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Effectiveness of a Structured Teaching Programme on Hand Hygiene Knowledge and Practice among Caretakers in an Intensive Care Unit at Sharda Care-Healthcity: A Pre- Experimental Study

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Research Article

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Abstract

Background

Hand hygiene is a simple, low-cost measure for reducing transmission of microorganisms in healthcare settings. Family caretakers in intensive care units frequently remain close to critically ill patients but may not receive formal instruction on appropriate hand-hygiene indications and technique.

Methods

A quantitative pre-experimental one-group pre-test–post-test design was used among 100 adult family caretakers of patients admitted to the ICU at ShardaCare-Healthcity, Greater Noida. Participants were selected using purposive sampling. Data were collected using a demographic proforma, a 25-item structured knowledge questionnaire, and a 15-step observational practice checklist based on WHO hand-hygiene recommendations. A structured teaching programme consisting of lecture-discussion, demonstration and supervised return demonstration was administered after the pre-test. Post-test assessment was conducted approximately seven days later. Descriptive statistics, paired t-tests and Chi-square tests were used, with significance set at $p < 0.05$.

Results

Mean knowledge scores increased from 9.32 ± 3.03 before the intervention to 16.21 ± 4.11 after the intervention, while mean practice scores increased from 5.56 ± 1.63 to 10.97 ± 2.17. The paired t-test demonstrated statistically significant improvements in knowledge ($t = 46.03$, $p < 0.001$) and practice ($t = 56.68$, $p < 0.001$). Post-test knowledge and practice were significantly associated with age, educational status, availability of a handwashing station at home, availability of hand sanitizer, and previous knowledge of hand hygiene.

Conclusion

The structured teaching programme was associated with substantial short-term improvements in hand-hygiene knowledge and observed practice among ICU caretakers. Incorporating brief, demonstration-based caretaker education into ICU admission and infection-prevention practices may strengthen patient safety.

Trial registration:

Not applicable for the study

Background

Hand hygiene is an essential component of infection prevention and control in healthcare facilities. Appropriate hand hygiene helps reduce the spread of microorganisms between patients, healthcare personnel, equipment and the surrounding environment. Healthcare-associated infections continue to be an important patient-safety concern because they can result in additional illness, prolonged hospital stay, increased treatment expenses and, in some cases, death. They also contribute to the development and spread of antimicrobial resistance.[1,2]

The importance of hand hygiene is particularly evident in intensive care units (ICUs). Patients admitted to ICUs are often seriously ill and may require invasive procedures, urinary or vascular catheters, mechanical ventilation and other supportive measures. These patients therefore have frequent contact with healthcare personnel and the equipment used in their care. Such repeated contact creates several opportunities for microorganisms to be transmitted if appropriate hand hygiene is not performed.[3]

In addition to healthcare personnel, patients' relatives and family caretakers may have regular contact with hospitalized patients. In many Indian hospitals, family members remain closely involved in patient care and may assist with feeding, repositioning, mobility, personal needs and emotional support. Their involvement can be particularly noticeable when patients require continuous assistance. WHO guidance recognizes patients, caregivers and visitors as important users of hand-hygiene facilities within healthcare environments.[4]

The hands of family caretakers may come into contact with the patient as well as objects in the patient's immediate surroundings. Bed rails, bedside tables, medical equipment and other frequently touched surfaces may serve as potential points for the transfer of microorganisms. An Indian study that directly observed hand-hygiene behaviour among patients' family members found that compliance was only 46.1% across 7,302 observed opportunities. The study also reported considerable variation according to the specific hand-hygiene opportunity, particularly following contact with the patient's surroundings.[5] These findings indicate that family members should not be overlooked when infection-prevention practices within hospitals are considered.

Another concern is that knowledge about hand hygiene does not necessarily result in consistent performance. Studies involving patients, relatives and visitors have identified differences between what individuals report doing and what is observed in practice.[6] Direct observation can therefore provide useful information about actual hand-hygiene behaviour and may identify areas that require further education or reinforcement.

