
Simulation in Education: Making it Work

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Presentation Overview

- Simulation in Medical Education
 - Defining fidelity
 - Simulation in Department of Anaesthesia
 - What is in the literature about simulation:
Benefits, Barriers & Critical Factors
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Apprenticeship Model

- See one, do one, teach one
 - Learning on patients
-

Apprenticeship Model

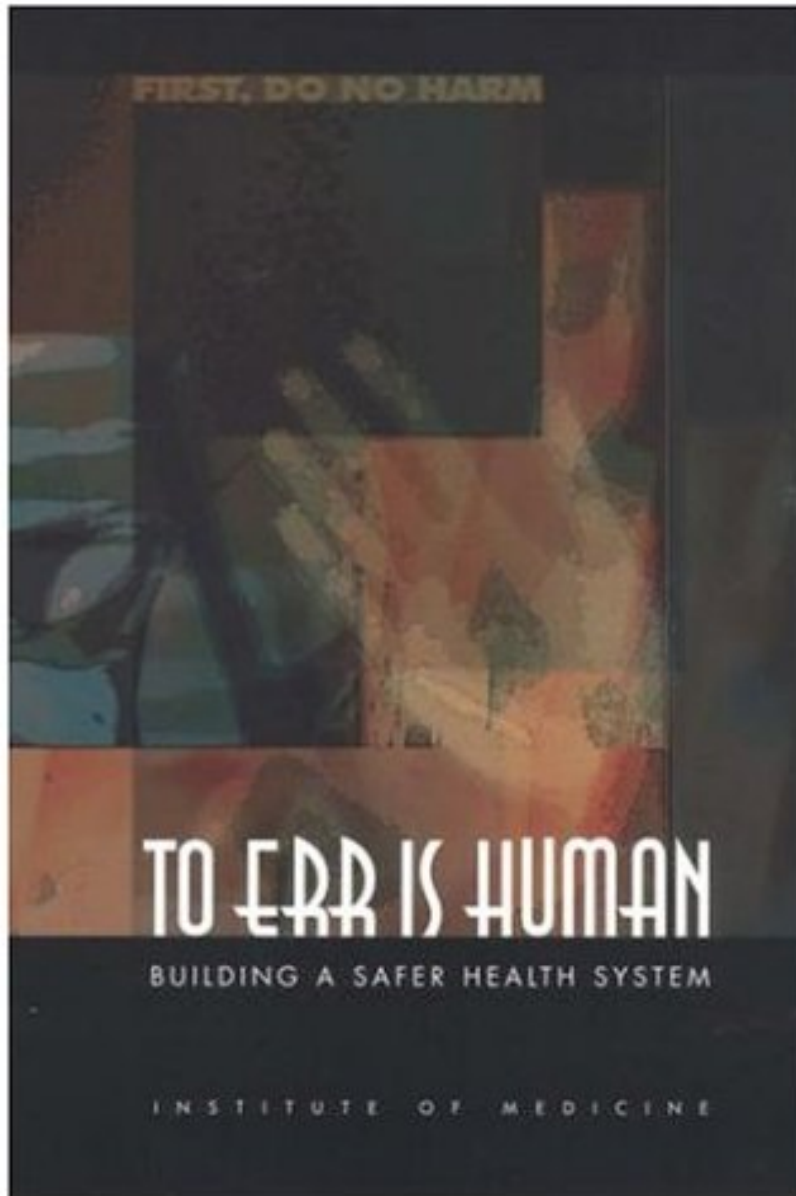
- Weaknesses of apprenticeship model
 - Training clinicians in risky procedures on real patients is less acceptable
 - Limited opportunities to experience rare events and crises
 - Apprenticeship means you have to wait for something to happen to learn
 - Training for teamwork is non-existent
 - High cost of teaching in clinical environment
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**“In order to make a good surgeon,
you need to fill a lot of cemeteries”**

