Original Article

A Multimodal Interventional Strategy to Increase Hand Hygiene Compliance in Intensive Care Unit of a Tertiary Care Hospital in South India

Shashwath[1], Deepashree Rajashekar[2], Sujatha Shimoga Ravi kumar[3], Satyasai Badveti[4], Chetak[5]

[1]MBBS Student, JSS Medical College, JSSAHER, Mysore, [2]Assistant Professor, Department of Microbiology, JSS Medical College and Hospital, JSSAHER, Mysore, [3]Assistant Professor, Department of Microbiology, JSS Medical College and Hospital, JSSAHER, Mysore, [4]Tutor, Department of Microbiology, JSS Medical College and Hospital, JSSAHER, Mysore, [5]Assistant Professor, Department of Paediatrics, JSS Medical College and Hospital, JSSAHER, Mysore.

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Abstract

Objective: Health care associated infections (HAIs) are major threat to patient safety in a hospital. Inadequate hand hygiene (HH) practice plays a very important role in transmission of HAIs.

Material and Methods: The present study was a prospective interventional study, divided into 3 phases: pre-intervention, intervention phase, and post-intervention. A total of 40 HCWs, including doctors, nurses, and cleaning staff had given consent to participate in the study. Using standard formulas HH complete adherence rate (HHCAR), HH partial adherence rate (HHPAR), and HH total adherence rate (HHTAR) were calculated.

Results: HHCAR, HHPAR, and HHTAR were estimated to be 18.03%, 49.53%, 67.57% respectively. HHCAR in the pre-intervention and post-intervention phases were 2.4% and 22.37%, respectively, reflecting a significant improvement in HH compliance (P<.001); whereas the improvement in HHPAR was found to be marginal, from 46.16% in the pre-intervention phase to 50.46% in the post-intervention phase. The HHTAR significantly improved to 72.83% in post intervention phase from 48.58 in pre-intervention phase. **Conclusion:** The present study demonstrated a statistically significant improvement in HH compliance following a multimodal educational intervention in the neurosurgery ICU of a tertiary care hospital.

Keywords: Health care associated Infections, patient safety, Hand Hygiene

Introduction

Health care associated infections (HAIs) are major threat to patient safety in a hospital. Time and again World health organisation (WHO) has emphasized importance of practicing HH and all health care organizations needs to work on integrating HH into

Corresponding Author: Deepashree R, Assistant Professor, Dept of Microbiology, JSS Medical College and Hospital, JSSAHER, Mysore.

E-mail: drdeepu.rajshekar@gmail.com

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routine practice and promote the correct behaviour on HH practice[1,2]. As per a well-known proverb that "If you can't measure it, you can't improve it", hence measuring hand hygiene compliance becomes an integral part. In a Hand hygiene monograph, WHO has described three main methods of measuring hand hygiene, i.e., direct observation, measuring product use and conducting surveys. Among these, direct observation is considered gold standard method of measuring hand hygiene compliance, where the trained observer directly watches the HH behaviour of HCWs and proactively performs HH audit[4,5]. Various components monitored in this method includes WHO HH moment, professional affiliation of HCWs, availability of hand rubs and thoroughness of cleansing. Surveying HCWs is an indirect method of assessing aspects of hand hygiene adherence. It also helps in planning the educational interventional sessions[5]. There are various methods of assessing thoroughness of cleansing, which includes glove juice method, swab method and by using luminometer. According to literature review, glove juice method is more reliable& feasible method[1,6].

In the present study, multimodal interventional strategy was conducted, in terms of educational interventions, visual reminders and by conducting survey i.e., Knowledge, attitude & practice (KAP) questionnaire analysis to increase awareness of HH. Hand hygiene adherence rate (HHAR) was analysed & thoroughness of cleansing was assessed during pre-intervention and post intervention period, by which we can determine the effect of multimodal intervention on HH compliance. Hence the current study is aimed to compare hand hygiene compliance between pre-intervention and post-intervention period by direct observation method, to assess thoroughness of cleansing hand by WHO validated glove juice method and to assess KAP of HCWs by conducting survey through structured and validated questionnaire.

Material and Methods

The present study was a prospective interventional study, conducted for a duration of 2 months (from 1st February 2021 to 31st March 2021) in the neurosurgery ICU of a tertiary care hospital with a total occupancy of 12 beds. The study period was divided into 3 phases: pre-intervention (two weeks), intervention phase (1 month), and post-intervention (two weeks).

