**What do we mean by “medical simulation”?**

- Why is simulation necessary?
- How does simulation work as an educational tool?
- Is there any evidence?
- What features lead to effective learning?

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**Introduction**

Simulation is valuable when ‘on-the-job’ training is expensive or risky. Simulation has been adopted for training where consequences of error expose many people to risk or the cost of error is high, for example:

- Aerospace
- Military
- Nuclear power plants

Simulation-based medical education involves practical application of knowledge. It will both kindle the grey cells while improving dexterity and knowledge. Simulation-based education has revolutionized learning; making it more engaging and fun.

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**Why simulation?**

- “Tell me, and I will forget
- Show me, and I may remember
- Involve me, and I will understand

CONFUCIUS, 450BC

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**Ethical Themes of Simulation**

1. Best standards of care and training
2. Error management and patient safety
3. Patient autonomy
4. Social justice – resource allocation

“patients are to be protected whenever possible and they are not commodities to be used as conveniences of training.”

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**SIMULATION-BASED MEDICAL EDUCATION**

- Aerospace
- Military
- Nuclear power plants

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**“Simulation and Virtual Reality” the Future of Education, Training and eLearning**

Sanjeev BANDI MD, FRCSI, FRACS(Urology)
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**Medicine: A High-Risk Industry**
- Harvard Medical Practice Study (1991) identified a ‘serious error’ rate of 3.7%
  - (serious error leads to prolonged hospital stay or disability)
- Vincent (2001) NHS ~11% error rate with 50% preventable
  - ~50,000 patients pa die from medical error or accident. Litigation cost £44billion
- Australian data - adverse event rate of ~16% in 1995 to 6.9% in public and 3.9% in private hospitals in 2012.

**Best standard for patient care**
- First do no harm to patients
  - Using patients as learning instruments is only justified when all approaches to minimize risks have been taken
  - Simulation allows trainees first encounters with real patients to be at higher technical and clinical proficiencies

**Best Standards in Simulation**
- Best standard for education
  - Responsibility of educators to provide clinicians with best training
- Best standard for evaluation
  - Traditional evaluation focused on cognitive domain
  - With simulation can assess attitudinal and psychomotor as well

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**Error management in SBME**
- Even with supervision it is inevitable that trainees cause preventable injuries
- In clinical setting errors must be stopped promptly
- In simulation errors may be allowed to progress
- Errors can occur at any level in medical education
  - SBME has uses in UME, PGME, CME

**Social Justice**
- Basic principle of distributive justice states:
  - Citizens equally share the risks of medical innovation, research and practice training
  - Most teaching institutions are urban and provide disproportionate care to the poor and under privileged
  - SBME may help equilibrate this imbalance

**Uses of Simulation Based Medical Education (SBME)**
- ‘hands on’ uses to teach clinical skills
- CME tool for practicing MDs
- Teamwork training to enhance patient safety
- Introduction of new technologies in safe manner
- Ultimately may be used for assessment for licensing and certification
- In broad range of situations
  - Traditional classrooms, home PC, simulation suites
**What is Medical Simulation?**

- “...an instructional process that substitutes real patient encounters with artificial models, live actors, or virtual reality patients”

  Gaba DM 2004

**Simulation technologies used in medical education**

- Computer-based simulations (micro-worlds, micro-simulation)
- Virtual environments +/- haptics
- Part-task trainers
- Low-fidelity simulators/manikins
- Simulated or standardised patients
- Hybrid simulations
- High-fidelity (full mission) simulation

**Non-Technical Skills**

- “behaviours ...not directly related to the use of medical expertise, drugs or equipment.”
- “They encompass both interpersonal skills eg. Communication, team working, leadership and cognitive skills eg. situational awareness, decision making...”