anonymous



Key Driver in Simulation Worldwide
is Patient Safety



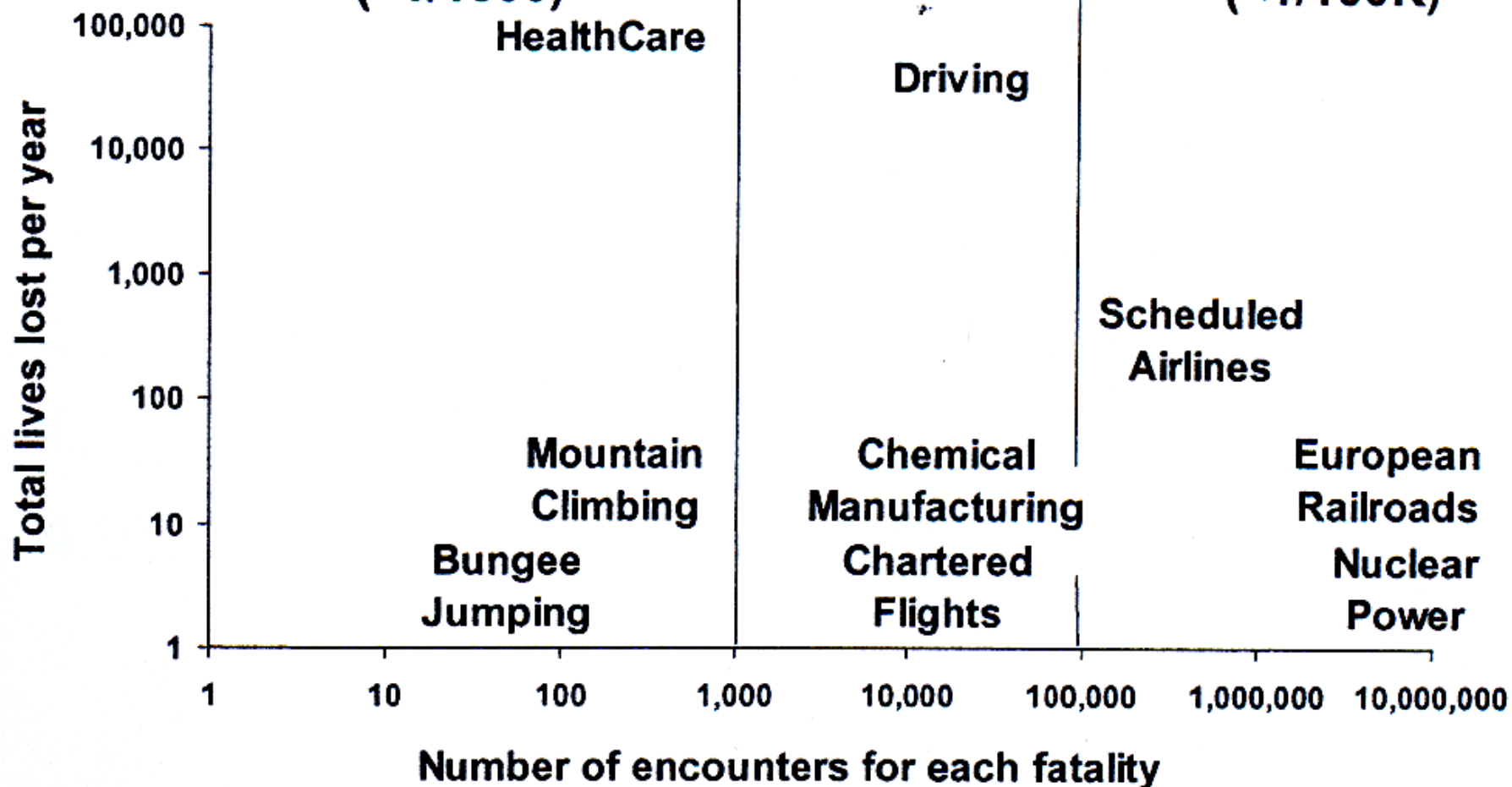
- Published by Institute of Medicine, USA in 2000
 - Medical errors cause 98,000 deaths annually
 - Recommended the use of simulators for training
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How Hazardous Is Health Care? *(Leape)*

DANGEROUS
(>1/1000)

REGULATED

ULTRA-SAFE
(<1/100K)



“DÉJÀ VU IS A GOOD THING FOR A PILOT TO FEEL
WHEN WALKING INTO A COCKPIT”

Boeing Advertisement



“...no industry in which human lives depend on skilled performance has waited for unequivocal proof of the benefits of simulation before embracing it.”

D. Gaba, Anesthesiology 1992

The Underlying Reasons for using Simulator Training

It's Experiential

- For changing behaviour, simulation is better than books and lectures
 - It is safer to practice on simulators than on patients
-

Simulation in Anaesthesia

- Historically, anaesthesia has led the way in patient safety and education
 - In 1980s, the Anesthesia Patient Safety Foundation (ASPF) became the world's first patient safety organization
 - In 1986, Stanford pioneered CASE (Comprehensive Anesthesia Simulation Environment) for team performance during critical events
 - Univ of Florida used simulators to introduce residents to anaesthesia techniques, common errors and machine failure (ACRM: Anesthesia Crisis Resource Management)
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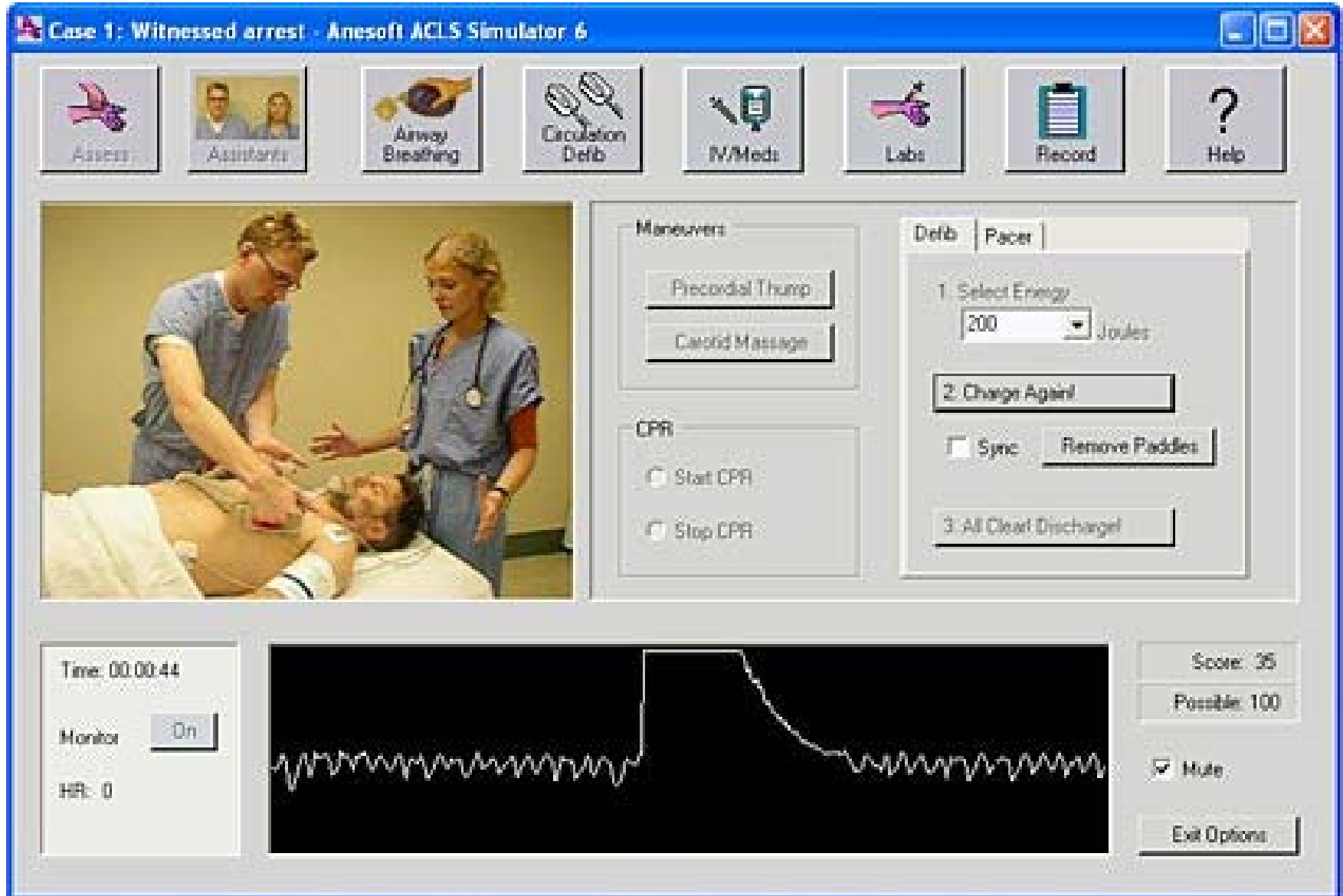
Simulation in Dept of Anaesthesia