The World Health Organization's **“My 5 Moments for Hand Hygiene”** approach provides a simple framework for identifying the situations in which hand hygiene should be performed. These include before touching a patient, before performing a clean or aseptic procedure, after a body-fluid exposure risk, after touching a patient and after touching the patient's surroundings.[3,7] Teaching these five

moments to family caretakers can help them recognize situations in which hand hygiene is particularly important during their interaction with a patient.

The choice of hand-hygiene method also depends on the condition of the hands and the circumstances. Alcohol-based hand rub is recommended for routine hand antisepsis when the hands are not visibly dirty. Washing with soap and water is required when the hands are visibly soiled and is recommended in certain other situations.[7] In either method, appropriate technique is necessary to ensure that all areas of the hands are adequately cleaned or covered with the hand-rub preparation.

Evidence from India indicates that hand-hygiene practices remain an area requiring continued attention. A recent systematic review and meta-analysis of Indian studies reported considerable variation in hand-hygiene knowledge and compliance among healthcare workers. The review identified several factors associated with poor practice, including inadequate training, workload, availability of resources and behavioural barriers.[8] Although these findings primarily concern healthcare workers, they demonstrate the broader importance of strengthening hand-hygiene education within Indian healthcare settings.

Intervention studies conducted in Indian intensive-care environments have also demonstrated the potential benefit of education, monitoring and feedback. In a neonatal intensive care unit in North India, a series of interventions that included self-directed learning, participatory learning, monitoring and feedback was associated with an improvement in hand-hygiene compliance.[9] Similarly, a large multicentre Indian study reported differences in hand-hygiene adherence between intensive-care units and general wards, reinforcing the need for continued monitoring of hand hygiene in critical-care areas.[10]

Assessment of hand hygiene through observation is important because self-reported behaviour may not accurately represent actual performance. An Indian study conducted in a tertiary-care setting found that although healthcare workers possessed knowledge regarding hand hygiene, observed compliance was lower than might have been expected from their reported knowledge and attitudes.[11] Another Indian study that conducted repeated hand-hygiene audits in intensive-care units and wards demonstrated the usefulness of continued observation in identifying changes in adherence over time.[12]

Education is an important element of programmes aimed at improving hand-hygiene behaviour. Evidence from systematic reviews suggests that educational interventions, monitoring and feedback can contribute to improvements in compliance.[13] Educational methods have also expanded beyond conventional lectures. Audiovisual materials, demonstrations, interactive learning activities and other educational technologies have been investigated as approaches for improving understanding and practical hand-hygiene behaviour.[14]

For family caretakers, an educational programme needs to be simple, practical and appropriate to their role in patient care. Family members may differ in age, educational level, previous exposure to healthcare information and familiarity with infection-prevention procedures. A structured teaching programme can provide the same essential information to all participants and can include opportunities for clarification

and practical demonstration. Return demonstration can further help the educator determine whether the caretaker is able to perform the hand-hygiene procedure correctly.

Recent research has also drawn attention to family caregivers as a group that may receive less formal infection-prevention education than healthcare professionals. Studies involving family caregivers have reported that targeted interventions can improve hand-hygiene behaviour.[15,16] This is relevant to hospital settings where relatives remain closely involved with patients and may participate in routine bedside activities.

Despite the recognized importance of hand hygiene, comparatively limited research has focused specifically on **family caretakers of patients admitted to Indian ICUs**. Much of the available literature has concentrated on healthcare workers, while fewer studies have examined the combination of hand-hygiene knowledge and directly observed practice among family caregivers.[5,8] This represents an area in which nursing-led educational interventions may have practical relevance.

Nurses are in a suitable position to provide health education to family caretakers because they interact with patients and relatives regularly and are directly involved in infection-prevention practices. A structured teaching programme delivered by nurses can provide caregivers with information regarding the importance of hand hygiene, the five moments of hand hygiene, appropriate handwashing and hand-rubbing techniques, and situations requiring particular attention.

