


Compliance and adherence to hand hygiene practices for effective infection control

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ABSTRACT

Hand hygiene (HH) is the most effective way to curb the spread of healthcare-associated infections. Nonetheless, healthcare personnel encounter difficulties in adhering to WHO HH recommendations. This study aimed to investigate HH compliance and adherence after the implementation of an action plan in a municipal hospital in Moscow. An initial evaluation of HH compliance among clinical health workers was carried out in June 2022 according to the WHO HH guidelines followed by a 3-month re-audit of HH practices. The results were compared to the baseline to evaluate compliance and adherence to HH among healthcare personnel. From June to September 2022, there were 2,732 moments of contact with patients or their immediate surroundings. The HH total compliance rate significantly ($p < 0.05$) increased from 52.3% in June 2022 to 83.3% in September 2022 with a 75% overall total compliance rate. The profession-specific total compliance rate was highest among nurses (79.6%) and lowest among ancillary staff (69.7%). Staff were also more adherent to the before-moments compared to the after-moments of the HH guidelines. Monthly re-audits and providing feedback resulted in a significant improvement in compliance and adherence with HH guidelines after implementation of the action plan.

Key words: hand hygiene, healthcare personnel, infection control, surgical staff, WHO guidelines

HIGHLIGHTS

- After implementation of the action plan, the hand hygiene compliance rate increased from 52.3 to 83.3%.
- Nurses were found to be more compliant with hand hygiene practices than doctors and ancillary workers.
- Clinical staff were more adherent to hand hygiene before-moments than the after-months.
- Providing feedback is essential to ensuring compliance and adherence to hand hygiene practices.

ABBREVIATIONS

CC complete compliance rate
 HH hand hygiene
 NC noncompliance rate
 PC partial compliance rate
 TC total compliance rate
 WHO World Health Organization.

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BACKGROUND

Hand hygiene (HH) is the primary measure to reduce infections. A simple action, perhaps, but the lack of adherence among healthcare personnel (HCP) is problematic worldwide (Rosenthal *et al.* 2012). Recent European studies reported hospital-wide prevalence rates of healthcare-associated infections that increased from 4.6 to 9.3% (World Health Organization 2009; Lotfinejad *et al.* 2021). Such infections lead to longer hospital stays, long-term disability, high resistance of microorganisms to antimicrobials, excessive mortality, additional financial burden on the health systems, and emotional stress for patients and their families (Pittet & Donaldson 2005). The incidence of these infections is 5–15% among hospitalized patients and 9–37% among intensive care unit patients (Vincent 2003; Pittet & Donaldson 2005). HH is the most effective way to prevent healthcare-associated infections and the spread of antimicrobial resistance (World Health Organization 2009). However, it has been proven that HCPs find it difficult to adhere to HH recommendations at various levels (Lotfinejad *et al.* 2021). HCP compliance with recommended HH procedures is reported to range from 5 to 89% with an overall average of 38.7% (World Health Organization 2009; Lotfinejad *et al.* 2021; Müller *et al.* 2022).

Risk factors of nonadherence to the WHO guidelines include status (hierarchy in patient care) in the hospital, wearing gloves, short duration of contact with patients, lack of handwashing agents, and forgetfulness (Pittet & Donaldson 2005). For an effective prevention of infections associated with healthcare, the WHO has recommended an HH compliance rate of more than 90% (Pittet & Donaldson 2005; World Health Organization 2009). This audit was prompted by a rise in such infections in the surgical department of A.A. Vishnevskiy 3rd Central Clinical Hospital in Moscow. We aimed to assess compliance with the WHO guidelines on HH in a cardiac surgery department.

METHOD

Study design

This observational analytical study was initially conducted in June 2022 to evaluate the practice and compliance of HH among clinical HCPs in a surgical department of a municipal hospital. After the implementation of an action plan, a prospective re-audit was conducted from July to September 2022 on a monthly basis, and after every audit, performance feedback was given in the form of a presentation at the staff meeting. We had to start an HH improvement programme from scratch since there was none already established in the hospital, and hence, we carried out the evaluation according to the WHO 5 essential steps (World Health Organization 2009). This was aimed at evaluating staff knowledge of HH and making recommendations for the hospital administration to add mandatory HH training to their new recruits and routine training for old staff. These include:

Step 1: Facility preparedness – readiness for action; we were ready to tackle the rise in healthcare-associated infections.

