

Integration of Simulation into a Internal Medical Residency Program: More than just code team training

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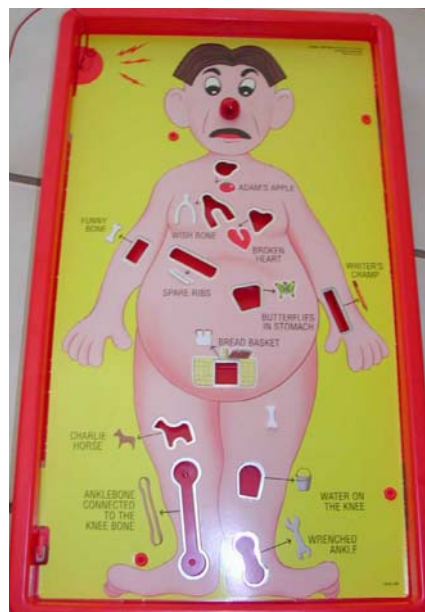
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History of Simulation In Medicine

- Simulation has a long established history in other high risk fields such as aviation, aeronautics, nuclear energy and in the armed forces.
- Medicine, while rife with risk and known medical error, has been slow to embrace simulation as part of medical training, for a variety of reasons.

History of Simulation



Why has simulation become important?

- Public demand for accountability in performance, training and safety
- Limited work hours limit resident exposure to certain clinical conditions, such as rare events like codes and unusual clinical syndromes.
- Simulation technology has improved significantly over the last 10 years
- Attempts to identify better tools for assessment of competence

Simulation and the Concept of Experiential learning

- 3 domains of learning (Bloom)
- Cognitive
- Psychomotor
- Affective

Principles of experiential learning

- Key driver in significant experiential learning is when the subject matter is linked to the personal interests of the student
- A negative driver is learner perceived threats to self esteem
- Experiential learning proceeds faster when external threats are at a minimum and the learner has the opportunity to fail and learner is in a safe environment.
- Self initiated learning is deeply embedded in memory.

How do physicians learn? The three domains of learning

- Physician is confronted with a concrete clinical experience
- Applies existing knowledge base to clinical case
- Cares for the patient
- Pursuit of greater knowledge thru literature review and consultation
- Application of new knowledge to next patient.

SBME and learning

- Event>reflective observation>abstract conceptualization>plan for future implementation >active implementation
- This cycle of brief, experience, debrief is at the heart of of the simulation experience.

What types of simulation are being used?

- Low tech simulators (models or mannequins)
- Simulated or standardized patients
- Screen based computer simulators (ACLS, problem based solving)
- Complex task trainers (ultrasound, bronchoscopy, laparoscopic procedures, colonoscopy)
- Patient simulators, computer driven, full length mannequin

Steinberg Advanced Skills Laboratory



Steinberg Advanced Skills Laboratory

- Video fiberoptic towers
- FO/video bronchoscopes/laryngoscopes
- Advanced ACLS trainers
- Task trainers:
 - Pediatric ACLS, heart sound simulator, intraosseus, umbilical vascular access, IV
 - Adult central line, chest tube, cric, IV access, arterial line, Foley catheter, dressings
- Defibrillators/AEDs

Microsimulation and Debriefing Laboratory



MicroSim
Inhospital

Debriefing

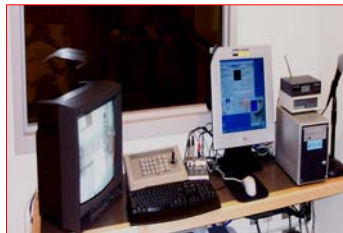
Zak Butlerworth
A 32-year-old man has been brought into the emergency department after being found unresponsive outside the local library. The paramedics return that they found an empty syringe lying beside the patient.
Diagnosis: Hypoglycemia

