UT Southwestern
Simulation Center

May 12, 2021

4th Annual Simulation-Based Quality Improvement and Research Forum

Welcome from the Simulation Center Directors

On behalf of the UT Southwestern Simulation Center, we are thrilled to have you join us for our fourth annual Simulation-Based Quality Improvement and Research Forum. Since opening our Simulation Center in September 2018, we have hosted high-quality simulation activities for a high volume of learners involving a wide variety of content and simulation methods.

We are grateful for the overwhelming institutional support that has fostered this effort. This Forum aims to recognize the tremendous amount of scholarly activity that students, trainees, faculty, scientists, and educators are currently generating within our simulation community. We anticipate further growth of these activities as our participants continue to explore innovative aspects of simulation. We would like to thank all of our presenters for their contributions, and we are delighted to welcome Dr. Carla Pugh as our keynote speaker.

Daniel Scott
M.D., FACS, Director

Krystle Campbell
M.S., CHSE, Operations Director

Keynote Speaker

Carla Pugh, M.D., Ph.D., is a Professor at Stanford University School of Medicine and Director of the Technology Enabled Clinical Improvement (T.E.C.I.) Center. Her clinical area of expertise is acute care surgery, and her research involves the use of simulation and advanced engineering technologies to develop new approaches for assessing and defining competency in clinical procedural skills. Dr. Pugh is considered to be a leading, international expert on the use of sensors and motion tracking technologies for performance measurement.

Dr. Pugh earned her undergraduate degree in neurobiology at UC Berkeley and her medical degree at Howard University School of Medicine. Upon completion of her surgical training at Howard University Hospital, she attended Stanford University to obtain her Ph.D. in education. Her goal is to use technology to change the face of medical and surgical education.

Dr. Pugh holds multiple patents on the use of sensor and data acquisition technology to measure and characterize hands-on clinical skills.

Currently, more than 200 medical and nursing schools are using one of her sensor-enabled training tools for their students and trainees. Her work has received numerous awards from medical and engineering organizations, including the Presidential Early Career Award for Scientists and Engineers from President Barack Obama at the White House in 2011. In 2014, she was invited to give a TEDMED Talk on the potential uses of technology to transform how we measure clinical skills in medicine. Dr. Pugh is a Fellow of the American Institute for Medical and Biological Engineering and a member of the American College of Surgeons Academy of Master Surgeon Educators and the American Board of Surgery Council.

Learning Objectives

At the conclusion of this symposium, participants will be able to:

1. Review advantages of simulation-based education and mastery learning over traditional education strategies
2. List translational science studies that use simulation-based education to improve patient outcomes
3. Describe how return on investment can be calculated after simulation-based interventions
4. Describe current research at UTSW in a variety of areas related to health care simulation

Accreditation and Credit Designation Statements

UT Southwestern Medical Center is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

UT Southwestern Medical Center designates this LIVE activity for a maximum of **6.0** *AMA PRA Category 1 Credits*™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

UT Southwestern Medical Center certifies that non-physicians will receive an attendance certificate stating that they participated in an activity that was designated for a maximum of **6.0** *AMA PRA Category 1 Credits*™.

VIRTUAL MEETING
4th Annual Simulation-Based Quality Improvement and Research Forum
May 12, 2021
7 a.m. – 4:30 p.m.

Agenda

7 a.m. – 8 a.m.

Introduction: **Daniel Scott, M.D., FACS**
Speaker Introduction: **Krystle Campbell, M.S., CHSE**
Keynote Address: **Carla Pugh, M.D., Ph.D.**

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8 a.m. – 8:15 a.m. Poster Viewing and Coffee Lounge

8:15 a.m. – 8:51 a.m. Oral Presentations – Session 1 (See page 9)

1. Presentation: **State of Simulation in Undergraduate Medical Education; Region of Medical School Associated Lower Odds of Simulation Exposure**
   Presenter: **Anne Marie Kerchberger, M.D.**
2. Presentation: ***To Simulate or Not to Simulate?* Exploring Use of Endoscopic Simulation in North American Pediatric Gastroenterology Fellowship Training Programs**
   Presenter: **Aayush Gabrani, M.D.**
3. Presentation: **Does Simulation Improve Clinical Performance in Management of Postpartum Hemorrhage?**
   Presenter: **Shena J. Dillon, M.D.**

8:52 a.m. – 9:25 a.m. Oral Presentations – Session 2 (See page 12)

4. Presentation: **In-Person Versus Virtual Measurement of Clinical Competence – Are the Formats Complementary?**
   Presenter: **James M. Wagner, M.D.**
5. Presentation: **Pivoting to Virtual Simulation to Develop Communication Competencies in the Era of COVID-19**
   Presenter: **Jessica Hernandez, M.D.**
6. Presentation: **Creation of a Simulation Curriculum to Train Residents to Respond to Microaggressions**
   Presenter: **Christina S. Renner, M.D.**

9:26 a.m. – 10:01 a.m. Oral Presentations – Session 3 (See page 16)

7. Presentation: **Rapid Learning of Focused Cardiac Ultrasound Exam for Early Identification of COVID-19-Related Cardiomyopathy: Hospital Medicine and Cardiology Collaborative Workshop**
   Presenter: **Dergham Alzubaidy, M.D.**
8. Presentation: **An Innovative Curriculum for Teaching Transesophageal Echocardiography (TEE) to Emergency Medicine Residents**
   Presenter: **Steven Field, D.O.**
9. Presentation: **Management of Congenital Cardiac Defects in the Delivery Room: A Simulation-Based Curriculum for Neonatal Trainees**
   Presenter: **Noorjahan Ali, M.D., M.S.**

10:01 a.m. – 10:15 a.m. Break – Poster Viewing and Coffee Lounge

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10:15 a.m. – 10:50 a.m. Oral Presentations – Session 4 (See page 20)

10. Presentation: **At-Home Medical Student Simulation: Achieving Knot-Tying Proficiency Using Video-Based Assessment**
    Presenter: **Madhuri B. Nagaraj, M.D., M.S.**
11. Presentation: **Creating a Proficiency-Based Remote Laparoscopic Skills Curriculum for the COVID-19 Era**
    Presenter: **Deborah E. Farr, M.D., FACS**
12. Presentation: **Utilizing a Comprehensive Module in Improving Student Comfort and Competency**
    Presenter: **Shan R. Luong, M.D.**

10:51 a.m. – 11:06 a.m. SIMS Code Black Highlight

Continued on page 4

Agenda continued

11:07 a.m. – Noon

Emerging Ideas Oral Presentations (See page 24)

1. Presentation: **Predicting the Future? Revealing Postoperative Patient Outcomes with Surgical Video AI**
   Presenter: **Andrew R. Jamieson, Ph.D.**
2. Presentation: **IMAGINE: Implementation of a Virtual Reality Training Tool for Mass Casualty Incidents**
   Presenter: **Bhargav Arimilli, B.S.**
3. Presentation: **Ambiguous Conversations: A Combined Obstetrics & Pediatrics Simulation for Graduating Medical Students**
   Presenter: **Ladan Agharokh, M.D.**
4. Presentation: **A Virtual Simulation for an Interprofessional Team Meeting for Discharge Planning**
   Presenter: **Jennifer Roye, M.S.N., RN**
5. Presentation: **Time Is Brain: Pharmacy Preparation to Stroke Management Perfection**
   Presenter: **Neena John, Pharm.D., MBA, BCPS**

Panelists: Aditee Ambardekar, M.D.; Kim Hoggatt Krumwiede, Ph.D.; Kavita Joshi, M.D.

Moderators: Daniel Scott, M.D., FACS; Krystle Campbell, M.S., CHSE

Noon – 1 p.m.

Lunch Break + Rebroadcast Recording of Keynote

1 p.m. – 2 p.m.

Session 1 (Live)

1. I Want to Use the Sim Center: Where Do I Start? (Krystle Campbell, M.S., CHSE; Rahm Heymann, B.S.; Ian Nazareno)
2. Basics of Debriefing: Creating a Psychologically Safe Learning Environment (Jessica Hernandez, M.D.; Ravi Bhoja, M.D.)
3. How to Run a Virtual Simulation for Communication and High Fidelity (Jamie Morgan, M.D.; Ladan Agharokh, M.D., Shena J. Dillon, M.D.)
4. How to Run a Virtual Simulation for Task Training (Madhuri B. Nagaraj, M.D., M.S.; Daniel Scott, M.D., FACS)
5. How to Run a Virtual Simulation for Standardized Patients (James Wagner, M.D.; Thomas Dalton, M.D.; Carla Mosley)
6. Developing Simulation-Based Educational Scholarship (Philip Greilich, M.D.; Blake Nichols, M.D., SIA)
7. Engineering in Health Care Simulation (Ann Majewicz-Fey, Ph.D.; Caroline Park, M.D.)

2:15 p.m. – 3:15 p.m.

Session 2 (Live)

1. I Want to Use the Sim Center: Where Do I Start? (Krystle Campbell, M.S., CHSE; Rahm Heymann, B.S.; Ian Nazareno)
2. Basics of Debriefing: Creating a Psychologically Safe Learning Environment (Jessica Hernandez, M.D.; Ravi Bhoja, M.D.)
3. How to Run a Virtual Simulation for Communication and High Fidelity (Jamie Morgan, M.D.; Ladan Agharokh, M.D.; Shena J. Dillon, M.D.)
4. How to Run a Virtual Simulation for Task Training (Madhuri B. Nagaraj, M.D., M.S.; Daniel Scott, M.D., FACS)
5. How to Run a Virtual Simulation for Standardized Patients (James Wagner, M.D.; Thomas Dalton, M.D.; Carla Mosley)
6. Developing Simulation-Based Educational Scholarship (Philip Greilich, M.D.; Blake Nichols, M.D., SIA)
7. Engineering in Health Care Simulation (Ann Majewicz-Fey, Ph.D.; Caroline Park, M.D.)

3:30 p.m. – 4:30 p.m.

Session 3 (Rebroadcast from Session 1)

Poster Presentations (See page 30)

1. Presentation: **Virtual Introduction of Teamwork Competencies to Health Professions and Medical Students**
   Presenter: **Devin J. Shah, B.A.**
2. Presentation: **Continued Inequity of Performed Clinical Tasks in Undergraduate Medical Education by Gender, Despite Incorporation of Simulation-Based Education**
   Presenter: **Anne Marie Kechberger, M.D.**
3. Presentation: **Resuscitation Practice, Testing, and Remediation for Junior EM Residents**
   Presenter: **Sonika Raj, M.D.**
4. Presentation: **Virtual Reality in Vascular Ring Education: A Novel 2D-3D Comparison Study**
   Presenter: **Ryan S. Bishop, M.D.**
5. Presentation: **Simulation-Based Cross-Cover Training For Fourth-Year Medical Students: A Novel Approach**
   Presenter: **Jaini Sutaria, M.D.**
6. Presentation: **Communication Simulations: Preparing Students for the Difficult Conversations of Pediatric Residency**
   Presenter: **Benjamin Masserano, M.D.**
7. Presentation: **Pediatric Trauma Surveys – An Educational Intervention**
   Presenter: **Chelsea A. Day, M.D.**
8. Presentation: **Roll for Initiative: The Application of Role-Playing Game Techniques to Adapt High-Fidelity Simulation to a Virtual Environment**
   Presenter: **Kavita Joshi, M.D.**
9. Presentation: **Novel Ultrasound Probe-Holder Device: Frees Up Staff and Minimizes Health Care Workers' Exposure to COVID-19**
   Presenter: **Carlos Trigo, M.D.**
10. Presentation: **Simulation Center Utilization: The Effects of COVID-19 and the Need for Innovation**
    Presenter: **Madhuri B. Nagaraj, M.D., M.S.**
11. Presentation: **American Heart Association HeartCode BLS and ACLS for Medical Students**
    Presenter: **Paul Rosenberger, Ed.D., NRP**
12. Presentation: **Effect of Blindfolding on Closed-Loop Communication and Critical Action Completion During Simulated Resuscitations Using Rapid-Cycle Deliberate Practice**
    Presenter: **Sonika Raj, M.D.**
13. Presentation: **Transitioning a Medical Simulation Elective to the Virtual Environment**
    Presenter: **Devin J. Shah, B.A.**
14. Presentation: **A Structure for Team-Based Simulation in the Virtual Environment**
    Presenter: **Devin J. Shah, B.A.**
15. Presentation: **COVID-19 PPE Training Gaps: Using Simulation to Assess Vulnerable Learner Population Comfort**
    Presenter: **Madhuri B. Nagaraj, M.D., M.S.**
16. Presentation: **Novel Procedural Sedation Simulation Skill Maintenance Curriculum for Emergency Medicine Faculty**
    Presenter: **Carlos Trigo, M.D.**
17. Presentation: **Approach to the Patient, Cytologic Techniques, and Ultrasound Guidance for Fine-Needle Aspirations**
    Presenter: **Luis De Las Casas, M.D.**
18. Presentation: **Sample Size Calculation in Stratified Cluster Randomized Trials**
    Presenter: **Jijia Wang, Ph.D.**
19. Presentation: **Method of End-of-Rotation Examination Question Development and Validation for Medical Training Programs**
    Presenter: **Sin-Hin Wan, M.D.**

 (See page 52)

1. Presentation: **Emerging Idea – Mixed Reality Will Have a Significant Impact on Medical Education**
   Presenter: **Majorie Zielke, Ph.D.**
2. Presentation: **"Night On Call": Triage and Teamwork in the Transition to Pediatric Internship**
   Presenter: **Ladan Agharokh, M.D.**
3. Presentation: **Collaborating to Ensure Safety: An Interprofessional Domestic Violence Simulation Experience**
   Presenter: **Tracy Owing, M.S.S.W., LCSW**
4. Presentation: **Use of a Virtual Simulation Platform to Prepare Students to Influence Teamwork After Graduation**
   Presenter: **Shena J. Dillon, M.D.**
5. Presentation: **Are We Ready to Practice? A Virtual Multipatient Simulation**
   Presenter: **Jennifer Roye, M.S.N., RN, CSHE, CNE**
6. Presentation: **Pediatric Emergency Robotic-to-Open Conversion Protocol**
   Presenter: **Yvonne Y. Chan, M.D.**
7. Presentation: **Simulation Training Program for Pediatric Tracheostomy Management**
   Presenter: **Stephen Chorney, M.D., M.P.H.**
8. Presentation: **Teaching Emotional Intelligence Via Simulation Education**
   Presenter: **Bau P. Tran, Pharm.D., M.S., PA-C**
9. Presentation: **The Use of Augmented Reality to Immerse and Enhance Learner Experience During Simulation-Based Education and Training**
   Presenter: **Bau P. Tran, Pharm.D., M.S., PA-C**
10. Presentation: **Using Voice of the Student to Design a Longitudinal, Interprofessional, Simulation-Based Teamwork Curriculum**
    Presenter: **Ian Shields, B.A.**

1. State of Simulation in Undergraduate Medical Education; Region of Medical School Associated Lower Odds of Simulation Exposure

Kristen E. Wong, M.D.[1]; Krystle Campbell, M.S.[2]; Jerzy Lysikowski, Ph.D.[3]; Anne Marie Kerchberger, M.D.[1]; Daniel Scott, M.D.[2,4]; Melanie S. Sulistio, M.D.[1]

[1]Department of Internal Medicine, UT Southwestern Medical Center; [2]Simulation Center, UT Southwestern Medical Center; [3]Office of Medical Education, UT Southwestern Medical Center; [4]Department of Surgery, UT Southwestern Medical Center

Introduction: Simulation-based education (SBE) provides experiential learning, improving quality of care and reducing errors. The Association of American Medical Colleges (AAMC) previously described adoption of SBE in 68.0% of medical schools and 25.0% of teaching hospitals. We sought to update the current state of SBE in American undergraduate medical education (UME).

Methods: From 2016-2019, incoming interns to UT Southwestern Medical Center were invited to participate in a survey assessing overall simulation experience and simulated experience with 26 clinical tasks in three categories: procedural, communication, and other. De-identified results were analyzed to determine distribution of survey respondents by gender, specialty, residency program type (procedural vs. nonprocedural), allopathic vs. osteopathic, and region of medical school. High SBE exposure was defined as exposure over 2+ years in medical school of 7+ hours of simulation time. Analyses were performed in SAS, significance level at 0.05. Continuous and categorial variables were compared using a t-test and a chi-square test, respectively.

Results: 950 out of 1,047 (90.7%) possible responses were obtained, representing 139 U.S. medical schools, 91% allopathic (N = 127). Regional representation of allopathic residents was as follows:

Northeastern (N = 79, 9.3%)	Southern (N = 550, 64.4%)
Central (N = 145, 17.0%)	Western (N = 41, 4.8%)

50% were female (N = 475), and 60% were entering nonprocedural residencies (N = 572). Of procedural tasks, most simulated was suturing (N=848, 89.6%) and least simulated was thoracentesis (N = 737, 80.9%). Of communication tasks, most simulated was taking a history (N = 475, 51.13% reporting simulation >30). Least simulated communication tasks (never or 1) were obtaining a consent (N = 669, 73.2%) and disclosing a medical error (N = 666, 72.4%). Of other tasks, most simulated was chest compressions (N = 898, 96.0%) and least simulated was

operating a defibrillator (N = 206, 22.1%). Results were similar regardless of program type. A majority of participants had not simulated the following procedures: arterial line, (N = 500,

54.4%); paracentesis (N = 614, 67.5%); and thoracentesis (N = 560, 61.5%). There was no significant difference in SBE exposure in allopathic and osteopathic students (p = 0.89). Two (0.002%) participants reported no simulation exposure. Allopathic students from Southern medical schools had 67.0% lower odds of high SBE exposure compared to regions elsewhere (OR: 0.67, 95% CI: 0.490-0.923, p = .0139).

Conclusions: Our data is the first to describe SBE use across specialties and schools nationwide since the AAMC's 2011 publication. SBE adoption is widespread amongst the medical schools represented in our study population, with equal overall exposure for students regardless of gender or residency type. Frequently simulated tasks were relatively low-cost, low-risk tasks. Students from Southern schools had lower odds of receiving high exposure to SBE. Although schools have widely adopted using simulation to teach basic skills such as history taking, there are opportunities to expand SBE use in procedural and communication skills. Future studies examining SBE use and resultant clinical competence will deepen the medical community's understanding of trends in SBE in UME and identify opportunities for enrichment.

2. *To Simulate or Not to Simulate?* Exploring Use of Endoscopic Simulation in North American Pediatric Gastroenterology Fellowship Training Programs

Aayush Gabrani, M.D.[1]; Iona M. Monteiro, M.D.[2]; Catharine M. Walsh, M.D., M.Ed., Ph.D.[3]

[1]Division of Pediatric Gastroenterology, Hepatology, and Nutrition, UT Southwestern Medical Center; [2]Department of Pediatrics, Division of Pediatric Gastroenterology, Hepatology, and Nutrition, Rutgers New Jersey Medical School; [3]Division of Gastroenterology, Hepatology, and Nutrition and the Research and Learning Institutes, Hospital for Sick Children, Department of Paediatrics and the Wilson Centre, University of Toronto

Introduction: There is increasing evidence to support integration of endoscopy simulation into training, and recent training guidelines have encouraged its uptake. However, limited data exists regarding its use in pediatric gastroenterology (GI) training. We aimed to explore the current landscape of endoscopic simulation-based training and assessment in pediatric GI fellowship programs across North America.

Methods: GI fellowship program directors (PDs) from the United States and Canada were surveyed from August to November 2018. The pre-tested, electronic survey comprised 3 sections: program demographics; details of current simulation-based training; and PDs' perceptions of endoscopy simulation. Responses were analyzed using descriptive statistics.

