Designing a Simulation Program

for

Polish Medical Universities

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Background:

Medical education is rapidly changing and simulation is becoming an integral part of these changes because of its ability to teach and objectively assess skills, critical thinking and management. Furthermore simulation is a tool that is becoming integral in improving patient safety.

The American Association of Medical Colleges made the following statement: "Simulation has the potential to revolutionize health care and address the patient safety issues if appropriately utilized and integrated into the educational and organizational improvement process."[1]

In 2010, the first multidisciplinary medical simulation center was established in Poznan, Poland. This center became the model for medical simulation in Poland. Following the opening of this center in October 2010 several meetings in Warsaw with the participation of medical university's and the Ministry of Health lead to Poland receiving $60 million euro for the development of a national simulation network.

This report provides recommendations based on the data from 5 years of experience using simulation in Poland; and current recommendations from medical education societies. The purpose is to help the Polish medical universities transition their current education program to include medical simulation in order to improve medical education and improve patient safety.

This report is divided into three parts: (1) Introduction of observations and insights into best practices that define the field of simulation and medicine at this time, (2) The Approach that is advocated for Simlab based on international best practices and Polish experience and (3) The Organizational Steps to Establish a Simlab.

(1) Introduction of Best Practices:

Polish medical universities are attempting to improve on the current medical education program to meet EU and Polish requirements. The national discussion to implement simulation began with the change in Polish law that eliminates the mandatory internship year for an unrestricted medical license. Discussions that began in 2010 evolved around medical simulation being able to guarantee competency in specific clinical skills and provide an objective assessment tools in the form of OSCE's (Objective Standardized Clinical Exam) to assess competency prior to graduation.

Poland also educates students from North America and Europe so a brief review of the assessment and recommendations of changes in medical education from North America and Europe are included. There is a considerable amount of overlap and the goal is competency based education.

A report by the Carnegie Foundation entitled "Toward a Vision for the Future of Medical Education" made the following assessment of the current medical education system in the United States.[2]

- Medical training is inflexible, excessively long and not learner centered.
- Clinical education is overly focused on inpatient clinical experience, supervised by clinical faculty who have less and less time to teach and who have ceded much of their teaching responsibilities to residents, and situated in hospitals with marginal capacity to support their teaching mission.
- There are poor connections between formal knowledge and experiential learning
- Inadequate attention to patient populations, systems of health care delivery, and effectiveness.
- Learners have inadequate opportunities to work with patients over time and to observe the course of illness and recovery.
- Students and residents often poorly understand non-clinical physician roles.
- Medical education does not adequately make use of the learning sciences.
- The pace and commercial nature of health care impede the inculcation of fundamental values of the profession

The authors of "Toward a Vision for the Future of Medical Education" recommended the following four goals for improving medical education:

1. Standardization of learning outcomes and individualization of the learning process;
2. Integration of formal knowledge and clinical experience;
3. Development of habits of inquiry and innovation; and
4. Focus on professional identity formation

WFME Guidelines

In 2012 the World Federation of Medical Education [3] updated its guidelines for European medical education. The details can be found at www.wfme.org. I want to draw to the reader's attention of some of the recommendations in this report that will support a common theme. The report recommends:
1) Clear objectives/expectations of the students
2) Moving toward a more integrated curriculum
3) Using contemporary teaching modalities.

Current medical Education:

Taught	Not Taught
Facts/diseases	Decision making
Therapies	Communication
Physical exam	Team approach

(2) Sim Lab Recommended Approach

Best Evidence for Medical Simulation:

A review by Steinert et al.[4] produced a best evidence in medical education report on simulation and described the following features and uses of high fidelity medical simulations that lead to effective learning:

1. Mechanism for repetitive practice
2. Ability to integrate into a curriculum.
3. Ability to alter the degree of difficulty.
4. Ability to capture clinical variation
5. Ability to practice in a controlled environment
6. Individualized active learning
7. Adaptability to multiple learning strategies
8. Existence of tangible/measureable outcomes
9. Use of intra-experience feedback
10. Validity of simulation as an approximation of clinical practice

Poznan Experience:

The Simulation center at Poznan University of Medical Sciences was the first multidisciplinary simulation center established in Poland. It was also established as a free standing entity not affiliated with any particular department. This was done intentionally so simulation would not be associated only with anesthesiology and resuscitation. When the simulation center was established assessment of scenarios and curriculums was integrated as part of routine operations of the center. We have selected several examples of the utility of simulation and how data from simulation courses can be used to evaluate and improve medical education.

