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"LAUNCHPAD FOR SUCCESS" IMPROVING NEW NURSE ORIENTATION WITH TARGETED SIMULATION TRAINING

Bonnie Haupt, DNP, RN, CHSE, CNL,[1] Irene Silvernail, BSN, MS, RN, BC,[2] Debra Bartoshevich, MSN, RN, CEN, CHSE,[3] Renada Rochon, BSN, DNP, MSN, RN, ACNS[4]
[1]VA Healthcare System, Helotes, TX, USA; [2]STVHCS, San Antonio, TX, USA; [3]Audie L. Murphy VA Hospital, STVHCS, San Antonio, TX, USA; [4]South Texas Veteran's Healthcare System, San Antonio, TX, USA

Introduction: Will a nurse orientation program incorporating simulation education improve staff satisfaction, competencies and reduce total new nurse orientation training time.

Methods: A comparison was done between the Legacy Nursing Service Orientation and the New "Launchpad for Success" nursing orientation. Kirkpatrick's levels of evaluation were used to determine the value-added benefit of the new orientation process. The addition of simulation bridges the gap between didactic learning and on the job training. The integration of simulation during the onboarding process of new employees has shown by effectively creating an experiential learning environment that invigorated and challenged new employee will both develop facility process skills and improve current skills. The legacy nursing orientation consisted of subject matter experts providing PowerPoint presentations. The orientation had several areas of replication without simulation learning. A new orientation process was introduced in 2019 called, "Launchpad for Success." During the simulation, core competencies and other high-risk, low-volume skills are completed prior to the nurses arriving on the unit.

Results: Core competency skills validation and unit specific orientation was driven by each specific service educator in consultation with the simulation nurse offering simulation and didactic (see graph). A comparison was done between the Legacy Nursing Service Orientation and the New "Launchpad for Success" nursing orientation. Kirkpatrick's levels of evaluation were used to determine the value-added benefit of the new orientation process. There was a focus on Kirkpatrick's Level 3 evaluation which targets behavioral change examining the transfer of learning to the workplace or willingness of learners to apply new knowledge and skills (Yardley & Dornan, 2012). Learning outcomes including performance and confidence was used to determine Kirkpatrick's level of evaluation of the participants of "The Launchpad for Success" Nursing Orientation.

Conclusion: The "Launchpad for Success" Nursing Orientation provided an energized learning platform with simulation and a reduction of overlap. The new process developed a collaboration between all education staff, which alleviated repetitive workload, reducing orientation hours. Simulation provided a key component of the orientation process, which promoted a hands-on learning experience. New employee positive satisfaction and learner outcomes, nurse educator outcomes, time study outcomes comparative to historical new nurse orientation successes would benefit the simulation community.
References available upon request
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"HUH… WELL… YOU'VE GOT CANCER". PARALINGUISTIC CUES AS INDEX OF POOR COMMUNICATION SKILLS WHILE BREAKING BAD NEWS IN SIMULATION TRAINING FOR MEDICAL STUDENTS.

Fabrizio Bracco, PhD,[1] Giancarlo Torre, MD, FNP,[2] Michele Masini, PhD,[1] Donald Glowinski, PhD[3]
[1]University of Genoa, Genoa, Genoa, Italy; [2]Centro di simulazione e Formazione Avanzata (SimAv), Genova, Italy, Italy; [3]University of Geneva, Geneva, Switzerland

Introduction: Establishing a positive relationship with patients and mastering communication skills is of paramount importance for clinicians, both for clinical and ethical concerns (Kaplan et al., 1989). The quality of the doctor-patient relationship is based not only on the cognitive and verbal content of the interaction, but mostly on the affective and non-verbal communication between them (Robinson, 2006; Hart et al., 2016). Simulation with standardized patients can be a powerful method to address these issues, especially when the communication involves breaking bad news, e.g. a chronic or life-threatening disease diagnosis (Schildmann et al., 2012). We hypothesize that non-verbal cues of anxiety (namely, paralinguistic indexes of hesitation and emotional strain) are correlated with the quality of bad news communication of medical students with standardized patients in simulation-based training.

Methods: Three independent judges analyzed the paralinguistic cues (PLC) for stress and emotional tension in video recordings of simulation sessions where 29 medical students of the University of Genoa had to break bad news to standardized patients (15 diagnoses of diabetes and 14 diagnoses of cancer). The PLC were: tone, rhythm, silences, and hesitation markers (e.g. "erm", "huh", etc.), (Crane and Crane, 2010). Each video was also rated in terms of communication quality, using the Modified breaking bad news assessment scale (mBAS) (Schildmann et al., 2012). This scale evaluates the communication performance from "very good" (1) to "very poor" (5) under 5 facets: (mBAS_A) the quality of the introduction and greetings, (mBAS_B) the doctor's communication while delivering bad news, (mBAS_C) the doctor's capacity to elicit concerns, (mBAS_D) the quality of the information provided to the patient, (mBAS_E) the doctor's capacity to explore patient's concerns.

Results: The correlations among the three raters concerning the number of PLC and the mBAS ratings were strong ($r > .577$, $p < .001$). The correlations between the overall mBAS ratings and the PLC of emotional tension were as follows: PLC-mBAS_A ($r = -.19$, $p = .920$); PLC-mBAS_B ($r = .398$, $p = .033$); PLC-mBAS_C ($r = .580$, $p = .001$); PLC-mBAS_D ($r = .567$, $p = .001$); PLC-mBAS_E ($r = .074$, $p = .703$); PLC-mBAS_Global ($r = .430$, $p = .020$). There was no significant difference in the mBAS ratings between the two types of diagnoses (cancer vs diabetes), except for the mBAS_D, i.e., the doctor has given information in a logical and ordered manner, checked whether the patient understood it, and summarized the information in a structured manner ($t = -2.243$, $p = .033$). No significant difference was found concerning the average number of PLC of the two types of diagnoses.

Conclusion: As expected, we observed a moderate to strong positive correlation between the occurrence of PLC for stress and emotional strain and the medical students' difficulty in delivering bad news, especially concerning the doctor's communication skills while disclosing the diagnosis, the doctor's capacity to elicit patient's concerns, and the quality of the information provided to the patient. These results highlight the importance of non-verbal cues in the evaluation of the relational aspects of communication between doctors and patients. Simulation-based training could improve the debriefing phase taking into account these cues as indexes of stress in coping with difficult topics with patients. The analysis could be performed in a qualitative way during the debriefing while watching the recording, but greater advantage could come by the automatic analysis with specialized software for speech recognition and body movements capture (Hart et al., 2016).
References available upon request
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"THE INFLUENCE OF THE ONCOLOGY FOCUSED TRANSGENDER SIMULATED PATIENT SIMULATION ON NURSING STUDENTS' CULTURAL COMPETENCE DEVELOPMENT"

Eda Ozkara San, BSN, MBA, PhD, RN, CHSE[1]
[1]New York University, New York, NY, USA

Introduction: Three research questions guided this work: (1) What is the effect of the Transgender Simulation Patient Simulation (TSPS) cultural competence education strategy on ABSN nursing students' transcultural self-efficacy (TS)E perceptions? (2) What are the differences in TSE perceptions between the experimental and control groups? and (3) What is the relationship between mean item responses on four additional questions (TSPS) and corresponding post-test TSET subscales?

Methods: Guided by the National League for Nursing (NLN)/Jeffries Simulation Theory (Jeffries, 2015) and Cultural Competence and Confidence Model (jeffreys, 2016), this grant funded, pretest ($n = 48$) and post-test ($n = 41$) comparison group, quasi-experimental study aimed to understand changes in students' transcultural self-efficacy (TSE) following the Transgender SP Simulation (TSPS) (Ozkara San et al. 2019) focusing on an oncological emergency management. Developed by following recommended guidelines and standards, the TSPS had content validity review and pilot testing. It aimed to improve students' knowledge, skills, and attitudes with regard to providing culturally congruent nursing care. The statistical methods included paired sample t-tests, independent t-tests, and correlation analyses.

Results: Overall, students who participated in this study completed the learning objectives of the TSPS strategy satisfactorily, and demonstrated positive changes on

their cognitive, practical, and affective learning ($p < 0.05$). Students who completed the TSPS intervention (experimental group) had a greater increase in their scores ($p < 0.05$). Additionally, high mean scores obtained on the SET-M tool (ranged from 2.91 to 3.00) focusing on the evaluation of the TSPS as well as statistically significant positive correlations between post-test experimental group TSET responses to the four additional questions focusing on culturally competent nursing care further supported that the TSPS experience was effective in helping students to develop confidence to provide culturally congruent nursing care.

Conclusion: Consequently, this study fills the gap in the area of a carefully orchestrated cultural competence educational intervention and findings support that SP methodology can be an effective way to foster cultural congruence in nursing care. The TSPS serves a practical evidence-based resource for nurse educators to adapt and utilize for various populations and settings to foster culturally congruent care within their nursing curricula. The findings also contribute to the importance of continuous efforts for the inclusion of LGBTQ topic in nursing education to enhance cultural competence education of nursing students.
References available upon request
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A COMPARISON OF MANIKIN-BASED HIGH FIDELITY SIMULATION TO SYNCHRONOUS SCREEN-BASED VIRTUAL SIMULATION

Christopher Garrison, AAS, BS, MSN, PhD, RN, CHSE, CNE[1]
[1]The Pennsylvania State University, State College, PA, USA

Introduction: High-fidelity simulation in nursing education is supported by a growing body of research1,2. Virtual simulation (V-sim) is an alternative strategy to consider if high-fidelity simulation is not feasible or cost effective3. Foronda et al. define V-sim as "clinical simulation offered on a computer, the internet, or in a digital learning environment including single or multiuser platforms"4. There is support for using V-sim to improve knowledge, skill, performance, confidence, and clinical judgment5. A significant problem is the lack of a clear definition of V-sim5. Many studies have defined and operationalized the concept of V-sim quite differently. Often the simulations were conducted asynchronously, used avatars, or did not incorporate real-time instructor led debriefing6. No studies were found that directly compared existing high-fidelity manikin-based simulations to versions of the same simulations delivered synchronously as a V-sim. This study was designed to address that gap.

Methods: This study used a quasi-experimental design. Prior to campus closure, students participated in high-fidelity manikin-based simulations on sepsis and cirrhosis with GI bleed. The transition to remote learning required an alternative. The existing simulations were converted to a synchronous, virtual format using the same learning objectives. Photos, video clips, and audio clips were embedded in a Power Point to replace the interaction with the manikin. Sessions were held on Zoom. A Prebrief was done describing expectations, safe learning environment, and fiction contract. Learners were provided with a shift report and chart. Assessment findings were presented when students asked. The cases unfolded in the same manner as in the lab. Each session was followed by an in-depth debriefing. The same instructor facilitated and debriefed all sessions. After each session, students completed a 20 item Likert scale evaluation. Responses were compared between groups using independent sample t-tests.

Results: The sample consisted of senior nursing students in a medical-surgical course. A total of 31 students participated in the manikin sim and 38 participated in the vSim. The instrument asked students to evaluate the sim in terms of their perception of the sim and their own learning on 20 items. Items addressed multiple learning outcomes including preparation to care for patients, realism, ability to recognize changes in conditions, learning of pathophysiology, pharmacology, and classroom information, assessment skills, teamwork, communication skills, and effectiveness of debriefing. Each item is rated on a 7 point scale from strongly disagree to strongly agree. Independent sample t-tests were used to compare groups and there were no significant differences on any item except "developed better understanding of pathophysiology" was rated higher in the manikin group.

Conclusion: Converting face to face, manikin simulations to a virtual format was challenging. We wanted to maintain the focus on students independently interpreting patient data and making clinical judgments. Findings indicate that synchronous vSim is a viable alternative when a high-fidelity manikin is not available. It was surprising that there was no difference on items related to realism or assessment skills between the two formats. Development of the vSims incorporated a strong emphasis on conceptual fidelity. The case details were carefully researched and supported by the chart documents and assessment data that was presented as the sims unfolded. It appears that conceptual fidelity was more important than physical fidelity in obtaining learner buy-in. Real time facilitation followed by synchronous debriefing also were unique elements to these vSims. Replication of these results using participant randomization and additional instruments to evaluate learning outcomes is recommended.
References available upon request
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A NOVEL APPROACH TO THE STANDARDIZED PATIENT EXPERIENCE: TELECOMMUNICATION SIMULATION

Hannah Bradfield, DO, FAAP,[1] Adam Barsella, BA, MD,[1] Sonali Patel, MD, FAAP,[1] Mark Butterly, MD, FAAP,[1] Kent Nelson, BS, MD, FAAP[1]
[1]Advocate Children's Hospital - Oak Lawn, Oak Lawn, IL, USA

Introduction: Effectively communicating difficult or sensitive information with patients and families is an essential component of training for physicians. Our program hosts an annual Standardized Patient Day emphasizing these communication skills. The COVID-19 pandemic both hindered our ability for in-person sessions and highlighted the necessity for telehealth proficiency.

Methods: We converted to an entirely virtual experience. We produced 2 telephone cases: Discussing Hyperbilirubinemia in the Ambulatory Setting and Reporting an Inpatient Change in Patient Status; and 2 video visits: Triaging an Asthmatic Teenager and Working Through a New Diagnosis of Type 1 DM. Eight pairs of professional standardized patients and faculty proctors participated in 1 of 4 cases. Thirty residents were divided into 8 groups. Two "rooms" were created for each case through a virtual meeting platform. Resident groups rotated virtually between rooms experiencing each case once, while proctor/standardized patient pair remained in their room. The "provider" roll rotated among residents, while the remaining residents observed virtually. Case interactions lasted 15 minutes followed by a 10-minute debrief centered on communication skills. Twenty-two Residents completed pre-/post-experience surveys. Proctors and standardized patients completed post-experience feedback.

Results: McNemar's test analyzed change in dichotomous variables and Wilcoxon signed-rank test compared change in Likert scale data. The residents surveyed were evenly distributed across training levels. They confirmed increased frequency of telehealth use during the COVID-19 pandemic compared to before ($p=0.003$). Only 41% of residents were comfortable using telehealth for patient interaction prior to the experience, while 100% of residents reported comfort after completing the cases ($p=0.0002$). Comfort discussing each case theme with telehealth also increased post-experience (all $p<0.01$). Proctors and standardized patients agreed that the content was sufficient, timing was appropriate, and technical difficulties were minimal.

Conclusion: Prior to COVID-19, a progressive movement to include telehealth education in residency training had already begun. Given this model's success and the likelihood telehealth will play a larger role in the post-COVID-19 practice environment, we will continue including telecommunication simulations in our annual Standardized Patient Day. No significant changes beyond minor clarifications to the case materials would be required to adapt this process. Our model effectively improves communication skills and could be adjusted to more directly test clinical knowledge depending on the program's goal.
References available upon request
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A SIMULATION-BASED FEASIBILITY STUDY OF VENTILATING TWO PATIENTS WITH ONE VENTILATOR

Robert Chatburn, MHS, RRT, RRT-NPS[1] Umur Hatipoglu, MBA, MD[1]
[1]Cleveland Clinic, Cleveland, OH, USA

Introduction: The COVID-19 pandemic has created an overwhelming demand for mechanical ventilators. This demand has stimulated much interest in using one ventilator for multiple patients, called multiplex ventilation [1-4]. Many have posted methods for this on the Internet, but there is little supporting evidence and no human studies. Multiplex ventilation is associated with risk because ventilation and PEEP effects are largely uncontrollable and depend on the difference between patient resistance, (R) and compliance (C). The purpose of our simulation-based study was to allow complete control over the relevant variables during ventilation of a passive lung mode to determine the effects of various degrees of RC imbalance on tidal volume, end-expiratory lung volume (EELV), and imputed arterial pH.

Methods: Two patients were simulated with two separate breathing simulators (ASL 500, IngMar Medical, Pittsburgh, PA). Evidence-based lung models were created to simulate a range of differences in R and C (six pairs of simulated patients). They were ventilated with a Servo-I ventilator (Getinge, Rastatt, Germany) using pressure control (PC) and volume control (VC) modes. Outcome data recorded were: differences in tidal volume, EELV, and imputed pH.

Results: As expected, differences in outcome variables between the two simulated patients depended on differences in lung model values for R and C. Differences in tidal volume ranged from 1% to 79%. Differences in EELV ranged from 2% to 109%. Differences in pH ranged from 0% to 5%. Failure of ventilation due to excessive tidal volume (> 8 mL/kg) did not occur. Failure due to tidal volume and pH too

low was 50% and 33% respectively. Failure due to excessive EELV difference (> 10%) was evident in 50% of patient pairs. There was no difference in failure rate between VC and PC.

Conclusion: This study confirmed the potential for markedly different ventilation and oxygenation for patients with uneven respiratory system impedances during multiplex ventilation. Three critical problems must be solved to minimize risk: (1) partitioning of inspiratory flow from the ventilator individually between the two patients, (2) measurement of tidal volume delivered to each patient, and (3) provision for individual PEEP. We provide suggestions for solving these problems
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A SIMULATION-BASED MECHANICAL VENTILATION CURRICULUM FOR MULTILEVEL LEARNERS IN AN INTERNAL MEDICINE RESIDENCY PROGRAM – A PILOT STUDY

Priscilla Loanzon, BSN, EdD, MA, MEd, RN, CHSE,[1] Joseph Mathew, MD, FACP,[2] James Salonia, MD,[3] Bertin Salguero, MD[4]

[1]Mount Sinai West-Mount Sinai Morningside (AKA St. Luke's) Hospitals, New York, NY, USA; [2]Mount Sinai West and Mount Sinai St. Luke's, Oradell, NJ, USA; [3]Mount Sinai West, New York, NY, USA; [4]Icahn School of Medicine at Mount Sinai Morningside - West, New York, NY, USA

Introduction: Internal Medicine (IM) residents currently receive mechanical ventilation (MV) education through clinical rounds in the intensive care unit (ICU) and self-directed learning. This traditional education for MV creates poor and inconsistent knowledge among residents. (1) In the US, only about 37% of the ICU patients are managed by intensivists, (2) with general internists providing most of the care to ICU patients. (3) Simulation is more effective to teach critical care knowledge and skills. (4) What is the effect of combined didactic, hands-on training, and case-based simulation on the comfort level and knowledge of MV among multilevel learners with various learning needs and clinical experience? It is hypothesized that the combined use of didactic and hands-on training followed by case-based simulation can improve the comfort level and knowledge of multilevel learner IM residents. This study aimed to evaluate multilevel learners' simulation-based MV course for IM residents.

Methods: The study aimed to evaluate the effectiveness of multilevel learners' MV curriculum for IM residents in improving their comfort level and knowledge. The curriculum was developed from a needs assessment survey of the IM residents and faculty consensus using a modified Delphi technique. The final curriculum has three parts 1) 15-minute "must-know" didactic MV contents, 2) 15- minute MV guided hands-on training and 3) 30-minute targeted case-based simulation for each level of learners: alarm interpretation for PGY 1, setting up the MV for PGY 2, and advanced MV concepts for PGY 3. The evaluation method has a two-fold purpose: 1) to measure the application of knowledge for each level of learners using two different sets of multiple-choice questionnaires, pre, and post-training, and 2) to determine the statistical difference between pre-and post-MV training comfort level through a questionnaire using a Likert scale. All questionnaires were administered immediately before and after training.

Results: A total of 116 residents participated in the study (91%): PGY1 42 (33%), PGY2 42 (33%), and PGY3 43 (34%). 100% of the participating residents completed the surveys, of which only 7 (9%) had completed an IM residency in the past. The survey questionnaire evaluated the residents' comfort level (attitude) and knowledge (cognitive). The comfort level component included (1) ordering basic parameters of ventilation changed from 5/10 to 7/10, (2) troubleshooting frequent alarms in the ventilator from 4/10 to 6/10, and (3) recognizing emergencies that need escalating from 4/10 to 7/10. In the knowledge section, gain in the correct answers was used as a metric. A mean increase of 24% was notable between pre- and post-training scores across all learners. The PGY 1 scores increased from 59% to 76% while PGY 2 showed improvement from 49% to 81% and PGY 3 climbed from 57% to 79%. The second phase is to evaluate after 6 months the comfort level and knowledge knowledge among the rising PGY 2 and 3.

Conclusion: A multilevel learners' simulation-based curriculum provides the IM residents hands-on learning experience that can increase their comfort level in handling an MV and troubleshooting common issues they have to encounter in the clinical settings while efficiently improving their knowledge of complex MV concepts. The study recognizes three limitations. It is unclear if an increase in comfort level and knowledge was directly related to the intervention given the absence of a control group. There is no data regarding knowledge decay. The study hopes to conduct phase 2 to evaluate knowledge decay. It is difficult to objectively evaluate how mechanical ventilation training translates to clinical care. Despite its limitations, the study demonstrated that a multilevel learner-centered approach can successfully close the knowledge gaps and provide meaningful education for IM learners with varying levels of knowledge and experience.
References available upon request
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A TALE OF TWO LEARNERS: USING DIFFERENT VIRTUAL FORMATS BASED ON LEARNER EXPERIENCE LEVEL

Karen Mangold, MD, MEd,[1] Mark Adler, MD, Fellow of SSH,[2] Anisha Kshetrapal, MD, MSED, FAAP,[3] Kathleen Marino, BA, MBA,[3] Kristin Van Genderen, MD, FAAP,[3] Lindsay Koressel, MD, MEd, FAAP,[3] Candace Mannarino, MD, FAAP[4]

[1]Feinberg School of Medicine, Northwestern University/Lurie Children's, Chicago, IL, USA; [2]Feinberg School of Medicine, Northwestern University, Chicago, IL, USA; [3]Ann & Robert H Lurie Children's Hospital of Chicago, Chicago, IL, USA; [4]Ann and Robert H. Lurie Children's Hospital/Northwestern, Chicago, IL, USA

Introduction: In March 2020, the COVID-19 global pandemic shut down all in-person educational events at the Ann & Robert H. Lurie Children's Hospital of Chicago, as it did to most academic centers nationally. Lectures and other didactic sessions were quickly adapted to a virtual format, but simulation sessions remained cancelled because of the close contact and hands-on format of learning required. As learners clamored for education, our simulation group developed new formats for virtual simulation using existing technology for two very different groups of learners: medical students on their pediatric clerkship rotation and pediatric subspecialty fellows across emergency medicine, critical care and cardiology fellowships, who do not usually have the opportunity to participate in simulation together. Our aim is to describe the virtual formats, report our learners' experience and lessons learned.

Methods: Our center's pediatric clerkship includes 2 in-person simulations for groups of 4-6 medical students that cover respiratory distress and hypovolemic shock. Our fellows usually participate in monthly in-person simulations of varying topics. A similar virtual format for these 2 groups was held over Zoom so 5-6 learners could participate from home. All sessions started with a pre-brief to create a safe learning space and orient learners to the virtual setting. Simulations ran by facilitators providing data from the case and performing tasks as requested by learners. Learners requested history, physical exam findings, or direct interventions from facilitators. Student simulations involved a croup case; fellows' cases involved complex resuscitations. Vital signs were projected on a separate zoom tile. Post-simulation debriefings followed our usual practice using the PEARLS framework to discuss content, communication and teamwork skills. All participants received surveys after the sessions.

Results: Six virtual medical student simulations took place with 22 participants, and 15 completed the post-survey. Reponses were compared to post-survey responses from 84 students who completed in-person simulation sessions earlier in the academic year. Important differences in responses include that fewer students in the virtual sessions agreed that "teamwork and communication issues were addressed in the debriefing" (73% vs 100% during in-person). Narrative comments from students who participated in virtual simulations reported it among the top three clerkship activities for learning and felt it was equally effective or better than their previous simulation experiences in other rotations. Two subspecialty fellow virtual simulations took place with 12 participants, but only 5 completed the post-survey. Comments reflected the difficulty in communicating between virtual and non-virtual participants who were masked.

Conclusion: Virtual simulations requiring minimal technology can support learning of learners at different levels. Key tips learned by our educators were to use breakout rooms to stagger entry, provide multiple facilitators and display vital signs through a separate zoom tile. The pediatric subspecialty fellow groups appreciated being able to learn from each other during the simulation and debriefing, as joint simulations have been difficult to schedule in the past. Challenges that needed to be worked out was translating team learning when distanced, avoiding talk-over, and unique communication issues across the virtual platform.
References available upon request
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ADOPTION AND EFFICACY OF AUGMENTED REALITY IN LUMBAR PUNCTURE SIMULATION BY MEDICAL STUDENTS

Korak Sarkar, MD[1] Jeffrey Coote[2]

[1]Ochsner Medical System, New Orleans, LA, USA; [2]Tulane University, Pearl River, LA, USA

Introduction: Acquisition of procedural skills for medical trainees remains challenging, time-consuming, and potentially risky. Unlike Virtual Reality (VR), which completely immerses its users into a virtual environment, Augmented Reality (AR) overlays a hologram over real-life setting, which overlays an interactive digital model on the physical environment. AR's use in the clinical setting is increasing due to its growing accessibility and its potential to aid medical education and clinical care delivery. This study investigated the adoption and utility of augmented reality (AR) in lumbar puncture simulation for medical student training.

Methods: A randomized control trial using a cross-over design was implemented to assess the impact of AR on puncture distance from target and number of punctures required

in lumbar puncture simulation. Qualitative survey data was also collected to assess medical student satisfaction with the AR simulation.

Results: No statistical difference in the average number of punctures was observed between the AR and standard groups. The average puncture distance from target was significantly less in the AR group (8.3mm vs 21.3 mm, p=<.001). Although most of this cohort had no prior exposure to AR, they were willing to use this technology in medical training. After exposure to AR. medical trainees confirmed that they would feel more comfortable learning procedures and performing simulations using this technology.

Conclusion: This study supports the feasibility, efficacy, and qualitative desire to use AR by medical students in a medical simulation setting. This study provides evidence that AR can improve accuracy in lumbar puncture simulation in medical students.
References available upon request
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ADVANCING MEDICAL STUDENTS' EXPERTISE BY RECORDING EDUCATIONAL VIDEOS ABOUT BASIC MEDICAL PROCEDURES IN A SIMULATED SETTING

Andrea Calandrino, MD, RPh,[1] Alessio Riitano, MD,[1] Serena Ricci,[1] Federica Imperiale,[1] Silvia Rebuffo, MD, RPh,[1] Marco Chirico, MA,[1] Giancarlo Torre, MD, FNP[2]
[1]University of Genoa, Alassio, SV, Italy; [2]Centro di Simulazione e Formazione Avanzata (SimAv), Genova, Italy, Italy

Introduction: Health care professionals require simulated education to learn or review a treatment modality prior to providing patient care. Although written text plays a central role in education, many people are visual learners and assimilate information better by observing images[1]. Video is a powerful teaching tool, in fact it offers advantages over verbal communication: it presents more information in a smaller time, simplifies complex concepts, transfers practical knowledge and is efficient at getting audience attention[2]. In order to realize an effective educational video teachers should reduce the cognitive load and increase the engagement and active learning of students. Also, they can use strategies as emphasis on important gestures, brief videos and a combination of auditory and visual channels to convey complementary information[3]. Moreover the possibility to orient students in advance and the adherence between the procedure and the video are among the greatest benefits obtainable[4].

Methods: We recorded 6 videos on clinical procedures in a simulated setting: intramuscular therapy, bladder catheterization, blood sampling, NG tube positioning, rectal examination, surgical dressing. Special attention was used to produce accessibile videos avoiding digital barriers: i.e. captions, easy to read, and closed up filmings of gestures were used to support a better user experience and improve students' learning; instruments and materials were exactly the same of the final examinations. Such videos were played during third year clinical classes, after students reviewed a checklist containing all the steps of the videos and could practice using interactive multimedia simulators. At the end of the classes, students were invited to fill out an anonymous questionnaire about the efficacy of videos. Internal consistency was measured by calculating Cronbach's Alpha (CA); a five-point Likert scale was used to measure satisfaction[5]; correlations were performed using Spearman's coefficients.

Results: 208 students filled out the questionnaire. CA scored 0,7. 24.5% found the video tutorial more effective than teacher demonstration (score 5/5; 49% very effective 4/5; 26% equally effective 3/5; 0.5% slightly effective 2/5). Further, trainees appreciated closed up sequences to stress key passages (5/5: 39%; 4/5: 53%; 3/5: 8%) and the use of the same materials of the practice (5/5: 49%; 4/5: 42%; 3/5: 8%; 2/5: 0.5%; 1/5: 0.5%). 59% felt partially safe (3/5) in repeating the skills on real patients (5/5: 2%; 4/5: 25%; 2/5 14%). We found a positive relationship between previous experience and confidence level in treating real patients (R=.18, p=.01). Interestingly, the effectiveness of the video positively correlated with the use of the same materials during practice (R=.28, p<.001) and the highlight of key passages (R=.33 p<.001), suggesting that videos are effective as they are a combination of different methodologies (i.e. video effects, materials used) into an educational tool.

Conclusion: Videos may improve student learning and engagement [6]. In order to maximize the benefit of educational videos it is important to positively affect students' engagement and reduce their cognitive load. This may be achieved by stressing performer's gestures and recording videos into the same setting, they would be trained in, using the materials, which are accessible during practical, and examination sessions. The main goal of this study was to evaluate active learning: students found the use of a digital tutorial associated with practical sessions more effective than classical hands-on demonstration of the teacher. This is probably the result of different modalities (i.e. images, sounds, highlights, video effect) accessible into a single tool, usable according to student's attitudes. Hence, the majority of the students (86,5%) felt safe in replicating the learned procedures during the real clinical activity, especially if they had a previous experience during the hospital activity.
References available upon request
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AIRWAY SETUP MODALITY CHANGES THE SPEED OF INTUBATION: A HEAD-TO-HEAD-TO-HEAD COMPARISON OF THREE DIFFERENT AIRWAY SETUP MODALITIES

Daniel Robinson, BS, MD, FACEP[1] Michelle Hughes, BS, MD[2]
[1]VA Puget Sound Healthcare, Seattle, WA, USA; [2]University of Wisconsin School of Medicine and Public Health, Madison, WI, USA

Introduction: Does intubation time to intubation setup and completion in a simulated airway model differ across three types of equipment storage modalities, including a standardized 6-drawer airway cart (Cart 1), the 'top-drawer' airway drawer (Cart 2), and an airway tackle-box.

Methods: This is a prospective, simulated trial of Emergency Medicine residents at a single academic center evaluating three different airway equipment storage modalities: a six-drawer airway cart vs. 'top-drawer' airway drawer vs. an airway tackle box. The primary outcome was time to intubation completion. Secondary outcomes included time to intubation setup and total time.

Results: ANOVA: Mauchly's test shows that the assumption of sphericity has been met $X2(2) = 0.973$, $p = 0.615$. The results demonstrate that one of the means is different given $F(2, 46) = 8.39$, $p = .001$. Partial eta squared (ηp^2) = 0.267 and partial omega squared (ωp^2) = 0.17, thus 17% of the variation is attributed to the airway equipment storage modality with the effects of the other variables partialed out. Average times to intubation setup, completion, and total time are outlined in Table 3. Paired t-tests were performed (Table 4) to evaluate the differences between Tackle Box, Distributed Cart (Cart 1), and "Top Drawer" (Cart 2). A Bonferroni corrected p-value of 0.016 was used (alpha level of 0.05 / 3 comparisons), 98.4% confidence interval.

