

Evaluating the Effectiveness of Cross-Disciplinary Simulation-Based Training on Emergency Care Outcomes in a Tertiary Hospital Setting

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Abstract

Background: Effective teamwork and communication are critical in emergency care, where rapid decision-making impacts patient outcomes. Cross-disciplinary simulation-based training offers a safe environment to improve technical and non-technical skills among healthcare professionals.

Objective: This study evaluates the effectiveness of cross-disciplinary simulation-based training on team performance and patient outcomes in a tertiary hospital.

Methods: A prospective study was conducted with 150 participants from various healthcare disciplines. Training included high-fidelity simulations of emergency scenarios, with pre- and post-training assessments using the TEAM tool, knowledge tests, and hospital performance data. Qualitative feedback was collected through focus groups and thematic analysis.

Results: TEAM scores improved significantly post-training ($p < 0.001$), with sustained improvement at three months. Knowledge and skills scores increased ($p < 0.001$), though a slight decline was noted at follow-up. Patient outcomes, including time to intervention, error rates, and protocol adherence, showed significant improvements. Qualitative findings highlighted enhanced communication, confidence, and collaboration.

Conclusion: Cross-disciplinary simulation-based training effectively enhances teamwork, clinical skills, and patient outcomes. Sustained benefits suggest its potential as a vital component of professional development in tertiary hospitals.

Keywords: Simulation-Based Training, Cross-Disciplinary, Teamwork, Emergency Care, Patient Outcomes, Healthcare Education, Tertiary Hospital

Introduction

Effective teamwork and communication are vital in emergency care settings, where timely decision-making and coordinated actions can significantly influence patient outcomes (Cheng et al., 2012).

However, traditional training methods often fall short in preparing healthcare professionals for the complexities and high-pressure scenarios encountered during critical patient care. To address this gap, cross-disciplinary simulation-based training has emerged as an innovative educational approach, providing realistic and immersive learning experiences that enhance both technical and non-technical skills among multidisciplinary teams (McGaghie and Harris, 2018).

Simulation-based training allows healthcare professionals to practice clinical and decision-making skills in a safe, controlled environment, reducing the risk to patients while fostering essential competencies (Gaba, 2004). Research has shown that such training improves clinical competence and promotes teamwork, leadership, and communication. For instance, studies have demonstrated that multidisciplinary simulation training leads to measurable improvements in teamwork efficiency and patient safety outcomes in acute care settings (Shapiro et al., 2004; Salas et al., 2008).

Additionally, simulation-based team training has been linked to improved attitudes toward collaboration and communication among healthcare professionals, particularly in high-stakes environments such as emergency medicine and critical care (Weaver et al., 2010). Despite its demonstrated benefits, the long-term impact of simulation training on real-world clinical outcomes and team dynamics remains underexplored. Understanding how these interventions influence patient safety and operational performance over time is essential to optimize their application in healthcare systems (Rosen et al., 2012).

This study aims to evaluate the effectiveness of cross-disciplinary simulation-based training on emergency care outcomes in a tertiary hospital setting. By examining its impact on team performance, communication, and patient outcomes, this research seeks to provide evidence for the value of simulation-based training as a critical component of healthcare education.

Literature Review

Simulation-based training has gained recognition as a transformative approach in healthcare education, particularly in emergency care, where teamwork and rapid decision-making are critical. This section reviews the existing literature on the efficacy of simulation-based training, focusing on its impact on technical and non-technical skills, teamwork, communication, and patient outcomes.

1. Enhancing Technical Skills through Simulation-Based Training

Simulation-based training has proven to be a powerful tool for improving technical skills in healthcare professionals. Gaba (2004) emphasized that simulation provides a safe environment where learners can practice procedures and clinical decision-making without endangering patients. Studies by Alinier et al. (2006) demonstrated that simulation training improves clinical skills in nursing students, preparing them for real-world scenarios. Furthermore, advanced simulation techniques have been shown to enhance procedural skills, such as intubation, catheterization, and emergency airway management, in multidisciplinary teams (Shapiro et al., 2004).

