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Original Research Article

Improving hand hygiene compliance among healthcare workers in intensive care unit: an interventional study

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ABSTRACT

Background: Hand hygiene (HH) is one of the most important measures to prevent healthcare-associated infections. The objective of the study was to assess the effectiveness of the augmented multi-interventional approaches on HH compliance rate among intensive care unit (ICU) healthcare workers (HCWs) of Farwaniya Hospital, Kuwait.
Methods: An interventional study was conducted in four phases throughout eight months among adult ICU HCWs. First; HCWs' HH compliance rates and alcohol-based hand rub consumption rate (ABHR) were assessed secondly; an augmented multi-interventional approach was implemented, which included administrative support, observation and reporting, education & training, recruiting champions, and maintenance of HH supplies & reminders. Then a washout phase. Finally, re-assessment of HH compliance rates and ABHR.
Results: Following the interventions, the overall HCWs' HH compliance rate increased significantly from 58.81% to 73.17% (p=0.000)**,** for doctors (39.82% vs. 64.93%) and nurses (68.24% vs. 80.18%), p<0.001. Significant improvement of HH compliance rates for most of HH moments**,** after moments were higher than before moments, p=0.000. ABHR increased significantly from 77.45 ml to 133.33 ml per patient day (95% CI=54.37-57.39, p<0.0001).
Conclusions: The applied augmented multi-interventional approach was effective in improving HH compliance rates among ICU HCWs. Sustainability is warranted by continues implementation of this approach.

Keywords: Hand hygiene, Compliance, Multi-interventional approach, Alcohol- based hand rub, Intensive care unit

INTRODUCTION

Healthcare-associated infections (HAIs) continue to be a burden on health care systems worldwide.[1] Hand hygiene (HH) practice i.e. the use of alcohol-based hand rub (ABHR) and/or hand washing with water and detergent is the single most fundamental method to prevent HAIs.[2] Despite the fact that the HH is simple yet, the adherence to HH protocols is generally poor among different healthcare workers (HCWs).[3,4]

HH interventional approaches may be single or multi-level interventions.[5]

World Health Organization (WHO) had established HH multimodal interventional strategy which is successful and efficient in improving HH compliance.[2]

Kuwait Infection Control Directorate, Ministry of health had introduced a comprehensive HH educational, motivational and patient empowerment program in all Kuwait governmental hospitals from the year 2013.[6] This

program includes system change, training & education, evaluation and feedback, workplace reminders and institutional safety climate.

Although this program is fully implemented in Farwaniya Hospital with sustained activities, yet previous, unpublished HH observations from the ICU show that HCWs HH compliance rates are generally poor. Therefore, this study was designed to augment the implemented interventions by introducing additional approaches that included administrative support and observation & reporting in addition to enforcing and activating the already applied HH interventions (education and training, workplace reminders, champion role) aiming to improve ICU HCWs' HH compliance rate.

This study was conducted to assess the effectiveness of the applied augmented multi-interventional approach on HH compliance rate among ICU HCWs of Farwaniya Hospital.

METHODS

Design and setting

An interventional study that was conducted throughout eight months period from May till December 2017 in adult ICU of Farwaniya Hospital. Farwaniya Hospital is 866 beds governmental general hospital that has 17-bed adult medical/surgical ICU. This ICU is staffed by eight doctors, 78 nurses and 9 other professions (physiotherapists, respiratory & radiology technicians).

Subjects

Participants were all ICU HCWs involved in direct care of adult ICU patients during the study period.

Data collection tools and procedures

The study was conducted in four distinct phases:

The first phase (baseline period - one month)

Assessment of HH compliance of HCWs was done using the standardized WHO direct observation method and form "Five moments for hand hygiene approach". The five moments are: before patient contact; before an aseptic task; after body fluid exposure risk; after patient contact; and after contact with patient surroundings.[7]

The observation was made by two trained observers; ICU infection control staff and in charge nurse. The observers were trained for one week, after which they were assessed for several HH observational sessions, compared to each other to avoid the inter-rater discrepancy

The observation procedure was conducted throughout half an hour each shift of the three hospital work shifts daily. Observations were anonymous with no more than two HCWs being observed simultaneously. To avoid the Hawthorne effect; (changing behavior being observed).[8] ICU staff were informed about the study but not aware about the start time and the person who would observe them since the observers were a part of the ICU team. The amount of the consumed ABHR solution and the total patient days were collected. At the end of this phase, feedback of the assessed HH compliance rates, and ABHR consumption rate were presented to ICU HCWs and to infection control committee (ICC).