Sample size: A total of 40 HCWs, including doctors (i.e., surgeons, post graduates and interns), nurses, and cleaning staff had given consent to participate in the study. Sample size was not predetermined but was instead based on practical constraints, available resources, or a more exploratory approach.

Throughout the study period, hand hygiene audit by direct observation method was conducted for a duration of 20 minutes per observation period per day. Following all the steps of hand rub or hand wash as per WHO for the recommended duration (≥20 seconds for hand rub and ≥40 seconds for hand wash) was considered as '*completely followed*'; whereas following fewer than all the steps and/or less than the recommended duration was considered as '*partially followed*'. Using standard formulas, HH complete adherence rate (HHCAR), HH partial adherence rate (HHPAR), and HH total adherence rate (HHTAR) was calculated[2,3,4,6].

Efforts were commenced to analyse the following parameters: profession specific HHCAR (physicians, nurses, and cleaning staff); shift duty (day shift and night shift) on HH compliance (HHCAR) of HCWs posted. The moment-specific HHTAR (complete and partial) for each of the 5 WHO moments of HH were also analysed. The data collection was carried out by cell phone using Android based Speedy audit application. The following measures were taken to curtail all possible bias predicted to occur while conducting the audit so as to warrant the reliability of the audit.

i) Prior training of the auditor

ii) Carrying out the audit in a random schedule of the day covering both day and night shifts

iii) Periodic rotation of auditors to conduct the audit

iv) Conducting the HH audit concurrently with other routine work in the ICU

Pre-intervention phase: During this phase, the baseline HHCAR, HHPAR, and HHTAR were analysed by the observer. A structured questionnaire

was given to HCWs for assessing their baseline KAP of HH, based on which multimodal interventions were designed, which were subsequently implemented in the intervention phase[6].

Intervention phase: Guided by the outcome of the pre-intervention phase, multimodal strategies were established. With the help of hospital infection control team, various educational materials including visual reminder pictographs were designed andprovided. The team conducted a series of didactic lectures and interactive sessions for healthcare workers, encompassing even the housekeeping staff. These sessions were meticulously designed to address their educational, contextual, and linguistic limitations, aiming to facilitate a smoother learning process.

Post-intervention: The impact of the multimodal intervention was evaluated by measuring the HHCAR, HHPAR, and HTHAR. A survey was conducted through a structured questionnaire for the participants to measure the difference in their knowledge on hand hygiene practices and also to determine their attitude and practice pertaining to hand hygiene protocols. We also analysed the thoroughness of cleansing hand by glove juice method as per standard hospital protocols followed by bacterial culture of the stripping solution.

Results

Of 40 HCWs, 12 were doctors (i.e., surgeons, post graduates and interns), 15 nursing staff, 13 were other HCWs (including housekeeping staff, physiotherapists and other support staff).

A total of 3460 hand hygiene (HH) opportunities were recorded over 600 minutes of audit, conducted over 30 observation periods. As depicted in Table 1, the HHCAR, HHPAR, and HHTAR were estimated to be 18.03%, 49.53%, 67.57% respectively. HHCAR in the pre-intervention and post-intervention phases were 2.4% and 22.37%, respectively, reflecting a significant improvement in HH compliance (*P*<.001). These findings further demonstrate the significant effect of interventional modalities on study participants (*P*<.001) to practice the all the steps of HH completely. The HHTAR significantly improved to 72.83% in post intervention phase from 48.58 in pre-intervention phase which further validates the measures taken during the intervention phase. (**Figure1)** depicts profession-specific HH compliance among the HCWs. In our study, the HHTAR was highest among nurses (51.77% and 73.60% in the pre- and post-intervention phases respectively).

The effect of diurnal variation on HH compliance was analysed **(Figure 2)** and was found that in the pre-intervention phase, HHCAR was slightly better during the night shift (3.8%) than during the morning (1.1%). In the post-intervention phase, HHCAR was better during the morning shift (23.76%) than during the night shift (20.34%) (P<.001). Moment-specific HH adherence is shown in Figure 3. In the pre-intervention phase, higher compliance was observed with Moments 3, 2 and 4 (68.88% and 58.02%, 54.97% respectively) compared to Moments 1, and 5. In the post-intervention phase, good compliance was observed with Moments 3, 2, and 4 (93.75%, 89.71%, and 77.59%, respectively) compared to Moments 1 and 5 (P<.001).

