THE ROLE OF SIMULATION THE FUTURE

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WHY DO WE SIMULATE?

*Primum non nocere* - “First, do no harm”

Hippocrates (460-370 BC)
Makary MA, Daniels M. Medical error — the third leading cause of death in the US. BMJ 2016.
PLANE CRASHES PER YEAR

Source: Bureau of Aircraft Accidents Archives
THE PRE-TRAINED NOVICE

- Technical skills
  - Simulation-based training
  - Clinical training

- Training time
PUBLICATIONS PER YEAR
“SURGICAL SIMULATION”
THE FOCUS OF SURGICAL SIMULATION OVER THE LAST 20 YEARS

Does surgical simulation work?

How should we structure simulation-based training?

What should we practice?

Who should practice?

Developing and improving simulators

Novices

Experienced surgeons?
SKILLS DEVELOPMENT

Technical skills development

- 1. Cognitive
- 2. Associative
- 3. Autonomous

Mastery
Proficiency
Competency

Training time
THE CURRENT SITUATION

Novices

Simulation

Experienced Surgeons
WHO SHOULD SIMULATE?

“Novices (none independently operating surgeons) and surgeons having performed fewer than 75 independent cataract surgeries showed significant improvements in the OR (32% and 38%, respectively after virtual reality training (P < 0.008 and P < 0.018). More experienced cataract surgeons did not benefit from simulator training.

Harden et al (1984) criticised “apprenticeship model: “the teaching itself is largely opportunistic and in medicine it is based on unpredicted clinical situations as they arise.

We have the opposite problem with technical surgical simulation today

- Standardized
- Lacks variation
- Simplistic
BASIC SKILLS VS. TRAINING

- Training of isolated skills or tasks
  - Examples of tasks
    - Clip applying
    - Sharp Dissection
    - Instrument coordination

PROCEDURAL TRAINING

- Practicing target procedures
  - Examples of tasks
    - Cholecystectomy
    - Appendectomy
    - Salpingectomy

WHAT’S THE NEXT STEP FOR SURGICAL SIMULATION?

- Clinical performance
- Simulator training
  - Part-task training (enabling skills on simulators)
  - Simplified whole-task training (procedures, but in isolation)
  - Team training with whole task training
  - Team training with complications and anatomical variations

We are here now

Still the most used
SURGICAL TEAM TRAINING
PATIENT-SPECIFIC SIMULATION


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| 1                 | How should a simulator curriculum be designed and evaluated?             | 1. Curricula developed for procedural skills and laparoscopic operations using simulation  
2. Curricula incorporated into residency programs in multiple countries | 1. Determine which simulation delivery methods are effective in skill acquisition  
2. Identify quality indicators and outcomes to measure curriculum effectiveness |
| 2                 | What are the best methods/metrics to assess technical and nontechnical performance on simulators and in the OR? | 1. Development of simple metrics for technical skill measurement and rating scales for nontechnical skills  
2. Publication of multicenter studies and statewide registries for remote rating of surgical skill | 1. Determine the relevance of current metrics  
2. Establish whether measures differ based on the procedure or skill being measured |
| 3                 | What are the performance criteria that surgical trainees need to achieve to be competent based on their training level (on a national level)? | 1. Learning curve of 275 procedures calculated for colonoscopy  
2. Performance scoring criteria developed for gynecology | 1. Research performance criteria using consistent methodology, taking level of training into account  
2. Implement multicenter studies at a national level |
| 4                 | What is the role of simulation for the certification of residents and practicing surgeons? | 1. Research published showing that recommendations for certification not yet an accurate reflection of surgical skills  
2. Pilot research from the United States and Canada demonstrated that scores for clinical skills using simulated patients were valid | 1. Comparison of different tools to assess feasibility, reliability, and validity  
2. Investigate certification at all clinical levels (student to independent practitioner) |
CERTIFICATION AND MAINTENANCE OF SKILLS

- Currently there is not convincing evidence to support the use of simulation for high-stakes certification

- There is no evidence to support the use of simulation for maintenance (re-certification) of skills for experienced surgeons

Studies are needed!
“While the use of selection tests for incoming surgical trainees that predict future technical skill performance would be beneficial in optimizing the technical competence of graduating surgeons, surrogate markers such as non-surgical experience and visual spatial tests do not appear to be reliable predictors.
To date, no single test has been shown to reliably predict the technical performance of surgical trainees. Strategies that rely on assessing multiple innate abilities, their interaction, and their relationship with technical skill may ultimately be more likely to serve as reliable predictors of future surgical performance.
“A PubMed search using the term “surgical simulation” identified 96 articles published in 1992, 436 in 2002 (454% increase), and 1221 in 2012 (1270% increase). Despite this growth, research efforts in the field remain uncoordinated, unfocused, and often redundant” (Stefanidis 2015 Ann Surg)
**Does documented simulator competence equal clinical competence?**

**Does training on simulators transfer to improved clinical performance?**

“A plethora of studies have shown that simulation can translate to improved simulated performance and, to a lesser degree, clinical performance but the definitive link with patient outcome measures remains out of reach.”

TAKE HOME MESSAGES

- Simulation-based training improve skills, but the impact on quality of care is unsure
- More research is needed for more experienced learners
- Simulation-based training and assessment has a large unrealized potential
- Research efforts need to coordinated and focused