Carolina Campus Simulation Center
Research
Research Day 2024 list of projects

• 1. Emergency Situation Response Time
• 2. Interpretation simulation
• 3. Crown-Rump length model
• 4. International Ultrasound project
• 5. Resource Guide
• 6. HCTZ-SCC
• 7. Shoulder Trainer
• 8. Wearable Breast
• 9. Ultrasound Procedure group
• 10. Forearm Fracture
• 11. Leadership Symposium
• 12. Drained Q&A
• 13. Ophthalmology trainer
• 14. Abdominal Surgery Trainer
• 15. International Health Disparities

Who builds these Projects?
• Sim Interns
• 20 Interns per class
• Not limited to interns
CREATING A LOW-COST ABDOMINAL SURGERY SIMULATOR TO INCREASE AVAILABILITY AND EXPOSURE TO SURGICAL CONCEPTS AND CAPABILITIES IN DIDACTIC MEDICAL TRAINING.


Edward Via College of Osteopathic Medicine, Simulation Center, Spartanburg, SC.

Introduction

Simulator Development

Background: Simulation learning provides hands-on, compartmentalized training, with immediate feedback in a controlled and safe setting (1,8). Interactive learning with simulators enhances retention by 45% compared to audiovisual learning (7,11).

Challenge: Cost and accessibility are hindering medical institutions’ ability to properly integrate simulation-based curriculum (6).

Rationale: Critical Component 6, Operative Anatomy, as mentioned in the ACS/APDS/ASE Residency Preparatory Curriculum can be learned most realistically using simulation throughout preclinical medical education (9).

Goal: To develop a low-cost abdominal simulator to assist medical students in better understanding abdominal anatomy and thus performing better on board-relevant gastrointestinal anatomy assessments.

Data Collection

We plan to test the efficacy of our simulator by conducting a randomized control trial on second-year medical students. One group will participate in a simulation event on March 4th, 2024, and one will use only the traditional curriculum. Both groups will complete a pre- and post-assessment. We will compare post-assessment scores between the two groups using a student’s t-test.

Simulator Procedure Development

Figure 1. Process for casting final organs
STL files of the liver, gallbladder, pancreas, stomach, kidneys, and uterus were taken from a public Abdominal CT scan on Embodi 3D. STL files were printed onto PolyLite Filament 3D Print material using a Flashforge 3D Creator Pro 2 printer (A). 3D prints were molded and cast using Reynold’s Advanced Materials (B). Colon and small intestine were cast from a custom mold (C).

Vasculature

Figure 2. Represented by Dragon Skin overlying PowerMesh
Different sizes and diameters of the vasculature that will be implemented (A).

Conclusions

• After data collection is completed, with data to reject the null hypothesis, we postulate that second-year medical students with exposure to our simulator will perform better on board-relevant gastrointestinal anatomy assessments.
• We will perform a Cost Benefit Analysis to evaluate the monetary impact of our abdominal simulator versus similar commercially available surgery simulators.
• With the rapid expansion of current technology and procedural capabilities, the integration of surgical simulation into medical curricula is necessary for the adequate training of our future surgeons.

Acknowledgements

This project was supported by Edward Via College of Osteopathic Medicine-Carolinas Campus and funded by the...
Medical education aims to serve the growing needs of patient populations. Each year, an estimated 2.4 million cases of blindness due to eye injuries occur in the United States.1 This represents a definite need for student training in management of common injuries. The future of eye care in both primary care and subspecialties is dependent on the educational foundation in medical school. Ophthalmologic exposure in the didactic years of medical school is limited, averaging at 12.5 hours.2 Additionally, less than 10% of medical schools require ophthalmology as a required clinical rotation.3 A systematic review of best practices in teaching ophthalmology to medical students called for the optimizing of learning innovations and resource effective models for interactive learning.4 Optimizing the curricula aims to increase retention and competency in management of ophthalmologic pathology without adding learning hours or increasing the studying burden on medical students.5 There is an evident training gap in the education of medical students concerning ophthalmic diagnosis and treatment management.6 Incorporating core Entrustable Professional Activities in medication education can overcome this barrier and better prepare students for residency and their future careers. This includes the ability to gather a thorough history, perform an ocular examination, and utilize common ophthalmic equipment for assessment.7 Objective: We hypothesize that students who participate in the integrated learning-simulation training session will be more confident to use eye examination equipment and better prepared to diagnose and treat ocular injuries.