Glove juice technique was performed on 22 HCWs in the post intervention phase to analyse the thoroughness of cleansing hands. As per the report, Coagulase Negative *Staphylococcus*, Gram positive rods (common commensals of hand) and no known definitive pathogens were isolated. These results suggest that the thoroughness of hand hygiene was appropriate and intervention on hand hygiene was effective.

The survey conducted through structured questionnaire and it was noted that, in the pre-intervention phase, the knowledge was found to be extremely poor (26.1%) on specific aspects of HH practice such as indication for hand wash and indication for moment 5 (after environment) opportunity and awareness of gloves not to be used as a substitute for HH; which subsequently found to be improved in the post-intervention phase. The attitude and practice of HCW on hand hygiene protocols were also assessed. Many (58.7%) HCWs opined that educational sessions motivated them to perform HH better.

Table 1: Overall hand hygiene practice among all healthcare workers

	Hand hygiene Moments available	Hand hygiene completely followed	Hand hygiene partially followed	Hand hygiene not followed	HHCAR (%)	HHPAR (%)	HHTAR (%)
Pre-intervention	743	16	343	382	2.4	46.16	48.58
Post-intervention	2717	608	1371	738	22.37	50.46	72.83
Total	3460	624	1714	1120	18.03	49.53	67.57

TTable 2: Questionnaire to assess knowledge, attitude, and practice of hand hygiene among healthcare workers (P<.05)

	Correct responses (%)	
Knowledge-based questions	**Pre-intervention**	**Post-intervention**
Most common route of transmission of resistant bugs in hospital setting	47.8% (22)	69.6% (32)
Awareness of WHO-assigned My 5 moments of hand hygiene	54.3%(25)	87.0 % (40)
Minimum duration of hand rub, as per WHO	45.7% (21)	60.9 % (28)
Minimum duration of hand wash, as per WHO	50.0%(23)	69.6 % (32)
Gloves not to be used as a substitute of hand hygiene	26.1%(12)	47.8 % (22)
Drying of hand should never be done by multi-use cloth towel	45.7%(21)	89.1 % (41)
Indications for mandatory hand wash	26.1%(12)	76.1 % (35)
Indications for WHO Moment-5 of hand hygiene	26.1%(12)	91.3 % (42)
Indications for WHO Moment-1 of hand hygiene	45.7%(21)	78.3 % (36)
Knowledge on hand hygiene measurement method	45.7%(21)	60.9 % (28)

Attitude and practice-based questions	
Are you satisfied with the hand hygiene practice you follow?	80.4% (37)
The reason which motivates you to perform hand hygiene better	
Educational sessions	58.7% (27)
Seeing your higher orders perform hand hygiene	30.4% (14)
Visual reminders like posters	28.3% (13)
Providing pocket hand rubs	21.7% (10)
Reason of not performing hand hygiene when required	
Forgetfulness	34.8% (16)
Allergic to hand rub product	32.6% (15)
Inadequate availability of hand rub products	21.7% (10)
Lack of motivation	19.6% (9)
Your colleague reminds you if you forget to follow HH and vice versa	
Always	41.3% (19)
Never	30.4% (14)
Sometimes	23.9% (11)
Only when superiors are present	4.3% (2)
What is the effect of HH audit on your hand hygiene behaviour?	
More motivated when audit is being performed continuously	69.6% (32)
Not influenced by audit	17.4% (8)
Performs HH better when hand hygiene is not being done	8.7% (4)
Performs HH only when audit is being done	4.3% (2)

