3 (2.5, 4)	0.13
4	What importance did the HOD attach to the fact that you perform optimal HH	6.5 (±0.9)	7 (6, 7)	6 (±1.3)	7 (5.5, 7)	6.2 (±0.6)	6 (6, 7)	6 (±1)	6 (5, 7)	5.2 (±1.9)	6 (4, 7)	5.7 (±1.5)	6 (5, 7)	0.01
5	What importance did your colleagues attach to the fact that you perform optimal HH	5.9 (±1)	6 (5, 7)	5.9 (±1.5)	6 (5.5, 7)	5.8 (±1.1)	6 (5, 7)	6 (±1.1)	6 (5, 7)	5 (±1.9)	5 (4, 7)	5.7 (±1.6)	6 (5, 7)	0.23
6	What importance did patient attach to the fact that you perform optimal HH	4.4 (±1.9)	5 (3, 6)	4.9 (±2.1)	5 (2.5, 6)	5.5 (±1.7)	6 (4.5, 7)	5.7 (±1.2)	6 (5, 7)	4.4 (±2.2)	5 (2, 6)	5.5 (±1.5)	5 (5, 7)	0.001
7	How did you consider the effort required by you to perform good HH when caring for patients	5.7 (±1.9)	7 (4.75, 7)	4.6 (±1.8)	5 (3, 6)	4.9 (±2.4)	6 (2, 7)	5.4 (±1.5)	6 (4, 7)	5.7 (±1.6)	6 (5, 7)	5.4 (±1.7)	6 (5, 7)	0.16
8	Had use of alcohol-based HR made HH easier to practice in your daily work	6.5 (±0.7)	7 (6, 7)	6 (±0.9)	6 (5, 7)	6.4 (±0.6)	6 (6, 7)	6 (±1.1)	6 (5, 7)	6.6 (±0.6)	7 (6, 7)	5.3 (±1.7)	6 (4, 7)	0.00
9	Were the educational activities you participated important to improve your HH practices	6.5 (±0.7)	7 (6, 7)	6.1 (±1.2)	6 (6, 7)	6.4 (±0.7)	6 (6, 7)	6.2 (±1.1)	6 (6, 7)	6 (±1.4)	6 (5.5, 7)	5.8 (±1.5)	6 (5.5, 7)	0.38

Contd..

Table 3: Contd...

S. no.	Perception item point	Faculty		Senior Resident		Junior Resident		Nursing officer		MBBS student		BSc Nursing Student		P	
		Mean (±2SD)	median (IQR)	Mean (±2SD)	median (IQR)	Mean (±2SD)	median (IQR)	Mean (±2SD)	median (IQR)	Mean (±2SD)	median (IQR)	Mean (±2SD)	median (IQR)		ANOVA
10	Was the use of alcohol-based HIR well tolerated by your hands	6.2 (±0.9)	6.5 (5.75, 7)	5.6 (±1.3)	6 (5, 7)	6 (±0.9)	6 (5.5, 7)	5.7 (±1.3)	6 (5, 6.25)	6.1 (±1.1)	7 (5, 7)	4.8 (±1.5)	5 (4, 6)	0.00	0.001
11	Did knowing the results of HH observation in your ward helped you and your colleagues to improve HH practices	5.8 (±1.3)	6 (5, 7)	6.1 (±1.1)	6 (5, 7)	6 (±1)	6 (6, 7)	6.1 (±1)	6 (5, 7)	6 (±0.9)	6 (5, 7)	5.9 (±1.4)	6 (5, 7)	0.91	0.95
12	Had the fact of being observed made you pay more attention to your HH practices	5.7 (±1.9)	6.5 (5, 7)	5.9 (±1)	6 (5, 7)	6.1 (±1.3)	6 (6, 7)	6.1 (±1.1)	6.5 (5, 7)	6.4 (±0.7)	7 (6, 7)	5.2 (±1.8)	6 (4, 7)	0.03	0.09
13	Did you consider that administrators in your institution were supporting HH improvement practices	6.7 (±0.7)	7 (6.75, 7)	5.6 (±1.7)	6 (5, 7)	6.4 (±0.8)	7 (6, 7)	6.3 (±1.1)	7 (6, 7)	5.8 (±1.6)	6 (5, 7)	5.9 (±1.7)	7 (5, 7)	0.03	0.09
14	Had the improvement of the safety climate (if actually improved in your institution as a result of the recent implementation of the HH promotion strategy) helped you personally to improve your HH practices	6.4 (±0.8)	7 (5.75, 7)	6.1 (±1.2)	6 (6, 7)	6.2 (±0.8)	6 (6, 7)	6.2 (±0.9)	6 (5, 7)	5.5 (±1.5)	6 (5, 7)	5.6 (±1.5)	6 (5, 7)	0.02	0.11
15	Had your awareness of your role in preventing HAI by improving your HH practices increased during the current HH promotional campaign	6.2 (±1.1)	7 (5.75, 7)	6 (±1.1)	6 (5, 7)	6.4 (±0.8)	7 (6, 7)	6.2 (±0.9)	7 (5, 7)	5.9 (±1.3)	6 (5.5, 7)	5.6 (±1.4)	6 (5, 7)	0.15	0.18