- Low Fidelity Simulation – Screen-based Simulation
 - Intermediate Fidelity Simulation – task trainer for Intubation
 - Group teaching with Human Patient Simulator (HPS), a High Fidelity Simulation tool
 - Individual teaching with HPS
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Screen-Based Simulation

Case 1: Witnessed arrest - Anesoft ACLS Simulator 6

Assess Assistants Airway Breathing Circulation Defib IV/Meds Labs Record Help



The screenshot displays the Anesoft ACLS Simulator interface for a 'Case 1: Witnessed arrest'. The top navigation bar includes icons for Assess, Assistants, Airway Breathing, Circulation Defib, IV/Meds, Labs, Record, and Help. The main area is divided into several sections:

- Video Window:** Shows two healthcare providers in blue scrubs performing resuscitation on a patient lying on a gurney.
- Maneuvers:** A panel with buttons for 'Precordial Thump' and 'Carotid Massage'.
- CPR:** A panel with radio buttons for 'Start CPR' and 'Stop CPR'.
- Defib/Pacer:** A control panel for the defibrillator. It has tabs for 'Defib' and 'Pacer'. Under 'Defib', there are steps: '1. Select Energy' (with a dropdown menu set to '200 Joules'), '2. Charge Again!', '3. All Clear/Discharge!', and 'Remove Paddles'. There is also a 'Sync' checkbox.
- Monitor:** A large black window displaying a white ECG waveform. To its left, there is a 'Time: 00:00:44' display, a 'Monitor' button set to 'On', and 'HR: 0'.
- Score:** A panel on the right showing 'Score: 35' and 'Possible: 100'. It also has a checked 'Mute' checkbox and an 'Exit Options' button.

Gas Man

The background of the slide is a blue-tinted image of a person's face, possibly a patient, with a medical device or mask over their mouth. A vertical scale with numbers 2, 3, and 4 is visible on the right side of the image. The text is overlaid on this image.

Gas Man[®]

*Understanding
Inhalation
Anesthesia
Uptake &
Distribution*

**The unique computer tool for teaching, simulating and
experimenting with anesthesia uptake and distribution.**

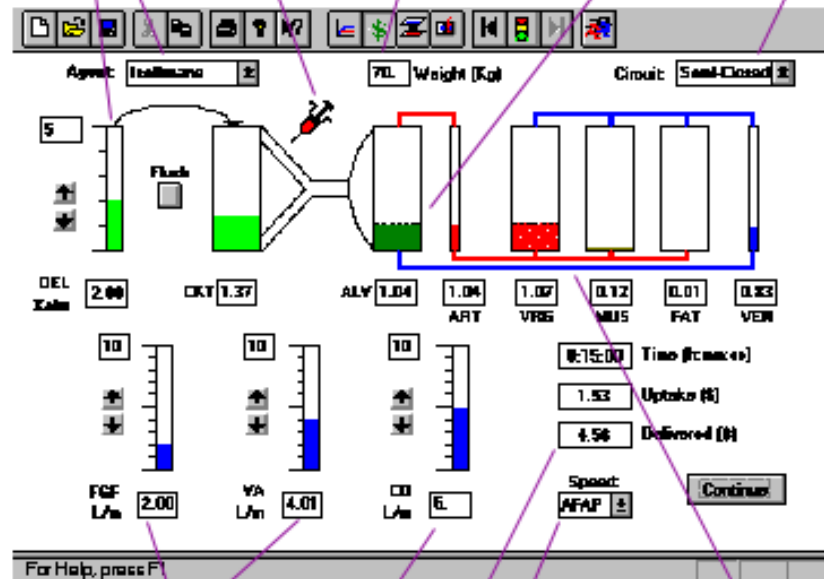
Choose which agent you wish to simulate and adjust the tension delivered (DEL) anytime during the simulation

Enter patient weight, to see the changes in effect from infants to adults. This feature also makes Gas Man applicable to veterinary practice

Choose Open, Semi-Closed, Closed or Ideal circuits

Inject liquid anesthetics

Watch the agent wash into the lungs (ALV) and arterial blood



Adjust fresh gas flow and alveolar ventilation

Change cardiac output to simulate patient disease or drug effect

Run your simulations at speeds ranging from real-time to upwards of 5000x

Go beyond agent monitoring - watch anesthetic tension in the brain and other tissues

Monitor either Cost or Volume of agent delivered, which is calculated from the price/volume values you can modify for your institution

