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Corresponding Author
Pavani Kalagara,
Department of Microbiology, RVM institute of medical sciences and research centre, Laxmakkapally, Mulugu, Siddipet, Telengana, India

Author Designation
[1]Associate Professor
ddm66434@gmail.com
[2]Associate Professor
ajita.b.reddy@gmail.com
[3]Professor and HOD
pavanikalagara@gmail.com

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Effectiveness of Demonstration, Observation, Assistance and Performance (DOAP) Session on Hand Hygiene Practices and Addressing the Existing Knowledge Gap Among Phase II Medical Undergraduates: A Cross-Sectional Proof-of-Concept Study

[1]Debadutta Mishra, [2]Ajitha Reddy Edula and [3]Pavani Kalagara
[1]*Department of Microbiology, S.S. TantiaMedical College, Hospital and Research Centre, Sri Ganganagar, Rajasthan, India*
[2,3]*Department of Microbiology, RVM Institute of Medical Sciences and Research Centre, Laxmakkapally, Mulugu, Siddipet, Telengana, India*

ABSTRACT
Adequate knowledge, attitude and practice of hand hygiene are crucial in preventing healthcare-associated infections, especially in the current era of the SARS-CoV-2 pandemic. However, compliance with hand hygiene among junior doctors and medical undergraduates is low. The study was aimed at assessing the effectiveness of demonstration, observation, assistance and performance (DOAP) session focused on hand hygiene and evaluating the existing knowledge of hand hygiene measures among the phase II medical students. To assess the baseline knowledge level, a questionnaire tool based on the World Health Organization (WHO) checklist for hand hygiene, with a total of 27 questions was used in the pre-test before the DOAP session. The DOAP session on hand hygiene was designed performed in accordance to the Peyton's Four-Step Approach. The same questionnaire was administered immediately after the DOAP session as post-test and after one month interval as retention test. The level of hand hygiene knowledge was evaluated compared by segregating the responses into three groups in the pre-post and retention test: good (score more than equal to 75%), average (score between 50% to 74%) and poor (score less than 50%). Out of the 122 participants, 93% of the participants had already received formal training in hand hygiene. The knowledge level was good in 68% of the participants in the pre-test, which improved to 90% in the post-test. Knowledge gap exists amongst medical students with respect to appropriate hand hygiene practices and focused DOAP sessions are an effective tool in bridging the gap and promoting retention of the acquired knowledge.

INTRODUCTION

Hand hygiene by all medical professionals has been recognized as an indispensable measure to reduce transmission of multi-resistant pathogens in healthcare settings[1]. Also, adequate knowledge, attitude and practice of hand hygiene is of utmost importance, more so in the current era of SARS-CoV-2 global pandemic, wherein hand sanitization is regarded as one of the most effective prevention tools. However, although hand washing or chemical disinfection is a simple procedure, many researchers have shown that the compliance is low among junior doctors and medical undergraduates[2]. Hence, there is need to appropriately train the medical undergraduate about the importance of hand hygiene in patient care, preferably by the use of innovative teaching-learning methods for better retention.

Recently, there has been a paradigm shift in the medical education in India, with the implementation of "Competency Based Undergraduate Curriculum for the Indian Medical Graduate". For the first time demonstration, observation, assistance and performance (DOAP) session on infection control practices like hand hygiene maintenance was being introduced as a skill to be performed by medical undergraduates of phase II. This questionnaire-based survey was conducted with the dual objective of assessing the effectiveness of DOAP session focused on hand hygiene and to evaluate the existing knowledge on hand hygiene measures amongst the fifth semester medical students.

MATERIALS AND METHODS

This study was conducted among phase II medical undergraduate students of a tertiary care hospital and teaching institute during February 2022. A total of 150 phase II MBBS students were invited to fill the questionnaire on hand hygiene knowledge before DOAP session. Only 122 students were agreed to participate and were subsequently enrolled in the study. The questionnaire tool was designed based on the World Health Organization (WHO) checklist for hand hygiene and consisted of ten main questions, few with sub-questions, thereby making a total of 27 questions (Table 1)[2,3]. Questionnaires were administered as paper handouts as Pre-test. Prior to taking the test, the study participants were explained about the purpose of the study and were requested to complete and return the survey questionnaire within 15 min. For each correct response 1 mark was awarded and 0 for unanswered or incorrect response. Hence, the maximum score for knowledge was 27 and minimum was 0. After collecting the pre-test responses, a structured DOAP session on hand hygiene practices was carried out for one hour using Peyton's four-step approach. At the end of the session, the students were asked to answer the same questionnaire once again (post-test). A retention-test was performed exactly two months after the initial DOAP session, wherein again the same questionnaire was administered to the students. The level of hand hygiene knowledge of pre-post and retention test was evaluated by dividing the responses into three groups as follows:

- A score of more than equal to 75% was considered as good
- 50-74% as average
- Less than 50% as poor[3,4]

Data points were analyzed using descriptive statistics

RESULTS

The detailed results of responses obtained in pre-post and retention test are depicted in Table 1. To begin with, 87 (71%) students had already received formal training in hand hygiene. In the pre-test, the knowledge level was 'good' in 68% of the participant in the pre-test which improved to 90% in post-test (Fig. 1).

DISCUSSIONS

Hand hygiene is essential for medical students as it plays a crucial role in preventing the transmission of infectious agents in healthcare settings. Healthcare associated infections (HAIs) are a major concern in hospitals and they can cause serious consequences for patients including prolonged hospital stays, disabilities and even death[5]. Medical students are often exposed to a wide range of infectious agents during their clinical rotations and laboratory postings, making them particularly vulnerable to HAIs. Therefore, it is of utmost importance for medical students to have adequate knowledge and practice appropriate hand hygiene in order to protect themselves and also patients from these infections. Having said that, various researchers have demonstrated poor knowledge and compliance of hand hygiene in Indian

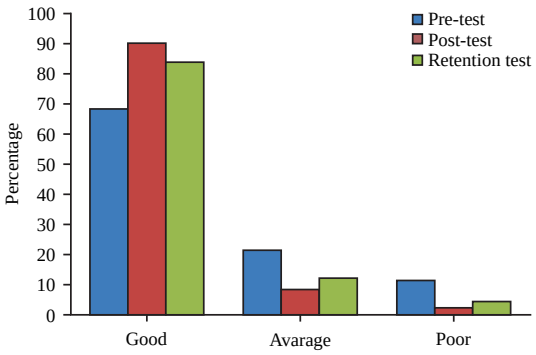

Fig. 1: Graphic comparison of knowledge level of participants in pre-, post- and retention test

Table 1: Questionnaire tool used along with the performance of participants in pre-, post- and retention test