**Why is simulation necessary?**

- Reduced training hours (EWTD)
- Less patient exposure
- Competency based training
- Safety

  To Err Is Human: Building a Safer Health System
  Institute of Medicine 2000
  CMO 2009 Report
  machines manikins and polo mints

**How simulation can improve patient safety**

- Fewer errors
- Better error trapping
- Improved recognition of error and/or consequences of error
- Develop capacity to manage consequences of error

**Advantages of Simulation**

- Structured learning
- Guaranteed and scheduled opportunities for teaching learning
  - Uncommon situations can be presented
  - Teacher can model process, give feedback, repeat process, modify process
- Repetition as often as needed
Simulation-based training should be:
- within training programmes for clinicians at all stages.
- adequately resourced by NHS organisations
- importance of human factors training should be widely communicated.
- Medical Royal College should identify leads for simulation training.

“lack of non-technical skills can have lethal consequences for patients. However, the NHS lags unacceptably behind other safety critical industries, such as aviation, in its respect. Human Factors training must be fully integrated into undergraduate and postgraduate education”


Knowledge/Skills/Attitudes
- Teaching best practice
  - integrated
  - learner centred
  - appropriate use of technology
- Assessment best practice
  - valid and reliable
  - reproducible

Standards for Leadership for Doctors

Individuals as leaders
- Values and principles: “ability to manage effectively differences within and across teams”
- Reflective practice
- Self-awareness
  - A balanced approach “manage competing priorities”
  - Personal commitment to professional standards
  - Responding to uncertainty
  - Leading and communicating change

Leading groups
- Fostering learning
- Leadership and follower ship
- Organisational behaviour
- Motivating others
- Group and team dynamics
- Performance
How does Simulation work as an educational tool?

- Adult learner principals that apply to the medical learner:
  - Need to know why they are learning
  - Are motivated by the need to solve problems
  - Previous experiences of learners must be respected and built upon
  - Educational approach should match the diversity and background of adult learners
  - Need to be actively involved in the process

Bryan et al

Principles of Teaching Procedural and Technical Skills

- STEPS:
  1. Develop a curriculum
  2. Learners prepared with cognitive knowledge of procedure
  3. Techniques then demonstrated with clarifying commentary
  4. Learners then directly observed performing the skill
  5. Repetition encouraged
  6. Encourage learner self-assessment (reflection)
  7. Formative feedback imperative

Seven Principles for Teaching Procedural and Technical Skills
Academic Medicine, Vol. 76, No. 10/November 2001

Learning Pyramid

What features of simulation lead to effective learning?

- Mechanisms for repetitive practice (39%)
- Ability to integrate into a curriculum (25%)
- Ability to alter the degree of difficulty (14%)
- Ability to capture clinical variation (10%)
- Ability to practice in a controlled environment (9%)
- Individualised, active learning (9%)
- Adaptability to multiple learning strategies (10%)
- Existence of tangible / measurable outcomes (10%)
- Use of intra-experience feedback (57%)
- Validity of simulation as an approximation of clinical practice (3%)

Issenberg et al 2005

What’s the evidence?

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

Gaba
Who’s who in medical education

- Basic medical education
  - Medical students
- Pre-vocational medical education
  - Interns, RMOs, PGY 1&2
- Specialist training (discipline-based)
  - Registrars/Senior registrars/Fellows
- Specialists and GPs (life-long learning)
  - CME, MOPS, IRM, etc
- Teachers and trainers

The future of simulation...

- Skills training tool for all disciplines
  - Acute care
  - New techniques and/or equipment
  - Managing complications
  - Retraining
- Multi-disciplinary training
  - inter-professional communication
  - team performance
- Training in decision-making/resource co-ordination

Conclusion
- Simulation
  - Huge potential in the way we deliver modern medical education for both technical and non-technical skills
  - Different types to suit different budgets
  - Opportunity to practice and develop skills in a safe environment whilst protecting patients

Simulation saves lives........

What the apps can do...

- Ostergaard H, Ostergaard D, Lippert A. Implementation of team training in medical education in Denmark. Qual Saf Health Care 2004 13 (suppl 1) i91-95
- Flin R, Maran N. Identifying and training non-technical skills for teams in acute medicine. Qual Saf Health Care 2004;13 (suppl 1) i80-84