Simulation-Based Pharmacy Education: The LAU SOP Experience

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Outline

• General Overview of Simulation-Based Education
• Integration of Simulation-Based Pharmacy Education in the Curriculum
• Assessment of Simulation-Based Training
• Available Simulation Technologies
• Challenges and Pearls
Disclosure

• Dr. Lamis Karaoui and Dr. Aline Saad declare to meeting attendees that there are no financial relationships with any for-profit companies that are directly or indirectly related to the subject of their presentation.
Definition of Simulation

• Simulations are approximations to reality that require trainees to react to problems or conditions as they would under genuine circumstances

• Simulation-based medical education is defined as any educational activity that utilizes simulation aids to replicate clinical scenarios

Characteristics of Simulations

• Imitate but do not replace reality
• Offer almost unlimited opportunities to “go wrong”:
  - Decrease risk to patients
  - Enable deliberate practice
  - Safe to learn from errors
  - Provide a controlled environment
• Provide corrective feedback as a guide to future action
  - Can ensure learning outcomes are addressed
  - Can create relevant simulations when required
Healthcare and the Adoption of Simulation for Training and Assessment

• Healthcare lags behind
• High-risk performance environments have long and successfully incorporated simulation technology in their training and assessment programs
  - Aviation (flight simulators for pilots and astronauts)
  - Military (war games and training exercises)
  - Business executives (management games)
  - Nuclear power plant (technical operations scenario)
Evolution of Simulation in Clinical Education

- Reduced patient availability as learning and assessment opportunities
  - Higher acuity of illness
  - Shorter hospital stay/clinic visits
- Changes in healthcare delivery
- Faculty shortage, lack of faculty time to teach and train
- Technological advances in diagnosis and treatment
- A culture of safety
  - Risks to patients, correction of faults in the system of care
- Ethical considerations
  - Real patients/patient substitutes
  - Train on sick patients, use of cadavers
- Consumer awareness
Benefits of Simulation-Based Education (SBE)

• Readily available at any time (great flexibility for the evaluator)
• Reproducibility of a wide range of clinical conditions (rare & critical)
• Available for assessment (& credentialing) of competence across multiple domains (skill, knowledge, attitude)
• No ethical concerns with technology as with real patients
• Simulators have no tiredness or embarrassment
• Simulators provide standardized experience for all
• Simulators help in skill acquisition
Potential Applications

• Soft Skills:
  - Team-readiness
  - Learning and rehearsal of clinical and communication skills at all levels
  - Training of teams in crisis resource management
  - Leadership Skills

• Problem Solving and Clinical Skills:
  - Practice of complex clinical situations: BLS, ACLS
  - Rehearsal of serious and/or rare events
  - Rehearsal of planned, novel or infrequent interventions
Can We Turn a Team of Experts into an Expert Team?
Conceptual Framework of SBE

• Miller’s “Pyramid”

• Kolb’s “Experiential Learning Theory”

• Ericsson’s “Deliberate Practice”
Miller’s Pyramid
Taxonomy of Knowledge and Skills

- **Knows**: Descriptive/elaborative knowledge: e.g., MCQs, oral examination
- **Knows how**: Procedural knowledge: e.g., Key-Feature, oral examination
- **Shows**: Performance "in vitro": e.g., OSCE (with standardized patients)
- **Does**: Performance "in vivo": e.g., MiniCex (undercover standardized patients)
Kolb’s Learning Cycle
Experiential Learning Theory

Concrete Experience: Having the experience (Feeling)
Reflective Observation: Reflecting on the experience (Watching)
Abstract Conceptualisation: Learning from the experience (Thinking)
Active Experimentation: Trying out what has been learnt (Doing)
Ericsson’s Deliberate Practice
Pillars for an Effective Simulation Intervention

- Institutional integration
- Trained simulation instructors
- Motivated learners
- Training resources
- Continuous assessment
Features of High-Fidelity Simulation Leading to Effective Learning

- Clinical Variation
- Individualized Learning
- Increasing Difficulty
- Deliberate Practice
- Feedback
- Mastery Learning

