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Fabrication and Validation of a Cost-Effective Upper Endoscopy Simulator

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Categories: General Surgery
Keywords: upper endoscopies, fes, mechanical simulator

How to cite this poster
Jelinek L, Chen A, Deere M, et al. (2018) Fabrication and Validation of a Cost-Effective Upper Endoscopy Simulator. Cureus 10(10): e.

Abstract

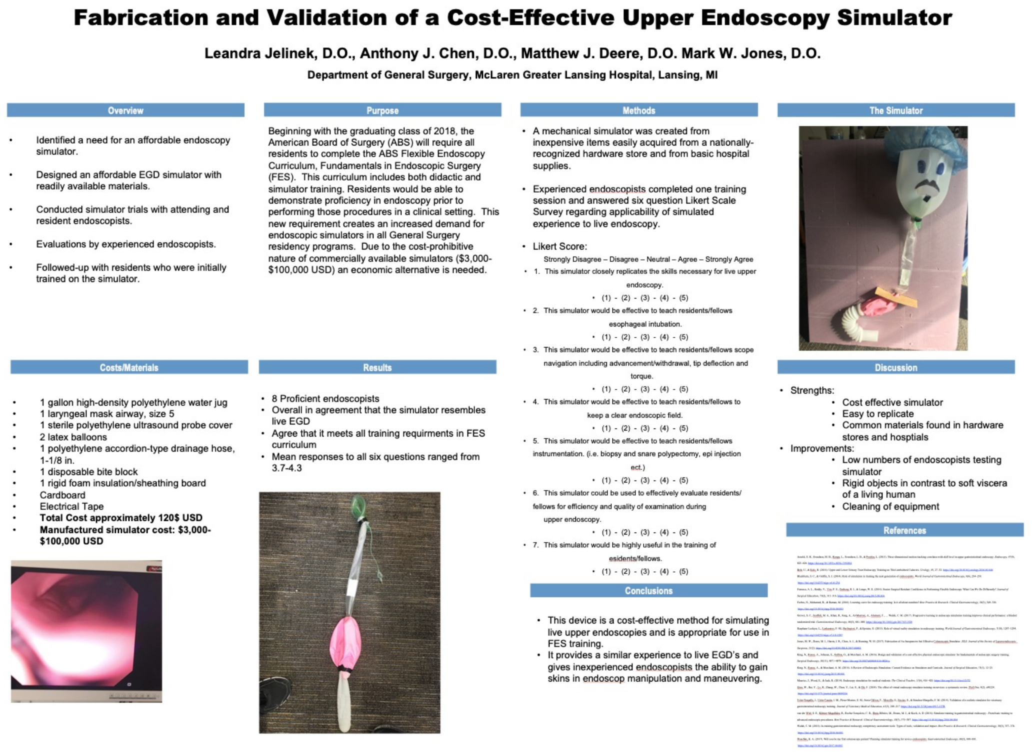
Beginning with the graduating class of 2018, the American Board of Surgery (ABS) will require that residents complete the ABS Flexible Endoscopy Curriculum, Fundamentals in Endoscopic Surgery (FES). This curriculum includes both didactic and simulator training. Ideally, residents would become proficient in simulated endoscopy prior to performing endoscopic procedures in a clinical setting. This new requirement creates a need for endoscopic simulators in all American General Surgery residency programs. Virtual reality simulators can be cost-prohibitive, ranging in cost from $50,000 - $100,000+ USD. An economic alternative is needed for surgical residencies.

A mechanical simulator was created from inexpensive items easily acquired at hardware stores and from hospital stores. The total cost of the simulator was approximately $120 USD. Validation of the simulator was accomplished by having experienced endoscopists complete a training session with the device. These endoscopists then completed a six-question Likert scale survey (1 - strongly disagree to 5 - strongly agree) that evaluated the simulated experience versus live upper endoscopies and the device's ability to meet the goals of the FES curriculum.