Conclusion: Different airway storage modalities change the speed and ultimately the efficiency of an Emergency Physician's ability to intubate a patient. We showed in a head-to-head-to-head analysis that a 'top-drawer' designed cart allowed for faster-simulated intubation than a distributed cart or a tackle-box. Our study also points out that iterative changes with feedback from important stakeholders (attending physicians, resident physicians, nurses, and technicians) has the ability to lead to a more efficient airway setup modality. Further study with more participants as well as other residency programs would be helpful to assess further and evaluate if iterative change may lead to similar results at other institutions.
References available upon request
Full disclosures for all authors and coauthors available upon request

AN EDUCATION CURRICULUM USING SIMULATION TECHNIQUE TO IMPROVE PARENT-PROVIDER COMMUNICATION FOR STRESSED PARENTS OF A SICK CHILD.

Renuka Mehta, MBBS, MRCP, CHSE, FAAP,[1] Matthew Tews, DO, MS, FACEP,[2] A.J. Kleinheksel, BA, MEd, PhD, CHSE-A[1]
[1]Medical College of Georgia @ Augusta University, Augusta, GA, USA; [2]Medical College of Georgia, Augusta, GA, USA

Introduction: Parent-provider communication affects patient safety, their outcome, hospital performance and parent's hospital experience. Studies have shown that parent-provider communication breakdowns, evidenced by lack of shared understanding about inpatient care plans occurred in 45.1% of parent-resident dyads. We hypothesize that Introduction of Pediatric Parent Communication curriculum will 1. Positively influence communication between residents and parents 2. Decrease stress and burnout among pediatrics residents associated with communicating with parents of children admitted with acute illness 3. Positively influence parents' satisfaction

Methods: All Pediatric residents and medical students (Pediatric Learners) rotating through pediatric rotations were recruited in the prospective study. This included Pre and post survey centered on effective communication techniques between parent and provider using Patient Family Centered Care (PFCC) framework. A 2 hour workshop which included 90 minutes of interactive sessions on teaching strategies to improve communication for stressed parents. followed by reinforcement with a 10 minutes simulation. Each Participant played the role of the physician and a confederate played the role of the pediatric patient's parent. They were assessed on standardized clinical assessment 11 items tool followed by post-session structured debriefings. Participants complted evaluation on effectiveness of simulation workshop. Pre survey was completed just before workshop and a time delayed Post survey to evaluate the successes or challenges/obstacles of family interactions in the six months after intervention

Results: A total of 56 learners participated in Presurvey and workshop and 18 responded to time delayed Post survey. All the post survey were completed by residents as it was hard to track medical students, as they had already moved out of pediatric rotation. All statistical analysis was performed using SAS 9.4 and statistical significance was assessed using an alpha level of 0.05. The overall differences between pre- and post-education self-assessment items

using Fisher's Exact tests was 0.04 suggesting that residents had made changes in their behaviour after attending workshop, though changes were more significant in 4 of the 11 items. A Wilcoxon Signed Rank test showed that learners completed most of the items on clinical assessment tools mean SD for medical students 7.2, and Residents 8.6, P 0.02. Majority of the learners rated the workshop to be above average to excellent.and comments included that they would like to have similar sessions in future to retain competency.

Conclusion: This study has shown the effectiveness of creating a parent provider communication study using PFCC communication framework for pediatric learners students as shown by their change in behavior 6 months after participating in the workshop. Providing residents and medical students with tools to be able to communicate effectively with parents can greatly impact patient safety, patient and family experience and overall patient satisfaction as well as resident/medical student wellness as they feel more prepared. They rated this curriculum to be valuable in their training. We will be making modifications to specifically tailor for students, residents and expand to other healthcare providers.
References available upon request
Full disclosures for all authors and coauthors available upon request

AN INTERNATIONAL MIXED METHODS STUDY ON THE USABILITY OF A 2ND GENERATION VR STERILE CATHETER INSERTION GAME

Karen Breitkreuz, BSN, EdD, MSN, RN, CHSE, CNE,[1] Suzan Kardong-Edgren, BS, MS, PhD, RN, ANEF, CHSE, FAAN, Fellow of SSH,[2] Carman Turkelson, BSN, DNP, MSN, RN, CCRN, CHSE-A,[3] Kelly Rossler, BSN, MSN, PhD, RN, CHSE,[4] Susan Lanzara, AAS, BSN, MSN, PhD, RN, CNE[5]
[1]Texas Christian University, Fort Worth, TX, USA; [2]MGHIHP, Boston, MA, USA; [3]University of Michigan -Flint & Beaumont Health System, Flint, MI, USA; [4]Baylor University, Kaufman, TX, USA; [5]Mansfield University, Athens, PA, USA

Introduction: Research Questions - What is the usability of the 2nd Generation Sterile Urinary Catheter Insertion Game (VR SUCIG)? - What are user reactions to the 2nd Generation Sterile Urinary Catheter Insertion Game? Background: Psychomotor skills teaching remains understudied in nursing education. Learning and retention of psychomotor skills in health care is essential. A VR SUGIG incorporating haptics was designed using Bauman's layered-learning model as a framework.(1, 2) The game was created to address the need for students to practice sterile catheter insertion in a step-wise manner and to point out contamination errors. Testing of the 2nd version of this game was conducted with 10 schools of nursing from the USA and Australia. Three-hundred nursing students and 46 nursing faculty and healthcare professionals completed Usability and User Reaction surveys. Bauman's Layered Learning model guided the research approach. (1,2)

Methods: Subsequent to IRB clearance a sample of 300 nursing students, and 46 nursing faculty and healthcare professionals were recruited. Nine universities in the USA and one from Australia participated. Participants were recruited, consented and offered game tutorials. Each was allowed up to 30 minutes to play the game, then complete a Usability Survey (3) and User Reaction Survey (4, 5). The System Usability Scale (SUS) measures the perceived usability of a product and has a tau-equivalent reliability (coefficient alpha) of .92. The 10 item scale measures effectiveness of computer applications. An average score is 50.9 (0-100 range) (SD 13.8).(5) The User Reaction Scale designed by Butt et al. (4) elicits user responses to perceived impact of a game on learning. Users respond to Likert style questions on a five-point scale anchored by strongly agree to strongly disagree. Tau-equivalent reliability (coefficient alpha) of the URS in the Butt et al. (4) study was .83.

Results: Descriptive statistics were calculated: means (standard deviations) for quantitative data and frequencies and percentages (relative frequencies) for qualitative data. The system usability score (SUS) for the student cohort was 57 (SD 17.3). The SUS for the faculty/professional cohort was 47 (SD 25.6). The overall SUS 54 (SD 18.9). The variation between faculty and student SUS score p = .0176. The User Reaction Scores: Students and faculty/professionals thought the game was fun, challenging and engaging, user reactions demonstrated greater readiness for adoption in the student group. The faculty/professional cohort had challenges learning the technical aspects of the game. The last question in the URS asked participants to share suggestions for improvement. Responses included; loving the game, great for learning, great for remembering steps, frustration with technical glitches, unfamiliar with VR function. Students appreciated step-wise practice and seeing the germs.

Conclusion: This paper reports the results of a usability and user reaction survey of the 2nd generation of the VR-SUCIG, completed by 300 nursing students, and a 2nd cohort of 46 nursing faculty and professionals. The system usability score in the student group was 57 (SD 17.3) The system usability score in the faculty professional group was in the medium-low range 47 (SD 25.6), and user reactions were mixed. Future studies should include faculty/professional feedback. However, adding a detailed orientation to VR gaming technology, purpose of the game and purpose of a usability study are essential for faculty and professionals. Researchers may also glean valuable information about faculty perceptions if questions about the pedagogical value of the game are included. Future faculty need to consider benefits of moving from a digitally naïve state to becoming masters of technology that students are embracing. The game needs further refinement before marketability will be successful.
References available upon request
Full disclosures for all authors and coauthors available upon request

ANALYSIS OF 9 YEARS OF SIMULATION CENTER BEST PRACTICES FROM ACCREDITATION REVIEWS USING EPISTEMIC NETWORK ANALYSIS.

James Cooke, MD,[1] Vitaliy Popov, PhD,[2] James Cooke, MD[1]
[1]University of Michigan Medical School, Ann Arbor, MI, USA; [2]University of Michgian, Ann Arbor, MI, USA

Introduction: Since 2005, the American College of Surgeons Accredited Educational Institutes has provided accreditation of surgically-focussed simulation centers with the added benefit of identifying best practices defined as "areas far exceeding the accreditation standards or novel methods of advancing high quality, impactful education." The organization began to compile all best practices from accreditation reviews in 2011 for dissemination to members through journal articles, on-line videos, newsletters, and workshops. Although this is a rich source of data for sharing innovations, the authors wanted to explore the content and associations of best practices to understand the evolution of the field, the accreditation process, and organizational perspectives over the last decade.

Methods: The compiled list of 337 best practices identified from 247 site visits over 9 years were analyzed and visualized using epistemic network analysis, or ENA. Raw text for each best practice along with the center name, date of accreditation review, and coded themes were analyzed based on research questions and overall networks were compared for additional hypothesis generation and analysis. Data from all best practices over the nine-year period was compiled into a single network analysis for an overall comparison of associations. To evaluate changes in best practice feedback from accreditation surveys over time, data was also divided into three 3-year periods, 2011-2013, 2014-2016, and 2017-2019 with means and standard deviations compared using graphical 2-dimensional network visualizations.

Results: Overall association network of the data demonstrated the strongest associations between assessment, curriculum development, faculty development, research and teaching methods. There were also detectable associations between all content areas demonstrating the very interrelated nature of simulation-based education. Modest associations were most commonly seen involving curriculum evaluation, which persisted throughout the nine-year period. Associations during the three time periods showed statistically significant changes in mean overall associations with both a change in mean content and broader standard deviation despite an increase in best practices in each period. Early associations were mainly seen between faculty development, curriculum development, collaboration and teaching methods, but migrated to include all areas with increases seen in the areas of assessment, research, resources and governance demonstrating much broader associations.

Conclusion: Best practices evolved from an early focus on teaching methods, faculty and curriculum development to higher-level educational topics including assessment, research, resources and overall center governance. The increased distribution of associations also clearly demonstrates an increase in complexity of the feedback, with more nuanced and interconnected statements demonstrating higher-level feedback including explanations, contributing factors, impact on other areas and, in some cases, recommendations to share best practices outside the organization. Much like individual learner assessment, compiled longitudinal assessments can sometimes say as much about the assessors as it does the learner in terms of both written and unwritten goals, competing perspectives, and organizational priorities. This nine-year database of simulation center feedback provides a novel perspective of an organization and the evolving field of simulation in healthcare professions education.
References available upon request
Full disclosures for all authors and coauthors available upon request

ANALYSIS OF LEARNER QUESTIONS POSED DURING PROJECT DOCC SIMULATION EXPERIENCES

Brooklyn Vrolyk, BS[1] Kori Crawford, BS[1]
[1]West Virginia University, Morgantown, WV, USA

Introduction: There is a growing need for a comprehensive approach to caring for medically complex children in primary care settings since more infants are surviving prematurity, complex congenital heart disease, childhood cancer, and a growing number of genetic diseases. Parents of medically complex children often become stressed and confused by daily demands of coordinating care between specialists, therapies and community with no real sense of someone "driving the bus". The patient centered medical home (PCMH) has data supporting its impact on reducing disparities in healthcare and is based on the relationship between the patient, community, and healthcare workers (Mielenz, Allegrante, & Rowe, 2016). With this in mind, our research question was: Do the questions being asked by medical residents and health professional students during Project DOCC simulation exercise knowledge of the patient centered medical home model?

Methods: The simulation exercise emerged as an adaptation of the 1994 Project DOCC (Delivery of Chronic Care) national curriculum that was designed by parents of children with special healthcare needs. This parent-led simulation training experience was conducted as an Inter-professional Education opportunity for 1) 3rd and 4th year medical

students; 2) medical residents; 3) pharmacy students; and 4) nursing students. The simulation exercise had multiple phases: 1) pre-simulation data collection; 2) team activity; 3) pre-briefing; 4) simulation/parent interview; 5) debriefing session; 6) post test data collection. Each parent interview was recorded via video and audio. Questions posed by learners were transcribed and categorized based on the PCMH model. The dependent variable is the focus of the questions asked, as they relate to the PCMH model. Time allowed during the parent interview, size of interview groups, and the team activity were independent variables throughout the study.

Results: Data was analyzed by categorizing each question into qualities of a PCMH as defined by The American Academy of Pediatrics (i.e. Accessible, Patient/Family Centered, Continuous, Comprehensive, Coordinated, Compassionate, and Culturally Effective). Our results indicated that a number of factors go into the quality of questions the learner's ask. The evaluation of five DOCC simulations from 2019-2020 indicated successes and declines in initiative taken by students when questioning parents. After implementing the team activity during the third simulation cohesiveness, leadership, and questions appropriateness increased among the team. Higher quantities of questions falling under the categories of Patient/Family Centered and Compassionate were asked across every simulation. The presence of a resident increased the quantity and quality of questions asked across all disciplines of the team. There are more findings to share about what was effective and ineffective as a learning tool.

Conclusion: The results of this project indicated that students' understanding of a PCMH did expand after participating in the simulation per questions asked and pre/post test results. Every question was able to be categorized into a PCMH quality, however, there were some limitations. When students were given less time with parents, asked to question multiple parents, or a medical resident was not present the quantity and quality of questions declined. It was learned that there is a particular team dynamic that encourages certain types of questions. These findings have positive implications for the healthcare simulation community as they identify specific areas of success in Project DOCC that will amplify the understanding of the young medical professionals involved and provide something they can carry with them throughout their careers as they interact with medically fragile families.
References available upon request
Full disclosures for all authors and coauthors available upon request

ANALYSIS OF THE PERFORMANCE OF POSITIVE PRESSURE VENTILATION BY IN-HOSPITAL PHYSICIANS AS MEASURED ON HIGH QUALITY SIMULATORS

Allen Kuo, BS[1] Lori Gallian, AA, BS, EMT, NREMTP[1]
[1]V4EMS Inc, Diamond Bar, CA, USA

Introduction: The recent outbreak of Coronavirus (Covid-19) highlights the need for healthcare professionals to be able to perform airway skills to a high level of accuracy. The most basic of such skills is how to correctly deliver positive pressure ventilation through use of a non-invasive bag valve mask. This study examines how well in-hospital physicians perform non-invasive ventilation.

Methods: Full time practicing physicians with various specializations working in hospitals were encouraged to stop by and hone their ventilation skills utilizing a BVM on SmartMan feedback manikins (adult or infant depending on specialization). 113 doctors stopped by (26 pediatrics; 87 non-pediatrics). All physicians were briefed on the real time feedback provided by the simulator. In order to control for the ability to attain a perfect seal and correct head position, all physicians were asked whether they would like an assistant to perform this for them. Almost all took advantage of this, although a few individuals opted out of the assistance. All physicians were asked to perform rescue breathing for 1 to 1.25 minutes and were allowed more attempts if they chose. A review of the correct performance for volume and rate was provided verbally to each participant with reference to the onscreen performance results review.

Results: Pediatrician's first performance score was 21.97% and rose to 45.97%. Non-pediatrician's performance was 30.80% and rose to 50.21%. Pediatricians made more attempts to attain a higher score (2.31 attempts) than non-pediatricians (1.92 attempts). The differences in first attempt between the two groups was not significant ($t(111)=1.7156$, $p=0.0890$) and was not significant in best attempt ($t(111)=1.0013$, $p=0.3188$). The difference in improvement for pediatricians compared to non-pediatricians was significant; pediatrician $p<0.0001$; non-pediatrician: $p<0.0001$. Further analyzing pediatrician's first performance: 67.98% tidal volume, 27.80% tidal flow rate, and 35.95% of the interval pause between ventilations which improved to 83.35% tidal volume, 51.35% tidal flow rate, and 62.38% for interval. Non-pediatrician's first performance: 71.22% tidal volume, 38.30% tidal flow rate, and 22.34% of the interval which improved to 84.59% tidal volume, 56.84% tidal flow rate, and 40.43% for interval.

Conclusion: The general ability to perform positive pressure ventilation is low among both pediatric and non-pediatric physicians. Most physicians can easily provide the right tidal volume, but often times have trouble with the right tidal flow rate, and interval pause between ventilations. With an accurate feedback simulator, physicians quickly improved. However, even with that improvement, performance levels were still below desirable level for in an In-Hospital respiratory emergency. This highlights the fact that physicians require additional specific and focused training for improving ventilation performance and they should train on high quality feedback simulators to improve their ability to provide positive pressure ventilation.
References available upon request
Full disclosures for all authors and coauthors available upon request

ASK THE EXPERTS: EARLY EVALUATION OF A CUSTOMIZABLE PERCUTANEOUS IMAGE-GUIDED PHANTOM

Deborah Rooney, MAMS, PhD,[1] Dylan Rushton, BSE,[1] Elaine Caoili,[1] Richard Brown, MD,[1] Deborah Rooney, MAMS, PhD[1]
[1]University of Michigan, Ann Arbor, MI, USA

Introduction: Percutaneous image-guided biopsies are common practice for diagnosis of organ lesions. [1-4] They require familiarity with patient anatomy and keen hand-eye coordination. Traditionally, residents have been trained on patients, with obvious risk. Commercially-available simulators have limited scope, and do not provide both customizable anatomy and biopsy skills training for a variety of organs/systems. Our team has designed and developed a customizable simulated body form that complements real patient CT or MRI exams, with customizable "tissues" from a variety of organs/systems that can be biopsied. We propose this novel task-trainer allows for a much more realistic training and practice experience for trainees of all the specialties that commonly use percutaneous image-guided biopsy skills. Expert feedback of the different "tissues" will guide refinements prior to use with trainees. -Research question: Are the simulated tissues adequately realistic as evaluated by expert radiologists?

Methods: Simulator build. Our simulator consists of two primary components— a body form frame, and "tissue" pucks. The TPU body form frame adjusts to different patient body types and has 5 entry ports to allow an instructor to stack up to 9 ballistics gel "tissue" pucks (10x12.5cm) at commonly accessed angles. The pucks vary in density, and represent actual patient radiographs that are used in biopsy procedures. Study. In this preliminary work, 13 radiologists independently evaluated 6 "tissue" samples with varying densities (A-F) with ultrasound and needle biopsy. Participants with 15.4 mean years' experience reported how familiar they were with 17 organs/systems. For each of these tissues, participants also identified the best sample, and rated its density as "too soft, "just right," or "too firm." Ratings were compiled, and percent agreement calculated by frequency.

Results: Participants had high experience with brain, cartilage, colon, heart, kidney, liver, lungs, nerve, pancreas, stomach, and uterus, and less experience with bladder, breast, spleen, and vasculature. They identified sample B with liver and pancreas, C with cartilage, D with kidney and abdominal muscle, E with colon and lungs, and F with bladder and stomach-all with high agreement. Liver, pancreas, and stomach densities were considered "just right" with majority (>67%) agreement, while cartilage was considered too soft (100% agreement), colon was considered too firm (100% agreement), and lungs were undecided (Just right-50%, Too firm-50%). Consensus on breast, brain, heart, lymph nodes, nerves, spleen, thyroid, uterus, and vasculature "tissues" was not reached. Refinement and more data collection will follow and updated findings will be reported.

Conclusion: Preliminary results suggest liver, pancreas, spleen, and stomach samples are acceptable "as is", while colon and lung samples need slight density refinement. The samples for remaining four tissues need more development and follow-up with expert participants prior to use for biopsy training.
References available upon request
Full disclosures for all authors and coauthors available upon request

ASSESSING RESIDENT COMMUNICATION WITH FACULTY FROM MULTIPLE SPECIALTIES DURING HIGH-FIDELITY SIMULATION DESIGNED TO PROVIDE MULTI-SOURCE FEEDBACK

Michael Nguyen, MD,[1] Rebecca Dudley,[1] AS Nicole Elliott, BS, DO,[1] Bryan Kane,[2] Katie Best, BSN, MSN, RN, RN-BC, CEN, CPEN,[1] Matthew Nimmo, DO,[1] Matthew Cook,[1] Jennifer Macfarlan, BS, MPH,[1] Lisa Lindauer[3]
[1]Lehigh Valley Health Network, Macungie, PA, USA; [2]Lehigh Valley Health Network & U South Florida Morsani College of Medicine, Bethlehem, PA, USA; [3]First Health of Carolinas, Pinehurst, NC, USA

Introduction: Communication is critical in healthcare and affects patient safety, disposition and coordination of care. Although simulation has been tied to improvements in medical knowledge, procedural performance and education of residents, there has been relatively little data to establish how simulation can be used to assess communication skills of residents as it pertains to discussing with consulting and admitting physicians. The 5C's (Contact, Communicate, Core Question, Collaboration, Close the Loop) is a validated model of Emergency Medicine (EM) resident phone communication.1,2 This study seeks to assess the differences of 5C's based communication checklist scores between EM and

non-EM faculty embedded in a resident-led high-fidelity adult resuscitation multi-source feedback (MSF) simulation (sim) case.

Methods: This IRB approved, prospectively enrolled study of MSF and communication was conducted at a PGY 1-4 EM residency based at an independent academic medical center. The program trains 13 residents per year. PGY 2-4 EM residents were eligible to be enrolled to lead a multi-disciplinary team through a single adult sim case. The case required resuscitation of a high-fidelity adult simulator due to toxic ingestion. The team included a PGY 1, an EMT, and a nurse. This team, and 2 on-site EM attendings, provided MSF. Remote from the sim lab were both an EM Toxicologist (Tox) and Internal Medicine Critical Care (ICU) physicians. These faculty were contacted by phone during the case for consultation about management (Tox) and request for admission/transfer of care (ICU). The faculty completed a checklist of 12 objective behaviors based on the 5C's.2 Data were compared across faculty specialty and PGY year using Chi-Square, Fisher's Exact, and t-Test. Alpha was set to 0.05.

Results: Enrollment straddled two academic years. Of the four PGY classes eligible, 34 (22 male, 12 female) resident team leaders were enrolled. No resident identified their supervisor in any conversation. PGY year was rarely communicated (12.5% Tox, 6.5% ICU). Significant differences were noted for Core Questioning ($p<0.0001$ for both Need and Timeline) and one Loop Closure task (Reviews/Repeats $p<0.0001$). There were significant differences in the summative scores. The ICU rated the entire resident cohort as having completed significantly more communication tasks (10.0 +/- 0.4) than did Tox (6.9 +/- 0.9), $p<0.0001$. A significant difference was also seen between Tox and ICU within each PGY year ($p<0.0001$ except end PGY 1/beginning PGY 2 where $p=0.0016$). For ICU, completion of communication tasks increased with PGY year of experience. For Tox, the summative scores had a variable pattern by PGY year.

Conclusion: Using a previously validated framework,1,2 this single site study evaluated the ability to communicate on the phone while in the middle of a standardized high-fidelity resuscitation case in the sim lab. Completion of communication tasks during this internally developed simulation case varied significantly by attending specialty both for the entire cohort overall and for each PGY year. Significant differences were also seen in 2 of the 5C categories. These findings may be limited by the fact that the Tox phone call was placed first by the resident in the majority of cases. This study suggests that adding evaluation of phone communication to MSF appears feasible to measure in the sim lab and may provide valuable information to both residents and program leadership. As an example for this cohort, identification of supervising physician is an opportunity for improved communication.
References available upon request
Full disclosures for all authors and coauthors available upon request

ASSESSMENT OF JUST-IN-TIME TRAINING ON PROVIDER SELF-EFFICACY DURING THE COVID-19 PANDEMIC

Les R. Becker, PhD, CHSE, NREMTP[1]
[1]MedStar SiTEL, Washington, DC, USA

Introduction: The novel coronavirus (SARS-CoV-2, severe acute respiratory syndrome coronavirus) is a pandemic with more than 6 million confirmed cases worldwide and over 100,000 deaths in the US to date (7). The pandemic has overwhelmed hospital resources throughout the world. And, has been previously reported from both Italy (13) and Singapore (9), non-intensivists and support providers received training to treat COVID-19 patients. MedStar Health's Simulation Training and Education Lab (SiTEL) has launched a similar effort, utilizing their 'Mobile Sim'40-foot straight-truck simulation unit (8) to train acute care providers to augment ICU surge capacity (hereafter ICU Mobile Sim (IMS)). SiTEL's simulation team also supported orientation training in basic life-saving skills for personnel assigned to MedStar's Alternative Care Site (ACS) at the Washington Convention Center. We assessed the potential impact of these training activities on provider self-efficacy.

Methods: Perceived self-efficacy (SE) contributes to cognitive functioning through cognitive, motivational, affective and selective processes (2). The stronger the perceived SE, the higher the goal challenges people set for themselves and the firmer their commitment to them (3). We constructed retrospective pretest/post-tests (RPPs) following guidance (4) for design of traditional self-efficacy scales. RPPs present the learner with a single instrument at the close of the intervention and learners are asked to record judgments regarding their pre- and post-intervention states (12). Conventional pretest-posttests, requiring two delivery events, consume time that is better spent on program delivery (10). The study was determined to be exempt by MedStar's IRB. At each of the training events, participants were provided with an opportunity to complete an RPP. Analysis was conducted via within-subjects t-tests in SPSS v. 26. The Holm-Bonferroni correction was utilized to control error rates (1).

Results: 41/41 (100%) ACS and 11/15 (73%) IMS day 2 participants completed surveys. ACS learners reported significant pre/post gains in self-efficacy ratings in airway insertion [4.4 vs 8.9, Δ=4.5 (95%CI 3.4-5.7) $p<0.01$], BVM ventilation [6.3 vs 9.1, Δ =2.8 (95%CI 1.7-3.9) $p<0.01$], "analyze button" use [5.4 vs 9.3, Δ=3.9 (95%CI 2.9-4.9) $p<0.01$], delivering AED shock [6.8 vs 9.4, Δ=2.6 (95%CI 1.7-3.7) $p<0.01$], and Lucas® device use [2.2 vs 8.8, Δ=6.6 (95%CI 5.4-7.7) $p<0.01$] as did IMS learners in specifying initial ventilator settings [4.0 vs 8.2, Δ= 4.2 (95%CI 2.3-6.0) $p<0.008$], identifying PiP waveforms [4.6 vs 8.5, Δ=3.9 (95%CI 2.3-5.5) $p<0.007$], plateau pressures [5.1 vs 8.9, Δ=3.8 (95%CI 2.0-5.6) $p<0.008$] and ventilator complications [5.1 vs 9.1, Δ=4.0 (95%CI 2.6-5.3) $p<0.007$], resolving ventilator complications [4.6 vs 8.1, Δ= 3.5 (95%CI 2.1-5.0) $p<0.007$], obtaining consult [2.7 vs 9.1, Δ= 6.4 (95%CI 4.6-8.2) $p<0.007$] and intraosseous access [3.8 vs 8.5, Δ=4.7 (95%CI 3.1-6.4) $p<0.007$].

Conclusion: Our findings indicate that just-in-time training in healthcare skills can be effective in boosting providers' SE levels. Mavis (11) notes in a medical context that competent functioning in a in a particular situation requires the necessary knowledge and skills as well as personal beliefs of efficacy to meet the demands of a specific situation. Our just-in-time training boosted those beliefs. The skills training in our ACS orientation module is similar to elements of our successful First Fives hospital first-responder training where we have previously demonstrated increases in provider SE after First Fives training (5). Self-efficacy gains may be especially important in the COVID-19 pandemic context where health care roles are fluid and unpredictable (6, 9, 13).
References available upon request
Full disclosures for all authors and coauthors available upon request

BEING A HYBRID FOR A DAY; PHENOMENOLOGICAL ANALYSIS OF SIMULATED PATIENT'S EXPERIENCE.

Meghana Sudhir, MBA, MSN, RN, CHSE-A[1] Safeeja Rahuman, MBA[1]
[1]Mohammed Bin Rashid University of Medicine and Health Sciences, Dubai, Dubai, United Arab Emirates

Introduction: Medical students in year III are introduced to Hybrid Simulation for teaching male and female reproductive system examination. Hybrid simulation allows a better simulation experience for medical students during procedure skills learning, which is a demanding clinical skill where communication with patients is often neglected. However, there are not much literature in exploring the experience of simulated patients who are part of the whole experience as hybrid(1). This study explores the experience of simulated patients who were part of hybrid simulation experience at the University . Primary Research Question: As a simulated patient in a hybrid simulation, how do SPs describe their subjective lived experience? Secondary Research Questions • What practical insights can be gained from this experience? • How can these experience contribute to SP training in hybrid simulation? • Is there anything different, SPs want to do during the hybrid experience?

Methods: Qualitative Approach – Phenomenology In this study, the major data gathering method involves primarily in-depth interviews(2) . The purpose of a phenomenological interview is to describe the meaning of a phenomenon that several individuals share (3) Face to face interviews focused on simulated patient's experience were done. It was minimally structured to allow the information and themes to be as true as possible to their experience in accordance with phenomenological methodology(4). The questions were in depth addressing the participants' experience, feeling, emotions and belief. Duration varied based on the depth in which the SPs were discussing the topic. This ranged from 30 to 45 minutes. Nine SPs participated in this study. All of them were part of hybrid simulation session for reproductive system examination. They were selected randomly. All participants signed informed consent form before starting the study.

Results: Based on Hycner's (1999) explicitation process, Six themes were identified. The first theme was 'experience' where most of the SPs communicated their experience and felt it as unique. The next theme was feeling as 'extension of manikin' where they prepared themselves to feel like an extension. They had to put a conscious effort to focus and be attentive and feel or pretend the sensation like, touch, cold hands, pain, etc. The third theme was of 'emotions' where they conveyed their emotions during hybrid simulation. Some of them felt a bit awkward and some female SPs felt uncomfortable when male students were doing hybrid simulation. The fourth theme identified was 'communication' where they shared the communication with students. Next theme was 'repeating' where were willing to do again if needed. But they liked doing their regular SP sessions more comfortable than hybrid sessions. The last theme identified was about 'to do or see differently'. They shared suggestions regarding that.

Conclusion: SPs regularly contribute to communication skills training, physical examination training and various assessment. We recommend debriefing and deroling of SPs after every hybrid simulation session. Even though the procedure is done on a manikin, the experiences shared by the SPs reveal that there is emotional impact as well as feeling of awkwardness. The SPs had to deliberately put effort to make them feel as an extension of manikin. As hybrid simulation sessions were in areas involving intimate physical examination on simulators, some of the SPs felt unsafe being with opposite gender students. As SP trainers, it is our responsibility to provide proper pre briefing and ensuring a safe environment. The experiences shared by SPs are valuable for future SP training sessions. Orientation to environment, clear roles and responsibilities, sharing experiences of SPs, piloting etc will be useful. Feedback from SPs need to be incorporated and any changes required need to be adapted.
References available upon request
Full disclosures for all authors and coauthors available upon request

BLENDED LEARNING WAS INTEGRATED INTO THE CLINICAL SKILLS OF NURSES

Machiko Yagi, MSN, RN-BC, PHN[1]
[1]Jichi Medical University, Shimotsuke, Tochigi, Japan

Introduction: In the context of the diversification and increasing sophistication in healthcare, and the transition to home care in Japan, training has been under way to improve the clinical skills of nurses in physical examination, medical interviewing, clinical reasoning, and IPW to shift and share tasks. Among such training programs, the "specified medical acts training for nurses" was launched in 2015 (1). One training method to improve clinical skills is blended learning, where knowledge is acquired through e-learning, and simulation is used to integrate knowledge, skills, and attitudes. Blended learning has been shown to improve physical examination (2) and communication skills (3), but acquiring more integrated clinical skills has not been examined in relation to blended learning. Therefore, in this study, to test the hypothesis that blended learning improves the clinical skills of nurses, a blended learning program was designed and evaluated from multiple perspectives.