In view of the potential role of family caretakers in supporting patients and the possibility of microorganism transmission through inadequate hand hygiene, there is a need to assess their existing knowledge and actual practice. The present study was therefore undertaken to evaluate the effectiveness of a structured teaching programme on hand-hygiene knowledge and observed practice among family caretakers of patients admitted to an ICU at Sharda Care-Health city, Greater Noida. The study seeks to determine whether systematic and practical education can improve caregivers' understanding and performance of appropriate hand-hygiene practices.

Objectives

- To assess pre-test knowledge and practice regarding hand hygiene among ICU caretakers.
- To evaluate the effectiveness of the structured teaching programme on hand-hygiene knowledge and practice.
- To determine the association between post-test knowledge and practice scores and selected demographic variables.

Methods

Study design and setting

A quantitative pre-experimental one-group pre-test–post-test design was adopted. The study was conducted in the Intensive Care Unit of Sharda Care-Healthcity, the teaching hospital associated with Sharda University, Greater Noida, Uttar Pradesh, India.

Participants and sampling

The study population comprised adult family members or relatives accompanying and assisting patients admitted to the ICU. A total of 100 caretakers were recruited using non-probability purposive sampling. Participants were eligible if they were aged 18 years or above, were attending a patient in the ICU during data collection, could understand Hindi or English, provided written informed consent and were expected to remain available for post-test assessment. Caretakers with previous formal training in hand hygiene or infection control, healthcare professionals, and those unable to complete follow-up because of patient discharge, transfer or death were excluded.

Study design and procedure

The study followed the sequence O_1–X–O_2. O_1 represented the pre-test assessment of knowledge and observed practice; X represented the structured teaching programme; and O_2 represented the post-test assessment conducted approximately seven days later. During the intervention, the investigators provided a 30–35-minute teaching session using lecture-discussion, visual explanation, live demonstration at the wash basin and supervised return demonstration. Errors in technique were corrected immediately. The programme addressed the importance of hand hygiene, indications for hand hygiene, the WHO five moments, use of soap and water versus alcohol-based hand rub, recommended duration, removal of jewellery and correct step-by-step technique.

Study instruments

Three tools were used. Tool 1 was a demographic proforma covering age, gender, education, occupation, water supply, hand washing station, toilet type, soap and sanitizer availability, relationship with the patient, previous hand-hygiene knowledge and source of information. Tool 2 self-structured was a 25-item multiple-choice knowledge questionnaire; each correct response received one mark, with scores classified as poor (0–8), average (9–17) or good (18–25). Tool 3 was a WHO (2009) [1] standardized Checklist ,15-step observational checklist covering the recommended hand washing procedure; each correctly performed step received one mark, with scores classified as poor practice (0–5), average practice (6–10) or good practice (11–15).

Validity, reliability and pilot testing

The tools and structured teaching programme were reviewed by five experts from Medical-Surgical Nursing, Community Health Nursing and hospital infection control for relevance, clarity and suitability.

Reliability of the knowledge questionnaire was established using the split-half method with Spearman–Brown correction (r = 0.84). Inter-rater reliability for the observational checklist was r = 0.89. A pilot study involving 30 caretakers who were not included in the final sample was conducted to assess feasibility, comprehension and the practicality of observation in the ICU.

Data collection and analysis

After administrative permission, ethical clearance and written informed consent, the pre-test demographic and knowledge assessments were completed and hand-hygiene practice was observed. The structured teaching programme was then administered. The same knowledge questionnaire and observational checklist were used for the post-test approximately seven days later. Data were coded and analyzed using descriptive and inferential statistics. Frequencies and percentages summarized demographic characteristics and categorical outcome levels; means, medians and standard deviations summarized continuous scores. Paired t-tests compared pre-test and post-test knowledge and practice scores. Chi-square tests examined associations between post-test categories and selected demographic variables. A p-value below 0.05 was considered statistically significant.

Ethical considerations

Administrative permissions were obtained from Sharda University and ShardaCare-Healthcity, including permission from the ICU authorities. Participants were informed about the study procedures and their right to participate voluntarily, and written informed consent was obtained. Confidentiality and privacy were maintained throughout data collection and analysis. The study was conducted in accordance with applicable ethical principles for research involving human participants.

