Using Simulation
in
Medical Education

Aimee Martin, MD
Campus Director of Simulation and Ultrasound
AU/UGA Medical Partnership Simulation Center

Outline

- A brief history of medical simulation
- Use of simulation in medical education
- Anatomy of a medical simulation
- AU/UGA Medical Partnership Simulation Center in 2015 and now

Learning Objectives

- Describe the benefits of using simulation in medical education
- Describe the components of a medical simulation
- Outline how the AU/UGA Medical Partnership Simulation Center integrates simulation into medical education

Disclosures

I have no conflicts of interest and nothing to disclose.

Definition

Simulation:

An artificial representation of a real world process to achieve educational goals through experiential learning.

Purpose in Medicine

To improve the *safety, effectiveness, and efficiency* of healthcare services.

To enhance clinical competence.

To allow for acquisition of clinical skills through deliberate practice rather than an apprentice style of learning.

Brief History of Medical Simulation

Simulation in medicine has been practiced for hundreds of years, with the use of cloth birthing simulators in the 1700's, to Resusci-Anne in 1960 and Sim One in 1967. Modern simulation practices grew out of aviation industry practices and were initially used in anesthesiology to improve patient safety.

MEDICINE | Sim does almost everything—except say 'ouch'

Deathproof Patient for Student Doctors

http://cyberneticzoo.com/robots/1967-sim-one-denson-abrahamson-american/

Simulation Use with US Medical Students: 2011 AAMC Report

Figure 1. Simulation Use with Medical Students
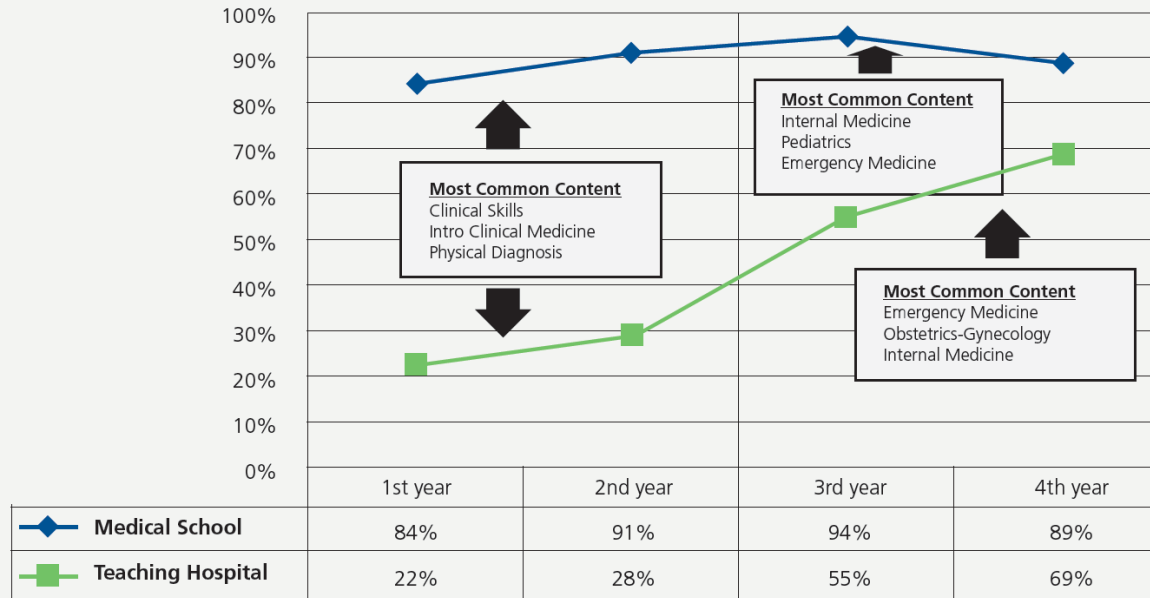
N=90 medical schools
N=60 hospitals

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Benefits of Simulation in Medical Education

Improvement in knowledge retention when compared to didactics.[4]

"...learners across all levels of expertise and practice areas gain self-confidence and self-efficacy through participating in simulation-based teaching and learning activities." [5]

Provides an **experiential learning** design that facilitates **deliberate practice**, essential for developing proficient clinicians.