8 proficient endoscopists completed the training session and survey. All agreed that the device closely replicated live colonoscopies and would meet all training requirements in the FES curriculum. Mean responses to all six survey questions ranged from 3.7-4.3.

A locally-sourced and constructed device may be a cost-effective method for simulating live upper endoscopies and is appropriate for use in FES training.

Open Access
Published 10/17/2018



Fabrication and Validation of a Cost-Effective Upper Endoscopy Simulator

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Overview

- Identified a need for an affordable endoscopy simulator.
- Designed an affordable EGD simulator with readily available materials.
- Conducted simulator trials with attending and resident endoscopists.
- Evaluations by experienced endoscopists.
- Followed-up with residents who were initially trained on the simulator.

Costs/Materials

- 1 gallon high-density polyethylene water jug
- 1 laryngeal mask airway, size 5
- 1 sterile polyethylene ultrasound probe cover
- 2 latex balloons
- 1 polyethylene accordion-type drainage hose, 1-1/8 in.
- 1 disposable bite block
- 1 rigid foam insulation/sheathing board
- Cardboard
- Electrical Tape
- **Total Cost approximately 120$ USD**
- **Manufactured simulator cost: $3,000-$100,000 USD**

Purpose

Beginning with the graduating class of 2018, the American Board of Surgery (ABS) will require all residents to complete the ABS Flexible Endoscopy Curriculum, Fundamentals in Endoscopic Surgery (FES). This curriculum includes both didactic and simulator training. Residents would be able to demonstrate proficiency in endoscopy prior to performing those procedures in a clinical setting. This new requirement creates an increased demand for endoscopic simulators in all General Surgery residency programs. Due to the cost-prohibitive nature of commercially available simulators ($3,000-$100,000 USD) an economic alternative is needed.

Results

- 8 Proficient endoscopists
- Overall in agreement that the simulator resembles live EGD
- Agree that it meets all training requirments in FES curriculum
- Mean responses to all six questions ranged from 3.7-4.3

Methods

- A mechanical simulator was created from inexpensive items easily acquired from a nationally-recognized hardware store and from basic hospital supplies.
- Experienced endoscopists completed one training session and answered six question Likert Scale Survey regarding applicability of simulated experience to live endoscopy.
- Likert Score:

Strongly Disagree – Disagree – Neutral – Agree – Strongly Agree

- 1. This simulator closely replicates the skills necessary for live upper endoscopy.
  - (1) - (2) - (3) - (4) - (5)
- 2. This simulator would be effective to teach residents/fellows esophageal intubation.
  - (1) - (2) - (3) - (4) - (5)
- 3. This simulator would be effective to teach residents/fellows scope navigation including advancement/withdrawal, tip deflection and torque.
  - (1) - (2) - (3) - (4) - (5)
- 4. This simulator would be effective to teach residents/fellows to keep a clear endoscopic field.
  - (1) - (2) - (3) - (4) - (5)
- 5. This simulator would be effective to teach residents/fellows instrumentation. (i.e. biopsy and snare polypectomy, epi injection ect.)
  - (1) - (2) - (3) - (4) - (5)
- 6. This simulator could be used to effectively evaluate residents/ fellows for efficiency and quality of examination during upper endoscopy.
  - (1) - (2) - (3) - (4) - (5)
- 7. This simulator would be highly useful in the training of esidents/fellows.
  - (1) - (2) - (3) - (4) - (5)

Conclusions

- This device is a cost-effective method for simulating live upper endoscopies and is appropriate for use in FES training.
- It provides a similar experience to live EGD's and gives inexperienced endoscopists the ability to gain skins in endoscop manipulation and maneuvering.

The Simulator

Discussion

- Strengths:
  - Cost effective simulator
  - Easy to replicate
  - Common materials found in hardware stores and hosptials
- Improvements:
  - Low numbers of endoscopists testing simulator
  - Rigid objects in contrast to soft viscera of a living human
  - Cleaning of equipment

References

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