Methods: The study participants comprised a total of 188 nurses aged between 28 and 58 (145 females and 43 males), all of whom were working full-time as registered nurses and had joined the "specified medical acts training for nurses" program in A center. For the design of blended learning, we used the Five Specific Blended Learning Models by Bersin (4). A five-day blended-learning program was designed consisting of two days of e-learning, two days of simulation, and one day of OSCE to enable students to learn through e-learning as much as possible. The learning task was to acquire clinical skills and the target population was employed in this study. After blended learning, the participants joined bedside training for a week. The 10-item, 10-step self-evaluation and OSCE evaluations were used for the program evaluation. Self-evaluation was conducted before and after blended learning and after bedside training. The analysis was performed on SPSS with a paired t-test.

Results: In the OSCE evaluation using Mini-CEX by the supervising physicians, all 188 participants passed both after blended learning and bedside learning. A total of 178 participants responded to all three self-evaluations. In the self-evaluation, "Understand team medicine and medical ethics," "Understand the differences between the roles of nurses and doctors," and "Understand how to work with multiple occupations" scored more than 6.5 points from before the blended learning and tended to be higher than the other 7 items. Additionally, seven items other than "Understand team medicine and medical ethics," "Understand the differences between the roles of nurses and doctors," and "Understand how to work with multiple occupations" significantly increased their ratings by an average of 1 to 1.5 points after blended learning. Ratings for all 10 items were significantly increased by 0.8 to 1.5 points after bedside learning than after blended learning.

Conclusion: In this study, ability acquisition was assessed by Mini-CEX and self-evaluation. Although self-evaluation is unreliable as an outcome evaluation, it is important as a process of reflection, leading to metacognition by learners. Participants were able to perceive an improvement in their abilities in seven items through blended learning. Further, we found that more integrated tasks such as medical ethics, the difference in roles between doctors and nurses, and interprofessional work were self-evaluated highly before blended learning, and that they were aware of the improvement in their abilities through bedside learning rather than blended learning. This is because awareness of integrative issues is greater during normal working hours and a more authentic learning environment is necessary to become aware of ability acquisition. In order to promote learning by blended learning, it is necessary to design programs that seek to enhance authenticity and clarify the role of bedside learning.
References available upon request
Full disclosures for all authors and coauthors available upon request

BUILDING A CULTURE: IN SITU SIMULATIONS OPEN NEW FACILITIES

Lindsey Scott, MSN, RN, CNE,[1] Chris Mcclanahan, DNP, RN, CHSE,[2] Brandon Carreker,[1] Hai-Duong Tran, MSN, RN[1]
[1]Baylor, Scott, & White Health, Pflugerville, TX, USA; [2]St. David's School of Nursing at Texas State University, Austin, TX, USA

Introduction: Opening new healthcare facilities can be daunting due to challenges in systems processes, integration, environmental design and effectiveness. Interprofessional teams from every department participated in 14 different clinical simulations with the aims of: 1) identifying gaps in processes and systems, 2) determining issues in the physical environment hindering patient care, and 3) improving the confidence and competency of staff working in the new environment and in newly formed teams. The goal of building a Culture of Continuous Improvement was a priority for the leadership of each new facility (Hoeft & Pryor, 2010). A partnership with the healthcare system and a clinical simulation department of a major university was made through a Memorandum of Understanding to improve and develop the simulations, operationalize learning events, and evaluate outcomes. The healthcare system's Lean Management coaches assisted in project planning, management, and throughput of simulations.

Methods: Prior to the opening of three hospitals, each facility completed simulations in situ. All facilities opened in an 18 month period, allowing for rapid cycling changes in operational processes using the Plan-Do-Check-Act (PDCA) process. Staff members completed pre/post, facility designed surveys. Fourteen different simulations were developed using INACLS Standards of Best Practices (INACSL, 2016). Each scenario was designed to create collaboration or cause staff to access systems or processes in the environment. The electronic medical record team created charts to ensure simulations included documenting. Debriefing was conducted using Plus Delta debriefing model. A scribe in each debriefing captured outcomes and started the PDCA process to ensure root cause of issues were addressed and sustainable process solutions were implemented. Value-Stream Maps (VSM) were completed pre/post simulations. Standard workbooks were developed and revised as the new teams came together through simulation.

Results: A total of 280 participants were involved in the simulations across the three hospitals. Facilities 1 and 2 were used to validate processes and lead to the use of Project Management to coordinate the simulation activities. Facility 3 participants (n=106) were surveyed. Pre-survey (n=42) responses, based on 1-10 scale, for confidence level/or comfort with: 1) processes and workflow average score was 5.6, 2) ability to provide safe quality care in the new environment average 6.9, and 3) working with new peers and teams averaged 7.24. Post-survey responses (n=16) were obtained immediately after the event, with average scores of 6.6, 8.44 and 8.84. A follow-up survey was administered approximately 2 weeks after the simulation with n=25 response showing sustained improvement. During the final simulation debrief, a total of 343 comments and opportunities for improvement were collected from the staff. These led to 29 VSM changes from pre to post simulation.

Conclusion: The use of simulation prior to opening the new facilities has the capability to improve the staff members confidence in working with new team members, accessing systems and processes and providing safe, quality patient care. Creating a culture of continuous improvement and allowing staff the opportunity to practice patient care, access systems, and work in new teams can create excellence in patient care and lead to great outcomes. The project team needs to further evaluate if the identified gaps found during the simulations correlate to established successful throughput times, high HCAHPS and Press Ganey scores, and zero harm incident already established at the three new facilities. Further evaluation will also need to be completed to see if the culture remain sustained and if this model of simulation and process improvement will have replicated positive results as other new facilities are built.
References available upon request
Full disclosures for all authors and coauthors available upon request

COMPARING LEARNING OUTCOMES IN EMERGENCY MEDICINE AND PEDIATRIC EMERGENCY MEDICINE FACULTY AFTER SIMULATION

Christine Saracino, DO, FAAP,[1] Michele Fagan, MD,[1] Evan Mahl,[1] Annemarie Cardell, MD, CPhys,[2] Maria-Pamela Janairo, MD,[3] Nubaha Elahi, MD, MPH,[4] Amish Aghera, BS, MD, CHSE[1]
[1]Maimonides Medical Center, New York, NY, USA; [2]Maimonides, Brooklyn, NY, USA; [3]SUNY Downstate/Kings County Hospital Center, Sunnyside, NY, USA; [4]UCF/HCA Emergency Medicine Residency of Greater Orlando, Orlando, FL, USA

Introduction: Pediatric skills are a common focus for simulation-based training (SBT). Choosing appropriate learning objectives is critical in promoting positive learning outcomes. There are well-developed curricula that address appropriate needs in undergraduate and graduate medical education. For practicing physicians, there has been significant controversy in how to best guide lifelong learning – both for content and modality. Given the general success of SBT for a broad array of learners, it seems like it would also be an excellent platform for practicing physicians. However, there is a paucity of guidelines or curricula to help educators tailor content. Our objective was to explore the phenomena of learning outcomes in Emergency Medicine (EM) and Pediatric Emergency Medicine (PEM) Faculty after SBT, and also compare and contrast them as unique subsets of learners.

Methods: This was a qualitative study of EM and PEM faculty in an urban academic medical center. Groups of 3-5 faculty participated in 2 high fidelity scenarios in pairs or groups of 3. Two unique sessions were held. Session 1 focused on neonatal resuscitation and infant respiratory failure, while session 2 focused on head trauma secondary to non-accidental trauma (NAT) and neonatal shock secondary to congenital heart disease. Each scenario was debriefed by physicians with expertise in SBT. Following each session, faculty answered open-ended survey questions to describe action-oriented goals in neonatal care, infant airway management, general pediatric resuscitation, approach to pediatric head trauma, management of NAT, and approach to neonatal shock. Using a grounded theory approach, 3 study team members independently coded blinded responses to identify major themes (MT). They subsequently triangulated independently coded answers, while also looking for differences in EM and PEM responses.

Results: A total of 47 EM and 9 PEM faculty participated, with a subset of 19 participating in both sessions. 21 major themes (MT) were derived. MT related to neonatal care: Neonatal Resuscitation Program (NRP), checking glucose, beginning resuscitation with room air oxygen, calling for help early, and the importance of heart rate in assessing clinical status. MT for infant airway management: stepwise approach to escalating therapy. MT around general resuscitative skills: expanding pediatric knowledge, gaining more

procedural experience, accessible pediatric resources such as smartphone applications, more clinical experience, and more SIM. MT for pediatric head trauma: airway management, pharmacologic management of intracranial pressure, thorough physical exam, and considering NAT on a broad differential. MT for pediatric NAT: importance of thorough physical exam, calling child protective services, considering NAT as part of a broad differential, and remaining non-judgmental toward caregivers.

Conclusion: Both EM and PEM Faculty had numerous action oriented learning goals after SIM, with many overlapping themes. However, there were a few notable differences. EM Faculty focused more on general medical knowledge, whereas PEM Faculty wanted more procedural experience. No PEM stated a need to call for early help (in general or for specific support resources like child protective services), a need for immediately accessible knowledge resources like a smartphone app, or need to improve upon their physical exam. We actively used this data to help guide internal initiatives (e.g. more scenario based sessions for EM to support general knowledge and dedicated procedural based sessions for PEM). Codifying these needs are ultimately important, as practicing physicians are less likely to buy in to learning programs if they do not feel they are relevant. In general, we did find that Faculty enjoyed SBT as a learning modality, and were eager to return for additional sessions.
References available upon request
Full disclosures for all authors and coauthors available upon request

COST-EFFECTIVENESS OF A QUALITY IMPROVEMENT PROJECT REDUCING DOOR-TO-NEEDLE TIMES IN STROKE THROMBOLYSIS

Soffien Ajmi, MD[1] Hege Ersdal, MD, PhD[2]
[1]Stavanger University Hospital, Stavanger, Norway; [2]SAFER (Stavanger Foundation for Education and Research), Stavanger, Norway

Introduction: Stroke is the second leading cause of death and disability worldwide (1). Rapid revascularization in acute ischemic stroke is crucial to reduce the total burden of stroke including societal costs. A quality improvement project including protocol revision and simulation-based training was followed by a considerable reduction in median door-to-needle time (27 to 13 min) and improved patient outcomes in stroke thrombolysis after 13 months at our centre (2). In the present study, we aim to retrospectively determine the costs of implementing and maintaining the quality improvement project, including costs of simulation-based training, and relating the costs to the observed effects in a cost-effectiveness analysis. There are few reports that describe the costs involved in implementing and running a simulation-based training intervention as part of a quality improvement project. A formal cost-effectiveness analysis could assist decisionmakers to prioritize such projects.

Methods: Costs for implementing and maintaining quality improvement were assessed using recognized frameworks for cost reporting in quality improvement and simulation-based training. Effectiveness was calculated from previously published outcome measures (2). Cost-effectiveness was presented as annual costs per minute door-to-needle time reduction, and as costs per averted death in the 13-month post-intervention period. We projected future cost-effectiveness for a 5-year period. Costs were calculated including and excluding costs of donated time.

Results: We observed a mean reduction in door-to-needle time of 13.1 min per patient and 6,36 averted deaths annually. All costs, including fixed costs for implementing the quality improvement project totalled 40 086 €, while costs for maintaining quality improvement were 1916 € per month. The estimated costs per minute reduction in door-to-needle time ranged from 12-26 € across different scenarios, and the estimated costs per averted death ranged from 4439-9433 €. In the 5-year future cost-effectiveness projection, estimated costs per minute averted in the fifth year was 3 €, while costs per death averted was 1 017 € excluding costs of donated time.

Conclusion: Economic consequences of quality improvement projects including simulation-based training interventions are rarely reported. We have shown that a QI project including in-situ-simulation based training sessions can be implemented and maintained at a relatively low cost with increasing cost-effectiveness over time. The presented cost-effectiveness data might help guide decisionmakers planning similar interventions.
References available upon request
Full disclosures for all authors and coauthors available upon request

CPR FEEDBACK – YOU BETTER KNOW YOUR COACH

Jutta Novalija, MD, PhD, CHSE,[1] Tina Smith, BSN, MS, RN, BC, CHSE,[2] Jean Borck, BSN, MSN, RN,[2] Michelle Matheny, BSN, MSN, RN, CHSE[3]
[1]Milwaukee VA Medical Center, MCW, Milwaukee, WI, USA; [2]Zablocki VA Medical Center, Milwaukee, WI, USA; [3]Clement J. Zablocki VA Medical Center, Oconomowoc, WI, USA

Introduction: The American Heart Association (AHA) Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care identify high-quality cardiopulmonary resuscitation (CPR) as the primary component in influencing survival from cardiac arrest(1). Nowadays manikins are capable of providing real time feedback on rate and depth of compression, as well as other markers of quality CPR. Also, some newer medical devices, commonly used during resuscitation, can give visual feedback and provide verbal coaching to the code team to help improve the quality of chest compressions during a code(2). To encourage deliberate practice, simulation equipment is frequently used to offer immediate feedback on the quality of chest compressions and ventilation(3). These various devices use different mechanisms to measure the effectiveness of chest compressions. We compared the feedback from commonly used medical equipment using internal and external methods to determine quality of CPR on manikins.

Methods: Compressions were performed by certified BLS or ACLS instructors, who were giving chest compressions to AHA recommended depths at 2 and 2.5 inches for 30 second time periods. We compared depth of compression determined by external accelerometer measurement (Real CPR Help, ZOLL® R series® defibrillator) to the CPR feedback from a high fidelity manikin (QCPR, SimMan 3G, Laerdal, Stavanger, Norway) and a moderate fidelity manikin (voice activated manikin (VAM) Laerdal, Stavenger, Norway) using their internal method to measure depth of compressions. To eliminate human error we also compared the feedback from the external and internal measurement methods using an automatic CPR device (LUCAS®2 Physio Control, Redmont, WA).

Results: Data was analyzed using a two tailed t-test for comparison. There was a significant difference comparing the feedback from all of the devices tested in this study. The depth measured by the voice activated manikin (average 40.7 mm, SD 4.7) was significantly higher than results for the high fidelity manikin (30.7mm, SD 1.7, $p<0.05$), which share the same manufacturer, but slightly different internal mechanism. Using the automatic CPR device, the feedback from the defibrillator using external measurement methods was significantly higher (75.3mm, SD 0.9) than the depth measured by internal methods within the manikin torso (59.3mm, SD 0.5, $p<0.05$).

Conclusion: More and more medical devices and simulation training equipment are capable to provide important feedback about quality of chest compressions in real time and immediately after a code (mock or real). However, the methods used to measure the quality of compressions are highly variable and the limitations of the various methods have to be understood. We found that the manikins used for practice of basic life support skills provide significantly different haptic and quality feedback than equipment used during mock code drills and real codes. This might lead to overestimating the quality of compressions in certain clinical environments. In the worst case, this can give a false sense of accuracy and lead to reduced quality of care.
References available upon request
Full disclosures for all authors and coauthors available upon request

CRITICAL CARE EDUCATION AND SKILLS VALIDATION COURSE FOR INTERNAL MEDICINE PHYSICIANS IN THE MILITARY

Lauren Sattler, MD,[1] John Hunninghake, MD, FACP,[1] Tyson Sjulin, DO,[1] Robert Walter, MD[1]
[1]Brooke Army Medical Center, San Antonio, TX, USA

Introduction: Military internal medicine (IM) specialists and subspecialists must be prepared to function in both traditional inpatient and outpatient settings, as well as manage a wide spectrum of medical and surgical conditions in the deployed setting, ranging from a common upper respiratory infection to complex polytrauma.[1] Military IM physicians are expected to manage critically ill medical and surgical patients as part of multidisciplinary trauma teams, as well as during medical air evacuation.[2-3] This high-paced and stressful atmosphere requires adequate crisis resource management, which is a core tenant of high fidelity simulation training.[4] We hypothesized that a significant portion of military IM physicians would not have had adequate training or experience in the critical care skills necessary to perform these duties and would therefore improve significantly through a standardized education and validation course.

Methods: In accordance with the Army's Individual Critical Task List (ICTL)5 and the Air Force's Comprehensive Medical Readiness Program (CMRP),[6] the Army/Air Force Internal Medicine Education and Skills Validation Course was developed to provide essential training in critical care procedures and knowledge to active duty military IM specialist and subspecialist physicians. After three courses, over 60 attending physicians were educated via hands-on instruction and demonstration, followed by skills validation via high fidelity simulation. Educational objectives included, but were not limited to, central and arterial line placement, eFAST ultrasound exam, airway management and endotracheal intubation, chest tube thoracostomy, and mechanical ventilation. The course was conducted in a 4-1 faculty-to-learner model with a small group round-robin platform in order to optimally facilitate feedback and repetition necessary for deliberate practice.[7]

Results: On average, participants had been practicing medicine for 3 to 4 years and had never deployed. Most participants reported that they did not meet the ICTL or CMRP requirements and had not performed the required procedures on a human patient in the previous 5 years. Almost 90% of participants had not performed the majority of these procedures at all in the previous 12 months. After completion of the course, all participants successfully obtained rigorous validation in all the required procedures. Based on survey data, they expressed a significant improvement in overall skill confidence, with 100% of

participants indicating improvement in their ability to function independently as deployed medical officers.

Conclusion: This course successfully met its intent to educate and validate essential clinical skills that are critical to the deployed environment. Prior to the course, the majority of participants had not recently performed the required procedures and did not feel confident in their procedural abilities. Upon course completion, however, participants had validated all critical care skills through high fidelity simulation and felt confident in their ability to apply these skills in the deployed environment. Due to the success of this course, it is now a fundamental part of an annual requirement for active duty staff IM specialists and subspecialists.
References available upon request
Full disclosures for all authors and coauthors available upon request

CROWDSOURCING AUTHORING FOR HEALTHCARE COMPETENCE ASSESSEMT TOOL

Thomas Che-Wei Lin, MD, PhD[1]
[1]Taipei Medical University CEMS, Taipei, Taiwan, Taiwan

Introduction: The current OSCE development method is complex and costly, and many institutions lack human and financial resources to develop high-quality assessments. Crowdsource authoring has been highly successful in both the medical field and non-medical field. The aim of this project was to create a platform in which experts from around the world can easily interact and exchange materials, ideas and opinions related to competency assessment tool development. The Crowdsource Authoring Assessment Tool (CAAT) is an online collaboration system that allows the creation and sharing of assessment tools that can be easily edited and customized to match local needs and conditions. This research project analyzed data collected from recognized international experts in the field of competency assessment after participating in the CAAT system beta test.

Methods: Fifty experts were asked to edit a urinary catheterization checklist using CAAT online system, after which participants completed a Technology Acceptance Model (TAM) questionnaire. The scale consisted of 14 items evaluating four domains of TAM. The results were analyzed using descriptive statistics for background information, and inferential statistics for hypothesis testing. This study conducted an independent sample t-test, Pearson correlation, one-sample t-test, and dependent sample t-test according to the hypotheses.

Results: This study found positive feedback about CAAT acceptance from experts. The results demonstrated experts with less experience were significantly spent less time. They also scored higher in the intention to use the CAAT in the future. The median time for developing a new checklist by using the CAAT was 65.76 minutes while the traditional method was reported at 167.90 minutes. Experts expressed positive feelings towards crowdsourced authoring. Respondents expressed they were inclined to share checklists and would like contributors to be acknowledged for their contributions, and also agreed that the CAAT could potentially change practices in checklist development. 96% of participants indicated they were willing to recommend CAAT to others.

Conclusion: In this study, the CAAT was evaluated and accepted by experts to be used in designing a medical competence assessment tool. The CAAT system represents a first step in the concept of online communities for assessment development, through a simple yet effective method that allows collaboration regardless of geographical location and local institutional development. The future of assessment lies in the collaboration of experts free from the barriers of geography, finances and time constraints, the CAAT takes steps towards promoting this future through the power of the crowdsource authoring.
References available upon request
Full disclosures for all authors and coauthors available upon request

CUMULATIVE EFFECT OF LONG TERM TRAUMA TRAINING ON TEAM SKILLS

Safinaz Alshiakh, MD[1] Claudia Ranniger, MD, PhD, CHSE[2]
[1]King Abdul Aziz University, Washington, DC, USA; [2]George Washington University, Washington, DC, USA

Introduction: Hypothesis/Research Question Most published trauma simulation outcomes span training periods of 1-2 years (1-3). These data focus on current team performance, but may not address long term changes in trauma team norms that arise from repeated training and trauma education. Although personnel turnover can decrease team performance, literature from the business and engineering domains suggests that integration of novice individuals into functioning teams (5), and presence of mentors with strong teamwork skills (4), help new members learn teaming. Thus, sustained team training may have benefits to team performance that counterbalance turnover. GWU has supported monthly interdisciplinary, multispecialty, in-situ trauma simulations since 2011, over several epochs of resident and trauma nurse participants. We hypothesize that there is a long term, cumulative, net positive effect of sustained trauma training on team performance despite regular team member turnover.

Methods: Methods After obtaining IRB approval, we reviewed existing trauma simulation videos from 2011-2019. A checklist for primary and secondary survey items was developed from ATLS guidelines (6). Items were evaluated as fully completed (2 points) partially completed or delayed (1 pt), and not completed (0 pt), with maximum scores of 18 for the primary survey and 28 for the secondary survey. A validated 11-item trauma teamwork scale (7) was used to assess team skills, and a global team performance score (range 1-10) assigned. Two reviewers, both Emergency Medicine physicians, evaluated the videos. Two videos were reviewed together to establish checklist norms, and an additional 5 were reviewed independently to establish interrater reliability. The remaining videos were evaluated by one of the reviewers. Overall scores for primary and secondary survey, team skills, and global performance were averaged by academic year, and a 1 sided t-test ($p<0.05$) applied.

Results: Results 48 videos spanning 2011-2019 were reviewed. On average, 5.2 videos were available for each academic year (range 2-11). Scores for the videos graded by both reviewers demonstrated high interrater agreement. Scores for completion of primary (88%, stdev 4%) and secondary (89%, stdev 5%) surveys did not vary significantly over academic years. Overall team skills scores averaged 91% over all years (range 81-97%), and global ratings averaged 7.9 (range 6.5-9.0). Statistically significant differences ($p<0.05$) in global rating were noted between 2019 and 4 previous years (2011, 2012, 2014, and 2015), and between 2018 and 2016 and 2 previous years (2011, 2014). Likewise, statistically significant differences in teamwork skills scores were noted between 2019 and 2018, when compared to 2011 and 2012. Trends towards improvement were noted in the teamwork, communication, and task management items of the teamwork skills scale.

Conclusion: Conclusion We demonstrate that trauma team performance in the in-situ simulation environment improves cumulatively when sustained over several years, despite frequent team member turnover. Since new trauma members join the team every 2-3 months in different roles, a reset to the initial performance baseline would be expected as more experienced members are replaced. A possible explanation for the positive teamwork and performance trends is that the presence of existing team norms and experienced team mentors help new members rapidly acquire team skills, both in the simulation and clinical environment.
References available upon request
Full disclosures for all authors and coauthors available upon request

CYBERSICKNESS SYMPTOM PROFILES IN LONG-DURATION IMMERSIVE AR

Claire Hughes,[1] Cali Fidopiastis, BA, BS, MA, PhD,[1] Kay Stanney, BS, MS, PhD,[1] Peyton Bailey[1]
[1]Design Interactive, Orlando, FL, USA

Introduction: Cybersickness resulting from use of virtual reality (VR) devices has been studied for decades. Using the Simulator Sickness Questionnaire (SSQ),(2) the typical VR symptom profile has been well-characterized; typically greater disorientation (D), then nausea (N), and little oculomotor disturbances (O), a D>N>O profile(1,3,5). However, the same cannot be said for augmented reality (AR) systems. Many assume that since AR is not fully immersive with intense visual-vestibular mismatches, its capacity for causing adverse physiological symptoms is reduced. If AR technology does indeed impose substantial maladaptations, this could present safety risks post exposure. It is thus critical to assess the physiological impact of AR exposure and its implications on military medical simulation safety and efficacy. It is hypothesized that AR systems will lead to a symptom profile of O>D>N, with low levels of nausea allowing for longer exposure duration but with the potential for prolonged aftereffects.

Methods: A total of 48 participants (mean age=25.45 [SD=7.36] 19 females and 29 males) participated in the study. The experiment was a mixed design, with 2 (display types) × 2 (exposure protocol) between factors and a 5 (post exposure measurement time) within factor. The display types were HoloLens (n=24) and Magic Leap (n=24). The exposure protocols were either three (3) 40-min sessions or six (6) 20-min sessions, both with 30-min breaks between sessions. The post exposure measurement times were 0, 15, 30, 45, and 60 min post exposure, with the SSQ being measured at each time. Military medical focused content was developed using Unity game engine. Four 20-min AR scenarios were developed, two focused on treating a massive hemorrhage and the others focused on treating respiration failure due to tension pneumothorax.

Results: Previous VR research has shown that medium to high intensity SSQ scores (the 50th or higher percentile, with a Total SSQ score of 20 or higher) suggest significant cybersickness is being experienced.(4) Total SSQ scores for the Magic Leap did not exceed 20 for any of the post exposure measurement time periods. In comparison, total SSQ scores remained approximately 20 for each of the post exposure periods for the HoloLens. Preliminary analyses using nonparametric Friedman Test showed that there was a significant difference in Total SSQ score compared to baseline only for the HoloLens in the

3-40min protocol X2r(5) = 38.99, p = .001. As expected, both AR HWDs followed an O>D>N SSQ symptom profile. A one-way ANOVA, F(1,100) = 3.90, p = .05 showed that the HoloLens Oculomotor SSQ scores were significantly higher than those for the Magic Leap, suggesting higher levels of eyestrain, headaches, visual fatigue, and blurred vision are associated with the HoloLens.

Conclusion: Immersive AR medical training solutions hold promise to accelerate training expertise given the capability to present battlefield conditions in a more realistic, embodied, and contextualized manner. Understanding the potential for cybersickness and associated symptom profiles can assist in the design of optimal AR training protocols. This study confirmed an O>D>N SSQ symptom profile for both AR display types. In the HoloLens, high levels of oculomotor symptoms were sustained 60 min post exposure for 40 min exposure durations. Thus, this preliminary research suggests that time within AR training systems may best be kept to 20-30 min, with breaks of at least 30 min between sessions to minimize prolonged adverse visual aftereffects. It seems that even though the symptom profile for AR is loaded on oculomotor symptoms, which are less incapacitating than the nausea symptoms associated with VR systems, the adverse symptoms can linger for long periods of time post AR exposure, just as in VR.
References available upon request
Full disclosures for all authors and coauthors available upon request

DEPLOYED IN SITU SIMULATION: READY FOR REBOA?

Kyle Couperus, BN, MD[1]
[1]Madigan Army Medical Center, Olympia, WA, USA

Introduction: We present a project evaluating in situ readiness for REBOA (Resuscitative Endovascular Balloon Occlusion of the Aorta) placement and monitoring at four U.S. Military medical treatment locations in the Iraq and Kuwait during the spring of 2019. We hypothesized there would be a support staff training gap and equipment limitations. We completed site evaluations, focus group discussions, and integrated a REBOA simulation curriculum in a mature combat theater.

Methods: We completed four site evaluations (3 in Iraq, 1 in Kuwait) during the spring of 2019. These included two Role 2s (one was collocated with a German FST, and another a Danish FST), one role three in Iraq, and one role three in Kuwait. Data was collected through individual site visits, equipment inspection (evaluating trauma bays and equipment storage locations), focus group discussion with local physician/nurse/medic/supply personnel, audience polling, and pre-post tests before and after the training. a lecture-simulation curriculum was presented for physicians and support staff. The curriculum involved 1.5 hours of lecture describing pathophysiology, indications, contraindications, complications, management, transport considerations, and discontinuation of REBOA. It was followed by a hands-on simulation segment with two simulated cases (Zone 1 and Zone 3), that required the team to correctly select a zone, deploy, and monitor a REBOA catheter in a pressured simulation model.

Results: All four sites had the minimum training and equipment requirements (one trained provider, and a REBOA device plus introducer catheter) to complete the procedure, all though one site did have the introducer located in an outside overflow storage facility. None of the sites had all the equipment for best-case use and deployment. Each site had training limitations in primary, support, and transport personnel. There were noted training limitations in support staff roles (nurses/medics). We do note several of these skills are not in traditional training for these groups, and all individuals present were very enthusiastic to learn about this intervention. Of the individuals surveyed, very few nurses/medics felt they could assist with REBOA placement, or set up, and use an arterial pressure monitoring system/device. Our training curriculum was implemented for 98 individuals with most indicating it was a useful course.

Conclusion: All four sites were capable (based on training and equipment) to deploy a REBOA catheter. However, we did note several potential areas for improvement. These include additional training for support personnel (medics, nurses, transport teams), and better equipment tracking. We also recommend in situ training with deployed teams (perhaps coordinated by the role 3) when in mature theaters. There were several limitations to this study, most notably that all data was obtained from individuals who sought out the training. We did try to account for this through discussions with on-site leadership teams, but we may have missed additional providers/support staff who may have had formal training. In conclusion, based on this in theater site evaluation, we are very optimistic this life-saving capability is slowly becoming more readily available, and we propose further efforts could include in situ team training and in-theater supply optimization.
References available upon request
Full disclosures for all authors and coauthors available upon request

DESIGN, BUILD AND EVALUATION OF A LOW COST, PANDEMIC VENTILATOR USING SIMULATION AND NON-VENTILATOR SUPPLY CHAIN PARTS

Samsun Lampotang, PhD,[1] Anthony DeStephens, MS,[1] William Johnson[1]
[1]University of Florida, Gainesville, FL, USA

Introduction: Simulation played a behind-the-scenes role in rapid design, build, evaluate cycles of Emergency Use Ventilators (EUV) for the COVID-19 pandemic and to receive Emergency Use Authorization (EUA) from the Food & Drug Administration. EUV teams worldwide1 encountered: (1) traditional parts in the ventilator supply chain for building ventilators had become unavailable, (2) transportation had become disrupted with some countries in total lockdown and (3) lung simulators essential to ventilator design and development and safety and performance validation for regulatory authorization were difficult to find. As a simulation center with lung simulators, patient simulators and simulation engineers experienced in designing and building simulators to meet training gaps, the Center for Safety, Simulation & Advanced Learning Technologies embarked on the research question of whether a safe EUV could be mass produced in 100,000s for $300 in spite of disruption of the global ventilator supply chain.

Methods: We designed and built our PanVentTM ventilator with equivalent, readily available, non-ventilator parts, like solenoid-controlled sprinkler valves for flow control of high pressure gas, water pipes and Arduino microcontroller boards. We made the project open source project that volunteers could contribute and benefit worldwide. The open architecture variant (PanVentTM-OS) can be localized to use equivalent, locally available parts or modules. We used lung models (Michigan Instruments TTL 1600) with variable compliance (C), airway resistance (R) for simulating the lungs of a COVID-19 patient as information became available and to test features we added specifically for COVID-19 patients like Positive End Expiratory Pressure (PEEP) and an inspiratory pause and to evaluate ISO 80601-2-80 ventilator performance. We also used the Human Patient Simulator, instead of animals, to verify gas exchange, specifically how capnography would work with the PanVentTM.