The simulation environment creates valuable action feedback loops that are uniquely tied to the choices of the decision maker, and this process actively builds decision-making expertise.[7]

Benefits of Simulation in Medical Education

No harm to patients.

Allows time for immediate directed feedback, not typically available in the clinical environment.

Can create the scenario that is needed, vary the response based on the intervention, change the difficulty level.

Practice management of rare/infrequent events.

Practice team training/crisis management.

Brief Look at Medical Simulation Modalities

https://www.healthysimulation.com/virtual-reality-in-medicine/

https://www.healthysimulation.com/19181/oxford-medical-simulation/
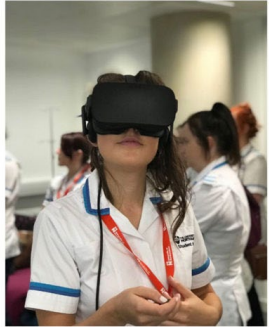
Simulation and Adult Learning Theories

Andragogy- the art and science of teaching adults

Simulation taps into andragogical principles:
- *Need to Know* - can see the benefits of knowing or the costs of not knowing in a safe environment
- *Self-Directed* - can take charge of their learning in learner-led discussion/debriefing
- *Task-Oriented* - can see that this will have immediate application to help them perform tasks or solve problems they will be confronting
- *Experienced*- the opportunity to tap into their accumulated experience and build on it

Simulation and Adult Learning Theories

Deliberate Practice

A highly structured activity with the goal of improving performance.
- Learner is motivated
- Performance of the skill with focus and attention.
- Assessment with immediate and specific feedback to improve performance.
- Repeat

Research about the acquisition of expertise consistently shows the importance of intense, deliberate practice for the acquisition, demonstration and maintenance of skills mastery.

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Simulation and Adult Learning Theories

Deliberate Practice

Examples in Simulation:
- practicing history-taking skills with a standardized patient
- taking repeated attempts at peripheral-line placement on a plastic arm
- resuscitating a simulation mannequin more than once
- reviewing one's own performance on video to augment reflection and facilitate feedback.

"See one, do one, teach one," is replaced by "see a lot, practice a lot, reflect a lot, and practice more."

Simulation and Adult Learning Theories
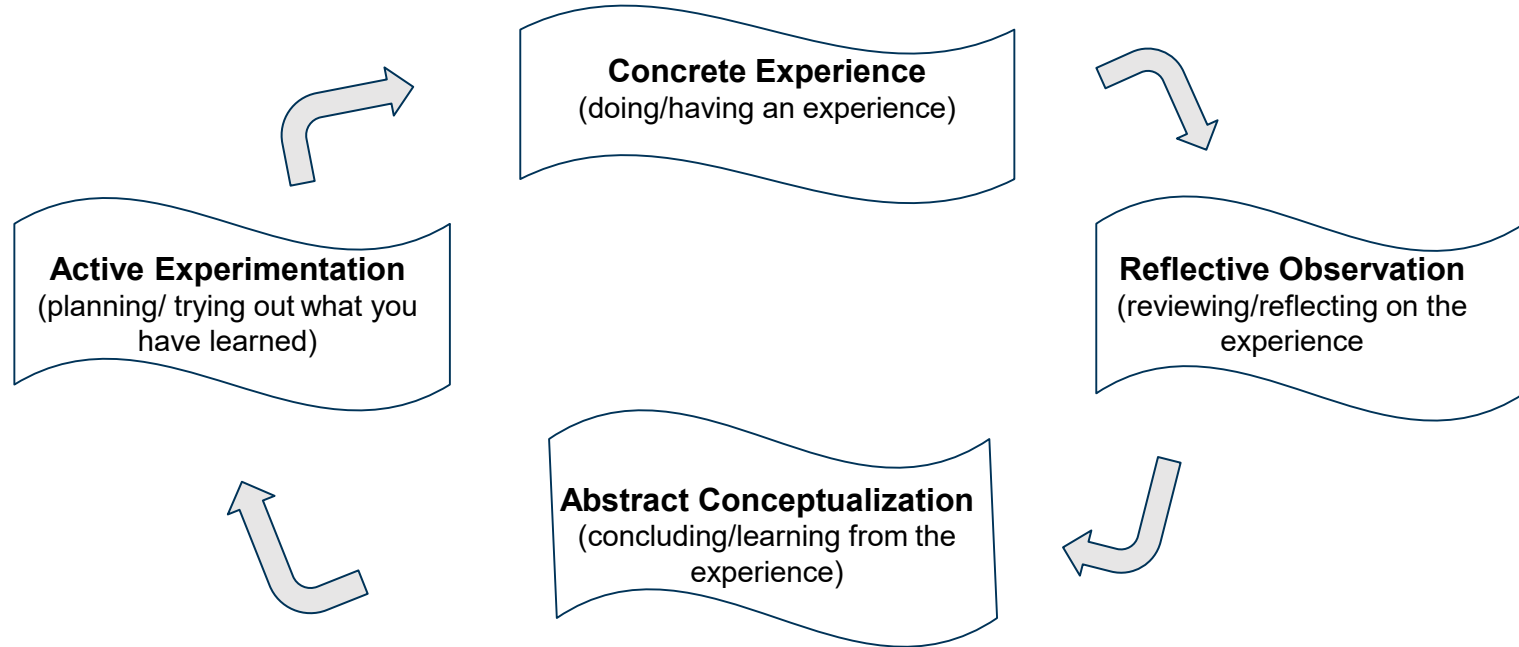
Experiential Learning Model

