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13. SUPPLEMENTARY NOTES 8th Annual International Meeting on Simulation in Healthcare, held January 13-17, 2008 in San Diego.					
14. ABSTRACT This contract supported the publication and distribution of research presentations in the area of simulation in healthcare via print and on-line video. These presentations increased the knowledge of best practices to incorporate into simulation programs and partnerships. Research was divided into education, patient safety and technology. Simulation is increasingly being used to train health care professions and being used for high stakes assessment.					
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Table of Contents

	<u>Page</u>
Introduction.....	4
Body.....	4
Key Research Accomplishments.....	4
Reportable Outcomes.....	5
Conclusion.....	6
References.....	7
Appendices.....	8-42

Introduction:

The 8th International Meeting on Simulation in Healthcare provides an exciting and unique experience for a diverse population of stakeholders who share a common mission to promote excellence in patient care through innovation and collaboration. These include: physicians, nurses, prehospital providers, educators, engineers, technology specialists, administrators, center operators, other clinical providers and non-healthcare simulation enthusiasts. Participants will be able to deepen their understanding and application of the latest advances in simulation methods for training and assessment; describe innovations in simulation-based research and development, identify the growing opportunities for multi-center collaboration; improve their effectiveness as center operators, curriculum and scenario developers, learner and program evaluators and researchers and designers. The program addresses the spectrum of introductory to advanced topics through a variety of engaging sessions that include keynote and large group presentations, interactive workshops, expert panel and roundtable discussions, affinity group meetings and research abstract presentations. Interdisciplinary themes covering broad areas of research, education, team training and assessment are embedded throughout the conference. All simulation methods will be represented including mannequin and computer-based simulators, virtual reality systems, standardized patients and task trainers.

Body:

The 8th Annual International Meeting on Simulation in Healthcare, held January 13-17, 2008 in San Diego was attended by about 2000 individuals representing multiple clinical and service areas and industry representatives. The program offered 26 CME hours. Presentation included:

- 11 Expert Panel sessions on a variety of topics; 33 faculty
- 28 Hands on workshops; 56 faculty
- 8 Post Graduate Courses; 25 faculty
- 11 Roundtable discussions on topics of interest and/or concern; 22 faculty
- 69 Research abstract presentations
- 117 Work in Progress and How I Do It abstract presentations

The keynote and educational presentations are available to the public on-line. Other selected panel sessions are also available to members and attendees of the conference and by request to the public.

Research abstracts were published in Vol 2 Issue 4 of the Society's Journal, Simulation in Healthcare and are also available on-line.

Key Research Accomplishments:

- 11 Expert Panel sessions on a variety of topics; 33 faculty
- 28 Hands on workshops; 56 faculty
- 8 Post Graduate Courses; 25 faculty
- 11 Roundtable discussions on topics of interest and/or concern; 22 faculty
- 69 Research abstract presentations
- 117 Work in Progress and How I Do It abstract presentations

Reportable Outcomes:

The following is a list of presentations and activities at the conference.

Sunday January 13

8:30 am – 12:30 pm	☐ PG1.A Research Design and Implementation
8:30 am – 12:30 pm	☐ PG1.B Instructor Training
8:30 am – 12:30 pm	☐ PG1.C Starting a Simulation Center
8:30 am – 12:30 pm	☐ PG1.D Curriculum and Scenario Design
1:00 pm – 5:00 pm	☐ SS1 Technology Mini-Workshop Sessions *
1:00 pm – 5:00 pm	☐ PG2.E Standardized Patients & Multi-modality Simulation
1:00 pm – 5:00 pm	☐ PG2.F Nursing Skill Development
1:00 pm – 5:00 pm	☐ PG2.G Grant and Proposal Writing
1:00 pm – 5:00 pm	☐ PG2.H Instructor Training
5:30 pm - 6:30 pm	☐ SS2 New Member/New Meeting Attendee Session *
6:30 pm – 7:30 pm	☐ AG 1: Hospital Based Sim Centers*

Monday January 14

7:00 am – 4:30 pm	☐ Work in Progress Poster Viewing
8:00 am – 9:30 am	☐ PS 1 Opening Session & Keynote Address
10:30 am – 12 noon	☐ EP2.A Educational Standards
10:30 am – 12 noon	☐ EP2.G Operational Technology: SimCtr Ops I
10:30 am – 12 noon	☐ RT2.1 Hospital Information Systems
10:30 am – 12 noon	☐ RT2.2 Working with Non-healthcare Users
10:30 am – 12 noon	☐ V2 (see separate schedule)
10:30 am – 12 noon	☐ W2.1 Train the Raters
10:30 am – 12 noon	☐ W2.2 Set up for Mobile Simulation
10:30 am – 12 noon	☐ W2.3 Manuscript Review
10:30 am – 12 noon	☐ W2.4 Integrating Standardized Patients
10:30 am – 12 noon	☐ W2.5 Designing Complex Scenarios
12 noon – 1:00 pm	☐ AG 2: Pediatrics *
1:00 pm – 2:30 pm	☐ EP3.A Technology – Mannequin Development
1:00 pm – 2:30 pm	☐ EP3.B Simulation-based Research
1:00 pm – 2:30 pm	☐ EP3.G Finance & Physical Considerations: SimCtr Ops II
1:00 pm – 2:30 pm	☐ RT3.3 Leadership Skills
1:00 pm – 2:30 pm	☐ V3 (see separate schedule)
1:00 pm – 2:30 pm	☐ W3.6 Special Effects
1:00 pm – 2:30 pm	☐ W3.7 Curriculums for Mobile Environment
1:00 pm – 2:30 pm	☐ W3.8 SP Nuts and Bolts
1:00 pm – 2:30 pm	☐ W3.9 Advanced Sim Man Programming
1:00 pm – 2:30 pm	☐ W3.10 Instructor Skills
3:30 pm – 5:00 pm	☐ EP4.A Computer-based Simulation Development
3:30 pm – 5:00 pm	☐ EP4.B Non-healthcare Simulation
3:30 pm – 5:00 pm	☐ EP4.G Scenario Planning: SimCtr Ops III
3:30 pm – 5:00 pm	☐ RT4.4 Simulation as Lever for Faculty Development

3:30 pm – 5:00 pm	☐ V4 (see separate schedule)
3:30 pm – 5:00 pm	☐ W4.11 Crisis Management
3:30 pm – 5:00 pm	☐ W4.12 QI Measures for Activities
3:30 pm – 5:00 pm	☐ W4.13 In-situ Simulations
3:30 pm – 5:00 pm	☐ W4.14 Alternate Evaluations
3:30 pm – 5:00 pm	☐ W4.15 Teaching Debriefing

Tuesday, January 15

7:00 am – 4:30 pm	☐ Research Poster Viewing
7:00 am – 8:00 am	☐ AG 3 Technicians *
7:00 am – 8:00 am	☐ AG 4 Psychiatry/Psychology *
7:00 am – 8:00 am	☐ AG 5 Anesthesiology *
7:00 am – 8:00 am	☐ AG 6 Emergency Medicine *
7:00 am – 8:00 am	☐ AG 7 Nursing*
7:00 am – 8:00 am	☐ AG 8 Standardized Patient Educators *
7:00 am – 8:00 am	☐ AG 9 Canadian Sim Center *
7:00 am – 8:00 am	☐ AG 10 Surgery *
7:00 am – 8:00 am	☐ AG 11 Gaming *
8:00 am – 8:30 am	☐ SS3 SSH Annual Meeting *
8:30 am – 9:30 am	☐ PS 2 Research Keynote
9:30 am – 10:00 am	☐ PS 2a Research Award Winners Oral Presentations
10:00 am – 11:00 am	☐ PS 2b Poster-side Professor Rounds
11:00 am – 12:30 pm	☐ EP6.A Cross-platform Simulation Research
11:00 am – 12:30 pm	☐ EP6.B Credentialing and Accreditation
11:00 am – 12:30 pm	☐ EP6.G Quality Debriefing: Nursing Forum I
11:00 am – 12:30 pm	☐ RT6.5 Ends of Age Spectrum Simulation
11:00 am – 12:30 pm	☐ RT6.6 Engaging Proceduralists through Teamwork
11:00 am – 12:30 pm	☐ RT6.7 Should SSH Certify Instructors
11:00 am – 12:30 pm	☐ V6 (see separate schedule)
11:00 am – 12:30 pm	☐ W6.16 Building Microcomputers
11:00 am – 12:30 pm	☐ W6.17 OB Scenarios
11:00 am – 12:30 pm	☐ W6.18 Educational Research
11:00 am – 12:30 pm	☐ W6.19 Preparing Abstracts/Posters
11:00 am – 12:30 pm	☐ W6.20 Procedural Skills & Feedback
1:00 pm – 2:30 pm	☐ EP7.A Military Challenges to Implementing Simulating
1:00 pm – 2:30 pm	☐ EP7.B Team Training
1:00 pm – 2:30 pm	☐ EP7.G Learner Profiles: Enhancing the Simulation Experience
	Nursing Forum II
1:00 pm – 2:30 pm	☐ RT7.8 Funding Simulation Research
1:00 pm – 2:30 pm	☐ RT7.9 Collaborating with Industry
1:00 pm – 2:30 pm	☐ V7 (see separate schedule)
1:00 pm – 2:30 pm	☐ W7.21 Choose/Evaluation Scenarios
1:00 pm – 2:30 pm	☐ W7.22 Objective/Subjective Debriefing
1:00 pm – 2:30 pm	☐ W7.23 AAMC MedEdPortal
1:00 pm – 2:30 pm	☐ W7.24 Realism/Fidelity
7:00 am – 8:00 am	☐ AG 12 Multi-disciplinary/Critical Care *
7:00 am – 8:00 am	☐ AG 13 OB/GYN *
3:30 pm – 5:00 pm	☐ EP8.A Civilian Challenges to Implementing Simulation
3:30 pm – 5:00 pm	☐ EP8.G Getting Operational: Nursing Forum III

3:30 pm – 5:00 pm	☐ RT8.10 Reality in Simulation
3:30 pm – 5:00 pm	☐ RT8.11 Changing Culture within Institutions for Support
3:30 pm – 6:00 pm	☐ SS4 Simulation Center Coordinators Meeting
3:30 pm – 5:00 pm	☐ V8 (see separate schedule)
3:30 pm – 5:00 pm	☐ W8.25 Use of Pause Time
3:30 pm – 5:00 pm	☐ W8.26 Hi Fidelity for Medical Students
3:30 pm – 5:00 pm	☐ W8.27 Multi-disciplinary Scenarios
3:30 pm – 5:00 pm	☐ W8.28 Multi Professional Outcomes

Wednesday, January 16

7:30 am – 8:00 am	☐ SS5 SSH Affiliated Organizations Updates *
8:00 am – 9:30 am	☐ EP9.D Pre-Hospital: Delivery of High Fidelity Simulation
8:00 am – 9:30 am	☐ EP9.E Improving Educational Pedagogy with Collaboration
8:00 am – 9:30 am	☐ EP9.F SSH Simulation Center Accreditation Program
10:00 am – 11:30 am	☐ PS3 Closing Panel: Key Tips on Key Topics

Conclusions:

This is an annual conference. With extensive evaluation of content and format a number of recommendations have been made for improvement for the 2009 conference the most important is the need to increase the number of “advanced” workshops and sessions for those who have been involved in simulation for more than 5 years.

References:

1. A Ziv, P Wolpe, S Small, S Glick, Simulation-based medical education – An ethical imperative Academic Medicine, 78:783-788, 2003.
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4. DJ Scott Patient Safety, Competency and the Future of Surgical Simulation. Simulation in Healthcare Vol 1:3, 164-170, 2006
5. SB Issenberg The Scope of Simulation-based Healthcare Education. Simulation in Healthcare, Vol 1:4, 203-208, 2006
6. EA Shepherd, CM Kelly, FM SKene, KT White Enhancing Graduate Nurses' Health Assessment Knowledge and Skills Using Low-fidelity Adult Human Simulation. Simulation in Healthcare, Vol 2:1, 16-24, 2007

Appendix

Attached Research Abstracts

RESEARCH ABSTRACT 1

Evaluation of High Fidelity Neonatal Simulation as a Method to Teach Pediatric Residents Neonatal Airway Management SkillsJennifer Arnold^{1,2}, Becky Lowmaster¹, Melinda Fiedor-Hamilton¹, Jennifer Kloesz¹, Dena Hofkosh¹, Patrick Kochanek¹, Robert Clark¹¹University of Pittsburgh School of Medicine, Pittsburgh, PA, United States; ²Stony Brook University School of Medicine, Stony Brook, NY, United States

INTRODUCTION: Current research shows that pediatric residents have poor neonatal airway management skills. In many settings, the general pediatrician is responsible for managing delivery room resuscitation and stabilizing infants in distress. Since 1996, the Accreditation Council for Graduate Medical Education (ACGME) and the Residency Review Committee (RRC) for pediatrics have included neonatal airway management and neonatal intubation as skills required by all trainees prior to graduation. However, multiple changes have taken place over the past 5 years in postgraduate medical education resulting in less opportunity for pediatric residents to practice neonatal airway management skills. Resident work hours have been restricted to 80 hours per week and the number of months residents are allowed to spend in the neonatal intensive care unit (NICU) has decreased. A growing concern for many academic training centers is how to meet the demands of postgraduate medical education, while following RRC and ACGME recommendations. Although there have been few studies documenting current pediatric resident success at neonatal airway management skills, results are concerning. Falck (2003) demonstrated that the success rate of neonatal intubations within three attempts by first year pediatric residents was 50%, by second year residents was 55%, and by third year residents was 62%. A total of 35% of intubation procedures were never successful by pediatric residents at their institution. Leone (2005) reviewed a 10 year database and found the median success rates for first year residents to be 33%, for second and third year residents 40%, and only 68% for neonatal fellows. These studies emphasize that pediatric residents are not mastering a core clinical competency, that of neonatal airway management and intubation skills. As a required competency for graduation and the care of sick newborns there is a need for new and innovative ways to teach this important skill. The goal of this study is to improve pediatric residents' ability to manage the airway of a critically ill neonate including proper set up of resuscitation equipment, bag-mask ventilation, and endotracheal intubation using the infant simulator, Simbaby (Laerdal).

METHODS: 97 pediatric residents at Children's Hospital of Pittsburgh have been randomized to participate in the simulation curriculum. All residents receive the current standards of teaching including the Neonatal Resuscitation Program (NRP). The educational intervention includes a web-based module reviewing management of the newborn in respiratory distress and a simulation curriculum consisting of delivery room scenarios where residents practice delivery room set up, bag-mask ventilation, and endotracheal intubation. The primary outcome is intubation success rates in the clinical arena as documented by respiratory therapists (blinded).

RESULTS: Preliminary intubation success rates (106 intubations) for controls were 53.3%, 37.9%, and 66.7% for 1st, 2nd, and 3rd year pediatric residents respectively vs. study group rates of 66.7%, 62.5%, and 100%. Interim statistical analysis is currently being performed and will be presented at the conference. Study is ongoing, but will be completed by time of presentation.

DISCUSSION: Preliminary results show that pediatric residents who went through the simulation curriculum have better intubation success over controls.

REFERENCES**CATEGORY:** Education**COI STATEMENT:** The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 2

High Fidelity Clinical Simulations in Nursing Education: Senior Students' Response to Critical IncidentsPamela Baxter¹, Janet Landeen¹, David Musson¹, Geoff Norman¹, Greg Peachey¹, Mary Lou King², Wendy Stanyon³, Noori Akhtar-Danesh¹, Mary-Anne Andrusyszyn², Susan Sproul³, Ruta Valaitis¹¹McMaster University, Hamilton, Canada; ²University of Western Ontario, London, Canada; ³University of Ontario Institute of Technology, Oshawa, Canada

INTRODUCTION: This study is the third phase of a multi-phase, multi-site evaluation of clinical simulation in Schools of Nursing in Ontario. The purpose of this sub study was to examine the effectiveness of simulation in preparing senior nursing students to respond to critical incidents in the simulated clinical environment. This study examined the following research questions: What effect does low-fidelity simulation (LFS) vs. high-fidelity simulation (HFS) have on senior nursing students in terms of gaining comfort and confidence, clinical decision making skills, communication, collaboration, and psychomotor skills when faced with a "real-life" clinical crisis? Our hypothesis was that HFS was more effective than LFS in preparing students to manage crisis in the clinical setting.

METHODS: An experimental design was utilized to answer the research question. Fourth year nursing students (n = 36) were randomly assigned to one of three groups. Both intervention groups participated in a 1/2-hour teaching session involving a critical incident (pending cardiac arrest). The first group received instruction via videotape (low-fidelity) and the second group engaged in 'hands on' experience using a high-fidelity simulator (SimMan). The third group (control) received no instruction and relied on their previous clinical knowledge and skills. All groups received a general orientation to the equipment and how to use it. Students were evaluated using an Objective Structured Clinical Examination (OSCE) involving a (HFS) and incorporated a standardized patient to reflect a 'life-like' clinical setting. Students moved through three 20-minute OSCE stations (patient rooms) involving a different critical incident, each requiring the students to respond by providing safe patient care which required them to transfer their knowledge from one station to the next. Students had a multidisciplinary team available to them, and could access them when they felt that they did not have the knowledge or skill to deal with the situation. The time spent at each station included a 5-minute debriefing session. Students also completed pre and post-tests to determine the effect of simulations on their self-perceived levels of confidence, competence, ability to collaborate with other members of the health care team, to make clinical decisions, to assess, communicate, and manage a crisis situation. These scores were later compared to the actual OSCE scores.

RESULTS: Analysis of the data revealed a statistically significant difference between the control group and the high-fidelity group (p = .007) and the control group and the low-fidelity group (p = .035). No statistical difference could be found between the low and high-fidelity groups. Results from the pre-test/post-test revealed a negative correlation between the OSCE scores and the students' self-assessment in all areas except collaboration.

DISCUSSION: Simulation technology is an effective tool in teaching students to respond to critical incidents in the clinical setting. It provides a safe area where students can be given constructive feedback and praise. More research needs to be completed to determine whether or not high-fidelity interventions are more effective than low-fidelity ones.

CATEGORY: Education**COI STATEMENT:** The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 3

Rating Intensivists' Non-Technical Skills and Clinical Performance in Simulated Emergencies Before and After Two Different Simulator Based Course Concepts. A Prospective Blinded Randomized Trial

Florian Hardt, Andreas Fichtner, Mike Haensel, Soeren Weber, Theo Koch, Michael Mueller
Dept. of Anesthesiology and Intensive Care Medicine; Carl Gustav Carus
University Hospital; University of Technology, Dresden, Germany

INTRODUCTION: Medical education is currently a hot topic. More and more people want to be involved in developing new educational and assessment methods and in conducting research in medical education. This study was performed to determine differences in two simulator-based training approaches. The study-group received psychological training focused on crew resource management (CRM) competencies whereas the control group obtained classic medical simulator training. The outcome was measured by comparing pre- and post-treatment human patient simulator data.

METHODS: 32 physicians with more than 6 months experience in intensive care medicine had been randomly selected and divided into two groups, the study-group and the control-group. Testing: Half of the participants in each group were randomly assigned to scenario 1 or 2 for pretest and the remaining scenario for posttest. To assess the non-technical skills the test scenarios were evaluated using the anesthetist's non-technical skills (ANTS) assessment tool (1). The evaluation was done by two psychologists who were blinded and had been trained in using the ANTS checklist. The clinical performance of the participants in the test scenarios was rated using a novel designed checklist with 6 items on diagnostic skills, 13 items on therapeutic actions, and 4 items regarding overall performance. Each item was rated with 1 (poor) to 5 (optimum) points. The evaluation was done by two blinded and trained physicians who are experienced in intensive care medicine. Training: Both high fidelity patient simulation courses lasted 8 hours. The study group (CRM) took part in a crew resource management course according to the six steps previously published. This course consisted of four modules on situation awareness, team working, task management, and decision making. Each module contained psychological training including exercises as well as simulator scenarios and video assisted debriefing. The control group (MED) accomplished the same scenarios as the other course. The psychological training was replaced by four theoretical seminars on airway management, induction of anesthesia, periarrest arrhythmias, and advanced cardiac life support.

RESULTS: 29 participants completed the course ($n = 17$: CRM, $n = 12$: MED). Age, gender, and experience did not differ between groups. Concerning the non-technical skills we found in general significant higher values in posttest compared with pretest scenario in the four categories: situation awareness ($p = 0.017$), task management ($p = 0.013$), team working ($p = 0.026$) and decision making ($p = 0.008$) but no significant differences between the two groups. Concerning the clinical performance our study yielded also significant rise between pre- and posttest in the three categories: diagnostic skills ($p = 0.042$), therapeutic actions ($p = 0.045$) and overall performance ($p = 0.003$), but showed also no significant differences between study- and control group.

DISCUSSION: Overall performance of the participants concerning both the non-technical skills and the clinical performance in the posttest was significantly improved compared to pretest. The fact that the intervention in each CRM category was so short may be responsible for the lack of significant difference between the groups in ANTS score. (1) Fletcher G, et al. Anaesthetists' Non Technical Skills (ANTS): evaluation of a behavioural marker system. Br J Anaesth 2003.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 4

A Virtual Reality Simulator for Training Veterinary Students to Perform Rectal Palpation of Equine Colic Cases

Sarah Baillie¹, David Rendle²

¹LIVE (Lifelong and Independent Veterinary Education), The Royal Veterinary College, University of London, London, United Kingdom; ²Faculty of Veterinary Medicine, University of Glasgow, Glasgow, United Kingdom

INTRODUCTION: When a veterinarian is presented with a horse with colic, rectal palpation is part of the diagnostic process. A systematic examination of the abdominal cavity is performed to identify changes in the gastrointestinal tract. However, students have limited opportunities to develop the required skills. Clients are often reluctant to allow trainees to practice on their horses. Additionally, as the examination is internal the student's hand movements are not visible and this makes providing effective instruction difficult. Therefore, a project was undertaken to develop an equine colic simulator using haptic (touch feedback) technology and to evaluate the simulator's potential as a training tool.

METHODS: Computer generated virtual models were created to represent structures palpated in the normal abdomen and in cases of colic (displacements, dilations and impactions of the intestines). The models were evaluated and improved by clinicians at an equine veterinary conference. The 'feel' or haptic properties were adjusted dynamically to capture the expert's knowledge. A teaching protocol was developed for use with the simulations based on information gathered during interviews with veterinarians and a focus group with students. An experiment was then conducted to determine the effects of simulator training on skill development. Sixteen student volunteers, who had no previous experience of rectal palpation of horses, were randomly allocated to two groups. Eight students were trained with the simulator and eight received a PowerPoint tutorial with a clinician on rectal palpation of equine colic cases. Each student then performed a rectal examination on a physical model of the equine abdomen. The students' ability to perform the examination systematically, to differentiate normal from abnormal and to identify the abnormality present were assessed. In the final part of the project, simulator-based tutorials were introduced into clinical rotations and the use of the simulator was discussed with clinicians at the end of the course.

RESULTS: The input from the equine clinicians at the beginning of the project resulted in the development of a range of reasonably realistic models. The experiment to assess the simulator as a training tool found significant differences between the two groups of students, with simulator-trained students being more systematic in their examination technique and more able to differentiate normal from abnormal. The simulator was then successfully integrated into clinical rotations, and benefits identified by clinicians included: being able to direct the examination, giving all students the opportunity to practice, and providing a valuable complement to clinical cases. The main concern was the need to highlight aspects of the real examination not represented in the simulation.