Results: Forty-three of 71 (61%) PDs responded (6 Canadian, 37 U.S.). Programs were predominantly academic (95%) and enrolled 1.87 ± 1.01 fellows/year. Twenty-four programs (56%) reported using simulation for endoscopy training, while 8 (19%) used simulation for non-procedural education. Only 2 programs (5%) used endoscopy simulation for assessment purposes. Other forms of endoscopic skills assessment used included: (1) procedure numbers (84%); (2) clinical parameters, such as ileal intubation rate (63%); (3) EPA assessment forms (30%); and (4) direct observation procedural assessment tools (60%), including the GiECATkids tool (23%). Of those programs using simulation (n = 24), upper endoscopy and colonoscopy were trained most frequently, and mechanical simulators were used most commonly. Eight programs (33%) required simulation training prior to clinical performance. While 10 programs (42%) provided protected training time, only 2 (8%) tracked hours. Three programs (12.5%) reported having an organized curriculum, and 6 (25%) train their endoscopic trainers. Cost, time constraints, and lack of standardized curricula were perceived as key barriers to integration (Table). Most PDs reported a need for endoscopy simulation to train both technical and nontechnical skills; however, they felt simulation cannot replace clinical experience.

Table: Perceived barriers to use of simulation among fellowship programs

Barriers	Programs with simulation (N=24)	Programs without simulation (N=19)
Cost/budget constraints	12 (50.0%)	13 (68.4%)
Fellow time constraints	10 (41.7%)	2 (10.5%)
Faculty time constraints	15 (62.5%)	3 (15.8%)
Lack of faculty training	7 (27.2%)	5 (26.3%)
Lack of curriculum	12 (50.0%)	6 (31.6%)
Accessibility	6 (25.0%)	7 (36.8%)
Not validated	6 (25.0%)	3 (15.8%)
Do not mimic real life	8 (33.3%)	5 (26.3%)

Conclusions: Pediatric GI fellowship PDs recognize the importance of endoscopy simulation; however, only 56% report using it. Perceived barriers indicate the need for inexpensive portable simulators to teach and assess simple endoscopic skills and the need for development and validation of a pediatric simulation curriculum and short, feasible, simulation-based learning modules targeting specific skills to promote uptake across programs.

3. Does Simulation Improve Clinical Performance in Management of Postpartum Hemorrhage?

Shena J. Dillon, M.D.[1]; Whitney Kleinmann, M.D.[1]; Yevgenia Fomina, M.D.[1]; Bethany Werner, M.D.[1]; Donald D. McIntire, Ph.D.[1]; David B. Nelson M.D.[1]

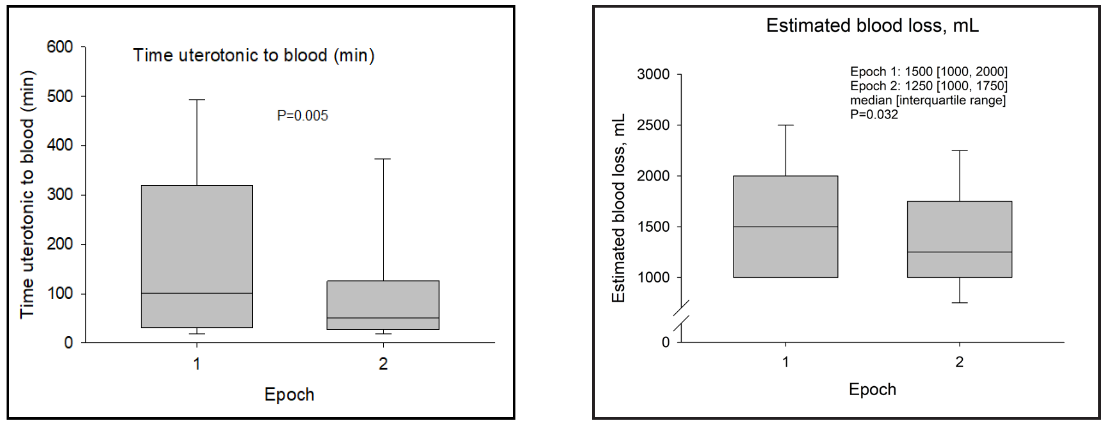
[1]Department of Obstetrics and Gynecology, UT Southwestern Medical Center

Introduction: Although simulation is now widely used to improve teamwork and competency, there are limited data demonstrating improvement in clinical outcomes. Thus, our aim was to examine the clinical performance and outcomes associated with postpartum hemorrhage (PPH) due to uterine atony following implementation of a multidisciplinary simulation program.

Methods: This was a prospective observational study of response to PPH due to uterine atony in an academic center before (Epoch 1: July 2017-June 2018) and after (Epoch 2: July 2019-June 2020) implementing multidisciplinary simulation. Twenty-two PPH simulations were performed from July 2018-June 2019 involving more than 300 nursing, obstetric, and anesthesia providers. The primary outcome was response to PPH defined as time from uterotonic to first unit of blood administration within 12 hours following delivery. Secondary outcomes were estimated blood loss (EBL) and severe maternal morbidities. Statistical analysis included use of the Pearson chi-square, Wilcoxon rank sum, and Hodges-Lehmann statistic for differences with $P < 0.05$ considered significant.

Results: There were 157 and 165 women with PPH requiring a transfusion before (Epoch 1) and after (Epoch 2) simulation, respectively. As shown in Figure 1, women in Epoch 2 began receiving blood products significantly earlier in the first 12 hours following delivery compared to Epoch 1 (51 [28,125] min versus 102 [32,320] min, P = 0.005). Women in Epoch 2 did have significantly lower EBL when compared to Epoch 1 (1250 [1000,1750] mL versus 1500 [1000,2000] mL, P = 0.032).

Figure 1: Time from administration of uterotonic medication to administration of blood (left) and EBL at time of delivery (right)



Conclusions: Implementation of a multidisciplinary simulation program resulted in a significantly improved response to PPH with faster times to transfusion and lower EBL. Because delay in treatment is a major cause of preventable maternal death in obstetric hemorrhage, these results suggest simulation can improve clinical outcomes in this emergency.

4. In-Person Versus Virtual Measurement of Clinical Competence – Are the Formats Complementary?

James M. Wagner, M.D., M.Sc.[1]; Thomas Dalton, M.D.[1]; Krystle Campbell, M.S., CHSE[2]; Pavankumar Petluru, Ph.D.[3]; Jerzy Lysikowski, Ph.D.[3]; W. Gary Reed, M.D.[1]; Robert Rege, M.D.[3,4].

[1]Department of Internal Medicine, UT Southwestern Medical Center; [2]Simulation Center, UT Southwestern Medical Center; [3]Office of Medical Education, UT Southwestern Medical Center; [4]Department of Surgery, UT Southwestern Medical Center

Introduction: Schools of Health Professional Education have an obligation to ensure they are graduating health professionals that are competent in clinical skills. With the cancellation of the USMLE Step 2 CS, this responsibility to society becomes even more critical for medical schools. The summative assessment of clinical skills is traditionally accomplished through an Objective Structured Clinical Examination (OSCE) with an in-person format using trained Standardized Patients, which has been shown to be a valid, reliable, and generalizable measure of clinical skills. There is a gap in literature comparing similar measures for virtual OSCE cases. The 2020 pandemic forced the administration of a hybrid OSCE, blending both in-patient and virtual formats for OSCE stations for each examinee. This hybrid OSCE presented an opportunity to address this gap.

Methods: We chose i-Human as the best available virtual representation of patients for the OSCE. We split the traditional 10 stations between two formats: Five virtual (i-Human) and five in-person (traditional). Students participated in five 25-minute in-person and five time-unrestricted virtual OSCE stations. Our conceptual framework for measuring clinical skills was the USMLE Step 2 CS scoring rubric. We compared student overall performance to historic controls as well as this year's virtual and in-person formats. Given the paucity of CIS data produced during a virtual encounter, we focused the comparison of virtual to in-person performance on the ICE score. We compared virtual to in-person halves of the OSCE in relation to the dichotomous historic cutoff scores, continuous scores, and time spent on cases. We then performed a principal component analysis to explore the sources of variation in scores.

Results: 227 MS2s took the hybrid OSCE in Fall 2020. Students performed equally well on all sub-scores compared to historic controls. However, the in-person versus virtual formats identified a significantly different set of students as being below a performance cutoff, and there was a weak correlation ($r = 0.27817$) between the continuous ICE sub-scores. Students spent 25 minutes on each in-person station (by design) and significantly more time on the virtual patients (67-80 minutes). The length of time spent on each virtual encounter had a moderate positive correlation to virtual encounter ICE score ($r = 0.45957$). Principal component analysis of the seven components of the ICE sub-score revealed student scores significantly higher on four in-person stations and three on the virtual stations, when compared to the alternate format. There was no significant trend between median image scores when stratified by quartile of number of scans performed ($p = 0.34$). 39% of all fellows were able to obtain appropriate images for the assessment of pericardial effusion, and 61% for aortic stenosis.

Conclusions: Students performed equally well when compared to prior classes, suggesting a minimal impact of the global pandemic on their learning clinical skills. Virtual and in-person formats for OSCE stations have poor correlation, suggesting they measure different factors. Principal component analysis suggests the virtual stations may measure some components of clinical skill better. This study provides some preliminary data suggesting a virtual OSCE may add value to a summative OSCE. Future studies should aim to establish best-practice guidelines for integrating virtual versus in-person modalities for both ICE and CIS subcomponents.

5. Pivoting to Virtual Simulation to Develop Communication Competencies in the Era of COVID-19

Jessica Hernandez, M.D., M.E.H.P.[1]; Chrissy Chan, M.D.[1]; Meghan Michael, M.D.[1]; Mary McHugh, M.D.[1]; Mozhdeh Sadighi, Ph.D.[2]; Ian Shields, B.A.[2]; Richard Preble, B.S.[2]; Eleanor Phelps, RN[2]; Philip Greilich, M.D., M.Sc.[1]

[1]UT Southwestern Medical Center; [2]UT Southwestern School of Medicine

Introduction: Team *FIRST* is an institutionally sponsored plan dedicated to expanding and improving teamwork training for medical and health professions students. Team *FIRST* aims to develop a longitudinal educational program that features a series of five interprofessional learning modules to teach a set of 12 evidence-based teamwork competencies. The purpose of Module 2: *Introduction to Handovers*, delivered during Transitions to Clerkship, is to teach pre-clinical students teamwork skills so they are able to perform structured communication and closed-loop communication and ask clarifying questions during handovers. The target audience was medical and health professions students. Traditionally, these skills have been taught in a face-to-face setting; however, given restrictions due to the COVID-19 pandemic, we were challenged to teach these competencies virtually utilizing simulation techniques.

Methods: During the virtual session, 254 students were divided into groups of about six students. Each group met for approximately 45 minutes using the Microsoft Teams platform to conduct four different simulated patient handovers. Each student in a group was randomly assigned to a role of sender, receiver, or observer of information during patient handover. Real-time behavioral assessments were performed by trained evaluators using the assessment instrument shown in Table 1. Multimodal training included reading material, demonstration videos, live drop-in sessions, and individualized phone/email help. scores for each session.

Results: A total of 192 handovers from 48 sessions with 254 medical and health professions students were analyzed with a 99% capture rate. Students successfully demonstrated four behaviors for structured communication between 84% -94% of the time; two behaviors for closed-loop communication 62%-66% of the time; and clarifying questions behavior 61% of the time (see Figure 1 for averages).

Conclusions: Teamwork competencies can be successfully taught to pre-clinical students using virtual simulation-based training and behavioral assessments. Further improvements in the methodology will target the collection of a pre-activity communication skills assessment and improving educational activities for teaching closed-loop communication and asking clarifying questions. The feedback collected from instructors and learners from this pilot will be used for a multi-year effort sponsored by the Office of Medical Education to implement the Team *FIRST* Module 2: *Introduction to Handovers*.

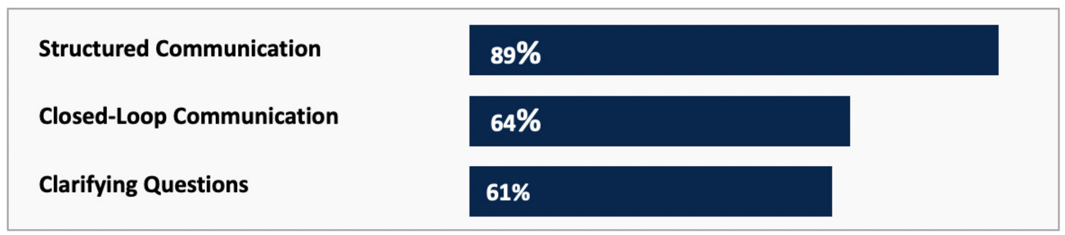


Figure 1. Demonstrated behaviors for team-based competencies in Module 2.

	Behavior	No/Never	Sometimes/Somewhat	Yes/Always
Structured Communication	Sender described Situation succinctly	☐	☐	☐
	Sender provided additional Background info	☐	☐	☐
	Sender offered Assessment based on situation and background	☐	☐	☐
	Sender stated clear Recommendation about what should happen	☐	☐	☐
Closed-loop Communication	Receiver repeated what they heard (not just "I understand")	☐	☐	☐
	Sender clearly confirmed or corrected the check back	☐	☐	☐
Clarifying Questions	Receiver asked clarifying questions from sender when receiving handover	☐	☐	☐

Table 1. Real-time behavioral assessment tool for team-based competencies in Module 2.

6. Creation of a Simulation Curriculum to Train Residents to Respond to Microaggressions

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Introduction: Microaggressions are subtle, indirect words or actions that create hostility, communicate disrespect, or imply a sense of exclusion. They have been noted to be akin to carbon monoxide – "invisible, but potentially lethal." In aggregate, over time, these microaggressions can contribute to physician burnout and negatively impact well-being in general. Although studies have found that a majority of physicians have been subjected to these deleterious comments by patients, many physicians have never received training on how to address these situations. This is in part because such training is difficult – simulation with practice and feedback is necessary to train these complicated skills.

Methods: A simulation workshop was created and delivered to UT Southwestern Internal Medicine residents as part of their didactic curriculum. An online pre-survey was administered weeks prior to the workshop to gauge the prevalence of microaggressions they had observed over the course of their training, in addition to their beliefs regarding how best to address these behaviors and their confidence in doing so. Residents participated in four unique standardized patient scenarios – which enabled them to practice and develop their skills. Although initially planned as an in-person workshop at the Simulation Center, this was transitioned to an online format due to the COVID-19 pandemic. An online post-survey was administered to residents after completion of the workshop, again assessing their confidence addressing microaggressions.

Results: We had a 57% response rate (85/150) for the pre-survey. There was a surprisingly high number of microaggressions observed by residents. Gender-related microaggressions were reported by 65% (18% reported frequent occurrences); ethnic microaggressions were reported by 60% (7% reported frequent occurrences); and class-related microaggressions were reported by 60% (5% reported frequent occurrences). Only 7% of trainees reported being very confident to manage microaggressions personally experienced, and only 6% reported being very confident to manage microaggressions that they observed. Female residents were more likely to report having experienced gender-related microaggressions (Mann-Whitney $U = 244$, $N = 85$ [50 males, 35 females], $p < .001$). Similarly, underrepresented group (URG) (Black/Hispanic) individuals were more likely to report having experienced ethnic-related microaggressions (Mann-Whitney $U = 283$, $N = 85$ [15 URG, 70 Others], $p = .003$). Example qualitative comments from the post-survey included the following: a) "I learned … how to nip in the bud small things like a patient calling you 'honey.' In general, I feel more empowered to respond to microaggressions now"; b) "I have learned that setting boundaries is OK/encouraged. While trying to find that fine line between not straining the patient/physician relationship and respecting ourselves will likely still be something I need to develop, I feel more empowered to stand up for myself when appropriate"; c) "Excellent workshop; really enjoyed the simulated patients and the discussion following them. Feel much more empowered and encouraged to handle microaggressions." Additional data analyses (including improvements in confidence from the workshop) will also be presented (our last workshop will be completed shortly).

Conclusions: Our project demonstrates an innovative way to address an important problem faced by our trainees. A majority of our trainees have observed and/or experienced microaggressions, and our simulation-based training was designed to empower them to better manage these behaviors. Specifically, using a practice-and-feedback approach over several vignettes in small teams with trained faculty facilitators, residents learned that they needed to communicate when confronted with microaggressions and, even more importantly, how to do so. A couple limitations to our study include the preliminary nature of this as a pilot study and our somewhat low response rates (several residents were called to COVID surge teams during the course of the study).

7. Rapid Learning of Focused Cardiac Ultrasound Exam for Early Identification of COVID-19-Related Cardiomyopathy: Hospital Medicine and Cardiology Collaborative Workshop

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[1]UT Southwestern Division of Hospital Medicine at Parkland Memorial Hospital

Introduction: Cardiomyopathy has been described as one of the most severe complications of COVID-19 disease where one of the accepted sequelae of COVID-19 is left ventricular dysfunction amongst other cardiac complications. Echocardiography is instrumental for evaluating the ventricles' structure and function and wall motion abnormalities and for better understanding of cardiac hemodynamics. In most cases, a limited study can provide the needed information for medical decision-making. Given the shortage of personal protective equipment (PPE) and the importance of minimizing sonographer time with COVID-19 patients to reduce the risk of spread, the need to learn point-of-care ultrasound (POCUS) became more evident to provide timely information about the cardiac function while reducing the number of health care providers that are exposed to an infected patient. At Parkland Memorial Hospital, the COVID-19 unit was named the Tactical Care Unit. It was completely isolated from the rest of the medical and surgical wards and followed strict infection control measures, limiting the number providers having direct clinical care to the hospital medicine and intensive care physicians while utilizing telemedicine for the rest of the medical specialties.

Methods: In collaboration with the UT Southwestern Simulation Center, cardiology team, and Hospital Medicine Department, we set up daily POCUS simulator workshops that lasted on average two hours with an additional one hour of hands-on training on multiple built-in cases. Pre-course educational material included: a 20-minute YouTube basic cardiac point-of-care ultrasound video; a UTSW Clinical Ultrasound Workshop: FOCUSED CARDIAC ULTRASOUND EXAMINATION (FOCUS) PDF file; and a free University of Toronto Virtual Transthoracic Echocardiography website link. We had two instructors – a POCUS-trained hospitalist and a senior cardiology fellow – to provide training. A learners-to-instructor ratio of 4:1 was enforced, as was maintaining six feet of social distancing while wearing surgical masks and gloves to reduce the risk of COVID-19 infection. Long-axis parasternal, short-axis parasternal, apical four- chamber, subcostal four-chamber, and subcostal inferior vena cava views were covered during the simulation session.

Results: This was a survey study of a three-phase educational intervention that recruited 32 internal medicine faculty members at an 870-bed safety-net academic hospital. The three sequential phases included independent study, a simulation-based workshop, and bedside scanning. Respondents were given pre- and post-surveys that assessed confidence and knowledge of topics covered in the curriculum, and these had a 75% and 69% response rate, respectively. Twenty-two faculty members reported 100% confidence in capturing the parasternal, apical, and subcostal views, which was statistically significant compared to the mean pre-course confidence of 52.8%. We also saw a statistically significant improvement in knowledge of optimal positioning of patients for each view.

Conclusions: Simulation-based ultrasound training can significantly improve understanding of focused cardiac ultrasound in faculty caring for COVID-19 patients with diminished access to immediate formal echocardiography.

