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# AN OBSERVER TOOL TO ENHANCE LEARNING OF MEDICAL STUDENTS DURING SIMULATION TRAINING OF CARDIOPULMONARY RESUSCITATION: A RANDOMIZED CONTROLLED TRIAL

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## ABSTRACT

**Background:** In cardiopulmonary resuscitation (CPR), simulation training plays a vital part of medical education, but there is limited time of active practice due to large class sizes, resulting in a small learning effect. A tool called an observer tool (OT) is a checklist which summarizes CPR skills and actions stepwise, has been proposed to improve learning during observation.

**Objective:** To evaluate the importance of an OT in improving the learning outcome of medical students during simulation training of CPR.

**Methodology:** The study design was prospective, randomized controlled trial was conducted at Kabir Medical College, Gandhara University in a time span of February 2022 to February 2023. The sample size was 200 and these medical students were randomized into two groups: OT+ (using the observer tool) and OT- (without the observer tool). OT checklist assessed the primary outcome. Secondary outcomes included non-technical skills (NTS) scores, chest compression quality, knowledge scores (MCQ), perceived improvement in skills, and satisfaction levels.

**Results:** A significantly higher global performance score was of OT+ group (25.2 ± 0.9) compared to the OT- group (24.6 ± 1.3, $p = 0.001$). The OT+ group also showed significant improvements in chest compression quality (96% vs. 91%, $p = 0.032$), knowledge scores (19.2 ± 1.3 vs. 17.5 ± 1.6, $p = 0.003$), and perceived improvement in skills (4.7 ± 0.5 vs. 4.4 ± 0.6, $p = 0.023$). No significant differences were observed in NTS scores ($p = 0.224$) and satisfaction levels ($p = 0.139$).

**Conclusion:** An observer tool significantly improve the performance of medical students globally. Notable improvements were seen in participants using observer tool in chest compression quality, knowledge scores, and perceived skill improvement. However, no significant differences were seen in non-technical skills and overall satisfaction, the results suggest that structured observation can effectively enhance certain aspects of CPR training. These findings highlight the potential of observer tools to improve specific learning outcomes, representing their value in medical education.

**Keywords:** Simulation Training, Cardiopulmonary Resuscitation, Observer Tool

## INTRODUCTION

Simulation-based training is a crucial component of medical education, providing a secure and regulated setting for trainees to hone their clinical abilities.[1] Medical students need to be proficient in performing cardiopulmonary resuscitation (CPR), which is one of the most important emergency operations. Patients experiencing cardiac arrest have a much better chance of surviving and recovering when CPR is administered effectively.2 To become proficient in CPR, though, you must not only practice often but also use learning tactics that enhance your ability to retain information and gain new skills. Even with simulation training's established advantages, there are still a number of problems.3 The restricted amount of time that each student has for active practice as a result of big class sizes is one prominent problem. This restriction may result in less than ideal learning opportunities and decreased skill development.4

Educators have sought innovative methods to address these challenges and to maximize the learning potential during simulation training.5 One promising approach is the usage of an observer tool (OT). An OT is a structured checklist that outlines the critical steps and skills required for a procedure, guiding the observer through a systematic evaluation of their peer's performance.6 The rationale behind this approach is that active engagement through structured observation can improve the learning experience, allowing observers to adopt the procedural steps and critical actions required for effective CPR.7

Several studies in medical education have found differing results about whether structured observation tools are effective. Indeed, although some investigations have shown benefits on learning outcomes and skill performance compared with traditional training or among novices who never performed a laparoscopic task previously 8-10, other studies reported no clear advantage.11 This variation emphasized the necessity of additional research to quantify appropriately an OT's value for various educational contexts and settings.

The main objective of this study is to determine the effect on medical student learning outcomes from observed-tool use during CPR simulation-training. The particular research, therefore, has the objective of finding out whether OT intervention helps overall student performance and CPR skill improvement or knowledge retention and skills, and overall satisfaction with the training.