DISCUSSION: A simulator was developed to address some of the challenges faced when training veterinary students to perform rectal palpation of equine colic cases. The simulator equipped students with useful skills and has a valuable role augmenting clinical training. Haptic technology has the potential to provide safe, accessible and effective training environments for all health professionals and therefore, work is underway to expand the range of simulations to other species and procedures.

CATEGORY: Technology Development and Evaluation

COI STATEMENT: Conflict Reported - Sarah Baillie developed a simulator called the Haptic Cow which is now a commercial product sold to vet schools for teaching. The product is marketed and distributed by a company called Virtualis based in the UK. My (i.e. Sarah Baillie's) involvement with the company is an agreement for them to sell the product, I do the training course for new customers/users. The colic simulator described in the abstract is likely to be added to the Haptic Cow package at some point in the future.

Table 1.

	Situation awareness		Task management		Team working		Decision making	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Study group	7.9 ± 2.5	10.4 ± 1.6	12.0 ± 4.3	15.3 ± 3.4	7.9 ± 2.5	9.1 ± 2.9	6.7 ± 2.4	8.9 ± 2.3
Control group	8.5 ± 2.9	9.5 ± 2.7	12.0 ± 3.8	14.7 ± 4.9	7.5 ± 2.2	9.0 ± 4.9	6.7 ± 2.4	8.6 ± 2.7
p_{time}	0.017		0.013		0.026		0.008	
$p_{\text{time} \times \text{group}}$	0.230		0.324		0.552		0.739	

Mean rating of participants in the four categories of non-technical skills (mean ± standard deviation). p -values are given for the difference between pre- and post-intervention (p_{time}) as well as for the group differences ($p_{\text{time} \times \text{group}}$). $p < .05$ is considered significant.

Table 2.

	Diagnosis		Therapy		Overall performance	
	Pre	Post	Pre	Post	Pre	Post
Study group	6.2 ± 1.6	7.5 ± 1.4	19.7 ± 2.7	24.5 ± 5.3	5.9 ± 2.0	7.4 ± 1.5
Control group	6.4 ± 1.7	6.9 ± 1.5	19.9 ± 5.2	22.5 ± 4.1	5.6 ± 1.6	6.6 ± 1.6
p_{time}	0.042		0.045		0.003	
$p_{\text{time} \times \text{group}}$	0.375		0.433		0.534	

RESEARCH ABSTRACT 5

Learning Endotracheal Intubation Using a Simulator in a Clinical Skills Learning Center: An Effect of Direct Feedback from an Expert

Sun Ju Im, Hae Kyu Kim, Hae Jin Jeong, So Jung Yune, Shin Young Kang Medical Education Unit; Pusan National University School of Medicine, Busan, South Korea

INTRODUCTION: Giving feedback to students on their work performance is an essential component of teaching in clinical practice. Corrective feedback encourages learners to modify their behavior to achieve a more desirable result. This study was conducted to investigate the effect of direct verbal feedback from an expert during training endotracheal intubation skill using the manikin compared to practice alone.

METHODS: 154 forth-year medical students at the Pusan National University were randomized to receive training in control or feedback groups. Both groups were taught by an expert using a manikin (Laerdal Airway Management Trainer) in clinical skill learning center. The feedback group ($n = 66$) received verbal feedback from an expert during training. Skill acquisition was tested in the Clinical Performance Examination. The students are categorized in three main groups: Exceeds expectations, Meets expectations and Needs development Exceeds expectations- The student does a near flawless interview or exam addressing most of the elements on the checklist. The student exhibits excellent technique, and excellent communications. The student's performance is above that expected of most fourth year students. Meets expectations- The student does most of the requested task reasonably well. They may miss a number of minor points, and technique flaws are correctable with suggestions from the observer. The student's performance is consistent with that expected of a fourth year medical student. Needs development- The student's exam or history has elements that are so far off the mark that it raises serious concerns about the student's clinical ability to function as a fourth year student or resident. The student's performance or technique is significantly below that expected of most fourth year students at this point in the year.

RESULTS: There were no differences in prior experiences with endotracheal intubation, confidence level to perform the skill and grades of previous clinical clerkship between control and feedback groups. The average score in the feedback group was significantly higher than the control group (14.1 versus 12.0, $p < 0.05$). The result showed no significant relation with training date. When the students were divided into 'exceeds expectations', 'meets expectations' and 'needs development' groups according to the global ratings, the students in feedback group were more in the 'exceeds expectations' group and less in the 'needs development' group compare to control group ($p < 0.05$).

DISCUSSION: This study demonstrated that direct verbal feedback from an expert during training improves the performance of endotracheal intubation skill significantly. Feedback is an essential component of clinical education, especially to educate the inferior students. We think that medical educators should know the way how to either give or receive feedback. Institution had better consider faculty development program to improve teaching skills.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 6

Evaluation of an Orientation DVD for Medical Students Learning Gynaecological Examination

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INTRODUCTION: Gynaecological examinations require effective and sensitive communication, as well as professionalism and competent technical ability. Such examinations may have heightened sensitivity due to exposure of intimate body parts which can lead to embarrassment. This may be pronounced when the clinician lacks experience. An increasing number of women are declining student involvement in intimate examinations, and this has led to a decrease in opportunities for medical students to develop clinical skills in obstetrics and gynaecology [1]. Instructional videos can be an effective adjunct to teaching [2]. We developed a 30-minute instructional DVD using simulated patients (actors) attached to pelvic models (hybrid simulations). The DVD demonstrates smear test and bimanual examination on a pelvic model and then shows two consultations from meeting the patient, explaining and doing the examination to the post-examination encounter. This study evaluates the impact of the DVD on medical students' orientation to this examination.

METHODS: We recruited a convenience sample of fifth year medical students ($n = 19$) at Imperial College London whom we allocated to two experimental and a control group. The first experimental group watched the DVD together, the second group watched the DVDs individually and the control group did not view the DVD until after the study. We used a pre- and multiple post-test study design to assess students knowledge of the examination. Students also participated in a post-test only skills assessment using a hybrid simulation similar to those shown in the DVD. The Direct Observation of Procedural Skills (DOPS) evaluation form [3] was used by experts, simulated patients and students (self-assessment). Students also completed a semi-structured evaluation form designed to elicit their views on the DVD.

RESULTS: Quantitative data showed no significant differences in knowledge, technical ability or communication skills between the experimental and control groups. However, qualitative data suggests that students who viewed the DVD found it to be both valuable in their learning, and a powerful influence on their skills test performance. Students who watched the DVD on their own were more positive than those students who watched the DVD in a group.

DISCUSSION: Overall students had a positive response to the purpose of the DVD. That is, in orientating them to perform a gynaecological examination. Using actors and the pelvic model enabled us to introduce students to the examination prior to working with real patients. It also provided an early opportunity to emphasise the broader context in which all examinations takes place including meeting the patient, performing the examination and post-examination discussion with patient. There were several limitations to the study and further research is being undertaken. We believe that the DVD has potential value for orientating large cohorts of students and is relatively inexpensive.

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 7

Incorporating Simulation-Based Objective Structured Clinical Examination Into the Israeli National Nephrology Nursing AccreditationInbal Levin¹, Rina Sela¹, Hilla Fighe², Orit Rubin³, Shoshana Riba², Sima Reicher², Mazal Albagli², Shuli Benita¹, Haim Berkenstadt^{1,4}, Amitai Ziv^{1,4}¹The Israel Center for Medical Simulation, Ramat Gan, Israel; ²Ministry of Health, Nursing Division, Jerusalem, Israel; ³The National Institute for Testing and Evaluation, Jerusalem, Israel; ⁴Sackler School of Medicine, Tel Aviv, Israel

INTRODUCTION: The Israeli national accreditation in nephrology advanced nursing course has been traditionally based on institutional assessment and national written examination. The need to evaluate examinees' clinical competence using national objective standards while giving formative feedback to the different training programs, and the increased recognition in the validity of medical simulation as an assessment tool, has led the Israeli Ministry of Health to begin a process of incorporating OSCE as an accreditation tool. In this study, we evaluated the perspectives toward the new examination format of nephrology nurse specialists involved in the development and implementation of a new OSCE based examination.

METHODS: 8 nurse specialists in nephrology from 8 different institutions participated in the process. All nurses were involved in writing the traditional written examination, had no or minimal previous experience in medical simulation, experienced the new OSCE as examinees during the examiners' preparation and took an active part as examiners during the examination. The nurse specialists completed feedback questionnaires immediately after the examiners' preparation and after the examination.

RESULTS: Following a task analysis of nephrology nurses and taking into account the advantages and disadvantages of medical simulation, 8 examination stations were developed: in 2 stations communication skills were assessed using role-playing actors, in 1 station examinees were asked to assess communication skills using videotaped scenario, in the other stations clinical tasks such as recognizing and treating hemolysis during hemodialysis were presented using - the SimMan simulator, dialysis shunt model (including arterial pulse and bleeding) and others. Following the examiners' preparation, all participants indicated that the tasks incorporated into the OSCE stations represent the professional profile of nephrology nurses and that they could demonstrate their professional performance as examinees (4 on 1 to 4 Likert scale). According to the feedback following the examination - the aims of the examination station and the evaluation tools were clear 4.0 ± 0.0 , the checklist items were appropriate for nurse specialists evaluation 3.6 ± 0.5 , and standardization was kept during the examination 3.9 ± 0.3 (a 1 to 4 Likert scale was used). The nurse specialists were asked also to comment on the value of different examination techniques for the evaluation of nurse specialists (1 to 4 Likert scale was used). The scoring was: written multiple choice examination 3.4 ± 0.5 , written open examination 3.1 ± 0.6 , oral examination 3.2 ± 0.7 , evaluation by instructors during the clinical rotations 3.5 ± 0.5 the newly developed OSCE 3.6 ± 0.5 .

DISCUSSION: This survey demonstrates that nurse specialists participating in the development and implementation of a new national OSCE for accreditation accept this examination mode as a standard and objective tool. The results give experts' validity to the process aiming to develop OSCE based accreditation tool.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 8

Assessment of Novice Anesthesia Resident Competencies Using High-Fidelity Patient SimulationLauryn Rochlen, Christine Park, Leonard Wade, Robert McCarthy, Rozanna Templin
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INTRODUCTION: Simulation-based assessment of physician competencies is an area of active development. Our study focused on the novice anesthesiology trainee's transition to semi-independent function. There is currently no standard method to evaluate their preparedness for this increase in responsibility and autonomy. A simulation-based method to train and assess competencies at this crucial juncture would be invaluable. In our institution, this transition occurs at six weeks of training. Our hypothesis was that simulation training of novice anesthesia residents in management of acute intraoperative hypoxemia will improve the completion rates and time to completion of relevant tasks by six weeks.

METHODS: Twenty-one first year Clinical Anesthesia (CA-1) residents participated during their first six weeks of anesthesiology training. Three scenarios were created representing different etiologies of acute intraoperative hypoxemia these included bronchospasm, endobronchial intubation and circuit disconnect. Using a wait-list control study design, all participants were baseline tested at week zero, then randomly divided into two groups. During the first three weeks, group 1 received simulation-based training in intra-operative hypoxemia, while group 2 was trained in intra-operative hypotension. After mid-testing at week three, the groups switched. Final testing occurred at week six. Four tasks constituting a general immediate response were chosen for evaluation of correct completion rates and times to completion. These are: recognize decreased oxygen saturation, listen to breath sounds, increase inspired oxygen and call for help. A specific treatment maneuver, withdrawing the endotracheal tube, was examined for correct completion in the endobronchial tube migration scenario. All parameters were measured by reviewing videotaped testing sessions.

RESULTS: All residents in all testing sessions correctly recognized desaturation time to recognition improved from baseline to mid-test regardless of group assignment. Correct completion rates and times for listening to breath sounds and increasing FiO₂ improved from baseline to mid-test, regardless of group assignment. Correct completion rates and times to calling for help improved from baseline to midtest and again from midtest to final, regardless of group assignment. For the specific task of endotracheal tube withdrawal, correct completion was improved at the mid test for residents in group 1 versus group 2 (50.0% v. 9.1% correct completion rate, $p = 0.038$). Residents in group 2 reached the same completion rate by the final testing session (70.0% v. 81.8% correct completion rate, $p = 0.525$).

CONCLUSIONS: This study demonstrates correct recognition of desaturation is independent of experience or specific training. Other tasks, such as increasing FiO₂ and listening to breath sounds, were mastered early. This may be due to increased familiarity with generalized rote reactions rather than specific training. In order to function semi-independently, residents are expected to recognize the need for assistance. Therefore, it is encouraging that higher success rates and reduced times to calling for help were observed at both mid and final tests. Our results demonstrate that certain skills are not acquired until specific training occurs. Using simulation, novice residents learn and practice necessary skills in the immediate and initial management of critical intraoperative events. Furthermore, competence in these skills may be assessed prior to transition to semi-independent function.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 9

Simulator Training Improves Risk Awareness in Beginners of Coronary Interventional Procedures- A Randomized Controlled Study Using A Pulsatile Coronary Flow Duplicator

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INTRODUCTION: Progress in computer technology has promoted virtual-reality (VR) simulators for multiple disciplines in medicine. CATHI is a VR-simulator, which provides a realistic teaching environment for coronary interventions. We assessed the hypothesis that CATHI can improve the hand-eye coordination and psychomotor skills of beginners in coronary interventional procedures.

METHODS: To assess the teaching potential of CATHI a randomized study was performed in 36 residents with knowledge in diagnostic coronary arteriography but no experience in interventional cardiology. 18 persons (group 1) underwent an intensive 8 hour-training program on the CATHI simulator, 18 participants served as control (group 2). Before and after the training session each test-person had to perform a coronary intervention in a pulsatile flow model containing a target lesion at a bifurcation. This procedure was performed in the cath lab under fluoroscopic guidance. All steps of the intervention (handling of wire, balloon and stent) were video-documented and assessed by two independent and blinded observers using predefined objective criteria. Taking these aspects into account the degree of risk awareness was determined.

RESULTS: No differences in baseline variables were found between the groups. Simulator training had no significant effect on the consumption of contrast dye, the time to complete the procedure and the total fluoroscopy time. However, the pre-defined score for risk awareness significantly increased in Gr. 1 (2.75 ± 0.2 vs. 3.93 ± 0.20 $P < 0.01$), but remained constant in Gr. 2 (2.88 ± 0.27 vs. 3.00 ± 0.19 , n.s.).

DISCUSSION: The VR-simulator CATHI is a valid tool for training of catheter psychomotor skills. If the documented increase of risk awareness after VR-training translates into a reduction of the complication rate in beginners of interventional procedures has to be clarified in further studies.

CATEGORY: Technology Development and Evaluation

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 10

Effectiveness of a Virtual Patient Product in Training for Biological Events

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Biological warfare agents such as smallpox and hemorrhagic fever are candidates for use in terrorist attacks. Medical presentations of these diseases may be missed by health professionals or confused with other diseases. At our center, we have used live simulated patients and theatrical makeup to re-create diseases for medical teaching; a method which is cumbersome and expensive. The purpose of this study was to test the feasibility and effectiveness of computerized virtual patient software program designed to teach the recognition of four disease states without the need for live simulated patients.

BACKGROUND: The authors designed and tested a virtual patient product (VPP) using software designed by SIMmersion LLC. This screen based simulation allowed conversations between a learner and the virtual patient based on technology previously used for training in suicide intervention and substance abuse counseling. We designed cases specifically to improve the initial evaluation and management of four patients presenting with a rash and accompanying symptoms. Four diseases were presented: smallpox, varicella, hemorrhagic fever and rocky mountain spotted fever. These diseases were chosen to mix infrequently encountered biological agents with more common illnesses. The simulation was engineered to enable learners to speak with the virtual SP using voice-recognition software while viewing video clips of an actor delivering responses to learner-selected questions. Questions and responses are linked using proprietary software that relies on non-branching logic, resulting in conversations that are never repeated in exact sequence or with the same content.

METHODOLOGY: Seventeen medical and graduate nursing students volunteered to test the product. After instruction on the use of the VPP, study subjects completed all four cases. Subjects could practice as many times as needed. Within one month of receiving the VPP, all subjects were assessed by an OSCE using live simulated patients portraying the four diseases under study. Outcomes were measured by analysis of clinical skills checklist items scored by the simulated patients and an end of project survey of the study subjects.

RESULTS: 14 medical students and 3 nursing students completed the VPP. The mean time each subject spent using the VPP was 63.3 minutes. Analysis of checklist items revealed that subjects asked 69.4% of relevant history items, performed 84.8% of critical PE components, and documented the correct diagnoses and management in all cases. In post project surveys, 80% of subjects reported that they became immersed while using the VPP and 82.4% reported that the VPP positively affected their ability to make the correct diagnoses during the OSCE. Conclusions: A virtual patient simulation for biological events was effective in training learners to recognize and correctly diagnose the diseases under study. The VPP was feasible to use and engaging to learners. When teaching large numbers of providers, this method may be an alternative to using live simulated patients.

CATEGORY: Education

COI STATEMENT: Conflict Reported - Dale Olsen is president of SIMmersion LLC, and Debbie Sticha is an employee of SIMmersion LLC. No other authors have any relationships that would constitute a conflict of interest.

RESEARCH ABSTRACT 11

High-Fidelity Patient Simulation-Based Pediatric Emergency Training for Emergency Medicine Residents

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INTRODUCTION: Emergency medicine (EM) providers must be prepared to care for severely ill children because the majority of ill children present to general emergency departments. The rarity of severe childhood illness limits the opportunities to learn from clinical experience. Other methods of providing training are needed. Simulation offers an alternative method to improve exposure and acquire necessary practice.

METHODS: 69 residents from two EM residencies participated in a randomized, wait-list control trial. An initial intervention group received a six-case, single-day sim-based training. The control group receiving no simulation-based training. One month later, all participants were evaluated using three simulated cases covering similar material. The control group received identical training three months later and then a second round of evaluation followed. Each resident was evaluated by two raters using dichotomous (37–61 item) checklists. Percent correct for each checklist is reported. T-tests were used to compare mean scores and ANOVA was used to assess the effect of possible confounding variables. Rater agreement was assessed using intraclass correlation (ICC).

RESULTS: The educational intervention resulted in a statistically significant effect for two of three evaluation cases for the second evaluation phase (Table). Training year was significantly associated with performance for all cases. In a multivariate analysis, training year and session (2nd evaluation session) predicted score but study group did not. ICC for the three checklists was 0.88.

DISCUSSION: A single-day, intensive sim-based training in pediatric EM content resulted in limited educational gains. The rating approach appears valid and reproducible for the population studied. The logistics of studying a larger group necessitated the single-day intervention design and likely limited our effect. Future studies should consider designs that incorporate multiple rounds of practice despite the increased workload. In addition, using different teaching and evaluation cases may be a more conservative method to measure learning effectiveness, as it requires learners to generalize.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 12

Interrater Reliability of Data from Difficult Airway Simulations

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INTRODUCTION: The ability to utilize simulation based assessment for establishing competency and other high stakes assessment necessitates the investigation into the reliability and validity of data collected during the simulation scenario(s). Our study evaluates the interrater reliability of the data collected during difficult airway management scenarios with a method that uses the Laerdal SimManTM high fidelity human simulation system software.

METHODS: Nine experienced simulation course instructors individually viewed five prerecorded simulated difficult airway cases on video. Six had extensive experience teaching with the system in a difficult airway program and three were novice instructors having taught less than three courses. The participants were not given any further instruction. They used the SimManTM software and recorded the tasks performed by the trainee as if they were operating the simulator during an actual airway course. The data was recorded into XML files by the software. We evaluated interrater reliability by calculating kappa values and percent of correlation when kappa scores could not be calculated.

RESULTS: The overall kappa for all nine facilitators across all tasks for all five scenarios was 0.6. The Kappa for all nine facilitators by individual scenario ranged between 0.5166 and 0.7592. Kappa for each individual task ranged from 0.0065 to 0.8468. Percent correlation ranged from 77%–99.5%. The facilitators did not exhibit a higher kappa value or percent correlation as they completed each scenario and did not appear to be impacted by their previous simulation experience. Procedural task scored higher than tasks requiring a judgment rendered by the instructor.

DISCUSSION: There is an overall high interrater reliability when using the SimManTM data collection system during airway simulation scenarios. Overall, the kappa values and percent of correlations indicated very high rates of interrater reliability for documenting the completion of procedural tasks. Less reliability was noted on items that required a judgment to be rendered by the evaluator. The need to develop instructor preparation for data collection is necessary to ensure reliable result collections, particularly in items requiring judgment by the instructor. It appears that this method of data collection has the capability to collect highly reliable data during simulation scenarios.

CATEGORY: Technology Development and Evaluation

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 13

Evaluation of Effect of Cathsim Intravenous (IV) Simulation Training on Nurse Anxiety, Confidence and Patient Satisfaction Related to IV StartJenya Antonova², Kelly Bennett¹, Kendra Jacobsen¹¹Madison Patient Safety Collaborative, Madison, WI, United States; ²Center for Health Systems Research and Analysis (CHSRA), Madison, WI, United States

INTRODUCTION: There is evidence that skillful start of intravenous (IV) infusions reduces patients' pain and anxiety and improves their satisfaction with care. The Madison Patient Safety Collaborative (MPSC) team investigated the effect of CathSim Accutouch vascular access simulator training on improving IV start skills among nurses working in Madison WI. The aim of this project was to evaluate effect of CathSim training on nurses' IV start skills, anxiety and confidence related to IV start, and patient satisfaction with their IV start experience.

METHODS: Seventy nurses were recruited from four area hospitals (non-surgical units) and two clinics with multiple specialty areas (e.g., urgent care, primary care, and pediatrics). Participation in the study was voluntary and free. Half of the recruited nurses started an IV once a month or less. Training occurred over a three-month period. The train-the-trainer approach was utilized in the study. One trainer was assigned to all units and provided initial instructions on the enrollment day and support during individual practice. After initial instructions, the simulator was available to all enrolled nurses for practice at their own convenience for one week. Pre- and post-training surveys were administered to participants to determine their perceived level of confidence (Likert scale: 0 = not confident at all and 10 = extremely confident) and anxiety (Likert scale: 0 = not anxious at all and 10 = extremely anxious) with IV administration, and overall satisfaction with CathSim training (Likert scale: 0 = not satisfied at all and 10 = extremely satisfied) (post-test only). After nurses' practice, patients in the unit were asked to complete a survey about their IV experience consisting of two questions comparable with Press Ganey. A paired t-test was used to evaluate the effect of CathSim training on nurse's confidence and anxiety levels associated with IV start.

RESULTS: All enrolled nurses completed a pre-training survey and 31 completed the post-training survey. Twenty six patient satisfaction surveys were returned. CathSim training reduced nurses' anxiety (from 3.18 to 3.02 points) and increased their confidence (from 6.02 to 6.58 points) with IV starts. Nurses with IV experience once a month or less reported significant decrease in anxiety, from 4.46 to 3.65 (p-value = 0.004). Experienced nurses had low anxiety at the pre-test, which did not change. Overall, nurses with less experience performing IV starts reported more positive experiences with the CathSim device. Nurses' comments varied regarding CathSim training: some appreciated the opportunity to practice IV starts others mentioned little resemblance to real life conditions. Patients satisfaction surveys reported good (n = 4) and very good (n = 20) experience with their IV starts.

