GlobalSurgBox: A Portable Surgical Simulator for Surgical Trainees Worldwide

Michael J. Kirsch[1], Courtney Mangham[2], Yihan Lin[3]

1. Department of Surgery, University of Colorado Anschutz Medical Campus
2. University of Colorado School of Medicine, Aurora, Colorado.
3. Division of Cardiothoracic Surgery, Department of Surgery, Stanford Medicine

Purpose

Simulator training is increasingly recognized as a critical component to surgical education. However, successful implementation of these platforms is often limited by affordability, portability, and accessibility. The goal of this study was to evaluate whether a novel, portable surgical simulator would be of value to surgical trainees. Additionally, we aimed to assess whether this simulator would be of value to surgical trainees in multiple countries across the income spectrum.

Methods

The GlobalSurgBox was designed as a compact, portable, and modular surgical trainer. This trainer was designed to be adaptable for trainees of all skills levels, as well as locally adaptable and replenishable in countries across the income spectrum. Between March and November 2021, medical students and general surgery residents from three academic medical centers in three countries (USA - high income, Kenya - middle income, and Rwanda - low income) were instructed on how to perform basic surgical technical skills using the GlobalSurgBox. Participants were sent an anonymized survey evaluating the practicality and helpfulness of the trainer.

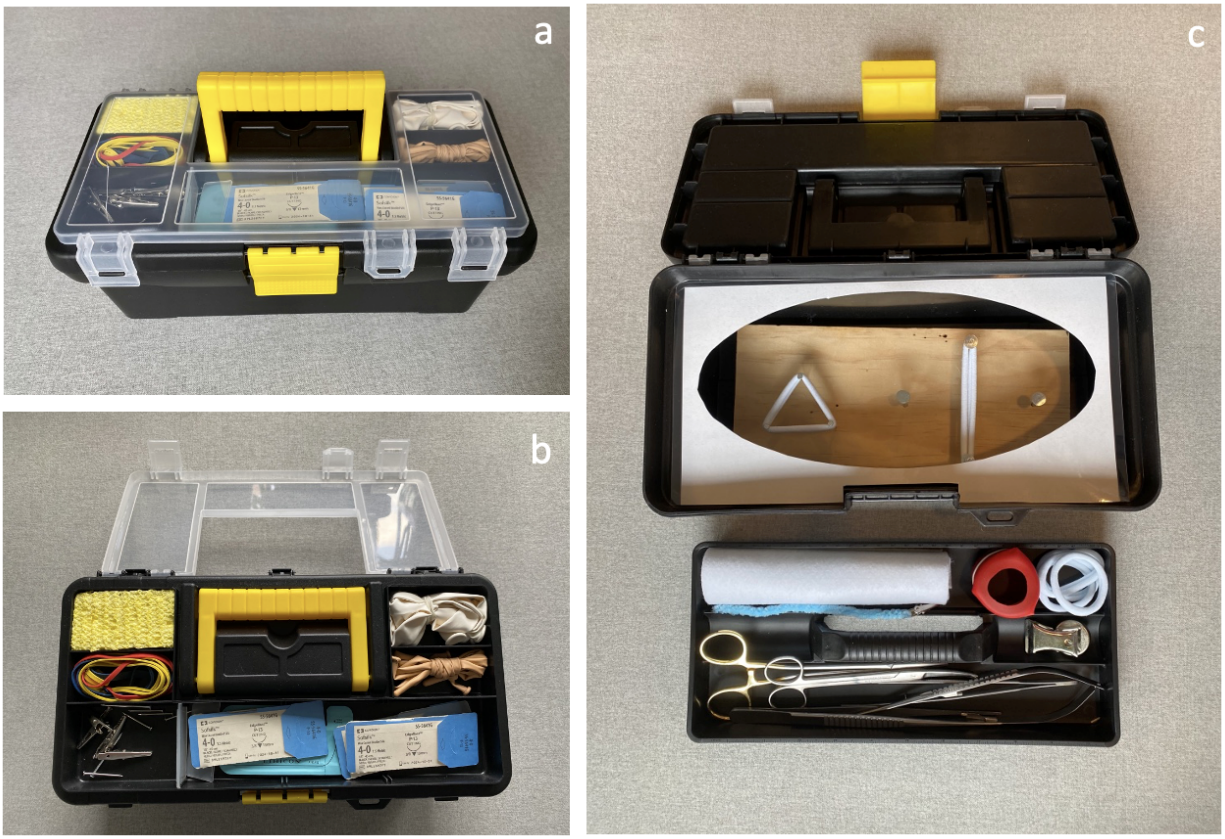
Results

A total of 69 participants used the GlobalSurgBox and responded to the survey (100% response rate). This included 30 from the USA, 26 from Kenya, and 13 from Rwanda. All respondents agreed that surgical simulation was an important aspect of surgical education. Despite varying levels of access to simulation resources, only 1 of 30 (3.3%) USA trainees, 13 of 26 (50%) of Kenyan trainees, and 10 of 13 (77%) Rwandan trainees stated they used these resources routinely. 29 (96.7%) of USA trainees, 13 (50.0%) of Kenyan trainees, and 9 (69.2%) of Rwandan trainees stated that there were barriers to using simulation resources. The most commonly cited barriers to using these simulators included lack of convenient access and lack of time. After using the GlobalSurgBox, only 3 of 30 (10.0%) residents reported lack of convenient access as a continued barrier to using the trainer. 26 (86.7%) of US trainees, 25 (96.2%) of Kenyan trainees, and 12 (92.3%) of Rwandan trainees stated that the GlobalSurgBox was a good facsimile of the operating room. 30 (100%) US trainees, 25 (96.2%) Kenyan trainees, and 9 (69.2%) Rwandan trainees stated that the GlobalSurgBox better prepared them for clinical settings.

Conclusion

A majority of residents across all three countries reported multiple barriers to surgical simulation in their current surgical training. The GlobalSurgBox eliminated many of

these stated barriers by providing a portable, affordable, and realistic way to practice skills needed in the operating
room.



1A: Comprehensive surgical trainer that fits in a toolbox. 1B: The lid holds necessary materials for building modules. 1C: A removable tray holds surgical instruments and a wooden board serves as the foundation for individual modules.

Fig 1.png

3A: Suturing Module - Nails are positioned in the wooden board in linear/triangular shapes. Hair ties are wrapped around the nails to simulate tissue. This allows for practice of forehand, backhand, and mattress suturing. These drills can be practiced with a full length suture to learn suture spacing, or a needle with only a small suture tail to hone needle angles and forceps agility.

3B: End-to-side coronary/vascular anastomosis module - A balloon is nailed to the wooden board to simulate the target vessel, while a second balloon suspended by pipe cleaners and an alligator clip serves as the graft. Using a prolene suture, the anastomosis is started. The alligator clip can be tilted downward to simulate "parachuting" of the graft to the target vessel.

Han JJ, Patrick WL. See one—practice—do one—practice—teach one—practice: The importance of practicing outside of the operating room in surgical training. J Thorac Cardiovasc Surg. 2019;157(2):671-677. doi:10.1016/j.jtcvs.2018.07.108