8. An Innovative Curriculum for Teaching Transesophageal Echocardiography (TEE) to Emergency Medicine Residents

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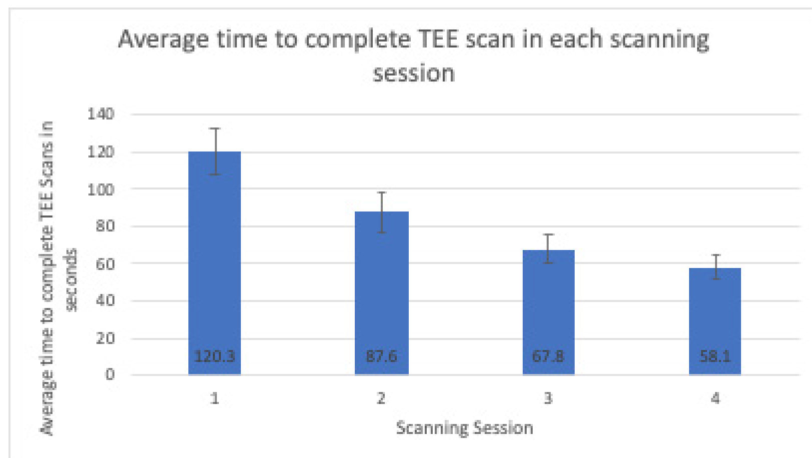
Introduction: Limited transesophageal echocardiogram (TEE) can be a valuable tool for emergency physicians (EPs) during cardiac arrest as it can guide high-quality compressions and inform resuscitation decisions. Currently, there is no standardized TEE curriculum. The purpose of this study was to demonstrate the ability of emergency medicine (EM) residents without prior TEE experience to perform a four-view TEE following a short, flipped conference simulation curriculum.

Methods: This was a prospective, simulation-based study in which EM residents were recruited and consented to participate in the following TEE training curriculum: one hour of online videos reviewed before attending a 20-minute lecture and a 30-minute hands-on practice session using a 3D Systems TEE trainer. The residents were tested on their ability to perform and obtain the four TEE views used most commonly in cardiac arrest – 25 times divided into four different sessions (on the day of training, one week later, four weeks later, and eight weeks later). Each scan was graded live using a 10-point rubric (to assess for proper technique, safety measures, and image acquisition) by a TEE-credentialed EP with corrective feedback following each scan. A subset (n = 60) of TEE scans were videotaped and graded independently using the rubric by two different TEE-credentialed EPs in order to calculate Cohen's kappa coefficient (κ) to demonstrate inter-rater reliability. A subset (n = 65) of scans were reviewed by an intensivist with extensive experience in TEE who blindly graded each image using the standard point-of-care ultrasound 1-5 scale for image acquisition quality with a "3" indicative of minimal criteria to make a diagnosis. Residents also completed an online 10-question pretest before reviewing any TEE material and a post-test following session one.

Results: 21 residents (13 PGY1, 4 PGY2, 4 PGY3) participated. Mean pre- and post-test scores were 52% (SD 16) and 92% (SD 12) respectively. Mean TEE scores using the 10-point rubric after sessions one and four were 9.4 (SD 0.4) and 9.7 (SD 0.3), respectively. Mean time to complete each four-view TEE scan after session one and four were 118.1 (SD 28.3) and 57.1 (SD 17.0) seconds, respectively. The κ for the rubric was 1. The median score for the image acquisition review was 3 (IQR 3-4).

Figure: Average time to complete TEE for each scanning session



Conclusions: This simplified flipped conference curriculum can train EM residents to competently perform TEE and obtain satisfactory images in a simulated environment.

9. Management of Congenital Cardiac Defects in the Delivery Room: A Simulation-Based Curriculum for Neonatal Trainees

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Introduction: Despite early detection of fetal cardiac defects, certain cardiac lesions continue to carry high morbidity and mortality in the delivery room and immediate postnatal period. Neonatal Resuscitation Program guidelines do not routinely focus on delivery room management of neonates with cardiac defects. In order to address this gap in NRP management of neonates with cardiac defects, we developed and conducted a simulation-based educational curriculum workshop for neonatal trainees.

Methods: The educational workshop was developed using the American Heart Association statement on diagnosis and treatment of fetal cardiac disease. Workshop participants included all 12 neonatal fellows at UT Southwestern. The workshop focused on three neonatal emergencies, including: fetal arrhythmia with associated hydrops, restricted atrial septum in a neonate with transposition of great arteries, and presentation of a neonate with undiagnosed hypoplastic left heart syndrome and closed ductus arteriosus. The participants received a pretest prior to simulated scenarios and concluded the workshop with a post-test and survey. Debriefing sessions after each simulated scenario included didactic sessions on neonatal cardiac physiology.

Results: Out of the 12 participants, 33% had completed a Cardiac Intensive Care Unit rotation prior to the workshop. There was a statistically significant difference in the average pretest score of 60% and average post-test score of 89% (p-value < 0.05) (Figure 1). The significance was present even when comparing the pre- and post-test scores within each year of fellowship (Figure 1). The post-workshop survey revealed that 100% of the participants found the scenarios to be appropriate. Out of all participants, 67% preferred simulation-based learning over lectures, and over 92% are willing to participate in future simulation-based learning (Table 1).

Figure 1

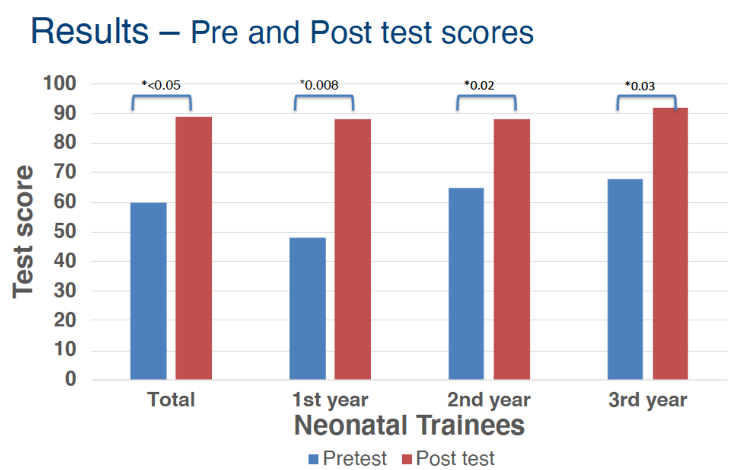

Table 1

Results – Post workshop survey

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I found these simulation scenarios appropriate					100%
I learned useful information from this workshop					100%
I prefer simulation based learning over lectures				33%	67%
I am willing to participate in future simulation based learning				8%	92%

Conclusions: In conclusion, we have used a simulation-based curriculum to address the gap in NRP management of neonates with congenital heart defects in the delivery room and in the immediate postnatal period. Future studies are needed to investigate the use of simulation for enhancing education of neonatal cardiac physiology for neonatal providers and in turn improve the clinical outcomes for patients with congenital cardiac defects.

10. At-Home Medical Student Simulation: Achieving Knot-Tying Proficiency Using Video-Based Assessment

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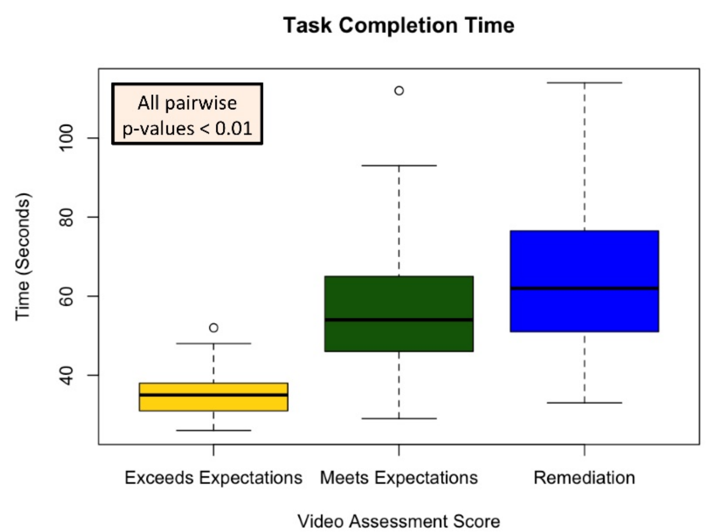
Introduction: Due to the pandemic, we restructured our medical student (MS) knot-tying simulation to a virtual format. This study evaluated curriculum feasibility and effectiveness.

Methods: Over one month, second-year MS (n = 229) viewed a video tutorial (task demonstration, errors, scoring) and self-practiced to proficiency (no critical errors, < 2 minutes) using at-home suture kits (simple interrupted suture, instrument tie, penrose drain model). Optional virtual tutoring sessions were offered. Students submitted a video performance for proficiency verification. Two sets of 14 videos were viewed by two surgeons until inter-rater reliability (IRR) was established. Students scoring "needs remediation" attended virtual remediation sessions. Non-parametric statistics were performed using RStudio.

Results: All 229 MS completed the curriculum within 1-4 hours. 1% attended an optional tutorial. All videos were successfully assessed: 4.8% scored "exceeds expectations," 60.7% scored "meets expectations," and 34.5% scored "needs remediation." All 79 needing remediation (critical errors: 47 instrument handling, 15 knot tying, 17 multiple) achieved proficiency during 1-hour group (2-9 MS) sessions. IRR Cohen's κwas 0.69 (initial) and 1.0 (ultimate). Task completion time was 56 (47-68) seconds (median [IQR]); $p < 0.01$ between all pairs (Figure). MS indicated "agree or strongly agree": 79.2% on overall curriculum effectiveness and 92.7% on video tutorial effectiveness. No definitive preference emerged regarding virtual versus in-person formats; however, 80.2% affirmed wanting other at-home skills curricula. Comments supported home-practice as lower stress; remediation students valued direct, formative feedback.



Conclusions: A completely virtual one-month knot-tying simulation is feasible for an entire MS class using self-practice and uniformly effective in achieving proficiency using video-based assessment and as-needed remediation strategies.

11. Creating a Proficiency-Based Remote Laparoscopic Skills Curriculum for the COVID-19 Era

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[1]Department of Surgery, UT Southwestern Medical Center

Introduction: Due to COVID-19, in-person simulation activities have been restricted. This situation has challenged our ability to educate incoming surgery interns who depend on early simulation training for basic skill acquisition. This study aimed to create a proficiency-based laparoscopic skills curriculum using remote learning.

	Expert Score	Trainee Pre-Test Score	p-value
Task 1: Bead Saucer Transfer	128 (127-131)	36 (0-78)	0.01
Task 2: Bead Post Transfer	182 (146-190)	96 (35-155)	0.03
Task 3: Rubber Band Transfer	115 (105-121)	87 (67-96)	0.04
Task 4: Paper Cutting	199 (139-208)	0 (0-124)	0.006
Task 5: Needle Bead Transfer	255 (238-256)	215 (171-237)	0.02

Methods: Portable laparoscopic box trainers, including a digital camera, instruments, and various simulation models, were donated. Content experts designed five tasks to address eye-hand coordination, depth perception, and precision cutting. A scoring formula was used: cutoff time – completion time – K (errors); the constant K was determined for each task. A faculty member performed three consecutive repetitions of each task; proficiency benchmarks were defined as the mean score minus two standard deviations. PGY1 surgery residents (n = 29) were each issued a portable trainer, task explanations, and score sheets. Remote training included submitting a pretest video, self-training to proficiency, and submitting a post-test video. Performance was assessed from the videos by supervising faculty. Construct validity (expert vs. trainee pretests) and skill acquisition (pretest vs. post-tests) were compared using Wilcoxon Test (Median (IQR) reported).

Results: All trainees completed pretesting; compared to expert performance, significant differences were detected for all tasks, supporting construct validity. One trainee was proficient at pretest. After one month of self-training, seven additional residents achieved proficiency on all five tasks after 2-20 repetitions; pretest vs. post-test scores were significantly different on all tasks ($p < 0.05$). The remaining 21 residents are expected to reach proficiency by the end of the two-month curriculum.

Conclusions: This proficiency-based curriculum is associated with construct validity, is feasible, and resulted in significant skill acquisition. The remote format, including video-based performance assessment, facilitates effective at-home learning and may allow additional innovations such as video-based coaching for more advanced curricula.

12. Utilizing a Comprehensive Paracentesis Module in Improving Student Comfort and Competency

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Introduction: New Internal Medicine interns are expected to be familiar with bedside procedures such as paracentesis. Medical students frequently have inadequate dedicated time to learn bedside procedures and are taught in a fragmented manner. As a result, new interns lack familiarity with these procedures. As such, we assessed whether a comprehensive module for paracentesis would improve fourth-year medical student comfort and competence compared to standard training.

Methods: We developed a novel comprehensive module in our Residency Essentials Course – Internal Medicine Track to teach paracentesis. The module covered 10 key areas about paracentesis. Students enrolled in our track were included and stratified into two groups based on their future residency specialty. Students answered a pre-practice survey of 9 questions related to paracentesis indications, technique, complications, and lab interpretation. The first group (specialties Internal Medicine, Medicine-Pediatrics, Interventional Radiology, Physical Medicine and Rehabilitation) received standard instruction, which included an online procedural animation video from *NEJM* to review. The second group (specialties Emergency Medicine, Family Medicine, Anesthesia, Neurology) were provided the comprehensive module. Students from both groups were divided into groups of 2-3 and received 30 minutes of practice time with task trainers supervised by resident/faculty instructors. Both groups completed a post-practice multiple choice quiz and post-practice survey and were evaluated by faculty on their practical procedural competence. The scoring for the practical had two components: a numerical checklist score of 100 points and a pass/fail on mastery of the technique. Nine students were excluded from this study because they were unable to practice with task trainers.

Results: 107 fourth-year medical students were included in the study. There was no significant difference in age or gender between the two groups. The median value for each pre-practice survey question varied between 3 or 4 on the Likert scale. There was no significant difference between the two groups, suggesting a comparable baseline comfort value. The intervention arm had significantly higher quiz scores (mean score of 63.5 in B vs. 44.7 in A out of 100 points; $P < 0.0001$) and practical competence pass rate (100% pass rate in B vs. 91.1% in A; $P = 0.0468$). The numeric checklist score was not statistically different amongst the two groups. Both groups A and B responded as being more confident in the post-practice survey (83.78%) as compared to the pre-practice survey (62.50%; $P = 0.0302$).

Conclusions: Our novel module was associated with better quiz scores and practical competence. Our study suggests that a comprehensive paracentesis module may improve student comfort and competence with procedures. This could help guide future curriculum development for procedural training.

Student Pass/Fail on Paracentesis Practical

	Percentage of Students to Pass	Percentage of Students to Fail	Total Number of Students
Group A	91% (41/45)	9% (4/45)	45
Group B	100% (50/50)	0	50
Both Group	91 (95%)	4 (5%)	95

The impact of intervention received by group B on the knowledge of performing paracentesis was statistically significant ($P = 0.0468$) at the 0.05 alpha level.

Student Quiz Score

	Group A	Group B
Mean Quiz Score (out of 100 points)	44.7	63.5

($P < 0.0001$)

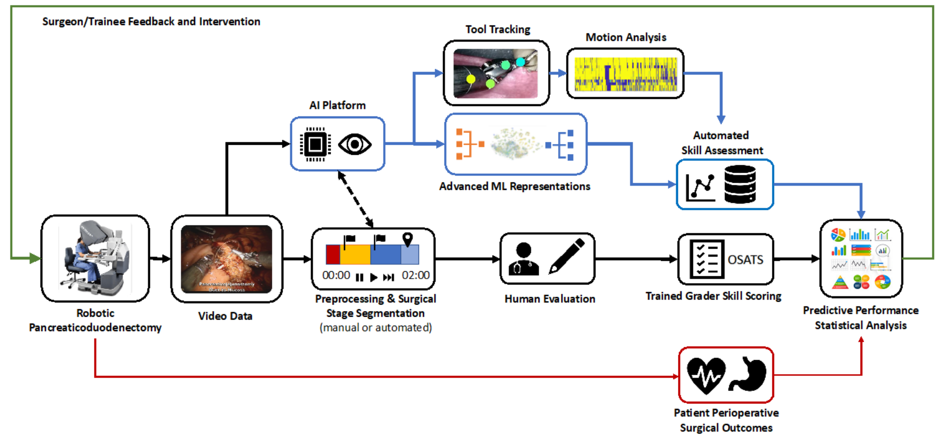
1. Predicting the Future? Revealing Postoperative Patient Outcomes with Surgical Video AI

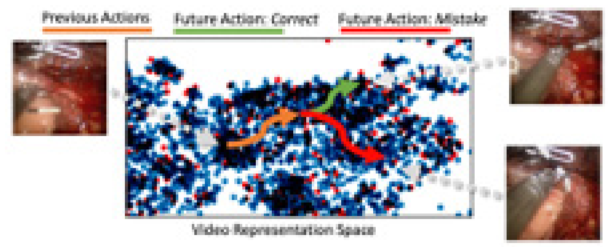
Andrew R. Jamieson, Ph.D.[1]; Michael Holcomb, M.S.[1]; Juan Tellez, B.S.[2]; Patricio M. Polanco, M.D.[2]; Herbert J. Zeh III, M.D.[2]

[1]Lyda Hill Department of Bioinformatics, UT Southwestern Medical Center; [2]Department of Surgery, UT Southwestern Medical Center

Introduction: Postoperative patient complications have been linked to surgical technical proficiency. Recent work suggests automated analysis of surgical videos using machine learning can also gauge surgical skill, in addition to other tasks such as identifying gestures and recognizing procedure phases. We are pursuing an immediate extension to these developments to address the open question: Can patient outcomes be directly anticipated via video-based analysis of surgeries? And further, can we quantitatively attribute/measure the impact of the respective clinical factors contributing toward detrimental patient outcomes? If validated, this technology could enable near real-time postoperative feedback to address surgeon weaknesses with targeted training curricula, to identify components of the operative workflow mattering most to decreasing the likelihood of complication-free surgeries, and finally, to better alert physicians of imminent case-specific complications.

Idea: We hypothesize that, on aggregate, live-recorded surgery videos (such as those captured by minimally invasive robotic systems) contain information (in conjunction with patient risk factors) that can help predict patient outcomes, including the differentiation of surgeon technical performance quality (i.e., skill). We believe recent advances in **state-of-the-art spatiotemporal/video-based machine learning** techniques now make it tenable to extract, represent, and systematize/generalize elements of this knowledge from ***long* videos (30 mins+)**. Importantly, these new methods also have the potential to reduce the load of expert annotation required by leveraging unsupervised and semi-supervised representations that can capture underlying patterns in surgical actions. We aim to accomplish these goals with the following steps: **1) Design advanced, hierarchical machine-learning-based surgical video representations**. We have begun developing and evaluating baseline models using an existing, large video dataset of Robotic Pancreaticoduodenectomies (RPD) recorded at UPMC collected by Dr. Zeh, including knowledge of patient outcomes. We anticipate the model will improve as we expand our video data repository here at UTSW. **2) Develop methods for model domain adaptation/generalization, including use in *simulated training* contexts**. To translate clinically relevant knowledge learned from actual surgery performances into the training environment and other contexts, we will develop approaches for adapting our models to analyze videos from new domains, including simulated exercises. We will compare performance of automated skill assessment when models are trained purely with simulated videos vs. when leveraging information from live surgery videos. We will also explore cross-procedure concordance with skill assessment and adverse outcome prediction. **3) Prospective study of algorithmic predictions for surgical outcomes and near real-time feedback using video-based analysis**. The ultimate validation of this technology will be to deploy and evaluate our predictive system in a prospective clinical setting. Actual patient outcomes will then be monitored and correlated against the model's predictions, along with a survey of the surgeon's perception of the expected outcomes.





Impact to Simulation and QI: Our work will drive development of key technologies needed for efficient knowledge-based representations of entire videos, which will in turn guide near real-time feedback both in training and in the operating theater.

2. IMAGINE: Implementation of a Virtual Reality Training Tool for Mass Casualty Incidents

Bhargav Arimilli, B.S.[1]; Sanjay V. Neerukonda[1,2]; Alec Siegel, B.S.[1]; Paul Kozak3; Andrew Hogan, M.D.[1]; Gilberto Salazar, M.D.[1]

[1]Department of Emergency Medicine, UT Southwestern Medical Center; [2]Department of Behavioral and Brain Sciences, University of Texas at Dallas; [3]Dallas College

Introduction: The COVID-19 pandemic has accelerated the shift toward digital education and has highlighted a need for flexible, on-demand educational models that can be accessed from home and maintain high-quality training while engaging students in novel ways. The purpose of this study is to validate the effectiveness of a novel, virtual reality (VR)-based educational platform designed to train EMT students for disaster preparedness and mass casualty incidents.

