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Overview Of the Initial Experience in Integrating Medical Simulation into Undergraduate Medical Curriculum in Kingdom of Saudi Arabia

Mohamed Yasser Ibrahim Daoud[1]

Department of Surgery, college of Medicine, King Faisal University, Al Ahsa, KSA[1].

Abstract— Increasing realization that traditional methods of apprenticeship style training in medicine are not acceptable has given rise to newer methods of acquiring skills and competence being integrated into the undergraduate curriculum. We study whether the simulation modules resulted in any gain of knowledge and skills, pre and post-tests were given in selected modules. The pre-test was given before starting the course. Post-tests were given 8 – 9 weeks following the course. 509 students of the first, second, third and fourth years undertook different sets of simulation modules and formed the basis of this study. Three simulation modules from the first year; eight from the second year, twelve from the third year and sixteen from the fourth year were included as example of which is the upper and lower GI endoscopy, sigmoidoscopy, basics of laparoscopy and management of shock using the SIM MAN 4G were assessed by pre and post tests as students had not been exposed to laparoscopic surgery, emergency room posting and gastroenterology before entering the 6th year. It has been concluded that the students benefitted by the Simulation Modules. Though they had not been exposed to live procedures on patients before the simulation sessions in the first and second years, there was a significant improvement in their knowledge levels as evidenced by significantly higher post-test scores in all the three modules tested. We found that the simulation sessions were very popular with the students with nearly 90% being satisfied with the training.

Keywords: Medical Simulation, undergraduate, Laparoscopy, Shock

Introduction:

The evolution of medical education has necessitated innovative approaches to enhance learner outcomes and preparedness for real-world clinical practice[1]. With a growing emphasis on experiential learning, medical simulation has emerged as a pivotal component of undergraduate medical curricula, allowing students to engage with complex clinical scenarios in a controlled environment. Taking a cue from the aviation industry, increasing use of virtual reality based on computer-based simulation is being made use of in medical schools all over the world. This pedagogical shift recognizes the limitations of traditional didactic methods, which often fail to adequately bridge the gap between theoretical knowledge and practical application. By incorporating high-fidelity simulations that replicate authentic medical settings, this integration fosters critical thinking, teamwork, and proficiency in procedural skills, ultimately promoting patient safety and care quality. The systematic incorporation of simulation-based training not only cultivates essential clinical competencies but also addresses the diverse learning styles of students, thus preparing them for the challenges of contemporary healthcare systems[2-5].

Medical Simulation enhances the understanding and retention of complex medical concepts, as learners can apply theoretical knowledge to realistic situations. Moreover, it not only fosters technical proficiency but also cultivates essential soft skills, such as communication and teamwork, critical to effective patient care. In their endeavor to integrate disability awareness within curricula, educators have recognized the importance of modeling inclusive practices through innovative pedagogies like simulation[6-9]. As such, establishing a robust framework for incorporating medical simulation into undergraduate medical programs holds significant potential to improve educational outcomes and prepare competent, empathetic physicians for the future [10,11].

The current study aimed to report the importance and effect of Medical Simulation in improving the students' knowledge and practice levels in different modules.

Materials& Methods:

The MBBS Course at the College of Medicine is of six years duration, during which clinical training is imparted in the 4th, 5th and 6th years.

The following table shows the distribution of Simulation Modules that have been integrated into the 4th, 5thand 6thyear teaching:

4th Year (Surgery I)	5th Year (Surgical Specialities)	6th Year (Surgery II)
Peripheral IV cannulation Nasogastric tube insertion Urinary Catheterization	Airway Maintenance Chest tube; DPL; Central Vein access Glaucoma & Retinoscopy Urological Endoscopy	Upper GI endoscopy Flexible Sigmoidoscopy Laparosocpy Management of Shock Revisit of life saving procedures Wound management and suturing

The learning objectives, course structure and assessment methods were determined after discussions in the Department

Teaching in each module consists of short power point or video presentation followed by the demonstration of the technique. The batch is then divided into small groups of five to six that practice the procedure under supervision. At the end of the week, practice sessions are scheduled where students practice procedures.

Assessment consists of OSATS at the end of the term, the marks of which are considered in the final assessment.