Results: PanVentTM provides time cycled, volume controlled, pressure limited, continuous mandatory ventilation with assist control with active PEEP and inspiratory pause (25% of inspiratory time). The PanVentTM flow diagram is in Fig. 1. Cost of goods is $301. Assembly time is ≤4 person hours. A PanVentTM has ventilated a test lung continuously ≥ 8 weeks at the time of writing. Fig. 2 displays flow and pressure plots using a test lung set at C = 0.1 l/cm H2O, R = 20 cm H2O/l/s. We disseminated build instructions, bill of materials, software at https://simulation.health.ufl.edu/technology-development/open-source-ventilator-project/ and GitHub https://github.com/CSSALTlab/Open_Source_Ventilator. At the time of writing, we are seeking Emergency Use Authorization from the FDA for PanVentTM, the fixed-design (non-open source) variant. While helping countries outside the US build local versions of the PanVentTM-OS, testing of the local ventilators proved difficult without mechanical lung models.

Conclusion: We built a low cost ($301) and scalable (≤ 4 hours assembly time without special tooling or assembly lines from widely available parts) Emergency Use Ventilator. Simulation was an essential part in completing the design, build and validation for regulatory authorization at our simulation center in less than 2 months. For some countries outside the US, lack of access to lung simulators proved to be more of an impediment to building and testing an open-source EUV that can be localized with local parts, than access to ventilator parts. Testing of Emergency Use Ventilators to ensure they are safe in design and also in manufacture is an essential contribution of simulation. For the current and future pandemics, one way to help low resource countries is to create open source lung models2 that can be used for ventilator testing.
References available upon request
Full disclosures for all authors and coauthors available upon request

DEVELOPING ALGORITHMS OF NURSING CARE FOR HOSPITALIZED ADULTS WITH AUTISM SPECTRUM DISORDER USING STANDARDIZED PATIENT SIMULATION

Linda Wilson, PhD, RN, ANEF, BC, CAPA, CHSE-A, CNE, CPAN, FAAN,[1] Ellen Giarelli, EdD, RN,[1] Kathleen Fisher[1]
[1]Drexel University, Philadelphia, PA, USA

Introduction: Can an algorithm for the care of the patient with autism be developed and tested using standardized patient simulation? Will the development of an algorithm for the care of the person with autism improve the care for this patient in the hospital setting?

Methods: In phase one the SP portrayed patients with high functioning & low functioning Autism Spectrum Disorder (ASD) in three scenarios: 1) Admit to the room; 2) Orient to the room; and 3) Assessment, vital signs. A panel of experts critiqued the content and process of the six therapeutic encounters using a checklist. The experts constructed the interventions by integrating observed ASD core characteristics and associated features with the steps for each skill. In phase two algorithms were piloted with nurses using simulation. Intervention and control groups were compared for completion of steps, completion time, ease of use, and satisfaction with outcomes. The investigators examined the content of nurses' notes and debriefings for evidence of consideration of behavioral issues. Data included videotaped encounters, nurses' notes, questionnaires and interviews and measure of efficiency and completeness. Video data was analyzed thematically and survey data analyzed statistically for each skill.

Results: Two algorithms for the care of the patient with ASD were developed, implemented and analyzed: 1) Admit and Orient to the Room; and 2) Assessment and Vital

signs. The intervention group that used the algorithms to guide their care of the patient in the simulation: 1) completed more of the required tasks during the interaction; 2) provided a more quality interaction with the person with ASD; and 3) expressed more satisfaction with the interaction.

Conclusion: Standardized patient simulation was an effective method for the development of algorithms to guide the care of the patient with ASD. Future considerations for research include: 1) development of additional algorithms for different situations for the person with ASD; and 2) development of algorithms for patient care for other populations that are challenging for nurses.
References available upon request
Full disclosures for all authors and coauthors available upon request

DEVELOPMENT AND IMPLEMENTATION OF A PHARMACY STUDENT MEDICATION ORDER VERIFICATION SIMULATION

Theresa El-Murr,[1] Emily Green, PharmD,[1] Shelley Carruba, PharmD,[1] Jonathan Fowler, MPH, PharmD, RPh[1]
[1]UAB Hospital, Bessemer, AL, USA

Introduction: Pharmacy students spend three years of training in a didactic classroom setting before entering advanced pharmacy practice experiences (APPE) under the supervision of licensed pharmacists during the fourth year of pharmacy school. Pharmacy students have limited exposure to an electronic health record (EHR) prior to APPE rotations. Baseline knowledge of navigating an EHR, and the information obtained, is important knowledge for all pharmacy students in order to evaluate a patient's chart and collect information on which to provide evidence-based care. Therefore, exposure to a hospital based EHR, specifically in a simulated environment, provides students with the ability to practice navigating and collecting health information on which to provide evidence-based, patient-centered care. The purpose of this research was to design and implement a pharmacy medication order verification simulation for fourth year pharmacy students and to assess the impact of simulation on student confidence.

Methods: Eligible participants in the simulation were students > 18 years old completing their APPE rotation at UAB Hospital between October 2019 and February 2020. The simulations occurred on weeks three and five of each APPE rotation with the simulation case in week five increasing in degree of complexity. Simulated patient electronic health records (EHRs) were built in the training domain of Cerner®, with each participant assigned his or her own patient chart to review and take action on medication orders. The student simulation activity consisted of prebriefing, completion of the simulation case, and debriefing. A Likert scale survey was administered before and after the simulation activity to assess the impact of the simulation on the confidence levels of those who participated.

Results: We found a statistically significant difference between the pre- and post- simulation surveys on student confidence in using an EHR to detect drug therapy problems and to verify or reject an order in the simulation environment. Other statistically significant survey questions showed an increased interest in institutional pharmacy practice and in incorporating simulation into APPE curriculum to enhance learning. Overall, 89.7% of student participants strongly agreed that the simulation was a worthwhile learning experience.

Conclusion: Our research demonstrated that incorporating a pharmacy medication order verification simulation increased student confidence in evaluating medication orders and using an EHR. Furthermore, students' perceptions of institutional pharmacy practice and their confidence to assess and critically evaluate medication orders improved. Our experience with incorporating this simulation into APPE course activity demonstrated value by providing students with an opportunity to practice essential pharmacist duties while practicing in a safe and simulated environment. Furthermore, incorporating this simulated activity into the training of new residents, new pharmacist hires, and creating an interprofessional activity with multiple disciplines alongside pharmacy will give students further simulated experience with working in the healthcare team in a safe environment.
References available upon request
Full disclosures for all authors and coauthors available upon request

DEVELOPMENT OF A MULTI-STEP SIMULATION FOR IMPROVED COMMUNICATION IN A CARDIAC CATHETERIZATION LAB

Julie Hartman, BS, MS, Other,[1] John Keech, MD,[1] Dyan Anderson, BSN, Other, RN[2]
[1]University of Iowa, Iowa City, IA, USA; [2]University of Iowa Hospitals and Clinics, Iowa City, IA, USA

Introduction: The cardiac catheterization lab (cath lab) is a dynamic environment where the efficient delivery of critical, life-saving interventions is essential for maintaining high quality care. Effective communication between personnel who work in the cath lab, as well as those transporting patients to the lab, is crucial to patient safety. A needs assessment by cath lab leadership identified specific clinical scenarios where the safe delivery of care was at-risk due to ineffective communication. The aim of this project was to develop a simulation to improve communication between cath lab team members in high-risk, low-resource situations.

Methods: After review of a root cause analysis, several opportunities for improved communication in the cath lab were examined. A needs assessment was conducted with experts from the quality and safety team, simulation center, and cath lab. After the initial discussion of which simulation scenarios should be included, additional team members provided input to add details and highlight training opportunities. Participants were given a retrospective pre-post evaluation to assess their confidence in the goals of the simulation.

Results: A simulation was developed with 3 contiguous scenarios to highlight team communication and role assignment during high-risk, low-resource situations. The simulation involves one patient's arrival to the cath lab with communication scenarios involving an ideal sign off from the transport team, cath lab team response to patient coding, and cath lab team response to not having proper equipment. After a predetermined time and or specific goal has been reached in each scenario the simulation will pause and allow for immediate debriefing. An overall debriefing was held at the completion of the entire simulation. Participants were given a retrospective pre-post evaluation to assess their confidence in the goals of the simulation. For each question the difference in confidence (post minus pre) was calculated for each participant. A statistically significant increase in confidence was measured by each question.

Conclusion: Based upon feedback from learners and facilitators, we showed a statistically significant increase in knowledge and skill confidence for course participants. Annual simulations with the cath lab team to highlight additional skills were discussed with cath lab leadership. Some of the lessons learned from participants were: Team members are required to take multiple roles/switch roles as needed when staffing is short. Clear communication prevents two people from taking the same role. Code Blue workflow is best when the Code Leader is loud and gives clear directions.
References available upon request
Full disclosures for all authors and coauthors available upon request

DEVELOPMENT OF A NOVEL CLINICAL DEBRIEFING TOOL TO PROMOTE TEAM LEARNING AND PROCESS IMPROVEMENT DURING THE COVID-19 PANDEMIC

Thomas Welch-Horan, MD, FAAP,[1] Cara Doughty, MD, MEd, FAAP,[2] Daniel Lemke, MD, CHSE,[3] Cassidy Penn, MEd,[4] Julia Lawrence, BS, MS, RRT, RRT-NPS,[4] Royanne Lichliter, BSN, MSN, RN, CPN[4]
[1]Texas Children's Hospital / Baylor College of Medicine, Houston, TX, USA; [2]Baylor College of Medicine, Houston, TX, USA; [3]Baylor College of Medicine/Texas Children's Hospital, Houston, TX, USA; [4]Texas Children's Hospital, Houston, TX, USA

Introduction: The COVID-19 pandemic has created many challenges for teams across a variety of healthcare environments. Shifting clinical guidelines and safety protocols have provided opportunities for rapid-cycle process change and the evolution of new communication strategies. Opportunities for discovery during a crisis create an urgent need to gather and disseminate information to improve patient care and keep providers safe. To help healthcare workers and their leaders seek information about the proper use of personal protective equipment (PPE), teamwork, medical management and crisis resource management for COVID-19 events, we created Debriefing in Suspected COVid-19 to Encourage Reflection & Team Learning (DISCOVER-TooL). This novel tool allows teams to reflect on high-risk events, and identify safety threats and potential solutions that can be shared with leadership and with other teams across the hospital or health system.

Methods: DISCOVER-TooL was adapted from the prior DISCERN tool, and was designed to address safety threats related to COVID-19. Both tools assist teams during self-guided debriefing after a clinical event. DISCOVER-TooL provides advice for briefing the team about of the tool, how to have a safe discussion on what went well in the care of the patient, and to identify opportunities for improvement. Specific categories to guide the discussion include logistics (e.g. patient flow, use of PPE), communication team roles and responsibilities (leadership, followership, role clarity), and medical management (e.g. treatment of respiratory distress or shock). The prompts on the DISCOVER-TooL direct teams to identify potential solutions for challenges they have encountered during patient care. An intraprofessional team was assembled to review each form that was submitted, and to categorize and follow up on safety concerns and suggestions for process improvement.

Results: The DISCOVER-TooL became available for clinical event debriefing on March 31, 2020. Since that time, 27 debrief forms have been submitted from 9 service areas across the Texas Children's Hospital system. Based on the data collected, themes were identified and categorized. These included the role of SARS-CoV-2 testing and timing of results; changes in resuscitation team roles due to COVID-19 infection concerns, and limiting staff in the patient room; availability and correct use of PPE; communication challenges due to PPE and having fewer team members in the room; unique considerations for specialized support such as ECMO; and issues related to end-of-life care for a suspected or confirmed case of COVID-19.

Conclusion: Structured event debriefings using communication enhancement methods such as DISCOVER-TooL and enacting principles of psychological safety are becoming crucial to organizational learning in healthcare environments where teams are subject to rapidly changing and evolving care processes because of COVID-19 and other emerging threats. DISCOVER-TooL can be adapted to varying healthcare contexts, and provides an avenue for information sharing between disciplines and across a spectrum of clinical settings in order to enhance teamwork and improve patient safety.
References available upon request
Full disclosures for all authors and coauthors available upon request

DEVELOPMENT OF A NOVEL MIXED REALITY CHEST TUBE THORACOSTOMY SIMULATOR

Samsun Lampotang, PhD,[1] Anthony DeStephens, MS,[1] William Johnson[1]
[1]University of Florida, Gainesville, FL, USA

Introduction: Chest tube thoracostomy is an emergent and life saving procedure used to drain excess fluid or air build up from around the lungs. Serious and life threating complications can occur when performing this procedure due to poor knowledge and technique. Simulation is an effective tool that can be used to bridge gaps in knowledge and technique for chest tube thoracostomy. Many commercially available chest tube thoracostomy exist, however often lack realistic feel and require an expert to be present to instruct and debrief learners. To address these needs, we have built a self instructing, self debriefing mixed reality simulator for chest tube thoracostomy.

Methods: Our system is composed of both physical and virtual components. The physical model consists of a skin shell, ribcage, lung, parietal pleura, and a molded trilayer and durometer muscle/subcutaneous tissue/skin insert. The virtual model is collocated to the physical model and contains virtual representations of all the physical components plus the intercostal nerve bundles and heart. Additionally, our system provides the ability to track the 3-dimensional positions of the learner's "feeler finger", Kelly clamp, and chest tube. At the end of the simulation, the system generates a simulated chest x-ray for the learner to see the final placement of their chest tube. The system also has an automated checklist algorithm that provides learners feedback on what steps they performed correctly. Learners can use the replay feature to watch a video of their performance in the virtual environment.

Results: This simulator lends itself well to practicing chest tube thoracostomies. To date, this simulator has been used to train 15 emergency medicine residents at UF COM. Response to the simulator has been universally positive.

Conclusion: Deliberate practice of chest tube thoracostomy provided by our mixed reality simulator helped to increase familiarity and confidence through simulation. Future work includes validating our simulator and incorporating it into our anesthesia and surgery residency and fellow education curriculum.
References available upon request
Full disclosures for all authors and coauthors available upon request

DEVELOPMENT OF A SAFETY-FOCUSED HIGH-FIDELITY SIMULATION TRAINING COURSE FOR REAL-TIME ULTRASONOGRAPHY-GUIDED CENTRAL VENOUS CATHETERIZATION: AN EVIDENCE-BASED SKILL TRAINING COURSE ACCORDING TO THE "DO NO HARM" PRINCIPLE

Ichiro Kaneko, MD, PhD, CPhys,[1] Yasuhiko Ajimi, MD, PhD, CPhys,[1] Yasuo Takeuchi, BA, MSHS, EMT[1]
[1]Teikyo University, Tokyo, Japan, Itabashi-City, Tokyo, Japan

Introduction: In 2017, the Japan Medical Safety Research Organization issued special warnings about the serious complications of central venous catheterization (CVC) and reported 12 fatal cases. Among 10 analyzed cases, complications occurred during ultrasonography (US)-guided procedures in six cases. For knowledge translation to clinical practice, a simulation-based skill training course was recommended to understand the standard procedure and its pitfalls. The CVC committee of our university hospital was established to develop a comprehensive CVC safety system of the hospital. We revised our practice guidelines as a CVC manual according to the patient-safety principle. Finally, we designed and developed a simulation system in accordance with the evidence-based procedure with a strict protocol, which conformed to the Japanese Society of Medical Simulation (JAMS) CVC course. The results of the performance assessments for the attendees were analyzed to optimize the safety-focused simulation training.

Methods: The course was designed as a high-fidelity hands-on course using ultrasonic equipment and simulators to acquire the skill for performing the internal jugular vein puncture technique under real-time ultrasonic guidance. For the cognitive domain of competence, a blackboard learning management system was used, and a computer-based test was conducted during the skill training. In the 150-min training session, after a 30-minute lecture, a 100-minute practice session was conducted, which included a skill test and catheter insertion procedure. The simulator, CVC Puncture Insertion Simulator (Kyoto Kagaku), and Venue 50 Ultrasound (GE Healthcare Japan) were prepared by one of three students. Understanding the pitfalls of real-time ultrasonic guidance was emphasized. Procedures such as prescanning, out-of-plane use of US, real-time ultrasonic guidance, and confirmation of the needle and inserted guidewire were decided and used as core skills in the skill assessment checklist.

Results: Data from 182 experienced doctors (ExD) and 31 junior residents (JR) among the 256 attendees for 2 years were analyzed. Of the ExD, 66% had an experience of ≥30 US-guided CVC cases as an expert and 182 had successfully passed the instructor assessment involving direct observation of procedural skills and a final oral examination. Among the ExD, 166 (91.2%) were ranked grade A (excellent) or B (good) and 16 (8.8%) were ranked grade C (fair). Among the 31 JR, 25 (81%) were ranked grade C, and 6 (19%) needed additional training and skill tests to pass. The questionnaire results, rated using a 4-point scale, showed that 99% of the 207 attendees agreed that the simulation was effective in terms of patient safety. No significant difference was found between the ExD and JR groups. Of the 177 ExD and 23 JR, 170 (96.0%) and 30 (76.6%) agreed, respectively, that US guidance provides confidence in CVC insertion. A chi-squared test revealed a significant difference between the two groups ($p<0.01$).

Conclusion: By referring to the latest evidence and the contents of the JAMS CVC seminars, a high-fidelity task training course was designed and implemented. As the ExD achieved excellent outcomes and achieved great satisfaction from their acquired hands-on skills, this compact and focused program was considered satisfactory, suitable for the needs of the participants, and effective for CVC implementation. The JR group were less competent and less satisfied with their self-confidence, but they performed relatively well as beginners. From their self-estimation of their knowledge of the patient-safety concept, which showed no significant difference from that of ExD, we hope that they fully understand the concept of zero-risk intervention and share the mindset of experts. Based on the results of learner assessment and course evaluation, the quality of the CVC safety program can be improved and the simulation skill training sessions can be redesigned for both experts and less experienced doctors.
References available upon request
Full disclosures for all authors and coauthors available upon request

DISTRIBUTING THE WORK-LOAD: TRAINING SIMULATED PATIENTS IN BASIC MANIKIN BASED OPERATIONS.

Nicole Turley,[1] Rebecca Bowden, PhD, CHSE,[2] Sean Hickey,[3] Sue Cobb, BS, MBA, LPN,[3] Katie Moore[3]
[1]KCUMB, Joplin, MO, USA; [2]KCU-Joplin, Joplin, MO, USA; [3]Kansas City University of Medicine and Biosciences, JOPLIN, MO, USA

Introduction: This project was a necessity for a department with minimal staffing. Training additional operators for manikin-based simulations became high priority due to recent increased usage of our center. Our hypothesis is Simulated Patients (SPs) can gain confidence to operate and trouble-shoot manikin-based technology independently of staff oversight. In order to provide the SPs with the skills necessary to operate manikin technology, SimMan3G training workshop was developed for 14 technology savvy SPs. The ability of SPs to solve manikin technology difficulties during simulations benefits student learning by lessening disruptions currently experienced waiting for center staff to resolve the problems. The SPs ability to work independent of staff oversight permits center staff to focus on other essential job responsibilities during simulations. Adoption of this training modality in simulation centers can provide additional staffing options for manikin-based simulations.

Methods: Study subjects were recruited from current SPs (n=14). The recruits did not have previous experience operating the manikins. The 2-day workshop design included a pre- and post- survey of SPs confidence in basic manikin technology and problem solving. These anonymous surveys were 4 items anchored by a four point Likert scale. A training manual was developed and distributed to the participants. Day one, SPs took the pre-survey, received an introduction to the manikins, computer program and supplies available for use. Later, SPs were randomized into four rotating practice groups for development of skills associated with simulation set-up, real-time operation, shut down maintenance and the resetting process. Day two, SPs practiced scenarios and trouble-shooting prior to skill testing. After practice, departmental staff assessed each SP on ability to independently prepare and operate a simulation for volunteer student doctors.

Results: Participants self-reported increased confidence in ability to program, operate and troubleshoot basic manikin tasks. Comparison of pre and post training surveys demonstrate a numerical increase from 7.5 pre-training to 10.8 post training as measured by a four point Likert scale. Additionally, the participants demonstrated increased confidence in medical terminology commonly used by faculty when asking for a change in patient status on the fly during a simulation. Each SP was assessed over basic skills/operation/troubleshooting via checklist. The average checklist score achieved by the participants was 24.5 out of maximum of 26 points. For departmental purposes, a score of 21/26 (80%) was considered mastery of skills to a level of independent operation of manikins.

Conclusion: SPs demonstrated proficiency in manikin operations and problem solving via skills assessment at the completion of training. Our simulation technology trained SPs

have greatly enhanced our program's ability to staff simulation-based curriculum and allows us to offer additional times for events when the center staff is not available. Additionally, the training has significantly improved the SPs confidence in use of the technology when participating in hybrid scenarios. An unintended outcome of the training was the SPs increased confidence to move forward with remote SP encounters with little additional technology training required. Workshops focusing on manikin technology skills for SPs interested in advancing their skills for remote simulations are in development.
References available upon request
Full disclosures for all authors and coauthors available upon request

DIVERTER VALVE AND VOLUME DISPLAY FOR VENTILATING TWO PATIENTS WITH ONE VENTILATOR-SIMULATOR BASED PERFORMANCE EVALUATION

Robert Chatburn, MHS, RRT, RRT-NPS[1] Umur Hatipoglu, MBA, MD[1]
[1]Cleveland Clinic, Cleveland, OH, USA

Introduction: The COVID-19 pandemic has created an overwhelming demand for mechanical ventilators. This demand has stimulated much interest in using one ventilator for multiple patients called multiplex ventilation [1-4]. Many have posted methods for this on the Internet, but there is little supporting evidence and no human studies. Multiplex ventilation is associated with risk because the method, as described in the literature, results tidal volumes and PEEP levels that are largely uncontrollable and depend on the difference between patient resistance, (R) and compliance (C). The purpose of our simulation-based study was to determine the feasibility of controlling volume distribution from one ventilator to two patients using prototypes of a flow diverter valve and a dual pneumotachometer.

Methods: Two patients were simulated with two separate breathing simulators (ASL 500, IngMar Medical, Pittsuburgh, PA). Two lung models were created with resistance of 10 cm H2O/L/s and compliance of 45 mL/cm H2O) simulating mild ARDS. They were ventilated using parallel patient circuits with a Servo-I ventilator (Getinge, Rastatt, Germany) using pressure control with total volume to the two patients = 800 mL. A prototype flow diverter valve was 3-D printed. Adjustment of the device progressively occluded one inspiratory limb of the circuit while maintaining total cross sectional area of the combined dual patient circuits. This allowed reduction of tidal volume for one patient while maintaining a constant tidal volume for the other. We also designed and tested a small dual pneumotachometer to monitor the tidal volumes. Measurement error was defined as (pneumotachometer measured volume – simulator measured volume)/simulator measured volume, expressed as %.

Results: The flow diverter valve had settings displayed as 10 equal marks around the circumference of the device indicating arbitrary amounts of outflow occlusion. Figure 1 shows that as the valve was adjusted through the range of 10 settings, tidal volume delivery to patient B decreased in a highly linear fashion while tidal volume delivery to patient A was held constant. The dual pneumotachometer showed a mean (SD) error for Patient A of -19% (2%) and for patient B of -23% (3%).

Conclusion: The prototype flow diverter valve demonstrated the feasibility of multiplex ventilation when patient needs differ enough to require controllable, unequal volume delivery. It allowed easy partitioning of the total volume delivered by the ventilator to two simulated patients, ranging from equal distribution to total occlusion of one patient (eg, when disconnection of the patient is necessary). The prototype dual pneumotachometer demonstrated that an inexpensive device based on disposable, commercially available flow sensors underestimated the true volumes but was accurate enough for emergency use. These two devices, if commercially available, would make multiplex ventilation safe enough for emergency use in the dire situation of ventilator shortage.
References available upon request
Full disclosures for all authors and coauthors available upon request

DOES A SIMULATED STETHOSCOPE COMPLEMENT CARDIOPULMONARY KNOWLEDGE AND CONFIDENCE IN DOCTOR OF PHYSICAL THERAPY STUDENTS?

Melissa Morris, MSN, RN, CHSE,[1] Archana Vatwani, DPT, PT,[1] Alicia Fernandez-Fernandez, BS, DPT, MS, PhD, PT, PT[1]
[1]Nova Southeastern University, Fort Lauderdale, FL, USA

Introduction: Simulation offers students exposure to skills that they may not otherwise encounter during their training prior to entering their practicum. Physical therapy (PT) students may not have the opportunity to perform and master cardiorespiratory skills until after they complete didactic content and participate in clinical experiences. There is limited research to support utilization of a computerized stethoscope to impact confidence and competence in cardiorespiratory assessment skills, but literature shows that laboratory-based training with a simulated stethoscope had positive impacts on cardiopulmonary skill acquisition and confidence for pharmacy (Sherman & Stover, 2011) and paramedic (Simon et al, 2012) students. The purpose of this study is to ascertain if utilizing a computerized stethoscope during a lab session will improve Doctor of Physical Therapy (DPT) student cardiopulmonary assessment knowledge and confidence in auscultation and identification of heart and lung sounds.

Methods: The study was conducted on volunteer DPT students in year two (DPT2, n=39) and year three (DPT3, n=48) of the program. All students had already completed their cardiovascular and pulmonary PT course, which did not include simulated stethoscope use in any didactic activities. As part of the study, all students completed a 12-question multiple-choice pre-test and confidence survey related to cardiopulmonary assessment. Two weeks after baseline data collection, DPT2 students attended a one-hour cardiopulmonary lab session (intervention) which included practicing cardiopulmonary assessment utilizing simulated stethoscopes. At the conclusion of the intervention, DPT2 students completed a post-test and confidence survey. Statistical analysis was carried out with SPSS 26, with alpha = 0.05 unless otherwise indicated, and effect size r was calculated. Specific details of the tests that were utilized for each comparison are given alongside the results.

Results: After the training session, DPT2 students had significantly higher quiz scores ($p=0.005$, $r=0.32$, paired t-test). They also showed significant increases in confidence from pre-survey to post-survey (related-samples Wilcoxon signed-rank tests with Bonferroni correction, alpha=0.008), in several areas: physical assessment for respiratory system ($p=0.001$, $r=0.37$), using physical assessment tools to determine effectiveness of PT for respiratory disease ($p = 0.002$, $r=0.35$), physical assessment for cardiovascular system ($p=0.006$, $r=0.31$), and using physical assessment tools to determine effectiveness of PT for cardiovascular disease ($p=0.004$, $r=0.32$). There were no significant differences in DPT2 and DPT3 quiz scores or confidence at the pre-test. Compared to the DPT3s at baseline, the DPT2s scored significantly higher in the post quiz ($p=0.001$, $r=0.33$, independent samples t-test), and in the confidence post-survey ($p<0.001$, $r=0.42$, Mann-Whitney-U).

Conclusion: The results of this study show that a one-hour lab session that utilizes simulated stethoscopes results in increased cardiorespiratory assessment knowledge and confidence in DPT students. Students who participated in the session improved their score in the knowledge test, and also reported increased confidence in cardiorespiratory assessment skills, even surpassing students in later years of the program. It is important to note that although use of the same quiz and survey tools at the two time points provides internal consistency, it also creates the limitation of having students take the same quiz twice. The chances of improved performance due to item recall were minimized by the two-week period between pre- and post-data points. The use of simulated stethoscopes may thus provide an effective means of supplementing other didactic experiences for the cardiorespiratory system.
References available upon request
Full disclosures for all authors and coauthors available upon request

DONNING AND DOFFING OF SIMULATED PERSONAL PROTECTIVE EQUIPMENT (PPE) IMPROVES LEARNER CONFIDENCE WHEN PREPARING TO CARE FOR PATIENTS DURING A PANDEMIC

Shannon DiMarco, MSHS, CHSOS,[1] Gina Tranel, BSN, RN,[2] Ryan Thompson, MD, CHSE, FACEP[1]
[1]University of Wisconsin - Madison, Madison, WI, USA; [2]UW Health, Madison, WI, USA

Introduction: Properly donning and doffing personal protective equipment (PPE) can protect clinical staff from contact with respiratory droplets and aerosols emitted from a patient infected with or under investigation for a special pathogen virus such as SARS-CoV-2 (COVID-19)1. Simulation can assist in supplementing donning and doffing PPE practice in the clinical setting. Additionally, simulation-based training can improve learner confidence in preparation to care for patients2. However, PPE was at a critical shortage during the COVID-19 pandemic; patient grade PPE materials could not be used for training purposes, as they were needed for patient care3. We hypothesized that learner confidence would improve after a brief training exercise of donning and doffing simulated PPE.

Methods: This study was IRB exempt. We developed a hands-on procedural based simulation training session for frontline staff workers at a large tertiary academic medical center during COVID-19. The 20-minute training included viewing a video on donning and doffing of PPE, hands on practice with simulated PPE with instructor guidance and a voluntary post-participation evaluation. The video was created based on CDC and institutional Infection Control. Simulated PPE kits were distributed for hands on practice including a launderable patient care gown, disposable gloves, in-house fabricated single use masks and in-house fabricated reusable face shields. Masks and shields were created using readily accessible materials. An instructor read off a checklist during hands on practice of donning and doffing PPE. In order to practice social distancing, learners were in a group of six or less and remained six feet apart during the training session. Room and materials were disinfected between each use.

Results: 2026 UW Health employees participated in the PPE training. Training population consisted of 604 registered nurses (29.8%), 592 physicians (29.22%), 361 Advanced Practice Provider's (17.82%), 214 members of allied health (10.56%), 213 residents (10.51%) and 43 others (2.09%). Of that, 859 filled out the post participation evaluation (42.39%). There was no indicator on the evaluation of the background of the participants. Average confidence level before training was reported at 3.62 (s = 1.02) on a 5-point Likert scale (1=least confident, 5=most confident) and an average of 4.73 (s = 0.47) confidence level was reported after the training.

Conclusion: Hands-on procedural based simulation training can be done in a short time frame and show a significant change in confidence of its learners. For this training, we saw a significant increase in the confidence of learners. Using simulated, not-for-patient-use PPE materials did not seem to inhibit learner confidence. Limitations to this study were that the post participation evaluation did not ask for the credentials of participants nor did it ask about past PPE donning and doffing experience. Additionally, no assessment of learners was completed to understand competency for donning and doffing PPE. Limitations were due to a short time frame in developing the procedural based simulation training and could be incorporated into future studies.
References available upon request
Full disclosures for all authors and coauthors available upon request

EFFECTS OF CLERKSHIP EXPERIENCE ON SIMULATED CLINICAL PERFORMANCE

A.J. Kleinheksel, BA, MEd, PhD, CHSE-A[1] Matthew Tews, DO, MS, FACEP[2]
[1]Medical College of Georgia at Augusta University, Augusta, GA, USA; [2]Medical College of Georgia, Augusta, GA, USA

Introduction: Do clerkships affect medical students' simulation performance? Medical students rotate through their clerkships in varying order, which exposes them to different cases and content at different points in time. This study sought to determine if clerkships have an effect on simulation performance.

Methods: This study was conducted at the mid-year break between students' two blocks of clerkship rotations. Students completed each of their assigned block's rotations in a different order, but then switched blocks mid-year. This study introduced an individual simulation in which each student played the role of the physician. In the first year of the study, students encountered an adult patient with an acute myocardial infarction. In the second year, students encountered either an adult or a pediatric patient with an asthma exacerbation. Each simulation was facilitated by a faculty member who completed an assessment documenting the order and timing of key performance items. Outcomes were examined to identify any performance differences between rotation blocks.

Results: A total of 385 students participated in simulations over two years. For the 192 students who experienced the AMI case, there were no statistically significant differences between rotation blocks in the time it took to order an EKG, call for help, or for overall simulation time. For the 193 students who experienced the asthma exacerbation case, there were no statistically significant differences between rotation blocks in the time it took to order diagnostic or therapeutic treatments or call the attending. Though, students in both rotation blocks spent more time with the pediatric patient than the adult patient.