Methods: We will study the effectiveness of a VR training tool developed by Augmented Training Services (ATS) for disaster preparedness in a cohort of 50 EMT students at Dallas College and UT Dallas's University Emergency Medical Response (UEMR). This cohort will be divided into two groups of 25 students each. The control group will undergo the standard lecture-based curriculum that is already in place at Dallas College. The test group will undergo

training using the VR tool. The VR tool has more than 100 simulated patients (avatars) with different injuries due to a bus crash on a highway. The software includes three progressive levels of difficulty – beginner, intermediate, and advanced. In each level, students will be randomized to evaluate and treat 30 patient avatars using Simple Triage and Rapid Treatment (START) principles. Students will have 60 seconds to triage each patient. At the end of each level, students will receive a report card of their accuracy and proficiency. In the beginner stage, the software will provide prompts and hints to guide the student through the scenario, but in the intermediate and advanced levels, the number of prompts and hints will decrease as students will be expected to have a greater level of autonomy in responding to the virtual disaster scenario. The intermediate and advanced stages will also introduce more complex environments, with distractions such as harsh weather and increased ambient noise. The VR headsets and associated equipment will be delivered to Dallas College for distribution to the 25 students. We will generate a schedule to share the four headsets between 25 students, taking steps to disinfect the equipment between each student. We will also produce a short video to orient learners on how to appropriately use the VR equipment for training. Each of the three stages will take approximately 10-15 minutes to complete; we anticipate that it will take approximately one week to have all 25 students finish all three stages. We will concurrently ask learners to make note of any software glitches or technical difficulties.

Results: Data collection for this project has not yet begun.

Conclusions: We hypothesize that the implementation of a virtual reality-based, mass casualty incident simulation tool will improve retention and competency in a cohort of EMT students in comparison to the existing lecture-based curriculum.

3. Ambiguous Conversations: A Combined Obstetrics & Pediatrics Simulation for Graduating Medical Students

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[1]Department of Pediatrics, UT Southwestern Medical Center; [2]Department of Obstetrics and Gynecology, UT Southwestern Medical Center

Idea Description: Physicians must work in interprofessional and interdisciplinary teams in an increasingly complex health care environment.[1] The delivery room presents an opportunity to practice collaboration between two specialties that frequently overlap in patient care: obstetrics and pediatrics. The delivery room also creates a high-pressure environment for crucial conversations; residency program directors identify communication skills as a crucial area of focus during the transition to internship phase.[2]

This simulation is designed in three phases with clinical- and communication-focused learning objectives:

1) Phase 1, Delivery room: Pregnant mother in labor; students must recognize fetal distress (clinical objective) and counsel mother on immediate delivery (communication objective).

2) Phase 2, Delivery room: Baby has been delivered successfully; students must recognize ambiguous genitalia and counsel mother on implications (communication objective).

3) Phase 3, Newborn nursery: Baby has vital sign changes; students must recognize shock (clinical objective) and initiate first steps in resuscitation, including recognition of adrenal insufficiency (clinical objective).

Because the learning objectives focus on cognitive and nontechnical skills, the chosen simulation modality was virtual and low-fidelity. Realism was increased with the use of programmable, live fetal heart rate tracing (Phase 1) and programmable, live cardiorespiratory monitors (Phase 3). Phase 1 and 2 uses embedded participants (bedside nurse and patient) to interact with students; Phase 3 uses videos to convey important physical exam findings (capillary refill, lethargic infant, respiratory distress with grunting) that convey a critically ill neonate. During discussion, students are asked to unmute to signal wanting to speak to facilitate discussion in a medium-sized group in a virtual setting.

The biggest challenge is reliance on expensive software (Gaumard's Victoria) for the auditory cues that indicate fetal decelerations. This software requires expertise for programming, which makes dissemination of this unique simulation limited to institutions with a Simulation Center with trained personnel. Additionally, we would like advice on how to study this educational intervention and/or how to make it scholarly; if proven to be successful, we would like to create more interdisciplinary – and even interprofessional – simulations throughout undergraduate medical education, culminating in the capstone courses of the final year of medical school.

[1]Mayo AT et al. "Teamwork in Health Care: Maximizing Collective Intelligence via Inclusive Collaboration and Open Communication." *AMA J Ethics*. 2016;18(9):933-940.

[2]Angus S et al. "What Skills Should New Internal Medicine Interns Have in July? A National Survey of Internal Medicine Residency Program Directors." *Acad Med*. 2014;89:432–435.

4. A Virtual Simulation for an Interprofessional Team Meeting for Discharge Planning

Thomas Dalton, M.D.[1]; Jennifer Roye, M.S.N., RN[2]; Krystle Campbell, M.S., CHSE[3]; James Wagner, M.D.[1]; Carla Mosley[3]; Kim Hoggatt Krumwiede, Ph.D.[4]

[1]Department of Internal Medicine, UT Southwestern Medical Center; [2]College of Nursing and Health Innovation, University of Texas at Arlington; [3]UT Southwestern Simulation Center; [4]Interprofessional Practice and Education, UT Southwestern Medical Center

Idea: Our idea is to transition the existing face-to-face *Interprofessional Skills Simulation: An Interdisciplinary Team Meeting for Discharge Planning with the Cooper Family* to a virtual simulation.

Introduction: The goal of this session is for students to gain skills in working in teams during a particularly difficult situation: discharge planning. Discharge planning is most effective when involving a team of health care workers involved in the patient's care. After completing an online module, students in medical, nursing, and health professions programs will attend a virtual joint simulation session via Zoom. Students meet virtually in small teams of three to four, with each group having multiple health professions represented. The students will work as an interdisciplinary team to help the Cooper family prioritize their options for the best residential placement for Ms. Cooper following her discharge from the acute care hospital. Afterward, students will also participate in a student-led debrief of their encounter.

Objectives: This session is designed to introduce students to milestones (recognition and understanding) on the path to obtaining core competencies for interprofessional collaborative practice identified by the Interprofessional Education Collaborative (IPEC).1 Working effectively as a member of a clinical team is key to safe, high-quality, accessible, patient-centered care. The learning objectives are that, by the end of this session, students will:

1) Work effectively as part of a team by using shared, patient-centered problem-solving
    a) Communication of roles (Roles/Responsibilities)
    b) Respecting/valuing contributions of other team members, patients, and their family members (Values/Ethics for Interprofessional Practice)
    c) Active listening (Interprofessional Communication)
    d) Managing meeting to be patient-centered (Team and Teamwork)
2) Compare and contrast outpatient placement options for hospitalized patients who cannot be safely discharged home
3) Given a scenario, solve the problem of patient placement by coming up with a prioritized list of placement options for the Cooper family

We have faculty from three different institutions (UT Southwestern Medical Center, University of Texas at Arlington, Texas Woman's University) working with the UT Southwestern Simulation Center team to plan and implement this session for approximately 789 students from eight different programs in medicine, nursing (Undergraduate Nursing, Nurse Practitioner), and health professions (Physician Assistant, Physical Therapy, Prosthetics-Orthotics, Clinical Nutrition, Social Work).

We plan to conduct this virtual simulation online via Zoom over three consecutive days from 5 p.m.-9 p.m., including a make-up day if needed. Students will meet in interprofessional teams for one 70-minute session. The interprofessional team will discuss, plan, and meet with a family member (standardized patient) to discuss the discharge destination options for a patient. The standardized family member will debrief the team on their effort followed by a student-led team debrief. The challenges for this virtual simulation include: a) the logistics of a virtual session including student sign-up, Zoom, and having breakout rooms and IT support; b) the number of individuals participating in this event – approximately 789 students; c) coordinating the event and students across the different institutions; d) devising the best way to debrief the session with students.

5. Time Is Brain: Pharmacy Preparation to Stroke Management Perfection

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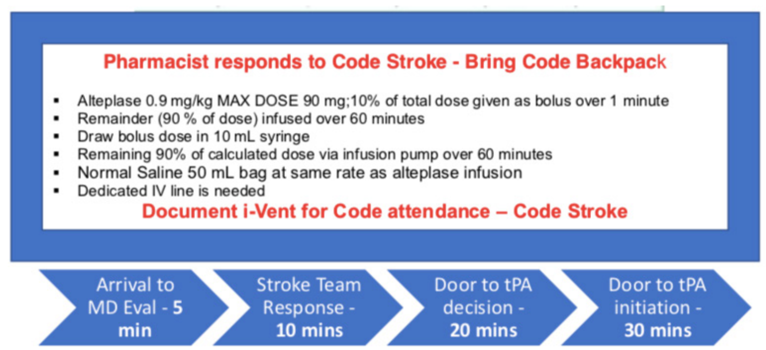
[1]Department of Pharmacy, UT Southwestern's William P. Clements Jr. University Hospital

Introduction: UT Southwestern Medical Center (UTSW) is the only Comprehensive Stroke Center certified by The Joint Commission and The American Heart Association in Dallas, Texas. Strokes are the fifth-leading cause of death in the United States and the leading cause of long-term disability in survivors, thus timely care is essential. There are two types of stroke: hemorrhagic and ischemic. Acute ischemic stroke accounts for approximately 87% of all strokes. The standard of care in the management of ischemic strokes is with an IV thrombolytic, alteplase or tenecteplase. Administration of an IV thrombolytic within 3 hours for most patients or 4.5 hours for select patients from time of stroke onset is critical to improving patient outcomes. The time that a patient presents to the hospital to the time of IV thrombolytic administration is a benchmarking measure known as door-to-needle time (DTN). In order to decrease the current DTN time of 45 minutes to 30 minutes, the UTSW stroke committee implemented several best practice measures. One of the changes was to transfer the responsibility of mixing alteplase from the nursing staff to the inpatient pharmacy staff, thus allowing nursing to focus on other tasks to ensure rapid treatment of ischemic stroke patients. The change has required every inpatient pharmacist to become knowledgeable of when a patient is an appropriate candidate for alteplase administration, decrease dosing errors, to be familiar with the intricate components in alteplase preparation and monitoring post-administration.

Methods: Education through simulation has been an integral part of teaching inpatient pharmacists responding to Code Stroke alerts. Virtual exposure to a simulated Code Stroke through in-service training was required for all new and current inpatient pharmacy staff. Concepts were then further supplemented with an Elsevier educational module. The educational modules had virtual simulations within them to highlight key mixing procedures of alteplase, the contents of a Code Stroke kit, and patients deemed appropriate for alteplase administration. Knowledge assessment questions were embedded in the simulation. A standardized "Code Stroke kit" was created and incorporated into the current pharmacist Code Blue backpack. A pharmacist Code Stroke "badge buddy" was also created for quick reference during Code Stroke attendance. Inpatient pharmacists are required to attend all Code Stroke pages post-training, verify alteplase orders, and quickly mix alteplase from the "Code Stroke kit" at the bedside.

Results: The DTN results are currently in the process of being collected. The transition of responsibility from nursing to pharmacy for mixing alteplase occurred on September 1, 2020. The previous standard in the DTN was 45 minutes; the new targeted DTN is 30 minutes.

Conclusions: Simulations have remained a cornerstone in educational processes and instrumental during the COVID pandemic. Due to in-person COVID restrictions, simulations help provide an avenue to transfer knowledge and teach concepts that were once restricted to a classroom setting. The pharmacist Code Stroke virtual simulation has been critical in teaching inpatient pharmacists to be key players in multidisciplinary stroke care management, not only to decrease DTN but potentially improve patient outcomes.



1. Virtual Introduction of Teamwork Competencies to Health Professions and Medical Students

Devin J. Shah[2]; Brayden Seal[2]; Mozhdeh Sadighi, M.S., Ph.D.[2]; Bau Tran, Pharm.D.[1]; Nneka Nweke[1]; Abby Wolf[1]; Ian Shields[2]; Rich Preble[2]; Logan Gisick, M.S.[3]; David Klocko, M.P.A.S., D.M.Sc.[1], Kimberly Hoggatt Krumwiede, M.A., Ph.D.[1]; Philip Greilich, M.D., M.Sc.[2]

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Introduction: Team *FIRST* is an institutionally sponsored plan dedicated to expanding and improving teamwork training for health professions and medical students. The first module in this longitudinal curriculum is designed to teach evidence-based teamwork competencies during Convergence. The Module 1 pilot, *"Introduction to Interprofessional Teamwork,"* aimed to introduce two competencies: structured communication and closed-loop communication (CLC). The activities for these competencies were incorporated into the Convergence 2020 program, which was conducted virtually and included a simulation-based activity to assess students' ability to successfully perform CLC.

Methods: Prior to the event, students received a preparatory document containing information relating to structured communication and CLC. During Convergence, students participated in a series of virtual teamwork activities and group debriefs, including the CLC virtual simulation activity. Student self-efficacy in completing team-based communication tasks was assessed using a pre- and post-survey. Additionally, a trained observer reviewed the recordings of students' completing the simulation activity to evaluate the proper performance of the three steps of CLC – the call-out, check-back, and close.

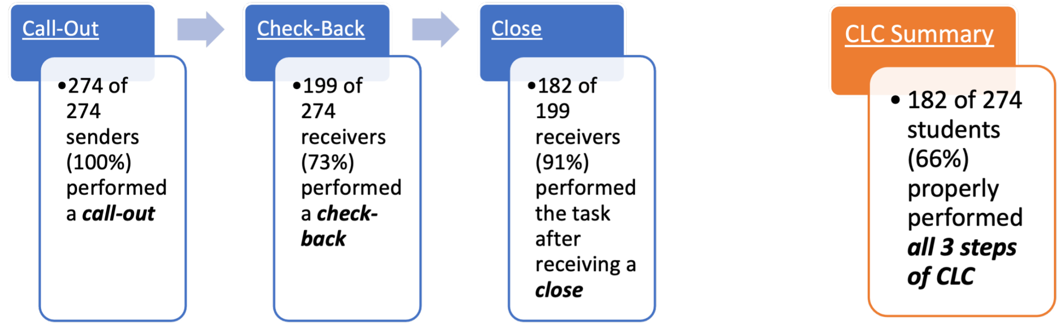
Results: Of the 863 students who participated in Convergence, 95% and 89% completed the pre- and post-self-efficacy surveys, respectively. Each team-based communication task demonstrated significant improvements ($p < 0.05$) after completion of the Convergence virtual activities *(Table 1)*.

Table 1: Percentage of Students Who Responded As Confident Or Strongly Confident in Self-Efficacy Survey

Level of Confidence in Performing Team-Based Communication Tasks	Pre-Survey	Post-Survey
Receiving a handover from a peer	19%	44%
Giving a handover to a peer	14%	40%
Participating in an interprofessional handover	11%	39%
Leading an interprofessional handover	7%	32%
Eliciting clarifying questions from a peer during a handover	17%	46%
Correcting erroneous information during a handover	11%	43%

Recordings of 274 students attempting to perform CLC during the virtual simulation were assessed. 66% of students (182 of 274) properly completed all three steps of CLC. Figure 1 summarizes the students' performance of CLC in the virtual simulation. Results were limited by the event's time constraints and the technological proficiency of its participants.

Figure 1: Behavioral Assessment of Closed-Loop Communication in the Virtual Simulation Activity



Conclusions: Convergence Day 2020 was the largest virtual interprofessional education activity at UT Southwestern to date. It provided Team *FIRST* an opportunity to pilot a teamwork curriculum that included virtual simulation and video-assisted behavioral assessment. Our findings support the hypothesis that development of interprofessional teamwork competencies will require a longitudinal curriculum that can be conducted virtually, if needed.

2. Continued Inequity of Performed Clinical Tasks in Undergraduate Medical Education by Gender, Despite Incorporation of Simulation-Based Education

Anne Marie Kerchberger, M.D.[1]; Kristen E. Wong, M.D.[1]; Krystle Campbell, M.S.[2]; Jerzy Lysikowski, Ph.D.[3]; Daniel Scott, M.D.[2,4]; Melanie S. Sulistio, M.D.[1]

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Introduction: Historically, male learners in medical education have reported higher numbers of performed procedures and levels of confidence compared to their female counterparts [1, 2]. Simulation-based education (SBE), now widely adopted in undergraduate medical education (UME), provides learners opportunities to learn and perform clinical tasks in a safe environment, without relying on chance exposure or self-advocacy. We sought to evaluate the associations between recent medical student graduates by gender, experience performing clinical tasks – both simulated and actual, and self-reported confidence.

Methods: From 2016 to 2019, UT Southwestern matriculating interns completed a survey querying their simulated and actual experience, as well as their confidence with 26 clinical tasks in three categories (procedural, communication, and other). Survey results were de-identified and entered into an institutional quality improvement database. A chi-square test was utilized to compare categorical groups, with significance based on P-value < 0.05. Nonbalanced analysis of variance was used to determine the relationship of gender, program type, and gender and program type on self-confidence. This effect was examined for simulation exposure, hours spent in simulation, and total performed tasks, with and without direct supervision. Type III SS was selected for testing hypotheses with a significance level of 5%.

Results: Of 950 respondents, 50% (N = 450) were female. 63% of females (N = 298) and 58% of males (N = 274) were entering nonprocedural residencies. For half of simulated tasks (13 of 26, $p = 0.0003$), men reported more experience. Men also reported more non-simulated experience with clinical tasks (19 of 26, $p < 0.0001$). Women performed a higher number under direct supervision in only one clinical task, gynecologic examination. Men performed more unsupervised tasks (20 of 26, overall $p < 0.0001$). The number of total performed tasks was associated with increased confidence, regardless of gender ($p < 0.0001$). Overall, women were less confident than men ($p < 0.001$), regardless of procedural or nonprocedural residency program type ($p = 0.0007$). Men had a more positive linear association with confidence per simulated task compared to women.

Conclusions: Although women constitute 50% of matriculating medical students nationwide, our study shows continued discrepancy in the number of performed clinical tasks between female and male students. Male medical students may have reported higher confidence with clinical tasks as a result of their increased experience performing these tasks. We show for the first time that this trend persists irrespective of procedural or nonprocedural specialty. Our study highlights continued inequity of the clinical experience between men and women in medical schools. It is unclear if increased experience and confidence translates to increased competence. Additionally, further work must be done to elucidate and address the etiology of this disparity in clinical experience between genders in UME.

3. Resuscitation Practice, Testing, and Remediation for Junior EM Residents

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[1]UT Southwestern Medical Center

Introduction: Simulation is a vital component of EM resident education. Our PGY2 residents inherit the responsibility of leading our critical care/trauma pod. In response to this internal requirement, a curriculum was developed to assess all 22 PGY2 EM residents. The curriculum's objective was to put each resident through complex resuscitation simulations to assess medical knowledge, leadership skills, and readiness for the EM critical care environment.

Methods: This curriculum consisted of three stages: formative, testing, and remediation. Each stage involved cases observed by EM faculty and was designed to assess resuscitation competency. In the formative stage, the resident faced four cases of cardiac arrest, each due to different etiology. The resident was debriefed after each case. Testing sessions were held after formative sessions were complete. In the testing stage, the resident faced two cases (one patient with undifferentiated shock and one with cardiac arrest) but was not informed beforehand that there would be a second case. The resident began Case 1, was called to Case 2 partway through, and at the end of Case 2 returned to Case 1. EM faculty scored the resident's performance per our objectives. The resident was debriefed and told if they required remediation; five did. The remediation case was a patient with hypoxic respiratory failure followed by cardiac arrest. Residents were debriefed post-case in a summative fashion; all five passed. After this, all residents received feedback on their individual areas of weakness and resources to spur further study.

Results: Out of the 22 residents initially tested, only five were found to require remediation. All five of these residents passed the remediation case successfully.