Integrated into overall curriculum


Issenberg S, et al. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systemic review. Med Teach 2005
Kern 2009. Six steps approach in developing curriculum
Planning Curriculum Integration

- Develop a curriculum with expected outcomes
- Determine outcomes that are best addressed using simulation in your curriculum (blueprinting)
- Determine the simulation to be used
- Develop content and mode of delivery
- Determine logistics and training needs
ACPE Mandates on Simulation

• In determining acceptable simulation, the Board reiterated the language of the Addendum 1, Section 1.2 of the Policy and Procedures Manual as it relates to:
  - Standards 2007: “Simulation as a component of IPPE should clearly connect the pharmacy activity or delivery of a medication to a patient”.
  
  - Standards 2016, Key Element 12.7 Simulation for IPPE: “Simulated practice experiences (a maximum of 60 clock hours of the total 300 hours) may be used to mimic actual or realistic pharmacist-delivered patient care situations.”
Our Experience

• Budget allocation
• Training Faculty: faculty development through the clinical simulation diploma
• Preparing faculty for the culture change through workshops
• Curriculum integration: PY, hrs, activities, assessment tools
  - Physical Assessment
  - Immunization Elective
  - Introduction to Pharmacy Practice Experiences
    • Community Pharmacy Management
    • Community Pharmacy Practice
    • Hospital Pharmacy Practice
Assessment of Simulation-Based Training
Clinical Assessment Questions

Examiner

Patient

Examinee
## Standardized Patient vs. Simulated Patients

<table>
<thead>
<tr>
<th>Standardized Patient (SP)</th>
<th>Simulated Patient (SiP)</th>
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</thead>
<tbody>
<tr>
<td>A real patient who has been directed to use his/her own history and physical exam findings to participate in the education of medical students</td>
<td>A normal person who simulates a real patient based on varying levels of training</td>
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<tr>
<td>A standardized patient is a person who is not an actor</td>
<td>A lay person who must be trained and coached carefully to play the role of patients</td>
</tr>
<tr>
<td>A standardized patient presents his/her real feelings e.g. emotional and personality characteristics</td>
<td>A simulated patient cannot be recognized by an expert clinician</td>
</tr>
<tr>
<td>A standardized patient is a patient who has been briefed to play a patient role</td>
<td>A simulated patient is a person who is directed by a facilitator to take a role within the simulation</td>
</tr>
<tr>
<td>A standardized patient can be people with or without actual diseases who have been trained to portray a medical case</td>
<td>A simulated patient portrays various scenarios for the teaching and assessment of history taking, communication skills or physical examination where no abnormality is really present</td>
</tr>
</tbody>
</table>

Psychometrics – Considerations

• Simulator do not comprise an entire assessment but serve as tools to complement existing evaluation methods, present clinical findings and facilitate standardization

• Reliability
  - Number of examinees, standardized examiner/patient components

• Validity
  - Construct validity (simulator used for testing – to what extent is it measuring what it needs to measure)
  - Content validity (consensus opinion, test items)
  - Predictive validity (inference on future performance)
Fidelity

- Some aspect of the reality of the experience or likeness of the simulation experience to the real-life circumstance it was designed to duplicate.

- Close to the concept of “face validity”
  - Estimate of whether a test appears to measure a certain criterion.

- Engineering restrictions, psychometric requirements, ethical and safety considerations, time and cost constraints.
Fidelity cont’d.

• Physical (engineering) fidelity
  - Degree to which the simulation device or training environment reproduces the physical characteristics of the real task (appearance)
  - Simulators with high-level engineering fidelity often employ high-tech components
    • Expensive to purchase, operate and maintain

• Functional (psychological) fidelity
  - Degree to which the simulated task duplicates the skills in the real task (behavior)
  - High-level psychological fidelity can be achieved with low-technology methods
    • SP, scenarios

• Highest fidelity may not be necessary for teaching (may be too complex, expensive)
Feasibility