## MATERIALS AND METHODS

This prospective, randomized controlled trial assessed the impact of an observer tool (OT) on medical student performance in CPR simulation training. This study was carried out at Kabir Medical College, Gandhara University over twelve months starting from January 2022 to December 2023. From three consecutive batches of 3rd professional year at Kabir Medical College in the current study total number of students to enroll for CPR training was 200. Students were then randomized into groups of two and thus they became 100 dyads; one group worked with the Observer Tool (OT+) during their observation, while another did not (OT -).

Participants were randomly assigned to the OT+ and OT- groups using a computer-generated random number sequence. Each dyad was allocated to either the 'intervention group' (OT+) or the 'control group' (OT-) to ensure balanced distribution.

The intervention was an observer tool (OT): a blueprint-type checklist of CPT actions and critical CPR skills. Items in the checklist were:

- Acknowledgment of if being unconscious
- Assessment of breathing
- Calling for help
- Performing cardiac massage
- Using a defibrillator

In this simulation training, one student of each dyad performed the CPR skills on a manikin while his/her partner observed every performance. The observing student took guide checklist of OT to observe and note key points (OT+ group). In the OT- group, the observing student did not use any structured tool.

**Training Workshop**

The CPR training workshop included theoretical and practical components:

1. **Theoretical Component:** A 1-hour lecture covering the principles of CPR, 'recognition of unconsciousness, assessment of breathing, calling for help, performing cardiac massage, and defibrillation'.
2. **Practical Component:** A 2-hour hands-on session where students practiced CPR on manikins in dyads. Each dyad had three practice cycles, with one student performing and the other observing, followed by role reversal.

**Outcomes**

The primary outcome was the 'global performance score of the dyad, assessed by an independent evaluator using the OT checklist at the end of the training'. Secondary outcomes included:

- 'Quality of non-technical skills' (NTS)
- 'Chest compression quality'
- 'Perceived improvement in knowledge and skills'
- 'Knowledge score measured through multiple-choice questions' (MCQs)
- 'Satisfaction with the training'

Data were collected immediately after 'the training sessions. The global performance score was evaluated on a scale of 0 to 25, with higher scores indicating better performance'. Non-technical skills were assessed using a standardized NTS rating scale. Chest compression quality was measured in terms of depth and rate of compressions. Perceived improvement in knowledge and skills was recorded using a self-reported questionnaire. Knowledge scores were assessed using a 20-item MCQ test. Satisfaction was measured using a 5-point Likert scale.

Data were analyzed using SPSS software (version 25.0). Continuous variables were expressed as means and standard deviations or medians and interquartile ranges, as appropriate. Categorical variables were presented as frequencies and percentages. Comparisons between groups were made using independent t-tests or Mann-Whitney U tests for continuous variables and chi-square tests for categorical variables. A p-value of $<0.05$ was considered statistically significant.

**RESULTS**

The participant characteristics between the two groups were well-matched, ensuring the validity of the study outcomes. The average age in the OT+ group was 22.5 years with a standard deviation of 1.5 years, while the OT- group had an average age of 22.8 years with a standard deviation of 1.4 years ($p = 0.682$). The gender distribution was also similar, with the OT+ group consisting of 50 males and 50 females, and the OT- group having 48 males and 52 females ($p = 0.842$). (Figure 1) Additionally, 41% of participants in the OT+ group had previous CPR training compared to 39% in the OT- group ($p = 0.692$), indicating no significant difference in prior training between the groups. (Table 1)

In terms of the primary outcome, the global performance score was significantly higher in the OT+ group, with an average score of 25.2 and a standard deviation of 0.9, compared to the OT- group's average score of 24.6 with a standard deviation of 1.3 ($p = 0.001$). This suggests that using the observer tool (OT+) can improve overall performance during training of CPR simulation. (Table 2)