IQR-Interquartile range (25-75), Likert scale used in above table for S. no. 1 to 2 means 1 (very low) to 4 (very high), S. no. 3 means 1 (low priority) to 4 (very high priority), S. No. 4 to 6 means 1 (No importance) to 7 (very high importance), S. No. 7 means 1 (no effort) to 7 (big effort), S. no. 8 & 9 means 1 (not at all important) to 7 (very important), S. no. 10 means 1 (Not at all) to 7 (very well), S. no. 11 to 15 means 1 (not at all) to 7 (very much)

Table 4: Attitude towards HH practices among different categories of HCW using Likert scale

Attitude items	Faculty			Senior Resident			Junior Resident			Nursing officer			MBBS student			BSc Nursing Student			ANOVA Kruskal-Wallis H	P
	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)	Mean (±2SD)	Median (IQR)				
Adherence to correct HH practices all time	1.3 (±0.48)	1 (1, 2)	1.4 (±0.6)	1 (1, 2)	1.4 (±0.5)	1 (1, 2)	1.5 (±0.6)	1 (1, 2)	1.8 (±0.6)	1 (1, 2)	1.8 (±0.9)	1 (1, 2)	1.8 (±0.9)	1 (1, 2)	1.8 (±0.9)	1 (1, 2)	0.04	0.08		
Sufficient knowledge about HH practices is necessary	1 (±0.3)	1 (1, 1)	1.3 (±0.5)	1 (1, 2)	1.7 (±0.6)	2 (1, 2)	1.3 (±0.6)	1 (1, 2)	1.2 (±0.4)	1 (1, 2)	1.4 (±0.5)	1 (1, 2)	1.4 (±0.5)	1 (1, 2)	1.4 (±0.5)	1 (1, 2)	0.01	0.01		
Sometimes I had more important things to do than HH	4 (±1.1)	4.5 (3, 5)	3 (±1)	3 (2, 4)	3.3 (±1.1)	3 (2.5, 4)	2.5 (±1.2)	2 (2, 3)	3.2 (±1.2)	3 (3, 4)	3.4 (±1.3)	4 (2, 4.5)	3.4 (±1.3)	4 (2, 4.5)	3.4 (±1.3)	4 (2, 4.5)	0.00	0.00		
Emergencies make HH more difficult at times	3.2 (±1.3)	3 (2, 4.25)	2.6 (±1.2)	2 (2, 4)	2.6 (±1)	2 (2, 3.5)	2 (±1.2)	2 (1, 3)	2.5 (±1.2)	2 (1.5, 3)	2.4 (±1)	2 (2, 3)	2.4 (±1)	2 (2, 3)	2.4 (±1)	2 (2, 3)	0.01	0.01		
Wearing gloves reduce need for HH	4 (±0.9)	4 (3, 5)	3.3 (±1.1)	4 (2, 4)	3.4 (±1)	4 (2.5, 4)	2.7 (±1.2)	2 (2, 4)	3.5 (±1)	4 (3, 4)	3.6 (±1.2)	4 (3, 4)	3.6 (±1.2)	4 (3, 4)	3.6 (±1.2)	4 (3, 4)	0.00	0.00		
I feel frustrated when others omit HH	1.8 (±0.8)	2 (1, 2)	2.2 (±1)	2 (1.5, 3)	2.6 (±1.1)	2 (2, 3)	2.3 (±1.1)	2 (1.8, 3)	2.5 (±0.8)	2 (2, 3)	2.4 (±1.2)	2 (1.5, 3)	2.4 (±1.2)	2 (1.5, 3)	2.4 (±1.2)	2 (1.5, 3)	0.12	0.10		
I am reluctant to ask others to do HH	3.7 (±1.1)	4 (3, 5)	2.7 (±1.1)	3 (2, 3)	3 (±1.2)	3 (2, 3)	2.4 (±1)	2 (2, 3)	3.6 (±0.9)	4 (3, 4)	2.8 (±1.2)	3 (2, 4)	2.8 (±1.2)	3 (2, 4)	2.8 (±1.2)	3 (2, 4)	0.00	0.00		