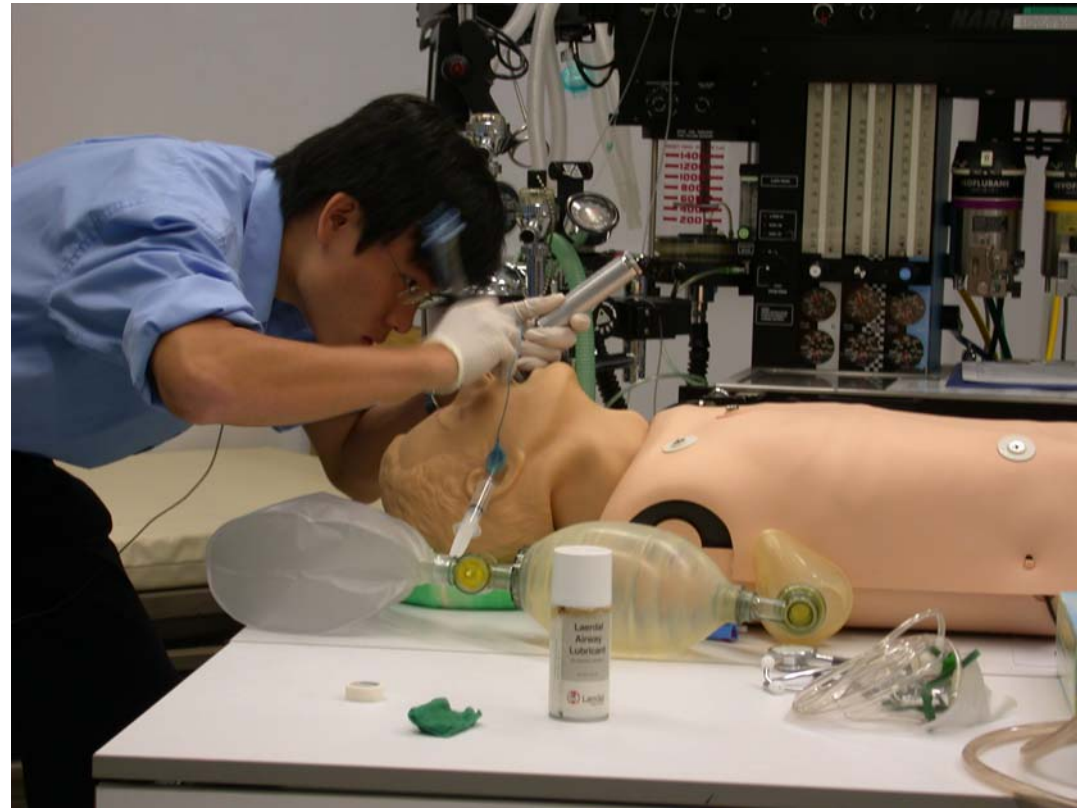
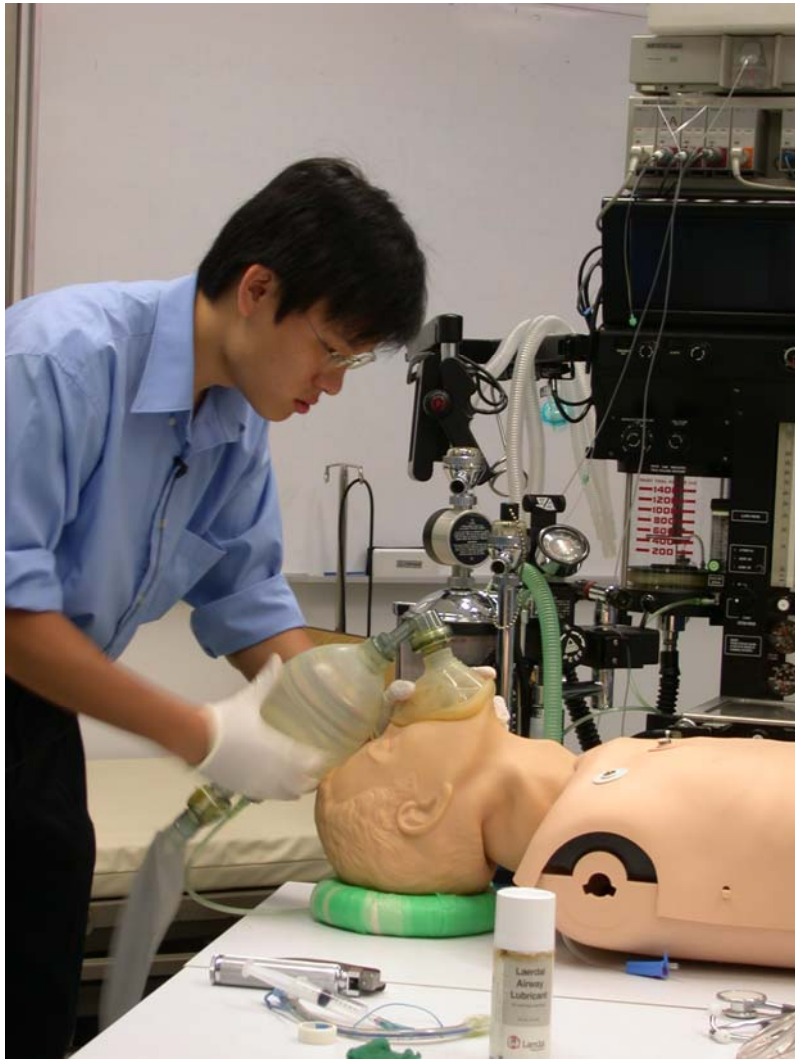
Intermediate Fidelity Simulation Tools