- 0:00 You arrive at the patient's side.
- 0:06 ✓ You shook the patient's shoulder. The patient was unresponsive. It is correct to assess responsiveness here.
- 0:16 You checked the airway. The airway was clear.
- 0:21 ✓ You performed a head-tilt-chin-lift. This is the preferred method for opening the airway.
- 0:26 ✓ You examined the chest. He's breathing at 12 breaths per minute. The chest is moving normally. His skin is cool and he's very sweaty. It is correct to check for breathing.
- 0:36 ✓ You gave the patient 100% oxygen on a nonrebreathing mask. It is correct to give oxygen at this point.
- 0:38 ✓ You checked the pulse. The pulse is strong, 90 a minute and regular. It is correct to assess the patient's vital signs.
- 0:44 ✓ You attached the automatic NIBP measurement cuff.
- 0:45 ✓ You attached a 3-lead ECG. It is correct to place the patient on the monitor.
- 0:51 ✓ You attached the pulse oximeter.
- 0:58 ✓ You examined the patient's skin. His skin is cool and he's very sweaty.
- 1:00 Patient status - ECG: Sinus rhythm, Heart rate: 90, Pulse: Present, Blood pressure: 118/82 mmHg, Respiration: 12, Respiratory rate: Unresponsive, SpO2: 95%, Temp: 98.7°F

Level of detail in debriefing
Essential Details

DEBRIEFING
New problem
Previous problem

Human Patient Simulation



Courses at STRATUS

- Arrhythmias
- Acute Coronary Syndromes
- CHF
- Pulmonary Emergencies
- Difficult Airway
- Endocrine Emergencies
- Trauma/Environmental
- Trauma/Core Competency
- A Fib/Core Competency
- Orthopedics
- Toxicology 1
- Toxicology 2
- Infectious Diseases
- Pediatrics
- ENT Emergencies
- Electrolyte Abnormalities
- Urologic Emergencies
- Renal Emergencies

What are the benefits of SBME to housestaff?

- Technical expertise (procedures)
- Acquisition of new knowledge thru new and unfamiliar scenarios (filling a “blind spot”)
- Improved interpersonal communication with other physicians
- Improvement in communication/teamwork with other health care personnel (nurses, RT)
- Experience in dealing with family members

The Main Principles of CRM (Crisis Resource Management)

- Support
- Roles
- Communication
- Resources
- Global Assessment

Support

- In general, you can't do it all by yourself.

Role Clarity

- Event manager is key
- Organizes team
- Articulates goal
- No playing with toys
- Communications go-between



Role Clarity

- All communications go through event manager
- Event manager shares communications with the team
- Close the Loop!

Resources

- Be prepared
- Anticipate trouble
- Know the systems
- Practice



Global Assessment

- Step back and look at the big picture
- Review the situation out loud
- Differential diagnoses

Cardiac Arrest Management: Is There Room for Improvement?

- 31% of physicians able to use the defibrillator correctly.
- 75% did not know (or come close to knowing) the VF/Pulseless VT protocol.
- 75% felt training was insufficient.
- 50% of residents felt inadequately trained to run code teams (Hayes et al CCM 2007;35(7):1781)

Support for the Concept that Simulation reduces error and accelerates learning: a work in progress

- Correlation of physician performance in a simulator based environment to actual error rates in the ICU (Gorden JA et al *Sim Healthcare* 2007:2(1);68)
- Residents underwent SBME in a rested state vs sleep deprived state (group I) (24 hr call shift)
- Subgroup of this group underwent modified overnight shift (16 hr on call) and then underwent simulation with 2 scenarios of critically ill pats.
- Performance assessment tool looking at major errors , scored 1-8 (worst to best)

Gorden et al

- 50 simulation sessions, 25 rested, 25 sleep deprived
- Group I (rested) avg score 6.0 , declined to 5.0 after 24 hr shift.
- Group II (modified overnight shift) scores avg 5.8, compared to 4.3 with traditional overnight score
- This study suggests that physician performance and elements of patient safety may be ascertained using SBME

Evaluating the management of septic shock using patient simulation (Ottestad et al. (CCM 35(3):769)

- Septic shock model gauging interns interventions using a retrospective review of video tapes of house staff managing a standardized simulation scenario using established guidelines in the management of septic shock
- Pre-session 75 minute session on crisis management.
- Pt managed by intern for first 10 mins of scenario and then senior level residents arrived at 10 minutes

Ottestad et al. results

- Grading was done for interns and then the group was graded for the entirety of the 35 minute exercise
- Technical and nontechnical scores were assessed by two independent observers
- 16 technical (0 or 1 score) items deemed consistent with care of patient with septic shock
- Nontechnical scores involved 0-5 scale

Ottestad et al;results

- Of 16 technical items, interns completed a mean of 7 (range 1.5-11)
- Team technical ratings mean 9.3 (3.3-13)
- Nontechnical scores applied to team as a whole mean 3.7
- **This study, while retrospective, demonstrated the development of objective measures of knowledge and behavior based skills in the management of a specific clinical problem**