2. Non-Technical Skills: Communication, Teamwork, and Leadership

Non-technical skills, such as communication, teamwork, and leadership, are crucial in emergency care. Simulation-based training has been instrumental in fostering these skills. Rosen et al. (2012) noted that simulation scenarios enhance communication and collaboration, especially in high-stress environments. Salas et al. (2008) found that multidisciplinary team training significantly improves team dynamics and situational awareness, which are essential for patient safety. Additionally, simulation-based training has been shown to cultivate leadership skills by placing individuals in roles that require coordination and decision-making under pressure (Weaver et al., 2010).

3. Improving Patient Safety Outcomes

Simulation training's ultimate goal is to enhance patient safety. Numerous studies highlight its role in reducing medical errors and improving clinical outcomes. A systematic review by McGaghie and Harris (2018) concluded that simulation-based training enhances patient outcomes by reducing complications and fostering adherence to clinical protocols. Similarly, Shapiro et al. (2004) reported that simulation training for emergency department staff leads to significant reductions in response times during critical incidents, thereby improving patient survival rates.

4. The Role of Cross-Disciplinary Training

Cross-disciplinary simulation-based training is particularly effective in emergency care settings, where interprofessional collaboration is essential. Cheng et al. (2012) observed that multidisciplinary simulation exercises improve mutual understanding and trust among team members, leading to better coordination during emergencies. This approach aligns with findings by Salas et al. (2008), who highlighted the importance of team cohesion in achieving optimal patient outcomes. Moreover, interdisciplinary training bridges the gap between professions, fostering a unified approach to patient care.

5. Gaps in Research and Future Directions

While the benefits of simulation-based training are well-documented, gaps remain in understanding its long-term impact on clinical practice. Rosen et al. (2012) pointed out the need for longitudinal studies to evaluate whether the skills learned during simulation are consistently applied in real-world settings. Additionally, the scalability of simulation training and its integration into routine hospital education programs require further exploration.

The literature underscores the value of simulation-based training in improving technical and non-technical skills, fostering teamwork, and enhancing patient outcomes. While existing studies demonstrate its efficacy, further research is needed to address gaps in long-term application and scalability. This review provides a foundation for the current study, which evaluates the effectiveness of cross-disciplinary simulation-based training in emergency care settings.

Methodology

Study Design

This study employed a prospective, observational design to evaluate the effectiveness of cross-disciplinary simulation-based training on emergency care outcomes in a tertiary hospital. The study was conducted over six months in the emergency department (ED) and involved healthcare professionals from various specialties, including physicians, nurses, paramedics, pharmacists, and respiratory therapists.

Study Setting and Participants

The study was conducted at a tertiary care hospital with a fully equipped simulation training center. A total of 150 participants from different disciplines were enrolled, including 50 physicians, 40 nurses, 30 paramedics, 20 respiratory therapists, and 10 pharmacists. Participants were selected using convenience sampling, and eligibility criteria included:

- Employment at the hospital during the study period.
- A minimum of one year of professional experience.
- Consent to participate in both training sessions and subsequent evaluations.

Intervention: Simulation-Based Training

The intervention consisted of a structured simulation-based training program designed to mimic high-acuity emergency scenarios. Training was conducted over four weeks, with each participant completing three simulation sessions:

1. **Scenario 1:** Cardiac arrest management.
2. **Scenario 2:** Trauma team activation for a multi-injury patient.
3. **Scenario 3:** Sepsis management in a deteriorating patient.

Each session was facilitated by trained instructors and incorporated high-fidelity simulation mannequins, audiovisual tools, and real-time feedback. Teams were composed of mixed disciplines to ensure cross-disciplinary interaction.

Data Collection

Data were collected at three time points: pre-training (baseline), immediately post-training, and three months post-training.

1. **Assessment Tools**

- **Team Performance:** Assessed using the Team Emergency Assessment Measure (TEAM), which evaluates leadership, communication, and teamwork during simulation scenarios.
- **Knowledge and Skills:** Assessed using a written test and a practical skills checklist tailored to each scenario.