Conclusion: The order in which medical students completed their clerkships did not significantly affect simulation performance. While relevance of a simulation to a clerkship is presumed to be ideal, these results demonstrate that medical students can perform and learn from simulations at any point in their clerkships.
References available upon request
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EMERGENCIES IN CLINICAL OBSTETRICS (ECO) COURSE AND COMPETENCY-BASED ASSESSMENT USED IN PREPARING WAKE FOREST BAPTIST MEDICAL CENTER NURSES FOR EXPANDED LABOR AND DELIVERY SERVICE

JaNae Joyner, MHA, PhD,[1] Maria Crawford, BS,[2] Dorothy Parnian, BS, MS,[1] Nona Smith, Other, CNM,[1] Troyanne McMillan, Other, RN,[3] Joshua Nitsche, MD, PhD,[1] Anne Arnold, BA, MA, MSED,[4] Alisa Starbuck, DNP,[1] Mary O'Brien, MD[2]
[1]Wake Forest Baptist Health, Winston Salem, NC, USA; [2]Wake Forest School of Medicine, Winston Salem, NC, USA; [3]Wake Forest Baptist, Pfafftown, NC, USA; [4]American College of Obstetrics and Gynecology, Washington, DC, USA

Introduction: The Center for Experiential and Applied Learning partnered with The American College of Obstetricians and Gynecologists (ACOG) to identify a relevant adoptable curriculum. The Emergencies in Clinical Obstetrics (ECO) course was used to train nurses in management of obstetrical emergencies. Pre-learn video modules were sent to participants. The ACOG ECO training, led by skilled and certified facilitators, included lectures on shoulder dystocia, breech birth, umbilical cord prolapse, and postpartum hemorrhage. Teamwork and communication strategies (TeamSTEPPS™) were reviewed (2). Simulation exercises, reinforcing skills through referencing checklists and role-play were performed using high fidelity and task trainer birthing simulators. Pre/post competency-based assessments were administered to evaluate understanding of material/simulations and gauge proficiencies in dealing with emergencies presented during and after childbirth. Post-training evaluations collected learner feedback.

Methods: The Center for Experiential and Applied Learning partnered with The American College of Obstetricians and Gynecologists (ACOG) to identify a relevant adoptable curriculum. The Emergencies in Clinical Obstetrics (ECO) course was used to train nurses in management of obstetrical emergencies. Pre-learn video modules were sent to participants. The ACOG ECO training, led by skilled and certified facilitators, included lectures on shoulder dystocia, breech birth, umbilical cord prolapse, and postpartum hemorrhage. Teamwork and communication strategies (TeamSTEPPS™) were reviewed (2). Simulation exercises, reinforcing skills through referencing checklists and role-play were performed using high fidelity and task trainer birthing simulators. Pre/post competency-based assessments were administered to evaluate understanding of material/simulations and gauge proficiencies in dealing with emergencies presented during and after childbirth. Post-training evaluations collected learner feedback.

Results: A paired t-test compared pre-post competency results. There was a statistically significant ($p < 0.05$) improvement in competence following the simulation training (pre-test = 77.3 + 1.5; post-test = 89.0 + 0.8; n=58). Class participants were asked to complete a survey evaluating their before and after knowledge of protocols, techniques, risk factors, and team collaboration. On a scale of 1 (not at all confident) to 4 (very confident), the mean self-ranked score among nurses was 2.3 before the intervention and 3.5 afterward. When asked to evaluate the class in terms of course material, simulation experience, and facilitator's ability to effectively teach, participants rated the class 3.9 on a scale of 1 (strongly disagree) to 4 (strongly agree). When asked to name the ONE thing they learned in the class that they planned to apply in the clinical setting or share with colleagues, 57% of responses were related to technique and protocol, while 43% were about communication and teamwork.

Conclusion: Nurses at Wake Forest Baptist Medical Center demonstrated day one readiness to open the new Birth Center through reaching competency-based assessment thresholds (>80%) and improved post-test scores following simulation training paired with didactic learning. Program improvements have been implemented regularly as the result of participant feedback surveys, test scores, and facilitators' observation of gaps in competence or technique. For example, maternal cardiac arrest training has been added to the course to address the rise in maternal mortality in the USA (3). ACOG ECO training has expanded from military hospitals into civilian institutions, and was designed to be trained among multidisciplinary audiences to better care for patients. Monthly simulation training now occurs in the Birth Center at Wake Forest to regularly reinforce best practices during obstetric emergencies.
References available upon request
Full disclosures for all authors and coauthors available upon request

ENHANCED PSYCHOLOGICAL SAFETY STRATEGIES: EFFECT ON LEARNER'S CONFIDENCE

Daryl Gumban, BSN, MSN, RN, CCRN, CS[1] James Cavalier, MBA, MSN, PhD, RN, CHSE[2]
[1]MD Anderson Cancer Center, Houston, TX, USA; [2]UT MD Anderson Cancer Center, League City, TX, USA

Introduction: Simulation can be an anxiety-provoking experience for learners. Anxiety stems from several reasons such as not knowing what to expect, low self-confidence, performing in front of their peers, fear of humiliation, and performance anxiety were identified in the literature (Edmondson, 2018). Psychological safety is the perception that it is safe to take interpersonal risks and that one will not be embarrassed, rejected, or otherwise punished for speaking their mind, not knowing or asking questions." (Kolbe et al, 2019). Enhanced psychological safety strategies include pre-briefing that establishes goals, objectives, expectations, fiction contract, logistic details, modeling the expected behaviors and use of "bail-out" strategy where the learner in the "hot seat" has an option to be saved by other learners by waving a sign requesting a switch. This study aims to evaluate if enhanced strategies optimized learning among Patient Access Representative (PAR).

Methods: Two four-hour fully immersive, high fidelity simulations were conducted monthly for eight months. Enhanced psychological safety measures were emphasized before and throughout the simulation event. The simulation was designed using a traditional simulation technique followed by reflective debriefing. Simulation-based education focused on telephonic skills, empathy, clear communication, and accurate documentation. A researcher-developed tool was implemented to measure perceived confidence before and after simulation-based training. A paired-samples t-test was conducted to evaluate the impact of the simulation intervention on learner confidence.

Results: Sixty-one (N=61) learners participated in the training conducted between July 2019 and February 2020. There was a statistically significant increase in confidence level pre-simulation (M=5.66, SD= 2.27) and post-simulation (M=8.92, SD=0.95), $t(60) = -12.25$, $p = <.0005$ (two-tailed).

Conclusion: Anxiety related to simulation activity is one of the barriers that educators need to acknowledge in curriculum design. Enhance psychological strategies are effective measures to decrease learner's anxiety and enhance learner's confidence in PAR training.
References available upon request
Full disclosures for all authors and coauthors available upon request

ESCAPING THE OPERATING ROOM

Jutta Novalija, MD, PhD, CHSE[1] Jean Borck, BSN, MSN, RN[2]
[1]Milwaukee VA Medical Center, MCW, Milwaukee, WI, USA; [2]Zablocki VA Medical Center, Milwaukee, WI, USA

Introduction: Our Operating Room (OR) team has been using simulation for interprofessional team training on a quarterly basis for many years. Maintaining high levels of engagement can be challenging, as only some of the learners are actively participating during in-situ scenarios, while the rest of the team is watching. We looked for innovative ways to reinforce critical skills and team building activities between members of the operative care team. The use of multimodal teaching methods incorporating team-based and problem-based learning activities found in role play and simulations have success in interprofessional education(1). Escape room learning activities teach individuals to utilize teamwork and communication, while perceived as entertaining at the same time. They provide hands-on experience and create knowledge based on team learning. Our hypothesis is, that the escape room format is a feasible option to increase learner engagement, while promoting interprofessional team training in the OR.

Methods: The goal for this activity was for interprofessional teams work together in each escape room, solving clues and riddles, while practicing critical skills needed during emergencies. An interdisciplinary team of educators, nurses and physicians created three escape room formats around topics which might be challenging during emergencies in the OR (cardiopulmonary resuscitation, code cart and advanced airway management). Some of the critical skills included proper application of the defibrillator pads, ability to operate the recently changed defibrillator model, working together during an airway emergency and finding and preparing medication commonly used during codes. Learners were assigned according to their training in interprofessional groups of 5-7 and had one hour to complete the rooms. While solving the puzzles in each room, the team picked up scrabble pieces, which would spell "teamwork" once the tasks were completed successfully.

Results: Participants completed a survey in the end of the escape room activity and confirmed, that the learning objectives were met. The most relevant topics they learned from the exercise were Teamwork (43.5%), looking into the code cart (30.3%), helping the Anesthesia team with airway management (13%) and using defibrillator correctly (10.8%). At the same time there was a clear sense for 98% of the participants, that the escape room format was fun, informative and a useful supplement to get more people engaged in the learning activity. Comparing the survey responses to previous simulation team training events, the learner engagement was significantly higher when the escape room format was used.

Conclusion: The Institute of Medicine recommends, that health care teams that work together should learn together (2). Escape rooms are a novel and useful addition to the educational tools available for teaching in the healthcare setting. It is a labor-intensive learning modality to develop, but at the same time very rewarding due to the high degree of engagement and acceptance by the learners. While escape rooms are not applicable to all learning context, we found the setup very valuable for team training and learner engagement. We incorporated the tool into our interdisciplinary team training curriculum. Setting up the escape rooms in the simulation center provided a safe learning environment for the participants. At the same time utilizing props and supplies resembling OR equipment allowed the learners to make the transition to real life practice in the OR.
References available upon request
Full disclosures for all authors and coauthors available upon request

ESTABLISHING A CULTURE OF SAFETY IN OBSTETRICS AND NEONATAL INTENSIVE CARE THROUGH MOBILE IN-SITU SIMULATION

Jackie LeVan, DO, CPhys, FAAP,[1] Gillian Gonzaba, BSN, MSN, NP, ARNP-BC,[2] Julie Dyer, MSN, NP, ARNP-BC,[3] Diana Galvis, MBA[4]
[1]Mednax, San Antonio, TX, USA; [2]Pediatrix Medical Group San Antonio; MEDNAX, Helotes, TX, USA; [3]Mednax, Chattanooga, TN, USA; [4]Mednax, Hollywood, CA, USA

Introduction: Communication failures and leadership are known to be the leading causes of medical errors in the USA. In obstetrical (OB) and neonatal emergencies, it is crucial for the team to have effective, concise communication and an effective leader to guide the team1-5. Leadership and communication are difficult concepts to assess in the clinical environment. Mobile simulation allows for an objective observer to note aspects of team performance, leadership, and communication5. Our hypothesis is that through mobile in-situ simulation we can evaluate patient safety techniques in multiple units, identify areas of improvement in patient safety, and provide feedback further building a culture of safety.

Methods: The MEDNAX Simulation Program provides mobile in-situ simulation-based education for multiple MEDNAX facilities across the USA. The simulations primarily focus on OB and neonatal emergencies, as well as team dynamics during a medical emergency. Extensive metric data are collected for each simulation based upon the scenario and national standard of care. A total of 200 simulations were performed at 29 sites from January 2019 to March 2020. There were a total of >550 nurses, 102 respiratory therapists, 61 neonatal nurse practitioners, and 74 physicians that participated during this time frame. The main objectives: 1. Assess safety culture techniques and strategies utilized in medical emergencies through simulation 2. Identify areas of improvement in team dynamics and communication through simulation 3. Improve patient safety through feedback in simulation debriefing and post visit summaries.

Results: Analysis of team performance regarding patient safety strategies such as closed loop communication and SBAR handoffs was performed. Evaluation of team dynamics were analyzed regarding: identification of a team leader, role and scribe assignment, and verbalized plan of action. Results confirm closed loop communication was more readily performed with standardized, non-weight based medications as seen in the OB population (91% vs 57% for OB and neonatal teams). ACLS and hemorrhage protocols enable the OB team to quickly confirm medications. The identification of a team leader was similar in OB and neonatal teams (76% and 79%). Areas for improvement were noted in role assignments, verbalizing a plan of action, and assigning a scribe in both teams. SBAR handoffs were more consistently noted in neonatal teams. Each facility receives a summary with recommendations for areas of improvement, discussing the previously mentioned patient safety strategies and team dynamics to improve performance.

Conclusion: Through utilization of a national mobile in-situ simulation program, safety culture can be assessed across multiple facilities and areas for improvement in communication and team dynamics can be identified. Team members can identify areas of strength and weakness through direct feedback and discussion. This feedback builds a climate of focusing on patient safety and implementation of patient safety strategies. With the feedback provided, hospital partners can focus education efforts to improve communication, leadership, and team performance to improve patient safety and ultimately patient outcomes.
References available upon request
Full disclosures for all authors and coauthors available upon request

EXPLORATION OF A CAPTURE AND ANALYSIS SYSTEM TO IDENTIFY WHAT A GOOD DEBRIEFER LOOKS LIKE

Mindi Anderson, BSN, MSN, PhD, NP, RN, ANEF, CHSE-A, CNE, FAAN,[1] Desiree Diaz, BSN, MSED, MSN, PhD, RN-BC, ANEF, BC, CHSE-A, CNE,[1] Steven Talbert, PhD, RN,[1] Laura Gonzalez, PhD, NP, ARNP, CHSE-A, CNE,[1] Syretta Spears, CHSOS, MA, CHSOS,[1] Melanie Keiffer, BSN, DNP, MSN, CRNP, APRN, CNE,[2] Frank Guido-Sanz, PhD, RN, APRN,[1] Helen Mills, AA, AS, MSN, RN,[1] Peggy Hill, AS, BSN, MSN, RN, CHSE,[1] Gregory Welch, MS, PhD[1]
[1]The University of Central Florida, Orlando, FL, USA; [2]University of Vermont, Orlando, FL, USA

Introduction: Quality debriefing enhances learning through facilitated discussions that allow participants to identify how their decisions impact simulated patient care (1). However, objective data about the characteristics of a good debriefer are lacking. This study aims to explore the components of a good debriefer by using new technology to capture and analyze debrief discussions. The goal is to use the discussion capture system technology to answer the following research questions: 1. Which elements collected and reported by the discussion capture device are associated with student perception of a high-quality debriefer? 2. Which elements collected and reported by the discussion capture device are associated with higher student post-debriefing knowledge test scores? 3. Is student perception of a high-quality debriefer associated with higher student post-debriefing knowledge test scores?

Methods: Using an exploratory design, facilitated semi-structured debrief discussions of pre-licensure, Baccalaureate of Science in Nursing (BSN) students (approximately n=176) and debriefers (approximately n=7) were captured and analyzed. Discussion Capture, a prototype technology by Sony, was used to capture and analyze the data including detected predefined keywords (related to simulation objectives, content, and critical elements) and other analytics (i.e., direction; discussion features) (2, 3). Participant perception of the debriefer was determined with the Debriefing Assessment for Simulation in Healthcare© Student Version (DASH-SV, Long Form) (4). Demographics were collected from both students and debriefers, and student participants' knowledge acquisition was explored with a post-test.

Results: Data are currently being analyzed to determine relationships between participants' perception of a good debriefer and the components identified by the technology. It is planned that descriptive statistics will be used to summarize demographics. Associations between discussion capture data and DASH-SV scores (4) and knowledge scores will be evaluated using correlations or One-Way ANOVA with an appropriate post-hoc test. Associations between DASH-SV (4) and knowledge scores will be evaluated using correlation. Discussion capture transcripts (2,3) may be used to triangulate data.

Conclusion: The results will be used to inform healthcare education and research. If effective, new discussion capture system may be used to transform simulation debriefing education and research.
References available upon request
Full disclosures for all authors and coauthors available upon request

EXPLORING MEDICATION ADMINISTRATION SAFETY FOR USE IN A VIRTUAL REALITY SIMULATOR: A NOMINAL GROUP TECHNIQUE WITH REGISTERED NURSES

Kelly Rossler, BSN, MSN, PhD, RN, CHSE,[1] Ganesh Sankaranarayanan, MS, PhD,[2] Mariana Hurutado, BSN, RN[3]
[1]Baylor University, Kaufman, TX, USA; [2]Baylor University Medical Center, Dallas, TX, USA; [3]Baylor Scott and White, Dallas, TX, USA

Introduction: What is the effect of human or other factors on safe medication administration among Registered Nurses? Approximately 2% of all hospital inpatients have experienced harmful effects from errors associated with the administration of medications(1). Registered Nurses (RNs) have the responsibility to safely administer diverse classifications of medications to patients. Distractions, unexpected interruptions, technology, and human factors impact safe medication administration processes; potentially resulting in an adverse patient safety event(2,3). Virtual reality simulation is emerging as a strategy to teach healthcare professionals. However, use of immersive virtual reality simulation to educate practicing RNs is profoundly absent(4,5). This presentation describes how the Nominal Group Technique (NGT) was conducted to identify medication administration error scenarios to educate RNs practicing in the acute care setting with immersive virtual reality simulation.

Methods: The NGT provided both a methodological template and a psychologically safe process to gain consensus from practicing RNs regarding medication safety practices(6). Overarching steps of an NGT described by Gallagher and colleagues were followed. Steps incorporated a) preparation, b)running the group with an introduction of the subject, c) generation of ideas, d) listing of ideas, e) discussion of ideas, f) ranking top ideas, g) voting on top ideas, g) discussion of the vote outcome, and i) re-ranking and rating the top items. Interview sessions were conducted with a convenience sample of novice and experienced RNs practicing in a medical surgical setting. The interview question items focused on identifying human and other factors which could impact safe medication administration practices. All identified idea items generated during the interviews were categorized and subsequently ranked based on the chance of encountering or the chance of the idea item occurring during a schedule shift.

Results: The original NGT interviews resulted in acquiring feedback from 22 RNs. A total of 12 RNs completed the initial NGT rank of ideas. The final NGT process was conducted with 23 RNs completing a second re-rank of idea items. All ranked idea items were analyzed by category and years of experience with descriptive statistics. Secondary to the sample size, testing with the Kruskal-Wallis Test was conducted to compare for differences among RNs grouped by years of experience. These ranked idea items demonstrated relevance: Right Medication for sound alike or look alike (KW-H 11.1, df 4, $p = .025$) and Time Management for urgency (KW-H 11.2, df 4, $p = .025$). In order to identify which RN groups (novice or experienced) ranked these specific idea items, post-hoc testing was conducted with a Mann-Whitney U test. Results demonstrated no relevance between being a novice or experienced RN with Right Medication as ($p = .28$) and Time Management as ($p = .26$). Additional findings will be presented.

Conclusion: The Nominal Group Technique served to identify three medication administration safety scenarios to develop for use in educating practicing RNs with immersive virtual reality simulation. As an initial step toward discovering human or other factors with the potential to influence medication administration practices, findings support the need to develop curricula encompassing medication administration safety. This NGT also provides one exemplar for healthcare professionals to consider when developing teaching strategies or seeking to change practice behaviors on subject content directly impacting patient care outcomes. Registered nurses and other interprofessional healthcare professionals can incorporate the NGT as a process for examining and exploring questions within quality improvement or research projects focused on practice and patient care.
References available upon request
Full disclosures for all authors and coauthors available upon request

EXTUBATION SIMULATION DURING COVID-19: LESSONS LEARNT ON "LOW STAKES" SIMULATION BETWEEN ADULT AND PEDIATRIC CRITICAL CARE UNITS

Pooja Nawathe, MD, CHSE-A, CHSOS, FAAP, FCCM[1] Russell Metcalfe Smith, BS, MS, CHSE, CHSE-A, CHSOS, EMT-P/NRP, MICP, NREMTP[1]
[1]Cedars-Sinai Medical Center, Los Angeles, CA, USA

Introduction: The Coronavirus disease 2019 pandemic has required that hospitals rapidly adapt workflows and processes to limit disease spread and optimize the care of critically ill adults and children. As part of our institution's Coronavirus disease 2019 critical care workflow design process, we developed and conducted a number of simulation exercises. Being an institution with adult and pediatric patients, an airway team was established(1) as an emergency response to assist the critical care units with the surge. The simulations in the adult units were all focused on the intubation procedure and lessons learnt during the procedure were disseminated amongst staff with continuous workflow enhancements. We (pediatric simulation program) hypothesized that simulation education of a "low hanging fruit" process such as extubation could provide more lessons learnt than a high stakes procedure such as intubation in a COVID-19 patient.

Methods: In situ simulation took place in a fully operational PICU isolation room designated for COVID-19 patient care. For aerosol generating procedure (extubation), personal protective equipment. The goal of the simulation was to identify potential patient care and system failure points in extubating a child with suspected COVID-19. We used a modified Pediatric HAL; Gaumard, Miami, FL to simulate a 8-year-old who was ready by extubation readiness protocols to be extubated. The extubation scenario was developed by two simulation educators. Data Collection: Two simulation educators (one of them a pediatric intensivist), and an anesthesiologist observed the simulation in addition to participating in the debriefing (done using the PEARLS framework) (2). When possible, potential solutions using human factors principles were sought throughout the debriefing. Feedback was obtained from all participants and observers during an immediate verbal debriefing process.

Results: The systems issues identified through all the COVID-19 simulations including the intubation and cardiac arrest simulation provided opportunities to learn under the themes of personnel in the room, donning, doffing, a procedure during the scenario itself. The latent safety threats identified during the extubation simulation scenario were clamping of the endotracheal tube (ETT), availability of the viral filter attached bag prior to disconnecting the circuit. The attachment of the inline end-tidal carbon dioxide monitor and the inline suction to the port before attachment to the ETT. These stress points during the workflow could be identified as part of the low stakes simulation and led to significant workflow changes that were employed not only during the process of extubation but also were deployed in a pediatric COVID19 suspected or confirmed patient during events that needed bagging, a high-risk event in COVID-19 patients.

Conclusion: Extubation is an aerosol-generating procedure in a COVID-19 patient(3). Our experience suggests that simulation by experienced practitioners in a "low stakes situation" is a useful component in developing workflows pertaining to the COVID-19 population. The totality of these experiences led to the creation of a patient-specific COVID-19 airway contingency (intubation, disconnection from the ventilator and extubation) planning bundle. Our group deployed simulation-based methodology to conduct feasibility tests and tests of change (end tidal carbon dioxide monitoring as opposed to our adult critical care patients) during the time-sensitive creation of new workflows for low risk processes such as extubation. We identified stress points in a mission-critical workflow as it was being designed. Incorporating simulation allowed us to be one step closer to demonstrating "work as done" compared to our "work as imagined."
References available upon request
Full disclosures for all authors and coauthors available upon request

FLORIDA SIMULATION CENTER SIGN-IN COURSE AND EVENT PROJECT

Robin Allerding, AA[1]
[1]Mayo Clinic, Jacksonville, FL, USA

Introduction: How to improve the Inefficiencies identified in the check- in process for our faculty and learners, and capture of metrics for the Simulation Center?

Methods: In 2019 there were 15,000 learners who attended events in the J. Wayne and Delores Barr Weaver Florida Simulation Center. Inefficiencies identified in the process included, documentation of learners, consent signing, and capture of metrics for the Simulation Center. Investigation of an improved process was undertaken to reduce workload and prevent redundancy in tasks. The aim of this project was to design a system to improve work flow, build/acquire technology to implement a more efficient protocol for check-in and to implement a new process for collection of metrics. Members of the Sim Center were looking for ways to develop a new more effective process. investigation of an improved process was undertaken to reduce workload and prevent redundancy in tasks.

Results: The previous process took three and half hours daily or equivalent to approximately 20% of the Administrative Assistant's FTE to complete 12 time consuming steps. Problems contributing to the old process included; paper and ink waste; illegible handwriting on the sign-in sheet requiring the collection of more than required information (person ID) from learners as a back-up identifier, scanning sign in sheets and consent forms, and sending email surveys to every attendee. The goal was to decrease the processing and reporting time from 33 hours per month to 14 hours per month.

Conclusion: Several software programs were tested before implementing a program that after careful research of other potential programs, we implemented the Corsizio software program, to decrease the course initiation and reporting time by the following: all data was collected digitally on IPad's so there was no need for manually inputting or scanning the sign in sheets or the consent forms. Evaluation surveys are sent to all course enrollees with only three clicks of the mouse. Data is exported to excel versus, the manual input and calculation of the metrics and QR Codes for faster check-in. Since the Florida Simulation Center has implemented technology in our check in system it has proven to be a game changer in all aspects.
References available upon request
Full disclosures for all authors and coauthors available upon request

FULFILLING AN URGENT NEED FOR PRONATION EDUCATION USING SIMULATION

Adriane Lewandowski, MSN, RN, CCRN[1] Lynne Kokoczka[1]
[1]Cleveland Clinic, Cleveland, OH, USA

Introduction: The 2019 Novel Coronavirus, otherwise known as COVID-19, made it's way to the USA in early 2020. The evolving situation quickly escalated into an international pandemic. Critically ill patients with COVID-19 have a high likelyhood of developing Acute Respiratory Distress Syndrome (ARDS) and requiring adjunctive therapies such as prone position ventilation (PPV). PPV education was implemented at a large teaching hospital in the mid-west. Prior to the COVID-19 pandemic, only certain units were educated on PPV. This created a gap in knowledge. Simulation was utilized as an education modality to address this gap. Interpforessional simulation-based training can improve provider comfort with PPV (1). In an effort to prepare caregivers to care for COVID-19 patients, additional PPV education was quickly assembled. The hypothesis formed was: Can simulation be used to prepare caregivers to safely and effictively implement PPV for patients in ARDS due to COVID-19?

Methods: Pronation education was provided using multimodal instructional strategies. Participants attended a three hour class on pronation therapy. The first hour consisted of didiactic based education incorporating video based learning, low-fidelity simulation, discussion, and question and answer. The second two hours, caregivers participated in two different simulations, each followed by a debrief. One simulatoin involved a high fidelity manikin that was moulaged with an endotracheal tube, ventilator, arterial line, peripheral IV, triple lumen internal jugular central line with multiple continuous infusions, a urinary catheter, ECG leads, and a pulse oximeter. The second simulation involved a standardized patient. Class size was limited to twenty participants in order to maintain adequate social distancing guidelines and group sizes of ten or less. Participants consisted of Registered Nurses, Licensed Independent Practictioners, Physicians, and Respiratory Therapists.

Results: Learners completed a standard evaluation immediately after the debrief. 118 out of 173 learners completed the evaluation. On the evaluation, all 118 learners reported the simulation experience evoked critical thinking skills and was appropriate to their clinical role. Using a scale of 0 to 9, with 0 representing "poor" and 9 representing "exceptional," the average score for the overall experience using simulation was 7.84, the overall learning during the session was 7.88, the relevance of learning outcomes to practice was 8.01 and the overall instructor rating was 7.96. Two open ended questions were included in the evaluation: "My simulation experience was positive because," and "My simulation experience would have been better if." Responses were classified into 5 main themes. Most free text responses commented on the benefits of hands on education and practice. Additional themes included facilitator style, followed by content, length of the course, and team dynamics.

Conclusion: Findings supported the original hypothesis and objectives for the project. Simulation proved to be an effective modality for pronation training. Objectives for the high-fidelity simulation were to prepare the manikin for pronation therapy (utilizing foam prevention dressings, eye patches, and additional IV securement), assign team roles, and implement manual pronation therapy. The standardized patient (SP) simulation consisted of proning a human in a hospital bed. There was no moulage involved. While participants were unable to implement appropriate preparation measures, after proning the SP, they received feedback on positioning and comfort. Twelve pronation classes were offered from February through April of 2020. 173 caregivers attend the pronation course, and an additional 299 caregivers were educated with supplemental in-situ pronation simulation. 472 caregivers total participated in pronation simulation between the two modalities.
References available upon request
Full disclosures for all authors and coauthors available upon request

HEALTH PROFESSIONALS' PERCEPTION OF THE RELEVANCE OF NON-TECHNICAL SKILLS IN A SIMULATED CRITICAL SCENARIO.

Laura Maria Millan Segovia, BSN, MSN,[1] Meritxell Jimenez Llahi, BSN,[2] Alfonso Biarnés,[3] Daniel Lopez Torres, Other, RN, Nurse Anesthesia,[3] Marcos Pérez, MD, PhD,[3] Cèsar Ruiz-Campillo, MD, PhD,[4] Sonia Cañadas,[3] Monica Rodriguez, MD, PhD,[5] Jordi Bañeras, MD, PhD,[5] Eduard Argudo, MD, CM, CNM,[2] Mireia Arnedo, PhD,[6] Sofia Contreras, MD[7]
[1]Vall d'Hebron Hospital Universitari, Barcelona, Barcelona, Spain; [2]Vall d'Hebron Barcelona Hospital Campus, Barcelona, Barcelona, Spain; [3]Hospital Universitari Vall d'Hebron, Barcelona, Barcelona, Spain; [4]Vall d'Hebron Hospital Universitari-Vall d'Hebron Barcelona Hospital Campus, Barcelona, Spain; [5]Hospital Vall Hebron, Barcelona, Spain; [6]Vall Hebron Hospital, Barcelona, Spain; [7]Vall d´Hebron University Hospital, Barcelona, Barcelona, Spain

Introduction: The aim of the study was to analyse the perceptions of health professionals in relation to non-technical skills after a simulated clinical scenario.

Methods: Descriptive study. As part of the training of the basic course in clinical simulation in our Hospital, participants from different editions viewed a 5.30 minute video replay. The setting was a patient who suffered anaphylactic shock due to the administration of an intravenous pain reliever after performing a cardiac catheterization, in which a multidisciplinary team (nurse, medical resident, associate physician) was in charge of the patient. After viewing the video, the participants had to carry out an exercise in order to identify and reflect on 3 correct NTS in order of priority and 3 improvable NTS, categorized as teamwork, situational awareness, decision-making, communication and leadership. After data collection, a descriptive analysis of the participants' reflections was carried out and a second analysis to delve into the type of communication, which was categorized into verbal communication: nurse-resident-assistant-patient-team and non-verbal communication.

Results: There were 46 participants. 28% of the participants were nurses compared to 72% who were doctors. From the preliminary result of the correct NTS practices in the video, the order that they establish as priorities are first: Situational awareness 35% (n: 16); in second place: Communication 33% (n: 15) and thirdly: Teamwork 35% (n: 16). As a global result of the correct NTS practices: Communication (25%) and leadership (25%), together represent 50% of the highest rated NTS. Correct communication between the team represents 77%. The results of the NTS that can be improved are: in first position Communication, which represents 54% (n: 24) of the responses; The second NTS that can be improved is Communication with 43% (n: 20) and the third option is Situational Awareness with 26%. Overall, communication has been the most common response with 39% of total NTS responses that can be improved, with doctor communication improving by 39%, followed by 21% of communication provided to the patient.

Conclusion: The learning strategy through the visualization of simulated critical scenarios, helps professionals to identify and give relevance to situational awareness, communication, teamwork, decision making and leadership. Communication is a fundamental part of NTS to provide the platform for a good job to be done by the team in critical situations
References available upon request
Full disclosures for all authors and coauthors available upon request

HEALTHCARE SIMULATION CENTERS IMPLEMENTATION IN CHINA: A MULTI-CASE PRELIMINARY STUDY

Li Li, MBBS, MPhil, PhD, CHSE[1]
[1]Guangzhou First People's Hospital, Guangzhou, China

Introduction: Healthcare simulation center (HSC) has become an emerging phenomenon in mainland China in recent five years. However, a common and critical dilemma confronting medical education facilities and hospitals in mainland China is how to ensure that they can realize value from their large-scale investments in these centers. We initiated this research in order to address the gaps in the current literature regarding implementation of HSCs in China and to provide possible solutions to the above dilemma. Specifically, this paper seeks to address the following three research questions: (1) what are the key factors influencing healthcare simulation center's implementation in China? (2) For the different implementation stages, do the influencing factors vary? and (3) what are the roles of information systems in the healthcare simulation center implementation?