DISCUSSION: Although some findings were not statistically significant, user feedback was positive toward using the CathSim for IV training. Since nurses with less experience reported to benefit from CathSim practice more compared to those who performed IV starts more frequently, we recommend simulated IV training for nurses not experienced with starting IVs such as nursing students, new graduates and healthcare professionals who start IV infusions infrequently.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 14

High Fidelity Simulation as a Technique for Resuscitation Education and Evaluation

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INTRODUCTION: The University of Wisconsin School of Medicine and Public Health, Department of Anesthesiology created a High Fidelity Simulation (HFS) resuscitation elective for 4th year medical students. This 5-day immersion course exceeds the American Heart Association (AHA) requirements for Advanced Cardiac Life Support (ACLS) provider recognition. The course has been consistently ranked as one of the top elective courses in the school since its inception. We hypothesized that students would demonstrate a cognitive and behavioral gain in resuscitation ability after intervention as demonstrated by several measures.

METHODS: The elective is taught utilizing a HFS laboratory with a METI Human Patient Simulator, accurately creating a high acuity patient setting, complete with actual patient monitoring, crash cart with defibrillator, and oxygen. This laboratory is fitted with three cameras, which capture students' performance and parameters displayed on the monitoring equipment. The following types of data were collected and analyzed for this study: a pre and posttest videotape of each student's ability to lead a cardiac resuscitation, the AHA multiple choice pre and posttest, and a pre and posttest written rhythm recognition examination. Analysis of the video data was completed by a panel of AHA experts not affiliated with the instruction of the students in this course or the Department of Anesthesiology. They rated each student's pre and posttest performance for cognitive and behavioral ability.

RESULTS: Examination of the data using the matched-pair Wilcoxon test indicated that students had significantly higher AHA posttest scores compared to their pretest scores (T = 820, N = 40, p < .001). Significantly higher posttest EKG scores were also achieved (T = 818.5, N = 40, p < .001). 100% of the students demonstrated proficiency on their written AHA posttest. Examination of the video data using the matched-pair Wilcoxon test indicated that students had significantly higher posttest cognitive scores compared with their pretest scores (T = 820, N = 40, p < .001). This was also true of their behavioral scores (T = 820, N = 40, p < .001).

DISCUSSION: The results of this study indicate that HFS can be successfully integrated into resuscitation curricula, and that HFS can prepare students for resuscitation crisis management. Additionally, students' behavior on posttest demonstrated that they had a significant gain in their ability to manage resuscitation. This research also addresses some of the challenges reported in the literature, calling for more rigorous research demonstrating the validity of simulation as a teaching and evaluative technique. Our research increases the available data and findings derived from empirical studies specific to HFS. These findings validate and extend the existing literature related to resuscitation and crisis management supporting the importance of integration of simulation into existing curricula.

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 15

Improving Shift Handoff at the Step-Down Unit Utilizing Simulation-Based Training and Proactive Risk Management Process

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INTRODUCTION: Handoff process should be interactive to enable effective communication among health care professionals.¹ Major barriers to effective handoffs include physical and social settings, language and cultural barriers, and the communication medium.² These factors make the handoff process prone to safety gaps and mistakes. However, it also raises the opportunity for intervention targeted at improving handoff communication skills. In this study nursing shifts' handoffs were observed and prospectively evaluated in order to document the effect of simulation-based intervention on the handoff process.

METHODS: Following ethics committee approval and signed informed consent from 25 nurses staffing a 5 beds medical step-down unit, 224 observations on nursing shifts' handoffs were completed using a preconfigured checklist. Based on the data collected a checklist for effective handoff was developed and incorporated into a full day simulation-based training focusing on team-work and communication skills. Training was conducted at a fully equipped simulated step-down-unit with three full-body manikins and an actress (SP) role-playing a patient's family member. The challenging simulated scenarios included handoff of three patients between nursing shifts and recognizing mistakes in three clinical procedures - medication administration, set up of mechanical ventilation, and blood administration. Audio-visual recording of the scenarios was used for debriefing sessions which following each scenario. 166 observations of handoffs were performed 6–8 weeks following training and results were compared to the pre intervention data using X2 analysis.

RESULTS: Following the intervention, there was an increase in the incidence of nurses indicating patients' name (from 48% to 96%), age (19% to 63%), disease (60% to 98%) and the reason for unit admission (61% to 100%) during the handoff process ($p < 0.05$). There was also an increase in indicating significant clinical events during the last nursing shift (88% to 100%), in presenting treatment goals for the next shift (43% to 69%), in referring to patients' physiological parameters presented by the monitoring system (54% to 84%), and to physicians' medical orders for mechanical ventilation (28% to 89%), sedation (64% to 100%) and medications in continuous infusion (from 65% to 100%). In addition, mechanical ventilators were checked in 8% before the intervention and 66% after, and medications administered in continuous infusion were checked in 11% before, and 65% of the cases after the intervention ($p < 0.05$). However, checking the monitor alarms and adopting them to the patients' status was hardly performed both before (0%) and after the intervention (2%).

DISCUSSION: The study demonstrates the value of simulation-based proactive risk management intervention aimed to enhance safety during patients' handoff. It suggests that effective and targeted simulated practice can result in improved handoff process and reduction in safety gaps as reflected by major changes in nurses' communications and actions during shift handoff process. Further studies are required to explore the long term impact of simulation-based training on handoff practice and on patient safety.

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CATEGORY: Patient Safety Products/Projects

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 16

First Step for Simulation Integration into Paramedic Training Curriculum

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INTRODUCTION: The integration of advanced human simulation (HPS) into any curriculum is a major goal for a training program. It is important to identify those scenarios for which simulator and faculty time will have the greatest impact. We hypothesized that a review of actual student reported field patient assessments would identify both high-frequency as well as infrequent but essential scenarios which could guide planning for curriculum integration of an HPS.

METHODS: **Design:** A single center, retrospective study. **Site:** An established, state-certified paramedic training program utilizing the National Registry of Emergency Medical Technicians Paramedic Curriculum. This lists "Assessment Based Management" scenarios important to demonstrate comprehension, critical thinking and leadership skills, which guided our categories. **Method:** review, collation and summarization of primary student reports of 433 field patient assessments, with categorization into presenting symptom groups.

RESULTS: High frequency presenting symptom categories were cardiac (24.7%), neuropsych (22.6%), injury (22.4%) and pulmonary (15.7%). Low frequency presenting symptom categories were general medical (9.2%), endocrine (4.8%), obstetrics/gynecology (0.5%). Most relevant and adaptable to HPS teaching were cardiac [arrhythmia, (6), chest pain (92), CPR (7)] medical [allergy/anaphylaxis (5)], injury [major trauma (11)] neuropsych [overdose (9)], Ob/Gyn [vaginal bleeding (1)], pulmonary [SOB, etc (60), nonbreather (8)]. Three subsets could be adapted to simulation technology: septic shock, cold/exposure, specialized mannequin for pregnancy. Subsets better taught by standard methods were hypertension (2), abdominal pain (19), infection (6), GI bleeding (3), miscellaneous medical (7), hyperglycemia (7), hypoglycemia (14), burns (2), brain injury (6), musculoskeletal (32), minor trauma (46), headache (5), syncope (33), seizure (19), various neuropsych (26), and stroke (6).

DISCUSSION: A review of actual paramedic student field assessments identified high frequency presenting symptoms (cardiac, pulmonary and injury) which lend themselves to teaching via HPS. However, the high frequency category of neuropsych, numerous subsets of injury, and many of the low frequency category subsets were felt to be better taught by standard didactic methods. This is the first reported analysis of student field experience applicable to integration of simulation into a paramedic curriculum.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 17

Incorporating Simulation-Based Objective Structured Clinical Examination into the Israeli National Advanced Nursing Courses Accreditation - The Examiners' PerspectivesRina Sela¹, Inbal Levin¹, Hilla Fighe², Shuli Benita¹, Shoshana Riba², Orit Rubin^{1,3}, Sima Reicher², Mazal Albagli², Amitai Ziv^{1,4}, Haim Berkenstadt^{1,4}¹The Israel Center for Medical Simulation, Ramat-Gan, Israel; ²Ministry of Health, Nursing Division, Jerusalem, Israel; ³The National Institute for Testing and Evaluation, Jerusalem, Israel; ⁴Sackler School of Medicine, Tel Aviv, Israel

INTRODUCTION: The Israeli national accreditation for 19 different advanced nursing professions has been traditionally based on written examinations. The need to evaluate examinees' clinical competence and the increased recognition of the validity of medical simulation as an assessment tool, has led the Israeli Ministry of Health to begin a process of incorporating OSCE as an accreditation tool. Initially, examinations were developed in the fields of intensive care, pediatric intensive care, neonatology and nephrology and the examination was validated on a group of actual examinees. In this study, we evaluated the perspectives toward the new examination format of nurse specialists involved in the development of the examination content and metrics, as well as in the actual examination day.

METHODS: 39 nurse specialists from 4 different nursing professions participated in the process. All nurses were involved in writing the traditional written examination, had no previous experience in medical simulation, participated in the development of the new OSCE, experienced the OSCE as examinees and as examiners during the examiners' preparation and took an active part as examiners during the examination. The nurse specialists completed a feedback questionnaire immediately after the examination.

RESULTS: 34 different examination stations were used during the 4 examinations including basic clinical skills (e.g. basic life support or connecting a patient to hemodialysis), advanced clinical skills (e.g. recognition and treatment of cardiac arrhythmia), communication skills (e.g. delivering bad news to a family member) and screen based stations (e.g. analysis of chest x-rays). Pulling the feedback on all the examination station indicates that - the aims of the examination station and the evaluation tools were clear 3.8 ± 0.4 , the checklist items were appropriate for nurse specialists evaluation 3.5 ± 0.6 , the examination station represent the professional profile 3.5 ± 0.7 , and standardization was kept during the examination 3.8 ± 0.4 (a 1 to 4 Likert scale was used). The nurse specialists were asked also to comment on the value of different examination techniques for the evaluation of nurse specialists (1 to 4 Likert scale was used). The scoring was: written multiple choice examination 3.4 ± 0.7 , written open examination 2.9 ± 0.6 , oral examination 3.3 ± 0.7 , evaluation by instructors during the clinical rotations 2.9 ± 0.9 , the newly developed OSCE 3.8 ± 0.4 .

DISCUSSION: This survey demonstrates that nurse specialists participating in the development and implementation of a new national OSCE for accreditation accept this examination mode as a standard and objective tool. They also find it superior to other examination tools. The results give experts' validity to the process aiming to develop OSCE based accreditation tools for 700 nurses a year in 16 different advanced nursing professions within the next 2 years.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 18

Fiberoptic Intubation Training: Effect of Model FidelityDeven Chandra¹, Viren Naik¹, Hwan Joo¹, Israel Weiss², Savoldelli Georges²¹St. Michael's Hospital, University of Toronto, Toronto, Canada; ²University of Toronto, Toronto, Canada

INTRODUCTION: Previous studies have shown that fiberoptic orotracheal intubation (FOI) skills can be learned outside the operating room (OR) more effectively on a bench model than by conventional didactic instruction (1). While advancements in bench model fidelity have improved their face validity, they are often associated with increased cost. The purpose of this study was to determine whether FOI skills learned on a high-fidelity bench model are superior to skills learned on a low-fidelity model with respect to transfer of skills to a clinical setting.

METHODS: After IRB approval, Registered Respiratory Therapists (RRTs) were recruited as subjects. RRTs are a useful surrogate for junior anesthesiology trainees because of their experience with FOI equipment and techniques but lack of actual bronchoscopic experience. Subjects were randomized to training on a low-fidelity ($n = 14$) or high-fidelity ($n = 14$) model. The low-fidelity group was trained by experts on a simple non-anatomic box model designed to refine fiberoptic manipulation skills. The high-fidelity group practiced on a computerized virtual reality (VR) bronchoscopy simulator. Following training, subjects performed two consecutive FOIs on healthy, consenting, anesthetized patients undergoing intubation for elective surgery. Two blinded examiners evaluated each subject's FOI performance using a validated checklist and global rating scale (GRS). Success at achieving intubation was also measured. Checklist and GRS scores were analyzed using a two-way mixed ANOVA with "fidelity of training model" as a between-subject variable and "first vs. second attempt" as a within-subject variable. Success was analyzed using Fisher's Exact Test.

RESULTS: There was no significant difference between the low-fidelity and high-fidelity model groups when evaluated with the checklist and GRS ($p = NS$). There was also no significant difference in success at achieving tracheal intubation between groups ($p = NS$). Interestingly, second attempts in both groups were significantly better than first attempts ($p < 0.001$) and there was no interaction between "fidelity of training model" and "first vs. second attempt" scores. Inter-rater reliability was strong (checklist: $r = 0.90$ GRS: $r = 0.85$).

DISCUSSION: These results suggest that there is no added benefit from training on a costly virtual reality model with respect to transfer of FOI skills to intraoperative patient care. The low-fidelity model costs \$20.00 CAD to produce, while the high-fidelity VR trainer retails at \$100,000.00 CAD. In an attempt to justify the increased cost of the VR trainer, this study was adequately powered to demonstrate the potential presence of a large effect of model fidelity on FOI training outside of the OR. Second attempts in both groups were significantly better than first attempts thus reinforcing the importance of clinical experience. Low-fidelity models for FOI training outside the OR are an alternative for programs with budgetary constraints.

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1. Anesth 2001 95: 343-8.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 19

Pre- and Post-Training Self-Assessment of Medical and Non-Medical (CRM) Skills in Prehospital Emergency Helicopter Teams. Results from 130 Participants of Mobile In-Situ Simulation Team Trainings by TuPASS and Team DRF Air Rescue. Alliance Europe

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INTRODUCTION: To evaluate the impact of mobile in-situ simulation team training, 130 participants were evaluated using a pre/post training self-assessment questionnaire. More than 800 emergency physicians and paramedics of Team DRF have been trained.

METHODS: After the training participants completed a questionnaire to self-assess 13 competencies for treating emergency patients before and after the training. The competencies were: "How do you judge your ability in an emergency case to . . . 1) realize when a situation gets critical, 2) keep the overview, 3) set priorities, 4) to delegate and monitor the tasks, 5) coordinate selected tasks, 6) keep track of the delegated tasks and their effects, 7) keep track of other problems to be solved, 8) communicate your plans effectively, 9) consider all available resources, 10) integrate all available information, 11) consider the risks of options, 12) be assertive even with more experienced colleagues, 13) handle an emergency successfully. The evaluation was done using a 6 point scale (very good – very bad). Paired t-test was used to check for significant differences. Hypothesis: the training improves the rating of the 13 competencies of *experienced air rescue teams* in simulated emergency situations.

RESULTS: In Figure 1 there is systematic improvement for all competencies. All differences are highly significant ($p < 0,001$). Looking closely to the self assessments related to crisis resource management.

DISCUSSION: As the teams in air rescue are among the most experienced prehospital emergency teams, it is amazing that even one training day improved their subjective self-assessment significantly. The methods of realistic in-situ team trainings focussing CRM aspects to stimulate self-reflection, seem to be very beneficial.

CONCLUSION: These preliminary data are encouraging to continue the efforts to improve the medical and non-medical skills of professional rescue teams. As the effort for these in-situ trainings is very high, it is essential to have some, even subjective, data supporting the impact in improving skills and patient safety.

CATEGORY: Patient Safety Products/Projects

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 20

Defining Professional Responsibilities of Simulated Patients in Medical Education and Research

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Simulated patients (SPs) are widely used in medical and health professional education. Initially, their contribution was ancillary however there are several drivers to their increased use and centrality. These include ethical imperatives for simulation based learning and assessment, patient safety initiatives, patient empowerment, and increased numbers of medical students with reduced access to patients in clinical settings.

At Imperial College London, SPs are extensively used. We recognise the need to improve several aspects of our SP programme as we move into what is for us uncharted territory. Reasons for clarity include:

- SPs work with students in sensitive and sometimes highly charged situations and are often asked to make judgments about students
- A shared understanding for all stakeholders to minimise the possibility of conflicting agendas
- Our SP bank is expanding rapidly
- The varied and evolving contexts education and research contexts in which SPs are working
- Bringing together significant numbers of culturally disparate individuals
- Demonstrating a commitment to this important learning resource
- Potential for attracting and retaining the most skilled SPs

We proposed that a starting point would be to clearly articulate the "responsibilities" of SPs and those with whom they work.

METHODS: We used questionnaires and interviews in an iterative manner with stakeholders in our SP programme – SPs, students, tutors and administrators. Convenience sampling was used for recruitment. Participants completed semi-structured questionnaires eliciting their experiences of working with/as SPs, what worked, what did not and the perceived responsibilities of SPs, students and tutors. Focus group interviews were conducted with stakeholders. Interviews were conducted by a senior medical student trained in qualitative research methods (VA). Topic guides ensured key topics were covered in each interview further exploring responses from questionnaires. We used a grounded theory approach to analyse questionnaires and interviews to identify themes on "responsibilities" in relation to working with SPs resulting in seven distinct but overlapping documents.

RESULTS: Eighty-six questionnaires were collected from SPs ($n = 59$); students ($n = 11$); tutors ($n = 8$); administrators ($n = 8$). Six interviews were conducted with population specific groups between 5 and 6 participants. The most striking finding was the lack of shared understanding of the purpose of SP work by different populations. Another notable finding was that the management of teaching sessions should reflect principles of working with real patients in real settings. The documents will be presented at the meeting. Examples of key topics for SPs include:

- Preparation for sessions (e.g. check purpose of session, review roles, timing and location)
- During sessions (e.g. listen carefully, work with student/clinician/tutor/researcher, offer specific and honest feedback as requested, clarify uncertainties)
- After sessions (e.g. complete evaluation forms, maintain confidentiality of all participants, complete pay forms accurately)

CONCLUSIONS: The guidelines may enable SPs to work safely and constructively in our education programmes. Future studies will evaluate stakeholder responses to the documents and changes in quality of our programmes.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 21

Fiberoptic Intubation Training: Correlation Between Simulator Performance and Clinical Skill

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INTRODUCTION: In anesthesiology, Fiberoptic Orotracheal Intubation (FOI) is an essential skill for managing the difficult airway. Training of FOI skills can occur outside the operating room on simulators of varying fidelity that teach trainees how to manipulate the bronchoscope. Both high fidelity simulators, which replicate human anatomy, and low fidelity simulators, which do not incorporate human anatomy have been successfully used to train this skill.^{1,2} It has been assumed that time to complete a simulator task translates to skill in the clinical setting, with a rapid completion of task indicating increased clinical proficiency. The purpose of our study was to determine whether the time to complete a simulator task translates into clinical FOI performance.

METHODS: After IRB approval, registered respiratory therapists (RRTs) were recruited as subjects. RRTs are a useful surrogate for junior trainee anesthesiologists because of their familiarity with FOI equipment and airway anatomy but lack of bronchoscopy experience. Subjects were randomized to training on a low fidelity (n = 14) or high fidelity (n = 14) model. The low fidelity group were trained on a simple non anatomic box model designed to refine fiberoptic skills. The high fidelity group practiced on a computerized virtual reality bronchoscopy simulator (Accutouch, Immersion Medical, USA). At the end of the training session, each subject was tested on the time taken to complete a specific but unrelated task on their respective models. Within one week subjects performed a FOI on healthy, consenting and anesthetised patients undergoing intubation for elective surgery. Performance on the patient was measured independently by blinded examiners using a checklist and global rating scale (GRS), and the time from insertion of fiberoptic scope to visualization of the carina. Performances were compared using Spearman rank order correlations.

RESULTS: There was no correlation between time to complete a task on either the high or low fidelity simulators and clinical FOI on a patient, when assessed with a checklist, GRS and time to complete the FOI (all p = NS).

DISCUSSION: A correlation between simulator performance and clinical skill did not occur, suggesting that simulator based, task orientated time measurement may not be a good indicator of FOI performance in the clinical setting. This might represent the fact that a "fast" FOI on a simulator does not capture the nuances of performance on a patient. A "slower" FOI may represent a technically more adept approach. Neither simulator is able to include all the key constructs of FOI clinical performance (for example secretions) and therefore may not completely replicate the intraoperative experience of FOI. Isolated part task simulator based training may be unsuccessful for acquiring the technical skills of FOI unless accompanied by clinical training, repeated practice and structured feedback.

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1. Anesth Analg. 2002 95: 62–6 (2) Anesth 2001 95(2): 343–8.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 22

Novel Integration of a Life-Sized, Immersive Virtual Instructor with a Mannequin-Based Procedural Simulator to Teach Central Venous Catheterization

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INTRODUCTION: Mannequin-based simulators are increasingly used to teach a variety of clinical skills. We have previously reported the use of life-sized, interactive virtual patients in teaching and testing communication skills. In this study, we report a pilot effort to integrate a virtual instructor (VI), a life-sized projected avatar, with a mannequin-based procedural simulator to teach central venous catheterization (CVC).

METHODS: Fourth year medical students (n = 12) at the Medical College of Georgia (MCG) interacted with a VI who took the learner through the steps of CVC (Figure 1). Each subject completed a baseline survey to assess previous experience, preparation for and anxiety in performing the procedure. Knowledge of indications, contraindications, and anatomical landmarks for the procedure were also assessed. After interacting with the VI, participants attempted simulated CVC via the right internal jugular vein using the CentralLine Man™ (Simulab Corporation). After the simulated procedure, subjects completed an exit survey to reassess their preparation and procedural anxiety and to test knowledge gained from the module. Outcomes were compared using paired t test, $\alpha = 0.05$.

RESULTS: The majority of students (58.3%) had never attempted CVC and felt anxious about performing the procedure. Of the 5 students (41.7%) who had attempted CVC, only one student (8.3%) had attempted an internal jugular vein CVC. After the simulated procedure, learners reported that they were more prepared to perform CVC and they scored better on the post-interaction quiz (Table 1).

DISCUSSION: Interaction with the VI and CentralLine Man™ increased student preparation and knowledge for performing CVC. This novel integration of a VI and a procedural trainer could be a useful tool for teaching CVC to novice learners and represents a prototype for the future integration of avatars and mannequin simulators.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

Table 1.

Measure	Pre-simulation	Post-simulation	Δ
Preparation ¹	2.17 $\pm$ 1.19	3.67 $\pm$ 0.78	1.50 $\pm$ 1.38*
Anxiety ²	3.58 $\pm$ 1.00	3.25 $\pm$ 1.06	0.33 $\pm$ 0.89
Knowledge ³	5.33 $\pm$ 1.78	8.67 $\pm$ 0.65	3.33 $\pm$ 1.50*

¹Likert scale 1 = least prepared 5 = most prepared. ²Likert scale 1 = least anxious 5 = most anxious. ³Score out of a possible 9. *p < 0.05.

RESEARCH ABSTRACT 23

Simulator-Based Situational Awareness Assessment of a Pharmacokinetic-Pharmacodynamic DisplayJodi Dayton¹, David Lamborn¹, Williams Parley¹, Noah Syroid¹, James Agutter², Diane Tyler¹, Johnson Ken¹¹Department of Anesthesiology, University of, Salt Lake City, UT, United States;²Department of Architecture, University of Utah, Salt Lake City, UT, United States

INTRODUCTION: A real-time graphical display has been developed to show model-based predictions of drug pharmacokinetics (Pk), pharmacodynamics (Pd) and drug-drug synergism intended for use by anesthesiologists in the operating room. The graphic display is a means for making complex Pk-Pd modeling useful and understandable in the operating room. To date, there has been no attempt to assess the display in terms of its usability. In order to make the display more intuitive, the Situation Awareness Global Assessment Technique (SAGAT) was used to probe participant understanding of the display in a simulated surgical case, and identify areas of the display that needed improvement prior to its use in the operating room.