Simulation and Adult Learning Theories

Experiential Learning Model:

Concrete experience

Reflective observation

Abstract conceptualization

Active experimentation

Example in Sim:

Simulated patient resuscitation with CPR unsuccessful.

Reviewing learner actions, realization that person performing chest compressions got tired and delivered poor quality compressions.

Changing out compressor to maintain quality CPR may improve outcome.

Plan for or try out plan to ensure compressors are rotated in a similar situation.

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Simulation Modalities

- Standardized patients
  - persons trained in simulating patients with medical diseases and in learner assessment
- Task Trainers
  - used to teach a specific procedural skill
- Mannequins
  - life-sized with ability to display human physiology
- Virtual Reality
  - includes 3D anatomy tables, online 'choose your own adventure' patient care games, online avatars, VR headsets

Choosing A Modality

- What are you teaching?
     Physical exam? Diagnosis? Treatment? Procedural skill? Teamwork training? Patient interviewing skills?

- Is a simulation with a mannequin the correct modality?

- What is the level of learner?
     Preclinical student, resident, practicing clinician?

Creating a Simulated Experience

- Can take about 60-80 hours to develop a case
- Determine and write LOs: reinforce basic science concepts, teach teamwork, learn management of routine vs rare medical cases, etc.
- Write case to learner's level: determine complexity, distractors, outcomes
- Create case props: X-Rays, labs, patient charts
- Scripting: write scripting and train embedded actors, operators, instructors/facilitators
- Plan implementation: prep space, mannequin (program and moulage), AV equipment
- Perform a trial run-through and revise as needed

Anatomy of a Simulation

Prebrief

- 10 minutes
- Logistics
- Psychological Safety
- LOs
- Roles of participants
- Fiction Contract
- Encounter type

Scenario

- 10-15 minutes
- Realism
  - Moulage
- Embedded participants
- Signal vs Noise
- Operator
- Observers

Debrief

- 30-45 minutes
- Intro
- Reactions
  - Feelings
  - Facts
- Analysis
  - Learner-led
  - Discussion
  - Teaching
  - Application
- Summary
  - Take-aways

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Prebriefing

- Critical to the success of the simulation and to the success of the learner.
- Establishes the learning environment.
- The Basic Assumption-"We believe that everyone participating in this activity is intelligent, capable, cares about doing their best, and wants to improve."
- Orients them to the physical space as well as to the fictional space.
- Fiction contract
- Provides guidance on learning objectives, interaction with patient, use of items in the room, expectations of learners, embedded participants.
- Address safety issues.
- Can head-off learner defensiveness, fear, anxiety