Methods: 1. Based on the review of the theoretical background and the related literature in Information Science field, we propose a synthesized framework to examine the implementation of healthcare simulation centers and developed a interviewing protocol for manager(s) of different HSCs in China. 2. We then performed interviews with the protocol towards manager(s) of HSCs in 5 geographically different hospitals. 3. Data from each case were analyzed separately, each hospital will be categorized into different implementation stage based on its implementation process and product. Subsequently, a cross-case analysis were conducted to identity any similarities or differences among the ten hospital settings.

Results: Our study has investigated healthcare simulation center's implementation and to focus on the China context, and contributed to developing an integrated framework to better understand the information technology implementation in the healthcare settings. 1. Factors that contribute to the current operation situation of HSCs from 5 healthcare organizations were have been examined and analyzed. 2. IT configuration, relationship with hospital(s), organizational culture/environment, context that the center is situated are the major factors that influence the the use of HSCs.

Conclusion: Insightful recommendations could be provided for local government and administrative entities to make better funding policies and for medical college and hospitals to manage these centers better. Nevertheless, as a preliminary study, our work is limited with potential interviewee bias and the small sample size. 1. Our work is to provide a comprehensive framework for understanding the factors that may facilitate or inhibit implementation of healthcare simulation centers in China. 2. Implications for decision-making by hospitals, medical academic institutions and even central and local government could be drawn based on the data from our work. 3. Successful HSC implementations are policy-driven and requires leadership support, as well as institutional reputation plays an important role in attracting external resources. The level of technology should also be taken into consideration.
References available upon request
Full disclosures for all authors and coauthors available upon request

HIGH-FIDELITY MEDICAL SIMULATION TO TEACH BASIC SCIENCE IMMUNOLOGY CONCEPTS

Eric Neilson, MD,[1] Reanna Penn, BS,[2] Sabrina Sahi, BA (HONS),[3] Caitlin Van Dyke, BS[4]
[1]Ross University, Bridgetown, Barbados; [2]Ross University School of Medicine, Howell Township, NJ, USA; [3]Ross University School of Medicine, Mississauga, ON, Canada; [4]Ross University School of Medicine, Boca Raton, FL, USA

Introduction: Medical simulation is often used to teach clinical skills and procedures in the later years of medical school and in post-graduate settings, limiting pre-clinical exposure. RUSM uses both low and high-fidelity simulation technology to teach limited basic science concepts and emphasize patient assessment and communication skills to year 1 and 2 students. The goal of this study is to develop, implement, and analyze a more robust debriefing discussion of basic science immunology concepts directly related to the clinical reasoning, assessment and treatment of a high-fidelity anaphylaxis simulation case for first year medical students. Results will include assessment of clinical reasoning, type 1 hypersensitivity immunology knowledge acquisition and retention, impacts on student perceptions of high-fidelity simulation curriculum and preparation for clinical skills examination, as compared to standard lecture-based curriculum.

Methods: An estimated 300 first-year medical students were asked to take part in a research study as an opportunity to complete an additional extracurricular high-fidelity simulation session. Consenting participants were randomized with half completing the additional simulation session while the other half completed standard curriculum content, including one high-fidelity simulation. Both groups were given short, multiple-choice quizzes after completion of the simulation session and at the end of the semester, six weeks later. All participants completed a survey detailing student perceptions related to high-fidelity simulation and to assess for confounding factors. Two-tailed t-tests were used to calculate p-values and determine statistically significant differences in quiz scores and survey responses. Additionally, a one hour faculty calibration session was held prior to the activity detailing case logistics, learning objectives and key basic science concepts to be discussed in the debrief.

Results: 70 students consented to participate in the study. They were randomized into control and intervention groups of 35 students each. 20 students in the interventional group and 21 in the control group completed the post-simulation quiz in which the interventional group scored significantly higher, 72.5% vs 55.5% (p=0.0106). 17 students in the interventional group and 15 in the control completed the second quiz at the end of the semester, which showed no significant advantage for the interventional group, 70.6% vs 67.8% vs (p=0.6831). There was no difference in follow-up quiz scores in either group. 22 students in the interventional group and 24 in the control group completed the survey showing the intervention group felt more prepared for their clinical skills practical exam (p=0.02214). There was no difference between groups in self-reported understanding of type I hypersensitivity reactions (p=0.1394) or confidence in the ability to treat anaphylaxis (p=0.05142).

Conclusion: This study suggests the addition of clinical reasoning and anaphylaxis basic science concepts in the debriefing discussion focused of a high-fidelity simulation setting improves learning faster than a standard lecture based curriculum. Students also demonstrated the ability to retain simulation content over the course of the semester. The additional simulation activity also helped students feel more prepared for end of semester clinical skills exams. Additionally, of the 46 students who completed the assessments, 38 were in favor of additional simulation sessions to support learning and reflect a commonly seen student request for more simulation activities. Students unexpectedly did not self-report feeling more confident in their understanding and treatment of anaphylaxis despite the additional simulation session specifically directed at those learning objectives. Limitations of the study included small sample size and disruptions of curriculum delivery due to Covid-19.
References available upon request
Full disclosures for all authors and coauthors available upon request

HIGH-FIDELITY ORTHOPAEDIC SURGICAL SKILLS MODELS AND RESIDENT PERFORMANCE IN THE SURGICAL TREATMENT OF TIBIAL PLATEAU FRACTURES

Christopher Smith, MD, FACS[1] Joy Greer, MD, CHSE[1]
[1]Naval Medical Center Portsmouth, Portsmouth, VA, USA

Introduction: There is a gap between the skills required of an orthopaedic surgeon and resident opportunities to practice such skills in a realistic setting (1-3). A survey conducted in 2013 of 86 U.S. orthopaedic surgery residency program directors and 687 residents found 80% of program directors and 86% of residents believed surgical technique simulation should be implemented in residency training (2,4). However, evaluation of performance on such simulations has proven to be difficult: the same survey found that 58% of program directors and 83% of residents felt surgical skill in simulation was not objectively measured (2,4). The use of low-fidelity Sawbones models in resident training has become commonplace but scant data exists measuring how the use of these models translates to the skills required in higher fidelity simulations and real world procedures. The purpose of this study was to quantify the impact of low-fidelity simulation on resident surgical skills education.

Methods: The study protocol was approved by the Naval Medical Center Portsmouth Institutional Review Board in compliance with all applicable Federal regulations governing the protection of human subjects. Fourteen orthopaedic surgery residents (PGY-1 through PGY-5) were separated into two, training-level-matched cohorts – an untrained control cohort (UCC) and a low-fidelity Sawbones training cohort (SAW). Together, both cohorts received didactic instruction from ABOS-certified orthopaedic trauma surgeons on Schatzker II tibial plateau fractures. The SAW group first rehearsed open-reduction, internal-fixation once on radiopaque Sawbones models (Pacific Research Laboratories Inc. Vashon, WA). Both cohorts were then evaluated while performing the same procedure on high-fidelity cadaveric models (Rimasys GmbH Cologne, Germany). Surgical skill and knowledge were assessed using the objective structured assessment of technical skills (OSATS) tool, a written exam, and an after-action survey.

Results: The mean overall OSATS score out of a possible 35 was 20.29 (range 10-33) in the UCC cohort and 22.71 (range 11-33) in the SAW cohort. While no statistically significant differences were seen between in average overall OSATS scores (p=0.62) or scores for any particular parameter, a near-linear positive relationship (R2=0.9737) existed between training year and average overall OSATS score. Additionally, no significant difference was seen between the written exam scores of the two cohorts (p=0.22). After performing the surgery on high-fidelity cadavers, 100% of the subjects felt better prepared to perform this procedure. All study participants did note in their after-action surveys that they felt using high-fidelity cadaveric models in a training environment prepared them for real-world performance better than using low-fidelity Sawbones models alone.

Conclusion: The results of this study fail to demonstrate an advantage when training with Sawbones low-fidelity models prior to evaluation of surgical skill using high-fidelity cadaveric models. However, the study did demonstrate the value of high-fidelity models in resident education. Despite similar outcomes in practical evaluation of surgical skill following different training interventions, residents across both cohorts qualitatively felt the high-fidelity models offered a better educational opportunity for surgical practice than did the low-fidelity models. Many residents asked that this exercise be performed for other surgical procedures as it offers realistic training outside of the operating room environment. Continued work should consider the aforementioned error modes to better define significant differences between the training interventions employed. Future work comparing the impact of low-fidelity and high-fidelity training models on surgical skill is warranted.
References available upon request
Full disclosures for all authors and coauthors available upon request

HOW DID THAT FEEL? UNFOLDING AN ADAPTIVE VERSION OF THE 3D MODEL OF DEBRIEFING WITH VIRTUAL PATIENTS

Cheryl Wilson, DNP, NP, ARNP-BC, CHSE, CNE[1] Francisco Jimenez, MA, PhD[1]
[1]Shadow Health, Riverview, FL, USA

Introduction: Debriefing is one of the most fundamental components of any simulation learning experience in nursing (Dreifuerst, 2009; Verkuyl et al., 2017). Virtual patient simulations provide a unique opportunity for experiential learning if debriefed efficiently because they allow students to explore different clinical situations and make complex decisions in a safe environment (Gordon, 2017; Verkuyl et al., 2018a, 2018b). In this experimental study, we explored the debriefing experience of students using the 3D Model of Debriefing (Zigmont et al., 2011) after completing a virtual patient simulation module on conflict management.

Methods: Participants: The virtual patient simulation on conflict management scenario was completed by 44 students enrolled in a nursing leadership course at a traditional four-year BSN program from a public university. Simulation Scenario: In the simulation, the student takes on the role of a nurse at a hospital's medical-surgical unit and faces challenges in the form of patient and workplace conflict. Throughout the simulation, the student must identify and use appropriate conflict management strategies to ensure positive outcomes for patient care. Upon completing the scenario, the student reflects on the experience by responding to a series of reflection prompts based on the 3D Model guided by a virtual preceptor (i.e., defusing, discovering, and deepening). The debrief prompts adapt based on student performance in critical decision points during the simulation. Students review these decision points in context and then answer specific, structured debriefing questions about those decisions.

Results: Fifty six percent of the students reported having positive feelings about their performance in the simulation, while 44% expressed having neutral or mixed feelings about their performance. Students reporting positive feelings mentioned practicing prioritization and interprofessional communication, understanding the rationale behind wrong choices made, fostering open communication with family members, and the ability to manage conflict professionally as factors contributing to their positive experience. On the other hand, students reporting mixed or neutral feelings mentioned the difficulties associated to assuming the role of a charge nurse, prioritizing patients, and communicating with patients and family members as factors contributing to their more neutral experience. More data insights will be shared during the presentation.

Conclusion: The results of this study suggest that students can experience the benefits of a transformative learning experience when they are debriefed using the 3D Model of Debriefing after completing a virtual patient simulation. Through transformative learning, the 3D Model facilitates the opportunity for students to reexamine their existing knowledge, assumptions, and biases. Likewise, students can extrapolate what was learned to other situations and think about how they would use it to guide their practice. The adaptive nature of the debrief used in this study also allowed students to reflect on those decisions and instances where patient-centered care leadership skills were needed to achieve the best patient care and outcomes.
References available upon request
Full disclosures for all authors and coauthors available upon request

HOW DO ANESTHESIA RESIDENTS RESPOND TO PATIENT CONCERNS ABOUT YOUNG AGE AND INEXPERIENCE DURING INFORMED CONSENT?

Richard Blum, MD, MS, FAAP,[1] John Scott, BS,[2] Mollie Ruben, PhD,[3] Danielle Blanch-Hartigan, MPH, PhD,[4] David Waisel, MD,[1] Ariel Henig,[5] Elaine Meyer, BSN, MA, MSN, PhD, RN[6]
[1]Boston Children's Hospital, Boston, MA, USA; [2]Boston University, Tyngsboro, MA, USA; [3]University of Maine & US Dept of Veterans Affairs, Orono, ME, USA; [4]Bentley University, Waltham, MA, USA; [5]Zucker School of Medicine at Hofstra/Northwell, Hempstead, NY, USA; [6]Harvard Medical School, Cranston, RI, USA

Introduction: Patients' concerns about resident physicians' inexperience may interfere with forming a trusting patient-doctor relationship and may limit patients' ability to fully participate and ensure the integrity of the informed consent process. A patient's perception of youth and/or inexperience may lead to concern about their qualification to provide care. This relational dynamic is central to patient-centered care, patient satisfaction and optimal clinical care. The aim of this observational study was to examine anesthesia residents' responses to standardized patients' apprehensions about the residents' inexperience and to develop a highly realistic model for characterizing physician-patient interactions. Specifically, findings from this study can serve to inform the field about the range of responses to such concerns and inquiries, and to develop simulation-based educational tools and approaches to address these issues.

Methods: After IRB approval, 67 1st and 3rd year anesthesia residents from 3 Harvard programs obtained informed consent from a standardized patient (SP), a 52-year-old male awaiting surgery for a perforated gastric ulcer; we present preliminary data on 24 residents. Residents were instructed to review clinical data and obtain informed consent. The SP expressed concern about the resident's young age and inexperience, e.g. "You look awfully young to be a doctor." Encounters were recorded for coding behaviors and analysis by 2 trained coders. Data included verbal interactions between the SP and resident about these concerns, and coded according to physician status, age and/or inexperience. Resident responses were coded by category e.g. thanks/compliment; denies/dismisses concern; acknowledges concern; provides information about care/role; provides evidence of experience; mentions supervision; and redirects concern. Descriptive analyses were conducted. Analyses of all 67 residents is ongoing.

Results: Of the 24 1st and 3rd year residents, 14 (58%) were male and 10 (42%) were female. Of the concern prompts expressed by the SPs, 24 (100%) expressed concern about age, 13 (54%) about experience; and 7 (29%) about status as doctor. The SP may have expressed more than one concern, e.g. "you look terribly young, are you a medical student?" Across the sample of 24 residents, there were 75 responses to the initial concerns expressed, with a range of 1-6 responses per resident, a mean of 2.88 responses per resident. Of the cumulative number of responses provided by the 24 residents, 18 (24%) provided information about care/role; 13 (17%) described clinical experience; 13 (17%) denied/dismissed the concern; 8 (11%) mentioned supervision; 6 (8%) acknowledged concern; 6 (8%) invoked formal/polite language; 5 (7%) laughed; 2 (3%) offered thanks/compliment; and 1 (1%) redirected focus to patient. Ongoing analysis will examine differences in responses by resident attributes such as gender.

Conclusion: We created a reproducible high-fidelity simulated environment to study physician-patient interactions. This has the potential to create a greater understanding of interactions and design methods to improve performance. All of the SP's expressed concerns related to age, experience and/or status as a physician. The residents had a variety of responses: 62% (information about role, described clinical experience and/or medical supervision) of the residents provided responses that attempted to alleviate the specific concerns of the SP. These responses could be considered patient-centered. 38% of the responses did not address the SP's concerns, e.g. denied/dismissed the concern. There is room for improvement with respect to resident responses to patient concerns about youth and inexperience. Residents may benefit from training interventions including deliberate practice opportunities to incorporate specific verbal and non-verbal responses to this frequently encountered situation in trainees.
References available upon request
Full disclosures for all authors and coauthors available upon request

I AM SORRY FOR YOUR LOSS: USE OF SIMULATION TO TRAIN EMERGENCY MEDICINE RESIDENTS TO DELIVER DEATH NOTIFICATIONS

Charles Lei, MD, FACEP[1]
[1]Vanderbilt University Medical Center, Nashville, TN, USA

Introduction: Emergency medicine (EM) physicians are frequently tasked with delivering death notifications. These interactions are uniquely difficult due to the busy and impersonal emergency department (ED) setting, the sudden and unexpected nature of the deaths, and the lack of established relationships with bereaved survivors. In addition, EM physicians often must perform the death notification shortly after participating in a stressful but ultimately unsuccessful resuscitation of the patient. Simulation has been identified as a potentially useful modality for providing EM trainees with the skills to deliver bad news more effectively (1-4). We developed a simulation-based curriculum for training death notification skills that incorporates many of the unique challenges faced by EM physicians. The purpose of this study was to evaluate the perceived realism of the simulation experience and assess its effect on the confidence of EM residents in performing death notifications.

Methods: We designed a death notification simulation scenario and implemented it during our EM residency educational conference. Participants served as team leaders in the resuscitation of a patient (high-fidelity simulator) in cardiac arrest; this resuscitation uniformly ended with the patient's death. Participants were then notified of the arrival of the patient's spouse (actor) and were expected to deliver the death notification to this simulated survivor. Participants then engaged in a debriefing of the scenario during which they received structured feedback from EM faculty and an ED social worker. At the end of the session, participants completed anonymous paper surveys in which they rated aspects of the scenario and their pre-course (retrospective) and post-course confidence in performing death notifications on a 5-point Likert scale.

Results: Thirty-nine EM residents participated in the simulation experience. Each resident participated the scenario individually. Ninety-two percent (36/39) of the participants completed the post-course survey. The residents rated the overall educational value of the session as very high (mean 4.92; SD 0.28) and felt the knowledge and skills gained would significantly improve their practice (mean 4.94; SD 0.23). The simulation scenario was rated as highly realistic (mean 4.97; SD 0.17). Compared to pre-course ratings, participants reported statistically significant post-course improvements in their level of confidence in delivering death notifications [mean 3.08 (SD 0.91) vs. mean 4.36 (SD 0.64); $P<0.001$] and felt they had a more systematic approach to these challenging interactions [mean 3.11 (SD 0.95) vs. mean 4.08 (SD 0.65); $P<0.001$].

Conclusion: We have developed and successfully implemented a simulation-based curriculum for preparing EM residents to perform death notifications in the ED. Participants felt the experience was highly valuable and found the simulation scenario very realistic. The session increased confidence in delivering death notifications and provided residents with a framework for approaching these difficult conversations. Simulation experiences that incorporate the unique challenges of the ED environment may be particularly beneficial for improving the death notification skills of EM physicians.
References available upon request
Full disclosures for all authors and coauthors available upon request

IDENTIFYING CONTRIBUTING FACTORS FOR HEALTH CARE PROFESSIONALS' SELF-REPORTED COLLABORATIVE PRACTICE BEHAVIORS

Susan Kilroy, PhD, RN, CHSE[1] Danielle Bielanski, MSN, RN-BC, CCRN[2]
[1]University of Illinois at Chicago, Chicago, IL, USA; [2]Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, IL, USA

Introduction: Limited research exists on self-reported collaborative practice behaviors (CBPs) in simulation-based Advanced Cardiac Life Support and Pediatric Advanced Life Support (ACLS/PALS) courses. Educational research of resuscitation courses focuses on changes in attendees' retention of knowledge, psychomotor skills, and perceptions of confidence [1,2,3]. ACLS / PALS courses can be used to prepare collaboration-ready health care professionals and lead to the development of CPBs, interprofessional teamwork, and improved patient outcomes [4]. ACLS/PALS courses could be an effective mechanism for delivering simulation to large groups and for promoting CPBs [5]. The aim of this study was to: determine the impact of (ACLS/PALS) courses on professionals' self- reported CPBs; identify differences between nurses, physicians, and respiratory therapists self-reported CPBs; and, (3) describe which specific CPBs were most strongly associated with professionals' perceptions in clinical practice.

Methods: A mixed methods explanatory design was utilized. Participants were health care professionals (N = 214) who attended ACLS/PALS courses. Quantitative and qualitative data was collected electronically using the Interprofessional Collaborative Competency Attainment Survey (ICCAS) and two open-ended questions. A confirmatory factor analysis

of ICCAS Survey answers was performed. Quantitative data was analyzed by the total CPB score for the sample and by each profession CPB score. Paired t tests were used to assess change in health care professionals' self-reported CPBs immediately after and 6 weeks post course completion. Mixed effects modeling was used to examine differences between and within three health care professions and interaction of time and healthcare profession on the dependent variable of self-reported CPBs. Directed content analysis was performed on qualitative responses and inferences were made across the quantitative and qualitative data.

Results: Health care professionals' participation in ACLS / PALS courses were positively associated with an increase in mean self-reported CPB scores over time. Nurse practitioners demonstrated the greatest change over time (pre-course M = 3.41 + .699 vs. post-course M = 3.80 + .590 vs. 6-week post-course M = 4.05 + .399). In self-reported CPB scores, a statistically significant change in mean was demonstrated by all professions (t (208) = –12.76; p 0.2639). A statistically significant interaction effect was found within each profession over time (z = 104.8, p > 0.0000). MDs identified roles and responsibilities (94%, n = 18) as most important CPB, and communication was identified by RNs (81%, n = 87) and RTs (42%, n = 3) as the most important CPB.

Conclusion: All health care professionals demonstrated an increase in mean self-reported CPB scores immediately after attending ACLS/PALS courses, suggesting that the simulation-based courses positively influenced their CPBs. This study demonstrated that the increased mean of CPBs scores was sustained over time for all professions. This research study was novel because it focused on simulation-based education and self-reported CPBs and it integrated health care professionals' perceptions of CPBs demonstrated during the interprofessional simulation-based ACLS / PALS courses with their perceptions of interprofessional teams and enhanced patient care in the clinical setting. Health care professionals' qualitative responses indicated that roles and responsibilities and communication were the most influential CBPs they gained from completion of interprofessional ACLS / PALS courses and then brought back to their clinical practice on their respective hospital units.
References available upon request
Full disclosures for all authors and coauthors available upon request

IMPACT OF THE SIMULATION IN THE SAFETY DAY OF THE SURGICAL PROCESS IN AN AMBULATORY SURGERY CENTER

Daniel Lopez Torres, Other, RN, Nurse Anesthesia,[1] Meritxell Jimenez Llahi, BSN,[2] Laura Maria Millan Segovia, BSN, MSN,[3] Marcos Pérez, MD, PhD,[1] Alfonso Biarnés,[1] Sonia Cañadas,[1] Cèsar Ruiz-Campillo, MD, PhD,[4] Sofia Contreras, MD,[5] Mireia Arnedo, PhD,[6] Eduard Argudo, MD, CM, CNM,[2] Monica Rodriguez, MD, PhD,[7] Jordi Bañeras, MD, PhD[7]
[1]Hospital university Vall d'Hebron, Barcelona, Spain, Barcelona, Spain; [2]Vall d'Hebron Barcelona Hospital Campus, Barcelona, Barcelona, Spain; [3]Vall d'Hebron Hospital Universitari, Barcelona, Barcelona, Spain; [4]Vall d'Hebron Hospital Universitari-Vall d'Hebron Barcelona Hospital Campus, Barcelona, Spain; [5]Vall d´Hebron University Hospital, Barcelona, Barcelona, Spain; [6]Vall Hebron Hospital, Barcelona, Spain; [7]Hospital Vall Hebron, Barcelona, Spain

Introduction: The safest hospitals have the highest notification rate of security incident. Incidents are reported in notifications and these are opportunities to improve the system. The objective of the study is to determine whether an intervention simulating the surgical process with debriefing improves the culture of safety, measured by increasing the notifications rate and generates improvement actions.

Methods: Intervention study. A Safety Journey with 114 participants took place on July 5th, 2019, in the Outpatient Surgery Unit of the Health Complex Pere Virgili, Barcelona, Spain from the Campus Barcelona Vall d'Hebron. Administrative, nursing assistants, nurses, anaesthesiologists and surgical professionals from diverse specialities participated in the study. Three activities were carried out with the simulation methodology: (1) Two clinical cases of a cataract intervention with the ambulatory surgical process. (2) Gammification and security. Notification and incident management using the pedagogical methodology "escape room" and experimental learning. (3) Non-technical skills workshop focused on communication. These three teaching activities were led by members of the hospital simulation commission and security related members. Pre and post intervention notifications were quantified.

Results: Significant differences have been observed. From January to July 5th, 2019, 85 incidents in this unit had been reported. From July 6th to December 31st, 126 incidents were reported. The intervention created the need to implement improvement groups, the participants requested training in safety and 9 referee professionals were trained.

Conclusion: The intervention with diverse multidisciplinary simulation techniques impacts directly in the safety culture: Increase the number of notifications, generates new organizational processes and joint strategies in order to improve the quality of care of the surgical process.
References available upon request
Full disclosures for all authors and coauthors available upon request

IMPLEMENTATION OF ADMINISTRATIVE MANAGEMENT IN THE CLINICAL SIMULATION CENTER (CSIMↃ) FOR THE PURPOSE OF SUNEDU LICENSING AND FUTURE ACCREDITATION

Rosali Aranzamendi Paredes, MEd[1]
[1]Centro de Simulación Clínica CSIMC, Arequipa, ARE, Peru

Introduction: The medicine programs of the faculties or schools of the peruvian universities with institutional licenses are in the process of licensing by the National Superintendence for Higher University Education (SUNEDU) (1). Peruvian universities that did not have Simulation Centers have been in charge of building and / or adapting spaces on their campuses to implement them for licensing purposes, considering the multiple benefits offered by the use of clinical simulation worldwide (2). In this context, in the simulation center (CSIMↃ) one of the new centers that came into operation has developed a master's thesis with the objectives of strategically planning administrative procedures, organizing administrative activities through policies and procedures, proposing the management model for integrating clinical simulation into the undergraduate curriculum grid and controlling the availability of resources.

Methods: The challenges for the new centers, in addition to complying with the basic quality conditions (CBC) of the licensing, is to achieve good administration and management of the simulation programs, as well as the insertion of the simulation into the curriculum to achieve competencies (3). The present investigation constituted a descriptive, observational, prospective and transversal study that was developed to implement administrative management at the Simulation Center of the Universidad Nacional de San Agustín de Arequipa. Its development was based on milestones established in the POP (Project Operational Plan) and had the support of the Simulation Center team work for the review and approval of proposals for the new administration and management model of the Simulation Center. Ethical considerations followed the Healthcare Simulationist Code of Ethics (4).

Results: An administration and management that supports the organization of the center and the development of all activities for the accomplishment the mission and vision of the CSIMↃ was achieved through the following milestones (3,5). - MILESTONE1: Development of the strategic plan - MILESTONE 2: Organization of administrative activities through guide formats and manuals - MILESTONE 3: Proposal for a model for integrating clinical simulation into the curriculum - MILESTONE 4: Model and management plan to manage resources and control their availability

Conclusion: The advantages of having and implementing a management and administration system for a new simulation center according to its reality allows for licensing to be completed; In addition to the administrative documentation, the model proposes a guide to insert the simulation within the curriculum in simulation environments that protects security and realism for the achievement of competences and their evaluation. The study recommends the Peruvian simulation centers to face the same process, taking as a model the thesis and the reasons for the next challenge of the sea to seek the accreditation of the simulation centers (7).
References available upon request
Full disclosures for all authors and coauthors available upon request

IMPLEMENTATION OF INSTITUTION -WIDE CENTRAL VENOUS CATHETER INSERTION CERTIFICATION PROGRAM AND COVID-19 MODIFICATIONS.

Julie Hartman, BS, MS, Other,[1] John Keech, MD,[1] John Ding, BS[1]
[1]University of Iowa, Iowa City, IA, USA

Introduction: In 2013, University of Iowa Health Care (UIHC) began a review of the full Healthcare Associated Infection (HAI) prevention portfolio and a subcommittee focused on reduction of central line-associated bloodstream infections (CLABSI) was formed. The purpose of this article is to share the process of developing a central venous catheter (CVC) insertion and maintenance program. Our objective was to design and implement an institution-wide standardized program of CVL insertion training and competency. The program includes standardization of insertion training process, equipment, supplies, documentation in the electronic health record (EHR) and checklist performance as well as the ability to track relevant data related to CVL insertion. The program has also been updated to accommodate modifications for COVID-19 policies.

Methods: The CVC program was initiated and implemented throughout the health system by team of health care providers, administrators, project managers, and support staff. A needs assessment survey was utilized to determine location of CVC insertion and provider information. The survey revealed high variation in supplies, process, and education. Supplies were standardized in a custom supply kit. Processes were standardized by requiring an assistant to observe for breaks in sterile technique and to complete a procedural checklist. Education including simulation was developed for practitioners and assistants. All practitioners performed a video recorded proficiency test on a CVC insertion model and were assessed on 27 metrics. Learners were given modifications to the metrics when COVID-19 precautions were implemented. All proficiency tests were assessed by faculty

experts in CVC insertion. The UIHC Center for Procedural Skills and Simulation (CPSS) trained CVC inserters and observers.

Results: Education and proficiency testing were implemented on a pilot unit in December 2015 and the remainder of the institution was onboarded over the following 18 months. Proficiency testing results were made available to clinical leaders in an interactive Tableau dashboard. A standardized grading form measured completion of all critical steps with emphasis on patient safety. Failure to complete the top three critical metrics required retraining and retesting. Preliminary data showed a 29% decrease in early CLABSI comparing 6 months before and after implementation was completed. Currently all new practitioners are required to certify in CVC insertion before performing the procedure clinically. CVC testing and training continue with COVID-19 modifications.

Conclusion: A CVC insertion certification program can be implemented in a major academic medical center and improve patient outcomes. COVID-19 modifications are possible for CVC insertion procedures.
References available upon request
Full disclosures for all authors and coauthors available upon request

IMPLEMENTATION OF KOLB'S EXPERIENTIAL LEARNING THEORY IN DEVELOPING AND TESTING CLINICAL PATHWAYS

Baraa Tayeb, MD, MS, MD, MS,[1] Abdulaziz Boker, MBBS, MEd, CPhys, FRCPC,[2] Abeer Alhazmi, MSN, PGCert, NP, RN,[3] Nada Noaman,[4] Wadeeah Bahaziq[5]
[1]Providence VA medical Center, Providence, RI, USA; [2]College Of Medicine, King Abdulaziz University, Jeddah, Makkah, Saudi Arabia; [3]KAUH, jeddah, Saudi Arabia; [4]King Abdulaziz university hospital, Jeddah, Saudi Arabia; [5]King Abdulaziz University, Jeddah, Saudi Arabia

Introduction: The World Health Organization (WHO) has declared COVID-19 as an epidemic on March 11th, 2020. Due to high contagiousness, potential high morbid outcomes, and public impacts on the community the WHO recommended "urgent and aggressive action". As part of the international effort to combat the virus, our Anesthesia and Critical Care Department (ACCD) at King Abdulaziz University Hospital (KAUH) had to develop, test, and train our Health-Care Workers (HCW) to optimize patient outcomes as well as HCW safety; a significant challenge especially during a crisis(1,2). David A. Kolb Experiential Learning Theory, a fundamentally different view of the learning process, and represents behavioral theories of learning based on an empirical epistemology (3,4). Our hypothesis is to employ the Experiential Learning Theory through clinical simulation to develop, test and train HCW on new clinical pathways in time of crisis in an efficient and effective manner.

Methods: Our project included a total of 6 simulation-based sessions: 4 training simulation sessions and 2 clinical drills (Table 1). For each session 2 instructors/raters used a checklist to conduct the session. The checklist was designed to evaluate room preparation, staff preparation, early patient assessment, preparation for drugs and airway management, and proper Personal Protective Equipment PPE donning and doffing. At the end of each scenario, instructors used the checklists to debrief and discuss the finding and provide a formative feedback to gain insight and assess the feasibility of new pathways for broader implementation in the hospital. After-session report with the checklists results and participants' debriefing outcomes and feedback were conveyed to relevant departmental and hospital leadership to be used to modify the hospital procedures between different sessions. These modifications were also incorporated in the following sessions for training and system testing.