Newly qualified staff not properly instructed about HH in training	2.2 (±0.9)	2 (1, 3)	2.7 (±1.2)	2 (2, 4)	3 (±1)	3 (2, 3.5)	3 (±1.1)	3 (2, 3)	3.3 (±1.2)	3 (2.5, 4)	3.2 (±1.3)	3 (2, 4)	3.2 (±1.3)	3 (2, 4)	3.2 (±1.3)	3 (2, 4)	0.01	0.02		
I feel guilty if I omit HH	2 (±0.9)	2 (1, 3)	2.2 (±1)	2 (1.5, 3)	2 (±1)	2 (1, 3)	2.1 (±1)	2 (2, 2)	2.2 (±1)	2 (2, 3)	2 (±1)	2 (1, 2)	2 (±1)	2 (1, 2)	2 (±1)	2 (1, 2)	0.92	0.94		
Adherence to HH easy in the current setup	1.7 (±0.8)	2 (1, 2)	2.2 (±1.1)	2 (1, 3)	2 (±1)	2 (1, 2)	1.6 (±0.7)	2 (1, 2)	2.1 (±1)	2 (1, 1.5)	1.7 (±0.5)	2 (1, 2)	1.7 (±0.5)	2 (1, 2)	1.7 (±0.5)	2 (1, 2)	0.09	0.42		
HCW should act as a role models for others	1.3 (±0.5)	1 (1, 2)	1.5 (±0.5)	2 (1, 2)	1.6 (±0.6)	1 (1, 2)	1.4 (±0.7)	1 (1, 2)	1.3 (±0.5)	1 (1, 1)	1.3 (±0.6)	1 (1, 2)	1.3 (±0.6)	1 (1, 2)	1.3 (±0.6)	1 (1, 2)	0.36	0.24		

IQR-Interquartile range (25-75), Likert scale: 1 (strongly agree) to 5 (strongly disagree)

this fact.^[23] Although high knowledge in the current study could be attributed to continuous and frequent training activities, but HCW still lack in certain domains of knowledge areas which needs to be highlighted in subsequent training activities. Most of the responders admitted that they perform HH whenever it is required. At the same time, they also agreed that if the patients remind them to perform HH, it would further improve their compliance. There was a positive response on being asked about role of promotional activities and posters about HH in the wards. Probably, it helped them reinforcing their attitude towards hand hygiene practice. It was interesting to note that most participants were satisfied with the facilities available in the ward for HH. This contrasted with a study in which about 55% of HCW were unhappy with such facilities at their institution.^[23] Most of the HCW agreed that alcohol-based HR is easier to perform in daily practice. A large number of responders gave credit to the role of observational activities to check their compliance; as such activities helped them in regular adherence to this practice. This showed that although they had a good knowledge about HH and knew when to perform it, but were reluctant to adhere to it when not being observed.