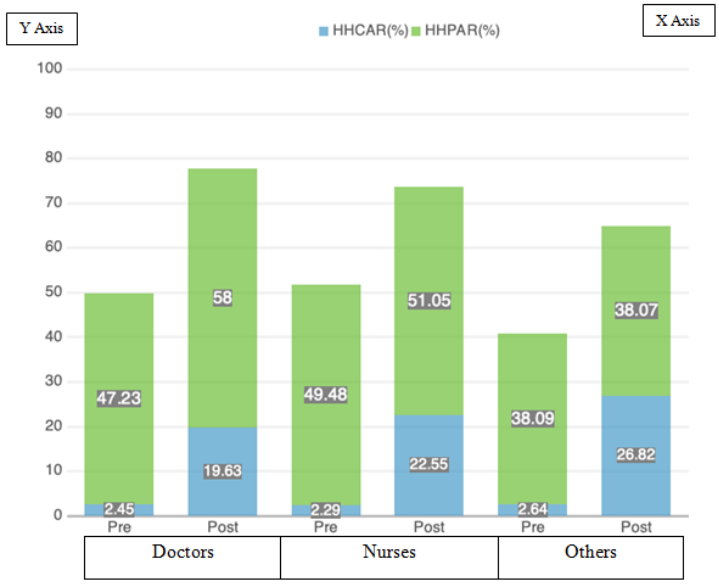

Figure 1: Profession-specific hand hygiene compliance

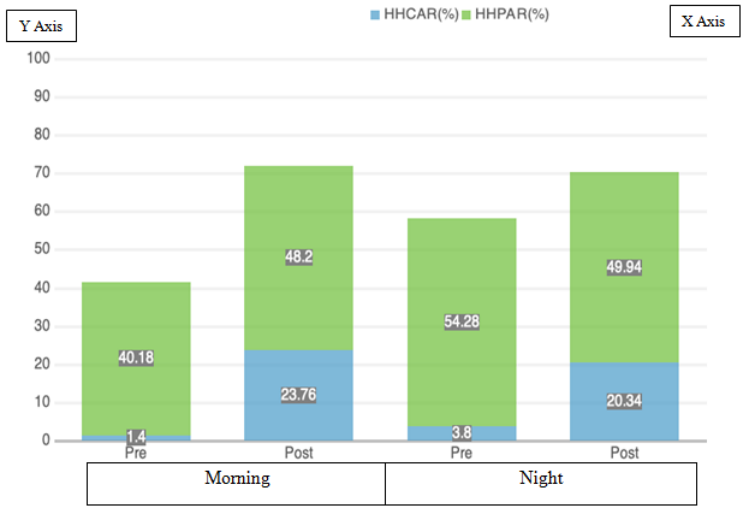

Figure 2: Diurnal variation (shift-specific hand hygiene compliance)

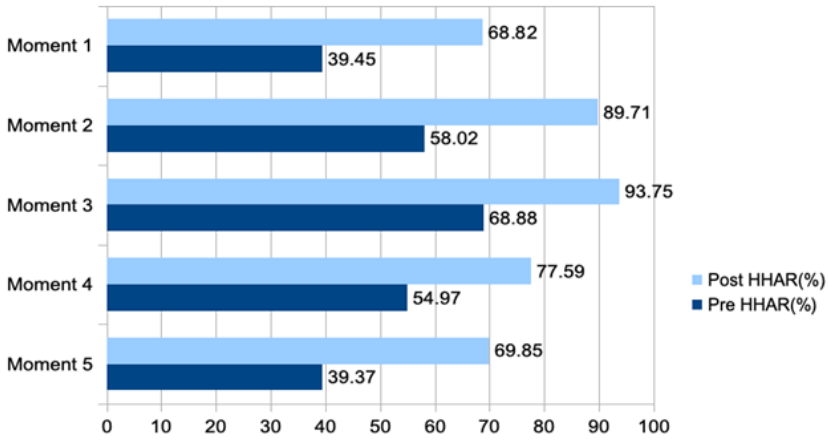

Fig 3. Moment-specific hand hygiene total adherence rate (HHTAR)

Moment 1: Before touching a patient

Moment 2: Before a procedure

Moment 3: After a procedure or body fluid exposure risk.