Step 2: Baseline evaluation – establishing the current situation; a baseline audit was performed in June 2022.

Step 3: Implementation of WHO HH recommended steps – introducing the improvement activities; we developed and implemented an action plan based on the five components of the WHO Multimodal Hand Hygiene Improvement Strategy which was used as the action plan for the study (Table 1).

Step 4: Follow-up evaluation – evaluating the implementation impact; we are carrying out this re-audit to assess the outcome of our action plan.

Step 5: Action planning and review cycle – developing a plan for the next 5 years (minimum); a quarterly audit will be performed routinely. Nonetheless, the HCP in the department should be informed of the outcome of the mini-audit (monthly audit).

Inclusion criteria of this study are as follows: The participants of this audit were all HCPs of the department, and these were doctors, nurses, and ancillary staff (e.g., nurse assistants and cleaners). HCPs (8% of the staff) who were not willing to participate in the audit were excluded.

Data collection and analysis

The HH procedure was described as complete compliance (CC) if all the five WHO steps of the HH technique were followed (for 20–30 s with an alcohol-based solution and 40–60 s with soap and water) at any of the ‘My 5 moments for HH’ for contact with patient or patient fluid (Figures 1 and 2) (World Health Organization 2009). Figure 3 shows the five moments of contact: moment 1 (before patient contact), moment 2 (before performing the aseptic task), moment 3 (after bodily fluid contact), moment 4 (after patient contact), and moment 5 (after contact with patient surroundings, e.g., bed). If ≥ 1 WHO’s HH steps were missed and/or the duration was less than recommended, the HH procedure was designated as partial compliance

Table 1 | Action plan for the study

Strategy	Implementation
1a. System change – alcohol-based handrub at point of care	<ul style="list-style-type: none"> - Introducing the improvement activities such as provision of alcohol-based hand rub at multiple locations. - Alcohol gel made available - Provision of 75 ml hand gel sanitizer for workers to carry in their pockets for personal use
1b. System change – access to safe, continuous water supply, soap, and towels	<ul style="list-style-type: none"> - Installation of sinks at more convenient locations - Provision of more soap and towels
2. Training and education	<ul style="list-style-type: none"> - Provision of posters and signs at more convenient locations - Lectures on significance of HH and how to achieve it. - Short films about HH on TV screens in the department
3. Evaluation and feedback	<ul style="list-style-type: none"> - Performance feedback - Results of environmental cultures on notice boards
4. Reminders in the workplace	Overt observations
5. Institutional safety climate	

(PC), and if HH was not performed, the instance was classified as noncompliance (NC). The observed CC and PC were together referred to as total compliance (TC). A detailed description of the WHO HH techniques and WHO contact moments is shown in [Figures 1–3 \(World Health Organization 2009\)](#). Pre-installed surveillance CCTV cameras that were installed for security reasons and for monitoring patients' conditions after surgery were used for the data collection. The monitoring was done from the doctors' room and the recordings were stored for 1 month before deleting. A 24-h record of activities in the department for each day of the audit was reviewed. On Friday of each week, the audit team which was made up of two doctors and two nurses of the department skimmed through the recordings at a fast speed and selected the HH moments in one of the three categories (doctor, nurse, and ancillary staff). To avoid observation confounding biases, the members of the audit team were rotated on a monthly basis. The classification of the HH moment by the audit team on each day was made by unanimous decision.

The HH CC rate, PC rate, and NC rate were calculated. The number of instances of the 'My 5 moments of HH' was noted. Observations involving HCP not giving consent for the study were not counted ([Rodriguez et al. 2015](#); [Lohiya et al. 2019](#)).

Profession-specific TC rate (TC-rate) and moment-specific TC-rate (for each WHO moment) were also calculated. The audit report and feedback for each month were shared with the entire department staff. The collected data were analysed using Microsoft Excel and IBM SPSS Statistics version 23. Changes in HH compliance and adherence for each follow-up audit or profession-specific compliance were compared to the baseline audit (June 2022) by one-way analysis of variance (ANOVA), and $p < 0.05$ was considered statistically significant.