METHODS: Attending and resident anesthesiologists (total n = 8) were given a 15 minute scripted Power Point presentation on the basic features of the display, and then subjected to a 45 minute simulated anesthetic using a high fidelity patient simulator. All participants were asked to rely heavily on the display during the simulation to make decisions regarding their administration of anesthesia to the simulated patient. The simulation was periodically frozen, and the participant's situation awareness was probed using the SAGAT. Responses to questions posed during the simulation were scored. Based on the results of this initial situational awareness assessment, several design improvements were identified and implemented. The redesigned display was subjected to a second simulation-based usability assessment by a different group of resident and attending anesthesiologists (n = 7). The redesigned PkPd display is shown to the right.

RESULTS: After the first assessment of participants on the display and evaluating their performance during the simulated case using the SAGAT, the average subject scored 95% correct overall. An analysis of missed questions revealed 5 areas of the display that were difficult for participants to interpret. Using the SAGAT, it was determined that difficulties in 4 out of these 5 areas stemmed from a shortfall in the 2nd level of situational awareness. After redesign to address these design weaknesses, the subsequent re-evaluation of the display found the average subject's scores increased to 99% correct overall.

DISCUSSION: Weaknesses in the initial display design were identified and addressed using a simulator-based situational awareness assessment. The analysis revealed that clinicians understood the redesigned display and were able to properly integrate it in the management of the simulated patient. This result indicates that the presentation was adequate in acquainting clinicians with the basic features of the display and also suggests that the display itself is largely intuitive.

CATEGORY: Technology Development and Evaluation

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 24

Procedural Learning in Simulated ColonoscopyRebecca Dezube¹, Catherine Dale¹, Matthew B. Weinger¹, Roberta Muldoon¹, Gregory Daniel Ayers¹, Caroline Cao²¹Vanderbilt University School of Medicine, Nashville, TN, United States; ²Tufts University, Boston, MA, United States

INTRODUCTION: Partial-task simulator training may improve clinicians' performance during patient procedures (1–2). There is still limited data on how best to incorporate procedural simulation into training curricula. For non-clinical psychomotor skills (e.g., sports), directed feedback through coaching improves learning (3). The purpose of this pilot study was to examine the effects of coaching on medical students' learning of colonoscopy using a partial task computer-based simulator and to compare students' performance with that of experienced endoscopists.

METHODS: 18 naïve Vanderbilt medical students completed 20 structured hours of colonoscopy training on the Simbionix GI Mentor II™. Nine of 18 students were randomly assigned to receive coaching from two of the authors each of whom had extensive experience with the simulator. Subjects sequentially practiced 10 canned scenarios. Six experienced endoscopists completed 6 of the same scenarios in a proscribed sequence over 2 hours. For each scenario, the simulator software calculated performance metrics. Generalized linear mixed models analysis of variance was used to compare individual trainees' performances over time and between groups as well as trainees vs. experienced participants.

RESULTS: Intragroup variation was substantial. All subjects demonstrated statistically significant learning over time. While trials to attain a plateau performance decreased with later scenarios, overall improvement per trial also decreased. There were no significant differences between uncoached and coached groups' peak performances or in their time required to reach proficiency. Trainees' performances after two hours on a scenario were comparable to experienced subjects' performance on the same scenario. Experts were initially faster and smoother yet saw less mucosa. As training on cases progressed, statistically significant differences disappeared. Coaches' performance with the simulator was superior to that of experienced colonoscopists.

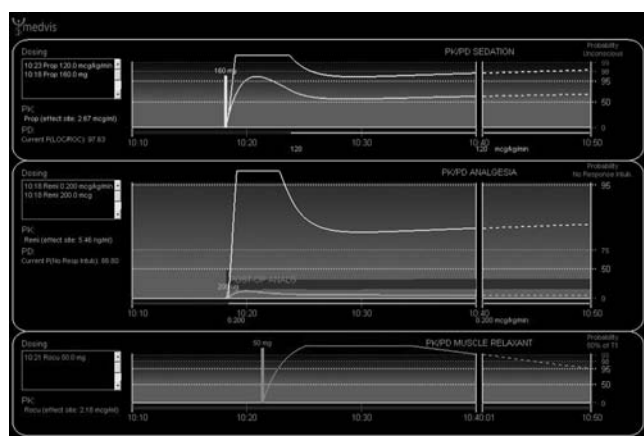
DISCUSSION: This study demonstrated the overall benefit of procedural simulator training but failed to find a significant effect of coaching in the training paradigm studied. Individual learning was highly variable, resulting in intragroup variation that exceeded intergroup variation. As a consequence a much larger sample size may be required to answer the original question. One limitation of the study was the available performance measures. The algorithms for their calculation were not available and this made interpretation of changes in performance difficult and may have limited the ability to coach the trainees effectively. Experience endoscopists consistently scored lower than trainees in percent mucosa observed suggesting that this aspect of the simulation does not adequately emulate real colonoscopies. Future studies will need to examine transfer of training to colonoscopies on patients (3).

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.



RESEARCH ABSTRACT 25

A Randomized Trial of High-Fidelity Simulation in Pediatric Resuscitation Training

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INTRODUCTION: Mock codes are an effective tool for teaching pediatric resuscitation skills. Simulation has been shown to be an effective training modality for uncommon high-risk clinical situations. Preliminary data from our trial suggests that pediatric house-staff response to a mock scenario involving an asystolic infant was significantly affected by use of high-fidelity simulation [1].

METHODS: Pediatric residents were randomized to simulation (SIM) or mannequin (MAN) groups. Each subject completed three study phases: phase 1, mock code exercises (asystole, tachydysrhythmia, respiratory arrest, shock) to assess baseline performance phase 2, a one-on-one didactic session reviewing PALS algorithms phase 3, repeated mock code exercises requiring identical cognitive skills in a different clinical context. SIM subjects completed all three phases using a high-fidelity simulator (SimBaby, Laerdal) and MAN subjects used SimBaby without simulated physical signs (i.e. as a standard mannequin). Thus, both groups underwent identical exercises with the exception of the presence/absence of simulated physical signs. Performance in phases 1 and 3 was measured by a novel instrument designed to measure cognitive performance; score were scaled to a range of 0–100 points. Improvement in performance was evaluated by mixed modeling using a random intercept to account for within-subject variability.

RESULTS: 50 subjects (SIM = 25, MAN = 25) completed all three phases. Phase 1 (baseline) performance was similar between groups. Phase 3 performance was better in SIM subjects than MAN subjects (mean score 60.5 vs 55.1, $p = 0.14$). The improvement in scores between phases 1 and 3 was significantly better in the SIM group (11.1 ± 4.8 vs 4.8 ± 1.7 , $p = 0.007$).

DISCUSSION: A training session enhanced by high-fidelity simulation resulted in a greater improvement in measured cognitive performance in mock codes by pediatric housestaff.

REFERENCE

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CATEGORY: Education

COI STATEMENT: Conflict Reported - Aaron Donoghue is a grant recipient from the Laerdal Foundation for Acute Medicine Vinay Nadkarni is a grant recipient from the Laerdal Foundation for Acute Medicine.

RESEARCH ABSTRACT 26

Simulation Used to Elicit Inappropriate Behaviors in New Physicians

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INTRODUCTION: Stressful situations are a part of everyday life for physicians. In our experience medical school graduates performed poorly when confronted with stressful situations. We hypothesized that medical schools do not sufficiently prepare students to cope with stressful patient encounters. Therefore, we designed a simulation model aimed to elicit inappropriate behaviors when encountering moderate to severe levels of stress.

METHODS: In a Center for Patient Safety Program for interns, two standardized patient (SP) cases were developed; SP-1 was a Chinese male who spoke no English, and SP-2 was a verbally abusive female. SP-2 scenario was designed to be more stressful than SP-1. A history was given to the interns who examined the patients. Both SPs were actors who recorded inappropriate intern behaviors during the exam. Independent observers reviewed each video-recording for the following behavior markers: chewing gum, washing hands with water only, drying hands on clothing, contamination of hands, and improper paper towel disposal. Simulation training concluded with debriefing by faculty who observed the simulations.

RESULTS: Out of 163 interns who completed the training, a greater number showed inappropriate behavior markers during the severe stress model (SP-2). The table illustrates behavior markers during each encounter using the McNemar test to determine statistical significance ($p < 0.05$).

DISCUSSION: While most interns did not exhibit negative behaviors, we were able to elicit numerous negative behaviors during two enacted patient encounters. Interns demonstrated more negative behaviors in the severe stress model (SP-2), suggesting that they were unaccustomed to such stressful patient situations. New modalities of education, including simulation, may help programs prepare physicians to handle stressful patient encounters. We believe using SPs in stressful scenarios can help educate medical school graduates by eliciting easily identifiable negative behaviors, thus desensitizing them while providing coping strategies to counteract stressful patient encounters.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

Table 2.

PGY1(interns) Behavior	SP-1 N = 163 (%)	SP-2 N = 163 (%)	McNemar p-Value
Chewing gum	1 (0.58)	7 (4.68)	0.008*
Water only	7 (4.09)	13 (7.60)	0.109
Dry on clothes	1 (1.75)	4 (2.34)	0.706
Contam hands	1 (0.63)	6 (4.38)	0.034*
Towel disposal	18 (13.13)	25 (16.25)	0.384

RESEARCH ABSTRACT 27

Simulation Training to Assess Hand Hygiene Program Efficacy of Recent Medical School Graduates

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INTRODUCTION: The annual rate of hospital acquired infections (HAI) is approximately 5% of inpatients in the US. Hand hygiene (HH) compliance among healthcare workers has remained below 50% in numerous studies despite various interventions (1). To improve HH compliance at this hospital, we have begun an extensive HH program, including lecture and video presentations and a pre/post test. Simulation training was used to assess the program efficacy among recent medical school graduates.

METHODS: As part of our Patient Safety training program, all incoming residents to Jackson Memorial Hospital (JMH) participated in a mandatory HH program. Compliance was monitored during videotaped simulations. Each trainee conducted consecutively directed physical examination of 2 standardized patients, and they were rated as regards to maintaining HH before and after examinations. The HH program was administered before the simulations in the morning of days 2 and 3; Day 1 served as the control group and those physicians received the HH program after the simulation. This design allowed us to assess baseline HH knowledge, and to compare 2 groups: those with HH before simulation and those with HH after simulation. Post-simulation debriefing concluded the training. Independent reviewers extracted HH compliance data from the videotapes as well as real-time assessments. Proper HH compliance was considered only if either 'soap and water' or Purell were used. Answering 18/20 questions correctly was considered a passing score on either HH exam.

RESULTS: The training and HH program were administered to 195 trainees. HH compliance rates by groups are as follows: Day 1 - 36.84% (received HHP after simulation); Day 2 - 85.53% and Day 3 - 93.02% (both days received HHP before simulation). Comparison of Days 1 and 2 shows statistically significant improvement in Day 2 ($p < 0.001$); there was also a statistically significant difference ($p < 0.001$) between Day 1 and Day 3. Comparison of trainees who passed the HH pre-test (32.59%) and post-test (47.41%) was statistically significant ($p = 0.0016$).

DISCUSSION: These results demonstrate that the HH program used at our institution improves HH compliance. Overall HH post-test results and successful passing scores improved significantly for trainees on Days 2 and 3. Trainees on Day 1 underwent simulation before going through our HH program, and less than 40% of them washed their hands. Once again, this suggests that HH is not being adequately addressed in medical schools. Our novel HH program improves HH compliance, at least in the short term. A refresher program will be administered in 6–8 months, which will be used to evaluate the program's efficacy as a long term teaching module. Supported in part by Dept of Labor grant #EA-15417-06-60.

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 28

Evaluation of a Formal Curriculum in Patient Safety for Final Year Medical Students

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INTRODUCTION: In 2006 Southern Health Simulation and Skills Centre developed a new subject on patient safety for the final year medical students at Monash University. The subject has been allocated 144 hours including 5 contact days conducted at the Simulation Centre. Each student participates in five highly structured contact days each with a different patient safety theme: Introduction to Patient Safety and Human Factors; Equipment and Procedures; Teamwork; Medication Safety; and 'Putting it all together'. The course uses a blended learning approach of immersive simulation scenarios, hands-on workshops, interactive lectures and on-line discussions interspersed with clinical placements to allow the students to reflect on patient safety in the clinical environment.

METHODS: Evaluation forms completed after each contact day and at completion of the subject included open questions as well as Likert category responses allowing both qualitative and quantitative data capture. Objective Structured Clinical Examinations (OSCEs) were used to assess the knowledge and skills of the students on the final contact day, and a pre- and post-course attitudes survey has been developed for longitudinal evaluation. Independent quantitative and thematic analysis of qualitative data was undertaken to assess the course's effect on change in practice as well as attitudes, confidence and effect on workplace learning.

RESULTS: The presentation will present results of the independent evaluation of the subject completed by 161 students. Overwhelmingly positive responses have been received for this course from both students and university faculty members. All of the 175 students completed the course requirements and assessment components. The majority of the students gave examples of ways that the course had helped them think, and react to the workplace differently. The simulation scenarios were by far the most popular and powerful learning exercises. In addition to the positive responses in terms of course content and delivery, the course appears to have had a secondary effect of enhancing learning away from the teaching sessions into the workplace. In addition to the positive responses in terms of course content and delivery, the course appears to have had a secondary effect of enhancing learning away from the teaching sessions into the workplace.

DISCUSSION: Greater attention to Patient Safety education is required at all levels of the healthcare system. A five-day course in patient safety using a blended learning approach in terms of educational formats achieved its aims of improving awareness and confidence in dealing with patient safety issues. A formal curriculum on Patient Safety is necessary and achievable at the undergraduate level.

CATEGORY: Patient Safety Products/Projects

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 29

The “First 5 Minutes”: Evaluation of a 30-Minute Simulation-Based Crisis Training Course for Non-ICU StaffTasota Fred¹, Dongilli Tom², Clontz Amy¹, Shatzer Melanie¹¹University of Pittsburgh Medical Center-Presbyterian University Hospital, Pittsburgh, PA, United States; ²Peter M. Winter Institute for Simulation Education and Research (WISER), Pittsburgh, PA, United States

INTRODUCTION: Medical Emergency Teams (METs) are designed to provide critical care at the point of need outside the Intensive Care Unit (ICU). Unfortunately, time to effective management of critical situations by METs may be inhibited by lack of training for the first staff arriving at the scene (the non-ICU nursing personnel). Early problem recognition, appropriate initial interventions, and rapid defibrillation for sudden cardiac arrest are skills required by non-ICU personnel to facilitate life-saving measures. The “First 5 Minutes” program was developed for non-ICU personnel to: 1) assess and improve staff completion of key resuscitative tasks before MET arrival; 2) utilize a high-fidelity simulator and cardiac arrest scenarios to facilitate learning; and 3) provide the training within a 30-minute time frame outside the simulation center and on the patient units.

METHODS: Subjects were 75 registered nurses who verbally consented to participate in our IRB-approved project involving response to two identical cardiac arrest scenarios with facilitator-led debriefing/critique sessions after each. Data were collected on: 1) pre and post surveys to assess perceptions of the use of simulation for learning; 2) pre and post true/false tests to assess cognitive knowledge related to identification of crisis situations and implementation of appropriate emergency measures; and 3) time to completion of selected emergency tasks in the first vs. second scenario. Simulation data were electronically obtained utilizing the Laerdal SimMan “and recorded into a laptop computer with SimMan” software.

RESULTS: Positive perceptions of five statements related to simulation training all increased pre vs. post training. The percentage of participants answering “strongly agree” to the statements in the survey increased by an average of 19% in pre vs. post training. Those who “strongly agreed” that they “felt comfortable managing the patient before the arrival of the MET” increased from 25–45%. Those who “strongly agreed” that “the simulated experience would be realistic” increased from 51–71%. Correct answers to the six-question test increased by an average of 45% pre vs post. The correct answers to questions related to: 1) “knowledge of where intubation supplies were kept” increased 73%; 2) “the first action to take upon assessing an unresponsive patient” increased 62%; and 3) “placement of ECG leads vs. defibrillator pads” increased 45%. The majority of nurses were aware of their ability to defibrillate without physician presence on the pre test (77% correct). Data related to comparison of time to completion of selected emergency tasks in the first vs. second scenario are currently being analyzed.

DISCUSSION: Participation in simulated cardiac arrest scenarios utilizing a high-fidelity simulator improved staff knowledge of selected information related to emergency situations in the short-term. Most staff attending the training sessions “strongly agreed” with statements related to a positive experience during the simulations. The “First 5 Minutes” is an effective means of reviewing emergency measures and improving standardized behaviors in a simulated environment on the patient units within a thirty minute time frame.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 30

Practice Is Not Enough-Repeated Breaches in Invasive Procedure Aseptic Technique by Novice Operators Despite Improved Skill as Reviewed by VideotapingZeev Friedman^{1,2}, Naveed Siddiqui^{1,2}, Katznelson Rita^{2,3}, Isabel Devito^{1,2}, Sharon Davies^{1,2}¹Department of Anesthesiology, Mount Sinai Hospital, Toronto, Canada; ²University of Toronto, Toronto, Canada; ³Department of Anesthesiology, University Health Network, Toronto, Canada

INTRODUCTION: Invasive procedures carry the risk for complications such as erroneous placement arising from inadequate manual skills and infection secondary to breaches in aseptic technique. With certain invasive procedures such as neuroaxial anesthesia, infectious complications may be devastating.¹ Although it is assumed that improvement in sterile technique parallels improved dexterity, this assertion remains unproven. In this trial we determined whether increased proficiency in the manual skills for epidural anesthesia is associated with improved aseptic technique.

METHODS: The study received Research Ethics Board approval. Novice second year anesthesia residents were repeatedly videotaped performing epidural anesthesia over 6-month periods. Three independent examiners blinded to the identity and level of training of the residents evaluated the procedures for manual skills and aseptic technique. Each procedure was graded using a scaled manual skills checklist, a global rating scale and a scaled checklist for aseptic technique.

RESULTS: 35 sessions were videotaped over 1 year. Inter-rater reliability was nearly perfect for all three measures. The correlation between manual skills checklist scores and the number of epidurals performed was 0.84 ($p < 0.0001$), suggesting a strong positive association between the two sets of measurements (Figure 1). Similarly, a significant relationship was found between the number of epidural procedures performed and the manual skills global rating scale scores with a correlation of 0.70 ($p < 0.0001$) (Figure 2). In contrast, no relationship was found between the number of epidural procedures performed and the aseptic technique checklist scores ($R = 0.23$, $p = 0.21$) (Figure 3).

DISCUSSION: Increasing virulence and resistance of contaminating organisms is presently a major concern for medical practitioners. With the increasing number of invasive procedures being performed, emphasis on meticulous aseptic technique is paramount to patient safety. Our results show that manual skills for epidural anesthesia improved with increasing experience but aseptic technique did not, despite formal teaching in this area.² These findings are applicable to all invasive procedures and contradict a common assumption that the acquisition of expertise in sterile technique parallels that of manual skills. Furthermore, we believe that breaches in sterility occur even among the most experienced practitioners. This study highlights major gaps in medical education in this regard. Educational initiatives are needed to correct these teaching flaws.

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 31

Establishing Proficiency Criteria for VR Simulator Training in Laparoscopic Surgery

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INTRODUCTION: Virtual reality (VR) simulators for surgical training are being used for almost a decade however, it is difficult to determine criteria for proficiency and only few attempts have taken place so far. The aim of our study was to establish learning curves of trainees from different levels of training, thus to determine the time needed for achieving proficiency on the MIST VR simulator used for laparoscopic surgery training.

METHODS: Two groups of trainees - 9 in the junior resident group (JR) and 7 in the senior resident group (SR), were asked to perform a sequence of tasks on the MIST VR simulator. Following an orientation session on the simulator, 45 minute training sessions were held weekly and performance was assessed using parameters provided by the simulator such as total score and time to completion. Training was completed once a plateau was reached, determined as no significant differences between three consecutive sessions. For statistical analysis, non-parametric tests were used and $p < 0.05$ was deemed significant.

RESULTS: All the trainees completed the study protocol. Participants in the JR group needed an average of 4 attempts before achieving a plateau while participants in the SR group achieved their plateau after 2 attempts only. Diversity in performance within the JR group was significantly higher compared to the SR group for all tasks and in all attempts.

DISCUSSION: Although tedious and time consuming, learning curves of performance are required to establish proficiency criteria for simulation training. Furthermore, it seems that seniority and previous experience influence the diversity in performance within groups. However, the plateau achieved by both groups was not significantly different thus; training objectives in terms of scores and time required can be standardized regardless of level of experience. Based on this study it appears that 4 consecutive weekly sessions should suffice to presume JR proficient in basic laparoscopy.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 32

Preclinical Simulation Training of Circumcisions Improves Resident's Proficiency and Confidence Levels

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INTRODUCTION: Prior to performing any surgical procedure on patients, residents should know how to perform the steps required and be confident in their abilities. Unfortunately, many residents' first circumcision is performed on a live infant with instruction and feedback given during and after the procedure. The purpose of this study was to evaluate 13 first year residents' proficiency and confidence in performing a circumcision after a 2 week series of simulation center learning.

METHODS: During the first two weeks of residency, 13 interns participated in a comprehensive simulation center course that included didactic sessions, surgical skills lessons, and procedural models. The residents were first given instruction on how to perform a GOMCO circumcision followed by a video. Next they began practicing circumcisions on models during the course. Residents were given Leikart scale questionnaires prior to and after the program documenting their confidence levels and experiences with performing circumcisions (1-expert level, 3-competent to perform the procedure independently, and 5-absolutely no or minimal experience). Their learning experience for the circumcisions were recorded and evaluated after the completion of the two week course. A repeat evaluation was performed one month after workshop completion and times were compared to current 2nd year residents. Statistical analysis was performed using a paired student t-test and other testing as appropriate.

RESULTS: The participants reported performing an average of 10 circumcisions (range 6 to 15) during the 2 weeks. The first time the average simulation was performed in 15.2 minutes with learners requiring 5.6 instructions during the circumcision from an attending physician. As the week continued, residents required less instruction while performing the circumcisions with 2.1 per circumcision. After the 2 weeks, the interns had a final session that was observed which had an average time of 13.8 minutes and required only 1 instruction per circumcision. This improvement in time and instruction was statistically significant ($p < 0.05$). The learners' confidence level using the Leikart scale also improved from an average of 4.0 to 2.2 over the two weeks ($p < 0.05$). One month post-workshop testing revealed an average circumcision time of 12.1 minutes compared to 11.5 minutes for the current 2nd year residents ($p > 0.05$).