Paramedic Pilot study

In this pilot study we evaluated 4 teams of 2 person paramedic teams using a self-evaluation survey and 4 simulated scenarios. In the self-evaluation surveys paramedics rated their abilities higher than actually demonstrated during the simulations. Standardized checklist from the National Registry of Emergency Medical Technicians were used for objective assessment.

Results:

- Polish paramedics rated their performance higher than was objectively measured
- Polish paramedics did not meet minimum requirements in management of pediatric advanced life support, pediatric trauma, and trauma of pregnant patient.
- There was insufficient feedback during their training on clinical performance.

Conclusion:

Overall this pilot study demonstrated that the paramedic curriculum did not adequately prepare the students for the skills and management of core clinical competencies the Ministry of Health has listed as scope of practice for paramedics.

Recommendations:

- Simulation is an effective tool to guarantee mastery of learning of the required skills and guidelines required by the scope of practice established by the Ministry of Health.
- Simulation is an effective tool for objective assessment of paramedics' knowledge and skills.

Medical Student Clinical Decision Making.

To obtain baseline data on how best to utilize simulation in the Polish medical curriculum we assessed the performance of 6^{th} year medical students by testing them on a morphine overdose cases. The students were presented with a clinical scenario of an unconscious patient. The human patient simulator was programmed to demonstrate the signs and symptoms of a patient with morphine overdose and would respond appropriately to the management of the students.

Results:

- 6^{th} year (final year) of studies had acquired knowledge but did not know how to use that knowledge.
- The students had difficulty in identifying morphine overdose in a clinical setting but easily identified the overdose when given in the form of a multiple choice questions.
- Students were not receiving adequate feedback on their clinical rotations to learn how to apply their knowledge and skills.

Conclusions: Students in their final year of study have adequate knowledge but have difficulty in applying that knowledge in a clinical context.

Recommendations:

- Simulation can be used as a tool to assess the knowledge and skills gap to performance.
- Faculty development needs to be conducted to inform faculty on how to give effective feedback during the clinical rotations.

Elective in Managing an Acutely Ill Patient

Medical students rarely have an opportunity to manage acutely ill patients during their clerkships. Human patient simulators allow trainees to gain experience in managing acute illness such as myocardial infarction, diabetic ketoacidosis, pneumothorax, and sepsis in a safe and realistic environment. Furthermore, we can reproduce the exact same clinical scenario for an entire class and compare performance of groups from the same year or different years to provide

data not only on student performance but on whether the education program being taught is adequate.

The pilot elective for managing acutely ill patients was conducted 3h a day over 5 consecutive days. Emergency cases from obstetrics and gynecology, critical care, internal medicine, general surgery, and pulmonology and thoracic surgery were employed. We used checklists and global performance rating to assess all the scenarios.

During the 5 day period we observed marked improvement in the students' management, team work and communication. In regards to communication a notable improvement was observed in a student dialogue with the patient explaining that he was now going to uncover and examine the patient's abdomen.

Results:

Our Global assessment showed improvement over the five days in the following areas:

1. Identification of a critically ill patient
2. Appropriate assessment of the critically ill patient
3. Calling for help early
4. Ordering of appropriate tests.
5. Initiation of appropriate management in a timely manner.

Conclusion:

Simulation is an appropriate tool to prepare medical students to manage acutely ill patients. The benefit of simulation was not limited to only helping students with technical skills such as medical management but also with non-technical skills such as teamwork and communication. The pilot study also demonstrated that the time required to improve the knowledge/skill gap to performance could be achieved with minimum hours and in fact could be integrated into the existing curriculum.

Recommendations:

- Implement simulation into the existing clinical rotations.
- OSCE assessments at the end of core rotations should be implemented to assess the progress of medical students.

(3) Recommended Organizational Steps to establish a Sim Labs and a Network in Poland:

General Guidelines:

1. Simulation should be used to enhance the curriculum to meet the objectives and competencies established by the Ministry of Health to prepare medical students as independent clinical providers.
2. Simulation scenarios should be integrated into the program curriculum.
3. Each simulation center should establish a core simulation faculty.
4. All faculty at the university who use simulation should have adequate training and scheduled performance evaluation.
5. All students participating in simulation should have equivalent opportunity to perform task training and/or participation in a scenario.

Recommendations for Simulation:

A. Personnel:

All faculty members that use simulation for teaching and/or assessment need to have adequate training and routine performance reviews.

Having a core simulation staff will create a fixed cost for the university. It will also provide expertise in simulation and serve as a resource for the university. The Simulation staff will also be able to conduct train the trainer courses at the university as part of their duties to increase the number of faculty who can teach using simulation technology.