Second phase (intervention period -four months)

The applied interventional approach included the following:

- *Administrative support*

Hospital administrators agreed and supported the study by ensuring the supply of HH products and posters. They attended ICC meetings to discuss the study findings. In addition to their supporting role in staff reporting.

- *Education and training*

A condensed educational sessions that were conducted by the researchers in the first month of the intervention period, as one session weekly for four weeks. Each session was 90 minutes. In the first two sessions, HAIs in the ICU, mode of transmission of infection, importance and indications of HH were discussed. The technique of HH; hand washing and alcohol rubbing were demonstrated in the third and the fourth sessions. HH educational materials were distributed to the staff.

- *HH champions*

Reactivating and enforcing HH champions role by recruiting new champions from the ICU staff, training them on proper HH practice for three sessions. They acted as a role model for HH practice, reminding and guiding other HCWs for proper HH. The researchers met the champions weekly throughout the intervention period for feedback and for overcoming any obstacle to HH practice.

- *Staff observation and reporting*

Different levels of staff reporting approach were explained and agreed by the HCWs. Observation of HCWs was done for half an hour every other day during the fourth month of the intervention period using the same observation tool used in the first phase. By the first missed HH opportunity of a healthcare worker (HCW), A confidential letter was sent to that worker. With the second missed opportunity, an official letter was sent to the head of the ICU unit. The head of ICU together with the researchers talked to the HCW to see any obstacle or misunderstanding of HH indications or value. After the

third missed opportunity an official letter was sent to the hospital administrators and at that time the HCW would attend all infection control courses that were conducted by infection control department.

- *Workplace reminders and HH supplies*

Ensuring that HH technique and indications posters were displayed beside ABHR dispensers and HH sinks. ABHR dispensers were available at the ICU entrances, nursing station and beside the patient bed. HH sinks were supplied with soap and disposable towels.

Third phase (washout period - two months)

During which none of the previously mentioned interventions were there.

Fourth phase (post-intervention phase – one month)

Re-assessing HCWs HH compliance rates and HH moments, calculating ABHR consumption rate by the same way as the first phase.

Ethical considerations

The necessary official approval was obtained from Ministry of Health Joint Committee for the Protection of Human Subjects in Research.

Statistical analysis

Data was coded, entered and analyzed using SPSS program version 19, qualitative data was presented as frequency and percentage. HH compliance rate was calculated as a percentage by dividing the total number of the performed HH actions by the total number of observed opportunities×100. Moments HH compliance rate = Total number of the performed HH actions for each moment/total number of HH actions required for the same moment×100. ABHR consumption rate was calculated by dividing the amount of the used alcohol for HH in milliliters by patient days. Chi-square test was used for comparing HH compliance rates among different professions and moments. Statistical significance of difference in ABHR consumption rates per patient day in pre-& post-intervention phases and confidence interval were calculated. Differences were considered statistically significant if $p<0.05$.

RESULTS

The total number of the observed HH opportunities requiring HH actions was 488 and 559 opportunities in the pre- and post-intervention phases respectively. The overall HCWs HH compliance rate increased significantly from 58.81% in the pre-intervention to 73.17% in the post- intervention phase (p=0.000). Following the interventions, HH compliance rates increased significantly in doctors (39.82% vs. 64.93%, p=0.000) and nurses (68.24% vs. 80.18%, p=0.001), with no significant change in other professions' rate (50.63% vs. 55.55%, p=0.284) (Table 1).

Table 1: HH opportunities, actions and compliance rates among ICU HCWs.