- **Patient Outcomes:** Clinical outcomes, such as time to intervention, error rates, and adherence to protocols, were collected from hospital records for actual emergency cases during the study period.
2. **Participant Feedback** Qualitative feedback was collected using focus group discussions and individual interviews to explore participants' perceptions of the training's relevance and effectiveness.

Data Analysis

Quantitative data were analyzed using SPSS version 26.0. Paired t-tests and repeated measures ANOVA were used to compare pre- and post-training performance scores. Qualitative data were analyzed thematically using NVivo software to identify key themes related to participants' experiences and perceived benefits.

Ethical Considerations

The study was approved by the hospital's ethics committee. All participants provided written informed consent before enrollment. Confidentiality was maintained by anonymizing all data.

Outcome Measures

The primary outcome measures included:

- Improvement in team performance scores (TEAM scores).
- Increase in knowledge and skills assessment scores.
- Reduction in medical error rates and time to intervention in actual emergency cases.

The secondary outcomes included participant satisfaction and perceived confidence in handling emergency scenarios.

Findings

Quantitative Findings

The quantitative data were analyzed to assess improvements in team performance, knowledge, skills, and patient outcomes.

Table 1: Improvement in TEAM Scores (Mean ± SD)

Time Point	Leadership	Communication	Teamwork	Overall TEAM Score
Pre-training (Baseline)	2.8 ± 0.5	2.5 ± 0.6	2.7 ± 0.4	2.7 ± 0.5
Post-training	4.2 ± 0.4	4.0 ± 0.5	4.1 ± 0.3	4.1 ± 0.4
3 Months Post-training	4.0 ± 0.3	3.9 ± 0.4	3.8 ± 0.4	3.9 ± 0.3

Results: TEAM scores showed a significant improvement immediately after training ($p < 0.001$) across all domains, with sustained improvements at the three-month follow-up compared to baseline ($p < 0.01$).

Table 2: Knowledge and Skills Scores (Mean \pm SD)

Time Point	Written Test (Max: 100)	Skills Checklist (Max: 50)
Pre-training (Baseline)	68 \pm 10	25 \pm 8
Post-training	88 \pm 7	45 \pm 4
3 Months Post-training	83 \pm 9	40 \pm 5

Results: Knowledge and skills scores improved significantly post-training ($p < 0.001$). A slight decline was observed at three months, but scores remained significantly higher than baseline ($p < 0.01$).

Table 3: Patient Outcomes during the Study Period

Outcome Measure	Baseline (Pre-training)	Post-training Period
Time to Intervention (mins)	12 \pm 3	8 \pm 2
Medical Error Rate (%)	15.2	9.3
Protocol Adherence (%)	74.5	91.4

Results: Significant improvements were observed in patient outcomes, including reduced time to intervention ($p < 0.01$), decreased error rates ($p < 0.05$), and increased protocol adherence ($p < 0.001$).

Qualitative Findings

Thematic analysis of participant feedback identified four main themes with corresponding sub-themes. Below are the themes, sub-themes, and representative participant quotes:

Theme 1: Improved Team Dynamics

- **Sub-theme 1.1: Enhanced Communication**

- *“I felt more confident voicing my concerns during critical moments because we practiced it in simulation.”* (Nurse, Participant 12)

- **Sub-theme 1.2: Strengthened Collaboration**

- *“Working with different professions in the simulation gave me a clearer understanding of everyone’s roles and responsibilities.”* (Pharmacist, Participant 35)

Theme 2: Realistic and Safe Learning Environment

- **Sub-theme 2.1: Practical Application of Skills**

- *“The realistic scenarios allowed us to practice emergency protocols without the fear of harming a patient.”* (Respiratory Therapist, Participant 18)

- **Sub-theme 2.2: Immediate Feedback**

- *“The feedback session after each simulation was incredibly helpful in identifying areas for improvement.”* (Physician, Participant 7)

Theme 3: Increased Confidence and Competence

- **Sub-theme 3.1: Building Confidence**

- *“After the training, I felt more prepared to handle real emergencies with a clear plan in mind.”* (Paramedic, Participant 22)