Conclusions: This curriculum, administered to 22 residents, proved to be a high-fidelity method of assessing junior EM resident resuscitation skills and remediating specific areas of weakness. Learners found it helpful to their growth and clinical skills. We plan to continue this for future residents while refining the cases and scoring system.

4. Virtual Reality in Vascular Ring Education: A Novel 2D-3D Comparison Study

Ryan S. Bishop, M.D.[1]; Mike Seckeler, M.D., M.Sc.[2]; Corinne Anton, Ph.D.[1]; Tarique Hussain, M.D., Ph.D.[1]; Ryan McMahan, Ph.D.[3]; Animesh Tandon, M.D., M.S.[1]

[1]Department of Pediatric Cardiology, UT Southwestern Medical Center; [2]University of Arizona Health Sciences; [3]Department of Computer Science, University of Central Florida

Introduction: Virtual reality (VR) is immersive and three-dimensional and thus has been hypothesized to be superior for spatial anatomical learning compared to two-dimensional approaches. However, the interstudy variability in the use of participant blinding and the heterogeneity of most educational control curricula have left the confirmation of VR educational superiority elusive. This pilot study was designed to compare 2D and 3D vascular ring curricula, both delivered with head-mounted display (HMD) VR headsets in their efficacy of spatial anatomical learning.

Methods: A vascular ring lecture was constructed using a combination of idealized embryonic models and segmented patient chest CT datasets to explain various types of vascular rings. Simultaneous 2D and 3D versions of the 25-minute vascular ring lecture were recorded in a novel virtual reality software platform. Residents, medical students, and fellows were then recruited to participate in the VR curricular study in the spring of 2021. Participants were assigned in a participant-blinded, quasi-random manner to receive either a 2D version or a 3D version of this lecture. Participants completed pre- and post-surveys, which assessed basic participant demographic data, prior VR exposure, subjective self-assessment of vascular ring understanding via a seven-point Likert scale, and objective understanding of vascular rings (15 total objective questions, eight specifically assessing spatial anatomy understanding).

Results: 24 participants were recruited to the study at this interim time point. Age, sex assigned at birth, gender identity, race/ethnicity, level of medical training, and prior 3D activity engagement were not statistically different between the 2D and 3D study groups. Subjective self-assessment and objective assessments showed statistically significant improvement in both the 2D and 3D groups ($p < 0.05$). The 3D group objective assessment score improvement was not statistically greater than the 2D group.

Group	Participants	Average Total Improvement in Post-Intervention Objective Assessment Score Out of 15 questions (p-value for significance of improvement from baseline)	Average Improvement in Spatial Anatomy Assessment Score Out of 8 questions (p-value for significance of improvement from baseline)
3D	11	2.3 ± 2.3 questions ($p<0.05$)	1.2 ± 1.6 questions ($p<0.05$)
2D	13	1.7 ± 2.1 questions ($p<0.05$)	1.0 ± 1.4 questions ($p<0.05$)

Conclusions: So far, in this novel 2D-3D anatomy educational comparison study, the VR vascular ring curriculum was noninferior to a 2D recording of the same curriculum. We plan to complete enrollment in the study over the next few months. Future research should propose standardized assessment techniques for VR anatomy education curricula to mitigate interstudy assessment variability.

5. Simulation-Based Cross-Cover Training for Fourth-Year Medical Students: A Novel Approach

Jaini Sutaria, M.D.[1,3]; Shan Luong, M.D.[1,3]; Ladan Agharokh, M.D.[2,3]; Farihah Perwez, M.D.[1,3]; Nida Rizvi, M.D.[1,3]

[1]Division of Hospital Medicine, [2]Division of Medicine-Pediatrics, [3]UT Southwestern Medical Center

Introduction: Feedback from last year's Residency Essentials course identified cross-cover as a deficiency. Interns are expected to cross-cover but lack formal training. Cross-cover requires gathering pertinent information quickly and making rapid clinical decisions and is prone to medical errors without adequate training. Program directors expect four core skills from new interns: recognizing sick from non-sick, asking for assistance, managing time wisely, and communicating effectively with health care teams. Cross-cover tests these core skills simultaneously.

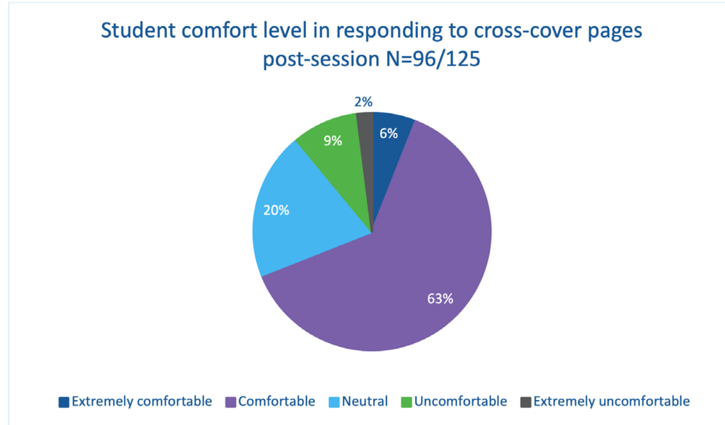
Methods: We designed a simulation-based cross-cover exercise for fourth-year medical students. The objective was to have students address common cross-cover scenarios and determine need to respond to a page in-person versus telephone. One hundred twenty fourth-year students were split into groups of four. Each received a written sign-out (in IPASS format) on six mock patients. They worked with two faculty, one acting as a nurse and another directly observing. Five cross-cover pages – one of which needed bedside evaluation while the other four could be resolved over the phone – were presented sequentially. Students were expected to call the nurse while on speaker and determine further management. At completion of each page, faculty debriefed with the students.

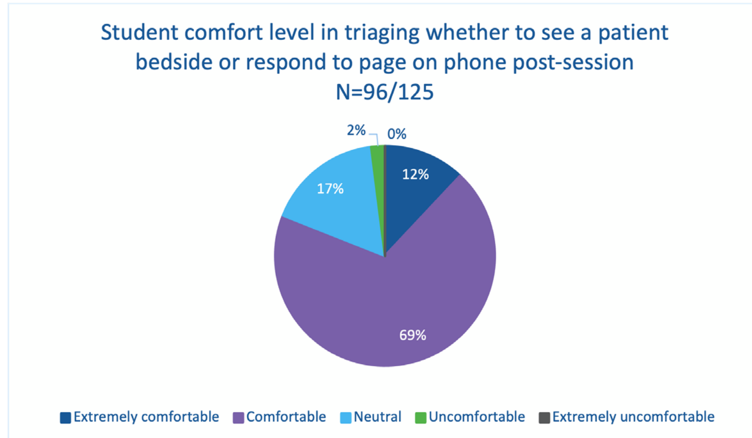
Results: 79% of the students responded they had received no training for cross-cover prior to this. At completion, 63% of students felt comfortable in responding to cross-cover pages, and 69% felt comfortable in triaging, whether to see a patient at bedside or to resolve the issue on the phone. More than 90% noted cases were relevant and realistic and said facilitators were knowledgeable and enthusiastic. Thematic analysis of students' comments was also done.

Conclusions: The Simulation Scenario Evaluation Tool, developed using a national consensus of content experts, is an instrument demonstrating content validity that assesses the quality of written simulation scenarios. This tool provides a basis to guide structured feedback regarding the quality of written simulation scenarios.

Theme (What went well)	Cases were realistic
	The cases were realistic. I especially liked the case with hypoxia where we had to go see the patient. I was at a loss at what to do, and I certainly learned some tips about how to manage hypoxia, as well as to try and distinguish between "right now" interventions and "will work in a few hours" interventions. I guess my main concern now is who will back me up when I'm alone on cross-cover, as my go-to now is calling for help and asking others for their ideas. *The variety of cases was excellent. Each one felt realistic, especially with the format of calling a nurse. I appreciated that we had time for group discussion before each student returned the page.* *Great selection of cases. Very realistic. Great acting by the "nurse" Dr. XXX. Many practical learning points.*

	Facilitators
	The proctors were amazing and super supportive! I loved the environment of learning and low stress they quickly established. *The residents were clearly the ones who really made these scenarios useful. They had a lot of insight into the various choices and how responding to these pages go in real life.* *I enjoyed working with the facilitators which were all very nice and encouraged conversation. They did a great job leading the sim session and I thought this was relevant to residency and very useful.*
	Simulation Format
	I thought this was one of the most useful activities I have had in my 4th year of med school. This was the best run simulation I have ever done. The learning environment was supportive, and we felt comfortable making mistakes/asking for help. I wish we could do more of these sessions. *I enjoyed the team effort, the realism with having a printed check out with only brief info, enjoyed the low stress environment but high yield learning* *The process and format were great, and I think it helped relate the fact that there is still a lot to learn. Loved this experience, would want it to be even longer and include more cases. Appreciated the format with 4 students and 2 facilitators, and telephone and bedside components!*
Theme (What went poorly)	**Time Per Case**
	We covered almost every case in the exercise except for one. Possibly, an area of improvement would be to allocate an extra 15 min to the exercise to allow ample time to get through all the cases. *Time management was a bit of an issue. I felt that we were rushed to finish because we were only give one hour for the activity.* *Maybe allowing more time (like 1 hour and 15 minutes or 1.5 hours instead of 1 hour) because there wasn't enough time to go through all 6 cases in depth and I thought that would've been useful.*
	Preparation
	A couple of the cases were pretty challenging, and it would have been nice to have some educational material beforehand on how to manage some of the more challenging cases, like a renal failure patient becoming acutely SOB, in order that we can learn better from the experience. *- prep material would be helpful - a sheet of tips would be helpful*
	Location Details
	Please send emails about exact locations to meet in an email the night before or morning of *Room number for where to go would be nice* *Having a bit more information on purpose of sim, if any.*





Please check all things that went well (Check all that apply)		
	Cohort 1	**Cohort 2**
	N=46/54	N=50/71
Orientation to Sim cross-cover course	82.61%	64.00%
Course objectives were clear	80.43%	68.00%
Location was conducive to learning	97.83%	82.00%
Cases were relevant	100.00%	94.00%
Time-Management	93.46%	68.00%
Facilitators medical knowledge	100.00%	88.00%
Facilitators openness to questions	100.00%	86.00%

Conclusions: The simulation format provided practice in a low-risk environment. Students found problem-solving in groups and evaluating a crashing patient bedside valuable. Limitations include the need for faculty manpower and a smaller student sample size (120 instead of 160) due to the COVID pandemic. This exercise can be adopted by other specialties and has potential to reduce medical errors.

6. Communication Simulations: Preparing Students for the Difficult Conversations of Pediatric Residency

Benjamin Masserano, M.D.[1]; Ladan Agharokh, M.D.[1]

[1]UT Southwestern Department of Pediatrics

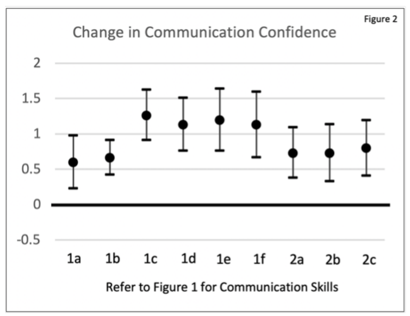
Introduction: Communication training is an integral part of medical student preparation for residency, and every specialty has distinct communication needs. This study focused on medical students preparing for pediatric residency and the unique set of challenging interactions between physicians, parents, and patients that this entails. An obstacle to this preparation is the paucity of published communication curricula available for medical students that are specific to pediatrics. On review of curricula on MedEdPORTAL, with search terms "communication" and "medical student," of the 300 most relevant results only 6.3% involved doctor-patient communication and none had a pediatric focus. The objective of this study was to use communication scenarios specific to intern year of pediatric residency to improve medical student confidence in engaging in difficult conversations, managing conflict, and interacting empathetically.

Methods: This was a cohort study of fourth-year medical students from the UT Southwestern Medical School matching into pediatrics (n = 15). The communication training consisted of four scripted scenarios between parent actors and groups of four to five medical students, each supervised by a facilitator. The students took turns interacting with the parent actor followed by time for peer-to-peer discussion and feedback. The four scenarios included: vaccine hesitancy, lumbar puncture refusal, bronchiolitis worsening overnight, and functional abdominal pain in a teenager. Pre- and post-surveys were obtained to assess change in student confidence in a variety of communication skills via a five-point Likert scale. Anonymity was maintained using student identification numbers.

Results: The intervention led to statistically significant improvement in self-reported confidence across all measured areas of difficult conversation, conflict management, and empathetic communication. The significance was assessed via two-tailed, paired sample t-tests (all p-values < 0.01), and the degree of improvement was demonstrated via 95% confidence intervals (all lower limits > 0.0).

Conclusions: This study demonstrated the value of medical student communication training focused on scenarios specific to pediatric residents during intern year. These findings suggest that communication simulations tailored to field and level of training may be effective tools in preparing fourth-year medical students for residency within their desired specialty.

I am confident in my ability to... (circle response):					Figure 1
1. Implement Strategies for Difficult Conversation/Conflict					
a. Communicate via non-verbal cues	1	2	3	4	5
b. Identify areas of conflict/caregiver concern	1	2	3	4	5
c. Defuse provider-caregiver conflict	1	2	3	4	5
d. Communicate viewpoint to a distressed caregiver	1	2	3	4	5
e. Communicate viewpoint to an angry caregiver	1	2	3	4	5
f. Manage expectations of a caregiver	1	2	3	4	5
2. Demonstrate Empathetic Communication					
a. Identify emotional response of caregiver	1	2	3	4	5
b. Articulate empathy for emotions of caregiver	1	2	3	4	5
c. Tailor communication to emotional state of caregiver	1	2	3	4	5



7. Pediatric Resident Trauma Surveys – An Educational Intervention

Chelsea A. Day, M.D.[1]; Douglas A. Potts, M.D.[2]; Jennifer McConnell, M.D.[1]; Kenneth Yen, M.D.[1]; Faisal Patel, M.D.[3]; Ngoc Van Horn, M.D.[1]

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Introduction: The trauma evaluation begins with a primary and secondary survey (PSS). These are protocol-driven examinations designed to efficiently identify life-threatening injuries. Pediatric resident physicians are required to rotate through the Emergency Department with little to no formal trauma education and are not provided with Advanced Trauma Life Support (ATLS) certification. This is reflected in inaccurate PSSs, which can contribute to missed injuries and poor outcomes. In the current literature, there are no prospective studies regarding pediatric resident education and performance of trauma surveys. The objective of this blinded, prospective, randomized pilot study is to demonstrate how a simple educational intervention can improve the ability of pediatric interns to perform simulated trauma surveys.

Methods: Pediatric interns performed simulated PSSs on mannequins while being video recorded. The interns were then randomized into an intervention or nonintervention group. The intervention group received online access to a teaching video demonstrating a complete trauma survey. After a "cooling off" period, each intern was again video recorded performing the trauma surveys. The recordings were scored for content by two blinded ATLS-certified evaluators.

Results: Eighteen pediatric intern study participants have thus far completed both pre- and post-intervention recorded trauma survey exams. Of the 18, seven were randomized to the intervention group and 11 in the nonintervention group. All interns in the intervention group sent confirmation of viewing of the instructional video. The interventional group demonstrated a 57% improvement in accuracy, compared with a 54% change in the nonintervention group ($p < 0.030$). The main difference in the accuracy of the trauma surveys was seen in the performance of the secondary survey, with the nonintervention group demonstrating a 16% improvement in accuracy and the intervention group demonstrating a 30% improvement in accuracy ($p < 0.025$).

Conclusions: This is the first prospective pilot study to improve pediatric resident trauma evaluation performance. The study demonstrates an improvement in the pediatric intern performance of the secondary trauma survey after receiving the educational video. This highlights that simple educational interventions can be used to improve accuracy of evaluations in pediatric trauma patients, and that pediatric residents should be given similar educational tools prior to providing care in the emergency department.

8. Roll for Initiative: The Application of Role-Playing Game Techniques to Adapt High-Fidelity Simulation to a Virtual Environment

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Introduction: The SARS-CoV-2 epidemic caused widespread changes to education. One restriction was the inability to have learners congregate in a simulation center for high-fidelity simulation sessions. A common solution to this problem was simply to have “oral boards”-style cases and case-based discussions via an online meeting platform such as Zoom. However, this technique was ill-suited to true group participation because common online meeting etiquette dictates all participants mute themselves unless directly called upon by the proctor. It also allowed one or two learners to “take over” while the other learners could comfortably sit in silence. Simulation-based medical education replaces the pressure of patient care vs. patient harm with the pressure of being “on the spot” to make the learning experience more impactful. It also is an immersive experience. These factors are lost in case-based discussion. Role-playing games, such as Dungeons & Dragons, are immersive, rule-based games that occur largely in the players’ imaginations. Teams work together to solve complex problems, and an immersive experience is achieved often without significant physical props. Within gameplay, when the group engages in combat with an adversary, the game becomes turn-based, with each player “rolling for initiative” to determine the order in which they go. They then have a set number of actions they can take before it becomes the next player’s turn. The method of engaging in combat used in Dungeons & Dragons seemed an ideal method for adapting high-fidelity simulations to a virtual environment in a way that was immersive, engaging, and requiring all learners to have input.

Methods: We applied this method to Emergency Medicine interns who were previously scheduled to have high-fidelity simulation sessions but whose sessions could not be completed due to COVID restrictions. Thus far, it has been four groups of interns, eight learners each. They underwent four cases that were previously written for high-fidelity simulation but adapted to the virtual platform. To augment the realism of the cases, images of a “patient” and any possible visual physical exam findings were added to the typically provided lab values and radiology images. Additionally, a PowerPoint with an image of a patient monitor, which was manually progressed as vital signs changed, was displayed side by side with the patient images on the Case Master’s screen, which was shared. Learners “rolled initiative” using an online 20-sided die, and the clinical case was progressed in a turn-based manner until disposition was achieved. Feedback surveys were sent out afterward.

Results: A total of 11 of the 28 residents filled out the survey. 11/11 (100%) of the participants liked the turn-based method better than oral boards.

How well do you think you learned the material in this session?	Better than real-life sim sessions	About the same as real-life sim sessions	Better than oral boards style	About the same as oral boards style	Better than pure discussion-based	About the same as pure discussion-based	I did not learn at all from the experience today
# Responses	1 response (9%)	2 (18%)	4 (36%)	2 (18%)	2 (18%)	0	0

Conclusions: Turn-based virtual simulation, as adapted from role-playing games such as Dungeons & Dragons, is an effective way of engaging and teaching learners in a situation where in-person learning is not possible.

9. Novel Ultrasound Probe-Holder Device: Frees Up Staff and Minimizes Health Care Workers’ Exposure to COVID-19

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Introduction: We present a novel ultrasound probe-holder device that enables health care providers performing ultrasound-guided procedures under sterile technique to install the required sterile probe cover sheath without the need of an assistant. The current standard of practice for the installation of the sterile probe cover sheath requires two operators to guarantee full sterility throughout the procedure. By facilitating a solo physician in performing the entire procedure independently, unnecessary COVID-19 exposure is prevented when such procedures are necessary in COVID-19-infected patients. This device will not only help decrease unnecessary staff exposure to COVID-19-infected patients by eliminating the need of an assistant but will also increase efficiency in the emergency department in all situations. The need for a procedure assistant often leads to delays, both to the procedure and to other ED functions, because necessary personnel are coordinated and pulled into the procedure. This device will change forever the way we will teach and perform ultrasound-guided procedures.

Methods: We designed and constructed a novel ultrasound probe holder (patent pending) that facilitates a single operator to install the sterile probe cover, no longer needing an assistant. The device consists of three main parts: vase, gooseneck, and an expandable cylinder. We used a combination of prefabricated parts and 3D-printed parts to build our probe-holder device. The device anchors on the ultrasound machine by inserting the expandable cylinder into the gel cup holder and expanding it by twisting a knob until a tight fit is achieved. The UTSW Simulation Center served as our testing center. We tested the ability of this device to allow for a single operator to install the sterile probe cover on the ultrasound probe. The device anchoring system was tested to ensure the device is secured and without risk of falling. We also tested the device adaptability to multiple user ergonomics in the Simulation Center to ensure our device worked for users and patients of different heights and body types.