Scenario

- Realism-must contain physical fidelity, conceptual fidelity, emotional fidelity leads to a learner perception of realism, increases engagement
- Signal (clues) vs Noise (distractors)
  - Embedded participants-helpful or disruptive/distracting
  - History-available?
  - Patient-cooperative?
- Scripting vs ad-libbing
- Mannequin operation-physiologic states preprogrammed or changed "on the fly"
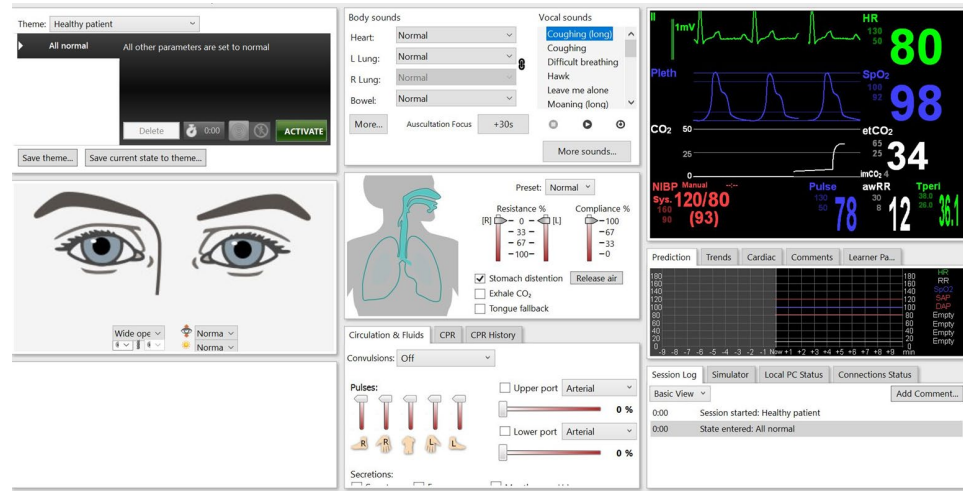
Debriefing

- A conversation to review an event in which participants analyze thoughts, action and outcomes with the intent to improve or sustain performance in the future.
- Debrief "with good judgement" rather than with "harsh" or "hidden" judgement.
  - Harsh-creates shame, disrupts trust, accusatory
  - Hidden-confusing, obscure, "guess what I'm thinking", withholds information
- Be inquisitive-look for the 'frame' of the learner-thought process behind the action
  - Assumptions
  - Knowledge gaps
  - Emotionally overwhelmed
  - Incorrect use of a 'rule'
- Avoid "dirty questions"
- Don't just debrief negative actions

AU/UGA MP Sim Center in 2015

Facilities:
- 1 sim room with 3 mannequins (1 adult, 1 child, 1 infant)
- 1 skills lab/storage room with task trainers .
- Total of 900 Sq Feet

Curriculum:
- Single patient case encounter in second year to introduce students to working through an acute patient case in real-time.
- EM skills lab once a month.
- 3rd Year Procedure Day.

AU/UGA MP Sim Center in 2020

Facilities:

- Total of 3000 Sq Ft
- 5 Patient Bays with functioning headwalls, hospital beds, crash carts and defibrillators
- Skills Lab
- Control Room
- Debriefing Room
- 5 adult, 2 child and 2 infant mannequins
- Task Trainers including CVC placement, airway management, LP, thora/paracentesis, chest tube, art lines, etc.

Simulated Cases in the AU/UGA MP Curriculum

M1 and M2 Years
- Introduce rapid assessment of an acutely ill patient
  - ABCDE (Primary Survey) and Secondary Survey
- Introduce Teamwork Concepts as they apply to healthcare teams
  - Interprofessional teams
- Emphasize basic science concepts while treating common disease states
- Begin critically evaluating the use of bedside tests in caring for acutely ill patients

M3 Year (Peds, OB, GS)
- Practice rapid assessment and management of acutely ill patients, including airway management, pharmaceutical and procedural interventions, communication with patient and family
- Demonstrate effective teamwork skills

Procedural Skills in the Preclinical Years

M1

        Oxygen delivery (N/C, Simple F/M, NRB F/M, BVM)
        Phlebotomy
        Injections (ID, SQ, IM)
        EKG lead placement and basic reading skills

M2

        Foley catheter insertion
        NGT insertion
        IV insertion (peripheral, with and without US guidance)
        Local anesthesia

Procedural Skills in the Clinical Years

M3

        Aseptic technique
        Suturing
        Vaginal delivery

M4

        Ultrasound-guided central line placement
        Endotracheal intubation
        Lumbar puncture
        Thoracostomy

Running Simulations during COVID-19

Protocols-temp and questionnaire screening, masks, shields, hand washing and gloves, wiping surfaces between groups, limiting groups to 4 plus instructor, physical distancing in rooms, close spacing for 10-15 minutes at most.