HCWs	Pre-intervention*		Post-intervention**		P value
	Opportunities/ actions	Compliance rate (%)	Opportunities/ actions	Compliance rate (%)	
Doctors	113/45	39.82	154/100	64.93	p=0.000
Nurses	296/202	68.24	333/267	80.18	p=0.001
Others	79/37	50.63	72/40	55.55	p=0.284
Total	488/287	58.81	559/409	73.17	p=0.000

HCWs= health-care workers. Others = physiotherapists, respiratory and radiology technicians. * Pre- intervention: nurses vs. doctors, p=0.000; nurses vs. others, p=0.000; doctors vs. others p=0.334. **Pre-vs. post-intervention p values: nurses vs. doctors, p=0.000; nurses vs. others, p=0.000; doctors vs. others, p=0.176.

Table 2: HH opportunities, actions and compliance rates during HH moments pre- and post-intervention.

HCWs	Pre-intervention*		Post-intervention**		P value
	Opportunities/ actions	Compliance rate (%)	Opportunities/ actions	Compliance rate (%)	
Before patient contact	153/75	49.01	135/100	74.07	p=0.017
Before an aseptic task	70/27	38.57	100/50	50.00	p=0.006
After body fluid exposure	80/63	78.75	113/100	88.49	p=0.004
After patient contact	145/110	75.86	160/146	91.25	p=0.000
After contact with patient surroundings	40/12	30	51/13	25.49	p=0.632

*Pre- intervention: before moments (before patient contact & before an aseptic task) vs. after moments (after body fluid exposure risk, after patient contact and after contact with patient surroundings) p=0.000. ** Pre-versus vs. post-intervention p values; before moments vs. after moments, p=0.000.

Regardless of the study phase; nurses compliance rates were significantly higher than doctors and other professions, however, doctors' adherence to HH protocols was not significantly different than the other professions (Table 1).

Significant increase in HH compliance rates during different HH moments; before patient contact (49.01% vs.74.07%, p=0.017); before an aseptic task; (38.57% vs.50.00%, p=0.006) after body fluid exposure risk (78.75% vs. 88.49%, p=0.004); after patient contact (75.86%% vs. 91.25%, p=0.000) was achieved in the post-intervention phase except for after contact with patient surroundings moment (30% vs. 25.49%, p=0.632) which declined with no statistical significant difference as compared to the pre-intervention phase (Table 2).

Moreover, HH compliance rates for the after moments (after body fluid exposure, after patient contact and after contact with patient surroundings) were significantly higher as compared to the before moments (before patient contact and before an aseptic task) in the pre- and post-intervention phases, p=0.000 (Table 2).

ABHR consumption rate increased significantly from 77.45 ml per patient day in the pre-intervention phase to 133.33 ml per patient day in the post-intervention phase (95% CI =54.37-57.39, p<0.0001).

DISCUSSION

Improving HH to prevent HAIs is one of the core elements of the WHO patient safety solutions.[9] There is an increasing attention and efforts by Farwaniya Hospital ICC for developing effective strategies to improve HH compliance among HCWs particularly in critical care areas in order to reduce HAIs and to improve patient and HCWs safety as well.

In the present study, an augmented multi-interventional approach was implemented, which included administrative support, observation and reporting, education and training, recruiting champions, and maintenance of HH supplies & workplace reminders.

Following the implementation of these interventions, the overall HH compliance rate significantly increased from 58.81% in the baseline period to 73.17%, p<0.000. A similar finding was observed in various ICUs setting after implementation of multimodal HH interventional approaches; In a Kuwaiti teaching hospital adult ICU, the overall HH compliance rate increased significantly from 42.9% to 61.4%, p<0.001.[10] A similar improvement in the overall HH compliance rate from 60.8% to 86.4%, p=0.001 in different ICUs of Aseer Central Hospital, Saudi Arabia had been reported.[11]

Furthermore, our findings were in consonance with other studies which used multi-interventional approaches with administrative support in ICUs.[12,13] Administrative support had a positive effect on efforts improving HH adherence.[14] Education and training were also included, which were identified by other researchers as an important HH promotive activities improving HCWs compliance.[11,15]