DISCUSSION: Simulation center training had a significant impact on first year residents with regards to improving circumcision procedural competency and confidence. This was accomplished on models and not live patients. More efforts should be made to train residents in a simulation center setting prior to clinical care in order to garner confidence and skill while maximizing patient comfort and minimizing potential adverse events.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 33

Objective Scoring of Team Performance and Medical Task Performance on Simulated Scenarios During the Obstetric Crisis Team Training CourseGabriella Gosman¹, Patricia Dalby¹, Karen Stein², Nancy Wise², Jean Donohoe², Hyagriv Simhan¹¹University of Pittsburgh School of Medicine, Pittsburgh, PA, United States;²University of Pittsburgh Medical Center Magee-Womens Hospital, Pittsburgh, PA, United States

INTRODUCTION: Obstetric care requires co-coordinated team effort amongst a multi-disciplinary group of medical providers. In the event of an obstetric crisis, this multi-disciplinary team performance must be optimal to ensure good maternal and fetal outcomes. The Joint Commission Sentinel Event Alert, "Preventing infant death and injury during delivery" cited teamwork and communication deficits as the most common root causes of obstetric sentinel events. Magee-Womens Hospital instituted an obstetric-specific medical emergency team (Condition O) as a part of its rapid response system in June, 2005. We designed the Obstetric Crisis Team Training Course to train Condition O responders (obstetricians, anesthesiologists, and obstetric nurses) to function as an effective crisis team. The course takes place at the Peter M. Winter Institute for Simulation, Education and Research (WISER).

METHODS: Course participants prepare for the course with an online didactic and self-assessment. The half-day course consists of a didactic presentation, orientation to the WISER fullscale obstetric simulation environment, 3–4 simulated obstetric crises with debriefing, course summary, course evaluation, and self-assessment. Scenarios include fetal bradycardia, postpartum hemorrhage, maternal anaphylaxis, and maternal seizure. Video review and two structured scoring instruments are used during debriefing to make educational points and to objectively assess team performance. We report here on results from the Team Scoring Instrument (teamwork, organization, and communication) and the scenario-specific Medical Task Scoring Instrument (essential medical tasks for the specific crisis). The lead facilitator completes these multi-item checklists with the team after video review. The group scores each item as completed, not completed, or not applicable.

RESULTS: From June 2006 through June 2007, 11 teams completed the course. 9 teams completed 3 scenarios, 2 teams completed 4 scenarios. Team performance on the Team Scoring Instrument improved over the course of the three scenarios ($p = .006$, Kruskal-Wallis). Medical task completion on the Medical Task Scoring Instrument did not show the same stepwise improvement, but did improve overall during the course ($p = 0.003$, Kruskal-Wallis). Scores differed by scenario on the Medical Task Scoring Instrument ($p = 0.03$, Kruskal-Wallis), suggesting that some scenarios were more difficult than others. Median score on the Medical Task Scoring Instrument was 89% (89–100% for maternal seizure; 83% (74–95%) for fetal bradycardia; 78% (31–100%) for postpartum hemorrhage; and 73% (69–92%) for maternal anaphylaxis. However, Team Scoring Instrument scores did not vary by scenario ($p = .45$, Kruskal-Wallis).

DISCUSSION: Participants in the Obstetric Crisis Team Training Course at WISER improved their team performance on the Team Scoring Instrument during the course of the training. The WISER team training approach devotes the bulk of learners' time to simulation and structured debriefing. Because of this, participants in the Obstetric Crisis Team Training Course complete multiple cycles of hands-on practice and performance critique. It is important to investigate whether this instructional approach translates into improved team performance during live patient care.

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 34

A Multi-Center Approach to Improving Communication Between and Among Obstetric and Neonatal Teams During Delivery and Resuscitation of the Newborn Using Standardized Communication Techniques and Simulation-Based TrainingLouis Halamek¹, Butler T. Jeffrey², Janice Schrieffer³, Justin Lavine³, Kristine Larison⁴, Dana Nelson³, Yolanda Meija⁵, Teresa Harrington⁴, Jill Therien⁶, Susan Hendricks⁷, Patricia Ittmann⁸, Gautham Suresh⁹¹Packard Children's Hospital at Stanford University, Palo Alto, CA, United States;²Children's Hospital, Akron, OH, United States; ³Golisano Children's Hospital, Rochester, MN, United States; ⁴Providence St. Vincent Medical Center, Portland, OR, United States; ⁵Baptist Hospital, Miami, FL, United States; ⁶Children's Hospital and Clinics, St. Paul, MN, United States; ⁷Bronson Medical Center, Kalamazoo, MI, United States; ⁸Rockford Memorial Hospital, Rockford, IL, United States; ⁹Dartmouth Hitchcock Medical Center, Lebanon, NH, United States

INTRODUCTION: The Vermont Oxford Network (VON) is a national perinatal collaborative comprised of over 600 neonatal intensive care and labor and delivery units in the U.S. and abroad. In 2004 a subgroup of VON centers, We'll Be Better Births and Communication (We'll BBAC), sought to develop and evaluate a methodology to improve communication and team performance during delivery and resuscitation of the newborn.

METHODS: Study subjects were recruited from the physician, nursing and allied health-care professional staffs at the seven hospitals represented by We'll BBAC after IRB approval was obtained at each site. A CDROM-based training module in effective communication was developed and distributed across the sites to provide a common knowledge base. Following this, simulation-based training in delivery room scenarios requiring communication among and between the obstetrics and neonatology teams was conducted. Scenarios were developed using real working medical equipment, supplies and props found in the hospital patient simulators used in this study were of low fidelity and low cost. Scenarios were conducted unannounced in the actual hospital environment and recorded on videotape that was used in debriefings following each scenario. An 11-question Team Communication Survey (TCS) was distributed to subjects at three timepoints: at the start of the study, after the CDROM module (and before simulation-based training), and after simulation-based training. Communication during real deliveries was evaluated by investigators using a 16-item Team Performance Assessment (TPA) before and after simulation-based training.

RESULTS: TCS#1 was returned by 446 subjects and constituted the baseline. Whereas TCS#2 ($n = 412$) revealed a decrease in the overall percentage of "Excellent (highest)" ratings on nine of 11 questions after administration of the CDROM, TCS#3 ($n = 265$) showed an increase in percentage of "Excellent" ratings on all 11 questions compared to both TCS#1 and TCS#2. The percentage of "Excellent" ratings of team performance during real deliveries, as scored by study investigators, increased on 16 of 16 items in the interim between baseline measurement prior to simulation-based training ($n = 122$) and repeat measurement after simulation-based training ($n = 114$).

DISCUSSION: The near-uniform decrease in ratings of team communication on TCS#2 may reflect a lack of understanding of effective communication by subjects at baseline and misperception of their skill in this area only after learning what constitutes effective communication did they appreciate that their initial assessment of their proficiency was inaccurate. It is also possible that exposure to the CDROM alone was insufficient to allow acquisition of a behavioral skill such as effective communication. Indeed, an increase in the percentage of excellent ratings was achieved only after the simulation-based training component was initiated, where subjects experienced training scenarios designed to elicit communication skills.

CONCLUSIONS: Despite budgetary and other limitations simulation-based training in behavioral skills such as effective communication can be successfully accomplished in a non-academic setting using inexpensive patient simulator and audiovisual technology. Perceived benefits of such training, even when directed at highly experienced professionals working together in multidisciplinary teams, are substantial and can influence performance when caring for real patients.

CATEGORY: Patient Safety Products/Projects

COI STATEMENT: Conflict Reported - Louis Halamek: Grant, Laerdal Foundation Consultant, Laerdal Medical Consultant, Advanced Medical Simulation.

RESEARCH ABSTRACT 35

Error Disclosure: Using Human Patient Simulators to Train Medical Students

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INTRODUCTION: It is well established that patients strongly favor error disclosure. Several policies mandate full error disclosure and ethical and professional guidelines call for physicians to disclose medical errors. Despite these calls, a gap exists between strong support for error disclosure and actual training. To address this need, our study used human patient simulators (HPS) and standardized patients (SP) to train fourth-year medical students on medical disclosure. We hypothesized that students trained to disclose an error in a simulated environment would perform better in disclosing an error to a SP than students without this training.

METHODS: As part of their Capstone Course, fourth-year medical students completed a pre-self efficacy instrument via e-mail and were divided up into three groups. The control group ($n = 30$) received no training prior to their individually disclosing a medical error to an SP. The intervention group ($n = 27$) was broken up into teams of approximately 5 students who actively participated in committing an error using the HPS and then individually disclosed to a resident physician trained to portray a family member. They then received a one-hour lecture on error disclosure. Later the same day, they were assessed using a different case and SP. The lecture group ($n = 40$) received the same one-hour lecture and were assessed when they individually disclosed the error to an SP. Error disclosures were evaluated using the UNC physician-patient communication rating instrument and the validated Chan (2005) surgery error disclosure scale which measures explanation of medical facts, honesty, empathy, future error prevention, and communication skills. All groups completed a post self-efficacy instrument immediately following the SP assessment. Statistical analyses (Chi-square, inter-item and inter-rater reliability analyses, factor analyses, one-way ANOVA) were conducted using SPSS, v15.0.

RESULTS: The UNC physician-patient communication rating instrument, with a trained standardized patient playing the role of the patient and performing the evaluation, represented the primary measure of students' capacities to adequately disclose a medical error. The 20 items of the instrument had an excellent internal consistency (.946) and loaded onto a single factor that explained 50.7% of score variance. The three groups (simulation, lecture only, and control) did not significantly differ on the SP assessment ($F_{2,70} = .071, p = .932$). Additionally, there were no significant differences across groups on individual scale items. For the Chan (2005) error disclosure scale, there was no significant difference across groups ($F = 2.505, p = .136$). Student self-efficacy improved from pre-test to post-test.

DISCUSSION: Proper error disclosure technique is crucial for effective communication in clinical situations where mistakes are made. To our knowledge, no prior studies have demonstrated effective methods for training medical students in error disclosure. This preliminary data suggests that lecture interventions can improve student self-efficacy for disclosing medical errors. Furthermore, the physician-patient communication and Chan (2005) scales are valid instruments for measuring behavior change. However, limitations of this study (short duration of simulation exercise, student attrition) indicate a clear need for more robust interventions, including lecture and higher fidelity, more intensive HPS exercises to train medical students on this critical skill.

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 36

A Comparison of Educational Strategies for the Acquisition of Medical-Surgical Nursing Knowledge and Critical Thinking Skills: Human Patient Simulator vs. the Interactive Case Study Approach

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INTRODUCTION: This study determined whether the use of the human patient simulator (HPS) as an educational intervention with nursing students was more effective than the use of interactive case studies (ICS) with respect to knowledge gain and critical thinking abilities. The study also assessed the learner's perspective related to the experiences. Kolb's Experiential Learning Theory provided the framework.

METHODS: A quantitative quasi-experimental two group pre-test and post-test design was utilized with a sample of 49 nursing students from two different nursing programs at a simulation center. The nursing students were at similar levels in their academic preparation. After permission was obtained, the diploma and baccalaureate nursing students were pre-tested using a custom-designed Health Education Systems Incorporated (HESI) exam based upon ICS and HPS content (Care of the MI and CVA Patient), randomly assigned to either the ICS or HPS group, received the educational intervention, then were post-tested using another HESI exam based upon the same test blueprint. The HESI Scores were used to measure knowledge gain and critical thinking ability. Students also completed a researcher developed ICS/HPS evaluation form to assess their perspective of the teaching strategies.

RESULTS: Analysis of covariance (ANCOVA) revealed a significant difference with respect to knowledge gain using the HESI Conversion Score ($p = .018$) and HESI Scores ($p = .037$), and a mildly significant difference with respect to critical thinking ability using the Critical Thinking subscore ($p = .051$), with the HPS group scoring significantly higher on the posttest. Descriptive statistics revealed that the student's perspective of the HPS experience was more positive when compared to the case study group with respect to the stimulation of critical thinking abilities ($p = .070$), perceived value ($p = .001$), the ability to transfer learning to the clinical setting ($p = .059$), need for inclusion in undergraduate education ($p = .010$), understanding of concepts ($p = .010$), invoking nervousness ($p = .001$), decreasing anxiety in the clinical setting ($p = .074$), and substitution for clinical experiences ($p = .027$).

DISCUSSION: The results supported the use of simulation technology in undergraduate nursing education, demonstrated the effectiveness of the use of simulation as an innovative teaching strategy, validated the nursing students' positive experience with respect to simulation, and confirmed the cost-benefit ratio with respect to the resources needed to integrate simulation into an undergraduate nursing curriculum.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 37

The Effects of Using the Human Patient Simulator (HPS) Compared to a CD-ROM in Teaching Care of Patients Exposed to Chemical Agents

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INTRODUCTION: The study was approved by the Wilford Hall Medical Center Institutional Review Committee. The purpose of this study was to determine which of two approaches, the use of the Human Patient Simulator (HPS) or computer-assisted instruction (Chemical CD-ROM strategy) was more effective in increasing cognitive and performance proficiency as they relate to chemical casualty management. The research question was: Are there statistically significant differences in the educational strategies of HPS and CD-ROM compared to a control group relative to scores on the Lower-Level Cognition, Higher-Level Cognition, Critical Thinking Instruments and Performance Standards?

METHODS: A prospective, pretest-posttest experimental, mixed design (within and between) was used with three groups consisting of ninety active duty and reserve nurses (30 in each group). The framework was a combination of Bloom's taxonomy and critical thinking. Bloom recognized that there are different levels of cognitive skills or thinking, which he classified as the cognitive domains that include lower (knowledge through comprehension) to higher (application through evaluation). Critical thinking for this study was defined as the ability to assess, intervene, and evaluate care relative to caring for patients with chemical casualty management, and performance was defined as the ability to assess and implement appropriate care. The HPS used for this study was a computerized full-body mannequin that was capable of providing real-time physiological and pharmacological parameters. The CD-ROM used for the study was an interactive program that reviewed content and allowed participants to make choices relative to assessment, intervention, and evaluation by clicking a mouse. Four valid and reliable instruments (Lower-Level Cognition, Higher-Level Cognition, Critical Thinking Instruments and Performance Evaluation) were developed for the study. Participants were randomly assigned to one of three groups: use of HPS, CD-ROM, or control group. All subjects completed the pretest instruments. The participants in the HPS and CD-ROM groups then received instruction using the simulator or the CD-ROM. All of the participants were videotaped during the performance assessment and were evaluated by a blinded investigator. One month later, the participants returned and completed the same instruments. A Multivariate, Repeated ANOVA was used to analyze the data. A LSD was the post-hoc test used to determine where the significant differences existed.

RESULTS: There was no statistically significant difference in the scores on the Lower-Level Cognition Instrument between HPS and CD-ROM groups ($p > 0.05$). The participants in the HPS approach performed significantly better on Higher-Level Cognition, Critical Thinking, and Performance Evaluation Instruments compared to the CD-ROM and control groups ($p < 0.05$).

DISCUSSION: The HPS is not any more effective than a CD-ROM in increasing lower-level cognition skills however, educators want participants to learn higher-level cognitive, critical thinking, and more importantly the ability to perform appropriately. The data strongly suggest that HPS is more effective in achieving that goals of increasing higher-level cognition, critical thinking, and the ability to perform, specifically identifying patient problems, intervening, and implementing appropriate care for patients exposed to chemical warfare exposure.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 38

Using Patient Simulation in Baccalaureate Nursing Education Curricula to Enhance Clinical Readiness

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INTRODUCTION: The increased use of simulation in the health sciences invites interdisciplinary collaboration. Nursing faculty at the University of Colorado at Denver Health Sciences Center (UCDHSC) School of Nursing, participated in an intramural project, President's Teaching and Learning Collaborative, (PTLC) to examine whether the use of patient simulation mannequins positively impacts learning outcomes in clinical nursing education. Many nursing programs, due to the scarcity and congestion of clinical sites, struggle to maximize the clinical training in the learning laboratory environment to prepare students for their first acute care rotation. Clinical instructors and hospital partners verify that students require multiple shifts to acclimate to the fast pace, multi-tasking environment of the hospital. How can nursing educators bridge the "acuity gap" and promote clinical readiness for the acute care setting? Should simulation be integrated throughout the undergraduate curriculum? The study focused on the concept of clinical readiness for nursing students. Clinical readiness indicators included knowledge, critical thinking, skill performance, and satisfaction/self confidence. The research question asked if there is a measurable difference in demonstrated levels of clinical readiness between Medical-Surgical 1 nursing students who participated in patient simulation scenarios, compared to students who were not exposed to simulation.

METHODS: At the institution, IRB approval is waived for data collection and research that evaluates the student educational experience, however, COMIRB approval was secured. A small pilot study using a control and an intervention group was conducted. The intervention group was exposed to two patient simulation scenarios. Building on the national Laerdal/NLN study, data were collected using pre-post course knowledge professional judgment, satisfaction/self-confidence surveys, and a simulation design scale (NLN, 2006). Clinical instructors also assessed professional judgment in both groups of these Med/Surg I students during their clinical rotation.

RESULTS: Small, but not statistically significant increases were noted in the intervention group self-assessment of clinical judgment, satisfaction, and in the clinical instructor ratings of competence in the clinical setting. Qualitative results reveal benefits of simulation in preparing students for the clinical practice. Benefits included increased student self confidence and the value of one-on-one instructor guided feedback.

DISCUSSION: Study replications and larger sample sizes are needed to determine whether the timing, type, or number of simulation experiences prove to be statistically significant, as well as the significance of scenario design features and the debriefing process. Outcomes of the study may guide pedagogy and integration of clinical simulation throughout nursing program curricula to facilitate clinical readiness and safe transitions to the clinical settings.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 39

Preclinical Simulation Center Teaching of Episiotomy Repairs Improve Procedural Times and Learner Confidence

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INTRODUCTION: Most interns first attempt at an episiotomy repair on a patient generally takes 40–45 minutes as they do not have the requisite surgical skills to perform this procedure. This extended procedural time continues until the intern becomes competent in the procedure. The purpose of this study was to assess the rate of learning and confidence in episiotomy repairs for PGY-1 Family Medicine and Ob-Gyn residents.

METHODS: 13 interns and 1 fourth year medical student participated in a simulation center experience (9 Family Medicine and 5 Ob-Gyn) prior to beginning clinical responsibilities. A pre- and post-training questionnaire documented confidence level and prior experience. Participants were asked to assess their skills using a Leikert scale (1-expert level, 3-competent to perform the procedure independently, and 5-absolutely no or minimal experience). Skills taught prior to learning episiotomy repairs included knot-tying, suturing skills (surgical square knots and running continuous and locked suturing) and proper use of surgical instruments. These basic skills provided a foundation for subsequent learning of the episiotomy repair with concomitant decrease in initial procedural times. Documentation of the procedures included a progress diary and videos. Models were used which had a second degree midline or mediolateral episiotomy. The initial repair was taught by a MFM physician. Each participant then individually practiced this skill in groups of four with faculty members present for questions and close observation. Over the course of 3 days, residents had individual time to practice these skills. The final assessment was in a one-on-one setting. Statistical analysis was performed using a paired student t-test with $p < 0.05$ considered statistically significant.

RESULTS: The average number of episiotomy procedures practiced over the ~2 week period was 11.4 (range 4 to 19). The residents showed a serial decrease in total time needed to repair an episiotomy. The first day, the average time per repair was 15.7 minutes (range of 10 to 31). This progressively decreased throughout the four days the repair was practiced, from 11.4, to 8.3, to 9.1 minutes (range 6 to 14) on the final assessment day ($p < 0.05$). The self-assessment of procedural confidence increased from 4.6/4.4 for midline/mediolateral episiotomy to 2.6/2.5 respectively ($p < 0.05$). One month after completion of the workshop, the intern procedural times averaged 7.8 minutes (range 6.5 to 9.0) which was not statistically different than procedural times for current second year residents, 8.8 minutes (range 5.0 to 11).

DISCUSSION: After an intensive 2-week training in a simulation environment, residents were able to significantly decrease episiotomy repair times and increase their procedural confidence. This skill was retained one month after the workshop despite most interns not being on the obstetric service. This training will translate into increased confidence by participants' staff and their patients and improved patient care.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 40

"See One, Do One, Fail One" - How Simulation can Prevent Physicians from Forming Unsafe Procedural Habits

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INTRODUCTION: Trainees often feel inadequately instructed to perform invasive procedures and believe this poses risk to patients. Simulation-based teaching for invasive procedures has the potential to improve competence and confidence, ensure patient safety, reduce training cost, and minimize expenses incurred from errors. The aim of this study is to report the development of a pilot program to teach Internal Medicine trainees to perform 6 invasive bedside procedures.

METHODS: During July–August 2007 trainees participated in a program to learn six invasive procedures: lumbar puncture, thoracentesis, paracentesis, knee arthrocentesis, arterial line placement, and ultrasound-guided central venous catheter insertion. This instruction is a required component of a 2–4 week rotation designed to improve patient safety through reducing complications, improve education through direct faculty instruction, and bolster trainee confidence and competence. Each trainee 1) performed the procedures on simulators/task-trainers and was evaluated by an instructor via a checklist 2) completed a written pre-test that focused on indications, complications, and technical aspects 3) viewed a training video 4) participated in faculty-guided, simulation-based instruction 5) repeated the procedures on simulators/task-trainers (instructors provided feedback until the trainees were comfortable and judged competent) and 6) completed a similar written post-test. Faculty then evaluated trainees on their technique of performing the procedures on hospitalized patients. After the rotation trainees completed a questionnaire to assess satisfaction with the rotation and confidence in performing invasive procedures.

RESULTS: There was a statistically significant increase in post-test scores for the trainees, in all but arterial line, likely due to the small sample size.

DISCUSSION: We developed a standardized, simulation-based training program that improved the procedural competence and confidence of internal medicine trainees. This type of instruction has the potential to reduce risk to patients and physicians associated with invasive bedside procedures.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

Table 3.

Procedure	# Observations	Pre-test Mean (total)	Post-test Mean (total)	p-Value
Arthrocentesis	11	7.3 (10)	9.1 (10)	0.004
Paracentesis	12	9.5 (14)	12.3 (14)	0.001
Thoracentesis	13	9.5 (13)	11.9 (13)	<0.001
Arterial line	5	7.2 (10)	9.2 (10)	0.075
Central line	13	6.4 (10)	7.8 (10)	0.027
Lumbar puncture	13	6 (11)	9.6 (11)	<0.001

RESEARCH ABSTRACT 41

The Teaching of a Structured Tool Improves the Clarity and Content of Inter-Professional Clinical Communication

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INTRODUCTION: Suboptimal communication between health professionals has been identified as a significant causative factor in incidents compromising patient safety, with communication failures estimated to be a major factor in between 60 and 70% of sentinel events.¹ The use of a structured method of communication has been suggested to improve the quality of information exchange, particularly with inexperienced practitioners.² One structure that has been suggested to improve communication is the situational briefing tool SBAR.³ This tool was developed by the US Navy for standardising important and urgent communication in nuclear submarines. A new subject in the Monash University final year medical curriculum addresses many aspects of Patient Safety, including communication. Part of this education around communication involves the introduction of ISBAR, a structured tool developed from SBAR to aid with clinical interactions such as handovers, referrals and documentation. **AIMS:** A randomised trial was undertaken to establish whether the student's communication improved after an education session about and practice with the ISBAR tool.

METHODS: Half of the 168 medical students undertook training in the ISBAR tool prior to participating in a simulated trauma resuscitation scenario that required a telephone referral to a senior clinician - the control group undertook the scenario prior to the ISBAR education session. The communications with the senior clinician in all 17 scenarios were recorded and scored by two blinded, independent observers. Scoring of content and clarity of the referrals was undertaken using a 20-point item scale, and a 5-point global rating scale.