No.	Questions	Number (%) of students who answered correctly (n = 122) Pre-test	Post-test	Retention test
1	Did you receive formal training in hand hygiene in the last two years?	113 (93 %) said 'yes'	122 (100 %) said 'yes'	122 (100 %) said 'yes'
2	Do you routinely use an alcohol-based hand rub for hand hygiene?	113 (93 %) said 'yes'	113 (93 %) said 'yes'	119 (98%) said 'yes'
3	Which of the following is the major route of cross-transmission of potentially harmful germs between patients in a health-care facility? • Unclean hands of health-care workers • Patients' exposure to colonised surfaces (i.e., beds, chairs, tables, floors) • Sharing non-invasive objects (i.e., stethoscopes, pressure cuffs, etc.) between patients • Air-borne, that is, from the air circulating in the hospital	89 (73%)	116 (95%)	116 (95%)
4	What is the most frequent source of germs responsible for health care-associated infections? • The hospital's water system • The hospital's air • The hospital's equipment's and other surfaces • Microorganisms already present on or within the patient	75 (61%)	115 (94%)	106 (85 %)
5.	Which of the following hand hygiene actions prevents transmission of microorganisms to the patient? Choose between 'yes' and 'no'.			
	• Before touching a patient (Yes/No)	119 (98%)	122 (100%)	122 (100%)
	• Immediately after a risk of body fluid exposure (Yes/No)	82 (67%)	122 (100%)	122 (100%)
	• After exposure to the immediate surroundings of a patient (Yes/No)	28 (23%)	110 (90%)	104 (85%)
	• Immediately before a clean/aseptic procedure (Yes/No)	104 (85%)	110(90%)	100 (82%)
6	Which of the following hand hygiene actions prevents transmission of germs to the health-care worker? Choose between 'yes' and 'no'.			
	• After touching a patient (Yes/No)	111 (91%)	122 (100%)	122 (100%)
	• Immediately after a risk of body fluid exposure (Yes/No)	109 (89%)	122 (100%)	122 (100%)
	• Immediately before a clean/aseptic procedure (Yes/No)	28 (23%)	110 (90%)	102 (84%)
	After exposure to the immediate surroundings of a patient (Yes/No)	109 (89%)	111 (91%)	102 (84%)
7	Which of the following statements on alcohol-based hand rub and hand washing with soap and water are true?			
	• Hand rubbing is more rapid for hand cleansing than hand washing (True/False)	92 (75%)	100 (82%)	111 (91%)
	• Hand rubbing causes skin dryness more than hand washing (True/False)	29 (24%)	100 (82%)	83 (68%)
	• Hand rubbing is more effective against germs than hand washing (True/False)	100 (82%)	116 (95%)	122 (100%)
	• Hand washing & hand rubbing are recommended to be performed in sequence (True/False)	55 (45%)	100 (82%)	96 (79%)
8	What is the minimal time needed for alcohol-based hand rub to kill most germs on your hands? • 05 seconds • 20 seconds • 40 seconds • 60 seconds	90 (74%)	122 (100%)	113 (93%)
9.	Which type of hand hygiene method is required in the following situations? Choose between 'rubbing' and 'washing'.			
	• Before palpation of the abdomen (Rubbing/washing)	100 (82%)	115 (94%)	119 (98%)
	Before giving an injection (Rubbing/washing)	80 (66%)	119 (98%)	119 (98%)
	After removing examination gloves (Rubbing/washing)	95 (78%)	122 (100%)	119 (98%)
	After making a patient's bed (Rubbing/washing)	31 (25%)	111 (91%)	108 (89%)
	After emptying a bedpan (Rubbing/washing)	105 (86%)	122 (100%)	122 (100%)
	After visible exposure to blood (Rubbing/washing)	83 (68%)	122 (100%)	122 (100%)
10	Which of these are associated with increased likelihood of colonisation of hands with microorganisms and hence should be avoided? Choose between 'yes' and 'no'.			
	Wearing jewellery (Yes/No)	88 (72%)	110 (90%)	102 (84%)
	Damaged skin (Yes/No)	105 (86%)	122 (100%)	118 (97%)
	Artificial fingernails (Yes/No)	106 (87%)	118 (97%)	117 (96%)
	Regular use of a hand cream (Yes/No)	75 (61%)	118 (97%)	107 (88%)

Correct answers to the questions are highlighted in bold letters

medical undergraduates. Nair *et al*.[6] studied knowledge, attitude, and practices of hand hygiene among 98 medical and 46 nursing students in a tertiary medical college in Raichur. They documented poor outcome with only 9% of participants having good knowledge regarding hand hygiene. Thakker VS et al assessed the existing knowledge of hand hygiene among medical, dental, and nursing undergraduates at a teaching institute in Navi Mumbai, Maharashtra and found the knowledge level as moderate (69.19%, 137 of 198)[4] The knowledge level was good only in 7.58 % (n = 15) of the respondents[4]. Another multi-centric study conducted in 523 medical undergraduates from all the phases, reported overall good hand hygiene knowledge in only 12.2% of the respondents[3]. Average or moderate level of hand hygiene knowledge was observed by Susmita *et al*.[7] in their questionnaire-based study conducted in 703 medical and paramedical students during the COVID-19 pandemic. In the present study, the knowledge level was 'average' to 'poor' in more than 30% of the students before the DOAP session, despite the fact that 113 (93%) students said that they had received formal training in hand hygiene in the last two years.This suggests that, to boost up

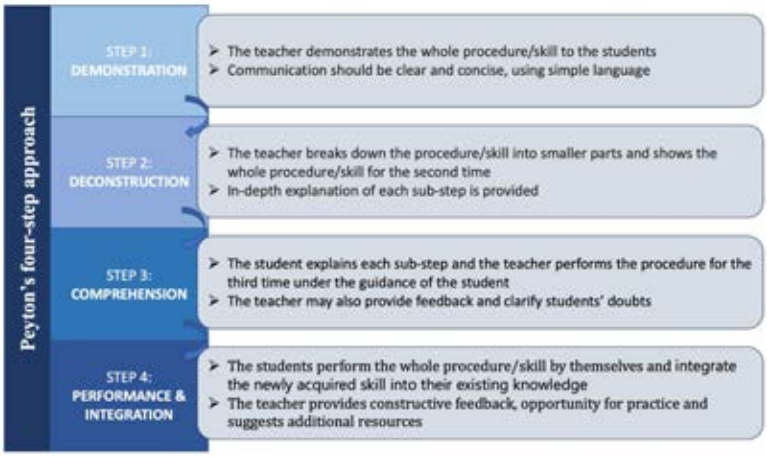

Fig. 2: Gist of Peyton's four-step approach

hand hygiene knowledge, attitude and practice among the undergraduate students, comprehensive hand hygiene teaching modules needs to be implemented along with reinforcement at various stages.

