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Original Research Article

Effectiveness of direct demonstration in clinical settings compared to conventional teaching for training medical students in infection control practices

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Abstract

Background: In today's world, exposing medical students to an environment where they can learn, and apply their knowledge and skills in clinical settings is crucial. One such effective method of achieving, is teaching by Direct Demonstration (DD) of Infection Prevention Control (IPC) practices in clinical settings. This links the basic science knowledge and clinical skill acquisition, allowing the learners to apply IPC in real-time contexts.
Objectives: To compare Direct Demonstration in clinical settings to Conventional Teaching among 2nd year MBBS students and to assess students' perceptions regarding teaching and learning methods.
Materials and Methods: A total of 100 students participated in the study and were randomly divided equally into Group A and Group B. Those participants who were either absent from the sessions or assessments were excluded. Group A underwent DD in clinical settings and Group B underwent Conventional Teaching (CT) on Biomedical Waste Management, Spill management, Hand Hygiene and Donning and Doffing of Gloves, with reversal of Group for alternate procedures. Students' perception was collected immediately after each session. After completion of all the sessions, Objective structured practical examination was conducted for all the procedures in four stations. A total of 94 students met the study inclusion criteria and were subsequently analyzed using unpaired t-test and Mann-Whitney test.
Results: The mean marks obtained by the students in DD for Biomedical waste management, Spillage management, Donning and Doffing of Gloves and Hand hygiene were 8.98±1.31,8.35±1.49,7.31±1.03,8.63±1.41 respectively compared to CT are 8.79±1.20, 8.38±1.38, 6.63±0.87, 8.44±1.95. The p-value was statistically significant only for donning and doffing of gloves. The students' perception regarding DD and CT yielded a favorable response for DD, which was statistically significant with a p-value of < 0.001.
Conclusion: In our study, DD method enhances IPC but when combined with traditional teaching methods, creates a comprehensive and engaging learning experience.

Keywords: IPC, Biomedical waste, Spill Management, Donning, Doffing, Hand Hygeine, Direct Demonstration, Medical education, Gloves.

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1. Introduction

Medical education in basic sciences requires diverse learning strategies to build a strong foundation of knowledge. However, many students primarily engage in lecture halls, dissection rooms, and laboratories, with limited exposure to clinical environments. This lack of early patient interaction and often creates gaps between theoretical knowledge and practical application in clinical settings.[1,2]

Introducing clinical exposure at an early stage can significantly improve students' retention of fundamental concepts while boosting their confidence as future healthcare professionals.[3] By integrating basic science education with hands-on clinical skills, students develop a more holistic understanding of medical practice, preparing them for their roles as physicians.

Hospital-acquired infections (HAIs) remain a major challenge in healthcare settings, contributing to increased

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patient morbidity, mortality, and healthcare costs.[4] Implementing Infection prevention control (IPC) practices among healthcare workers, including medical students, is a well-established strategy to reduce HAIs, protecting patients, professionals and the hospital environment. Despite the proven efficacy of IPC measures, adherence among healthcare professionals and students in developing countries remains low.[5,6] The medical undergraduate years serve as a critical training phase for cultivating infection prevention control practices, which is essential to be incorporated in the present medical curriculum.

Embedding IPC training early in medical education bridges the lacunae between acquired knowledge and clinical practice, equipping future doctors with the competence to manage infectious risks effectively. IPC education not only instills professional accountability but also aligns medical training with global healthcare standards, fostering a culture of infection prevention.

However, integrating IPC practices for training into clinical settings poses a considerable challenge due to various factors such as time constraints, resource limitations and the need for collaboration among diverse healthcare professionals. One effective strategy is Direct Demonstration of IPC procedures in real clinical environments. This study aims to compare the effectiveness of DD in clinical settings with Conventional Teaching methods. Overall, this approach aims to help the students to meet the practical demands of their medical profession, even before their actual clinical exposure. As a result, students emerge better equipped and more self-assured, poised to embrace the multifaceted challenges of their medical profession.

2. Objectives

1. To compare the effectiveness of direct Demonstration of IPC practices in clinical settings over conventional teaching methods in Microbiology.
2. To assess the student's perception in Direct Demonstration of IPC practices in clinical settings and conventional teaching methods.

3. Materials and Methods

3.1. Study design

This prospective cross-sectional study was conducted with second-year MBBS students in Al Azhar Medical College and Super Specialty Hospital. The study was conducted for a period of two months after obtaining approval from the Institutional Ethics Committee (IEC approval No. AAMC/IEC/2018-2019/07/25/3 dated 25-07-2019). The study was conducted between January 2019 and March 2019.

3.2. Inclusion criteria

Out of 120 second-year MBBS students, 100 consented to participate in the study. They were included in the study after obtaining informed consent.

3.3. Exclusion criteria

Those students who were absent from any of the sessions and assessments were excluded from the study.

Then 100 students were randomly divided into two groups, Group A and Group B, with each Group comprising of 50 students.

3.4. Study methodology

The study focused on teaching infection control practices such as Hand Hygiene, Spill management, Biomedical Waste Management and Donning and Doffing of Gloves, which are the basic infection control practices followed in clinical settings.