RESULTS: Inter-rater reliability of the scoring system was excellent with absolute agreement on the 5-point global rating scale, and mean Kappa of 0.87 on the items scored. The quality of communication was significantly improved in the group who undertook the training and practice with the tool prior to the simulated clinical case (Means of item scores 10.19 versus 17.39 $p < 0.001$, Global rating scores 2.75 versus 4.44, $p < 0.001$).

DISCUSSION: Despite only brief exposure to the tool, teaching a structured method of communication to final year medical students improved the quality of communication of a telephone referral during a complex simulation scenario. The use of an artificial clinical environment allowed replication of identical circumstances multiple times to different equivalent student groups. This ensured that potential confounding variables such as acuity and urgency of the situation were controlled for, in the context of a plausible simulated clinical situation.

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CATEGORY: Patient Safety Products/Projects

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 42

Understanding and Applying a New Technical Standard for Virtual Patients

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INTRODUCTION: Virtual Patients (VPs) are interactive computer programs that simulate real life clinical scenarios where the learner interacts directly with an on-screen patient or patients to solve clinical challenges while receiving dynamic, tailored instruction. These provide an effective, scalable, and sustainable way for healthcare professionals to learn about a wide range of clinical topics and practice in a virtual environment that is safe for both the patient and learner. Leading educational institutions worldwide have developed and validated virtual patients to meet educational objectives in undergraduate, graduate and continuing education with overlapping goals and features. However, these high-quality and expensive virtual patients are difficult, if not impossible, to share with outside institutions. Experts agree that a standard for virtual patients that specifies mechanisms to display, interact, import and export virtual patient data can facilitate application of this effective pedagogy to wider audience and a broader scope of topics.

METHODS: To address the need for a convenient, scalable and technically sound means of sharing VPs between institutions the Virtual Patient Working Group was formed under the auspices of MedBiquitous, a non-profit standards development organization dedicated to development of open, publicly available standards to promote healthcare education and improved patient care. Members of the group were drawn from academic institutions, professional societies and education companies possessing experience with virtual patients. Beginning in 2005 the VP Working Group met monthly by teleconference and periodically in-person to assess the needs and define the necessary requirements for a VP specification that encompasses major functionality of known VP implementations. A comprehensive list of features and functional specifications was compiled and a delineation of the essential components of a VP established. Members with technical expertise and engineers from MedBiquitous developed a detailed yet flexible model and XML-based schema that encompasses the essence of a VP. Additionally a written specification describing the schema in detail and a specification for a basic virtual patient player application, emanated from the group's dedicated voluntary work.

RESULTS: The MedBiquitous Virtual Patient Working Group has developed a common XML-based technical specification for the exchange of Virtual Patients across systems, enabling educators to exchange, modify, and play virtual patients from a variety of sources within varying educational systems and settings. Additionally, Tufts School of Medicine has created a player application that plays back virtual patient encoded in the MedBiquitous VP standard. Karolinska Institute in Sweden has enabled their virtual patient authoring system (WebSP) to export and import cases based on this VP standard. Finally, the European Union recently funded a large-scale program to collect all virtual patients cases into a widely available repository based on the standard.

DISCUSSION: The MedBiquitous Virtual Patient Working Group has established a technical standard for sharing and repurposing virtual patients, through a collaborative international effort among academic medical centers, industry and other interested organizations. This standard is poised to become the basis for future virtual patient design and utilization. Ultimately it will promote development and sharing of virtual patients worldwide and promote this technology for health science education.

CATEGORY: Technology Development and Evaluation

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 43

Passive Observation of High Fidelity Simulation Does Not Improve Performance of Medical Students in a Cardiac Arrest Scenario

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INTRODUCTION: Advanced Cardiac Life Support (ACLS) is essential knowledge for all physicians. Traditional structured teaching of ACLS results in poor retention of skill and knowledge¹. Commonly, simulation courses are designed such that the group of attendees are divided into smaller groups to perform high fidelity simulations. Those not actively participating in an individual simulation observe the scenario and join the active participants for the subsequent debriefing. This study aims to discover whether there is any benefit in terms of improved performance, resulting from passive observation of a high fidelity simulation scenario combined with participation in post-scenario debriefing.

METHODS: Following IRB approval, 252 semester 12 medical students were recruited to attend the St Vincent's Simulation Centre. In preparation, all students received a lecture on ACLS and had supervised practice on a part task trainer in the week prior to the simulation session. Groups of 8 students attended each simulator session. They underwent further standard ACLS teaching and were familiarised with the simulation environment and resuscitation equipment. Each group was divided into subgroups for the 3 simulated scenarios. Scenario A and C involved cardiac arrests while Scenario B involved a respiratory arrest. During each scenario, the other 2 subgroups observed and participated in the post-scenario debriefing. Scenarios were standardised and used Human Patient Simulator (Medical Education Technologies Inc.). The 2 cardiac arrest scenarios were analysed, through use of videotape, in areas of ACLS recognised to be important for improving survival post cardiac arrest.

RESULTS: The results for Groups A and C are shown in the table. Group C, despite the advantage of passive observation and debriefing, had a greater duration of pauses in CPR than Group A. There were no other differences in measured parameters, between the two groups. In 28/58 scenarios, the groups failed to use epinephrine. Difficulties were encountered with the defibrillator in 27/66 scenarios.

DISCUSSION: We conclude that merely observing a team perform ACLS does not improve performance. This may be a result of a deficiency of concentration, or lack of cognitive engagement. This result has important consequences for the educational design of simulation courses. It is also concerning that despite intensive education and supervised practice, about half of the medical students could not follow drug protocol or use the defibrillator. A follow up study is now planned to evaluate if making simulation observation less passive will improve performance. Teaching strategies for ACLS in medical students are being reassessed, in light of the inability to follow the protocol and use essential equipment.

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CATEGORY: Education**COI STATEMENT:** The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 44

Using Simulation to Increase Masters Entry Clinical Nurses' Critical Thinking, Knowledge and Confidence

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INTRODUCTION: This study evaluated the effectiveness of using manikin-based simulation to increase critical thinking, knowledge, and confidence in a cohort of Masters Entry-Level Clinical Nurse (MECN) students. The MECN program is a new, two-year nursing program at UCLA for students with bachelor's degrees in other areas. Students receive a master's degree in nursing and become registered nurses upon successful completion of the program and passing the national examination. The short duration of the program, coupled with a lack of clinical cases available for student training, necessitated early integration of laboratory simulations. Literature indicates that controlled, simulated experiences provide students an alternative, safe setting to perfect clinical application of theory.³ However, most studies related to nursing simulation are qualitative, subjective and focus on the associate degree and undergraduate nursing student level.^{1,2} Research regarding the use of simulation in the education of advanced adult learners such as the MECN students is lacking.² Additionally, studies that have been able to adequately quantify the acquisition of knowledge and critical thinking skills are few.^{1,3}

METHODS: As part of an evaluation of the newly established MECN curriculum (IRB not applicable), a pretest/ posttest, quasi-experimental design was applied to a convenience sample of first year MECN students (N = 54). During a five-week period, five groups of 10–13 students participated in six separate instructor-run scenarios over two days. A group debriefing occurred at the end of each of the simulation days, with the same instructors facilitating both simulation and debriefing sessions. Students were assigned articles to read a week prior to their scheduled simulation sessions. A 20-item test composed of National Council Licensure Examination (NCLEX) style questions to assess the students' knowledge, along with a Likert-scale survey to evaluate students' confidence in their knowledge and abilities, were given two weeks prior to and at the end of the simulation experience. An online critical thinking test (Assessment Technologies Institute, ATI) was given two months prior to and after the simulation experience. At the end of the simulation experience, each student completed a 17-item questionnaire that assessed the student's satisfaction with the simulation experience. Paired t-tests were used to compare mean differences.

RESULTS: Mean scores on the NCLEX style test improved significantly, from a pretest mean of 11.59 to a posttest mean of 13.80 ($p < 0.001$). Self-evaluation of confidence increased from a mean of 63.05 to a mean of 89.93 post-simulation ($p < 0.001$). Satisfaction scores regarding the simulation experience revealed a total mean of 65 out of 68 possible.

DISCUSSION: Simulation appears to be a valuable educational tool for MECN students. While there was no significant difference in critical thinking skills as measured by the ATI test, students increased their knowledge and confidence in their ability to apply theory to acute clinical situations. Satisfaction with the experience consistently ranked high among all participants. Future simulation sessions have already been planned to assess retention of knowledge and skills. A randomized, longitudinal, comparative study with additional measurement tools may be needed to better quantify the effect of simulation on critical thinking skills.

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CATEGORY: Education**COI STATEMENT:** The authors indicate they have nothing to disclose.**Table 4.**

	Group A Median, 10 th –90 th Percentile	Group C Median, 10 th , 90 th Percentile	p
Time to first intervention from arrest recognition (s)	70, 22–94	50, 12–97	0.2227
Time to first defibrillation (s)	80, 43–132	88, 71–158	0.1130
Time to commence CPR (s)	120, 45–160	56, 20–182	0.061
Significant pauses in CPR (% of available time)	0.65%, 0–7.1%	3.45%, 0–16.3%	0.0075

RESEARCH ABSTRACT 45

Simulation is an Effective Strategy for Orienting Code Blue Teams and Troubleshooting Facilities and Responses to Critical Events in a New Hospital Facility

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INTRODUCTION: Prompt and successful cardiopulmonary resuscitation during a sudden cardiac arrest can be hindered by multiple variables, such as an unfamiliar environment, like a new hospital facility. The main objective of the study was to use high-fidelity simulation to orient and improve Code Blue Team (CBT) responses to critical events in our new hospital facility. Additionally, this study would provide baseline information about team performance domains that are of interest for our hospital-wide team training initiative. A third objective was to elucidate human factors that may have contributed to response by debriefing team members.

METHODS: The Scott & White Memorial Hospital Institutional Review Board granted the following study an exempt status. Mock Code Blue exercises using high-fidelity simulation were implemented in real workplace settings of our new hospital facilities, the Center for Advanced Medicine (CAM) and the University Medical Campus (UMC). We measured arrival time of first responder, crash cart to code site, first six CBT responders, time of first chest compression, and first electrical shock. Following each mock code, participants were debriefed to assess any barriers to effective response and decision making.

RESULTS: At the CAM, we conducted a total of 12 mock codes at different locations during the 3 month study period and included 172 participants. Sixty-nine percent of the participants reported that the mock code simulation training was beneficial. The median time of arrival of the first responders was 42 seconds and the first CBT member was 66 seconds. The median time to initiation of chest compressions was 80 seconds, crash cart arrival was 68 seconds, and first electrical shock was 341 seconds. Prior to the UMC hospital's opening, we conducted 4 mock codes and included 43 participants. Ninety-eight percent of the participants reported that the mock code simulation training was beneficial. The median time of arrival of the first CBT member was 30 seconds. The median time to initiation of chest compressions was 112 seconds, crash cart arrival was 52 seconds, and first electrical shock was 220 seconds. An additional outcome of both study sites was the identification of facility and systems issues that had the potential to impact patient safety.

DISCUSSION: The results of the current study provide helpful information about the impact of a new facility on CBT performance and how simulation can orient healthcare workers to a new health care facility. Testing new and existing hospital facilities with simulated patients will allow healthcare leaders to identify, address, and correct breaches in patient safety in different domains and may prevent adverse events with real patients. Furthermore, the healthcare industry should consider the adoption of simulation for resuscitation team training in operational facilities because it provides an exposure of staff to crisis incidents within the work environment.

CATEGORY: Patient Safety Products/Projects

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 46

Reliability of Physiologic Data Presentation Using a High Fidelity Simulation System

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OBJECTIVE: Determine the ability of a high-fidelity simulation system to be able to present dynamic physiological data in a reliable and consistent fashion during simulated scenarios.

BACKGROUND: Human simulators are becoming more sophisticated in their ability to present physiological data to the trainee during simulation encounters for education and assessment. The displayed physiology is able to change in response to time, treatments administered and procedures performed by the trainee to recreate human physiologic changes. Physiologic data obtained from the patient monitor is incorporated into the decision making processes of the trainee providing care for the simulator. To create simulation based assessment tools that can be utilized for competency evaluations it is essential to know that the same "test" is administered across a given cohort of examinees. One step of this process is to validate that a potential test administering instrument such as a human simulator is able to display dynamic physiological data, capable of varying in response to a preprogrammed scenario with a high degree of reliability. This is one step to ensure that the decisions made by the trainee were based on a known set of circumstances that can be compared against a cohort participating in a similar assessment scenario.

METHOD: Five separate Laerdal SimMan™ systems had four pre-programmed research scenarios installed at WISER at the University of Pittsburgh. Five separate systems had the same scenarios loaded at SimTiki at the University of Hawaii. The ten systems utilized various computer configurations ranging from high performance desktop units to basic models of laptop computers that included a total of 6 unique systems. The first scenario displayed physiology data that did not change. The second scenario had physiologic changes that occurred along a trend that was pre-programmed. The third had physiology start at a fixed point and then began changing along a trend when initiated by the operator. The fourth scenario had physiologic trends that changed twice during the data collection in response to operator initiated events. The physiological data parameters studied included heart rate (HR), oxygen saturation (SpO2), end tidal carbon dioxide (ETCo2), respiratory rate (RR), systolic blood pressure (SBP) and diastolic blood pressure (DBP). The data displayed on the simulator patient monitor was recorded at the start of the scenario and then at one minute intervals by two of the authors (JT,KH). Scenario 1, a non-dynamic scenario was 5 minutes in length and the remaining three scenarios were 12 minutes in length which served as the end point for data collection. Correlation Coefficients (ICC) were calculated for each physiological parameter across all ten systems.

RESULTS: Extremely high to near perfect correlation was noted in all measured physiologic parameters. Correlation coefficients for each parameter included HR (+0.999); SpO2(+0.996); ETCo2(+0.986); RR(+0.998); SBP(+0.992) and DBP(+0.996).

CONCLUSIONS: In this preliminary report of physiologic parameter reliability studied at two separate simulation centers we demonstrate that the Laerdal SimMan™ high fidelity simulator system can reproduce dynamic physiologic changes across multiple systems with an extremely high degree of reliability and consistency.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 47

Effects of Multimodal Training Devices on Medical Education

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INTRODUCTION: Haptic knowledge cannot be learnt from books but must be trained individually. Training devices with multimodal feedback are being developed for medical education [1,2]. Effects on haptic memory and learning curves cannot be quantified easily because of the complexity of haptic therapeutical maneuvers. Effects of multimodality were examined in a plain haptic task.

METHODS: The delivery simulator [1] was used as test setup. The haptic task was a simplified forceps extraction. 8 students without obstetric knowledge had to perform $n = 48$ extractions. The correct pull was defined in direction (3 dof), magnitude ($F = 45 \pm 5$ N) and holding time ($t = 1$ s) by an expert. Group 1 (haptic only) pulled without further assistance, group 2 (haptic and optic) pulled with an additional graphical feedback. Time and the excess of force were measured. Finally an exponential learning curve was fitted in the data of excess of force and required time. The exponent of the fitted function is a quantification for the learning speed.

RESULTS: Group 1 had learning curve exponents of $-2.01E-3 \pm 1.27E-3$, group 2 had $-4.49E-3 \pm 1.71E-3$. Also the excess of force within group 1 showed no improvement over time compared to group 2, which had a linear falling trend.

DISCUSSION: The overall results show, that haptic memory exists and that haptic medical education can be improved with multimodal training devices. The linear falling trend in excess of force within group 2 compared to group 1 also shows that haptic sensitiveness can be gained faster using multimodal training devices.

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CATEGORY: Technology Development and Evaluation

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 48

Training New Physicians to Maintain Professionalism Under Duress

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INTRODUCTION: Professionalism is one of six core competencies for resident physicians (1). In a web-based survey (2), residency program directors (PD) felt well informed about such requirements, but cited numerous concerns about teaching and assessing these competencies. The University of Miami - Jackson Memorial Hospital Center for Patient Safety (CPS) has observed that young doctors often exhibit suboptimal behaviors, particularly when placed under stressful situations. It is hypothesized that lack of professional behaviors, especially as related to stressful patient encounters, are insufficiently addressed during medical school. Therefore, as part of CPS curriculum, simulation scenarios were specifically designed to elicit such nonprofessional behaviors and offering corrective post-session debriefings as needed.

METHODS: A total of 208 new interns and residents were video-recorded as part of the hospital's 2007 pre-clinical patient safety orientation program. Trainees were asked to consecutively examine two standardized patients, exactly as they would in a professional office encounter, but were challenged by time-deadline, linguistic-barrier, and patient hostility. Faculty conducted post-simulation debriefings, and video reviewers also noted unprofessional behaviors.

RESULTS: Omissions of the following professional behaviors were verified: door knock prior to entering the room, patient identification, call for interpreter to assist with patient who didn't speak English, call for help when dealing with an irate, verbally-abusive patient, hand hygiene, or the appropriate disposal of soiled towels. Observed negative acts included: washing hands with water only, drying hands on one's clothing, re-contaminating hands by touching the trash receptacle lid, gum chewing, forcefully tearing patient exam garments, eye-rolling, yelling at the patient, and in one case, overt flirtation.

DISCUSSION: This study confirms that professionalism may not always be adequately taught during medical school. When teaching professionalism, it can be difficult for medical educators to set clear expectations, create appropriate learning experiences, and evaluate outcomes. Educators must design clinical experiences which allow students to see how experienced practitioners maintain professionalism even under stressful situations. Although we often permit students to spend a full hour taking history and performing physical examination, busy physicians do not have that luxury. Inherent conflicts between what is taught and what students see in real-life settings (sometimes, with less than perfect role-models) may not promote professionalism. To conclude, lack of professionalism may erode the patient-physician relationship. Our simulation program demonstrated value both to elicit unprofessional behaviors and allow young physicians to observe them and modify their behavior. Medical schools should consider use of simulation as part of their curricula to more robustly teach medical students professional conduct able to withstand the rigors of extreme situations.

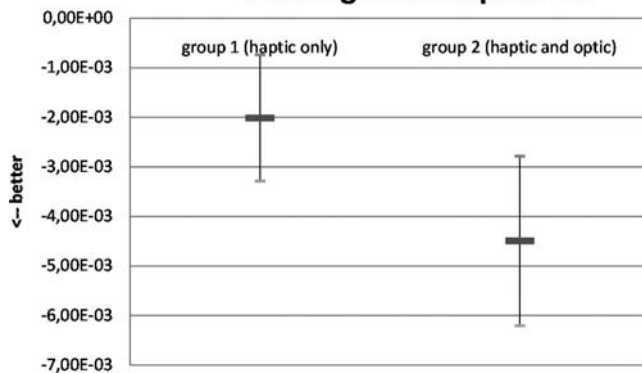
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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

learning curve exponents



RESEARCH ABSTRACT 49

Simulation in a Disaster Drill: Comparison of High-Fidelity Simulators vs Trained ActorsBradley F Peckler¹, Brian P Gillett², Spencer Nabors², Maguire Chris¹, Onkst Cherie¹, Galwanka Sagar¹, Arquilla Bonnie²¹University of South Florida, Tampa, FL, United States; ²State University of New York, Downstate, Brooklyn, NY, United States

INTRODUCTION: High fidelity patient simulation minimizes the disconnect between preparatory exercise and actual incident by providing life-like medical scenarios with real time stressors. Mass causality drills (MCD) must construct a realistic incident in which participant providers care for multiple injured and sick patients while simultaneously coping with numerous stressors. We compare the value of high-fidelity simulated patients (SP) to live actor-patients (AP) in such a drill. To our knowledge this is the first published study of this kind.

METHODS: During two large scale MCD's in Brooklyn and Tampa, we inserted 8 paired clinical encounters for AP and SP at the respective level one trauma centers. The paired encounters were equal in number of obvious injuries, number of discoverable injuries, number of required invasive procedures, vital signs and patient profile. A checklist of critical actions was logged for all scenarios. A survey was administered to all involved immediately after the exercise. Providers were not informed that they would be caring for SP prior to the drill.

RESULTS: A total of 78 people were involved in the study (20.5% attendings, 25.6% residents, 17.9% nurses, 36% ancillaries.) The null hypothesis was proven correct in that critical actions were almost universally preformed in both types of encounters. 74.7% of participants had some prior contact with simulators operational or technical problems were less likely to impact the experience of these participants than those with no prior simulation exposure. Nurses were more likely to perceive the SP as a distraction. Students and residents found the SP more constructive than attendings. Participants with less than 5 years or more than 15 years of professional experience found the SP more valuable than AP. Overall, participants rated the SP highly favorably in respect to encounter realism, disease representation, physical exam findings, facility of administering treatment options, utility in testing disaster response, and utility in testing resource allocation. Variability in enthusiasm was less likely to impact a participant's clinical encounter with an SP as compared to the AP.

DISCUSSION: High-fidelity simulators have already proven to be an effective tool in medical education. This study demonstrates that simulators successfully integrate into MCD and increase the perceived reality of such exercises. Prior exposure to medical simulation enhances the value of the experience.

CATEGORY: Technology Development and Evaluation

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 50

Teamwork Day - A Novel Daylong Simulation-Based Learning Experience for New Medical StudentsMatthew Weinger, Arna Bannerjee, Jason Slagle, Anne Miller, Daniel France, Teamwork Day Curriculum Committee
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INTRODUCTION: Failures of teamwork and interpersonal communication have been cited as a major patient safety issue. Healthcare is increasingly being provided in interdisciplinary teams yet medical school curricula have traditionally not explicitly included the specific knowledge, skills, attitudes, and behaviors required to function effectively as part of such teams. As part of a complete redesign of our curriculum, Vanderbilt School of Medicine created a Foundations core course that includes a two-week introduction to the most important themes in modern healthcare. The Center for Experiential Learning and Assessment (CELA) was asked to create an experiential introduction to teamwork for second-week medical students.

METHODS: 104 students were divided into 10 groups and assigned a faculty mentor for the day. Each group participated in six teamwork exercises in rotations. Exercises, based on explicit educational objectives, employed role-play, manikin simulation, and standardized patients in medically relevant scenarios. No formal didactics were employed. Upon course completion, students evaluated the course using 7-point Likert scale questions.

RESULTS: The course exercises and their final student evaluations are shown in the Table. Upon course completion, students believed they were able to identify "essential teamwork behaviors" (5.8 ± 1.5 (SD)) and be "more effective team members" (5.9 ± 1.5). They asserted that the course increased their "collaboration and teamwork skills" (6.0 ± 1.5) and "decision making skills" (5.6 ± 1.5), providing "insight into [their] strengths and weaknesses" (5.8 ± 1.6). Neither individual faculty ratings nor exercise order influenced overall exercise ratings.

DISCUSSION: We describe the nature and evaluation of a new highly interactive daylong session to introduce new medical students to basic teamwork principles. Exercises that were not fully participatory received lower scores (e.g., Crisis on Flight 1974) included observational roles. Students valued interaction with a standardized patient.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 51

Use of A Variety of Simulation Modalities in a Graduate Medical Education Safety Initiative on Central Venous Catheterization

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INTRODUCTION: The potential for adverse events associated with central venous catheterization (CVC) procedures is well-established.¹⁻² The overall goal of this multidisciplinary project was to improve patient outcomes by providing PGY-1 resident physicians with simulation-based training in the performance of CVC procedures. The purpose of this study was to obtain initial feedback from participants on self-rated performance and educational effectiveness of the training program.