Gorden et al. A randomized trial of Simulation versus traditional instruction in Medicine (Adv in Health Sci 2006;11:33)

- 38 3rd year medical students
- Randomized controlled trial with written pre and post testing
- Students received either simulation on MI and a lecture on reactive airway disease or reactive airway disease simulation and lecture on MI
- **Mean pre and post testing similar between simulator and traditional based teaching .**
- ?role of written testing to evaluate simulation performance
- **How best to evaluate simulation performance?**

Simulation Based Education Improves Quality of Care During Cardiac Arrest Team Responses: A Case Control Study (Wayne DB et al. Chest 2007)

- Retrospective case controlled study of cardiac arrest team responses from January-June 2004.
- Medical records were reviewed to assess adherence of ACLS quality indicators
- All residents received standard ACLS training
- 2nd year residents underwent an educational program of SBME practicing ACLS scenarios.
- Both standard and simulation trained residents responded to ACLS events

Wayne et al:results

- Results showed that simulator trained residents has a higher adherence to AHA standards (mean correct 68%) compared to standard ACLS training (mean correct 44% $p=.001$)
- Odds ratio for an adherent ACLS response was 7.1 (CI 1.8-28.6) for SBME trained residents compared to traditional training after controlling for patient age, ventilator and telemetry status.

Ways to integrate SBME into a residency

- Task trainers during orientation and thru year
- Ward rotations, especially attending rounds
- Orientation for interns in July and August
- Crisis resource management or code training
- Remedial training for residents deficient in particular skills
- Training of senior residents in teaching of SBME
- Gathering and “converting” faculty as champions of SBME

Utilizing simulation to improve acquisition of knowledge during orientation training at the beginning of internship: BWH pilot study

- We studied what benefits may accrue with the use of SBME in enhancing clinical competence, (Medical knowledge, practice based learning and interpersonal communication skills) in early internship compared to standard didactic training.

SBME in intern orientation

- As part of their summer orientation series, (Intern Workshops), interns are presented 10 one hour sessions on a variety of topics related to the management of common clinical problems encountered in the inpatient service. Sessions done as a roundtable format with a senior resident leading a discussion of a case based scenario.

- We took 2 of those topics, respiratory failure and hypotension, and created 3 scenarios that were duplicated for use both in a roundtable didactic approach and to be used for simulation purposes
- In Week I , Interns were randomized to receive training in the area of respiratory failure employing either the didactic form or SBME (intervention)

- 42 interns were randomized, group A and group B
- Interns randomized to SBME underwent simulation in the STRATUS center at BWH
- In week I Group A randomized to SBME on the topic of respiratory failure and Group B randomized to didactic instruction.
- In week II, for the topic of hypotension the groups were reversed.

- Each session involved 6-8 interns, with a senior resident presiding over the didactic session and attending supervision and teaching the simulation sessions. A senior resident assisted in some of the simulation sessions.
- 3 scenarios in each session; 60 mins total
- Course content for simulation and didactic groups were the same.

Scenarios chosen

- Early septic shock scenario
- Aortic dissection (chest pain)
- Pericardial tamponade
- Congestive heart failure
- Pulmonary embolism
- Pneumothorax
- 5 minute scenarios, 10 min debriefing