For the secondary outcomes, the non-technical skills (NTS) scores were slightly higher in the OT+ group, averaging 8.9 with a standard deviation of 0.6, compared to 8.7 with a standard deviation of 0.7 in the OT- group ($p = 0.224$), though this difference was not statistically significant. Chest compression quality was significantly better in the OT+ group at 96% compared to 91% in the OT-

group (p = 0.032). The knowledge scores, assessed through multiple-choice questions (MCQs), were also significantly higher in the OT+ group, averaging 19.2 with a standard deviation of 1.3, compared to 17.5 with a standard deviation of 1.6 in the OT- group (p = 0.003). Additionally, perceived improvement in skills was higher in the OT+ group, with an average score of 4.7 and a standard deviation of 0.5, compared to 4.4 with a standard deviation of 0.6 in the OT- group (p = 0.023). However, satisfaction levels were slightly higher in the OT- group, with an average score of 4.5 and a standard deviation of 0.8, compared to 4.3 with a standard deviation of 0.8 in the OT+ group (p = 0.139), though this difference was not statistically significant. These findings highlight the potential benefits of using an observer tool in CPR training to enhance performance, knowledge, and skill improvement, despite not significantly impacting non-technical skills and overall satisfaction. (Table 3) (Figure2)

**Table 1 Participant Characteristics**

| **Characteristic** | **OT+ Group (n=100)** | **OT- Group (n=100)** | **p-value** |
|---|---|---|---|
| Age (years) | 22.5 ± 1.5 | 22.8± 1.4 | 0.682 |
| Gender (Male/Female) | 50/50 | 48/52 | 0.842 |
| Previous CPR Training (%) | 41% | 39% | 0.692 |

**Table 2: Primary Outcome: Global Performance Score**

| **Outcome** | **OT+ Group (n=100)** | **OT- Group (n=100)** | **p-value** |
|---|---|---|---|
| Global Performance Score | 25.2 ± 0.9 | 24.6± 1.3 | 0.001 |

**Table 3: Secondary Outcomes**

| **Outcome** | **OT+ Group (n=100)** | **OT- Group (n=100)** | **p-value** |
|---|---|---|---|
| NTS Score (out of 10) | 8.9± 0.6 | 8.7 ± 0.7 | 0.224 |
| Chest Compression Quality (%) | 96 | 91 | 0.032 |
| Knowledge Score (MCQ, out of 20) | 19.2 ± 1.3 | 17.5 ± 1.6 | 0.003 |
| Perceived Improvement (out of 5) | 4.7 ± 0.5 | 4.4 ± 0.6 | 0.023 |
| Satisfaction (out of 5) | 4.3± 0.8 | 4.5 ± 0.8 | 0.139 |

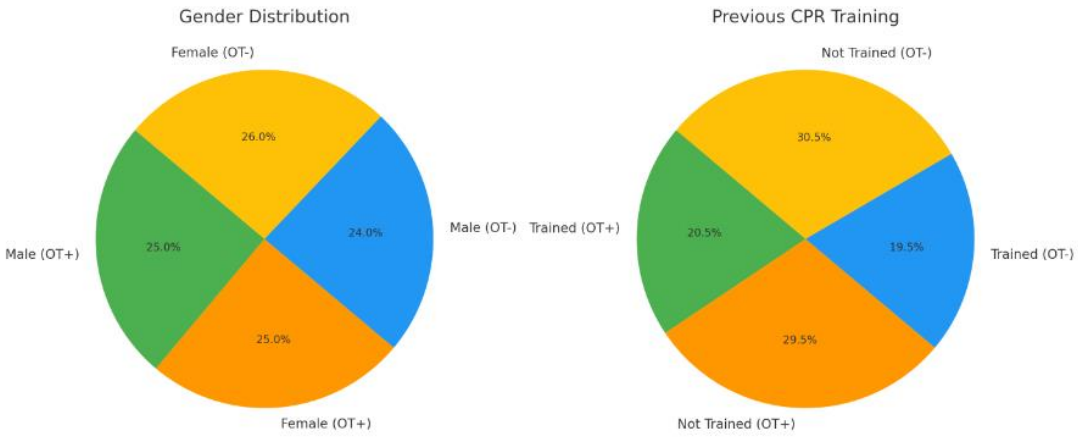


**Figure 1:** This pie chart displays the percentage of students in both groups who have and have not received prior CPR instruction, as well as the distribution of males and females in the OT+ and OT- groups.