Results: We conducted 6 simulation-based sessions with a total of 81 interdisciplinary participants (doctors, nurses, and support services) and 12 After-session reports. Qualitative thematic data analysis of the 12 after-session reports identified 3 main areas for improvement: PPE implementation, team dynamics, and airway management. In alignment with Kolb's Experiential Theory we incorporated appropriate clinical pathways in following sessions. These pathways included training HCW on proper PPE courses, training on team dynamics and Crisis Resources Management principals and deploying of clinical guidelines for anesthetic management for suspected/confirmed COVID-19 cases. Overall, incorporation of the interventions resulted in improvement of performance in all subsequent sessions; donning 59 % up to 100%, doffing 25% up to 100%, room preparation 33% up to 100%, staff preparation 17% up to 100%, early patient assessment 50% up to 67% and drug and airway management 68% up to 100%) (figure 2).

Conclusion: The 4 stages of Kolb's cycle guided the design of this project (figure 1). In the 1st stage 'concrete experience', we conducted 6 simulation session to engage participate and build the needed experience and feedback checklists. Followed by the 2nd stage 'reflective observation", where checklists guided post session debriefings and the development of after-session reports. For the 3rd stage 'abstract conceptualization,' after-session reports were used by relevant departmental and hospital committees to develop appropriate clinical pathways to address identified gaps. Finally, the 4th stage 'active experimentation', newly developed pathways were implemented in following sessions for testing and further improving. Out project showed that The Experiential Learning Theory is an excellent theoretical foundation to identify vulnerabilities and needs and to develop and test new clinical pathway. This had resulted in the enhancement of the overall performance of the institution.
References available upon request
Full disclosures for all authors and coauthors available upon request

IMPROVING THE QUALITY OF CLINICAL CARE OF CHILDREN WITH DIABETIC KETOACIDOSIS IN COMMUNITY EMERGENCY DEPARTMENTS FOLLOWING A COLLABORATIVE IMPROVEMENT PROGRAM WITH THE ACADEMIC MEDICAL CENTER

Hani Alsaedi, MD, FRCP,[1] Kamal Abulebda, MD, CPhys, FAAP,[2] Riad Lutfi, MD, CEng,[3] Andrew Beardsley, MD,[1] Erin Montgomery, BSN, RN, CCRN,[3] Samer Abu-Sultaneh, MD, FAAP[2]
[1]Indiana University School of Medicine, Indianapolis, IN, USA; [2]Riley Hospital for Children at Indiana University Health, Indianapolis, IN, USA; [3]Riley Hospital for Children, Indianapolis, IN, USA

Introduction: Diabetic ketoacidosis (DKA) is a life-threatening condition and can cause significant morbidity if not managed appropriately. Majority of pediatric patients with DKA present to community emergency departments (CEDs) that are less prepared to care for these children due to their low pediatric volume and limited access to pediatric resources and protocols. Despite the reported disparities in adherence to best practices and quality of care provided to pediatric DKA patients in CEDs, no studies have been conducted to improve the quality of care provided to children with DKA presenting to CEDs. The aim of this study was to evaluate the impact of a simulation-based collaborative improvement program on the quality of care and clinical outcomes provided to patients with DKA across a spectrum of CEDs in the state of Indiana.

Methods: This is a pre- and post-intervention study of children with DKA presented to ten CEDs following the implementation of a collaborative improvement program. The multi-faceted program consisted of (a) an in-situ simulation followed by debriefing, (b) targeted assessment reports, (c) distribution of DKA best practices, (d) ongoing interaction with the pediatric academic medical center (AMC). The primary outcome was the quality of clinical care as measured by adherence to the pediatric DKA critical action checklist. The secondary outcome was patient clinical outcomes pre and post-intervention. Pre and post-intervention variables were compared using the Wilcoxon rank-sum test and Chi-Square test or Fisher's Exact Test.

Results: A total of 85 children with DKA presented to the 10 CEDs that participated in the improvement program were analyzed. Patient demographics are presented in Table 1. There was a significant improvement in overall adherence to the DKA management guideline after the implementation of the improvement program (77.8% vs. 88.9% P <0.001). Eight of nine critical checklist actions showed an improvement, but only hourly glucose check and appropriate fluids rate were statistically significant. There was a 31-point significant improvement of hourly glucose check between the preintervention and postintervention ($P < 0.001$), and a 15-point significant improvement of using the appropriate fluid rate ($p < 0.05$) (Table 2). There was no statistically significant change in the patients' clinical outcomes before and after the improvement program (Table 3).

Conclusion: Our multi-faceted collaborative program resulted in significant improvement in adherence to pediatric DKA best practices across a spectrum of community emergency departments.
References available upon request
Full disclosures for all authors and coauthors available upon request

IN SITU SIMULATION BASED DEVELOPMENT AND TRAINING OF AN EMERGENCY AIRWAY MANAGEMENT PROTOCOL FOR USE IN THE PEDIATRIC POPULATION DURING THE COVID-19 PANDEMIC

Emily Mathias, MD,[1] Natalie Schellpfeffer,[1] Michele Carney[2]
[1]University of Michigan, Ann Arbor, MI, USA; [2]Emergency Medicine UM CES, Ann Arbor, MI, USA

Introduction: The evolution of the COVID-19 pandemic across the USA has been a rapidly changing learning curve for all medical providers. Critically ill children with COVID-19 are less common than adults, yet not absent from the illness' demographics [1,2,3,4,5]. Additionally, higher rates of asymptomatic infectious states in children have been reported [4]. We recognized a need to adjust our process for emergency airway management to reduce risk of aerosolization and contamination [6,7]. The COVID-19 airway process developed by our adult emergency medicine colleagues needed to be tailored to address pediatric-specific physiology, as well as differences in our space, team structure and equipment needs. Using a collaborative, team-based approach we formulated an emergency provider based airway management algorithm for the pediatric population. We postulated that in-situ simulation would be an effective tool to develop, revise and implement our new airway protocol.

Methods: A cohort of pediatric emergency medicine (PEM) faculty volunteered to lead our workgroup that included nursing leadership, respiratory therapy, and pharmacy. We performed a literature review of available pediatric COVID-19 publications, which was limited in general by the rapidity of the pandemic evolution. We also discussed available anecdotal evidence from collaborative PEM listservs and from personal communications with colleagues at other institutions. Prior to implementation, in situ simulation was used

to assess and iteratively improve the protocol through identification of potential process and system issues. After this preliminary development stage, a simulation-based training utilizing a case scenario was employed to educate and train providers. Pre- and post- training surveys were completed to determine how our developed airway process and simulation training had impacted provider comfort and safety.

Results: PEM faculty and fellows were surveyed at the onset of the COVID-19 pandemic prior to process implementation. They then received the same set of questions after in-situ simulation implementation for post-intervention evaluation, approximately two months after project origination. We had an 100% (n=27) survey response rate. There was a clinically significant improvement in provider's level of comfort in performing emergency airway management, with only 18.5% (n=5) reporting feeling at least somewhat comfortable pre intervention vs 88.8% (n=24) reporting feeling at least somewhat comfortable post-intervention. Furthermore, 96.2% (n=26) of respondents reported feeling at least somewhat confident in their ability to keep team members protected from infectious exposure following implementation and simulation based training, up from the 44.4% (n=12) prior to our intervention.

Conclusion: There is limited available data to guide pediatric airway management during the COVID-19 pandemic. Through the use of in-situ simulation for process development and training, our workgroup was able to tailor an airway management algorithm to address the inherently unique needs of the pediatric population during the COVID-19 pandemic. Changes were based on issues noted during in-situ simulations and were related to either refining procedural workflow, appropriate personal protective equipment (PPE) utilization, and discussions around pediatric anatomic and physiologic differences that necessitated adjustments. Most importantly, our simulation-based educational intervention greatly improved provider comfort and perceived safety in performing emergency airway management during this time of unprecedented risk. We hope our work will support our emergency medicine colleagues in the clinical care, workflow, and decision-making that pertains specifically to the pediatric population.
References available upon request
Full disclosures for all authors and coauthors available upon request

IN SITU SIMULATION TO ASSESS THE CURRENT STATE OF CARDIAC ARREST CARE IN THE PREGNANT PATIENT

Rachel Carroll-Bennett, MD, MPH,[1] Alexander Meshel, BA,[2] Suzanne Bentley, MD, MPH, FACEP[3]
[1]NYC Health + Hospitals/Elmhurst Hospital Center, Queens, NY, USA; [2]Icahn School of Medicine at Mount Sinai, Roslyn, NY, USA; [3]Elmhurst Hospital Center, Forest Hills, NY, USA

Introduction: Maternal mortality has been on the rise over the last 15 years. From 2014-2016, in New York, the maternal mortality rate for black women was 51.6 deaths per 100,000 live births, as compared to 15.9 deaths per 100,000 live births for white women over that same period of time. Previous education at New York Health and Hospitals/Elmhurst did not include simulation based training for maternal cardiac arrest. This initiative seeks to assess and improve the current state of maternal cardiac arrest care through in situ based simulations.

Methods: 19 impromptu, in situ, standardized, code team simulations were conducted on the labor and delivery unit with the actual responding obstetric and hospital code teams in order to allow for systematic assessment of areas of weakness and identification of latent safety threats (LSTs). These were divided into four main categories - equipment, medications, resources/systems, and technical skills. Additionally, participants (n=52) completed the National Aeronautics and Space Administration Task Load Index (NASA-TLX) questionnaire, a multifaceted assessment tool administered post-simulation to rate perceived workload (scale 0-20). This tool allows for assessment of workload domains and distribution among provider types and serves as a surrogate of task, system, and team taskload effectiveness.

Results: NASA Task Load Index: The average score of all participants was 12.51±2.88. Of note, the subcategories of mental demand and temporal demand were particularly high at 15.07±3.90 and 14.50±3.59, respectively. Latent Safety Threat Analysis: 37 unique threats were identified with the most common themes including role assignment and team leader identification, equipment use and location, knowledge deficiencies with regards to defibrillator use, code team activation, and time to perimortem cesarean section.

Conclusion: Using the results of the taskload and LST analysis, a number of improvements were made within the Obstetrics department at Elmhurst. Aimed at reducing the mental workload of healthcare team members, a cognitive aid (sign) was placed above each labor bed reminding providers to perform lateral uterine displacement during CPR. Standardized teaching points have been incorporated into sessions in response to the LST and TLX scores and a review of defibrillator use is completed during each debriefing. In response to the LST and temporal taskload finding that providers had difficulty obtaining a scalpel with sufficient time to perform a perimortem cesarean section by the 4-minute guideline, a system was implemented to stock scalpels in a lock-box inside each patient room. In situ simulation is a powerful tool to assess provider taskload and system threats to ultimately guide education and training as well as equipment allocation and signage, with the goal of improving patient outcomes.
References available upon request
Full disclosures for all authors and coauthors available upon request

INCREASING INTERNAL MEDICINE RESIDENT COMFORT AND KNOWLEDGE TREATING EMERGENT CARDIOPULMONARY SITUATIONS USING HIGH FIDELITY SIMULATION

Lindsay Sunzeri, BS, MD[1] Jenna Sizemore, MD[1]
[1]West Virginia University, Morgantown, WV, USA

Introduction: Simulation offers an opportunity to learn about crucial patient-care scenarios in a low-stakes learning environment. Treating patients with cardiopulmonary arrest is a challenging situation in many physicians' careers. While teaching rounds allow for real-time learning for non-acute situations, simulation offers an opportunity to mimic emergency scenarios in an environment that allows for the freedom for residents to practice independently. Simulation has been used to mimic emergency scenarios for training purposes.1 We implemented a high-fidelity simulation scenario across a longitudinal curriculum in a moderate sized academic Internal Medicine training program. We hypothesize that high fidelity simulation can improve Internal Medicine resident knowledge and comfort treating emergent cardiopulmonary situations.

Methods: 68 Internal Medicine and IM-Pediatrics residents from PGY1-PGY4, underwent small group scenarios utilizing high-fidelity simulation mannequins in acute, unstable patient scenarios. The training rooms used contained a high-fidelity simulation mannequin, telemetry monitor, "crash cart" with defibrillator/pacer and emergency medications. 5 scenarios were presented including: Unstable Bradycardia, Unstable Wide-Complex Tachycardia, Narrow Complex Tachycardia, Stable Wide-Complex Tachycardia, and Anaphylaxis Leading to Shock. Learners were given short patient scenarios, and then were to treat the simulated patient. A voluntary survey was conducted and responses were collected anonymously and in aggregate by non-study personnel. Surveys utilized a Likert scale with 5 denoting the positive anchor that the participants would strongly agree that simulation exercise increased the comfort for tachyarrythmia, bradyarrythmias, shock syndromes, and cardiopulmonary resuscitations.

Results: Simulations were conducted longitudinally over the academic 2018-2020 year. 20 of 68 participants responded to the voluntary survey (29%). The simulations were halted due to social distance requirements secondary to the SARS-CoV-2 pandemic in 2020. Survey results indicate that resident learners felt that this was an effective learning tool. The great majority of learners indicated that their knowledge and comfort regarding code scenarios was increased after participation in the simulation. The majority of resident learners also reported that they felt comfortable treating both tachyarrhythmias and bradyarrhythmias. There was overwhelmingly positive attitude towards future simulation scenarios.

Conclusion: The survey results support our hypothesis that high fidelity simulation can improve Internal Medicine Resident knowledge and comfort in treating emergent cardiopulmonary situations. Learners had overwhelmingly positive responses to surveys after their simulation experiences. This suggests that high-fidelity simulation can be used effectively for post-graduate medical training and can be a very helpful teaching tool. High fidelity simulation of emergent patient simulations can allow learners to operate in a low stakes environment with the freedom to practice independently. Many times, resident exposure to cardiopulmonary emergencies is either in ACLS training sessions or in real life code scenarios. Using high-fidelity simulation allows resident learners to increase their comfort and knowledge outside of those high-pressure situations.
References available upon request
Full disclosures for all authors and coauthors available upon request

INNOVATIVE APPROACH TO SIMULATION-BASED EDUCATION FOR DELIVERY ROOM RESUSCITATION TEAM PREPARATION FOR DELIVERY OF COVID-19 POSITIVE MOTHER

Jackie LeVan, DO, CPhys, FAAP,[1] Sanjuanita Garza-Cox, MD, FAAP,[2] Lindsay DeVries, MD, FAAP,[3] Gillian Gonzaba, BSN, MSN, NP, ARNP-BC,[4] Susan Mercier, MSN, NP, RN-BC,[5] Cody Henderson,[3] Shelley Solis, BSN, RN,[6] Renee Cadena, BSN, RN, CCRN,[6] Heather Delaney, MD, CHSE, FAAP,[7] Alejandra Herrera, BS, BSN, RN,[8] Jeanne Salgado, BSN, MSN, RN-BC, BC,[8] Kelli Brimager, MSN, RNC-NIC, MSN, RN[3]
[1]Mednax, San Antonio, TX, USA; [2]Mednax/Methodist Children's Hospital, San Antonio, TX, USA; [3]Children's Hospital of San Antonio, San Antonio, TX, USA; [4]Pediatrix Medical Group San Antonio; MEDNAX, Helotes, TX, USA; [5]Mednax Medical Group, Bulverde, TX, USA; [6]Baptist Health System, Boerne, TX, USA; [7]North Central Baptist, San Antonio, TX, USA; [8]Methodist Children's Hospital, San Antonio, TX, USA

Introduction: The World Health Organization declared COVID-19 as a pandemic on March 11, 2020. This crisis represents a great example of an evolving clinical situation where simulation-based education can add to the education of medical staff regarding new clinical policies and procedures. However, it is difficult to provide a simulation given the limitations in group gatherings and concern for risk of infection. Our hypothesis was that we could provide an innovative simulated experience for medical staff in Neonatal Intensive Care Units (NICUs) across a large metropolitan area showing improvement in

their self-assessment scores regarding knowledge of new COVID-19 delivery and resuscitation policy and procedures.

Methods: The Pediatrix Medical Group neonatal practice covers multiple hospital systems across San Antonio, Texas. Simulation leaders in the practice work with local NICU clinical educators providing simulation-based education at multiple hospitals. As a result of the current infectious concerns surrounding COVID-19, traditional group simulation activities were not advisable. This provided an opportunity to create an innovative approach to simulation education for the medical staff, specifically concerning the delivery room preparation/resuscitation and new PPE requirements. Between March-June 2020 each simulation program at the three major hospital systems created a video simulation unique to their respective facility outlining the COVID-19 delivery attendance/resuscitation. All NICU staff attending these deliveries watched the video simulation. All participants completed a Lickert scale pre and post assessment depicting personal knowledge concerning the newly devised policies and procedures.

Results: Multiple hospital systems provided a video simulation experience to NICU staff (>200 nurses) in an efficient manner during a rapidly evolving pandemic. A total of 185 self-assessments have been completed. Results show significant improvement in knowledge about the new COVID-19 policies/procedures. The two most significant improvements relate to knowledge of the delivery room location for the COVID-19 mother as well as the specific process for handoff of infant from L&D to NICU (39% and 32% improvement). The majority of participants showed baseline knowledge of proper donning/doffing of PPE and that intubation is the highest risk for infection during resuscitation (10% and 5% improvement). This demonstrates that the team understands the infectious risk of COVID-19, but significantly improved their knowledge of the policy adjustments for COVID-19 delivery. The COVID-19 video simulation demonstrated an effective and efficient way to show improvement in the education of NICU medical staff.

Conclusion: Simulation-based education offers an important visual and hands on educational experience for medical teams to efficiently review new policies and procedures. Simulation experiences often require significant educational time to capture all of the medical team members and generally involve multiple participants and facilitators. Video recorded simulation allows distribution to hundreds of medical personnel across a large metropolitan area in a short period of time. This type of simulation experience could be utilized in a situation such as a pandemic where there is limitation of the number of participants or if education is required for a large group in a quick manner.
References available upon request
Full disclosures for all authors and coauthors available upon request

INTEGRATING SIMULATION AND HUMAN FACTORS ERGONOMICS IN MEDICAL DEVICE DESIGN

Jordan Newman, MD,[1] Nora Colman, MD,[2] Kiran Hebbar, MD, FAAP, FCCM[2]
[1]Emory University School of Medicine, Decatur, GA, USA; [2]Children's Healthcare of Atlanta, Atlanta, GA, USA

Introduction: During the COVID19 pandemic, risk of disease transmission to healthcare workers during routine clinical procedures are high (1). Clinicians are utilizing barrier enclosure devises during intubations to protect from aerosols. In the development of medical devices, human factors ergonomics (HFEs) guide device development that is user-friendly and improves user performance to reduce human error (2, 3). User-centered design (UCD) is a human factor technique that focuses on observing and evaluating users' interaction with the design during the design process. Simulation sits at the interface of HFEs and UCD to identify inefficiencies in design and devise solutions to better meet end-user needs and minimize risk (4, 5). We describe how simulation anchored in HFE and UCD was used in the design of an intubation enclosure device and applied to better understand the interactions of clinicians with the device, elicit user needs, identify design inefficiencies, and unveil safety concerns.

Methods: This was a simulation based prospective process used to design a pediatric intubation enclosure device. Four iterations of the device prototype were made, each of which was evaluated by front-line staff through simulation. Simulation-based Iterative Design Testing included a simulated scenario, debriefing, and Failure Mode and Effect Analysis (FMEA). Front-line staff including physicians and respiratory therapists simulated an intubation using the device prototype. Debriefing was used to identify latent conditions and potential active failures related to the design. Facilitators probed participants to explore how the device impacted functionality, accessibility, flexibility, usability, and safety. Failure mode and effect Analysis (FMEA) was used to prioritize and categorize each latent condition identified. After each simulation, feedback was provided to the engineer, a design iteration was made, and was re-tested until the final product was developed.

Results: Simulation identified 29 latent conditions. Based on simulation feedback, four iterations of the device prototype were made. Identified latent conditions included performance impact, patient and staff safety, and patient experience. The most common latent conditions identified related to limited flexibility to accommodate for variation in end-user stature or sight lines. Additional high priority latent conditions related to the size of the box, accessing the patient, limitation in ability for oxygen/suction tubing and the ventilator circuit to reach the patient, and visibility through the box. Limited ability to create a box that provided a negative pressure space increased the risk of contamination of end-user, although this was balanced with the need for flexibility and a soft frame that allowed for easy passage of tubing into the box and easier accessibility to the patient.

Conclusion: Integration of simulation with HFEs to develop a pediatric intubation enclosure device demonstrates the role that simulation plays as a patient safety tool. Simulation provided a unique opportunity to bridge the gap in HFE approaches by engaging clinicians, providing an in-situ clinical context for device evaluation to identify inefficiencies and safety concerns. Focused simulations provided the engineer with real-time, comprehensive, prioritized feedback that was used to optimize device performance and minimize human error. Simulation demonstrated work as done, providing a rich opportunity to engage users, unveiling unintended consequences that could not have otherwise been predicted in the design process. The approach described can be adopted to evaluate other elements of the work system across a variety of clinical areas. Anchoring simulation with HFE approaches is an unharnessed opportunity to increase the safety evaluation and reduce error during device development.
References available upon request
Full disclosures for all authors and coauthors available upon request

JUST-IN-TIME CLINICAL VIDEO REVIEW IMPROVES SENGSTAKEN-BLAKEMORE TUBE PLACEMENT BY EMERGENCY PHYSICIANS: A RANDOMIZED CONTROLLED SIMULATION-BASED STUDY

James Bonz, MD,[1] Leigh Evans, MD,[1] Jessica Ray, PhD,[1] Ambrose Wong, MD, MSED[1]
[1]Yale School of Medicine, New Haven, CT, USA

Introduction: JIT training has been interpreted in many ways; ultimately the concept as it applies to medical education aspires to provide relevant instruction at the point of clinical care[1]. Variations on delivering JIT training that span the breadth of clinical medicine have improved the success of a variety of procedures[2-4] and enhanced medical education[5]. The concept has been successfully applied to surgical procedures[6-9], complicated bedside procedures[2], and less complex routine procedures for clinicians and laypersons[3, 10]. Current JIT training media is not designed to provide rapid, concise instruction in the emergent setting. Current studies include 3-D teaching models, frequent In Situ simulations, and simulator practice[7-9, 11-15]. The application of these modalities depends on the clinical environment and the patient's acuity. Can a tailored JIT video improve the performance of an emergently indicated procedure that is both rarely performed and of high consequence?

Methods: We created a succinct three-minute Just in Time (JIT) training video on Sengstaken-Blakemore tube (SBT) insertion. We recruited emergency medicine resident physicians to participate in a simulation scenario in which they had to quickly place an SBT. Participants were randomized to either procedure review by any media they chose (control) or review of the JIT video (intervention). The media review was limited to three minutes to simulate the realistic time constraint in a clinical environment. A checklist, created by a multidisciplinary group of SBT experts, established a passing score of 18 points with a maximum of 28 points. Dangerous actions resulted in point subtractions mandating failure. Pilot data suggested a baseline score of 14 with a standard deviation of 7. A 50% improvement in the primary outcome of the checklist was expected with the use of the JIT intervention. Planning for a power of 80% and a = .05 we calculated a sample size of 16 participants per group.

Results: 32 participants were randomized to media review (control) or JIT video (intervention). Within the control group, 2 of 16 (12.5%) reached a minimum passing score. Within the intervention group, 10/16 (62.5%) reached a minimum passing score. A Chi-square test indicated a significant difference in pass rates between groups ($X2 = 8.533$, $p = .003$). Videos were scored by a blinded reviewer and a subset of randomized videos were graded by two additional blinded reviewers to audit interrater reliability. Cohen's Kappa indicated substantial agreement ($k = 0.640$)

Conclusion: A readily available, focused JIT video may offer increased success for unexpected and complicated rare procedures like SBT insertion.
References available upon request
Full disclosures for all authors and coauthors available upon request

JUST-IN-TIME INTERPROFESSIONAL COVID-19 INTUBATION TRAINING IMPROVES HEALTHCARE TEAM PREPAREDNESS

Ryan Thompson, MD, CHSE, FACEP,[1] Shannon DiMarco, MSHS, CHSOS,[2] Gina Tranel, BSN, RN,[3] Erick Przybylski, MSMS, CHSE, MSMS, CHSE, EMT-P/NRP,[4] Joshua Glazer,[5] Leah Kaszubski[2]
[1]University of Wisconsin, Madison, WI, USA; [2]University of Wisconsin - Madison, Madison, WI, USA; [3]UW Health, Madison, WI, USA; [4]University of Wisconsin Health, Madison, WI, USA; [5]University of Wisconsin School of Medicine & Public Health, Madison, WI, USA

Introduction: Enhanced PPE and social distancing requirements during the COVID-19 pandemic have significantly changed protocols around team-based emergent intubations1. We hypothesized that healthcare teams would be relatively uncomfortable with new protocols and that interprofessional simulation training would improve confidence in future intubations. Simulation training has been shown to improve confidence in procedural skills, even in experienced providers2. Interprofessional simulation has been shown to improve teamwork and communication3. While social distancing guidelines and PPE conservation efforts added additional considerations to executing simulations safely, we believe that these effects will not negate the benefits of training.

Methods: We developed an interprofessional simulation-based training for ED physicians, ICU physicians, ED residents, ED nurses, and respiratory therapists. Working in teams of three as outlined in clinical guidelines (one physician/resident, one nurse, and one RT), participants watched a 10-minute prerecorded presentation reviewing protocols and best practices for intubating COVID patients. Groups then moved to a simulation room, where they prepared as a team to intubate a COVID patient. This included preparing equipment, donning PPE, and developing a plan. Mock PPE was used to preserve PPE stocks for patient care. After the patient was successfully intubated, the team cleaned their equipment and doffed their PPE. A physician facilitator was present throughout to answer questions that arose. A debrief was completed in a separate room. A post-session survey was completed either digitally or via paper. Social distancing was maintained throughout the training.

Results: All 118 participants filled out the survey, for a completion rate of 100%. The role of participants who filled out the surveys was 29.8% RN, 28.1% RT, 26.3% ED resident, 15.8% ED Attending. The majority of participants had not yet participated in the intubation of a COVID-suspected patient (59.2%). Of those 42 who had, 21 (50%) had been involved in a single intubation, 12 (28.6%) had been involved in two, and 8 (20%) had been involved in three or more. Participants answered questions about the helpfulness of the training and preparedness of intubating a COVID patient. Answers were given on a 5 point Likert scale (1=least helpful/prepared; 5=most helpful/prepared). Participants reported that both portions of the training were helpful, with the simulation session scoring a slightly higher average (4.53 for the presentation, 4.74 for the simulation). Average preparedness for intubating a COVID patient improved from 3.4 before the session to 4.49 after ($p<0.0001$).

Conclusion: The COVID pandemic has forced many changes to the way that even common procedures such as intubation are performed in the clinical setting1. The need for social distancing and mandate to preserve PPE adds additional challenges to rollout of substantial simulation training. However, even with these restrictions, an interprofessional simulation-based training program significantly improved self-reported preparedness among emergency department teams.
References available upon request
Full disclosures for all authors and coauthors available upon request

KEEP BREATHING: A SIMULATION FOR PEDIATRIC RESIDENTS ON RESPIRATORY COMPLICATIONS OF SEDATION

Elizabeth Mannino Avila, MD,[1] Elizabeth Mannino Avila, MD,[1] Daniel Hershey, MD,[2] Annie Larrow, MD, MS, FAAP,[2] Melissa Cameron, MD, FAAP[3]
[1]UCSD, RCHSD, San Diego, CA, USA; [2]RADY CHILDRENS HOSPITAL, SAN DIEGO, San Diego, CA, USA; [3]UCSD Rady Children's Hospital San Diego, San Diego, CA, USA

Introduction: Pediatric patients often require sedation for procedures or studies. Unfortunately, many pediatric residents have limited experience in sedation, and may be unaware of common risk factors for respiratory complications of sedation or their appropriate management. In order to properly care for pediatric patients upon graduation, residents need more experience with sedation. To bridge this knowledge and experience gap, we developed a pediatric simulation scenario using a high-fidelity mannequin, hypothesizing that through simulation, we can teach pediatric and medicine-pediatric residents: 1) to identify the risk factors of obesity, snoring, and obstructive sleep apnea (OSA) for respiratory complications of sedation, and 2) to identify methods to manage upper airway obstruction and central apnea due to sedation, and 3) increase resident confidence in management of respiratory complications of sedation.

Methods: The study design was a pre-post intervention survey-based study design. Thirty 2nd-4th year pediatric and medicine-pediatric residents were randomly divided into groups of 4-6 for the session. They were presented with a 10-15 minutes scenario of a sedated 5-year-old obese child with an upper airway obstruction and then central apnea. A Gaumard Hal 2225 mannequin was used. Sedation credentialed pediatric hospital medicine attendings facilitated the simulation to ensure learners met learning objectives by completing a critical action checklist. The checklist included actions such as recognizing and alleviating obstructive apnea, providing supplemental oxygen, and recognizing and treating central apnea. A debrief followed which included standardized teaching points. Residents completed pre-simulation and post-simulation self-assessments and open-ended knowledge-based surveys. Descriptive statistics were used to compare the survey response pre-simulation to post-simulation.

Results: A total of 19 (63%) pre/post surveys were completed. Residents noted an average increase in their confidence to manage respiratory complications during sedations from 3.1 to 4.1 on a 5-point Likert scale ($p<0.001$). There was a statistically significant improvement in listing the sedation risk factors of obesity, snoring, or OSA from 11% to 89% ($p<0.001$). The simulation did not significantly change the already high level of awareness of respiratory depression as a complication of fentanyl or midazolam (89% to 100% ($P = 0.5$)). All respondents listed at least one appropriate intervention to relieve airway obstruction in a sedated child both before and after the simulation.

Conclusion: We demonstrated significant improvement in resident confidence after participation in a simulation-based sedation educational session. In addition, there was significant improvement in identifying obesity, snoring, or OSA as risk factors for respiratory complications of sedation. We did not significantly increase the already high ability of residents to identify methods to manage upper airway obstruction and central apnea due to sedation.
References available upon request
Full disclosures for all authors and coauthors available upon request

LEARNER ASSESSMENT OF AN OCULAR TONOMETRY TASK TRAINER

Jeff Heimiller, MD,[1] Charles Lei, MD, FACEP,[1] Joseph Sikon, BS, MD,[2] Lawrence Stack, MD, CPhys[1]
[1]Vanderbilt University Medical Center, Nashville, TN, USA; [2]Vanderbilt University, Nashville, TN, USA

Introduction: Intraocular pressure (IOP) measurement is vital when assessing patients for ocular pathology. Novice learners are uncomfortable with this procedure due to fear of causing injury or discomfort. Commercially available task trainers carry heavy costs, and do-it-yourself task trainers focus on non-tonometry ophthalmology procedures (1-4). Foley catheter balloons and marbles have been used to teach tonometry. These models do not demonstrate relevant anatomy with accurate tactile feedback and the ability for the instructor to vary anterior chamber pressure. We are not aware of any model that provides these features. We developed a task trainer possessing these qualities for instructing medical students and emergency medicine (EM) interns. We hypothesized that use of this model would result in a significant improvement in learners' comfort in performing tonometry and confidence in the accuracy of their measurements.