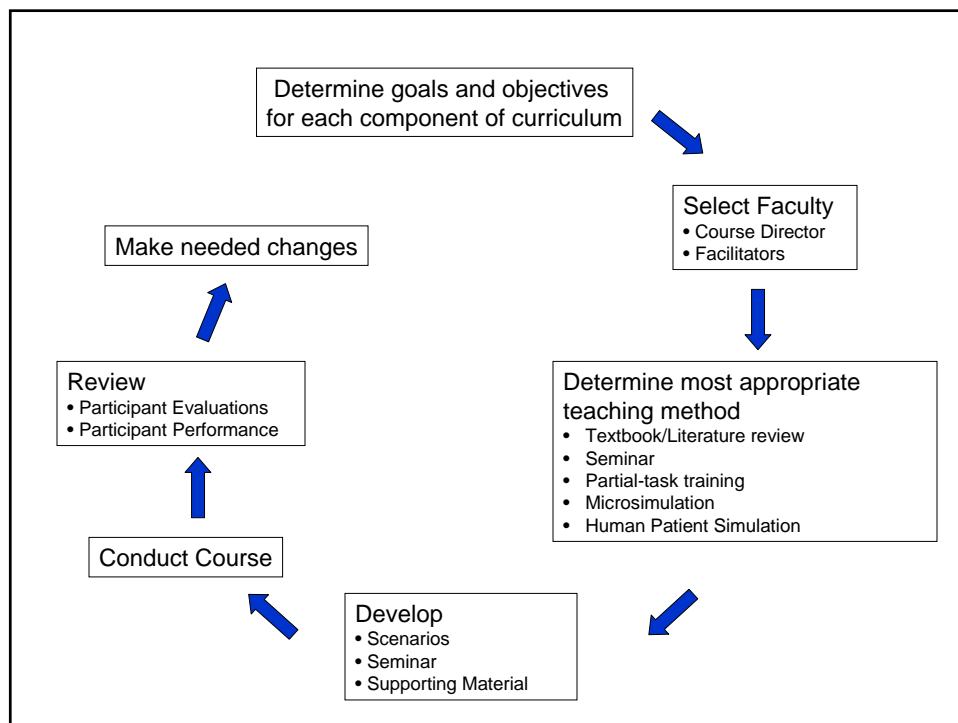
- Interns completed a short written test pre and post sessions both for didactic and simulation groups
- Questions for assessment were obtained from MKSAP program (ACP)
- Performance in simulation was assessed using a checklist of tasks expected to be completed based on the objectives of the simulation scenario graded on a scale of 0 to 2 (0 not meeting expectation , 1 partially meeting expectation, and 2 completely meeting exp)
- 2 independent observers did scoring and results were averaged.

Case I Resp pulmonary embolism checklist			
Physical exam (heart, lungs, Neck,)	0	1	2
BP	0	1	2
O2sat	0	1	2
Appropriate Use of Oxygen	0	1	2
EKG	0	1	2
CXR	0	1	2
ABG and interpretation	0	1	2
IV Fluid resuscitation	0	1	2
Consideration for dx of PE	0	1	2
Order CTA	0	1	2
Start Heparin	0	1	2
Resource assessment (call for help)	0	1	2
Leadership identified	0	1	2
Delegation of roles	0	1	2
Team members perform roles	0	1	2
Communication amongst team members	0	1	2

Results:

Criticisms of study

- Didactic sessions run by residents, simulation run by attending
- Validity of written testing
- Power of data
- Evaluation of groups of residents versus evaluation of individuals
- Small number in groups in 1 month follow up



What cases to simulate?

- Low or moderate severity/high frequency (chest pain, fever, asthma)
- High severity/low frequency (tamponade, aortic dissection)
- Both types are important!
- Time compression is necessary in SBME and needs to be done without upsetting the “reality” of the simulation
- Combining an initially stable patient scenario with an unstable course is a good way to test knowledge about a particular problem (cognitive) and then assess advanced cognitive, technical and behavioral skills needed in a crisis situation

What types of scenarios in internal medicine are amenable to simulation training

- Respiratory and cardiac emergencies/ICU
- Electrolyte disturbances, DKA
- Unusual clinical syndromes (vasculitis, oncologic emergencies)
- Technical skills (airway management, IV and CVL placement, , chest tube, needle decompression)

Which scenarios to choose?

- **Scenarios that are based on actual cases are often the best for learning: Be real!**
- **Use clinical guidelines to guide objectives**
- **Scenarios may reflect trends or patterns of failure in an individual institution based on data accumulated thru local institution or thru risk management**
- **Common scenarios work well for interns, more complex and esoteric cases are appropriate for senior level residents**
- **All levels of residents appreciate code training**

Creating a simulation library

- They actually already exist
- Choose topics for study
- Develop objectives for learning using clinical guidelines and EBM to help shape scenario
- Create scoring systems that determine if those objectives were met
- Debrief to reinforce concepts especially associated with EBM and correct errors.

Simulation schedules for residents

- Planning for 4 simulation session per month for 8 ward teams, goal is 8 sessions per month, taking place of one ward attending session per month for each team
- Attempting to involve more attendings
- Residents seem to like to work with other residents, interns with interns and no students, while comfortable for them, not as realistic.

Problems with implementation

- Initial costs of simulation infrastructure
- Institutional and cultural acceptance
- Sufficient attending input
- Pressure of time taken away from other resident activities
- Adapting scenarios to residents needs
- Creating a realistic environment

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