Ethical considerations

Since this was a clinical audit reviewing existing service provisions, formal ethical approval was not required. The study was registered with the local audit office at the Hospital, and audit and information governance standards were adhered to. Verbal consent was taken from all participants of the department for recording of daily activity, and the participants were actively involved to obtain information on HH compliance and adherence. The audit was conducted using pre-installed surveillance remote video observation. A 24-h record of activities in the department for each day of the audit was reviewed and the HH moments were selected. Recorded HH moments of HCPs who declined to be part of the audit were excluded. Even though patient privacy could not be ensured, it was not considered a violation as video recordings were available only to members of the audit team who were also staff members with unrestricted access to all parts of the department.

RESULTS

Study population and contacts

During the study period (June to September 2022), a total of 43–45 participants per month took part in the study. A majority (43.9%) of the participants were nurses, 23.9% doctors, and 32.2% ancillary staff (nurse assistants and cleaning staff) ([Table 2](#)).

Hand hygiene figures

Duration of the entire procedure: 40-60 seconds



Figure 1 | WHO-recommended hand hygiene technique with soap and water.

A total of 2,732 contacts were made by the surgical ward staff with patients or their environment between June and September 2022, from which most contacts were made by nurses (1,246), followed by doctors (939) and ancillary staff (547). The number of contacts was observed to increase from 512 (18.7%) in June through to 842 (30.8%) in September 2022 (Table 2).

Compliance rates of clinical HCP to HH

Over the 4 months, a directly inverse relationship was observed between NC (before intervention) and TC (post-intervention). There was a significant ($p < 0.001$) increase in the TC for HH from 52.3% (268/512 contacts) in June (baseline) to