Moment 4: After touching a patient

Moment 5: After touching a patient's surroundings

Discussion

Performing HH auditing in ICU and providing timely feedback to the stake holders is crucial to reduce HAIs. In our study we noted a significant improvement of HHTAR in post intervention phase (72.83%), compared to pre-intervention phase (48.58%); which was mainly attributed to a substantial upsurge in the complete adherence (HHCAR, from 2.4% to 22.37%). In contrast, the improvement in partial adherence was found to be marginally increased (HHPAR, from 46.16% to 50.46%). WHO states that hand hygiene is an all-or-none phenomenon; in other words, following all the steps is mandatory, and partial HH has no value on infection control. However, in the present study the partial adherence was also measured so as to motivate and encourage the HCWs to convert partial adherence to complete adherence. In concordance to our study, Laskar A M et al., reported an improvement of HHCAR from 3.0 % to 70% in a tertiary care centre from South India following a multimodal educational intervention[6]. Studies conducted by Venkatesh et al. and Ashu et al. demonstrated that HHTAR in the pre-intervention phase was 36.3% and 29.5% respectively, which were increased to 50.1% and 42.6% respectively in the post intervention phase[8,9]. Profession-specific HH compliance was evaluated in both the pre- and post-intervention phases. In the pre-intervention phase, the highest HHTAR was observed for nurses (51.77%), compared to doctors (49.69%) and others (40.74%). In the post intervention phase, the improvement in HHTAR was significantly observed for nurses (73.60%) and doctors (77.64%), as compared to the others group (64.90%) who was mainly comprised of the cleaning staff.

Consistent with our study, several other studies reported similar improvement in profession specific HH compliance rates — Laskar A M et al. documented HH compliance of 80% among nurses and 50% among doctors following a multimodal intervention[6]; Pittet et al. observed a compliance of 23% among physicians compared to 52% among nurses[2]; Karaaslan et al. reported a similar HHTAR of 41% among nurses and 31% among physicians[10]. We also analysed the impact of diurnal variation (i.e., morning and night shifts) on HH compliance in both the pre-intervention and post-intervention phases. We observed that HH compliance was noted to be marginally higher in day shift (HHTAR, 71.96%) compared to the night shift (HHTAR, 70.28%) in the post-intervention phase. In concordance to our study, Laskar et al.[6], Sahay et al.[11], and Suzuki et al.[12], observed that HH was lower during the night shift compared to the day shift. They opined that the higher frequency of HH neglect at night could be explained by a lack of supervision to monitor HH compliance. HCWs on the day shift had more work pressure and more patient contact, whereas HCWs on the night shift did not have proper supervision and were not subjected to routine HH audits. In our study, although we did not find a significant difference in diurnal HH compliance; there was significant improvement of HH compliance observed in both the shifts, in post intervention phase, compared to prevention phase[13,14]. The "before" indications (Moments 1 and 2) are intended to protect patients from the risk of microbial transmission from HCWs, whereas the "after" indications (Moments 3, 4, and 5) are directed to reduce the risk of microbial transmission from patients or the environment to the HCWs. In the post-intervention phase, although an overall increase in HH compliance was observed in all the Moments; "before" HH Moments were followed less frequently than "after" Moments. This finding is comparable to other studies such as Laskar et al. (93%, 83% for Moment 3 and 2 respectively)[6] and Lam et al., who reported an improvement of HHCAR from 40% to 53% for Moment 1 and from 39% to 59% Moment 4[15]. HCWs should be periodically educated about the importance of every HH Moment[6,16]. To recognise the pitfalls, we further assessed the KAP of HCWs through the questionnaire-based survey. In the pre-intervention phase, we identified the key factors that affect the hand-washing behaviour of HCWs. We

found that the overall knowledge on the HH practice was significantly improved in the post-intervention phase, when compared to pre-intervention phase. The knowledge was observed to be exceptionally poor on few aspects on HH practices. These specific areas were targeted in the educational sessions conducted during the intervention phase which resulted in a significant improvement of knowledge, which was documented in the post-intervention phase. The attitude and practice of HCW on hand hygiene protocols were also assessed. A large pool of HCWs (58%) opined that educational sessions motivated them to perform HH better.

Conclusion

The present study demonstrated a statistically significant improvement in HH compliance following a multimodal educational intervention involving all types of HCWs in the neurosurgery ICU of a tertiary care hospital, South India, which may subsequently result in a reduction of the HAI rate. We observed that the HH practices are awfully low among most HCWs working in ICUs. However, intervention approaches, such as the ones employed in this study effectively improved HH compliance in our ICUs, and these improvements were consistently seen among almost all HCW groups. The methodology of this study can be extended to the other ICUs in our healthcare facilities to obtain a similar improvement in HH compliance.

Ethical Clearance: Taken from Institutional ethical committee of JSS Medical college dated 22.01.2022. (Ref.No-JSSMC/IEC/220121/12STS/2020-2021)

Conflicts of Interest: All authors declareno conflicts of interest

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