The other key role of the simulation staff will be the design and implementation of assessment tools for the faculty and university to ensure that students are learning and progressing.

1) For simulation used for teaching/learning task training the recommended ratio should not exceed 1 trainer for 3 students.
2) Formative use of simulation (teaching sessions) in scenario based teaching should have 1 facilitator per 4-6 students.

3) Summative assessment using simulation for an individual student should have a minimum of 2 evaluators. Evaluations can be performed by direct assessment or recorded video. (Williams, Klamen, Mcgaghie 2003)

4) The simulation center should have sufficient staff to set up and maintain simulation equipment; provide support for running scenarios; and provide support to the university faculty in creating and assessing simulation curriculum.

B. Equipment, Physical Resources and Policies:

Simulation equipment can be divided into simple task trainers; advanced task trainers, high fidelity manikins and virtual reality. Each university will need some of each. In purchasing task trainers some such as central line trainers have useable parts. It is recommended that additional useables be made with the initial order and then planned for as a cost in each academic year. For example if the central line course is taught in the anesthesiology rotation then the department should add the cost of central line kits and task trainer parts to its annual budget or to the simulation center budget. It is also recommended that the extended warranty be purchased for all high fidelity task trainers and manikins. Depending on the use of the manikins' amortization should be planned on 3-5 years to replace.

Simulation requires physical space for storage, utilization and maintenance/repair of simulators. Additionally policies are required that protect the confidentiality of student and faculty that includes the security of all video content. Because of the portability of simulation equipment and the ability of in situ use policies regarding use, storage and maintenance in locations outside the main simulation center need to be developed.

Minimum simulation space requirements:

1) Simulation room with a control room.

- Simulation rooms should be multipurpose

- The number of simulation rooms will depend on several variables and include the ability of an institution to conduct in situ simulations. Most Polish universities will require at least 10 rooms to meet the educational mission.

2) Equipment of equivalent fidelity to that seen in the clinical setting.

3) Audio/video system with playback capability for debriefing.

4) Observation room for students observing a simulation.

5) Informed consent and confidentiality agreements for students and faculty.

C. Educational content for simulation scenarios.

After completing and educational needs assessment for all courses in the basic and clinical science courses the appropriate equipment for teaching and assessment can be procured to meet the curricular goals of courses and the medical school program at large. The table outlining required skills in"**ROZPORZĄDZENIEMINISTRA ZDROWIA[1)]**z dnia 30 lipca 2012 r.**w sprawie ramowego programu zajęć praktycznych oraz sposobu ich odbywania, dokumentowania i zaliczania"** should be used to identify core competencies to be taught using simulation.

1) All simulation content will have aligned goals and objectives.
2) Simulation objectives will include cognitive, affective ad psychomotor domains.
3) Standardized simulation scenario development process.
4) Structured debriefing with scenario participants.
5) Structured observational assignments that promote critical thinking for group of students that are observing their peers in a simulation scenario.
6) Validation of a scenario to ensure it is consistent with current medical practice.
7) Evidence of longitudinal use of simulation in the curriculum.
8) Annual report to the medical school administration as to the subjective and objective data of simulation performance by students and faculty with recommendations for improvement.

D. Faculty Development

The key to a successful simulation program is faculty development. Once a core simulation staff is designated and trained they can facilitate incorporation of simulation into existing curriculum designing new curriculums. The learning curve for clinical faculty to use simulation is quite small. As content experts clinical faculty already have the knowledge and experience to teach content from their specialty. As an example suppose we are teaching a case of Diabetic Ketoacidosis that presents to the emergency department. An emergency medicine, critical care or endocrinology physician could easily manage this case. In the simulation lab they will have assistance from the core simulation staff in helping write up the case; program and run the simulator; and conduct the debriefing. Over time some of the clinical staff will become comfortable in

programming and running the simulator themselves. If they become proficient or not the resources exist in assisting in the set up and running of the scenario.

1. Develop a curriculum for using simulation for faculty.
2. Develop a debriefing curriculum for faculty.
3. Evaluation process for faculty that is done no less than annually
4. Mechanism for remediation of faculty with poor evaluations.
5. Provide tools assistance with evaluation of simulation courses to allow faculty to make improvements.