Virtual simulation

Hybrid sim-Pediatrics Clerkship

Virtual Procedures Labs-Injections and Placing an IV, remote ultrasound instruction
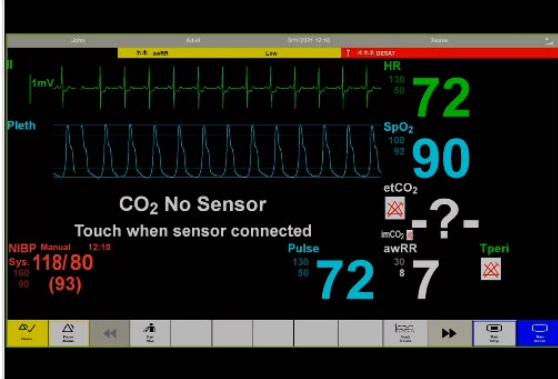
Hybrid Simulation

Simulation Center Utilization in CY 2020

945 learner and educator visits captured in 2020

- 23 Curricular Events for MP Preclinical students planned (6 cancelled Sp 2020, 3 converted to virtual)
- 51 Curricular Events for Clerkship MP students planned (14 cancelled Sp 2020, multiple converted to virtual)
- 6 UME Extra-curricular Events (Student Interest Groups, Open US Scanning, Demos)
- 7 GME Educational Events (4 cancelled Sp 2020, 1 converted to virtual)
- 12 faculty training Events

Simulation Center Utilization AY 2021

M1 Students-3 simulated encounters, 4 procedure and 5 US labs per year

M2 Students-6 simulated encounters, 4 procedure and 5 US labs per year

M3 and M4 Students

        Peds: 6 simulated encounters per 6 wk block

        OB: 2 procedure labs per 6 wk block

        EM: 4 procedure labs per 4 wk block

        GS: 2 procedure labs per 8 week block, 1 simulated pt encounter
          per 8 wk block

GME

        4-6 procedure and US labs per year

        2 simulated ACLS patient encounters per year

Resources in Simulation

Society for Simulation in Healthcare-"*The purpose of the Society Simulation in Healthcare is to serve a global community of practice enhancing the quality of healthcare*"
Founded in 2004. Publishes peer-reviewed journal.
Has more than 3,700 members in 57 countries, offers accreditation for qualified simulation centers, offers certification in healthcare simulation education and operation.

Center for Medical Simulation-"*Using simulation to improve safety, quality and education in healthcare.*"
Founded in 1993, CMS was one of the world's first healthcare simulation centers.
Associated with Harvard Medical School; provides training in all aspects of Medical Simulation.

Resources in Simulation

WISER -The Winter Institute for Simulation, Education and Research at the University of Pittsburgh Medical Center

Healthy Simulation website
www.healthysimulation.com
Provides news, conference coverage, links, research updates, etc.

Simulation Activities and Conferences

International Meeting on Simulation in Healthcare (IMSH) - yearly conference, 2200 attendees this year to the virtual conference.

SimOps - yearly conference aimed at the operations side of sim.

Healthcare Simulation Week - yearly in Sept. Celebrates global professionals who use simulation to improve the safety, effectiveness, and efficiency of healthcare delivery. Also raises awareness in communities nationwide about how healthcare simulation is leading to safer, more knowledgeable patient care.

SimGHOSTS - The Gathering of Healthcare Simulation Technology Specialists (SimGHOSTS.org) Non-profit group runs hands-on training events designed to inspire, inform and interconnect professionals responsible for operating the various technologies used in healthcare simulation centers.

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