METHODS: After review and approval from our medical center IRB, sixty-nine PGY-1 resident physicians from eight specialty and four generalist disciplines participated in the training program. Each resident completed a web-based CVC teaching module and then attended a simulation-based skills session. The session featured a lecture followed by individualized instruction using a combination of simulation modalities (video-recordings, skeletal models, live surface anatomy models, live patient actors, task trainers). Upon completion of the skills session, residents were assessed while performing an ultrasound-guided, internal jugular CVC. Performances were video-recorded, and each resident received immediate feedback. Post-training, residents completed a 9-item self-assessment survey of skill and degree of independence, and a 12-item satisfaction survey. We report descriptive data on self-rated resident performance and satisfaction with the course. We also compare resident performance and satisfaction based on two variables: specialty category (generalist versus specialist), and gender. Independent T-test procedures were used to test for item mean differences. All ratings featured 5-point Likert-type scales.

RESULTS: A total of 66 of 69 residents (96%) provided informed consent for the study and furnished useable data. Self-Ratings of Performance: residents rated their performance highly (mean rating = 4.31, SD = .71), and were confident that they were capable of performing CVC procedures independently (mean rating = 4.16, SD = .91). Generalist residents rated their performance lower than specialty residents on four of eight items, and were less confident of their independence level (mean rating = 3.79 versus 4.50, $p = .002$). Female residents were less confident of their independence level (mean rating = 3.90 versus 4.44, $p = .02$). Course Ratings: residents rated the course highly (mean rating = 4.77, SD = .46). Specialty residents (mean rating = 4.68 versus 3.33, $p = .000$) and male residents (4.57 versus 3.60, $p = .005$) were more likely than generalist residents to agree that they had prior experience with CVC procedures. Specialty residents were more likely to agree that they received feedback during educational sessions (mean rating = 5.00 versus 4.88, $p = .04$).

DISCUSSION: Residents were satisfied with the educational aspects of the course, felt that it was beneficial and recommended that it be mandatory for all future interns. Strengths of the format were supervised experiences in a safe environment and the use of a variety of simulation modalities. Potential performance differences based on trainee characteristics may be important when planning for simulation-based courses, and warrant further investigation.

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 52

Simulator Fidelity is not a Predictor of Effective Resuscitation Teamwork

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INTRODUCTION: Within simulation there are many forms of fidelity. Equipment fidelity pertains to the realism of the manikin being used. Psychological fidelity refers to the degree the participant feels the situation is real. Environmental fidelity concerns the realism of the teaching space. Task fidelity refers to realism of the task being performed in the simulation. This study examined the impact of equipment or manikin fidelity as a predictor for improved resuscitation team performance.

METHODS: 34 senior nursing students from four different nursing programs participated in Advanced Cardiovascular Life Support (ACLS) courses. Two ACLS classes were conducted with 16 participants taking ACLS using a high-fidelity patient simulator and 18 participants taking ACLS with the all elements of the course being the same except the simulator was turned off and operated in a low-fidelity mode. Immediately after completing the course, each participant served as team leader for a simulated cardiac arrest event that was video recorded. Each team leader was supported by other participants (6-7 members per team) from the same cohort group. A panel of expert ACLS instructors who did not participate as instructors in the ACLS course reviewed each video and independently scored team and team leader performance in 14 areas related to resuscitation skills including one item that focused on the teams' teamwork skills and actions using the ACLS course teamwork criteria as a guide to rate team performance.

RESULTS: Scores on the Likert-like scale of 1 to 7 with 1 being the lowest level of teamwork performance and 7 being the highest level of teamwork performance showed the low-fidelity group had a teamwork score of 4.54 (SD 1.54) and the high-fidelity group had a teamwork score of 5.06 (SD 1.68). Although higher, the high-fidelity score did not reach a level of significance ($t = -1.65$, $p = .102$).

DISCUSSION: The fidelity of the manikin being used in this course was not a predictor for significantly improved teamwork performance. This finding reinforces concepts presented in the simulation literature that a successful simulation involves more than just a simulator. Other forms of simulation fidelity in these classes were very high as each class used a realistic looking manikin, a complete array of working medical equipment, team members had specific roles that required interaction with other team members, and each class was conducted in a realistic clinical environment. These findings indicate that manikin fidelity may not be as important in team training as other forms of fidelity.

CATEGORY: Education

COI STATEMENT: Conflict Reported - David Rodgers is president and owner of Healthcare Simulation Strategies, a private education and training consulting firm. Clients include Laerdal Medical. Other authors have No conflicts.

RESEARCH ABSTRACT 53

Using In-Situ Simulation to Establish A New Intraoperative Radiation Therapy Program: A Novel Multidisciplinary Paradigm to Patient Safety

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INTRODUCTION: The use of simulation prior to the introduction of new technology offers the potential to proactively identify and mitigate risks. The specific aim of this project was to describe the process by which we used in-situ simulation to proactively identify and mitigate hazards prior to introducing a new technology (intraoperative radiation therapy -; IORT) in the operating room (OR).

METHODS: Prospective observational study, where a new structured process was used to uncover concerns among providers and potential defects for patients with the introduction of a new technology in the OR. Data were collected from simulation sessions. Sessions took place in the actual OR that would be used for delivering the therapy to real patients. All concerns and defects uncovered were recorded, in addition to provider interventions, reaction times, and outcomes during each simulated scenario.

RESULTS: The process used in this study identified and corrected 20 defects in the simulated patient care process. Six defects were related to radiation safety for both the patient and the clinical staff, 4 defects were associated with non-radiation safety for the patient, 6 defects concerned teamwork and communication, and 4 defects related to equipment and supplies. The defects and the implemented changes were added to a protocol and to a checklist. This protocol has been applied successfully to 5 real patients who have undergone IORT since the process was completed without any adverse outcomes.

DISCUSSION: The methodology presented in this paper, that includes in-situ simulation for introducing a new IORT technique at Johns Hopkins Hospital have been extremely successful in guaranteeing patient safety and decreasing the percentage of defects per hazard. This success can be attributed to steps that allowed identifying and addressing hazards through team training, creating a protocol for delivery of therapy, and changing the system before exposing patients to those potential hazards. This model can be applied to any old or new process that involves team interaction and for which training and preparation may decrease defects and their impact on patient safety. The structured process used in this paper allows clinicians to proactively identify hazards, design safe care systems and test them before exposing our patients. The multidisciplinary and systematic approach and the replication of the environment and the conditions in which processes occur, via in situ simulation, has greatly facilitated prospective risk management in patient care.

CATEGORY: Patient Safety Products/Projects

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 54

Validation of SimCom-T: An Instrument Measuring Team Communication as a Unit

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INTRODUCTION: The role of effective medical team performance has become a priority in efforts to improve patient safety and care. Communication is a critical component of highly effective teams. However, there are few instruments that assess team communication as a factor in medical team performance. SimCom-Team(T) is the first team communication instrument designed for the assessment of medical team performance.

METHODS: The Scott & White Memorial Hospital Institutional Review Board has granted the following study an exempt status. Development of SimCom-T is based on the work of various team performance theorists including Cannon-Bowers and Salas, Dickinson and Harris and Barnes-Farrell. The SimCom-T rating scale was refined over a number of innovative pilots including a website-based feedback mechanism and through a series of interactive workshops at international conferences. The constructs within SimCom-T represent key items reflective of team communication skills, which collectively influence team performance. The next step of the SimCom-T development is a series of validation studies to assess reliability and validity of the instrument. The current study will use the SimCom-T during simulated medical scenarios to assess communication skills. Teams will vary in expertise from novice to expert. Expert raters, blinded to the level of medical teams, will rate their performance using SimCom-T. Analyses will measure content validity, evidence that the simulation scenarios are appropriate vehicles for measuring teamwork skills, construct validity, including both concurrent (e.g., relationships between and among the teamwork dimensions) and discriminant measures (e.g., the ability to distinguish between groups of differing ability), and reliability, the consistency of measurement.

RESULTS: The pilot studies generated considerable feedback during the SimCom-T development and was used to revise the instrument to its current stage. The SimCom-T is a nine-factor holistic rating scale designed to measure medical team communication as a unit: leadership establishment and maintenance, global awareness, recognition of critical events, information exchange, team support, external team support, patient support, mutual trust and respect, and flexibility. To standardize the communication ratings, a rating guide was created that operationally defines each factor along a continuum from below standard to superior performance.

DISCUSSION: The SimCom-T assesses both the human factors influencing a medical team (e.g. leadership, information exchange, support, flexibility) and how the team responds to the work environment (e.g. maintaining a global awareness). Results of this study will determine if the SimCom-T is a reliable and valid measure of team communication in a clinical environment, both simulated and real. Consequently, standardization of healthcare team competencies has the potential for improving patient safety and decreasing medical errors in healthcare practices globally.

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CATEGORY: Patient Safety Products/Projects

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 55

Simulation Used in Evaluation of End of Life Issues

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INTRODUCTION: Hi-Fidelity simulation is rapidly becoming accepted as an advanced teaching tool for medical providers in all stages of practice. Simulation allows a student to be placed in a situation where they are asked to make management decisions that are above their current skill level. We sought to use simulation in an end of year high stakes Clinical Performance Examination (CPX) where of MS IIIs were asked to make critical action decisions. Students were faced with an end of life scenario where they were asked to discuss critical management decisions with family members of a traumatic terminal patient.

METHODS: All students had prior exposure to simulators during their educational year. This case was offered as an extra-credit case to boost their end of year CPX score. The patient was a simulator who was a 28 year old victim of a gunshot wound to the head that occurred the previous night. The head CT showed the bullet crossing midline. Notes from the Trauma and Neurosurgical service indicated the patient was non-operative and brain dead. Trained Standardized Patients (SPs) were the family who had just arrived from out of town. The student was asked to write a progress note on the interaction and the SPs evaluated the student on common end of life issues.

RESULTS: The exam was given to a total of 117 students. 96% of these students discussed organ donation with the SPs, while 84% mentioned advanced directives and/or power of attorney with these "family members". 100% of the students committed to death as the eventual outcome for this patient. 98% of the students were able to identify the stages of grief, and 99% were adept at the stages of delivering bad news to family members. The results for the issues regarding end of life care and complications were mixed.

DISCUSSION: Third year medical students receive no formal training in this point of their career to deal with end of life issues. While their exposure to such is sometimes touched upon, it is only as an ancillary member of the team and their input is rarely solicited. Upon examining the student responses, the team recommends it is important to include medical students in the discussions surrounding end of life issues and traumatic terminal illness in their academic training.

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 56

Global Intern Improvement During a Comprehensive 2 Week Preclinical Simulation Program

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INTRODUCTION: The new intern on labor and delivery or in the operating room is often minimally skilled and incredibly nervous regarding their ability to perform clinical procedures. We sought to prepare new interns through an innovative training program conducted exclusively in a simulation center to teach the basic skills needed to perform greater than 90% of intern specific procedures. The goal was to develop procedural competence prior to providing care in the clinical arena. Learners were assessed about their perception of their own level of improvement in the course.

METHODS: All new Obstetrics and Gynecology and Family Medicine interns ($n = 14$) at the Mayo Clinic participated in the 2 week course during which they had no other clinical responsibilities. Confidence and skill was built through repetition of different procedures including but not limited to knot tying, suturing, and surgical closure, amniotomy, normal vaginal delivery, episiotomy repair and circumcision. In addition the interns were given training in obstetric/gynecologic emergencies and basic gynecologic examinations. Learners were asked to rate their skills on a 1–5 scale prior to and upon completion of the course, with a 1 (expert level), 2, 3 (competent to perform the procedure independently), 4, or a 5 (absolutely no or minimal experience with a technique or procedure). On completion of the course, they were asked to assess what their "true level of skill was" prior to the course after working on the procedures. The data were analyzed using means and standard deviations, paired t-tests and Wilcoxon signed rank tests as appropriate. A p-value of < 0.05 was considered statistically significant.

RESULTS: The average learner reported an increase of 1.2 (95% CI 0.91–1.46) units on the 1–5 scale over the 45 items taught based on their pre-course and post-course self-assessment. There was an even larger increase when comparing the post-course self-assessment of pre-course skills with the post-course skill evaluation (1.3 ± 0.47). All individual items showed a statistically significant improvement when comparing the post-course evaluation of pre-course skills ($p < 0.05$ for all measures). 38/45 measures also showed a statistically significant improvement for the pre vs. post course evaluation. ($p < 0.05$ for those measures).

DISCUSSION: Medical school theoretically provides all incoming residents with a basic set of skills for clinical practice. Unfortunately, the specific demands of the surgical and labor and delivery suite require a host of items minimally or inadequately taught. These techniques are often required from the first day for patient care. Those who possess the necessary confidence and training will be given more opportunities earlier in the intern year and will provide safer, more comfortable, and efficient patient care. Upon completing this intensive 2 week training course the interns of the Obstetrics and Gynecology and Family Medicine departments felt that they were better prepared and were more confident about their procedural abilities.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 57

Effects of Simulator Training on Salivary Amylase And Cortisol Levels in Intensivists: A Pilot StudyMichael Müller¹, Andreas Fichtner¹, Florian Hardt¹, Mike Hänsel¹, Sören Weber¹, Clemens Kirschbaum², Christoph Eich³, Thea Koch¹¹Interdisciplinary Medical Simulation Centre ISIMED, Dept. of Anesthesiology, University Hospital Dresden, Dresden, Germany; ²Institute of Psychology I, University of Technology, Dresden, Germany; ³Department of Anesthesiology, Emergency, and Intensive Care Medicine, Georg-August University, Göttingen, Germany**INTRODUCTION:** Simulator training is one strategy to increase the performance of medical teams in critical situations. According to the Yerkes Dodson law the performance of humans is optimal with medium stress level. Stress in high fidelity patient simulation has not yet been studied. Objective was to investigate salivary alpha-amylase and cortisol during simulated emergencies before and after two different full-scale patient simulation courses.**METHODS:** After ethics board approval, 6 one day simulator courses had been offered to 32 intensivists. The courses were randomised to either crew resource management (CRM) training or classic simulator training (MED). The CRM course contained psychological teaching and simulator scenarios (1). The classic simulator training contained the same scenarios and seminars on life support, airway management, arrhythmias, and general anesthesia. Before and after the course each participant took part in a 10 minutes test scenario. Before (T1) and after (T2) the scenario, and 15 minutes later (T3) saliva samples were taken. Amylase and cortisol were measured. Analysis of variance was performed.**RESULTS:** 29 participants completed the course (17 – CRM, 12 – MED). Age, gender, and experience did not differ between groups. The amylase and cortisol concentrations are depicted in table 1 and table 2, respectively. Amylase ($p < 0.001$) and cortisol ($p < 0.001$) changes in the time course of the test scenarios were significant, but there were no differences between the groups (amylase: $p = 0.462$, cortisol: 0.506). The changes during posttest scenario were significant smaller than during pretest scenario for amylase ($p = 0.007$), but not cortisol ($p = 0.204$).**CONCLUSION:** Our data show that a simulator scenario produces significant stress and that a one day simulator training reduces stress in simulated emergencies. The study failed to show differences between the two course concepts.**REFERENCE**

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CATEGORY: Patient Safety Products/Projects**COI STATEMENT:** The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 58

Free Open-Source Shared Medical Simulation Case LibraryHoward Schwid^{1,2}¹University of Washington, Seattle, WA, United States; ²VA Puget Sound Health Care System, Seattle, WA, United States**INTRODUCTION:** Case and curriculum development for medical simulators is a time-consuming process. Sharing cases among simulation centers will greatly reduce the investment necessary to operate a simulation program.**METHODS:** The preliminary open-source medical simulation format was presented to about 25 simulation experts at the 2006 IMSH. Based on their feedback numerous format changes were made. The modified open-source format was endorsed by about 40 simulation experts at the 2007 IMSH. Each case consists of a text file that includes the case scenario, authors, affiliation, target audience, learning objectives, overall case management advice, what next help, automated debriefing and automated scoring. The initial library of 72 cases for ACLS, PALS, neonatal resuscitation and anesthesia was posted for free on the internet at a medical simulation website (www.anesoft.com).**RESULTS:** In the first few months after posting the free library, the cases have been downloaded over 15,000 times. In addition to the free downloads, the library has stimulated 16 new contributing authors at 13 different institutions to submit 23 new cases to share. These cases are currently undergoing peer-review.**DISCUSSION:** The large number of case downloads indicates the strong demand for case sharing among simulation centers. The submission of 23 additional cases to share further demonstrates the benefits of the shared case library. Furthermore, another 68 cases will be posted in the next few months for critical care medicine, emergency medicine, pediatrics, obstetrics and procedural sedation. The number of cases downloaded and new cases uploaded will continue to be tracked. The next step is to encourage other simulation companies to post cases to share among simulation centers. Furthermore, a common standard case format could be adopted so that case scenarios developed for one simulator will operate on another simulator.**CATEGORY:** Education**COI STATEMENT:** Conflict Reported - The free case library is funded by Anesoft Corporation. Howard Schwid is a member of the Anesoft Medical Advisory Committee.**Table 1.**

Alpha amylase [U/ml]	Pretest			Posttest		
	T1	T2	T3	T1	T2	T3
study group	55.6 ± 53.5	116.7 ± 93.2	56.8 ± 44.5	81.1 ± 81.5	88.9 ± 80.4	52.8 ± 45.5
control group	55.6 ± 44.4	108.9 ± 83.5	53.2 ± 35.3	85.7 ± 78.4	94.5 ± 73.9	64.2 ± 52.8

Table 2.

Cortisol [nmol/l]	Pretest			Posttest		
	T1	T2	T3	T1	T2	T3
study group	12.5 ± 8.4	15.9 ± 10.2	19.5 ± 12.0	6.9 ± 6.0	8.8 ± 8.0	11.0 ± 10.3
control group	5.2 ± 2.7	8.0 ± 6.0	13.2 ± 12.2	5.4 ± 2.7	7.0 ± 4.0	7.9 ± 4.9

RESEARCH ABSTRACT 59

Use of a 2-Week Intensive Preclinical Simulation Experience for Interns to Improve Patient Care on Clinical Services

Brian Brost, Robert Flinchbaugh, Bruce Johnston
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INTRODUCTION: The ability to use simulations and task trainers for post medical school training is rapidly evolving. Most programs in OB/Gyn utilizing simulation choose to use this technology for summative assessment of their learners. Only a few articles in our literature evaluate formative learning in Obstetrics and Gynecology. We present the use of a prolonged preclinical simulation experience for OB/Gyn and Family Medicine Interns.

METHODS: Course participants included all incoming interns for the first 2-weeks of July (5 entering OB/Gyn and 9 entering Family Medicine). This comprehensive program was designed to teach greater than 90% of the requisite clinical and procedural skills needed by interns in the clinics, L&D, and the surgical suites. No intern had any clinical or call responsibilities during this workshop. Short didactic sessions were interspersed between structure clinical rehearsal and repetitive procedural skills training. These sessions were designed to build competency and confidence in a skill. Training sessions built on prior skills to attain the next level of skill or procedure. All interns periodically self-identify deficiencies and were given the opportunity to work on the skills they needed throughout the two weeks. Each learners experience was documented in a progress diary and digitally recorded.

RESULTS: The interns felt this program allowed each of them to learn and hone their skills at their own pace. Globally, confidence and competence as evaluated by a pre and post-workshop assessment showed significant improvement in clinical and procedural skills. A pre and post-workshop assessment showed improvement across a range of ~50 individual procedural skills from a rating of 3.7 to 2.4 (Likert assessment - 5 = no experience, 3 = procedural competence and 1 = expert). One month comparison of the interns to current 2nd year OB/Gyn residents in the more difficult procedural skills (mediolateral episiotomy repair ($p > 0.5$), circumcision ($p > 0.5$), fascial and uterus suturing ($p > 0.5$), cervical examination of the pregnant cervix ($p = 0.001$) showed that the interns performed as well as, or exceeding the capabilities of their senior residents when evaluated for procedural time, tissue respect, adherence to proper technique and accuracy of assessment. A post-workshop survey developed and administered independent by the Simulation Center showed incredible learner support for repeating this program. The course was rated at 4.8/5.0 at meeting their learning needs. The faculty from both the OB/Gyn and Family Medicine programs observing the workshop was unanimous in their agreement that this should continue with expansion of the workshop as the training paradigm for our programs in the future. An unexpected important feature of this workshop was the closeness that developed between interns and faculty of the different programs. We will explore this finding in future studies.

DISCUSSION: Preclinical simulation experience had a significant impact on OB/Gyn Interns and a profound influence on the Family Medicine Interns and should become the norm for all training programs. Procedural competency can be documented prior to patient contact and we have demonstrated that this type of intensive training can meet or exceed greater than a years clinical experience utilizing traditional training methods. While these educational experiences can be performed in a simulation center, all training programs could develop a similar workshop utilizing in-situ training in Labor and Delivery, Clinics, and Surgical Suites. The ethics of learning these skills on patients when education can take place in a setting safer for our patients should be seriously re-evaluated.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 60

Blast Injuries in Children: Is There a Role for Pediatric Simulation?

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INTRODUCTION: The distinctive anatomy and physiology of children require specialized knowledge and training for optimal resuscitation in the wake of a blast incident. We are reporting the use and effectiveness of pediatric simulation as a training tool for emergency hospital personnel treating children with blast injuries.

METHODS: The Pediatric Blast Injury Simulation Workshop was developed to advance psychomotor abilities of medical responders from Chicago-area hospitals. Three blast injury scenarios were developed to illustrate pediatric presentations including pulmonary and crush injuries. The presentations highlighted the unique anatomic and physiologic vulnerabilities of children in regard to blast injury. The workshop included a lecture on the basic physics of blasts and different mechanisms of injury and treatment associated with them. After orientation to the simulator, cases were introduced to the participants who then proceeded to resuscitate three pediatric victims injured during a simulated terrorist attack (explosion). Afterward, the participants were debriefed about medical treatment, team performance, crisis resource management and other pertinent matters. Upon completion of the exercise, each participant was requested to complete an anonymous, 14-item, attitudinal survey evaluating the workshop on a 5-point Likert scale. Further, a comment section was available for remarks concerning the simulation environment (like/dislike) and any recommendations for improvement.

RESULTS: Over 25 hospitals from the Chicago metropolitan area were represented at the Pediatric Blast Injury Workshop. Seventy-one practicing health care providers participated in the workshop including 24 physicians and 41 nurses. Fifty participants (70%) completed the course attitudinal survey. Approximately 88% evaluated the workshop as a beneficial teaching experience. Only 1% disagreed that the workshop was an effective tool. Additional significant findings (Strongly Agreed and Agreed) included the following: 1) 88% noted the workshop improved their comprehension of the teaching objectives 2) 94% felt the simulator session improved their knowledge of the teaching objectives 3) 94% said the material presented was current and accurate 4) 94% commented that simulation enhanced their learning more than reading 5) 96% responded that learning objectives were met 6) 88% felt there was adequate time spent with the simulator 7) 92% encountered adequate time for debriefing 8) 80% felt that their PALS skills were improved by patient simulation 9) 2% disclosed a level of discomfort in the simulator environment 10) 8% discussed performing simulation tasks/skills in the past. The comment section revealed positive responses including: compliments for realism, appreciation for a hands-on experience and the beneficial application of learned knowledge. Participants also suggested a need for more time with the simulators and greater availability of simulation scenarios to all area hospitals.