The implemented different levels of staff reporting approach together with the involvement of hospital administrators had attracted HCWs' attention towards the importance of HH during patient care and made them accountable in front of the hospital administration. Talbot et al. had identified improvement in HH adherence after application of their accountability model supporting the safety culture.[16]

We believed that the visible role play performed by the HH champions had its positive impact in encouraging HCWs to adhere more to HH protocols as reported by many researchers.[17,18]

In association with the previous interventions, we ensured the proper distribution of HH reminders throughout the ICU and the availability of the supplies. Reminders are an important tool for reminding HCWs about the importance, indication and the procedures of HH.[2]

HH supplies were fairly available in our ICU for a fairly long time. Availability of the HH supplies in place is necessary to allow HCWs to perform HH.[2] Panhotra et al showed that introduction of accessible ABHR dispensers is associated with higher HH compliance.[19]

HH is one of the components of many implemented bundled infection control strategies in our ICU, therefore it is not possible to directly attribute the improved HH compliance rates to HAIs.

In the baseline period, HH compliance rates varied significantly among HCWs, being higher in nurses as compared to doctors (68.24% vs. 39.82%, p=0.000) and other professions (68.24% vs. 50.63%%, p=0.00).

Previous studies showed that doctors had less HH compliance rate than other professional categories.[20,21] This may be due to the sensation of their distinguished level that makes their compliance difficult.[22]

After implementation of our interventions a significant increase in HH compliance rates of nurses (68.24% vs. 80.18%, p=0.001), doctors (39.82% vs. 64.93%, p=0.000) had been reported with no significant change in other profession's rate (50.63% vs. 55.55%, p=0.284). Moreover, the improved nurses HH compliance rate remained significantly the highest. Except for other professions' rate, this observation is concordant with other studies.[11,13,23]

A remarkable improvement of HH compliance rates for all HH moments had been reported in the post-intervention phase, except for the moment of "after

contact with patient surroundings" which remained poor. Comparable results were reported by other researchers in different ICUs settings except for "after contact with patient surroundings" moment.[11,24] This may be attributed to the deficient understanding of HCWs for the value of performing HH after contacting the surrounding patient environment.[25] Many studies had explored the role of touching the patient surrounding environment and transmission of HAIs.[26,27] Moreover, increasing the effectiveness of environmental cleaning and HH programs are vital in preventing the transmission of pathogens from patient surrounding environment to HCWs and patients.[4,27]

The present study revealed that compliance rates for after moments (after body fluid exposure, patient contact, and patient environment contact) were higher than before moments (before patient contact and aseptic procedure) in the pre- and post- intervention phases (p=0.000). This finding had been also observed by Allegranzi et al who conducted a multicenter quasi-experimental study in 43 hospitals in six countries and found that the compliance of before moments was the lowest and the compliance of after moments was the highest.[25] Similar results were demonstrated by other researchers.[11,28] This finding reflects the high awareness of the staff towards their own protection rather than patients protection.[25] Further studies are needed to explore actual HCWs HH behavior and its determinant during patient care.

ABHR consumption rate was used as an indirect method for assessing HH compliance. This method is not subjected to selection bias and less time consuming than the direct observation method.[7,29]

Following the interventions, ABHR consumption rate increased significantly from 77.45 ml to 133.33 ml per patient day (95% CI=54.37-57.39, p<0.0001), together with the increase of the overall HH compliance rate. This result reflects the positive influence of the applied interventions. This relationship was concordant with boyec et al who had reported an increase in the amount of ABHR used when the overall HH episodes significantly increased.[30] The same finding was observed by other researchers.[31,32]

Based on the results of this study Farwaniya Hospital ICC is planning to continue the applied interventions in the adult ICU and to extend their implementation to pediatric and neonatal ICUs, after addressing different motivating factors for further HH improvement among HCWs.

CONCLUSION

Our study showed that the applied augmented multi-interventional approach was effective in improving HH compliance rates among ICU HCWs. Sustainability is warranted by continues implementation of this approach. Future studies are needed to explore the actual HCWs behavior and its determinant during patient care.

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