A pretest is given before starting of the course. A posttest is taken by the students 8 – 10 weeks after the course to assess if there has been any gain in knowledge.

A questionnaire to assess student response to the courses given is assessed at the end of each term.

Collected data

were analyzed using Statistical Packages for Software Sciences (SPSS) version 26 Armonk, New York, IBM Corporation. Descriptive statistics were presented using numbers and

graphs. For the comparison of variables, Student's T-test Chi square test was used. P-value <0.05 has been accepted as the significant level for all statistical tests.

Results:

Sixty students of the sixth year undertook the first set of simulation modules and formed the basis of this study. Three simulation modules from the sixth year; upper GI endoscopy, basics of laparoscopy and management of shock were assessed by pre and posttests as students had no previous exposure to laparoscopic surgery, emergency room posting and gastroenterology before entering the 6th year. The format of the tests consisted of multiple-choice questions and covered areas that were included in the learning objectives. For example, questions for GI endoscopy covered areas such as basic principles, indications, contraindications, patient preparation, endoscopic anatomy and post procedure care. The mean pretest scores for endoscopy were 11.9 out of 30 (range: 4 – 18; S.D: 3). 66% of students answered less than 40% of questions correctly while 30% answered 60% of questions correctly. The mean post test score for endoscopy was 24 out of 30 (range: 14 – 28, S.D: 4). 70% of students answered 80% or more questions correctly while 8% of students answered between 40% and 60% questions correctly. The mean gain in scores was 12.1 (range: 2 – 20; S.D: 4.5). The mean pretest score for laparoscopy was 14 out of 30 (range: 6 – 21; S.D: 4.5). 36% of students answered less than 40% of questions correctly while 64% answered 60% or more questions correctly. The mean post test score for laparoscopy was 24.64 (range: 21 – 30; S.D: 2.03) 80% of students answered 80% or more questions correctly. The mean gain in scores was 10.64 (range: 5 – 16; S.D: 3.5) Figure I.

The feedback from the students was very encouraging with more than 76%very satisfied with the simulation training and opining that it was very helpful. 17.3% were satisfied while 3.8% and 1.9% were somewhat satisfied or not satisfied. Figure II.

Discussion:

Integrating medical simulation into undergraduate programs presents considerable challenges that require thoughtful evaluation and strategic organization. A significant challenge is the requirement for faculty training and the acceptance of simulation-based instruction, as numerous educators might be reluctant to embrace innovative teaching methods. This hesitation can obstruct innovation in teaching approaches, ultimately impeding student involvement and educational results. In addition, logistical challenges like resource distribution and scheduling conflicts can make the integration process more complex. Institutions frequently face challenges in offering access to essential simulation technologies and facilities, leading to increased disparities in educational experiences among students. Furthermore, as highlighted in recent studies, the objectives and methods of simulated training lack sufficient clarity, resulting in diverse interpretations that cause inconsistent application across various departments[12-14]. Effective integration therefore relies on cultivating a culture of cooperation and inclusivity among faculty, allowing them to adopt varied viewpoints and approaches, as underscored in research that highlights the significance of demonstrating inclusive practices in curricular modifications [14,15].

Successful incorporation of medical simulation into undergraduate medical programs depends significantly on wise resource distribution and thorough faculty education. The

effective execution of simulation-driven education requires a proactive strategy for managing human and material resources, highlighted by the importance of skilled facilitators and professional cooperation in curriculum design[16]. Additionally, recognizing institutional and societal needs guarantees that resources are utilized efficiently to improve student learning experiences. Instructors who can utilize simulation tools enhance their teaching effectiveness and greatly impact the overall educational quality. Consequently, a targeted investment in faculty development and resource allocation is crucial for optimizing the advantages of simulation in medical education, ultimately resulting in more competent healthcare practitioners[18,19].

As underpinned in different researches, it's crucial to have well-defined design principles and deliberate links to educational theory to enhance the effectiveness of simulation-based learning. [17,20].

In conclusion, the insights gathered pointed out that a well-organized strategy for incorporating medical simulation not only fosters crucial skills in medical students but also guarantees that the educational setting equip graduates for the challenges of contemporary healthcare.

The current study presented a report of integrating Medical Simulation into undergraduate medical curriculum in Kingdom of Saudi Arabia.