Infection control practices were taught through Direct Demonstration (DD) in clinical settings for Group A. For Group B, the conventional teaching (CT) methods in the Microbiology Department are in the form of Demonstration. Each IPC practices was taught simultaneously for both groups on the same day. All four IPC procedural skills were conducted with a reversal of students in each Group for DD and CT.

The sessions were well-structured and pre-planned, involving the faculty members, both intra and inter-department, in both the Teaching learning methods. DD for Hand Hygiene were performed in the Pediatric OPD, Spill management was conducted in the Clinical Microbiology lab in a simulated environment, Biomedical Waste Management was shown in the Emergency Department, and Donning and Doffing of Gloves were demonstrated in the procedure room in Casualty. Conventional teaching was conducted in Microbiology Demo rooms and Practical hall for all the procedures.

The student perception questionnaires were self-administered immediately after each session, and as such, blinding of scorers was not applicable, since the data were collected anonymously and electronically, with responses directly recorded and analysed in aggregate form without group identifiers.

The questionnaire used in this study was adapted from previously published instruments evaluating teaching-learning methods in medical education. Prior to deployment, the questionnaire was reviewed by a panel of three subject experts (Microbiology, Medical Education, and Clinicians) for content validity and relevance to the infection control teaching context.

We also conducted a pilot test with a group of 15 students (not part of the final study cohort) to assess internal consistency, yielding a Cronbach’s alpha of 0.81, which is considered acceptable

Following the sessions' conclusion, OSPE (Objective Structured Practical Examination) was conducted as an

assessment method after one month for both groups on the same day. The OSPE examination was conducted by faculty members from the Department of Microbiology who were not involved in delivering the teaching sessions to either group. They were blinded to the group allocation of students during assessment to minimize bias.Four OSPE stations for each procedure was conducted.Each station used a standardized and checklist-based scoring system, further reducing the risk of subjective bias.

3.5. Statistical analysis

For further data analysis, 94 students who fulfilled the above inclusion and exclusion criteria were included. All the data were entered and analyzed by using SPSS 16. An unpaired t-test was done for descriptive variables. Mann-Whitney U test was done to analyze the students' perceptions.

4. Results

The mean exam scores for Biomedical Waste Management, Spill management, Donning and doffing of Gloves, and Hand hygiene in DD are 8.98±1.31, 8.35±1.49, 7.31±1.03, 8.63±1.41 respectively compared to CT are 8.79±1.20, 8.38±1.38, 6.63±0.87, 8.44±1.95 as described in **Table 1**.

The highest mean score is for Biomedical Waste Management and the lowest mean score is for Donning and Doffing of Gloves in both methods.

The p-value was statistically significant only for the Donning and Doffing of Gloves, and the p-value was insignificant for Biomedical Waste Management, Spillage management, and Hand Hygiene.

Perception of students regarding the two teaching-learning methods was recorded using the 5-point Likert scale yielded, a favorable response for DD over conventional teaching. The results were statistically significant, with a p-value of < 0.001 as described in **Table 2** and **Figure 1,2.**

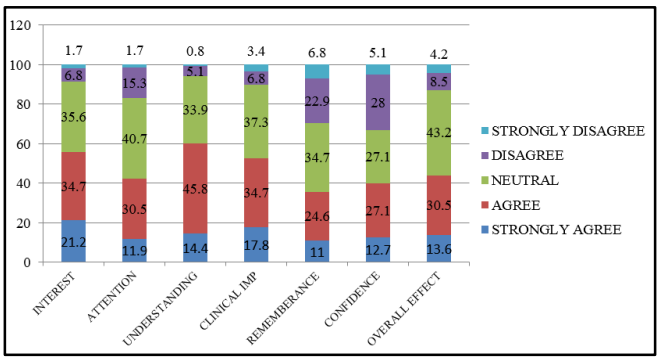

Figure 1: Perception of students on direct demonstration in clinical settings

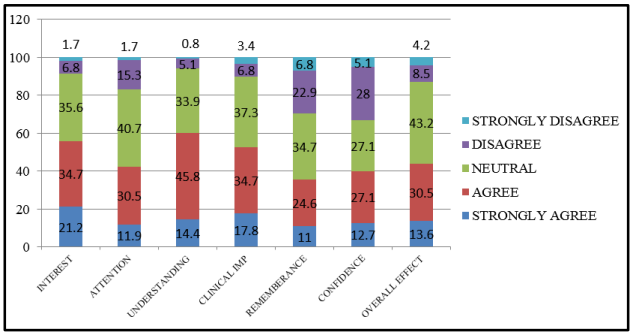

Figure 2: Perception of students on conventional teaching

5. Discussion

The initial years of medical schooling are essential, as they focus on building up the basic knowledge but with preconceived attitudes towards medicine and their role as competent physician.[3] Several studies revealed that early clinical exposure helped in learning and improving their attitude towards learning.[7-10]