- **Sub-theme 3.2: Perceived Skill Improvement**

- *“The hands-on practice made me more adept at critical procedures like intubation and managing sepsis cases.”* (Nurse, Participant 9)

Theme 4: Sustainability and Integration of Training

- **Sub-theme 4.1: Sustaining Knowledge Over Time**

- *“I found that the skills stuck with me even months after the training, especially the communication strategies.”* (Physician, Participant 10)

- **Sub-theme 4.2: Need for Continued Training**

- *“I think this type of training should be ongoing, as it helps us stay sharp and work better as a team.”* (Pharmacist, Participant 33)

Discussion

The findings of this study demonstrate the significant impact of cross-disciplinary simulation-based training on improving both team performance and patient outcomes in a tertiary hospital setting. These results align with existing literature and provide new insights into the sustained benefits of simulation-based education across healthcare disciplines.

Improvement in Team Performance

The marked improvement in TEAM scores post-training highlights the effectiveness of simulation in enhancing team dynamics, including leadership, communication, and collaboration. The sustained improvement at three months indicates that the skills learned were retained and applied in clinical practice. These findings are consistent with those of Rosen et al. (2012), who noted that simulation-based training strengthens teamwork by fostering trust and mutual understanding among team members. Furthermore, the improvement in communication aligns with Salas et al. (2008), who emphasized the role of simulation in breaking down hierarchical barriers and promoting open communication.

Enhanced Knowledge and Skills

Significant improvements in knowledge and skills scores reflect the ability of simulation to provide realistic and immersive learning experiences. Participants not only demonstrated enhanced technical proficiency but also reported greater confidence in their ability to handle critical situations. Similar findings by Shapiro et al. (2004) showed that simulation-based training equips healthcare professionals

with the technical and decision-making skills required to manage emergencies effectively. The slight decline in scores at three months suggests a need for periodic reinforcement training to maintain competency over time.

Impact on Patient Outcomes

The reduction in time to intervention and medical error rates, along with improved protocol adherence, underscores the clinical relevance of simulation-based training. These results are in line with McGaghie and Harris (2018), who highlighted the positive effects of simulation on adherence to clinical guidelines and reduced complications. The improvement in patient outcomes demonstrates that simulation training extends beyond the classroom, translating into tangible benefits in real-world clinical settings.

Qualitative Insights

Qualitative findings further illuminate the benefits of simulation training. Participants valued the opportunity to practice in a safe, controlled environment, allowing them to refine their skills without risking patient safety. Themes such as improved communication, increased confidence, and a better understanding of team roles resonate with previous studies that emphasize the holistic benefits of simulation training (Weaver et al., 2010). Moreover, the feedback regarding the need for ongoing training highlights the importance of integrating simulation into routine professional development programs.

Strengths and Limitations

One of the key strengths of this study is its interdisciplinary approach, involving professionals from various specialties to reflect real-world healthcare dynamics. The use of validated tools such as the TEAM assessment and skills checklists enhances the reliability of the findings. However, there are limitations to consider. The study was conducted in a single tertiary hospital, which may limit the generalizability of the results. Additionally, while the three-month follow-up provides insights into skill retention, longer-term studies are needed to evaluate the sustainability of these benefits.

Implications for Practice

The findings highlight the value of cross-disciplinary simulation-based training as a tool for improving emergency care outcomes. Hospital administrators should consider incorporating regular simulation training into continuing education programs to enhance team performance and patient safety. Furthermore, fostering a culture of interdisciplinary collaboration can help sustain the benefits observed in this study.

Future Directions

Future research should explore the long-term impact of simulation training on clinical practice, including its effects on team dynamics and patient outcomes over extended periods. Studies should also investigate the scalability of simulation programs across different hospital settings and evaluate the cost-



effectiveness of such training initiatives. Additionally, integrating virtual reality and other advanced technologies into simulation training could further enhance its educational value.

Conclusion

This study provides compelling evidence for the effectiveness of cross-disciplinary simulation-based training in improving team performance, knowledge, skills, and patient outcomes. The results emphasize the need for ongoing simulation training as an integral component of healthcare education to ensure high-quality, safe patient care.

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