Duration of the entire procedure: 20-30 seconds

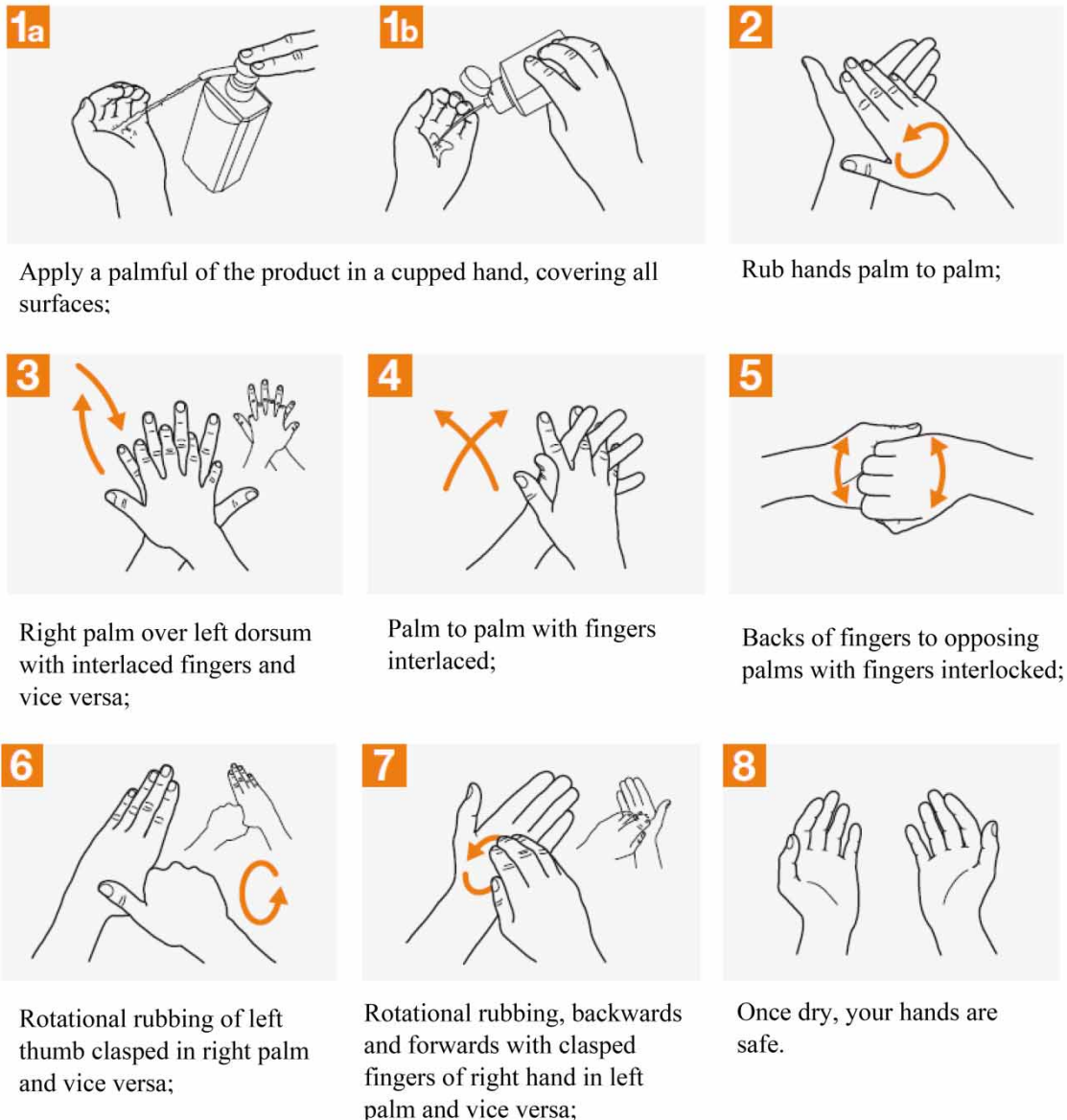


Figure 2 | WHO-recommended hand hygiene technique with alcohol-based solution.

83.3% (701/842 contacts) after the third re-audit with an overall TC-rate of 75% at the end of the study (2049/2732 contacts) (Table 2). Nurses were found to be the most compliant (TC-rate 79.6%) in terms of HH practices compared to doctors (TC-rate 72.0%) and ancillary staff (TC-rate 69.7%). For all five moments of contact, more than a twofold increase in the TC-rate of 12.8–13.3% to 28.4–34.3% was recorded from pre-intervention to post-intervention in clinical HCP (Table 2).

Profession-specific compliance and adherence to HH

The profession-specific TC-rate to HH guidelines was highest among nurses (79.6%) and lowest among ancillary staff (66.0%). There was a significant ($p < 0.05$) increase in the TC-rate in each month of re-audit as compared to the baseline. Similarly, there was a significantly ($p < 0.05$) higher TC-rate in each profession after re-audit compared to their respective baseline values (Table 3).