Results

Participant characteristic

Table 1
Characteristics of study Participant N = 100

Demographic characteristic	n	%
Age 18–25 years	19	19.0
Age 26–35 years	46	46.0
Age ≥ 36 years	35	35.0
Male	58	58.0
Female	42	42.0
No formal education	7	7.0
Primary education	26	26.0
Secondary education	38	38.0
Graduate and above	29	29.0
Unemployed	50	50.0
Private job	31	31.0
Government job	10	10.0
Self-employed/business	9	9.0
Handwashing station available at home	88	88.0
Hand sanitizer available at home	71	71.0
No previous hand-hygiene knowledge	54	54.0

Table 1 illustrate that Among the 100 caretakers, 46% were aged 26–35 years, 35% were aged 36 years and above, and 19% were aged 18–25 years. Males constituted 58% of the sample. Secondary education was the most common educational level (38%), while 29% were graduates or above. Half of the participants were unemployed (50%). Spouses (44%) and children (40%) constituted the largest relationship groups. More than half of the participants (54%) reported no previous knowledge of hand hygiene

Table 2
Distribution of level of knowledge on hand hygiene in percentage pre-test and post-test. N = 100

Knowledge level	Pre-test n (%)	Post-test n (%)
Poor (0–8)	41 (41.0)	0 (0.0)
Average (9–17)	59 (59.0)	60 (60.0)
Good (18–25)	0 (0.0)	40 (40.0)

Table 2 elaborate at baseline, 41% of caretakers had poor knowledge, 59% had average knowledge and none had good knowledge. After the structured teaching programme, no participant remained in the poor-knowledge category and 40% achieved good knowledge. The mean knowledge score increased from 9.32 ± 3.03 to 16.21 ± 4.11.

Table 3
Distribution of levels of practice **on hand hygiene in percentage pre-test and post-test. N = 100**

Practice level	Pre-test n (%)	Post-test n (%)
Poor (0–5)	46 (46.0)	1 (1.0)
Average (6–10)	54 (54.0)	41 (41.0)
Good (11–15)	0 (0.0)	58 (58.0)

For observed practice, 46% of caretakers demonstrated poor practice and 54% average practice at pre-test; none demonstrated good practice Table 3.

Table 4
Effectiveness of the structured teaching programme on hand-hygiene knowledge and practice. N = 100

Outcome	Pre-test Mean ± SD	Post-test Mean ± SD	Mean difference	t	p
Knowledge	9.32 ± 3.03	16.21 ± 4.11	6.89	46.03	< 0.001
Practice	5.56 ± 1.63	10.97 ± 2.17	5.41	56.68	< 0.001

At post-test, poor practice fell to 1%, average practice was 41% and good practice increased to 58%. The mean practice score increased from 5.56 ± 1.63 to 10.97 ± 2.17. Table 4 The paired t-test confirmed highly significant improvements in both knowledge and practice ($p < 0.001$).

Table 5
Association with demographic variables N = 100

Variable	Post-test knowledge p	Post-test practice p
Age	0.027*	0.008*
Gender	0.591	0.556
Educational status	< 0.001**	< 0.001**
Occupation	0.053	0.079
Water supply	0.229	0.209
Handwashing station	0.038*	0.038*
Type of toilet	0.226	0.487
Hand sanitizer	< 0.001**	< 0.001**
Relationship with patient	0.895	0.801
Previous knowledge	0.012*	0.039*
Source of information	0.683	0.574

* $p < 0.05$; ** $p < 0.001$.

Table 5

Post-test knowledge was significantly associated with age ($\chi^2 = 7.254$, $p = 0.027$), educational status ($\chi^2 = 67.434$, $p < 0.001$), availability of a handwashing station at home ($\chi^2 = 4.297$, $p = 0.038$), availability of hand sanitizer ($\chi^2 = 24.933$, $p < 0.001$), and previous knowledge of hand hygiene ($\chi^2 = 6.242$, $p = 0.012$). Gender, occupation, water supply, toilet type, relationship with the patient and source of information were not significantly associated with post-test knowledge.