• Cost-effectiveness of using a particular device as an evaluation tool

• Ask:
  - *Can* we afford simulator required resources?
  - *Should* we acquire and implement for a particular evaluation?
  - *Worthiness vs. traditional teaching methods*
Scoring

• Importance of scoring rubrics for simulation-based assessments

• Competency can be a “process” (ACLS checklist/steps/criteria) or an “outcome” (final result e.g. patient status after CPR)
Our Experience

• Checklists developed for each sim-based training based on learning objectives

• Observer rating + feedback to students

• Student evaluation of simulation experience
Objective Structured Clinical Examinations (OSCEs)
OSCEs

• Provide a comprehensive assessment of problem-based learning, as well as building critical thinking, communication skills, and clinical judgement

• Constitute an authentic assessment tool based on the principles of objectivity, structure, and standardization, which allows the assessment of participants’ performance in simulated environments, against standardized scoring schemes by trained assessor
Pre-OSCEs Steps

- Resource availability
- Student numbers
- Organizational structure
- Training of examiners
- Training of SPs/SiPs
- Examination scheduling
- Examination blueprinting and length
- Timeline for test development (up to 12 wks)
- Bank of OSCE stations
- Choice of scoring rubric or global rating scale
Running OSCEs

• Allocation of students to examination centers
• Transport and reporting instructions
• Distribution of paperwork
• Selection of standardized patients
• Selection of examiners
• Confidentiality statements
• Softwares for data gathering, scoring, digital recording, scheduling students and SPs
Post-OSCE Steps

• Handling results
• Publication of results
• Complaints and appeals
• Quality assurance
• External examiners
• Post hoc psychometrics
• Evaluation
Debriefing/Feedback

• What is it?
  - Specific information given to a trainee about the comparison between observed performance and a standard, given with the intent to improve the trainee’s performance
  - “Heart and Soul” of simulation-based training

• May come from different sources and may be given at different times
Our Experience

• Recent curricular and assessment endeavor
  - Faculty development stage
  - Support from the more seasoned School of Medicine faculty
  - OSCE work group
  - OSCE pilot
  - OSCE as an assessment tool of student competencies
Available Technologies

Part task trainers
Computer-enhanced mannequin (CEM) simulations
Virtual reality simulators
Part Task Trainers

• Representations of body parts/regions with functional anatomy for teaching and evaluating particular skills
  - Plastic arms for venipuncture or suture
  - Head/neck/torso mannequin for central line placement or endotracheal intubation
  - Foam pads
  - Vessels filled with mock blood
  - Ocular/Ear examination simulators
  - Breast trainers
  - Surgical/Orthopedic
  - Ob/GYN
Task Trainers
Anesthesia, Emergency Medicine, Critical Care

• Airway trainers
  - Simulate variations in tongue, dentition, other upper airway anatomy
  - Bag-valve-mask ventilation, placement of oral-pharyngeal or laryngeal mask airway, nasal, or oral endotracheal intubation and needle cricothyroidotomy

• Resusci Anne
  - One of the earliest mannequin simulators for teaching and practicing CPR
  - Functional anatomy to perform ventilation and chest compression
  - No pathophysiologic functions or interactive features
  - Mimics full-sized adult but is just one body part
  - Child- and infant-sized mannequins also available
Harvey

• Cardiopulmonary Patient Simulator
  - Most sophisticated example of computerized task trainers
  - Longest continuous high-fidelity simulation project in medical education
  - Not interactive and does not permit performing physical interventions (defib, intubation)
  - Designed to evaluate bedside physical diagnosis skills:
    • Blood pressure, arterial/venous/precordial pulses, heart and lung sounds
    • 30 different cardiac conditions
  - Portable
  - Can speak via wireless microphone from the operator
  - No programming/personnel required; computer is self-contained within the unit Used in rotations and high stakes certification exams
Pros and Cons of Part Task Trainers

• Advantages
  - Less expensive (low engineering fidelity)
  - Can reproduce the task to be assessed with moderate-to-high degrees of psychological fidelity

• Disadvantage
  - Interface with the user is passive (no response from model)
Computer-Enhanced Mannequin (CEM) Simulators