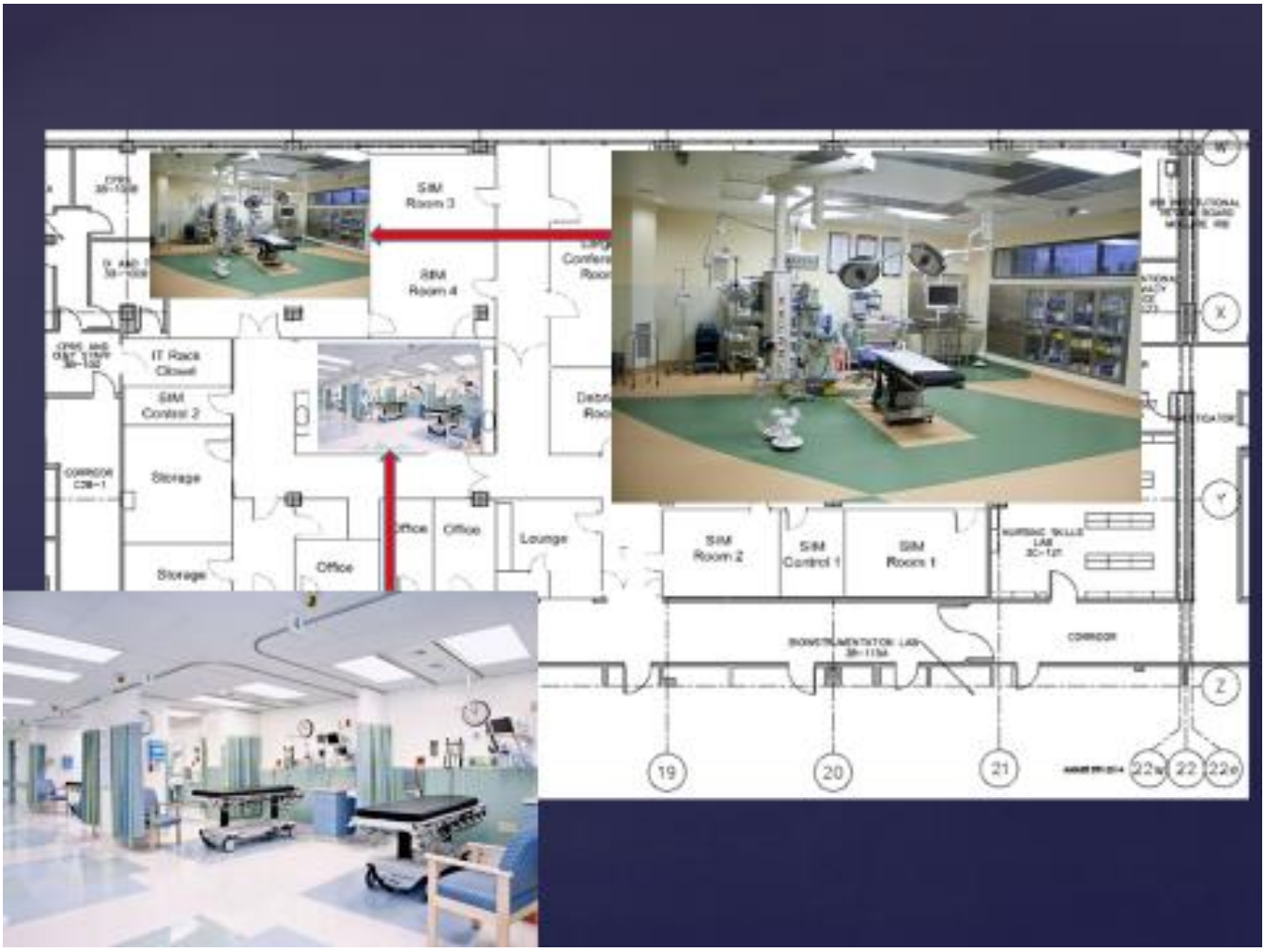
Appendix 1 Simulation Curriculum Examples:

Academic Year	***Course***	***Objectives***	***Simulation Examples***
1	Anatomy	Students will be able to correlate anatomy with clinical findings.	1. Students learn how to examine and tap a knee joint with fluid. 2. Students view ultrasound images of a normal gall bladder and one with gallstones on ultrasound.
2	Physiology	Students will learn how to apply the Starling curve clinically.	1. Students are put in the setting of the emergency department and shown a patient who is tachycardic and hypotensive. They give a bolus of IV fluid and his heart rate and blood pressure improve.
3	Communication	Students will take a history from a standardized patient.	1. Students given feedback by standardized patient as to how the "patient" felt about quality of interview. 2. Instructors assess whether appropriate questions asked.
4	Physical Assessment	Students will practice and then take an objective exam on eye and ear exam.	1. Case 1: 7 year old child with otitis media 2. Case 2: decreasing hearing due to cerumen build up 3. Case 3: assessment of 25 year old with pink eye 4. Case 4: assessment of 60 y/o patient with acute vision loss in one eye.