Post-test practice was significantly associated with age ($\chi^2 = 13.802$, $p = 0.008$), educational status ($\chi^2 = 62.498$, $p < 0.001$), handwashing station availability ($\chi^2 = 6.541$, $p = 0.038$), hand sanitizer availability ($\chi^2 = 38.801$, $p < 0.001$), and previous knowledge ($\chi^2 = 6.510$, $p = 0.039$). Other demographic variables were not statistically significant.

Discussion

The present study demonstrated a substantial short-term improvement in both hand-hygiene knowledge and observed practice following a structured teaching programme among ICU caretakers. Baseline findings showed that 41% of participants had poor knowledge and none had good knowledge. Practice was also limited, with 46% demonstrating poor practice and no participant achieving the good-practice

category. These findings highlight an important educational gap among family members who participate in patient care but may not be routinely included in formal infection-prevention education.

The increase in mean knowledge from 9.32 to 16.21 and in mean practice from 5.56 to 10.97, together with highly significant paired t-test results, suggests that an intervention combining explanation, demonstration and return demonstration can improve both cognitive understanding and practical performance. The findings are consistent with previous research emphasizing structured, multimodal or demonstration-based approaches to improving hand-hygiene behavior among healthcare personnel, patient companions and family attendants.

The study also found that educational status, previous exposure to hand-hygiene information and access to hygiene resources were associated with post-test outcomes. These associations suggest that health education should be adapted to participants' educational backgrounds and reinforced by accessible handwashing facilities and alcohol-based hand rub. The absence of significant associations for gender, occupation, relationship to the patient and several household variables indicates that the intervention may be useful across a broad range of caretaker groups.

The findings have practical implications for nursing. Nurses are well positioned to provide brief orientation to family members when patients are admitted to critical care areas. A standardized caretaker orientation could include the WHO five moments, appropriate use of alcohol-based hand rub and soap and water, correct duration and technique, and a supervised return demonstration. Such an approach may help integrate caretakers into the hospital's patient-safety culture rather than treating them solely as visitors.

Strengths and limitations

- The study assessed both knowledge and directly observed practice rather than relying only on self-report.
- The structured intervention incorporated demonstration and return demonstration, allowing immediate correction of technique.
- Tools were reviewed by experts and demonstrated acceptable reliability.
- The single-group pre-test–post-test design, purposive sampling and single-site setting limit causal inference and generalizability.
- Observed practice may have been influenced by the Hawthorne effect because participants knew they were being observed.
- Follow-up was short (approximately seven days); therefore, long-term retention of knowledge and sustained behavioral change were not established.
- The study did not directly measure changes in healthcare-associated infection rates.

Conclusion

Family caretakers in the ICU demonstrated inadequate baseline hand-hygiene knowledge and practice. Following the structured teaching programme, both knowledge and observed practice improved significantly. The results support the inclusion of brief, structured and demonstration-based hand-hygiene education for family caretakers as a complementary component of ICU infection-prevention practice. Future studies should use larger samples, controlled or randomized designs, multicentre settings and longer follow-up to determine sustainability and whether improved caretaker practices translate into reductions in healthcare-associated infections.

Abbreviations

Abbreviation
Full form
ABHR
Alcohol-Based Hand Rub
CDC
Centers for Disease Control and Prevention
HAI
Healthcare-Associated Infection
ICU
Intensive Care Unit
STP
Structured Teaching Programme
WHO
World Health Organization
SD
Standard Deviation
df
Degrees of Freedom
SPSS
Statistical Package for the Social Sciences

Declarations

Ethics approval and consent to participate:

The Institutional Ethics Committee (IEC) of Sharda University, Greater Noida, Uttar Pradesh, India, provided ethical permission for this work (IEC No. SU/SMS&R/76-A/2026/153). The study followed the Declaration of Helsinki's ethical standards, as well as all applicable institutional and national criteria for human-participant research.