A quality assurance and quality improvement retrospective analysis was conducted, employing a 3D-printed ophthalmic trainer for eye examination and treatment management (Figure 2). The integrated learning-simulation training session included a teaching session and hands-on learning. Students were taught indications, contraindications, and complications for the use of fluorescein dye with Woods lamp, management of corneal abrasions, tonometry, and foreign body removal. The pre and post test questionnaires were identical and included the following statements rated on a 5-Point Likert scale: I am confident in my ability to remove a foreign body from the eye. I am competent in utilizing a hollow bore needle for removal of a foreign object from the eye. I am confident in my ability to identify indications, contraindications, and complications of foreign body removal. I am competent in utilizing fluorescein dye with proper administration. I am competent in utilizing a wood lamp to diagnose corneal abrasion. Pre and post test quantitative evaluation was performed with 5 item multiple choice questions regarding diagnosis and management of corneal abrasion.

Methods

There was a 38% improvement in student confidence and competency in using ocular equipment to diagnose and manage ocular injuries. The post-test scores (10.12, standard deviation (SD) 3.38) showed significant improvement from the pre-test scores (10.65, SD 4.21) with \( P < 0.0001 \) (Table 1, Figure 1). The Kruskal Wallis chi-squared value was 138.53 with one degree of freedom generated a \( p \)-value < 0.0001 supporting significant change between pretest and posttest (Table 1). The TTEST procedure demonstrated a \( p \)-value <0.0001 which is less than the significance level of 0.001, we reject the null hypothesis and accept that integrated learning does improve student confidence and knowledge regarding diagnosing and managing ophthalmic injury.

There is less than a fifth of medical students learning. The ultimate goal of integrated learning for medical students is to effectively prepare students to perform these common-practice procedures. Future research should examine the benefits of this integrated learning in primary care resident training.

The authors of this poster would like to acknowledge and thank the Carolinas Campus Simulation Center for their assistance and guidance in developing this simulation. This is a quality improvement study. Literature search used various databases such as PubMed, Ovid, and Web of Science. The study was conducted in accordance with the Declaration of Helsinki. All data were de-identified and no private information was collected. The IRB protocol is pending.

Acknowledgements & References

The TTEST Procedure

<table>
<thead>
<tr>
<th>Test</th>
<th>Analyze Variable</th>
<th>Score</th>
<th>Kruskal-Wallis Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>138.53</td>
<td>1</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Post</td>
<td>20.12</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

The TTEST Procedure

Conclusion

Integrated learning-simulation training is an effective learning method to educate medical students on diagnosing and managing ophthalmic injuries. Given the prevalence of ophthalmic injury, it is vital that medical students learn to use common diagnostic tools and perform basic treatment options such as tonometry and foreign body removal. The ultimate goal of integrated learning for medical students is to effectively prepare students to perform these common-practice procedures. Future research should examine the benefits of this integrated learning in primary care resident training.

Figure 2. Left and Middle: 3D-printed ophthalmologic trainer for foreign body assessment and removal. Right: The synthetic eyeball using simulated fluorescein dye visualized under a Woods Lamp.

Results

Table 1. Top Left Analysis Variable score. Top Right: Kruskal-Wallis Test. Bottom: TTEST procedure.

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- **Results**

- **Methods**

- **Conclusion**

- **Acknowledgements & References**
Gamified Simulation of Gastrointestinal Emergency in Preclinical Medical Student Education

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Edward Via College of Osteopathic Medicine-Carolinas Campus, Spartanburg, SC.

Abstract

Gamification is an aspect of simulation which utilizes typical game aspects (eg. point scoring, competition, rules of play) into everyday or non-game like activities. Incorporating gamification into medical training is an innovative way to deliver simulated experiences and maintain student focus. There are few published simulations within the literature related to emergent gastrointestinal (GI) diagnosis and treatment for didactic medical education.1 This study aims to develop a gamified case study for small bowel obstruction to increase student knowledge and confidence in management as well as foster skills in teamwork, problem-solving, and patient management for second year medical students.

Methods

Study Design: This project will use a within subjects design to evaluate knowledge and confidence in the management of small bowel obstruction (SBO). The test will be administered to osteopathic medical students prior to didactic instruction on SBO. Prior to simulation, students will be given a 5 question assessment related to small bowel obstruction (SBO), providing them with missing information and physical exam findings at the start of the escape room. They will then develop a treatment plan which free them from the escape room. To begin the simulation, students who have completed phase I of the escape room have collected clues, with recorded bowel sounds. After determining that the patient has "tinkling" bowel sounds, the team will determine that the patient is decompensated. Utilizing physician guidance, students will systematically treat their patient, resulting in release from the escape room to debrief.