DOAP sessions are an important component of medical education and are particularly useful in the training of procedural skills[8]. These sessions provide hands-on experience to the learner and caters to higher domains of the learning ladder. The advantages of DOAP sessions are manifold. They provide students with an opportunity to observe and capture the nuances of a procedure in real time which can be difficult to appreciate through other learning methods such as textbooks or even videos. Additionally, DOAP sessions allow students to receive feedback on their own procedural skills, to identify areas for improvement and to refine their techniques. Research has shown that DOAP sessions can improve trainees' confidence in performing procedures leading to better patient outcomes. Furthermore, DOAP sessions can also facilitate the evaluation of the competencies of trainees, allowing educators to identify those who may require additional support. However, it is important to note that DOAP sessions should not be used in isolation but rather as a part of a comprehensive training program that includes didactic teaching, simulation-based training and clinical experience. It is also important to ensure that DOAP sessions are conducted in a supportive and constructive environment to facilitate effective learning and feedback.

For this study, the DOAP session on hand hygiene was planned in accordance with Peyton's Four-Step Approach, a widely recognized method for teaching adult learners. It involves four steps:

- Demonstration
- Deconstruction
- Comprehension
- Performance and integration (Fig. 2)[9,10]

Overall, it is a very effective method which emphasizes on clearing concepts by observation and 'do-it-yourself' experience and also provides opportunities for practice and feedback. Our session was under-taken as small-group teaching activity of 6 groups, each comprising of 20-21 students and a teacher. After the pre-test activity, following was done:

- **Pre-session briefing:** The teachers explained the importance of hand hygiene in infection prevention and control, proper hand hygiene techniques, and five moments for hand hygiene (using hand-outs and digital images)
- **Demonstration:** The teachers demonstrated appropriate time and techniques of proper hand hygiene through simulated patient encounters and situations
- **Deconstruction and observation:** The above demonstrations were repeated once again along with in-depth explanation and reasoning. The students were asked to meticulously observe each step
- **Comprehension and performance:** The students were asked to briefly tell about the importance of hand hygiene in hospital settings. They also preformed hand hygiene practices during simulated patient encounters, including before and after contact, before and after performing procedures and after contact with the patient's surroundings
- **Evaluation and feedback:** The teachers immediately provided feedback, including both positive feedback and constructive criticism where appropriate
- **Repeat performance:** The students were asked to perform the steps again for practice and better retention

At the end, post-test was conducted. Retention test with the same questionnaire was planned in order to test the long-term effectiveness of the teaching

methodology. In our study, the results of post-test and retention test were comparable, thereby validating the usefulness of such a session. The Medical council of India has aptly introduced the skill of proper handwashing as a competency to be acquired in the foundation course at the beginning of 1st phase of MBBS[11] Importantly, this acquired knowledge has to be reinforced during subsequent semesters and such DOAP sessions during 2nd phase can be highly effective. Mohammed SA and Wehieda SM have shown that DOAP session focused on hand hygiene effectively increase adherence to hand hygiene protocols and even reduce the incidence of HAIs among healthcare workers[12]. Not only hand hygiene, several studies have shown the effectiveness of DOAP sessions on various topics of medical education[8,13,14].

Our study has certain limitations. This study was conducted in a single institute with a limited sample size. A self-reporting questionnaire was used for assessment which is likely to be affected by self-observation capacity and recall bias. Hence, multicentric studies with larger sample size as well as practical qualitative assessments are needed to identify the potential gaps in hand hygiene among the undergraduate healthcare students and thereby formulate effective teaching strategies.

CONCLUSION

Knowledge gap exists among the undergraduate students with respect to appropriate hand hygiene practices. Formal hand hygiene DOAP session can have a positive influence on the attitude and practice of undergraduate students, with better retention capacity. Also, such DOAP sessions can be part of a comprehensive approach to infection prevention and control, which includes education, training, ongoing monitoring and evaluation of hand hygiene practices of undergraduates.

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