In our study, HCW had good attitude towards HH. This contrasted with study in which only the older participants (i.e. the participants with more experience in the hospital) were found to have good attitude towards HH.^[15] However, Rajcevic *et al.* found that knowledge and compliance rates were better in HCW less than 40 years of age. This could be explained by regular training and practice sessions carried out for the institution as a part of their curricular activity.^[24] Majority believed that knowledge about hand hygiene was necessary to improve hand hygiene practices among the healthcare workers. Similar were the findings in a recent study done in 2019 on nursing staff in Germany.^[25] Also, attending emergency patients made it difficult for most of the HCW to adhere to HH practice. Most of the HCW agreed on being asked if they have other important works to do than the HH practice. However, in a similar study on ICU staff, about 58% admitted that attending emergencies made it difficult for them to adhere to HH practice.^[23] HH material was found to be available at 71.7% of the areas observed, indicating good resource availability in our study – which was in contrast to a study conducted in Sri Lanka where only 17.5% of HH material was available.^[23]

The responders who were observed for compliance to HH practices remained unaware of the presence of observer (so as to eliminate Hawthorne effect). The overall compliance was dismally low being 1.4%. This contrasted with a similar study in which high compliance rates were noted among the participants.^[9] In our study compliance was better among faculty and students as compared to residents. These discrepancies could be attributed that resident doctors being affected by maximum patient workload either forgot or were unable to perform due to hectic work schedule. A great deal of difference in the compliance rates was seen between covert and overt observations suggesting that HCW were aware of the fact that they were being supervised in

Table 5: Hand hygiene compliance in various areas of hospital

Hospital area	Overt			Covert		
	Total Opportunities	Compliance %	Started %	Total opportunities	Compliance %	Started %
Emergency	171	9.9	44.4	112	1.8	13.4
General Medicine	165	17.6	52.7	92	5.4	17.4
Medical Oncology	112	15.2	74.1	120	0.8	14.4
Pulmonary ward	139	14.4	56.8	114	0.9	14
General surgery	206	15.0	45.6	118	0.8	14.4
OBG	174	4.6	28.2	114	2.6	13.1
Neurosurgery	141	17.7	70.9	94	1.1	11.7
Orthopedics	151	10.6	31.8	119	1.7	14.3
Pediatric surgery	101	17.8	66.3	92	2.2	15.2
Urology	148	28.4	59.5	75	0	12
HDU	155	22.6	53.5	98	0	15.3
ICU	127	20.5	55.1	55	1.8	30.9
RICU	87	10.3	52.9	85	1.2	17.6

OBG=Obstetrics and Gynaecology, HDU-High Dependency unit, ICU-Intensive care unit, RICU-Respiratory intensive care unit

overt observation and were unaware of the presence of observer in covert observation.

Conclusion

The discrepancies between appropriate knowledge, attitude and perception towards HH and the covert compliance rates shows that encouragement and reinforcement of hand hygiene activities in form of proper and adequate availability of hand hygiene material, posters and continuous education of HCW is still the demand of time to prevent the rising rate of HAI, and thus providing a better safety to the patients.

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Conflicts of interest

There are no conflicts of interest.