Results: During our proof of concept at the Simulation Center, we observed that the probe-holder device allowed a single operator to install the probe cover without a breach in sterile technique. The device was able to be anchored to the gel cup holder in a secure manner without risk of falling off. We also observed that the probe-holder device’s malleable gooseneck allowed for adaptability to the user and patient’s ergonomics.

Conclusions: In conclusion, the ultrasound probe holder we designed and built allows for a single operator to independently install the required probe cover for sterile ultrasound-guided procedures without a breach in sterile technique. We hope that this device will help minimize the number of staff require in COVID-19 patients’ rooms when these types of procedures are being performed and increase overall efficiency in the emergency department.

10. Simulation Center Utilization: The Effects of COVID-19 and the Need for Innovation

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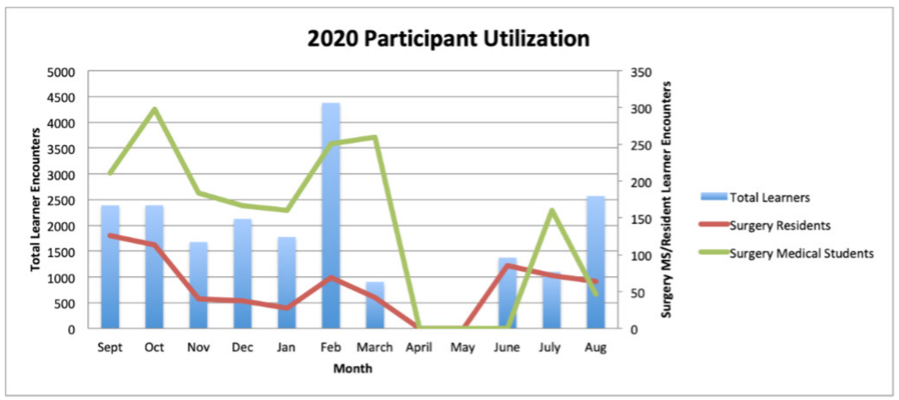
Introduction: The COVID-19 pandemic affected multiple aspects of surgery medical student (MS) and resident training, including simulation center (SC) utilization. This study aimed to investigate SC utilization post-COVID-19 and the use of new modalities to help plan for future circumstances.

Methods: SC utilization data were analyzed from 2017–2020; data were grouped by fiscal year (September–August). The SC was closed March 16–May 31, 2020. Utilization was broken down by (1) learner encounter (learner attendance per session), (2) learner type, and (3) session hours (# hours x # rooms). Surgery events included activities involving general surgery residents or MS on surgery rotations.

Results: Total learner encounters were 10,978 in 2018, 16,430 in 2019, and 22,663 in 2020. For 2020: MS composed 49.3% and residents 34.1% of the total learners. Surgery MS had 1,738 learner encounters and 142 session hours; surgery residents had 677 learner encounters and 373.5 session hours (Figure). Of 153 total canceled events due to COVID-19, surgery had 16 canceled events (9 MS and 7 resident). New virtual formats were created for 32 events: 15 for MS and 15 for residents (surgery 3 MS and 2 residents). Comparing average utilization pre-COVID-19 (December-February 2020) to year-end post-COVID-19 (August 2020), MS demonstrated 42.7% recovery and residents 208.8%. Surgery MS and residents demonstrated 24.4% and 152.6% recovery, respectively.

Conclusions: All learner populations were affected by the shutdown due to COVID-19. Canceled events included critical surgical training needs such as knot-tying (MS), cadaver labs, and flexible endoscopy (resident). Surgery resident events were rescheduled with the flexibility of smaller, more frequent sessions. However, MS sessions posed more difficulty due to curriculum constraints and large group sizes. These factors likely account for the substantial differences in the recovery of these learner types. The creation of new modalities such as virtual standardized patients, suturing sessions, and laparoscopic training allowed improved usage despite continued group size restrictions. Given the ongoing uncertainty of the pandemic, we continue to develop innovative solutions to maintain SC utilization. These efforts are particularly important given concerns of COVID-19 compromising both clinical and simulation opportunities for learning.



11. American Heart Association HeartCode BLS and ACLS for Medical Students

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Introduction: Medical students require knowledge, skill, ability, and proof of competency in essential emergency resuscitation procedures. One common methodology to satisfy this need is the adoption of and instruction in standardized courses that teach and evaluate these essential competencies. Obtaining and maintaining the American Heart Association's course credentials for hospital, clinic, and other clinical areas are widespread practices. As such, the UT Southwestern Department of Emergency Medicine, Division of EMS, and Simulation Center jointly undertook this task during the 2020 COVID pandemic environment. Great restrictions existed, and innovation and creativity were required to instruct these courses to meet course requirements and adhere to the implemented university-based protections.

Methods: A hybrid instructional methodology was utilized. The medical students were enrolled in and completed the online didactic portion of the course. This was conducted in an asynchronous manner. The first-year medical students were enrolled in the AHA HeartCode Basic Life Support course. The second- and fourth-year medical students were enrolled in the AHA HeartCode Advanced Cardiac Life Support course. The hands-on portion of the courses were conducted in the Simulation Center with credentialed AHA course instructors. The hands-on portion included instruction, practice, and evaluation. Learners were placed in groups of four students or fewer. Students and instructors were required to wear masks, goggles/shields, and gloves. Equipment was sanitized between sessions.

Results: The Basic Life Support course was conducted over three days in August 2020 (8/3, 8/4, and 8/5). The students were successfully educated and evaluated. Remediation was provided after a training, as required. Electronic credentialing cards were issued to 227 Basic Life Support learners. The Advanced Cardiac Life Support course was conducted over six days in December 2020 (12/3, 12/4, 12/5, 12/9, 12/10, and 12/11). A make-up session was required due to numerous COVID quarantines and positive results impacting learners (1/9/2021). The students were educated and evaluated. Remediation was provided immediately after a training, as needed. Electronic credentialing cards were issued to 431 Advanced Cardiac Life Support learners.

Conclusions: Despite extreme limitations from the COVID pandemic to course instructors, the UT Southwestern Simulation Center and the Department of Emergency Medicine were able to overcome obstacles and credential 227 medical students in Basic Life Support and 431 medical students in Advanced Cardiac Life Support.

12. Effect of Blindfolding on Closed-Loop Communication and Critical Action Completion During Simulated Resuscitations Using Rapid-Cycle Deliberate Practice

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Introduction: Closed-loop communication (CLC) is a vital aspect of high-quality medical care. Despite the general consensus in Emergency Medicine (EM) that CLC is an important skill, it remains difficult to perform CLC consistently. As CLC has gained traction in the team-training world, efforts have also been underway to improve resuscitation education – specifically through a technique called rapid-cycle deliberate practice (RCDP). This technique involves debriefing via pauses and micro-debriefs during a simulation, in contrast to the traditional method of reflective debriefing after a scenario is completed in full. Another technique that is gaining popularity in resuscitation education is blindfolding. Our study seeks to combine CLC, RCDP, and blindfolding into a novel teaching method for EM residents. We are measuring the rate of blindfolding on the rate of effective CLC during a simulated resuscitation, during which the team leader is debriefed using the RCDP technique. We are also measuring the time required to master critical actions in the simulation, the rate of critical action completion in the simulation, and the effect of trainee level (i.e., PGY1, PGY2, or PGY3) on the time required to master said critical actions.

Methods: This IRB-approved study is a randomized control trial being conducted on UTSW EM residents. It revolves around a ventricular fibrillation arrest case from the 2020 AHA ACLS handbook. Half of the subjects are randomized to the unblindfolded (control) arm and the other half to the blindfolded (intervention) arm. Each subject receives a pre-brief and then runs through the case, with micro-debriefs done in a formative fashion whenever he/she fails to perform CLC correctly for any of these 10 critical actions: obtain vascular access (either intravenous or intraosseous), initiate compressions, defibrillation #1, defibrillation #2, administer epinephrine, defibrillation #3, airway management, administer amiodarone, post-ROSC pulse and rhythm check, and initiate ED transport. In order to test the learner from multiple angles, we also built 3 "errors" into the scenario, all to be committed by the embedded person: failure to administer epinephrine, failure to acknowledge the command to manage the airway, and failure to dose the amiodarone correctly. The maximum time this "formative segment" is allowed to run, including micro-debriefs, is 25 minutes. The subject then repeats the case, this time without interruption, for the purpose of summative evaluation. Both segments are recorded. At the end of the summative segment, the subject receives a final short debrief to manage psychological safety and provide closure. During the simulation, a faculty member uses an evaluation tool to determine when the subject requires pauses/micro-debriefs. Each subject's recordings will be assessed by three independent reviewers to determine the following endpoints: the rates of check-back completion in the control group vs. the intervention group during the formative and summative segments, the rates of critical action completion in the control group vs. the intervention group during the formative and summative segments, the time required for each subject to complete the case, the rates of check-back completion in the control group vs. the intervention group during the formative segment for subjects who timed out, and the time required for each subject to complete the case separated out by stage of training.

Results: We are currently in the process of collecting data.

Conclusions: We anticipate that blindfolding will increase the rate of effective CLC and critical action completion and decrease the time required to master critical actions. We also anticipate that as a trainee's level of training increases, the time to mastery of critical actions will decrease.

13. Transitioning a Medical Simulation Elective to the Virtual Environment

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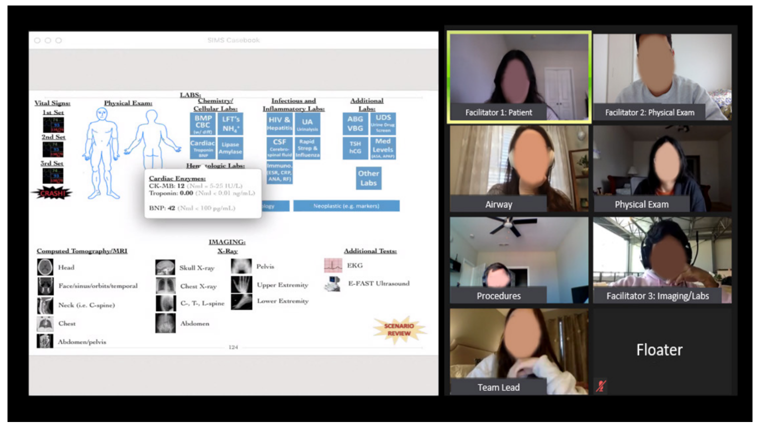
Introduction: Team-based simulation has been widely recognized as an effective educational tool for teaching and evaluating clinical knowledge and skills. In 2019, a team of UT Southwestern medical students created a Medical Simulation Elective (MSE) to promote team-based simulations for the clinical management of acutely ill patients. However, the COVID-19 pandemic public health restrictions prevented the continuation of an in-person MSE. To address the need for an alternative to the in-person MSE clinical experience, we developed a virtual Medical Simulation Elective (vMSE).

Methods: By integrating a framework for performing virtual simulations with the curriculum material and structure of the in-person MSE, we developed the vMSE for first- and second-year medical students.

Results: The vMSE consists of six two-hour virtual classes over the course of 12 weeks using the teleconferencing software Zoom. To receive credit, students enrolled in the elective must attend five of the six classes. Each class consists of three parts: (1) a virtual chief complaint-focused lecture (chest pain, shortness of breath, abdominal pain, back pain, toxidromes, and headaches), (2) a virtual team roles-focused lecture (Team Lead, Airway, Physical, Procedures, and Floater), and (3) two or more virtual simulations from the SIMS Casebook. Each student will perform one of the five team roles for each virtual simulation. At the end of each simulation, the Floater will create an SBAR (Situation, Background, Assessment, Recommendation) statement to facilitate and strengthen proper patient handover techniques. An informal debriefing focused on the clinical scenario, team dynamics, and effective communication will occur after each simulation.

Figure 1. Medical students piloting a vMSE class



Conclusions: To evaluate the utility of the vMSE for teaching clinical knowledge, team dynamics, and critical communication skills, we plan on assessing and comparing its effectiveness to the in-person MSE using assessments derived from Emergency Medicine Residents' Association (EMRA) and TeamSTEPPS resources.

14. A Structure for Team-Based Simulation in the Virtual Environment

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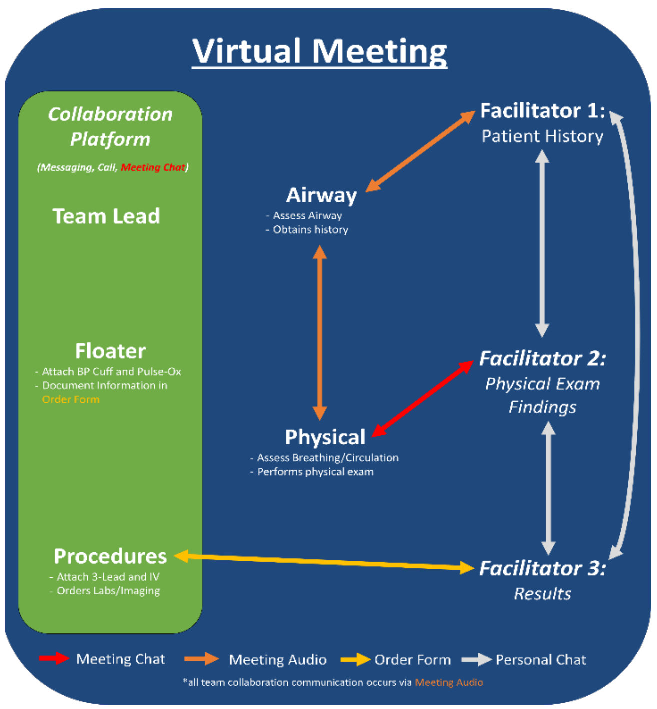
Introduction: Team-based in-person simulation (IPS) has been widely recognized as an effective educational tool for teaching and evaluating clinical knowledge and skills. However, the COVID-19 pandemic public health restrictions prevented or limited the continuation of IPS. To address the need for an alternative to IPS, we developed a structure for team-based virtual simulation (VS).

Methods: Utilizing the teleconferencing software Zoom, a document collaboration platform (Microsoft Teams), and the SIMS Casebook, we completely transitioned a model for IPS to the virtual environment.

Results: Participants in the VS were categorized into two groups: the team and the facilitators. Each simulation consisted of three facilitators and five students. Facilitators (F) provided the team with patient information, imaging, and test results from the SIMS Casebook. The students were assigned to unique roles: Team Lead (STL), Airway (SA), Physical (SP), Procedures (SPR), and Floater (SF). All participants were present in the Zoom meeting. F1 provided the SA with patient history information using Zoom Audio. F2 provided the SP with physical exam findings using Zoom Chat. F3 used the Zoom screen-sharing feature to display imaging and test results ordered by the SPR using a Teams-based order form. On the same shared document, the SF recorded patient information. The STL, SPR, and SF collaborated using Teams Messaging, Teams Call, or Zoom Chat. During periods of whole student team collaboration (i.e., time-outs, call-backs), all students were directed to use Zoom Audio. Inter-Facilitator communication occurred using the direct message feature on Zoom Chat.

Figure 1. Diagram of team roles and communication flow for virtual team-based simulation structure



Conclusions: Transitioning from IPS to VS can be accomplished using commercially available virtual platforms as described in this paper. Future studies should be focused on the efficacy of VS in comparison to IPS to determine whether VS can be incorporated into a medical school curriculum.

15. COVID-19 PPE Training Gaps: Using Simulation to Assess Vulnerable Learner Population Comfort

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[1]Simulation Center, UT Southwestern Medical Center

Introduction: In response to the COVID-19 pandemic's exponential rate of infection and the Centers for Disease Control (CDC)'s new personal protective equipment (PPE) guidelines, the UT Southwestern Simulation Center led a campuswide initiative for COVID-19 PPE training. The aim of this study was to assess the initiative's feasibility and the impact on learners' knowledge, comfort, and anxiety around COVID-19 patient care.

Methods: Following Kern's six-step approach to medical education, campuswide subject-matter experts developed a blended-theory COVID-19 PPE curriculum. The curriculum included (1) an asynchronous online module with narrated presentation reviewing the critical techniques of donning/doffing PPE and powered air-purifying respirator (PAPR) systems as well as (2) an in-person simulation-based training (SBT) providing expert demonstration, hands-on practice, and rapid-cycle deliberate practice feedback. Additionally, pre- and post-surveys were administered to assess previous training, comfort with PPE, and anxiety.

Results: Overall, 795 and 848 individuals completed the pre- and post-survey, respectively. Respondents were primarily medical students at 60%, followed by M.D.s at 23%, PA students at 4-5%, PAs at 2.5-3%, RNs at 2-2.5%, and others (lab technicians, respiratory therapists) at 7%. Despite 71-90% reporting previous experience wearing PPE, only 29-45% reported having formal training. Furthermore, 0-12% claimed previous experience with PAPRs. When comparing pre- and post-training surveys, there was a significant increase in comfort in donning/doffing PPE and PAPRs across all learner groups: donning PPE (64 to 98%), doffing PPE (61 to 99%), donning PAPR (18 to 40%), and doffing PAPR (18 to 40%) ($p < .001$). This was true also when analyzing comfort by learner type, barring the PA and Other category ($p < .001$). In response to the STAI-6 anxiety scale, there was no overall change from average pre- to post-training scores (46.0 to 46.6; $p = 0.385$). When examining by anxiety groups, most learner groups started with "moderate" or "high anxiety" (total 87%). Post-training, we recognized a significant 8.6% rise in "high anxiety" learners (p κ .001) that on secondary analysis was driven by M.D.s with a 3.6% increase ($p = .004$) and medical students up 4.3% ($p = .023$). Of all learner types, 92-100% felt (moderately or very much) the curriculum prepared them in PPE usage and the hands-on practice was worthwhile. Support for participating in future simulation experiences (moderately or very much) increased significantly from 44% to 69%; secondary analysis showed a positive change in all learner types (22-48%) ($p < .001$).

Conclusions: The COVID-19 pandemic has revealed a previously unrecognized lack of experience/comfort with PPE and especially PAPR use in vulnerable health care worker populations. Our survey analysis recognized a large gap in previous formal training experience seen across all learner types. With blended theory of online and SBE training experience, all groups had a noticeable improvement in comfort, with RNs experiencing the greatest improvement. Unfortunately, we did not see a change in anxiety scores across learner types, with most remaining in the "moderate" to "high anxiety" categories. This change has not been previously reported in simulation training and requires further research; it is unclear whether this anxiety is correlated to the pandemic and whether repeated training and deconditioning may improve these scores. As proven before, simulation training allows learners to gain comfort and skill in uncommon, high-risk techniques in a safe learning environment. Our study further confirms that learners continue to demand simulation-based training focused on situations associated with high-risk activities that are new and unfamiliar.

16. Novel Procedural Sedation Simulation Skill Maintenance Curriculum for Emergency Medicine Faculty

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Introduction: It is essential that emergency physicians (EPs) be skilled in the use of procedural sedation and analgesia (PSA) to facilitate the treatment of painful conditions in the Emergency Department. PSA is necessary for joint dislocation reductions, fracture reductions, cardioversion, and other procedures in which patients cannot tolerate treatment with conventional pain control methods. The current continuing medical education program for procedural sedation at our institution is an online module, followed by a test upon completion. We aim to enhance the PSA clinical learning experience for our Emergency Medicine (EM) faculty by developing high-fidelity simulation cases based on the principles of the current PSA education module, hospital policies, and current practice guidelines. Our PSA Skill Maintenance curriculum focuses on: pre- and post-sedation evaluation, PSA documentation, management of adverse events, patient disposition, completion of an equipment checklist for safety, management of sedation level, and team communication.