- Replicates part of the environment
 - Simulation of a subset of functionality
 - Virtual reality, haptic systems, part task models
 - Train basic and complex technique related to psychomotor skills
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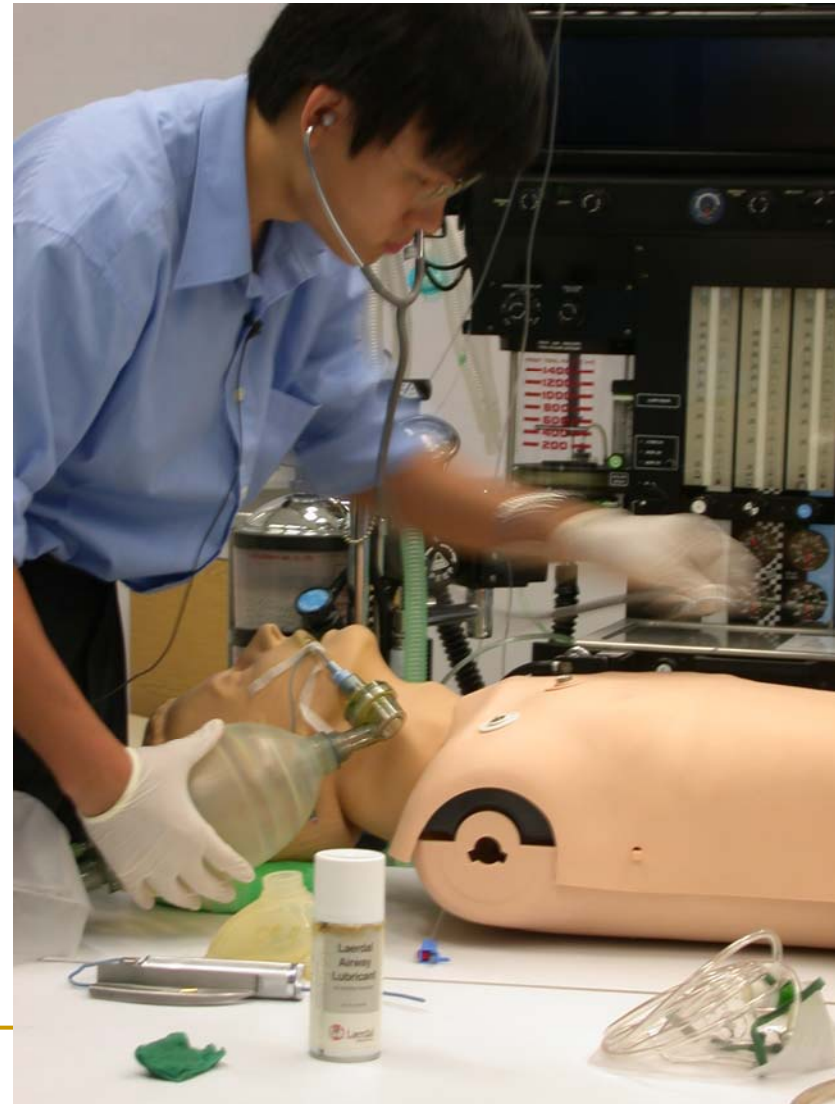
Endotracheal Intubation

- Study to evaluate 2 different teaching techniques
 - All students watched a standard video
 - Directed teaching – brought through step-by-step
 - Experiential teaching – swim or sink
 - Rescue after 10 min
 - Assessed as pass or fail; and overall score based on [1] equipment prep, [2] correct technique, [3] successful intubation & placement confirmation and [4] ventilation between attempts
 - Recalled at 3, 6, 9 and 12 months
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Intubation Module