DISCUSSION: Based upon the results, pediatric simulation seems to be an excellent tool for pediatric blast injury education. Future pediatric simulation research is required to validate this educational approach.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 61

Using Simulation to Improve Medical Students' Ability to Recognize Abnormal Heart Sounds: A Longitudinal Study

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INTRODUCTION: Medical students struggle to recognize abnormal cardiac sounds when performing physical examinations. Reasons for this include a lack of exposure to patients with heart sound abnormalities and limited faculty time to teach proper examination techniques. Our project was designed to determine whether the introduction of a cardiac auscultation simulation program could improve the ability of medical students to accurately recognize abnormal cardiac sounds.

METHODS: The class of 2007 at the University of Cincinnati College of Medicine was required to learn proper recognition of 7 abnormal heart sounds using Cardionics® Student Auscultation Manikins (SAM) and accompanying computer simulation program. Students' ability to correctly identify these heart sounds was tested during the end of 2nd year clinical exam for the Clinical Foundations of Medical Practice-2 (CFMP-2) course. The students were retested on 2 of the 7 heart sounds during their 4th year Clinical Competency Exam (CCX). The CCX is a 4 hour comprehensive exam utilizing standardized patient encounters and inter-station exercises to test students' clinical abilities after completion of their required clerkships. The class' ability to identify abnormal heart sounds 1 and 2 as second year students was compared to their performance on the same sounds, as 4th year students. We then compared the performance of the class of 2007 to that of the class of 2005 and 2006 (who did not have the simulation program) during the CCX. Chi-square analysis was used to determine statistical significance.

RESULTS: The mean (standard deviation) amount of time students reported using the simulation programs was 3.2 (1.7) hours. One hundred fifty eight students from the class of 2007 took the clinical exam at the end of year 2. One hundred twenty five (79%) correctly identified heart sound 1 while 96 (61%) correctly identified heart sound 2. Seventeen students from the class of 2007 did not take the CCX due to 7 participating in research for their MD/PhD program, 8 not completing all clerkship requirements and 2 students withdrawing from the College of Medicine. Of the 141 students who took the CCX in their 4th year, 117 (83%) correctly identified heart sound 1 and 87 (62%) correctly identified heart sound 2 ($p = 1.0$ for both heart sounds). These results suggest the class of 2007 retained the ability to identify the abnormal heart sounds from year 2 to year 4. These results are in contrast to the performance of students in the class of 2005 ($N = 145$) and 2006 ($N = 147$) during their CCX. One hundred four (72%) of 2005 students and 100 (68%) of 2006 students correctly identified heart sound 1 ($p < 0.003$ compared to class of 2007). Two (2%) of 2005 students and 19 (13%) of 2006 students correctly identified heart sound 2 ($p < 0.0001$ compared to class of 2007).

DISCUSSION: The use of cardiac auscultation simulation programs by second year medical students improved their ability to identify abnormal heart sounds. This improvement appears to be retained by the students when retested later in their curriculum.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 62

Assessment of Application of The Sepsis Bundles by First Responders

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INTRODUCTION: Patients with severe sepsis not receiving all components of the treatments known as the 6-hour sepsis bundle (SB) have a twofold increase in hospital mortality (1, 2). As residents are often the first responders to septic patients, the assessment of their clinical skills is a crucial element of training. Traditional medical education based on linear communication models has proved to be less effective for adult learning (3). Assessment should include both formative and summative functions to ensure professional competence (4). We evaluated a group of PGY-1 and PGY-2 residents in a scenario simulating inpatient sepsis using high-fidelity medical simulation. The speed and appropriateness of diagnosing sepsis, of fluid resuscitation, and of the residents' ability to complete all steps of the SB were specific objectives of this exercise.

METHODS: 19 PGY-1 and 11 PGY-2 house officers gave written informed consent to this IRB approved retrospective study. All participants attended a lecture on sepsis diagnosis, SB treatment, and had rotated in the ICU. Each carried a card listing SB components, and was individually introduced to the simulator prior to the standardized testing session. The subjects read a description of the patient prior to entering the room and were required to diagnose sepsis and perform the steps of the SB. Scenario tasks were scored as successfully completed or missed. The subjects received up to 3 prompts to help them complete the scenario. Descriptive statistics and 2-way ANOVA with repeated measures were used with $p < 0.05$ considered statistically significant.

RESULTS: The PGY-1 residents mean blood pressure at first check was 87/46 mmHg and decreased ($p < 0.001$) to 76/37 mmHg at first fluid bolus. One subject failed to administer fluid, 26% failed to administer antibiotics, 26% did not obtain a lactate level, 1 subject did not obtain blood cultures, and 11% failed to apply oxygen to the patient. In 5 of the PGY-1 subjects, the mannequin expired. The PGY-2 residents demonstrated similar results: mean blood pressure at first check was 83/43 with a significant decrease ($p < 0.001$) to 73/36 at first fluid bolus. The number of SB steps omitted was not different. 36% failed to obtain a lactate level, and 1 subject administered antibiotics before obtaining blood cultures. Mannequin death in both groups was a result of failure to fluid resuscitate and severe hypotension before treatment.

DISCUSSION: The SBs were not performed completely in both resident groups resulting in severe hypotension and in some cases, simulated death. Important steps were omitted or were carried out when the patient could no longer be resuscitated. Both groups had difficulty with appropriate fluid resuscitation, a primary goal of the exercise. We believe that traditional educational methods may be inadequate for training house staff to recognize and treat critically ill septic patients, and that observed exposure to experiential learning is desirable.

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CATEGORY: Patient Safety Products/Projects

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 63

Six Steps To Simulator Based Teaching of Non-Technical Skills: Evaluation of A New Course Concept

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INTRODUCTION: Non-technical skills are as essential as technical skills for an efficient treatment of critical patients. Situation awareness, teamwork, task management, and decision-making had previously been identified as important non-technical skills for anesthetists (1). A one-day crew resource management (CRM) course combining psychological teaching with high fidelity patient simulation had been established at the authors' institution (2). Objective of the study was to evaluate acceptance of the course and especially of the psychological teaching elements.

METHODS: Based on the previously published six step approach to teach non-technical skills, a curriculum for anesthetists as well as anesthetic nurses has been set up using the four categories of CRM skills. In contrast to the original concept the course has been set up as a two day training to have more time for psychological seminars and scenarios. The curriculum connects basic psychological knowledge with the participants' job context. The training starts with the demonstration of optimal CRM in a short scenario with the instructors as hot seat anesthesiologists, followed by an introductory lecture to explain basics about human error in the field of medicine. Afterwards, abstract psychological exercises related to the respective CRM category are done by the participants. During these steps a psychologist and an anesthetist serve as instructors. To enable the participants to transfer psychological knowledge into their daily work, psychological exercises in a medical context (MiniSim scenarios) are done. The psychological teaching is accompanied by full scale patient simulation scenarios with focus on the non-technical skills. Debriefing is done by a psychologist and an anesthetist. The participants of the first five courses received a standardized questionnaire for evaluation. The form captured the rating of the medical and psychological components.

RESULTS: 58 participants took part in the five courses. The questionnaire showed an excellent overall evaluation as 23 rated the course excellent and 16 good. The relevance for every day work life was rated excellent by 33 participants and good by 20. The relationship of theoretical versus practical contents was rated as optimal by 40 participants, 37 rated the proportion of psychological and medical teaching as ideal. 34 participants rated the applicability of the abstract psychological exercises in their medical job as excellent and 21 as good.

DISCUSSION: The evaluation data show clear excellent acceptance by the participants. Furthermore, the psychologist as instructor was widely accepted and the participants recognized the importance of the psychology of human error in their job. However, to further improve acceptance of psychological input in a course for anesthetists, the use of the classic categories of non-technical skills might be not feasible enough as the different skills are cross-linked and for optimal performance in a crisis a combination of these skills is necessary.

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 64

Defibrillation in Simulation; A Survey of Simulation Center Practices and Attitudes

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INTRODUCTION: Simulation is an established methodology in medical education. Simulation provides unique opportunities as an education adjunct, for rare, high acuity scenarios, with high risk of morbidity and mortality. Cardiac arrest requiring defibrillation and/or cardioversion is a common training scenario, utilizing live electrical current, and is not without risk. Published reports of injury or death of medical personnel during defibrillation exist. As defibrillation can be inherently dangerous, training prior to the use of live defibrillation should be considered, to ensure user safety and reinforce principles of safety in healthcare. This survey was designed to assess if existing simulation centers have policies for training students safe and effective defibrillation techniques. We also sought to determine the assignment of primary responsibility for implementing existing defibrillation policies.

METHODS: A convenience sample of persons attending the 3 day 7th annual International Meeting on Simulation in Healthcare (January 2007), was provided a closed ended 23 item survey instrument. Survey domains included responder and simulation center demographics, defibrillation practices, and attitudes towards defibrillation practices simulation training environments.

RESULTS: Surveys were returned from fifty seven (57) individuals representing forty (40) simulation centers returned surveys, 31 of which were in the United States. Responder average age was 43.27 years; 69% were male; 20 (35%) were physicians; 12 (21%) were nurses; 7 (12%) were EMTs or pre-hospital personnel; 9 (16%) were "other", and 9 (16%) did not identify a professional status. 93% of the centers used live defibrillation. The majority of responders (87%) felt there was a need for formal training prior to using live defibrillation, but only 34% reported that their center maintained an active defibrillation training policy. Of 14 reported centers with a training policy in effect, 6 placed the responsibility with the simulation center, 4 with the course directors, 3 with others, and for one center there was no response. Of the 49 survey responders who identified a positive need for formal training, 40 (82%) felt it should be conducted by the simulation center staff, 12 (24%) answered it should be done by course directors, and 3 (1.5%) felt it should be done by others (some responders had multiple answers). 46/52 (88%) strongly agreed or agreed with the statement, "I feel using live defibrillation plays an important role in simulation-based education."

DISCUSSION: The purpose of medical simulation is to promote patient safety, through education and training for procedures and medical management scenarios. However, before promoting patient safety, the safety of the training environment must be secured. Despite the fact that the majority of responders felt live defibrillation was important in training, and that there was a need for formal defibrillator training prior to using live defibrillation, only a third of the centers in this survey had a formal training policy in effect. These results suggest most simulation center staff feel that defibrillator training should be accomplished prior to student use of live defibrillation. It remains unclear which barriers effectively inhibit establishment and implementation of defibrillator safety training in US and international simulation training centers.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 65

Retention of Dental Student Skill at Interpreting Spatial Information in Radiographs After Radiology Simulator TrainingTore Nilsson¹, Leif Hedman², Jan Ahlqvist¹¹Dept. of Odontology, Umeå University, Umeå, Sweden; ²Dept. of Psychology, Umeå University, Umeå, Sweden

INTRODUCTION: A radiology simulator with an oral radiology program has been evaluated in a randomized experimental study. The results showed that training in the simulator for 90 minutes improved skill in interpreting spatial information in radiographic images when evaluated immediately after training. It was also found that individuals with low visual-spatial ability had better training results after simulator training than after conventional training¹. The aim with this study was to investigate the long-term skill retention after training in the radiology simulator.

METHODS: The study was a follow-up of a randomized experimental study on the effect of radiology simulator training on interpretative skills in oral radiology. It was designed in accordance with the ethical principles of the Helsinki declaration and approved by the University Ethical Board. The original study population comprised 57 volunteer dental students. A long-term follow-up was performed eight months after training. No additional formal training was given during the follow-up period. All participants in the original study were asked to participate. Forty-five agreed. Skill in interpreting spatial relations in radiographs utilizing parallax had been assessed before training and immediately after training. Assessment was performed with a proficiency test instrument comprising three subtests; the principle subtest, the projection subtest, and the radiography subtest. At the follow-up the students were tested with the original pre-training test instrument. Visual-spatial ability had been assessed before training with the Mental Rotations Test, version A (MRT-A). The outcome measures were proficiency test and radiography subtest scores before, immediately after, and eight months after training. Net improvement was calculated as the difference in test scores eight months after training and before training.

RESULTS: Proficiency and radiography test scores were higher immediately after training for both the experimental and control group. At follow-up, mean test results were lower than immediately after training, except for the control group at the radiography test. A comparison between the pre-training test results and the test results eight months after training showed a significant increase for the experimental group at the radiography subtest ($P = 0.02$). Net improvement was calculated for low, medium and high MRT-A categories. There were no statistically significant differences between the experimental and control groups for any MRT-A category.

DISCUSSION: The earlier reported improvement of interpretative skills immediately after simulator training was reduced at follow-up and the beneficial short-term effect of simulator training for individuals with low visual-spatial ability did not remain. In spite of the reduction in test results at follow-up, the effect of simulator training seems to be more persistent than the effect of conventional training.

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CATEGORY: Education

COI STATEMENT: Conflict Reported - Tore Nilsson and Jan Ahlqvist are stock owners of Qbion AB, Sweden. Qbion AB develops and markets radiology simulation software based on academic research results. The company was not founded at the time for this study and is not involved in any way in this research.

RESEARCH ABSTRACT 66

Simulation-Based Intervention to Reduce Occupational Burnout and Stress of Intensive Care NursesAtalya Tuval^{1,2}, Yael Haviv-Yadid³, Dalia Etzion², Yael Shemesh³, Amitai Ziv^{1,4}, Haim Berkenstadt^{1,4}¹The Israel Center for Medical Simulation, Sheba Medical Center, Tel Hashomer, Israel; ²Organizational Behavior Program, the Faculty of Management, Tel Aviv University, Israel; ³Department of Internal Medicine A, Sheba Medical Center, Tel Hashomer, Israel; ⁴Sackler School of Medicine, Tel Aviv University, Israel

INTRODUCTION: Health care professionals experience high levels of work stress and burnout associated to various characteristics of the stressful working environment. A recent survey amongst intensive care physicians and nurses (1,2) reported high levels of burnout related to organizational factors, quality of working relations, end-of-life factors and insufficient training in communication and management skills. Based on the recognized association between burnout and deficiencies in team work and communication skills, the present study was conducted to evaluate the impact of simulation-based intervention focusing on these aspects on stress, anxiety and burnout among nurses.

METHODS: Participants were 25 nurses staffing a 5 bed medical step-down unit. Data on participants' burnout, anxiety, subjective workload and enjoyment was collected through questionnaires completed at the launch of the study (t1), a week before (t2) and one month following a simulation-based intervention (t3). The intervention was based on the findings of one month of structured observations looking at common stressors in the working environment performed between (t1) and (t2). The intervention included a one day simulation-based training conducted in teams of three nurses and one physician in a fully equipped simulated step-down unit. The simulated environment consisted of three full-body high-tech simulators and actors (SPs) role-playing patients' family members or hospital personnel. Interpersonal and communication challenges were incorporated into clinical scenarios, followed by video assisted debriefing that focused on patient safety, mistake prevention, clinical performance, team work, and communication with patients and families.

RESULTS: Burnout (measured on 1–7 scale) decreased from 3.2 ± 0.7 (t1) and 3.1 ± 0.8 (t2) to 2.8 ± 0.6 (t3) ($f = 3.42$, $p < 0.05$), anxiety (1–5 scale) decreased from 2 ± 0.7 and 2 ± 0.6 to 1.7 ± 0.4 ($f = 2.77$, $p < 0.07$) and subjective workload (1–5 scale) from 4.1 ± 0.7 to 3.7 ± 0.8 and 3.7 ± 0.8 ($f = 2.77$, $p < 0.07$). Enjoyment did not change over time. Burnout correlated with anxiety ($p < 0.05$) and work load ($p < 0.01$), and inversely correlated with enjoyment ($p < 0.01$). At the end of intervention and one month later participants indicated that training contributed to medical knowledge (end of training 4 ± 0.8 / one month 3.3 ± 1 on 1–4 likert scale, $p < 0.05$), awareness to interpersonal (3.9 ± 0.7 / 3.8 ± 0.9) and staff-patient (4 ± 0.9 / 3.9 ± 0.9) communication aspects, ability to work as medical team members (4.1 ± 0.8 / 3.2 ± 0.9 , $p < 0.05$) and cope with interpersonal challenges (3.9 ± 0.7 / 3.1 ± 0.9 , $p < 0.05$). Satisfaction from training after one month but not immediate satisfaction was inversely correlated to burnout ($p < 0.05$) but not to anxiety.

DISCUSSION: The study proposes that simulation-based training, targeted at well identified and relevant clinical and communication challenges, can contribute to the reduction of burnout and anxiety among health professionals. Future studies are needed to explore methods to further decrease health professionals' sense of stress and anxiety and maintain long-term effects of simulation-based training in this domain.

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 67

Use of an Anchored Multidimensional Rating Scale for Evaluation of Trainee Performance in Pediatric Emergency Medicine Scenarios

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INTRODUCTION: As part of a study to evaluate the effectiveness of a sim-based training program, we developed two evaluation methodologies, an dichotomous checklist and an multidimensional Global Performance Assessment Tool (GPAT) as an alternative methodology.

METHODS: The GPAT was created using expert consensus followed by beta-testing and revision. The GPAT is case specific and has 7–9 dimensions, each scored on a 1–7 scale; 7 represents ideal performance. Each dimension is tied to an action or a cognitive task. The scale allows the rater to assess timeliness and efficiency. Sixty-nine emergency medicine residents from two programs were evaluated by two raters. A wait-list control model was used. Participants were randomized into a training group or waiting (control) group. After the first group was trained, all participants were evaluated on three cases (First Evaluation Session). The control group received the identical, one-day training three months later and a second round of evaluation followed (Second Evaluation Session). A summary score (mean score across all dimensions) is reported. Mixed effects linear models were used to examine the effects of confounding variables. Rater agreement was assessed using a weighted Kappa coefficient.

RESULTS: Mean GPAT scores are shown in the Table. There was a small, significant improvement in score between the first and second session for the 2nd Trained Group only. Multivariate analysis revealed that session and session*group interaction terms were significantly related to score. Post-graduate year (PGY) also predicted mean score for 2 of 3 cases. Overall Kappa was 0.77.

DISCUSSION: The GPAT performed similarly to the checklist tool (data reported separately), with an acceptable but somewhat lower interrater reliability (0.88 vs. 0.77). The lack of a significant educational effect of the intervention limits our ability to comment on validity, although the association between score and PGY status is a positive finding. Further use of these instruments is needed.

CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

RESEARCH ABSTRACT 68

Time to Perception as Part of Team Response to Critical Events: Novel Approach to Assessing Time-Critical Aspects of Team Performance. A Pilot Study Focusing on Cardiac Arrest During Simulated Anesthesia Inductions

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INTRODUCTION: The speed of sound team work after time-critical events in anesthesia is crucial. However, there is no standard to assess it. Time from occurrence of a critical clinical problem until its solution is affected by underlying pathology and thus unreliable as a measure of team performance. Time from occurrence until perception of a problem is less task dependent, but has been investigated only for individuals (Gaba 1989, DeAnda 1991 Weinger 1994). This study aimed to test if perception time is readily measurable in entire teams and to examine its potential to predict overall time needed to solve the problem in a standardized simulated setting.

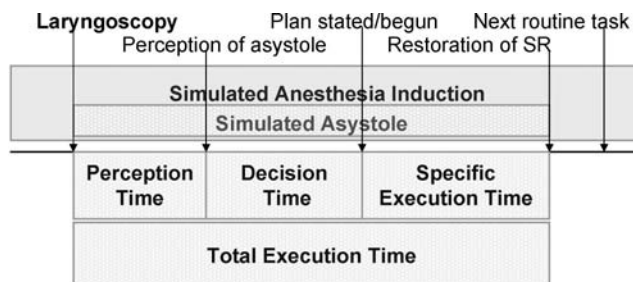
METHODS: Inclusion criteria was 6 months or more experience in anesthesia. The sample size of 15 teams (anesthesia resident and anesthesia nurse or nurse student) was determined by resources. Simulations of routine anesthesia inductions including asystole during laryngoscopy were performed using resuscitation mannequins with manipulable heart rhythm in a familiar OR environment. Sinus rhythm was reinstalled when pre-defined actions consistent with ACLS guidelines were taken. Video and vital parameter recordings were obtained using a setup allowing synchronized recording and DVD playback of video, monitor, and ventilator data. Time periods were determined comparing the three synchronized data sets based on observable occurrences. Overall performance was assessed by expert ratings. (See Fig. 1)

RESULTS: All teams except one perceived and resolved asystole within acceptable time. We found a slight correlation between time to perception and time needed to solve the problem.

DISCUSSION: Time needed to perceive a critical event can be readily determined in whole teams. This team-specific indicator may complement task-specific measures when assessing time-critical team response. Our small sample size precludes generalizing conclusions. Further research needs to validate this indicator in larger simulation and live studies and to examine its predictive value for overall speed of a team.

CATEGORY: Patient Safety Products/Projects

COI STATEMENT: The authors indicate they have nothing to disclose.



Period	Description	Results (mean $\pm$ SD)
Perception Time (PT)	Beginning of asystole until video-observable perception by team	11 ($\pm$ 18) sec
Decision Time (DT)	Perception until plan stated/begun	7 ($\pm$ 5) sec
Specific Execution Time (SET)	Plan stated/begun until restoration of sinus rhythm (SR)	20 ($\pm$ 13) sec
Total Execution Time (TET)	Beginning of asystole until restoration of SR	39 ($\pm$ 27) sec
Correlation Analysis (Pearson) showed slight correlation between PT and SET		

RESEARCH ABSTRACT 69

Affective Learning Outcome of Behavior Training of Experienced ICU Staff in Donor Management Using Full Scale Medical Simulation

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INTRODUCTION: The number of organ donations is low. Among contributing factors that have been identified in the ICU are: low occurrence, the staff's anguish, and low acquaintance to diagnosing brain death using direct signs. Uncertainty may lead to slow decision making and uncommitted medical management resulting in suboptimal quality of donated organs. Our hypothesis was that training of ICU staff in behaviors that support assurance should result in a higher confidence regarding donor management and determining brain death using direct signs.

METHODS: **Participants:** 14 ICU physicians and 14 ICU nurses participated in four separate one-day courses in a simulated ICU environment. **Training:** Training followed a introduction -; scenario -; reflection sequence. The ICU scenarios were focused on the care of a potential organ donor, clinical neurological examination and management of haemodynamic and respiratory dysfunctions. Behavioral targets for training were: team-building transfer of information, short term strategy collaborative physical top-toe examination of ICU patient, neurological examination as standard routine and collaborative decision making on standardized treatments for the potential organ donor and organ donor.^{1,2} **Evaluation Tools:** An exit questionnaire was used to determine reaction to training; a written test was used for knowledge. For affective learning outcome Self-Efficacy³ and The Situational Motivation Scale^{4,5} (SIMS) were used.

RESULTS: Participants' own perception of confidence and assurance in donor management improved ($p < 0,001$) as a reaction to training. Also knowledge improved ($p = 0,003$). Self-Efficacy increased ($p < 0,001$). Intrinsic Motivation increased ($p < 0,001$), while External Regulation and Identified Regulation did not change in response to training. Amotivation in relation to donor management decreased ($p < 0,001$).

DISCUSSION: 1-day behaviour training in a full scale simulated ICU environment resulted in higher confidence, higher Self-Efficacy, higher Intrinsic Motivation and, reduced Amotivation i.e. improved assurance regarding donor management and determining brain death using direct signs. Although not deliberately trained or objectively registered in this study, the improved assurance may have contributed to a management of the simulated donor that became more resolute in response to training. Transferred to clinical reality improved confidence and decision making may facilitate successful transplantations.

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CATEGORY: Education

COI STATEMENT: The authors indicate they have nothing to disclose.

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