Methods: The EM faculty participant will perform a series of procedural sedation cases based on common ED clinical presentations. They will be provided with a PSA checklist created for this purpose in compliance with the institutional and departmental sedation policies. The most common and standard sedation agents used in the ED will be available for the procedure. Specifically, propofol, ketamine, etomidate, and benzodiazepine/opioid combinations will be available as sedative choices. Each simulation case will have one or more complications related to 1.) the administration of medications, 2.) patient factors identified by history or physical, or 3.) underlying health conditions that need to be identified and managed appropriately. Faculty participant performance will be evaluated based on completion of Critical Actions (CA) completed during the case. Participants will have access to an interactive, reality-based electronic health record during the case to simulate PSA documentation as required by our intuitional policies. The case is to be followed immediately by a debriefing session with Simulation EM faculty and any other participating staff. After debriefing, the faculty participant will complete an online questionnaire, providing their self-assessment of performance and overall impression of the simulation session.

Results: We are currently in the process of collecting data. Early trial simulations resulted in several educational opportunities and the identification of areas for improvement of the electronic health record to better provide compliance and patient safety.

Conclusions: The addition of high-fidelity simulation will significantly enhance the current procedural sedation module-based skill maintenance curriculum. This will provide our Emergency Medicine faculty with a relevant, clinically applicable, and hands-on opportunity to apply and practice procedural sedation skills. This additional skill-maintenance resource will increase patient safety, adherence to institutional policy, and physician confidence when performing procedural sedation in the ED.

17. Approach to the Patient, Cytologic Techniques, and Ultrasound Guidance for Fine-Needle Aspirations

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Introduction: The use of cytologic preparations for tumor diagnosis has become the state-of-the-art diagnostic modality in many clinical scenarios. The use of fine-needle aspiration (FNA) as a diagnostic tool has been proven to be faster, less expensive, and safer than most tissue biopsies. Even though it has limitations and requires training and expertise, on many occasions FNA can reach the accuracy of tissue biopsy for most initial tumor diagnoses. Recently, the use of ultrasound guidance for fine-needle aspiration of superficial lesions has become a very important aid to these procedures. The use of ultrasound allows visualization of the exact location, borders, and physical characteristics of the target lesion. In addition, the use of ultrasound allows visualization of any vessels in the needle path as well as the vascularity of the lesion. A pathologist doing ultrasound-guided FNAs can easily detect technical biopsy or smearing issues and make the necessary corrections to improve the quality of subsequent sampling, optimizing the quality and quantity of the aspirated material for diagnosis and ancillary molecular studies. The aims of this project are to: 1) establish practice sessions to create timely and efficient workflows for the various events of the process of ultrasound-guided fine-needle aspiration, and 2) create a framework for a marketable and competitive service line for the benefit of our patients, education of our trainees, and growth of our institution.

Methods: The process involves preparation of cytology service units, each one composed of a cytotechnologist, a fellow and/or resident, and a cytopathologist. The events would be set as several steps linked to each other. These steps include initial approach to the patient; clinical history and physical exam oriented to the type of lesion; set up of the ultrasound machine, workstation, and patient's bed; needle aspiration; handling and triaging aspirated material; pattern-based microscopic exam; and closure of the procedure, reassuring the patient and giving instructions for care of the biopsy site. Once prepared and ready, a set of practice sessions using fictitious patients, phantoms, ultrasound, cytology instruments, and material for trainees will be in place.

Results: Expected outcomes from this process include: 1) Increased awareness of the capabilities of cytology services to the medical, hospital, and local community; 2) Training of residents, fellows, cytotechnologists, and pathologists on efficient cytology services; 3) Gradual incorporation of cytology as an integral part of the training curriculum for medical students, residents, and fellows from various specialties.

Conclusions: The creation of this practice module represents the basis of a cytology service line that can contribute to optimizing the efficiency of patient management and cost containments of patient care through the introduction of an accurate, minimally invasive, safe, and low-priced diagnostic, state-of-the-art procedure.

18. Sample Size Calculation in Stratified Cluster Randomized Trials

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Introduction: Stratified cluster randomized trial design is widely employed in biomedical research, and cluster size has been frequently used as the stratifying factor. Conventional sample-size calculation methods have assumed the cluster sizes to be constant within each stratum, which is rarely true in practice. Ignoring the random variability in cluster size leads to underestimated sample sizes and underpowered clinical trials. In this study, we proposed to directly incorporate the variability in cluster size into sample size calculation.

Methods: Based on the generalized estimation equation approach, we proposed a closed-form sample-size formula to detect the intervention effect in the stratified cluster randomized trials. This approach is flexible to accommodate arbitrary randomization ratios and varying numbers of clusters across strata. Extensive simulation studies were employed to investigate the performance of our proposed method.

Results: The simulation studies demonstrate robust performance of this approach over a wide spectrum of design configurations, including different distributions of cluster sizes (D1 and D2 in Table 1). Importantly, the random variability in cluster size is incorporated into the sample-size formula through coefficient of variability, which requires information about only the first two moments instead of the specific distribution, improving the applicability of the proposed method in practice.

Table 1. Empirical power (number of clusters per stratum) from 10,000 simulations for the fixed cluster size method (J*) and proposed method (J)

			b_1		
ρ	Method	D	0.20	0.25	0.30
0.01	J^*	D_1	89.66% (19)	91.38% (13)	91.67% (9)
		D_2	89.12% (19)	91.03% (13)	91.56% (9)
	J	D_1	90.64% (20)	91.74% (13)	91.28% (9)
		D_2	90.27% (20)	91.29% (13)	91.27% (9)
0.02	J^*	D_1	88.20% (25)	88.90% (16)	91.05% (12)
		D_2	88.68% (25)	89.05% (16)	91.26% (12)
	J	D_1	90.55% (27)	90.27% (17)	91.22% (12)
		D_2	90.71% (27)	90.56% (17)	91.12% (12)
0.03	J^*	D_1	88.80% (32)	88.70% (20)	89.39% (14)
		D_2	88.48% (32)	88.33% (20)	89.00% (14)
	J	D_1	90.71% (34)	91.03% (22)	91.04% (15)
		D_2	90.72% (34)	91.08% (22)	91.34% (15)
0.05	J^*	D_1	87.79% (44)	87.92% (28)	89.11% (20)
		D_2	88.09% (44)	87.63% (28)	89.28% (20)
	J	D_1	90.37% (48)	90.61% (31)	91.69% (22)
		D_2	91.10% (48)	91.14% (31)	91.51% (22)
0.10	J^*	D_1	87.71% (75)	87.70% (48)	88.03% (34)
		D_2	87.85% (75)	87.26% (48)	88.46% (34)
	J	D_1	91.16% (83)	90.70% (53)	90.56% (37)
		D_2	90.39% (83)	90.22% (53)	90.36% (37)

Conclusions: In this study, we proposed a sample-size calculation method for size-stratified cluster randomized trials that no longer requires the unrealistic assumption of constant cluster size within each stratum. Furthermore, this method is flexible to accommodate arbitrary randomization ratios and arbitrary numbers of clusters within each stratum.

19. Method of End-of-Rotation Examination Question Development and Validation for Medical Training Programs

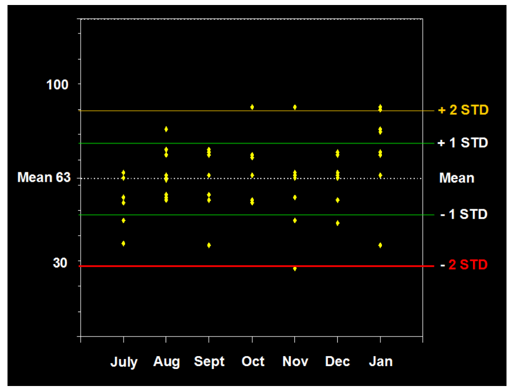
Siu-Hin Wan, M.D.[1]; Erin A. Fender, M.D.[2]; Andre C. Lapeyre, M.D.[3]

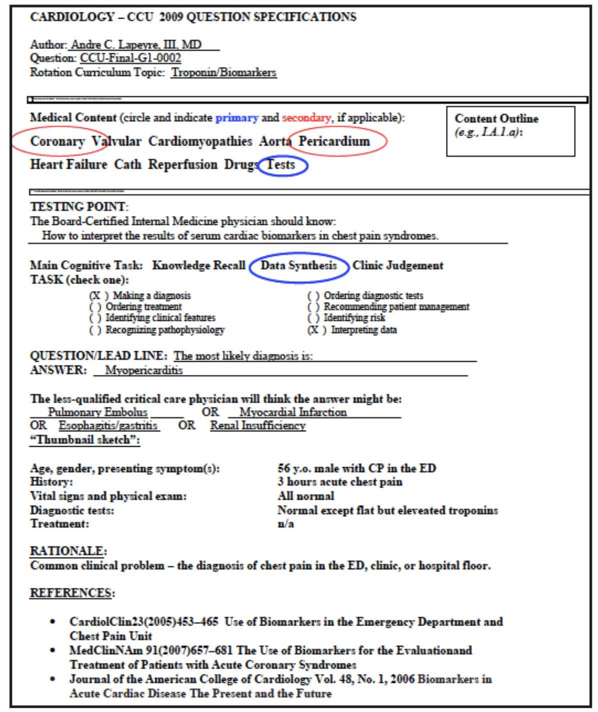
[1]Department of Internal Medicine, Division of Cardiology, UT Southwestern Medical Center; [2]Department of Internal Medicine, Division of Cardiology, ChristianaCare; [3]Department of Cardiovascular Diseases, Mayo Clinic

Introduction: No standardized evaluations exist to assess medical knowledge competency, there is great variability in evaluating knowledge acquisition, and there is a lack of assessment validation.

Methods: The methods describe a standardized protocol for end-of-rotation test question development that is practical for a single rotation or training program to implement and internally validate.

Results: The questions were validated by a small group of volunteers at different levels of training. The performance of questions developed by this method was then evaluated using the mean and standard deviation of end-of-rotation test scores obtained from internal medicine residents rotating in their four-week rotation in the cardiac intensive care unit for seven consecutive rotations. The results show that among 51 test scores, the test developed using this method had an average score of 63% (predicted/expected 60-70%) with standard deviation of 14.5 in a bell-shaped distribution, which is consistent with high discriminatory potential in assessing medical knowledge acquisition during a rotation at the end of that rotation.





CARDIOLOGY – CCU 2009 QUESTION SPECIFICATIONS

Author: Andre C. Lapeyre, III, MD
Question: CCU-Final-G1-0002
Rotation Curriculum Topic: Troponin/Biomarkers

Medical Content (circle and indicate primary and secondary, if applicable):
Coronary Valvular Cardiomyopathies Aorta Pericardium
Heart Failure Cath Reperfusion Drugs Tests

Content Outline (e.g., I.A.1.a):

TESTING POINT:
The Board-Certified Internal Medicine physician should know:
How to interpret the results of serum cardiac biomarkers in chest pain syndromes.

Main Cognitive Task: Knowledge Recall Data Synthesis Clinic Judgement
TASK (check one):
(X) Making a diagnosis
( ) Ordering treatment
( ) Identifying clinical features
( ) Recognizing pathophysiology
( ) Ordering diagnostic tests
( ) Recommending patient management
( ) Identifying risk
(X) Interpreting data

QUESTION/LEAD LINE: The most likely diagnosis is:
ANSWER: Myopericarditis

The less-qualified critical care physician will think the answer might be:
Pulmonary Embolus OR Myocardial Infarction
OR Esophagitis/gastritis OR Renal Insufficiency
"Thumbnail sketch":

Age, gender, presenting symptom(s): 56 y.o. male with CP in the ED
History: 3 hours acute chest pain
Vital signs and physical exam: All normal
Diagnostic tests: Normal except flat but elevated troponins
Treatment: n/a

RATIONALE:
Common clinical problem – the diagnosis of chest pain in the ED, clinic, or hospital floor.

REFERENCES:

- CardiolClin23(2005)453–465 Use of Biomarkers in the Emergency Department and Chest Pain Unit
- MedClinNAm 91(2007)657–681 The Use of Biomarkers for the Evaluationand Treatment of Patients with Acute Coronary Syndromes
- Journal of the American College of Cardiology Vol. 48, No. 1, 2006 Biomarkers in Acute Cardiac Disease The Present and the Future

Conclusions: A standardized and rigorous method for development of end-of-rotation examinations that can fairly, accurately, and reliably identify and correlate with success as an independent practicing physician is needed.

Emerging Ideas Poster Presentation Abstracts

1. Emerging Idea – Mixed Reality Will Have a Significant Impact on Medical Education

Marjorie A. Zielke, Ph.D.[1]; Djakhangir A. Zakhidov, M.F.A.[1]; Robert Rege, M.D.[2]; James Wagner, M.D.[2]

[1]Center for Simulation and Synthetic Humans, UT Dallas; [2]Office of Medical Education, UT Southwestern Medical Center

Introduction: This research is based on an ongoing collaboration between researchers at the Center for Simulation and Synthetic Humans at UT Dallas and colleagues from the Office of Medical Education at UT Southwestern on an NSF-funded research project titled: Exploring Social Learning in Collaborative Augmented Reality with Virtual Agents as Learning Companions (NSF Grant Number 1917994). Here we present our findings on how mixed reality enables novel methods for communication skills training and social and emotional learning in medical education. While there is no single definition for mixed reality, in our case it refers to an immersive, collaborative environment rendered in augmented reality (AR) and virtual reality (VR) headsets where learners acquire knowledge by interacting with virtual characters and each other. Our hypothesis is that mixed reality will have a significant impact on medical education.

Methods: Our research methods consist of iterative technology development and social science research. The technology development includes the creation of a virtual patient for practicing medical interviewing, automatic assessment of student performance during the interview, other virtual characters for social learning, and new interaction modes such as distributed and shared AR. Our key virtual character is an emotive virtual patient (EVP) hologram named Walter, who is designed for students to practice the communications component of an OSCE. Walter is capable of natural conversations with users, automatic assessment of performance based on the SP rubric, understanding users' emotive states, and expressing his own emotions through facial and body animations. In addition to Walter, we have developed a virtual professor and two virtual peers for students to engage with for social learning. Distributed AR enables an expert to remotely view a student's performance during an OSCE and provide real-time feedback. Shared AR enables a colleague to observe a student's performance from the same location and provide feedback. The social science research consists of three experiments on social learning. Experiment 1 aims to determine who students prefer to receive educational feedback from: peer or expert, real or virtual, co-located or remote. Experiment 2 aims to determine who students prefer to observe while learning. In Experiment 3 we let students decide who they want to receive feedback from and who they prefer to observe, and in what order.

Results: We completed several iterations of technology development, including improvements to natural language processing code and spatial mapping. We collected usability feedback from students. We are getting ready to conduct social science research experiments at UTSW. As a first step to integrate the EVP into UTSW's Pre-Clerkship OSCE curriculum, we plan to conduct an experiment funded by the AMA to determine if an extra practice session with Walter is as good as an extra practice session with an SP.

Conclusions: We have encountered several challenges, including restricted access to students due to the COVID-19 pandemic, technical problems with placing Walter's 3D hologram on the patient chair, and IT-related issues such as secured Wi-Fi access at UTSW. As a way ahead, we look toward a true intelligent hologram that can be rendered without a headset. We aim to design, develop, and implement custom synthetic human entities to address emerging needs of medical students, educators, administrators, and other stakeholders while we investigate the socio-technical and cultural implications.

2. "Night On Call": Triage and Teamwork in the Transition to Pediatric Internship

Ladan Agharokh, M.D.[1]; Beth Byrne, M.D., M.P.H.[2]

[1]Department of Pediatrics, UT Southwestern Medical Center; [2]Department of Pediatrics, Baylor College of Medicine-Children's Hospital of San Antonio

Idea Description: Among the most challenging aspects of the transition from medical school to residency are the jarring increase in the number of inputs (auditory, tactile, visual, cognitive), the increase in responsibility as the first-line provider, and having drastically less time available to process information and prioritize tasks. Residency program directors have identified time management, task prioritization, communication skills, and general medical knowledge as areas of concern for incoming interns. Additionally, sub-internship curricula are focused on recognition of sick versus not sick, communicating effectively within health care teams, time management, and knowing when to ask for help to address these deficits (and move toward entrustment in EPAs 2, 3, 4, 8, and 10). Using the principles of simulation-based education, with a focus on replicating realism on the multitude of important and unimportant stimuli, this simulation aims to replicate a night on call. A group of four to six students starts with a written and verbal handover of six patients. Immediately after handover, they are given a list of "pages" from nurses that were received during handover. They have the option to call the nurses to get more information or go to the bedside to examine the patient. Two of the six patients will decompensate and require acute management/stabilization. Students must demonstrate communication skills with each other – dividing up tasks and triage – and update their colleagues who enter a room in the middle of an acutely decompensating patient. They must order medications and lab/imaging studies and interpret the findings; they also will need to ask for help from their supervising resident/attending, consultants, and other health care professionals (nurses, pharmacists, etc.). There will be time constraints; by the 7- to 10-minute mark, both patients that require acute management will decompensate simultaneously – students will be notified by a nurse "page" – forcing students to work together to divide tasks. The simulation will end when both patients are stabilized and successfully handed over to the next "team." This simulation was completed once in the Sim Center in March 2020 (before the pandemic hit) and was well-received by the learners. This year, the simulation will be completed on Zoom, with participants able to choose their own breakout room (each room will be a patient room). We will use SimMon, a cardiorespiratory monitor app, to provide real-time physiologic patient changes. By the time of this conference, we will have completed the pilot virtual simulation (scheduled for March 2021), and we can share screenshots/videos, as well as lessons learned. We believe this simulation should be available for all graduating medical students; however, it requires multiple facilitators (this will require three to four) for a small group of students (max of eight students). It also requires the facilitators to be fairly familiar with Zoom and SimMon. Finally, how do we study this? Is there a way we can provide feedback to the students on their performance (as formative feedback rather than as an assessment) – is there a validated assessment we can use? How can we gather evidence that this simulation is worth the resources, outside of the students enjoying it? Finally, how can we share/disseminate the structure of this simulation in a scholarly way?

**Special thanks to the Simulation 101 Course – this simulation was created and piloted as the final project for that course!*

3. Collaborating to Ensure Safety: An Interprofessional Domestic Violence Simulation Experience

Tracy Orwig, M.S.S.W., LCSW[1]; Karla Arenas-Itotia, LMSW[1]; Saltanat Childress, Ph.D.[1]; Rachel Voth Schrag, Ph.D., LCSW[1]; Thomas Dombrowsky, Ph.D., RN[2]; Jackie L. Michael Ph.D., APRN, WHNP-BC[2]; Jennifer Roye, M.S.N., RN, CSHE, CNE[2]

[1]School of Social Work, University of Texas at Arlington; [2]College of Nursing and Health Innovation, University of Texas at Arlington

Idea Description: For patients experiencing violence, communication between health care providers is important to ensure safety. During a clinical visit, nurses are often the first providers to interact and engage with victims of abuse and may then refer to social work to assess and intervene with the individual (Wielichowski et al., 1999). While nursing and social workers engage regularly in health care settings, during their academic career there is often limited or no contact between the student populations. Interprofessional education (IPE) seeks to bridge this gap and create opportunities for students to build their skills in patient engagement and interprofessional engagement as members of a health care team. To prepare nursing and social work students, an online domestic violence (DV) activity was created providing the students the opportunity to screen, assess, and intervene in a domestic violence scenario. The activity prepares students to navigate cases they might encounter in future practice. It includes nursing students assessing a standardized patient who is experiencing domestic violence, practicing a warm handoff to social work, and collaborative safety planning. Due to restrictions in student interaction related to COVID-19 and the need to provide this important IPE activity, a virtual format was used. Video was utilized to record the standardized patient interview, which allowed for an asynchronous format to complete the activity. The panel will include both nursing and social work faculty who collaborated to build and implement an online asynchronous domestic violence IPE activity. The activity was conducted in April, with approximately 318 students. The panel will discuss the building of the activity, including its challenges and implementation, as well as preliminary feedback and next steps for the IPE activity.