Check Placement & Ventilate

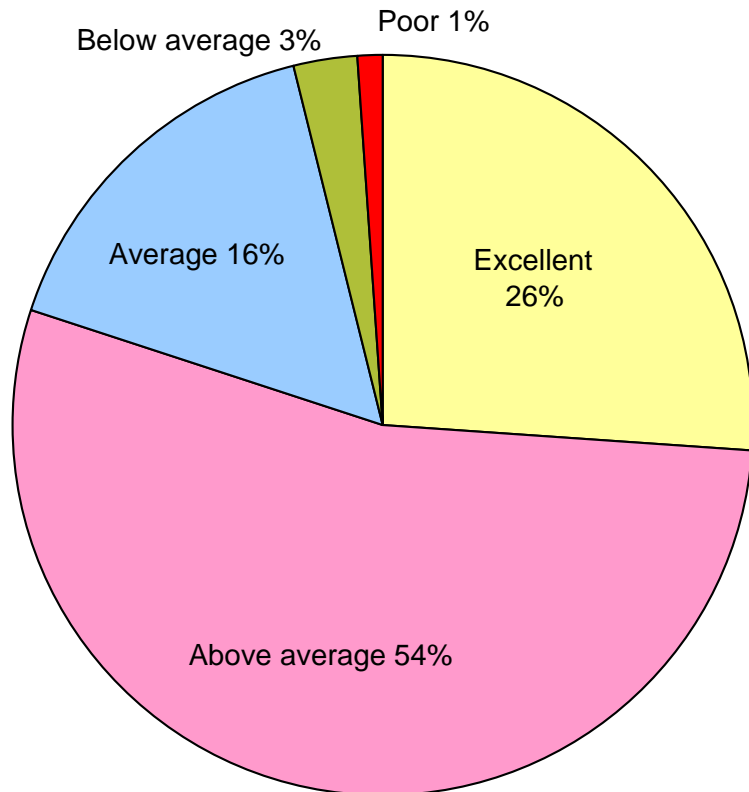


Preliminary Results

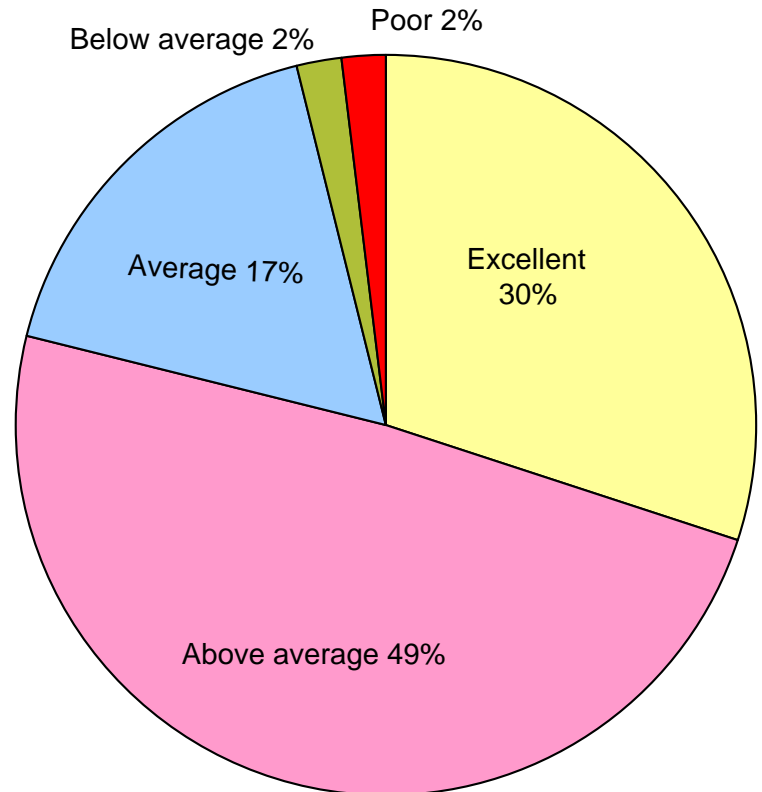
- 36 students
- 17 in directed group, 19 in experiential group
- At 3 months, experiential group had 78% pass rate vs. 41% in directed group
- Overall scores were higher in experiential group [82% vs. 72%]

INTUBATION MODULE

Quality of video

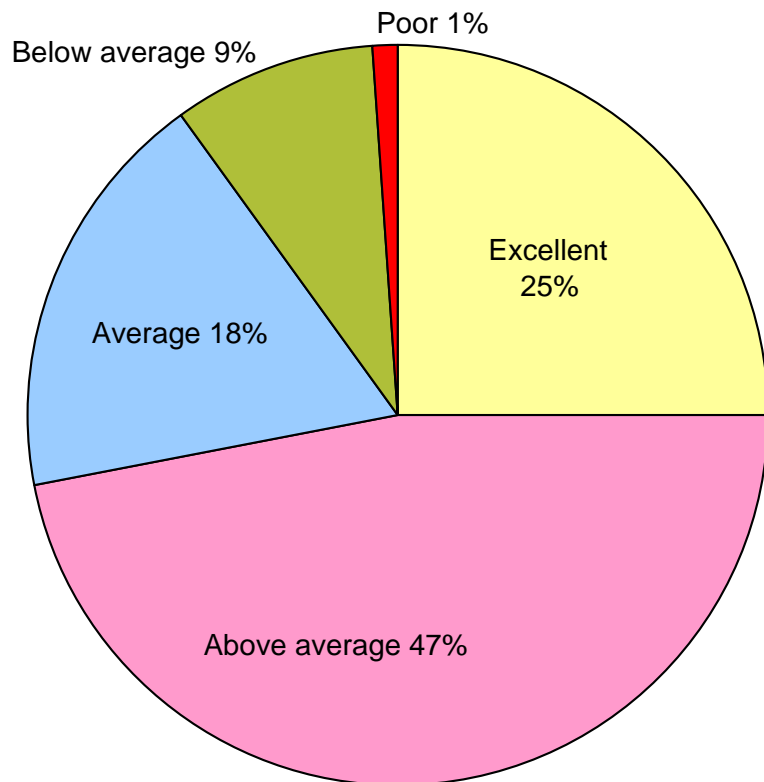


Usefulness of practical instructions

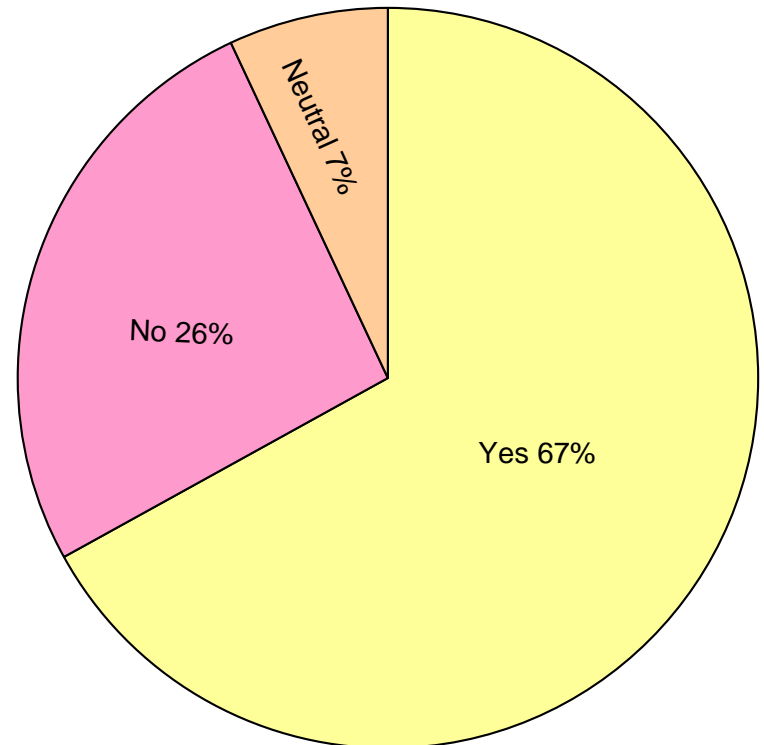


INTUBATION MODULE

Gave more confidence in
intubating patients



Improves success rate
of intubation



More Questions than Answers

- Awaiting completion of trial
 - Will there still be a difference at 6-12 months?
 - Does it translate into greater confidence or success in real life? Better patient outcome?
 - Will we get similar results with other tasks [cvp insertion, laryngeal mask, iv cannulation]?
 - What is the role of stress in learning, if any?
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High Fidelity Simulation Tools

- Requirements
 - Realism
 - Authenticity
 - Acceptability
 - High fidelity simulation requires suspension of disbelief
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Nature's High Fidelity Simulation: Smoke and Mirrors