• Life-sized (often full-body) mannequins connected to computers
• Reproduce anatomy and normal and pathophysiologic function
• Interface with user can be:
  - Active: simulator responds in a pre-programmed way to user actions (Vfib, HR changes with shock)
  - Interactive: simulator response varies according to user actions (HR changes appropriately based on drug dose)
• Best validated as assessment instruments among other types of simulators
Present-Day CEMs

- **Human Patient Simulator (HPS)** from Medical Education Technologies (METI) – most sophisticated among CEMs
  - Adult-sized
  - Simulated blood pressure, multiple peripheral arterial pulses, breath and heart sounds, pupillary reflexes, salivation, lacrimation, bleeding
  - System included with the simulator can display vital signs, EKG, O2 sat
  - Responds appropriately to Rx admin. and procedures such as intubation, ventilation..
  - Limited portability
  - Pediatric versions
  - Expensive
Other Types of CEMs

• iStan Adult Patient Simulator
• Sim Man
• Sim Baby
  - Infant-sized mannequin to assess pediatric emergency skills
• AirMan
  - Head and torso only
  - Focuses on airway and advanced cardiac resuscitation skills
  - Less complex/less expensive
• HAL/Noelle
Pros and Cons of CEMs

• Advantages
  - High-fidelity
  - Assessment can focus on individual skills or team skills

• Disadvantages
  - More costly
Virtual Reality (VR) Simulators

• Computer display simulates a physical world and user interactions are with the computer within that simulated (virtual) world
  - 3D games

• Examinees perform procedures on virtual patients

• Audiovisual features

• Haptic technology (feel of procedure)
  - Provides a lifelike feel during scope insertion and instrument manipulation
VR Simulators
Pros and Cons of VR Simulators

• Advantages
  - Evaluate both individual and collaborative skills
  - Examinees need not be collocated with team members even with the examiner
  - “Distance testing”
  - Very high-fidelity

• Disadvantages
  - High cost
Select Virtual Patient Softwares

- DecisionSim (Kynectiv)
- MyDispense
- NEEHRPERFECT
Our Experience

• Use of part task trainers:
  - Didactic courses such as physical assessment, immunization elective
  - Introductory hospital pharmacy practice experience

• Use of iStan:
  - Interprofessional simulation activities
  - Prospective use in the pharmacotherapeutics series
Challenges and Pearls
Exemplars of Simulation-Based Pharmacy Activities

• Student counsels a standardized patient on appropriate contraceptive choice given the patient’s condition and preference

• Student interviews a simulated, standardized patient and is assessed for professionalism, communication, accuracy, and quality of information

• Student verbally communicates a simulated, standardized patient’s history, medication-related problems, recommendations, and a plan for follow-up succinctly and effectively to a simulated prescriber

• High-stakes testing requires high reliability
Challenges of Simulation-Based Education

- Direct & indirect costs (human resources, device maintenance)
- Development of scenarios, time- and resource-intensive
- Lack of portability (bulky) or lack of flexibility to design testing with devices
- Research on simulation – evidence of face, construct & content validity, NOT “predictive validity”
- Pedagogical issues – standardized instruction
  - Computer-based training of SPs reduces variability in training
- Team training – looking at outcomes
- Training of trainers and SPs; calibration of examiners
Practical Suggestions

• Defined learning outcomes should drive the use of simulators for assessment
• Start with blueprinting that enumerate the competencies then determine the optimal instructional strategy to attain goals and assessment tools to attain best outcomes
• Evaluators must match the features and fidelity of the simulator to the competencies under examination
• Use early on in the undergraduate teaching and not only postgraduate
Practical Suggestions *cont’d.*

- Innovative ways: include coupling task trainers with SPs
  - HYBRID Simulation
- VR integrated with simulation: augmented VR will allow for assessment of complex procedures (if available)
- Simulators complement OSCEs in various areas of health education
- Time and cost of training personnel (avoid re-inventing the wheel, share experiences, evaluation tools, scenario scripts)
- Greater use for high stake assessments / licensure
References


Questions?

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