Wielichowski L, Knuteson C, Ambuel B, & Lahti J. (1999). A model for collaborative nursing and medical education within the context of family violence. *Journal of Nursing Education*, 38(1), 13-16.

4. Use of a Virtual Simulation Platform to Prepare Students to Influence Teamwork After Graduation

Jessica Hernandez, M.D., M.E.H.P.[1]; Shena J. Dillon, M.D.[2]; Chrissy Chan, M.D.[1]; Jennifer Hernandez, M.D.[3]; Mozhdeh Sadighi, Ph.D.[4]; Ian Shields, B.S.[4]; Richard Preble, B.S.[4]; Eleanor Phelps, RN[4]; Philip Greilich, M.D., M.Sc.[3,4]

[1]Department of Emergency Medicine, UT Southwestern Medical Center; [2]Department of Obstetrics and Gynecology, UT Southwestern Medical Center; [3]Department of Anesthesiology and Pain Management, UT Southwestern Medical Center; [4]Office of Quality, Safety, and Outcomes Education, UT Southwestern Medical Center

Idea Description: Team *FIRST* aims to develop a longitudinal educational program that features a series of five interprofessional learning modules to teach a set of 12 evidence-based teamwork competencies. The purpose of Module 5: Influencing Teamwork After Graduation is to teach students skills for conducting structured patient handovers, identifying obstacles to teamwork and how to overcome them, and being a good team member. The target audience is composed of fourth-year medical students as well as physician assistant students.

Pre-Event: These students will first experience asynchronous, self-paced learning through interactive modules prior to the synchronous simulation event. Topics covered via video and written materials include the I-PASS structured communication tool, clarifying questions, closed-loop communication, psychological safety, mutual performance monitoring, obstacles to teamwork, and qualities of a good team member. Students will also watch prerecorded videos of simulated patient encounters and prepare a handover pertaining to the patients in the videos.

Live Event: Students in groups of six will meet virtually with a faculty instructor to perform I-PASS formatted handovers during a simulated shift-change event. During the handovers, students will experience instructor-incited interruptions with varying degrees of acuity that challenge their ability to continue the handover. Students will then participate in a structured debrief of the clinical cases, including brainstorming on how best to handle interruptions during handovers. This will be followed by a discussion of separate case vignettes designed to highlight students' thoughts on challenges to psychological safety, mutual performance monitoring, and obstacles to teamwork. Finally, the debrief session will conclude with student reflections on obstacles they have encountered in clinical medicine and how they want to present themselves as good team members after graduation.

Objective and Future Plans: Our goal is to enhance student ability to identify teamwork obstacles and to facilitate their learning of how to apply evidence-based teamwork skills that enhance team-based communication and coordination and will be necessary skills after graduation. We have collaborated with teamwork scientists, students, and faculty from several departments to design an experience that is acceptable, appropriate, and feasible for medical and health professions students and faculty. Our implementation plan is to pilot the simulation with the entire fourth-year Medical School class and additional physician assistant students in groups of six using faculty instructors via Microsoft Teams during 90-minute sessions. Some of the challenges we are facing are competing schedules for physician assistant students, limited testing in the virtual environment, education of faculty on the teamwork competencies, and faculty experience in virtual debriefing. Some of the resources we are planning to use are 21 instructors, 18 evaluators, 2 floating moderators, Microsoft Teams, Google forms, RedCap, D2L, Microsoft Stream, and OneDrive.

Challenges: In the future, we will need to identify and develop the following institutional assets to support virtual simulation of Team FIRST competencies: 1) an interactive animated video library for the 12 teamwork competencies; 2) instructor training for virtual debriefing; and 3) increased access to Simulation 101 Training for faculty development.

5. Are We Ready to Practice? A Virtual Multipatient Simulation

Jennifer Roye, M.S.N., RN, CSHE, CNE[1]; Patti Allard, Ph.D., M.S.N., NPD-RN, CNE, LMFT[1]; Marianne Doan, M.S.N., RN[1]; Kamal Sandhu, M.S.N., RN[1]; Susan Norman, M.S., RN, CCRN-K[1]

[1]University of Texas at Arlington College of Nursing and Health Innovation

Idea Description: The purpose of this innovative simulation activity is to create opportunities for providing graduating nursing students individualized feedback related to their professional entry level competencies and thus help improve their preparedness as they transition from academia to professional practice. Formal research began in March 2021. Critical thinking and clinical judgment have been identified as some of the essential skills needed by new graduate nurses to effectively transition into professional practice (Benner et al., 2010). Students may acquire basic nursing skills through active learning modalities such as simulation, but in order to develop and enhance essential skills of critical thinking, clinical judgment, prioritization, and communication, learners need to be challenged in the simulation environment. Simulating care for a single patient provides valuable patient care experience; however, a multiple-patient simulation provides opportunities for the learner to exercise critical thinking and clinical judgment to communicate, delegate, and prioritize care in a safe and timely manner. This opportunity can be provided in a live simulation by utilizing multiple stations with manikins or standardized patients. However, in March of 2020, like most simulation centers, ours too was faced with the severe limitations placed by COVID-19 on our ability to do in-person simulations. We had to adapt. Our team quickly went to work and developed a virtual multipatient scenario (MPS) activity. The chosen virtual platform allowed for channels to be created within the outer shell that could be used to serve as patient rooms. Faculty members played the role of the patients, pre-briefers and debriefers. Students progressed through various patient rooms and ended the simulation in the debriefing channel, where a trained faculty member facilitated reflection about their critical thinking and clinical judgment regarding patient care and prioritization decisions as well as their communication skills and challenges. This simulation piloted in the fall of 2020 and was extremely successful. In the past we have not only been faced with the challenge of accommodating a large number of students in resource-intensive simulations but also struggled to provide our accelerated online students with simulation experiences consistent with their on-campus counterparts. This innovative approach will help us bridge those gaps. Some of the biggest challenges for such an endeavor are recruiting faculty and standardized patients comfortable with working in a virtual environment, providing extensive training to staff and students, and managing the technical glitches whilst running the simulation.

Benner P, Sutphen M, Leonard V, & Day L. (2010). *Educating nurses: A call for radical transformation*. San Francisco, CA: Jossey-Bass.

6. Pediatric Emergency Robotic-to-Open Conversion Protocol

Yvonne Y. Chan, M.D.[1]; Micah A. Jacobs, M.D.[1]; John Zhong, M.D.[2]; Charles Ammah3; Jennifer Longoria[3]; Rose Neduvelil[3]; Irina Stanasel, M.D.[1]; Bruce J. Schlomer, M.D.[1]; Linda A. Baker, M.D.[1]; Craig A. Peters, M.D.[1]

[1]Department of Urology, Division of Pediatric Urology, UT Southwestern Medical Center; [2]Department of Pediatric Anesthesiology, UT Southwestern Medical Center; [3]Operating Room, Children's Medical Center Dallas

Introduction: Use of the da Vinci robot has steadily increased in pediatric urology since the 1990s as pediatric urologists have become more accepting and proficient at robot-assisted laparoscopic procedures. Robotic procedures in pediatric urology are safe and have low complication rates. However, emergent intraoperative open conversion may be necessary in cases of visceral or vascular injuries. Conversion in these cases often needs to happen quickly, and the process can be chaotic in an already stressful situation. Established protocols and simulations for these scenarios have been reported in the adult literature and have been shown to improve communication and efficiency with the process. However, these protocols are rare in pediatric centers. We aim to 1) create an emergency robotic-to-open conversion protocol with regular simulations such that our team would be prepared during these rare but critical events and 2) assess the effect of simulation training on teamwork, communication, and efficiency of conversion.

Methods: We are in the process of protocol development and are engaging stakeholders, including pediatric urologists, pediatric anesthesiologists, and operating room personnel and leadership. With stakeholder involvement, we are identifying equipment that would be necessary during emergent conversion and ensuring it is readily available. We are drafting a protocol detailing task sequences, key communication exchanges, and workflow during these scenarios. Once protocol development is complete, we intend to perform dry runs to identify areas of improvement that will enable us to iteratively refine the protocol. In the future, we plan to incorporate this into a robotic curriculum.

Results: Metrics we intend to evaluate include intraoperative errors (lack of task sequence, robot movement errors, loss of sterility, space conflict, lack of leadership), teamwork, communication, and times to conversion, opening necessary equipment, undocking the robot, open incision, and controlling the complication. Teamwork will be assessed using validated scales (Clinical Teamwork Scale, Operating Room Teamwork Assessment Scale). We will also assess use of closed-looped communication and volume control.

Anticipated Challenges: While dry-run simulations would be helpful in increasing familiarity with the protocol, communication, and teamwork, they are ineffective in assessing the degree of blood loss during conversion. This would be better assessed in simulations involving a case-simulation model. Involvement of collaborators with whom we can develop this would be ideal in the future.

7. Simulation Training Program for Pediatric Tracheostomy Management

Rebecca Brooks, M.S.N., APRN, RNIC, PCNS-BC[1]; Ashley Brown, M.S., CCCSLP, BCS-S[1]; Candace Bailey, B.S.N.[1]; Cindy Whitney, RT[1]; Stephen R. Chorney, M.D., M.P.H.[1,2]; Romaine F. Johnson, M.D., M.P.H., FACS[1,2]

[1]Department of Pediatric Otolaryngology, Children's Medical Center Dallas; [2]Department of Otolaryngology – Head & Neck Surgery, UT Southwestern Medical Center

Idea Description: Children with a tracheostomy tube are susceptible to high morbidity and mortality at home. Adverse events including accidental decannulation, stoma infections, and mucous plugging result in 20% of tracheostomy-dependent children experiencing a hospital readmission or death. Many caregivers have limited health literacy, and 40% of nurses doubt their ability to perform emergency tracheostomy care. Therefore, providing safe tracheostomy management demands competent knowledge and skills. The Children's Health Airway Management Program (CHAMP) is a multidisciplinary team that cares for most of the 1,000 children with a tracheostomy throughout North Texas. A mandatory Tracheostomy Caregiver Education program at Children's Medical Center is designed and taught by CHAMP providers. This curriculum is crucial to preparing caregivers for tracheostomy management and includes strategies to safely resolve tracheostomy emergencies. The Children's Health Center for Clinical Simulation has recently approved the Emergency Tracheostomy Caregiver Training with high marks. Although the program is currently designed for parents and caregivers, the anticipation is that this should become part of education for nurses, respiratory therapists, residents, fellows, and medical staff. These providers may need to urgently resolve tracheostomy-related complications and could gain comfort with pediatric tracheostomies through this program. An important next step in this program's evolution is the incorporation of high-quality simulation training. Our team has developed a hands-on portion of the Emergency Tracheostomy Caregiver Training that provides caregivers an opportunity to demonstrate their skills in replacing a tracheostomy tube and to resolve several tracheostomy-related events. The SimBaby® with tracheostomy mannikin by Laerdal® is a state-of-the-art training tool that provides incredibly accurate physiologic and anatomic simulation in pediatric care. Parents would be able to respond to a child's vital signs, clinical status, and activity and problem-solve which aspect of the airway would need to be urgently addressed. Further, our staff who teach this course can utilize the technology in SimBaby® to respond accordingly to steps taken by trainees in replacing a tracheostomy tube or bag-mask-ventilating the child orally, if appropriate. The medical staff at the institution would be able to take advantage of many additional aspects of the mannikin, including orotracheal intubation, intravenous access, and cardiopulmonary resuscitation. This simulation will be a requirement for caregivers of children with a new tracheostomy prior to discharge and may be combined with graduate medical and nursing education programs. At this point, the biggest hurdle in adding simulation training to the Tracheostomy Caregiver Education program is funding. After meeting with representatives from Laerdal®, we obtained a quote of $36,099 to purchase the mannikin, an instructor tablet, wireless router, and on-site orientation. It has been difficult to obtain approval through departmental resources, and discussions with the institution, while encouraging, have been slow to progress. Therefore, we would like to submit this emerging idea to the UT Southwestern 4th Annual Simulation-Based Quality Improvement and Research Forum in the hopes of perspective, guidance, and recommendations on successfully funding this crucially important simulation training program.

8. Teaching Emotional Intelligence Via Simulation Education

Bau P. Tran, M.S., Pharm.D., PA-C[1]; Yulia Piller, Ph.D.[2]; Pamela Ponners, Ph.D.[3]

[1]Department of Physician Assistant Studies, UT Southwestern Medical Center; [2]Department of Information Resources – Academic Information Systems, UT Southwestern Medical Center; [3]Dallas College

Introduction: The definition of emotional intelligence (EI) is "one's ability to recognize, understand, and manage one's own and others' emotions, and to use this information to guide one's thinking and actions." This concept has been recognized and well-established in the business literature as a critical component to success, both individually and organizationally, but it is still a nascent field of research in medical education. When EI is conceptualized as an aptitude that can be taught, learned, and transformed, it may be used to address a specific aspect(s) of a clinician that is/are not working well, such as interpersonal communication, conflict resolution, or professionalism, all of which are linked to one's clinical performance level. Many medical programs teach EI in an informal process; others might have a formal process/curriculum in place, but few include any form of simulation component to teach EI. As health care becomes increasingly multidisciplinary and team-based, proficiency in EI can effect change in attitudes and behaviors and result in improved patient safety and outcomes, which influences performance and happiness.

Methods: As a way to improve EI among our didactic learners, we are in the process of recruiting subject matter experts (SME), instructional designers, and consultants to assist in the curriculum development and instructional design. As part of this design, the goal is to develop simulation-based education to teach learners about and improve their EI before they transition to Clerkship. The curricular design will incorporate strategies and a conceptual framework (personal competence and social competence) useful for overcoming adaptive challenges, many of which require high EI for success. Once the curriculum is implemented, the curriculum would be piloted in a venue similar to Convergence, a course similar to IDEAL, or as part of an OSCE curriculum using simulation-based training/education. EI would be measured using validated questionnaires such as the Mayer-Salovey-Caruso Emotional Intelligence Test Version 2.0 (MSCEIT V2.0), Trait Emotional Questionnaire, Emotional Quotient Inventory (EQ-i), or Quick Emotional Intelligence Self-Assessment.

Results: Data collection will begin upon development and implementation of the curriculum.

Conclusions: We hypothesize that implementing EI into the current curriculum will improve learner health, happiness, and performance, as well as patient safety and satisfaction.

9. The Use of Augmented Reality to Immerse and Enhance Learner Experience During Simulation-Based Education and Training

Bau P. Tran, M.S., Pharm.D., PA-C[1]; Yulia Piller, Ph.D.[2]; Krystle Campbell, M.S., CHSE[3]; Pamela Ponners, Ph.D.[4]

[1]Department of Physician Assistant Studies, UT Southwestern Medical Center; [2]Department of Information Resources – Academic Information Systems, UT Southwestern Medical Center; [3]Simulation Center, UT Southwestern Medical Center; [4]Dallas College

Introduction: As augmented reality (AR) has become more affordable and portable, the use of wearable/portable AR has expanded our prospects for facilitating medical education due to its extensive use in daily activities. AR enriches the interactive experience by intermingling virtual images into the user's real environment and bridges the gap supporting both realities, real and virtual. In its simplest form, AR can be the use of a handheld (e.g., smartphone) or wearable device (e.g., Microsoft HoloLens) activated by a target. The targets might be in the form of a coded marker, image, spatial map, or geolocation. Once triggered, the device projects a virtual image into the user's reality. Medical educators are beginning to understand and adopt the many ways AR applications can be and are being used in education. Therefore, our hypothesis is that the development of simulation-based education utilizing AR to immerse and enhance learner experience as part of their education and training prior to transitioning to Clerkship will significantly affect the learning process compared to the traditional OSCE learning method.

Methods: We are in the process of recruiting subject matter experts (SMEs), instructional designers, a third-party AR platform, and consultants to assist in the curriculum development and instructional design. As part of this design, the goal is to develop objective structured clinical examinations (OSCEs) utilizing AR to assist the learner with more visual/auditory media with augmented overlays, allowing more of an immersive learning experience. Once the curriculum is implemented, it would be piloted as part of an OSCE curriculum using simulation-based training/education. Learners' attitudes, experience, and perceived usefulness toward using AR will be measured using validated questionnaires such as the Technology Acceptance Model-2 (TAM-2) and a modified version of the Media and Technology Usage and Attitudes Scale (MTUAS).

Results: Data collection will begin upon development and implementation of the OSCEs.

Conclusions: From the project, we suspect that the incorporation of AR will enhance the learning experience and will provide for a more "realistic" clinical encounter.

10. Using Voice of the Student to Design a Longitudinal, Interprofessional, Simulation-Based Teamwork Curriculum

Ian Shields, B.A.[1,2]; Rodney Chen, B.A.[1,2]; Mozhdeh Sadighi, M.S., Ph.D.[1]; Rich Preble, B.S.[1]; Eleanor Phelps, M.A., RN[1]; Gary Reed, M.D., M.S.[1]; Philip Greilich, M.D., M.Sc.[1,2]

[1]Office of Quality, Safety, and Outcomes Education, UT Southwestern Medical Center; [2]Medical School, UT Southwestern Medical Center

Idea Description: Team *FIRST* aims to develop a longitudinal educational program that features a series of five interprofessional learning modules to teach a set of evidence-based teamwork competencies. Last year, we presented data on student feedback from AY2020 that identified several gaps in the preparation, conduct, and assessment of the simulation-based modules. Using the high-reliability quality design principle of "deference to expertise," we included the learner in an iterative approach to optimize the learners' experience. For the pilot phase, the aim was to incorporate the voice of the student into the structure, process, and outcomes for Team *FIRST* modules in AY2021.

Preliminary Results: The voice and effort of students in Team *FIRST* modules in AY2020-2021 are summarized in the Table below. Emerging results suggest improvements in learner experience and outcomes.

AY2021	Module 1 Interprofessional Teamwork	Module 2 Introduction to Handovers	Module 4 Teamwork Within the Clinical Environment	Module 5 Teamwork After Graduation
Structure				
O/QSOE Student Scholars[1]	8	5	12	7
Process				
Student Scholarly Activity (hrs)[2]	1332	1397	2718	1617[3]
Student Interviews/Discussions	18	10	10	4
Quantitative/Qualitative Student Feedback[3]	771/650	160/75	–/48	In progress
Outcomes				
Implementation[4]	4	4	4	4
Kirkpatrick1-3[5]	69	31	23	35

O/QSOE - Office of Quality, Safety, and Outcomes Education; [1]Student Scholars = Dean's Research Scholars (52-weeks); Distinction in QI students have (26 weeks). Scholarly Activity Students (12 weeks); [2]Effort adjusted hours dedicated to Team FIRST modules; [3]Number of student responses; [4]Implementation outcomes include acceptability, feasibility, appropriateness, and adoption. [5]Total items assessed for student reaction (K1), learning (K2), and behavior (K3).

Future Plans: The goal is to understand and operationalize a generalizable framework and strategy to integrate the voice of the student into simulation-based training. Using the tenets of high reliability and implementation best practices, students are incorporated into design-thinking processes and cyclical quality improvement to produce interprofessional teamwork curricula capable of achieving Team FIRST's learning outcomes.

Challenges: The voice of the health professions student community is critically underrepresented. Bridging interprofessional siloes within the Schools of Health Professions and Medicine are underway by creating curriculum, activity, and assessment design teams with balanced representation from both institutions. Rigorous assessment of the efficacy of educational activities is another challenge. Currently, feedback surveys with ad-hoc focus groups identify key barriers and enablers to improving outcomes. One promising strategy leveraged analytics captured by D2L/MediaSite to give insight into what learners prefer. Behavioral assessment of complex teamwork competencies is challenging, and several assessment instruments are being developed in conjunction with our consultant team scientists.

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