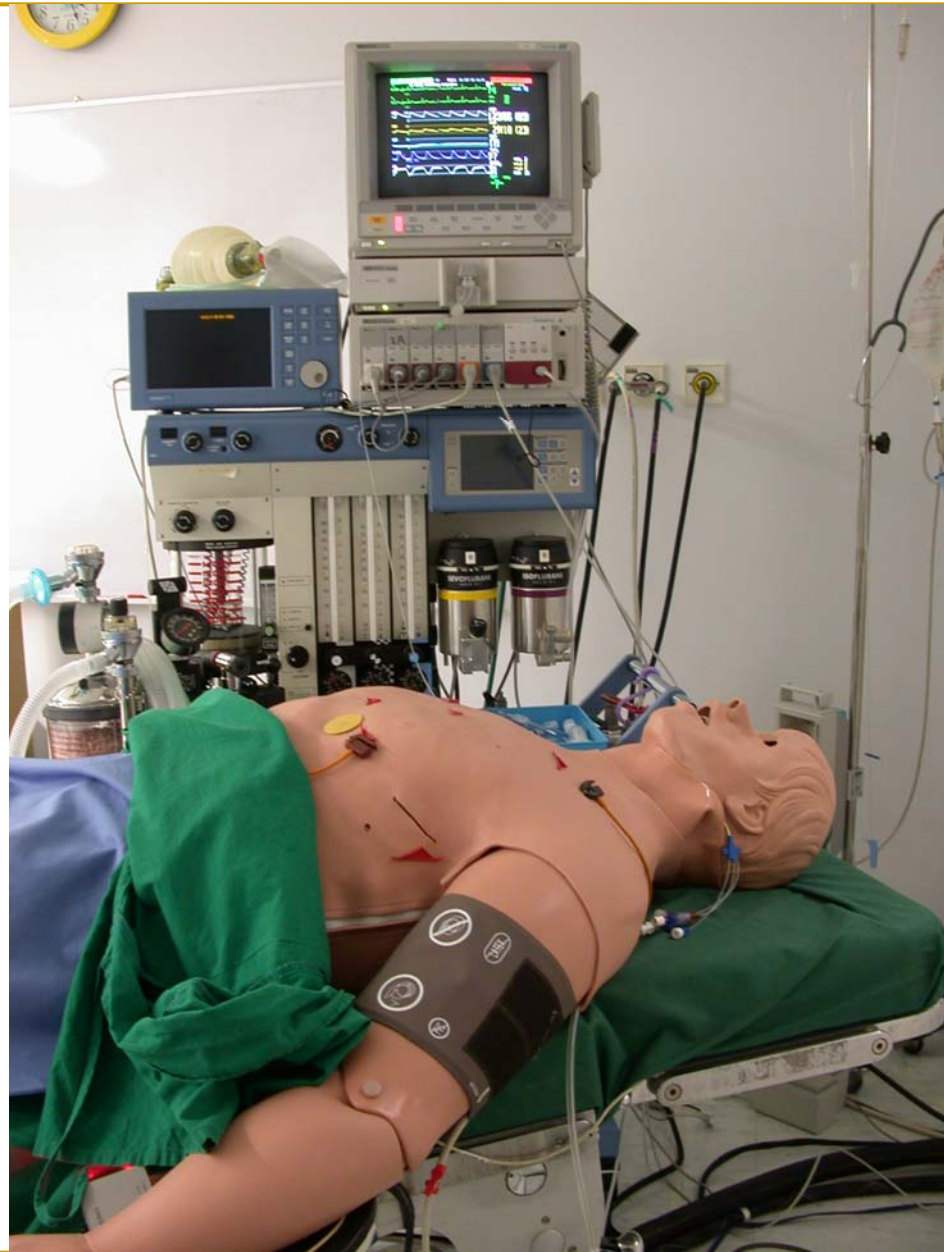




High Fidelity Simulation Tools

- Dynamic, integrated systems
 - Sophisticated, life-like manikin with computer programmes
 - Complex models of cardiovascular & respiratory physiology
 - Extensive pharmacological modeling of drugs
 - Meti-HPS and Laerdal SimMan
-

Meti HPS



Simulation Laboratory



Control Room



Group Teaching with HPS (Year 1)

- Cardiovascular & Respiratory Physiology to Year 1 Medical Students
 - Large groups of 20-25
 - Demonstrate manipulation of cardiac output & changes in pulmonary mechanics and gas exchange
 - Less than ideal set up although student feedback has been very good
-

Group Teaching with HPS (Year 3)

- Pharmacology for Year 3
 - Again, in large groups
 - Utilizes drug recognition system of HPS
 - Agonist, antagonist, partial agonist
 - Good feedback
-

Individual Teaching with HPS

- Crisis management to Year 4 students
 - To be effective, ideal group size should not exceed 6
 - Hands-on component essential
 - Study from Univ of Toronto suggests that HPS is no better than video teaching if students crowd around HPS
-

Crisis Management

- Groups of 4-6 students
 - 6 scenarios used with common history
 - Scenarios were anaphylaxis, myocardial infarction, pulmonary embolism, tension pneumothorax, hypovolemic shock and severe bronchospasm
 - Medical students individually managed a scenario while others watched live via video-link
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Introduction