Consent for publication:

Not applicable.

Competing interests:

The authors declare that they have no competing interests.

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Author Contribution

ALD and JJ contributed to study conception, data collection, intervention delivery, analysis, interpretation and manuscript preparation. RK provided methodological supervision, academic guidance, critical review and manuscript preparation. All authors reviewed and approved the final manuscript.

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No or not applicable. This manuscript does not report data generation or analysis.

References

1. World Health Organization. WHO guidelines on hand hygiene in health care. Geneva: World Health Organization; 2009. WHO/IER/PSP/2009.01.
2. World Health Organization. Global report on infection prevention and control 2024. Geneva: World Health Organization. 2024. ISBN: 978-92-4-010398-6.
3. World Health Organization. WHO guidelines on hand hygiene in health care: first global patient safety challenge, clean care is safer care. Geneva: World Health Organization; 2009.
4. World Health Organization. WHO guidelines on hand hygiene in health care: summary. Geneva: World Health Organization; 2009. WHO/IER/PSP/2009.07.
5. Biswal M, Angrup A, Rajpoot S, Kaur R, Kaur K, Kaur H, et al. Hand hygiene compliance of patients' family members in India: importance of educating the unofficial 'fourth category' of healthcare

personnel. J Hosp Infect. 2020;104(4):425–9. 10.1016/j.jhin.2019.09.013.
6. Patient family. visitor hand hygiene knowledge, attitudes, and practices at pediatric and maternity hospitals: a descriptive study. Am J Infect Control. 2021;49(6):740–5.
7. World Health Organization. WHO guidelines on hand hygiene in health care: consensus recommendations. Geneva: World Health Organization; 2009.
8. Basu S, Roy S, Roy D, Maheshwari V. Prevalence and determinants of hand hygiene knowledge, compliance, and practices among Indian healthcare workers: a systematic review and meta-analysis. Trop Med Int Health. 2026;31(2):113–37. 10.1111/tmi.70057.
9. Gopalakrishnan S, Chaurasia S, Sankar MJ, Paul VK, Deorari AK, Joshi M, et al. Stepwise interventions for improving hand hygiene compliance in a level 3 academic neonatal intensive care unit in north India. J Perinatol. 2021;41(12):2834–9. 10.1038/s41372-021-01141-3.
10. Dhandapani S, Rajshekar D, et al. Comparison of hand hygiene compliance among healthcare workers in intensive care units and wards of COVID-19: a large scale multicentric study in India. Am J Infect Control. 2023;51(3):304–12. 10.1016/j.ajic.2022.09.028.
11. Goyal A, Narula H, Gupta PK, Sharma A, Bhadoria AS, Gupta P. Evaluation of existing knowledge, attitude, perception and compliance of hand hygiene among health care workers in a tertiary care centre in Uttarakhand. J Family Med Prim Care. 2020;9(3):1620–7. 10.4103/jfmpc.jfmpc_1183_19.
12. Hand hygiene with. interventions: an observational study from a tertiary care institute over 2 years. Indian J Crit Care Med. 2024.
13. Luangasanatip N, Hongsuwan M, Limmathurotsakul D, Lubell Y, Lee AS, Harbarth S, et al. Comparative efficacy of interventions to promote hand hygiene in hospital: systematic review and network meta-analysis. BMJ. 2015;351:h3728.
14. Fernandes DR, Santos BN, Guimarães CS, Ferreira EB, Margatho AS, Reis PED, et al. Educational technologies for teaching hand hygiene: systematic review. PLoS ONE. 2024;19(1):e0294725. 10.1371/journal.pone.0294725.
15. Predictors of hand. hygiene performance among family caregivers: a cross-sectional study using the Health Belief Model. Am J Infect Control. 2026;54(5):544–51. 10.1016/j.ajic.2025.11.019.
16. Improving hygiene compliance. among family caregivers through infection prevention and control interventions in Bangladeshi hospitals: a pilot study. J Hosp Infect. 2026;171:174–82. 10.1016/j.jhin.2026.01.026.

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