References

- Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections, 1988. *Am J Infect Control* 1988;16:128-40.
- Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections, 1992: A modification of CDC definition of surgical wound infections. *Am J Infect Control* 1992;13:606-8.
- Centre for disease control prevention. Mortality and Morbidity weekly report. October 25, 2002/51(RR16);1-44.
- Collins AS. Preventing health care-associated infections. In: Hughes RG, editor. *Patient Safety and Quality: An Evidence-Based Handbook for Nurses*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008.
- WHO. Clean Care is Safer Care. Tools for evaluation and feedback. Available from: https://www.who.int/gpsc/5may/tools/evaluation_feedback/en/. [Last accessed on 2016 Sep 27].
- WHO. WHO Guidelines on Hand Hygiene in Health Care. First global patient Safety challenge clean care is safe care. World Health Organisation 2009. Available from: <http://www.who.int/gpsc/5may/tools/9789241597906/en/>. [Last accessed on 2016 Sep 17].
- Pessoa-Silva CL, Hugonnet S, Pfister R, *et al.* Reduction of health care associated infection risk in neonates by successful hand hygiene promotion. *Pediatrics* 2007;120:e382-90.
- Mathura P. Hand WHO. WHO Guidelines on Hand Hygiene in Health Care. First global patient Safety challenge clean care is safe care. World Health Organisation 2009. Available from: <http://www.who.int/gpsc/5may/tools/9789241597906/en/>. [Last accessed on 2016 Sep 17].
- Randle J, Clarke M, Storrs J. Hand hygiene compliance in healthcare workers. *J Hosp Infect* 2006;64:205-9.
- World Health Organization. WHO Global Strategy for Containment of Antimicrobial Resistance. 2001. Available from: https://www.who.int/drugresistance/WHO_Global_Strategy.htm/en/. [Last accessed on 2016 Sep 17].
- World Health Organization. Prevention of hospital-acquired infections A Practical Guide, 2nd Edition. 2002. Available from: https://apps.who.int/iris/bitstream/handle/10665/67350/WHO_CDS_CSR_EPH_2002.12.pdf?sequence=1 [Last accessed on 2016 Sep 17].
- Anwar MA, Rabbi S, Masroor M, Majeed F, Andrades M, Baqi S. Self-reported practices of hand hygiene among the trainees of a teaching hospital in a resource limited country. *J Pak Med Assoc* 2009;59:631-4.
- Arthi E, Abarna V, Bagyalakshmi R, Anitharaj M, Vijayasree S. Assessment of Knowledge, Attitude and Practice of Hand Hygiene among Nursing and Medical Students in a Tertiary Care Hospital in Puducherry, India. *Int J Contemp Med Res* 2016;3:1203-6.
- Nair SS, Hanumantappa R, Hiremath SG, Siraj MA, Raghunath P. Knowledge, attitude, and practice of hand hygiene among medical and nursing students at a Tertiary health care centre in Raichur, India. *ISRN Prev Med* 2014; Article ID 608927:1-4.

15. Dreidi MM, Alrimawi I, Saifan AR, Batiha AM. Hand hygiene knowledge, practices and attitudes among nurses and physicians. *Health* 2016;8:456-62.
16. Mortel V, Kermodé T, Prozano S, Sansoni J. A comparison of the hand hygiene knowledge, beliefs and practices of Italian nursing and medical students. *J Adv Nurs* 2012;68:569-79.
17. AbdElaziz K, Bakr I. Assessment of knowledge, attitude and practice of hand washing among health care workers in Ain Shams University hospitals in Cairo. *Int J Prev Med* 2015;50:19-25.
18. Nabavi M, Alavi-Moghaddam M, Gachkar L, Moeinian M. Knowledge, attitudes, and practices study on hand hygiene among Imam Hossein Hospital's residents in 2013. *Iran Red Crescent Med J* 2015;17:e19606.
19. Randle J, Clarke M, Storr J. Hand hygiene compliance in healthcare workers. *J Hosp Infect* 2006;64:205-9.
20. Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, *et al.* Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Infection control Programme. Lancet* 2000;356:1307-12.
21. Shukla U, Chavali S, Menon V. Hand hygiene compliance among healthcare workers in an accredited tertiary care hospital. *Indian J Crit Care Med* 2014;18:689.
22. Aledeilah R, Abo El-Fetoh N, Albaker A. Assessment of knowledge, attitude and practice of hand hygiene among health care workers in Arar City, Saudi Arabia. *Egypt J Hosp Med* 2018;70:491-8
23. Kudavidnange BP, Gunasekara TDCP, Hapuarachchi S. Knowledge, attitudes and practices on hand hygiene among ICU staff in Anuradhapura Teaching hospital. *Anuradhapura Medical Journal* 2011;5:29-40.
24. Abd Elaziz K, Bakr IM. Assessment of knowledge, attitude and practice of hand washing among health care workers in Ain Shams University Hospitals in Cairo. *Int J Prev Med* 2015;50:19-25.
25. Hammerschmidt J, Manser T. Nurses' knowledge, behaviour and compliance concerning hand hygiene in nursing homes: A cross-sectional mixed methods study. *BMC Health Serv Res* 2019;19:547.