Managing a Scenario



Resuscitation



Debriefing

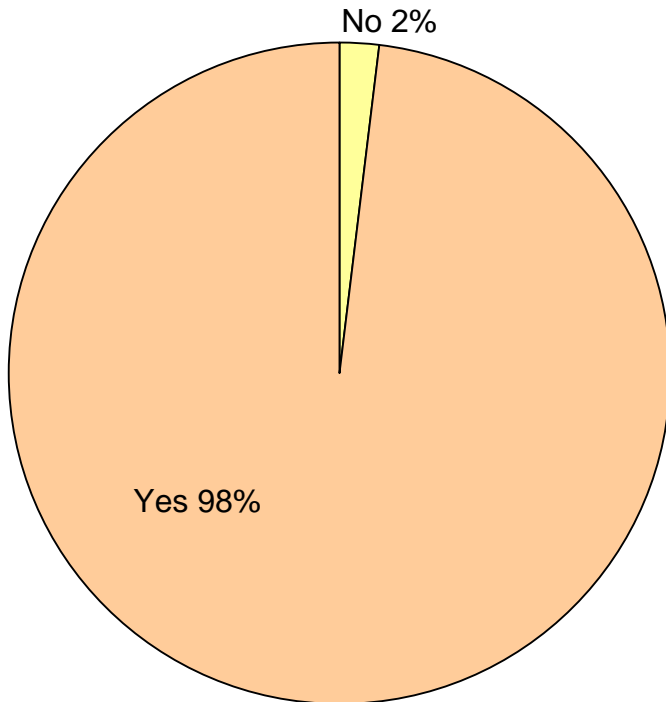


Debriefing

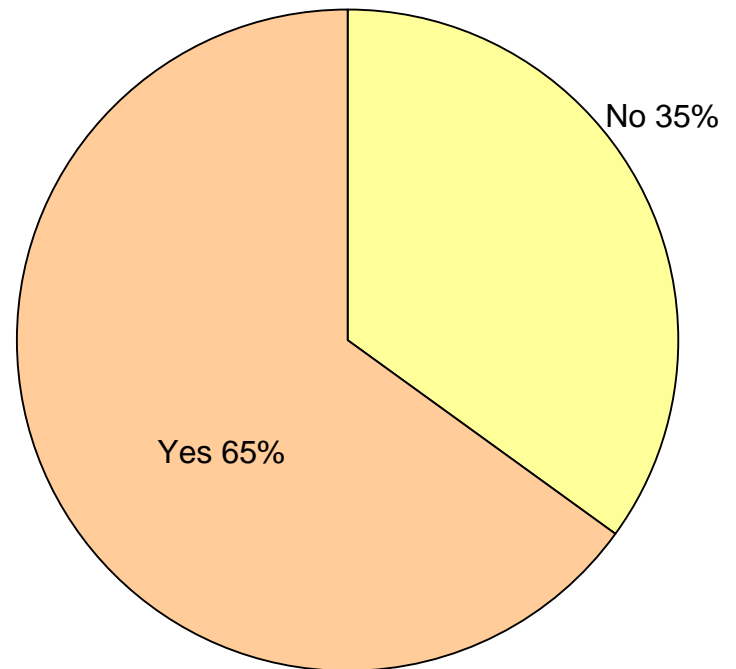
- Important part of process
 - Tutor facilitated
 - 5 learning objectives emphasized: [1] crisis recognition, [2] basic management, [3] differential diagnosis, [4] specific management and [5] correct drugs
 - Video playback
 - Opinions, Q & A
-

HUMAN PATIENT SIMULATOR MODULE

Were the scenarios appropriate and realistic?



Is the time allocated for the simulator training adequate?



COMMENTS : HPS

- Probably can give more obvious hints of the scenario.
 - More time, more sessions will be good
 - Make use of HPS in A&E modules too
 - I like it very much
 - We should be periodically have the chance to do such training to familiarize in the procedures instead of only one
 - More time would be better! The HPS is an excellent teaching aid
 - Enjoyable
 - Good and fun
 - Generally, good experience
 - Very fun and engaging
 - HPS is very, very useful.
 - More of such sessions should be conducted at regular intervals of our training. It truly helps us learn
-

COMMENTS : HPS

- A good and different learning experience. Number of sessions should be increased. Relevant module
- It is a very good training and should be further emphasis
- Should allocate more time for this. Very useful allows practical application and knowledge
- I felt that this program can be expanded
- Very good module, should have more time allocated for this.
- Very useful. Made us realize how unprepared we are
- It should be increased in frequency to other years such as Year 5
- More time and freedom to practice all scenarios
- HPS is effective in simulating acute scenarios. More sessions will be good
- Most interesting and useful of all the topics in the anaesthesia posting. Really improves learning and very interesting and very easy to recall.

Study: Hot Seat vs Control

- To determine if the person who was in the hot seat will perform better during retest
 - One of the previous scenarios randomly chosen
 - Students managed the scenarios individually
 - Scores based on learning objectives
 - Marked offline by 2 blinded assessors
-

Preliminary Results

- 54 students participated, 10 hot seat & 44 controls
- Hot seat students had better scores [72% vs. 64%]
- Hot seat students were the highest or second highest scorer in their groups 70% of the time vs. 36% for control [$p=0.078$]

Hot Seat Study

- Await completion of the study
 - Individual teaching is very resource intensive
 - Ideal group size not established
 - Team dynamics not tested
 - Role of stress unknown
-

Benefits of Simulation

- Skill development / assessment
 - Clinical skills practice in safe environment
 - Performance evaluation
 - Encourages self-assessment
 - Credentialing & certification
 - Culture / team development
 - Crisis resource management in a team environment
 - Multi-disciplinary, problem-solving approach
 - Safety
 - Controlled exposure to high acuity, low frequency
 - Detailed debriefing
 - Patient safety
 - Standardization of protocols and procedures
 - Research tool: improve education, error reduction, infection control
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Barriers to Simulation

- Under-funding & under-resourcing
 - Overcome traditional attitudes & practices
 - Generating institutional & departmental support
 - Slow growth in simulation technology
 - Lack of champions
 - Lack of hard evidence of increased competency or better patient outcome
 - Limited support for the use of simulation for accreditation and certification
 - Funding opportunities limited
-

Critical Factors for Future of Simulation

- Financial Planning
 - Good business plan
 - Financial autonomy
- People and Culture
 - Recruiting educators & simulation champions
 - Develop culture of patient safety
 - Multi-disciplinary collaboration
- Tools and Technology
 - Collaboration between vendors and users
 - Research
- Critical support from other entities
 - Malpractice insurance (e.g. reduction in fees)
 - Certification (simulation as an evaluative tool)
 - Medical device industry (simulation in design, assessment and training)

Thank You