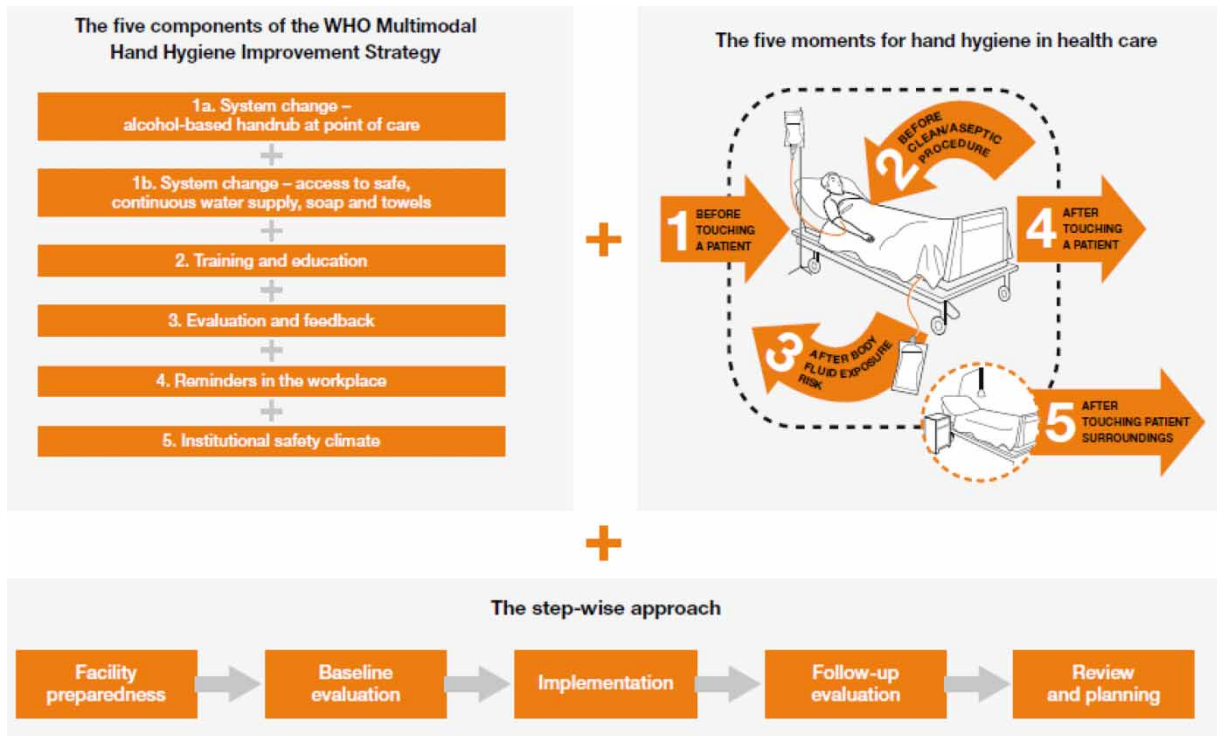


Figure 3 | WHO Multimodal Hand Hygiene Improvement Strategy. My 5 Moments for HH WHO 5 essential steps.

DISCUSSION

High standards of HH practice help in preventing the spread of nosocomial diseases (Rosenthal *et al.* 2012). This HH audit was carried out for a 4-month period (including the baseline audit). In this study, a total of 2,732 events were recorded by remote video observation with the CC rate, PC rate, and NC rate being 23.1, 51.9, and 25.0%, respectively. Though not a recommendation by the WHO, the HH guideline PC rate was measured to incentivize those HCPs who are not fully adherent to improve their HH performance. The higher number of contacts was recorded after the baseline due to the increase in hospitalised cases in subsequent months because more people had returned from summer holidays.

The aggregate compliance rate to HH guidelines after each audit cycle was presented to all HCPs (including those who did not partake in the study) at a staff meeting. All participants of the study were given access to their portions of the video recordings for self-assessment. In this study, a significant improvement in the TC-rate from 52.3 to 83.3% was recorded on the third audit cycle after the implementation of the action plan. This indicates that providing feedback and publicizing the HH monthly audit together with the other strategies in the action plan positively impacted adherence (Lotfinejad *et al.* 2021). Interestingly in this study, though there was a behavioural change consequently resulting in an increase in HH compliance, however, only 25% of the staff showed knowledge of the correct HH technique (CC rate). In a previous study in Kuwait, 42.9% pre-intervention HH compliance was recorded which increased to 61.4% post-intervention (Salama *et al.* 2013). A similar study in India found an increase in HH compliance from 33% pre-intervention to 56% after intervention (Lohiya *et al.* 2019). Though the improvement in compliance is still less than the WHO recommendation (90%) in all these studies, continuous implementation of action plans will lead to better results in the future (Rodriguez *et al.* 2015; Abdo & Al-Fadhli 2018; Lotfinejad *et al.* 2021).

Skin irritation and dryness from the use of some HH agents, insufficient time, forgetfulness, the thought that the use of gloves obviates the need for HH, and ignorance of the guidelines and protocols are factors that impact the correctness of HH procedure (Vincent 2003; Sastry *et al.* 2017; Lohiya *et al.* 2019). Taking steps to alleviate these factors will positively impact the HH campaign (Lotfinejad *et al.* 2021). This study and previous studies show that nurses were the most compliant with HH rules among all HCPs (Lohiya *et al.* 2019). This could be due to the fact that they are usually present in the ward and so always remember to perform HH rightly, whereas doctors who often walk into the ward from other parts of the

Table 2 | Study population by profession, number and moments of contacts made, and the HH compliance rates per month in the study period (June to September 2022)

	June, n (%)	July, n (%)	August, n (%)	September, n (%)	Total (n)
Participants by profession					
Doctors	11 (23.9)	11 (23.9)	10 (23.3)	11 (24.4)	43
Nurses	20 (43.5)	20 (43.5)	19 (44.2)	20 (44.4)	79
Ancillary staff	15 (32.6)	15 (32.6)	14 (32.6)	14 (31.1)	58
Number of participants	46	46	43	45	180
Contacts by profession					
Doctors	155 (30.3)	220 (33.8)	272 (37.4)	292 (34.7)	939
Nurses	249 (48.6)	311 (47.8)	313 (43.1)	373 (44.3)	1,246
Ancillary staff	108 (21.1)	120 (18.4)	142 (19.5)	177 (21.0)	547
Total contacts for study	512	651	727	842	2,732
Compliance rates					
NC	244 (47.7)	153 (23.5)	145 (19.9)	141 (16.7)	683
PC	180 (35.2)	344 (52.8)	404 (55.6)	490 (58.2)	1,418
CC	88 (17.2)	154 (23.7)	178 (24.5)	211 (25.1)	631
Total contacts	512	651	727	842	2,732
WHO TC moments of contact					
Moment 1	42 (12.8)	80 (24.5)	93 (28.4)	112 (34.3)	327
Moment 2	48 (13.1)	89 (24.3)	104 (28.4)	125 (34.2)	366
Moment 3	35 (13.3)	64 (24.2)	75 (28.4)	90 (34.1)	264
Moment 4	92 (13.1)	170 (24.3)	199 (28.4)	240 (34.2)	701
Moment 5	51 (13.0)	95 (24.3)	111 (28.4)	134 (34.3)	391
Total TC moments	268	498	582	701	2,049