Table 1: Comparison of marks of OSPE evaluation test between the groups

S.No.	Topic	Mean±SD		p-value
		Direct Demonstration (DD)	Conventional teaching (CT)	
1	Biomedical waste management	8.98±1.31	8.79±1.20	0.409
2	Spillage management	8.35±1.49	8.38±1.38	0.919
3	Donning and Doffing of Glove	7.31±1.03	6.63±0.87	0.001
4	Hand Hygiene	8.63±1.41	8.44±1.95	0.558

Table 2: Analysis of mean rank and p-value on perception

S.No	Questions	Mean Rank		p-value
		DD	CT	
1.	This was able to generate interest in the subject	151.78	85.22	0.000
2.	Attention span was good during the session	152.75	84.25	0.000
3.	Was able to understand the principles of the topic	150.45	86.55	0.000
4.	We can understand the clinical importance of the procedure	151.70	85.22	0.000
5.	Will remember the procedure skill with knowledge longer	156.53	80.47	0.000
6.	Were able to boost the confidence in performing the procedure	149.33	87.67	0.000
7.	Overall, this teaching method was effective and beneficial to me	154.07	82.93	0.000

Rangachari's study highlighted that the traditional conventional teaching method does not integrate basic science and clinical knowledge, impacting students' understanding of the concept. The study also emphasis that the students need better grasp of the practical significance. Students who learn to seek, synthesize and integrate information will be better prepared for life-long learning.[11]

Integrating knowledge and skills acquired in basic sciences into clinical practice is vital. DD of practical skills outside the traditional lab setting, offers a new approach to enhance learning and integration. Our study evaluated the impact of DD in real-time clinical settings in IPC procedures taught in Microbiology compared to conventional teaching methods. DD in clinical settings have certain overlapping concepts of early clinical exposure but differ from it distinctly in the context of interacting with the patients directly. Direct Demonstration in clinical settings reinforces the importance of IPC practices in clinical care which simultaneously aids students in developing essential practical skills.

Our study results revealed that DD in clinical settings yielded higher mean scores for all four microbiological procedures. While the p-value was significant for only one procedure (Donning and Doffing of Glove), it was insignificant for the others. The above result could be due to the multiple fine skill steps involved in donning and doffing gloves compared to other procedures, which was well perceived by the students in Direct Demonstration. The Students perception was positive towards the DD in clinical settings compared to CT, especially in terms of Clinical importance of the IPC practices.

DD in clinical settings has honed learners' skills and provided a vivid preview of their future real-world scenarios. It has underscored the importance of executing procedures accurately while efficiently managing time. This method effectively connects theoretical knowledge with practical application, preparing learners for their professional journey.[12-15] The integration of DD into clinical settings demanded meticulous planning and close collaboration with the clinical department, bringing both benefits and challenges. Although DD in clinical settings fostered student enthusiasm and engagement, it posed challenges regarding time and individual attention to students amidst regular patient care responsibilities.[16-18]

Furthermore, while students preferred DD in clinical settings, the CT offered benefits such as personalized attention and utilization of diverse teaching methods like PowerPoint presentations, video demonstrations and poster displays. Moreover, the initial stages of acquiring any skills require repeated observation and hands-on training, which cannot be achieved through Direct Demonstration in clinical settings due to practical difficulties. One of the limitation of our study is that we assessed students in their second year of MBBS, necessitating further evaluation during their real-time clinical practice. The authors acknowledge that the inclusion of second-year MBBS students from a single institution may limit the generalizability of the findings.

Learning basic sciences linked to a clinical context can definitely improve the student's curiosity to learn and improve for longer retention of knowledge and skill.[19] The present study has evaluated only four IPC practices, which cannot be generalized to all the skills learned in Microbiology. The medical curriculum can introduce feasible procedures to motivate the students in their learning process. This type of blended learning can significantly increase their professional skills. Increasing emphasis on infection control within undergraduate curricula, through systematic and recurrent education, particularly in clinical context, has the potential to enhance students' theoretical knowledge, attitudes, and behavioral practices. This approach may also contribute to cultivating a practice environment that prioritizes and promotes adherence to infection control protocols.[20]

6. Conclusion

In our study, the effectiveness of Direct Demonstration in clinical settings for IPC practices has proven significantly superior to Conventional Teaching methods. Direct Demonstration provides a practical approach allowing learners to observe, understand and replicate procedures in real-time, enhancing their learning experience and skill acquisition. However, Direct Demonstration cannot completely replace Conventional Teaching methods rather, it should enhance and supplement conventional teaching for an enriching learning experience. This blended approach ensures that learners benefit from the theoretical knowledge imparted through traditional teaching and the practical skills gained through Direct Demonstration, thereby fostering a more robust and holistic approach in mastering of clinical procedures. This recommendation is based on the principle that effective learning is best achieved through a combination of various teaching methodologies, each complementing the other.

The introduction of this innovative technique in traditional teaching, represents a progressive step in demonstrating skills in clinical settings has sparked a newfound enthusiasm for learning among students. This enthusiasm could be a significant catalyst, driving them to acquire and apply these skills in future real-world situations without compromising their basic learning techniques when blended with our traditional teaching.

7. Conflict of Interest

The authors declare that there are no conflicts of interest.

8. Source of Funding

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