

The Economics of Surgical Simulation



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KEYWORDS

- Surgical simulation • Economics • Surgical education • Residency training costs
- Cost analysis

KEY POINTS

- There are massive hidden costs in the current paradigm of surgical training related to increased operative times for procedures with resident involvement and costs of medical errors.
- Shifting training outside of the operating room through simulation can potentially improve patient safety, minimize learning time to achieve competency, and increase operative efficiency.
- Investment in surgical simulation has the potential to reduce costs to health care systems through improved operating room efficiency and reduction of medical errors.

INTRODUCTION

The traditional method of training surgeons has been threatened by 3 coincident challenges—an increased interest in patient safety in the operating room (OR), a compressed surgical training experience owing to duty-hour regulations, and increasing costs of operative care with decreased reimbursement. As surgical educators, each of these “problems” can be viewed as potential opportunities to improve the method by which we train future surgeons by shifting the learning outside of the OR environment into more effective learning environments that improve patient safety, minimize learning time required to obtain competency, and increase operative efficiency. This article explores each of these “problems” and the potential opportunity that each provides for simulation training from an economic perspective. What are the hidden costs

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of surgical training? How do we pay for surgical simulation? What will it cost... or will it actually save our system money?

CURRENT CONTEXT AND RESPONSIBILITY AS SURGICAL EDUCATORS

As surgical educators, we have a duty to teach to competence. This duty is not only to our trainees, but also to society. Our trainees enter residency without any surgical training and leave with both the ability and permission to operate independently.

Richard Bell eloquently outlined some of the modern challenges in surgical education in his well-known article, "Why Johnny cannot operate."¹ He argued that operative skills are acquired and are not innate, and that the current level of experience in operative training is insufficient to achieve competence, let alone proficiency or mastery. He demonstrated that the mean number of procedures performed by graduating general surgical residents was 1022 in 2005. One of the most compelling arguments is made from a bar graph sequentially plotting procedures performed in training with decreasing frequency, beginning with the most commonly performed procedure, laparoscopic cholecystectomy, on the far left, and then in descending order of frequency to the right. Although the average graduate performs more than 300 types of procedures during training, it is evident from this graph that most graduates perform only 18 procedures more than 10 times.¹

Such calculations have not been made in otolaryngology training, but are likely similar. In otolaryngology—head and neck surgery, we have enjoyed a broadening of our specialty over the past 30 years. This expansion has come at a time when technological advances have allowed for more types of surgical procedures within each domain. Our particular challenge in training to competency in otolaryngology is the diversity of surgical procedures, constrained training time owing to duty-hour requirements, and increased emphasis on supervision and operative efficiency. Together, these factors reduce resident autonomy and limit exposure to core surgical procedures. Countermeasures for consideration include extending the duration of surgical training or shifting surgical teaching outside of the operating theater.

THE COST OF TEACHING IN THE OPERATING ROOM

What is the economic cost of training a surgeon? The modest salary and benefits package is only a small component of the true cost to the training institution. It is probable that we, as surgical educators, significantly underestimate the true costs. Calhoun and colleagues² addressed this question by sending cost analysis templates to program directors of 6 thoracic surgery residency programs. Based on the templates, the average annual estimated cost for training was \$250,000 per resident. However, when formal accounting evaluations were performed, the annual calculated cost increased to \$483,000 per resident, with a range from \$330,000 to \$667,000.

These cost estimates for residency training do not fully account for the increased cost of OR time related to the involvement of a resident surgeon in a procedure. It has been argued that the increased time required to train surgeons does not increase the cost for the hospital directly, but rather is primarily a "cost" to the attending surgeon, as missed opportunity cost for performing more operative procedures during the same amount of time.³ However, several studies have demonstrated significant added costs related to surgical trainee involvement.

In plastic surgery, the cost of intraoperative education was estimated by Sasor and colleagues⁴ in 2013. They reviewed a single surgeon's experience for cleft lip and cleft palate repair to assess operative time for cases performed with or without a plastic surgery resident or craniofacial fellow. Cases with resident involvement (>85% of

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