Note: CC, complete compliance; PC, partial compliance; NC, noncompliance; TC, total compliance; n = 43–46 participants.

Table 3 | Profession-specific TC-rate and adherence to HH

Month	TC (PC + CC) moments out of total moments of contacts		
	Doctors, TC/contacts (%)	Nurses, TC/contacts (%)	Ancillary staff, TC/contacts (%)
June	70/155 (45.2)	150/249 (60.2)	48/108 (44.4)
July	160/220 (72.7)*	245/311 (78.8)**	93/120 (77.5)*
August	214/272 (78.7)*	266/313 (85.0)**	102/142 (71.8)*
September	232/292 (79.5)*	331/373 (88.7)**	138/177 (78.0)*

Note: TC, total compliance rate; data are presented as TC of profession/number of contacts (%), * $p < 0.001$ and ** $p < 0.05$ show comparison of TC-rate for each profession follow-up audits to baseline by one-way ANOVA followed by Dunnett's posthoc test.

department mostly go straight to the patient and walk straight out without an HH procedure (Pittet & Donaldson 2005; Salama *et al.* 2013; Lohiya *et al.* 2019).

The 'My 5 moments for HH' was designed to protect the patient from microbial transmission from HCP (before-moments; 1 and 2) and protect the HCP from microbial transmission from patients and their surroundings (after-moments; 3, 4, and 5) (Vincent 2003; Pittet & Donaldson 2005; World Health Organization 2009). The HH moments 2 and 3 (before the aseptic task and after contact with bodily fluid, respectively) were the moments that clinical HCPs were most compliant with HH practices (Pittet & Donaldson 2005; Lohiya *et al.* 2019). This can be attributed to the higher concern of risk of infection before an aseptic procedure and after contact with a patient's body fluids compared to other moments (before patient contact,

after patient contact, and after contact with patient surroundings) (Pittet & Donaldson 2005; Sastry *et al.* 2017). This outcome agrees with the findings of Lohiya *et al.* (2019) who documented higher adherence to the before-moments (Lohiya *et al.* 2019). In contrast, other studies reported higher adherence to after-moments (Rodriguez *et al.* 2015; Abdo & Al-Fadhli 2018; Laskar *et al.* 2018). On the basis of the results of this audit, we advocate for the implementation of the WHO multimodal HH improvement strategy in departments that have poor compliance with the guidelines. On the other hand, video recordings of HH behaviour may potentially be of great benefit to show staff for improving their adherence to HH guidelines and could also be adopted in other research for staff and/or patient noninvasive studies.

CONCLUSION

This study found that regular audits showed significant improvement in compliance and adherence to HH guidelines after the implementation of an action plan. It also underscores the immense role of remote video observation in identifying areas of guideline implementation that need improvement. This indicates that providing feedback and publicizing the HH monthly audit positively impacts adherence and video recording could provide great benefits for staff to assess their adherence to HH guidelines.

RECOMMENDATIONS

- Hospitals and healthcare facilities should incorporate mandatory HH training for their new recruits and routine training for old staff to help prevent/reduce the spread of healthcare-associated infections.
- Healthcare organizations should also add routine auditing of HH practices to help in infection control and provide feedback on routine audits.
- We advocate for the implementation of the WHO multimodal HH improvement strategy in departments that have poor compliance with the guidelines.
- Video recordings of HH behaviour may potentially be of great benefit to show staff for improving their adherence to HH guidelines and could also be adopted in other research for staff and/or patient noninvasive studies.

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DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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