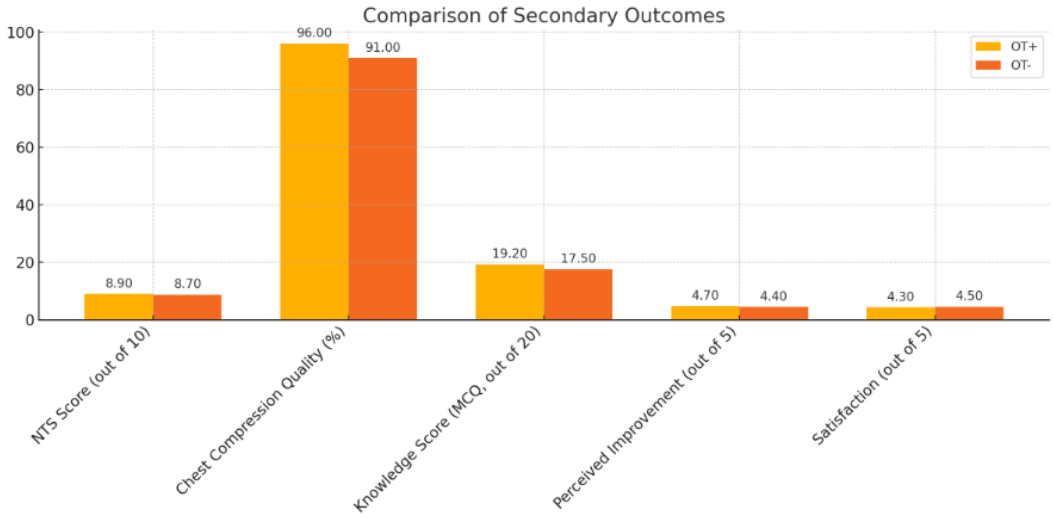


**Figure 2:** Graph comparing the secondary outcomes between the OT+ and OT- groups.

## DISCUSSION

Our study findings showed significant improvement in global performance observed in the OT+ group which is consistent with the findings of Ammar Goulamhoussen et al. (2024), who stated that structured questioning using checklists improved overall performance in surgical simulation training.12 Similar conclusions were made by Carmen et al. (2019), who discovered that participants' performance ratings increased when structured observation tools were used during emergency medicine simulations.13These results bring credibility to the idea that organized observation can offer a more thorough comprehension of the procedural processes, improving the overall academic achievement of students

The OT+ group's superior quality of chest compressions is consistent with Cheng et al. (2015)'s study results, which showed that structured observation and real-time feedback enhanced pediatric residents' CPR performance. By using an OT, students were probably able to better internalize the important principles of optimal depth and rate during chest compressions, which improved their performance in simulations.14

The significant increase in knowledge scores among students using the OT corroborates the findings of McCoy et al. (2019), who showed that active engagement through structured observation enhanced knowledge retention in medical trainees.15 The checklist likely reinforced key concepts and procedural steps, facilitating better recall and understanding during the MCQ assessment.

Regardless of improvements in technical skills, our study did not find a significant difference in non-technical skills (NTS) between the OT+ and OT- groups. Our result are contrary to the findings of Philippe Dewolf et al. (2020), who reported that structured questioning improved NTS such as communication and teamwork in simulation training. The discrepancy may be due to differences in the training focus and assessment methods.16 Our study primarily emphasized technical CPR skills, which might have overshadowed the development of non-technical skills.

Interestingly, satisfaction levels were slightly higher in the OT- group, though the difference was not statistically significant. This finding resonates with the finding of a study by Claude Muller et al. (2023), which found that students sometimes perceive structured tools as restrictive, preferring more flexible learning environments.17 The OT may have been viewed as an additional task rather than a supportive tool, affecting satisfaction scores.

## CONCLUSION

An observer tool significantly improve the performance of medical students globally. Notable improvements were seen in participants using observer tool in chest compression quality, knowledge scores, and perceived skill improvement. However, no significant differences were seen in non-technical skills and overall satisfaction, the results suggest that structured observation can effectively enhance certain aspects of CPR training. These findings highlight the potential of observer tools to improve specific learning outcomes, representing their value in medical education.

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