The overall student satisfaction in the current report was more than 76% was very satisfied with the simulation training and opining that it was very helpful. 17.3% were satisfied while 3.8% and 1.9% were somewhat satisfied or not satisfied.

Conclusion:

The incorporation of medical simulation into undergraduate medical programs signifies a major progression in medical education, enabling students to participate in realistic situations that improve their clinical skills and decision-making capabilities. Nonetheless, effectively executing these programs demands careful reflection on both teaching methods and the educational structure.

It has been determined that the students gained advantages from the Simulation Modules. Despite lacking prior exposure to live patient procedures during the simulation sessions in their first and second years, they demonstrated a notable enhancement in their knowledge, reflected by significantly elevated post-test scores across all three assessed modules. We discovered that the simulation sessions were highly favored by the students, with almost 90% expressing satisfaction with the training.

Figure legends:

Figure 1. Pre and Post test results for Laparoscopy and Endoscopy modules

Figure 2. Student feedback regarding different courses

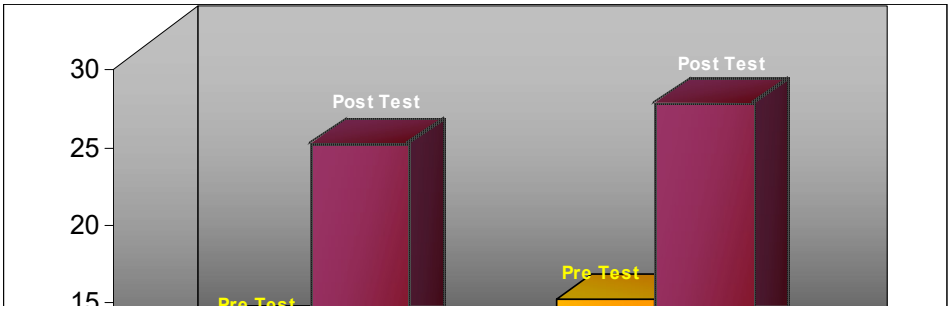

Figure 1: pre and post test results for endoscopy and laparoscopy simulation modules.

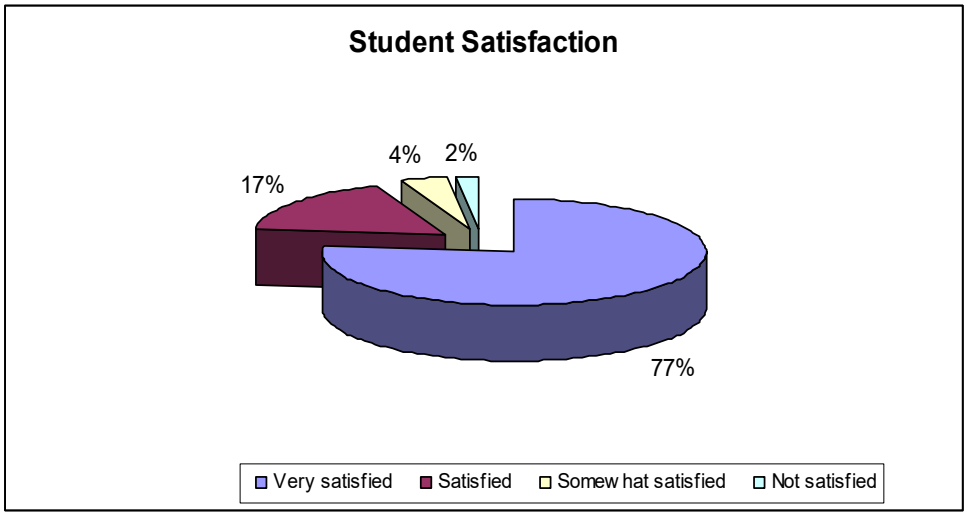

Figure 2. Overall Students feedback for all simulation modules.

Declarations:

Ethics approval and consent to participate

Research was conducted after obtaining the institutional researchers' board (IRB) of King Faisal University.

Consent for publication

We authorize the journal for publication of identifying images or other personal or clinical details of participants that compromise anonymity. (Not applicable)

Availability of data and material

All data and material are available upon request

Competing interests

The author declares that there is no compete or conflict of interests regarding the publication of this article.

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