Simulation Development: To develop a gamified simulation, an escape room will be created. Students will enter a 10 minute simulation where the patient has 15 minutes to receive treatment to avoid decompensation. The patient will present with vague abdominal pain, diarrhea, and increased bowel sounds. The students will have 5 minutes to complete the treatment, which includes NG Tube, and a Foley catheter insertion. During this time, students must also answer questions to determine their missing information. Students confirm their diagnosis of partial SBO by unlatching clues to lead them to the next phase.

Results

This study is currently in progress; therefore, the results have not been finalized. After the completion of the study, the results will reveal if there is a statistically significant increase in student knowledge and confidence in the management of small bowel obstruction.

Conclusions

Although gamification research is still in its infancy, early studies have shown that it has the potential to improve knowledge, skills, and satisfaction when used to teach traditional education methodologies. This simulation is still being developed, however it is predicted that it will have a meaningful impact on student knowledge and confidence when managing emergent GI diagnoses.

Future studies will evaluate whether participation in this gamified learning experience leads to statistically significant changes in testing performance in didactic settings. We acknowledge that one aspect of this research that was not well studied is whether any improvements in knowledge and confidence are maintained across time.

Acknowledgements

The authors of this poster would like to acknowledge and thank the Edward Via College of Osteopathic Medicine Carolinas Campus Simulation Center staff for their assistance and guidance in developing this simulation.

References

1. We acknowledge that one aspect of this research that was not well studied is whether any improvements in knowledge and confidence are maintained across time.

2. Future studies will evaluate whether participation in this gamified learning experience leads to statistically significant changes in testing performance in didactic settings.

3. We acknowledge that one aspect of this research that was not well studied is whether any improvements in knowledge and confidence are maintained across time.
Problem Statement:

It is not known if, or to what extent, the number of optional training(s) attended predict knowing how to pace, perform synchronized cardioversion, and perform unsynchronized cardioversion among osteopathic medical students.

Purpose Statement:

The purpose of this quantitative comparative study is to examine if, or to what extent, the number of optional training events attended predict knowing how to pace, perform synchronized cardioversion, and perform unsynchronized cardioversion among osteopathic medical students in the Southeastern United States.

Variables:

<table>
<thead>
<tr>
<th>Variable 1</th>
<th>Optional Hands-on Training</th>
<th>Ratio</th>
<th>(0 – 4) Hands-on Training Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable 2</td>
<td>Criterion Variable: Pacing</td>
<td>Continuous, Nominal</td>
<td>Continuous when measuring the time(s) Nominal when testing the accuracy (Correct or Incorrect)</td>
</tr>
<tr>
<td>Variable 3</td>
<td>Criterion Variable: Synchronized cardioversion</td>
<td>Continuous, Nominal</td>
<td>Continuous when measuring the time(s) Nominal when testing the accuracy (Correct or Incorrect)</td>
</tr>
<tr>
<td>Variable 4</td>
<td>Criterion Variable: Unsynchronized cardioversion</td>
<td>Continuous, Nominal</td>
<td>Continuous when measuring the time(s) Nominal when testing the accuracy (Correct or Incorrect)</td>
</tr>
</tbody>
</table>

RQ1: Does the number of optional trainings attended predict knowing how to pace (time to first action, time to completion, doing so correctly)?

RQ2: Does the number of optional trainings attended predict knowing how to perform synchronized cardioversion (time to first action, time to completion, doing so correctly)?

RQ3: Does the number of optional trainings attended predict knowing how to perform unsynchronized cardioversion (time to first action, time to completion, doing so correctly)?

Methodology & Justification:

The quantitative method will be used to examine an identifiable problem confirmed through research. Quantitative research produces objective data that can be clearly communicated through statistics and numbers (Dey, 2003). In studying the effectiveness of hands-on and virtual simulation quantitative method is utilized to investigate a group of osteopathic medical students during cardiopulmonary training. The data will be collected through a ratio of the number of trainings attended as well as continuous variables utilizing video to determine time to first action and time to completion, as well as Nominal data collecting accuracy data.

Design & Justification:

Design: Predictive correlational studies predict the variance of one or more variables based on the variance of another variable(s).

The purpose of this quantitative correlational-predictive design study is to examine if or to what extent a relationship exists between osteopathic medical student efficacy of various osteopathic medicine skills utilizing virtual and hands-on simulations of a College of Osteopathic Medicine medical students in the Southeast United States.
Thank You!