5	Cardiology	1.Students will be able to interpret basic heart sounds and murmurs. 2. Students will be able to assess and start management of acute myocardial infarction	1. Students work on the cardiac simulator to learn and then be assessed on 5 murmurs. 2. Case: 55 y/o male arrives in emergency department with chest and jaw pain. Students take focused exam, order and interpret EKG and enzymes and appropriately start treatment including consult for cardiac cath. They then write a note to document the encounter.
6	Anesthesiology /Intensive Care	1. Student will learn how to assess and manage the following common problems in the ICU: hypotension, respiratory failure, atrial fibrillation, seizure, sepsis. 2. Student will learn proper aseptic technique and how to gown. 3. Students will learn how to manage a complication from central line insertion.	1. Students are presented clinical cases where they have to make all decisions on assessment and management. They will have a nurse in the scenario to assist them. They are also assessed on their communication skills with the nurse and will be required to make a phone call and provide the family an update as to the change in status of the patient. 2. Student s will be taught how to insert a central line and will be required to a) appropriately prepare patient, b) demonstrate sterile technique, c) conduct a time out, d) insert central line, e) recognize and manage a pneumothorax after line insertion.

Graduation OSCE	Graduating students will be required to complete 10 OSCE stations that assess: a) History and physical exam skills b) Data analysis c) Communication with patient and family d) Communication with staff e) Management of common medical conditions f) Ability to adequately document a clinical encounter.		

Appendix 2. Sample Simulation Center Design



Appendix 3. Sample Equipment list

(Equipment decisions are made after curriculum has been drafted in order to support the objectives of the curriculum.)

Basic skills	**Quantity**	**Price per unit**	**Subtotal**
IV insertion adult	10	250	2500
Foley catheter insertion	6	800	4800
Lumbar puncture	6	800	4800
Eye exam	6	15000	90000
opthalmoscope	6	100	600
Ear exam	6	10000	60000
otoscope	6	100	600
Heart/lung simulator	2	15000	30000
Central line simulator	5	1000	5000
Central line simulator with ultrasound	5	2000	10000
Suture trainer	20	150	3000
Laparoscopic trainer	5	2500	12500
ultrasound	6	15000	90000
Pneumothroax trainer	6	800	4800
Enema/rectal exam trainer	6	600	3600
Vaginal exam trainer	6	1000	6000
Airway trainer adult	6	3000	18000
Airway trainer pediatric	4	2000	8000
Vital signs simulator	2	2000	4000
Wound care manikin	4	2000	8000
Trauma manikin	1	50000	50000
BLS Adult manikin	10	1000	10000
BLS Child manikin	10	1000	10000
BLS infant manikin	10	1000	10000
ALS adult manikin	6	30000	180000
ALS child manikin	3	20000	60000
ALS infant manikin	3	2000	60000
ALS birthing manikin	2	50000	100000
Human Patient Simulator adult	2	150000	300000
Human Patient Simulator child	2	100000	200000
Human Patient simulator infant	2	100000	100000
Advanced human worn trauma surgical suit	2	100000	200000
Hospital beds	10	5000	50000
stretcher	2	1000	2000
Wheel chair	1	1000	1000
Ambu bags adult	10	30	300
Ambu bags child	10	30	300

Ambu bag infant	10	30	300
Intubation set adult	6	200	1200
Intubation set pediatric	6	200	1200
Cricothyrodomy kit	2	250	500
Oralpharyngeal airways	6	50	300
Nasal pharyngeal airways	6	50	300
Oxygen supplies	6	100	600
Defibrillator	3	10000	30000
AED trainer	3	250	750
AED	3	2500	7500
suction	6	250	1500
backboard	3	200	600
Cervical collars	6	100	600
Head immobilizer	3	200	600
splints	4	100	400
bandages		500	500
gauze		500	500
Moulage kit	3	1000	3000
Code cart adult	3	1000	3000
Code cart pediatric	2	1000	2000
television/monitors	15	1000	15000
projectors	3	1000	3000
AV system		500,000	500000
Scenarios		25000	25000
Sim Center faculty training		25000	25000
Medical School faculty training		50000	50000
Replacement parts		50,000	50000

	2423150	
	x 2o% mark up =	965060
	x 23% vat =	776873
total =	$4,154,583	USD

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