Methods: Our model used swine eyes with an angiocatheter inserted through the optic nerve sheath into the vitreous chamber, pressurized via IV tubing and a syringe, to create a model with variable IOP. We incorporated this model into our EM medical student procedure lab and our EM intern ophthalmology boot camp (5). Participation in the study was voluntary, and learners had access to the model and accompanying instruction regardless of their participation. Participants completed a pre-test prior to the instructional session, providing data on basic demographics, knowledge of the procedure, and comfort and confidence related to the procedure. Learners then received instruction on the use of the tonometer followed by guided practice using the swine eye model. After the session, they completed a post-test. The Wilcoxon Signed-Rank test was used to analyze changes in learner comfort and confidence. This study was deemed to meet exemption criteria by the Vanderbilt University Medical Center IRB.

Results: Thirty-six learners in total participated in the study, including 13 EM interns and 23 medical students. All participants completed a pre-test and post-test. Of the medical students, 18 were in their fourth year of medical school, while 5 were in their third year. Of these 36 learners, 16 had never received training on tonometry, 10 had never seen it performed on an actual patient, and 18 had never personally performed the procedure. Among all learners, mean comfort with performing this procedure had a statistically significant increase from 3.26 to 7.64 ($Z = -4.95$, $p < 0.005$). Subjects' mean confidence in the accuracy of their measurements also had a statistically significant increase from 3.11 to 7.56 ($Z = -4.8$, $p < 0.005$). The significance of these increases remained when the results for medical students and interns were calculated separately.

Conclusion: We successfully constructed a realistic and inexpensive model for IOP measurement that allowed learners to practice ocular tonometry. This model was created using swine eyes and materials available in a typical emergency department. Only half of our learners had ever performed this procedure before, and nearly one-third had never seen the procedure performed. Both medical students and EM interns demonstrated increases in comfort with performing the procedure and confidence in the IOP measurements they obtained. These increases were both statistically significant and large in effect. Although these results do not directly support an improvement in clinical practice, they demonstrate a poor baseline comfort and confidence related to this procedure among most novice learners, which improved greatly after the use of this task trainer.
References available upon request
Full disclosures for all authors and coauthors available upon request

LEARNER ENGAGEMENT DURING VIRTUAL SIMULATION SESSIONS: A PILOT STUDY

Gretchen Hoelscher, BS, MS,[1] Darla Morton, BS, MS,[1] Brittney Sanderson, BS, MPH, MS,[1] Dawn Swiderski, BSN, MSN, RN, CCRN, CHSE, Fellow of SSH[2]
[1]Atrium Health, Concord, NC, USA; [2]Carolinas Simulation Center, Atrium Health, Charlotte, NC, USA

Introduction: The Covid-19 pandemic has increased the need and appeal for virtual simulation-based education, but few studies have examined the vital engagement of learners among these techniques (1-3). Carolinas Simulation Center has a wide array of user groups and, to meet their needs, our educators developed several different styles of virtual simulation education. We hypothesize that measured learner engagement and engagement perceptions will vary depending on the style of virtual simulation in the following order of highest to lowest engagement 1) hybrid: some learners are in-person and others on Zoom, 2) observer: all learners are on Zoom and full debrief follows a video-recorded scenario, 3) vignette: all learners are on Zoom and with a flipped debrief model, specific teaching points are covered before and after watching short video-recorded vignettes, 4) demo: all learners are on Zoom and an instructional discussion follows a live procedural demonstration.

Methods: Sessions from 4 styles of virtual simulation (hybrid, observer, vignette, demo) were included in this study. There were 2-4 sessions per style and 12 or fewer learners per session. All sessions were audio-recorded. To established learner engagement, a checklist was completed by three reviewers while watching the sessions live and listening to the audio-recording. Session demographics are presented in Table #1. Measurements of communication included "Answers & Comments Made by Learners to Educators," "Replies Made by Learners to Other Learners' Answers & Comments," "Percent Replies Made by Learners to Other Learners' Answers & Comments," and "Percent Learners with Cameras on." Data were analyzed using t-tests, Mann-Whitney, ANOVA, and the Pearson Correlation tests. Survey responses were analyzed to compare learner self-perceived level of engagement to educator/Simulation Operations Specialist (SOS) perception of learner engagement using the Mann-Whitney test.

Results: Comparing the 4 different styles of virtual simulation (Table 2), there were significantly ($p<0.05$) higher levels of "Answers & Comments Made by Learners to Educators per Hour" in the observer style compared to the vignette and hybrid styles. In addition, there were significantly ($p<0.05$) more "Replies Made by Learners to Other Learners' Answers & Comments per Hour" in the hybrid style compared to the vignette style. Table 3 shows that learners with active cameras were strongly correlated with higher levels of communication in both the vignette and the observer styles. Furthermore, significantly fewer learners had an active camera in the vignette style when compared to both the hybrid and observer styles (Fig 1). Except for the vignette sessions, the self-perceived level of learner engagement matched the educator/SOSs' perception of learner engagement. Educators using the vignette style believed the learners were significantly more engaged than the learners' self-perceptions (Fig 2).

Conclusion: While our results did not show the anticipated ranking of engagement levels (hybrid, observer, vignette, demo), a significant variation in engagement was found. Based on these pilot findings, it appears that the observer style, instead of the hybrid, resulted in the highest engagement, while the vignette, instead of the demo, resulted in the lowest. Active cameras were correlated with higher engagement. Virtual learners participating in the hybrid sessions may have felt a disconnect or left out since their fellow learners were in-person, whereas each of the learners in the observer style were virtual. Except for the vignette sessions, learners in each group were previously acquainted, which possibly contributed to their low level of engagement. Although more data is required, these invaluable results can inform curriculum development and help determine the best format for maintaining learner engagement, as virtual simulation is essential for learners in today's challenging world.
References available upon request
Full disclosures for all authors and coauthors available upon request

LIFE-SAVING PROCEDURES PERFORMED WHILE WEARING CBRNE PERSONAL PROTECTIVE EQUIPMENT: A MANIKIN RANDOMIZED TRIAL

Giulia Mormando, MD,[1] Matteo Paganini,[2] Chiara Alexopoulos, MD,[2] Sandro Savino, PhD[3]
[1]Università di Padova, Padova, Italy; [2]Università degli Studi di Padova, Padova, Italy; [3]University of Padova, Padova, Italy

Introduction: Chemical-Biological-Radiological-Nuclear-explosives (CBRNe) are complex events. Decontamination is mandatory to avoid harm and contain hazardous materials, but can delay care. Therefore, the stabilization of patients in the warm zone seems reasonable, but research is limited. Moreover, subjects involved in biological events are considered infectious even after decontamination, and need to be managed while wearing personal protective equipment (PPE), as seen with Ebola and coronavirus disease (COVID-19) pandemic. With this manikin trial we assessed the impact of CBRNe personal protective equipment (PPE) on cardiopulmonary resuscitation (CPR) and combat casualty care procedures.

Methods: We compared procedures performed by emergency medicine and anesthesiology senior residents, randomized in two groups (CBRNe PPE versus no PPE). Chest compressions (CCs) depth was defined as the primary outcome. Time to completion was calculated for: tourniquet application; tension pneumothorax needle decompression; peripheral venous access (PVA) and intraosseous access (IO) positioning; drug preparation and administration. A questionnaire was delivered to evaluate participants' perception.

Results: 36 residents participated. No significant difference between the groups in CCs depth (mean difference: 0.26 cm [95% CI: -0.26, 0.77 cm; p = 0.318]), as well as for CCs rate, CCs complete release, and time for drugs preparation and administration was detected. PPE contributed to significantly higher times for tourniquet application, tension pneumothorax decompression, PVA and IO positioning. The residents found simulation relevant to the residencies' core curriculum.

Conclusion: This study suggests that CPR can be performed while wearing PPE without impacting quality, while other tasks requiring higher dexterity can be significantly impaired by PPE.
References available upon request
Full disclosures for all authors and coauthors available upon request

MAKING THE VIRTUAL A REALITY DURING A PANDEMIC: IMPROVING LEARNING OPPORTUNITIES IN MEDICAL EDUCATION THROUGH VIRTUAL REALITY SIMULATION.

Amy Irvine, BA (HONS), MBChB,[1] Sally Shiels, MBChB, Other,[2] Sarah Flaherty,[3] Helen Higham, MBChB, Other, SFHEA, FRCA[4]
[1]Oxford University Hospitals, Oxford, United Kingdom; [2]Oxford University Hospitals NHS Trust, Oxford, United Kingdom; [3]Oxford University Medical Sciences Division, Oxford, United Kingdom; [4]Oxford University, Oxford, Oxfordshire, United Kingdom

Introduction: The Oxford physician, William Osler, was the first to be credited with taking medical students out of the lecture theatre and to the bedside(1). However, the COVID-19 pandemic has not just taken medical students out of lectures but also away from the bedside. This situation threatens to compromise learning quantity and quality and ultimately the competencies of future graduating doctors. Virtual Reality Simulation (VRS) can provide students with a computer-generated environment where users interact with virtual surroundings and patients in any location(2). To mitigate this gap in clinical experiences during the initial phases of the pandemic we created an education package using VRS for medical students at the University of Oxford. Our research questions were: 1) Could VRS provide meaningful learning under these adverse conditions? 2) Could we elicit strengths and weaknesses of virtual simulation in medical learning by examining VRS-based learning under these extreme conditions?

Methods: The Oxford Medical Simulation (OMS) VRS platform offers a library of standardized medical emergencies. The learner interacts with and manages an acutely unwell patient. Learning objectives are specified for each scenario with a score calculated and explained the end. We chose to use two-dimensional delivery to improve accessibility to students self-isolating at home. Access to VRS was offered to all clinical medical students at Oxford Medical School. Scenarios were sorted into groups of virtual patients based on presenting features, and groups were released on a weekly schedule. Each group of scenarios was accompanied by didactic learning resources in the medical school's online repository, including podcasts and lecture notes. Data was collected (using built in OMS metrics and online questionnaires) with students' consent on: · number of scenarios accessed · performance score on each simulation · student perceptions of learning using VRS

Results: In total, 213 students expressed an interest in accessing the VRS platform. 45 of the 213 accessed the scenarios (50% first year students). The students accessed 432 scenarios. Average scores on all first attempts of scenarios was 77%; second attempts 82% and third attempts 99%. Feedback from questionnaire: "I like…the 'real' feel of talking to the patient, informing next of kin….it surprised me how real my patient feels." "I do find it quite a refreshing and different way of approaching the scenarios, and have really enjoyed it." "They are incredibly useful…..I much prefer doing them on a computer screen than in 3D. It does make for a different way of revising."

Conclusion: The high initial response rate suggested student interest and engagement. The low (21%) conversion rate to accessing the VRS platform may be explained by initial technical issues and the voluntary nature of the project. The quantitative data shows the importance of repetition in improving learning. This study reveals some strengths of VRS: · it requires few faculty resources · it requires only basic equipment, available to students at home. · It can be accessed at the learner's convenience Participation may improve with incorporation into the medical school curriculum. Lower usage among the final year medical students may be explained by the fact that they were more likely to be volunteering in clinical and research settings and also the early commencement of official clinical duties due to COVID-19. Overall the VRS platform allowed the delivery of a rapid response to fill a gap in clinical education. The next phase of this project will be to provide live tutor-supported debrief.
References available upon request
Full disclosures for all authors and coauthors available upon request

MASSIVE, INTENSE AND TARGETED SIMULATION TRAINING CAMPAIGN: A CRITICAL CHALLENGE TO FACE THE COVID-19 PANDEMIC

Clement Buleon, MD, MSHS,[1] Erwan Guillouët, Other, CRNA, Nurse Anesthesia,[1] Rebecca Minehart, MD, MHPE[2]

[1]Caen Normandy University Hospital, Caen, France; [2]Massachusetts General Hospital, Boston, MA, USA

Introduction: The unexpected Covid pandemic revealed our unpreparedness. Challenges were multiple including managing a large number of highly contagious and severely ill patients. Among the strategies adopted, several dedicated Covid units were opened and included an increase in ICU beds capacities.[1] Caregivers with previous ICU experience, OR staff, and volunteers to work in those units were identified as backup. Knowing Covid is highly contagious,[2] it was mandatory to maintain both the quality of care and a high level of security regarding contamination for patients and caregivers.[3] It appeared necessary that all caregivers should benefit from specific (re)training early before managing Covid patients.[4] We report the creation of an intense, massive and targeted Covid personal protective procedures training campaign to precede the arrival of cases and enable caregivers in all potential Covid units to be operational early to ensure high quality and safe care.

Methods: A day before the 1st Covid patient hospitalization, 6 specific procedural simulation courses were designed for hand sanitizing, fitting N95 masks, donning, and doffing specific to droplet precautions, and airway management for Covid negative and confirmed patients. Over 3 days and six steps the training sessions were designed: (1) definition of pedagogical frameworks and concepts, (2) drafting of adapted procedures for airway management, (3) sequencing of procedural steps for (4) construction of cognitive aids, checklists (of procedures and validation of skills) and the necessary video tutorials, (5) recruitment of trainers and (6) development of the training schedule. In order to train a maximum of caregivers before the arrival of large numbers of patients, 10 experienced instructors with dual skills as simulation instructors and caregivers was gathered. Their instructor training lasted half a day and began early so that they could immediately initiate training for priority services.

Results: Social distancing was followed which led to a strategy of nights and days of in situ training in groups of 6 learners trained by a duo of instructors. This made it possible to train 1143 caregivers in 10 days, i.e. 27% of the hospital's caregivers and 96% of those involved with Covid patients. With a timeframe of 7 weeks, 231 patients with Covid have been hospitalized. Among all hospital caregivers, 62 (1.5%) became Covid positive including 4 (0.35%) trained and working in Covid units. Despite being potentially more exposed, caregivers in Covid units converted at a rate of 4 times lower than others. We hypothesized our training helped with those results (not directly tested). Training materials were freely accessible online so that others could use them.[5] Surrounding hospitals were contacted and simulation equipment was made available so that they could also carry out training. Media and social networks contributed in dispersing the training material (>45,000 views in 10 days).

Conclusion: It is difficult to prepare for the unlikely, and impossible to prepare for everything. However, we can now speculate that there will be a need for rapid, possibly massive and targeted adaptation to a future health crisis. By applying solid educational theory and targeted practical training to achieve competence, we were urgently able to support acquisition of skills in new procedures for a large number of caregivers. We have demonstrated that such an organization is possible with a high degree of safety (in this case, low rates of contamination in our large number of trained caregivers). The use of modern technologies (video tutorials and social networks) made it possible to extend the benefit beyond our hospital's walls to a national forum. These concepts deserve more study for future Covid-19 new waves or other pandemics.
References available upon request
Full disclosures for all authors and coauthors available upon request

MCI TRAINING OF PEM PROVIDERS USING A SCREEN-BASED SIMULATION TOOL

Emilia Fisher, BA, MD, MPH[1] Manu Madhok, MBBS, MD, CPhys, FAAP, FACEP[2]
[1]Children's Hospitals and Clinics of Minnesota, Minneapolis, MN, USA; [2]Children's Minnesota, Minneapolis, MN, USA

Introduction: Mass casualty event training has become an integral part of hospital preparedness, and pediatric hospitals are no exception. A novel tool for educating providers in START/JumpSTART mass casualty incident triage was developed in 2017 by Cicero et al [1]. 60 Seconds to Survival is a web-based triage simulation that enables providers to collect data on patients such as vital signs and clinical exam, perform life-saving interventions, and assign triage levels, followed by receipt of electronic feedback, with the goal of training providers in a cost-effective, high-fidelity manner. We set out to evaluate how this tool would perform when used to train Pediatric Emergency Medicine physicians in triage, as compared to an online lecture modality.

Methods: A 42-member Pediatric emergency physician group and seven pediatric emergency medicine fellows were recruited to participate. All participants were sent a 20-patient mass casualty scenario on which to perform triage prior to any educational intervention. After completing their initial triage, participants were randomized into two groups. One group received JumpSTART triage training by watching a traditional 11-minute online lecture. The other group was asked to play through each of the three scenarios in 60 Seconds to Survival at least once. All participants then completed a second triage to assess for improvement. A third triage was sent 3 months later to evaluate retention. Mann-Whitney U test was performed to compare the performances between the Online Simulation (OS) and Lecture (L) groups. Median patients correctly triaged as well as over and under triaged were evaluated for each scenario.

Results: At baseline, each group triaged 14 out of 20 patients correctly, with an IQR of 2 for the OS group and of 3.5 for the L group. Post-intervention the OS group triaged median 15 (IQR 4) patients correctly compared to 16 (IQR 3) in the L group. After degradation the OS and L groups each triaged 15 patients correctly (IQR 3 and 2, respectively). In the OS group initially 3 (IQR 3.5) patients were under-triaged and 2 (IQR 3.5) patients were over-triaged. Post-intervention, under-triage decreased to 2 (IQR 2) and over-triage remained 3 (IQR 3). After degradation this became 2 (IQR 2) under-triaged and 2 (IQR 1) over-triaged. In the L group, 2 (IQR 2) patients were under-triaged and 2 (IQR 2) patients were over-triaged at baseline. Post-intervention under-triage decreased to 1 (IQR 2), but over-triage increased to 3 (IQR 3). Post-degradation under-triage returned to 2 (IQR 2) and over-triage stayed at 3 (IQR 3). Numbers were too small to reach statistical significance in most cases.

Conclusion: While modest gains were demonstrated in each group, the online simulation intervention for teaching JumpSTART appears non-inferior to traditional lecture education for this group of pediatric emergency physicians. Particularly when accounting for degradation over time, the OS and L groups performed comparably in improvements in overall, over-, and under-triage. As distance learning gains popularity for economic, accessibility, and safety reasons, it is important to ensure that new modes of education perform as well as those they are replacing. More rigorous instruction and larger test groups may be required to see statistically significant improvements in triage performance between lecture and simulation groups.
References available upon request
Full disclosures for all authors and coauthors available upon request

MEASURING THE LONG-TERM IMPACT OF A HIGH-FIDELITY INTERPROFESSIONAL EDUCATION SIMULATION EXPERIENCE IN MEDICAL STUDENTS

Tina Gunaldo, PhD, PT,[1] Alison Davis, BSN, MSN, PhD, RN, CHSE,[1] Cornelius Rosenbaum[1]
[1]LSU Health-New Orleans, New Orleans, LA, USA

Introduction: There is a gap in the academic literature evaluating the long-term impacts of student outcomes post-engagement in high-fidelity simulation (HFS) interprofessional education (IPE) experiences. The authors sought to investigate student perceptions of interprofessional skills after engagement in a HFS experience during the 2018-19 academic year and post-engagement in similarly focused HFS IPE experience one year later. The research question investigated was "do 3rd year medical students retain their perceptions of interprofessional skills after a high-fidelity IPE simulation post 1 year."

Methods: During the 2018-19 academic year, third year medical students engaged in a HFS IPE experience with undergraduate baccalaureate nursing students focused on Basic Life Support. Students voluntarily engaged in an electronic survey post-engagement in the learning activity. The survey included two perception subscales (Communication, and Roles and Responsibilities) from a validated inteprofessional skills assessment, the Interprofessional Collaborative Competencies Attainment Survey (ICCAS). During the 2019-20 academic year, the now 4th year medical students engaged in a high-fidelity simulation IPE experience with nurse anesthesia students focused on Advanced Cardiovascular Life Support, which also included a focus on interprofessional communication and roles. Students voluntarily engaged in an electronic survey that included the same ICCAS questions as the previous academic year. The analysis was carried out using the Wilcoxon signed-rank test.

Results: Statistical significance ($p<0.05$) was found for changes in post-pre mean scores for both the communication and the roles and responsibilities ICCAS subscales after participation in the BLS and the ACLS experiences. No statistical significance was noted when comparing pre-mean scores in both ICCAS subscales across both academic years. However, statistical significance was found when comparing post-mean scores in both ICCAS subscales across both academic years, with higher post-mean scores after the ACLS experience.

Conclusion: The results indicated that students did not retain the same perception level in their interprofessional skills from 3rd year post-questions to 4th year pre-questions. However, their potential to improve their perception was seen by significantly higher means in 4th year post-questions compared to 3rd year post-questions. The ideal number of experiences throughout a student's academic journey is not yet defined. Implications from this research indicate IPE activities should be provided more often to prevent regression and support improvement in interprofessional skills, so that they are more prepared to collaborate post-graduation.
References available upon request
Full disclosures for all authors and coauthors available upon request

MOVING THE OSCE ONLINE - OUR EXPERIENCE IN THE UNIVERSITY OF NAVARRA. COMPARISON OF RESULTS AND STUDENT IMPRESSIONS WITH CONVENTIONAL OSCES.

Maria Honorato, MD, PhD[1]

[1]University of Navarra School of Medicine, Pamplona, Navarra, Spain

Introduction: There has been little to no experience with whether a virtual OS E can effectively measure the skills and knowledge of the students in comparison with a conventional, in person OSCE. Moreover, OSCEs in our medical school include a technical skills station and we didn´t know whether there was a way to effectively and accurately measure those skills through an only-online test.

Methods: We compared results and and student´s impressions from 2019 (conventional) and 2020 (virtual) OSCEs, as a whole and in four different categories: SP, technical skill testing, clinical scenarios, and database search.

Results: Overall and between groups grades were similar between both groups, as was the perception of difficulty and level of stress associated to taking the OSCE. From the educator point of view, the technical skills section was not considered equal to last year in terms of efficiency testing skills, but a "good enough" rule was applied. We did not experience significant technical problems while testing 200 students in the same time frame. Three educators and two technicians were permanently online during the OSCE and attended a total of 7 technical requests, while 2 students had to complete their tests online via videoconference with the educator due to connectivity problems due to the university security setup.

Conclusion: OSCEs testing solely SP and clinical case management will probably have a similar efficacy online, but testing clinical skills requires a different setup and technological capabilities.
References available upon request
Full disclosures for all authors and coauthors available upon request

MULTIMODAL SIMULATION TO PROMOTE LEARNING AND IMPROVE PATIENT SAFETY DURING THE COVID-19 PANDEMIC SURGE

Sheetal Sheth, DO, MA,[1] Christine Saracino, DO, FAAP,[1] Michael Lamberta, MD,[1] Amish Aghera, BS, MD, CHSE[1]
[1]Maimonides Medical Center, Brooklyn, NY, USA

Introduction: New York City hospitals were overwhelmed by an influx of critically ill patients during the initial surge of the COVID-19 pandemic, resulting in a large scale redeployment of healthcare workers and repurposing of patient care space. Novel teams, new workspaces, unique patient populations, and rapidly changing protocols were a perfect storm for active and latent errors. Social distancing and infection control policies made traditional simulation sessions in a dedicated learning space difficult. We aimed to develop a multimodal flexible approach to leveraging simulation-based techniques to close knowledge gaps in the management of the novel coronavirus, while simultaneously identifying and closing latent errors in the clinical environment.

Methods: This was a quality improvement initiative at a large urban academic medical center with a hospital-based Simulation (SIM) Center during a COVID-19 surge. Target participants were resident physicians and registered nurses. Multiple in-situ SIMs were run on COVID-19 adult inpatient units staffed by internal medicine, orthopedic surgery, or pediatrics. One in-situ was performed in Emergency Department triage. Two virtual scenarios were performed in the SIM Center: one live streamed for pediatric residents via a virtual meeting application and another for emergency medicine providers to watch asynchronously via web-based platform. Learning objectives included safe PPE usage, improving team dynamics, learning COVID-19 related ACLS modifications, and practicing with resuscitative equipment. Scenarios revolved around cardiopulmonary arrest as they enabled debriefing around each learning objective. Latent errors discovered during in-situ SIMs were escalated to unit supervisors in real time.

Results: Nine SIM sessions were performed, with 80 participants (20 RN, 60 MD) in pediatrics, orthopedics, internal medicine and emergency medicine. Knowledge gaps in identifying COVID patients, donning and doffing PPE, ACLS algorithms, and airway management were closed in real time. Participants were educated in limiting their viral exposure while maximizing patient care. Simulationists demonstrated the role of the laryngeal mask airway (LMA) with viral filter while allowing for deliberate practice on a manikin brought to COVID-19 units. A COVID-19 LMA procedural checklist was developed for new learners. Organization of supplies in code carts were reviewed by nurses transposed from outpatient settings. Several solutions to identified latent safety errors were implemented including marking COVID-19 resuscitation areas, modifying visitor triage policies, investigation of air purification systems, and deployment of viral filters across the institution. Participant feedback was uniformly positive.

Conclusion: In-situ and virtual simulation are effective methods to provide just-in-time training and identify and solve latent safety errors for unique clinical situations which may arise in the midst of a pandemic. Use of live streaming and video recording allowed the session to gain an expanded audience to share lessons learned for those whose physical presence was not possible due to social distancing requirements. Despite the stressors and volume of actual patient care, learners were enthusiastic to participate likely from internal motivation to improve the care they were providing. Similarly, the urgency for healthcare systems to quickly respond to safety issues allowed for in-situ simulations even more suitable as a platform to promote rapid cycle quality improvement.
References available upon request
Full disclosures for all authors and coauthors available upon request

MULTIPLE PERSPECTIVES ON CONVERTING A MULTI-STATION OSCE TO A VIRTUAL-HYBRID FORMAT IN RESPONSE TO COVID-19

Joshua Engle, BA, BS, MBA,[1] Kristen Hager, BS, NRP, EMT-P/NRP,[1] Sherry Jimenez, EdD, Other,[2] Roy Yonts, DO[2]
[1]Lincoln Memorial University-DeBusk College of Osteopathic Medicine, Harrogate, TN, USA; [2]Lincoln Memorial University (LMU), Harrogate, TN, USA

Introduction: COVID-19 has required safety protocols[1] that challenge traditional educational mediums. Facilitators have sought content delivery solutions of a remote nature, such as telemedicine and video telephony. Prior to the pandemic, these mediums were examined in educating medical profession students. Cantone et al found utility in providing students exposure to the telemedicine medium and the ability to remotely assess students' skills.[2] Recently, Major S et al resumed sessions using web-based exams and the Zoom video application.[3] Lincoln Memorial University osteopathic medical students on rotations participated in a virtual Clinical Skills Workshop (CSW) comprised of multi-session Standardized Patient (SP) encounters. We sought to understand the impact converting multi-session objective structured clinical exams (OSCE) to a virtual-hybrid format utilizing existing software/hardware would have on stakeholder perceptions of the overall function and efficacy of clinical evaluations.

Methods: Available A/V PC desktop capture hardware housed in our clinical exam center was integrated with B-Line Medical Learning Management System (LMS) and Zoom videotelephony. This was used to produce SP/Student recorded interactions in a telehealth format for CSW in an effort to prepare third-year osteopathic medical students for the physical exam component of their boards. State and federal COVID-19 safety protocols were followed. At the conclusion of each CSW, students were asked questions about their experience with the activity. After-action meetings were held, and reports filed capturing feedback from stakeholders responsible for developing the activity. SPs were interviewed to garner their perspectives on the success of the virtual format and for continuous quality improvement. Satisfaction data garnered from students who participated in the on-site format were compared with data collected from students who participated in the virtual-hybrid format to identify trends.

Results: Comparing cohorts of similar sizes (37 participants from the most recent fully on-site CSW to 38 who completed the virtual format), 100% and 97% of students respectively agreed/strongly agreed that practicing the advanced clinical skills via OSCE scenarios was useful. Ninety-five and ninety-seven percent respectively agreed/strongly agreed the schedule and flow of the OSCE activity was adequate. While 100% agreed/strongly agreed they would recommend the fully on-site OSCE activities for future DO students, 74% who participated virtually agreed/strongly agreed with the same statement. During interviews with two SPs, both reported that the virtual CSW went "well" and the flow was adequate with technical considerations in mind. Consensus amongst stakeholders from after-action reports was that flow and construct were adequate. Stakeholders also reported the largest hurdle being addressed is equipping a smaller group of SPs (due to COVID-19 occupancy limits) with varied case knowledge.

Conclusion: The hybrid-virtual multi-session OSCEs as used in CSWs were found to be positive and useful amongst the majority of stakeholder respondents. All stakeholder types involved noted that the medical provider/patient interaction provided an adequate environment for humanistic learning. Stakeholders also pointed out the system does have limitations. Notably the extent to which a focused physical exam may be performed. Outside of the encounter itself, stakeholders found COVID-19 occupancy precautions resulted in stresses to provide each student unique cases. Possible solutions to these items could be writing case scenarios to be more conducive to the physical exam process as can be applied in the hybrid-virtual model. Limits on staffing could be ameliorated by the introduction and training of more cases to each SP.
References available upon request
Full disclosures for all authors and coauthors available upon request

NATIONAL EVALUATION OF A LOW-DOSE, HIGH-FREQUENCY CARDIAC RESUSCITATION QUALITY IMPROVEMENT PROGRAMME IN THE UNITED KINGDOM – CPR PERFORMANCE PRELIMINARY FINDINGS

Katherine Kuyt,[1] Todd Chang, MD, Other, FAAP,[2] Ralph MacKinnon,[3] Naomi Herz, BS, MS[4]
[1]Manchester University NHS Foundation Trust, Manchester, Manchester, United Kingdom; [2]Children's Hospital Los Angeles, Los Angeles, CA, USA; [3]Royal Manchester Children's Hospital, Manchester, United Kingdom; [4]British Heart Foundation, London, United Kingdom

Introduction: High-quality cardiopulmonary resuscitation (CPR) is critical for patient survival during a cardiac arrest, providing manual circulation of oxygenated blood while any reversible causes of the cardiac arrest are identified and treated (1). Yet the traditional methods of teaching CPR; in a classroom based high dose, low frequency sessions, have room to be improved. To address this, a programme has been developed to provide users with simulation training and learning technology, delivering live feedback and on-going

assessments. The UK RQI Programme has been designed with mandated quarterly CPR training on a specially designed cart in the workplace. The national evaluation aims to explore any impact of RQI on CPR performance, compliance, cost-savings and acceptability to end-users. This work focuses on CPR performance – hypothesising that the UK RQI program will improve CPR skills performance of the participants.

Methods: CPR performance data is under evaluation from three hospitals based in the United Kingdom, recruiting health care professionals from a variety of clinical environments. Participants entering the study complete an un-coached baseline assessment; assessing rescue CPR, compression-only, and ventilation only technique. Following the baseline participants engaged with quarterly coached training sessions before completing an un-coached assessment after 4-quarters of training (assessment1). Participants were given a percentage score calculated as a composite based on the various aspects of the activity and their adherence to BHF high-quality CPR standards. An overall score of 75% was deemed to indicative of high-quality CPR. Change analyses were conducted on the three performance variables (ventilation only, compression only, rescuer CPR) for adult and infant CPR using paired t-tests.

Results: The mean adult CPR baseline score of 51.9% (Standard Error of Mean=1.6) increased to 66.4% (SEM=1.5) at assessment 1 ($p<0.001$, N= 249), mean adult ventilation score increased from 42.5 (SEM=2.9) at baseline to 70.3% (SEM=2.9) ($p<0.001$, N=142). Finally, the mean adult compression score increased from 59.2 (SEM=2.3) to 73.4 (SEM=2.0) ($p<0.001$, N=237). The improvement seen in mean CPR score for infants was not significant (P=0.1), rising from 39.6% (SEM=1.6) to 43.0% (SEM=1.7) at assessment 1 (N=224). However the mean score for infant ventilations rose from 35.8% (SEM=2.2) to 57.3% (SEM=2.0) ($p<0.001$, N=182). The mean score for compressions also significantly improved, increasing from 45.9% (SEM=2.6) to 66.3% (SEM=2.6) ($p<0.001$, N=209)

Conclusion: Preliminary findings suggest that the RQI programme, with quarterly training using a state of the art CPR simulation cart in the workplace, is a useful tool to improve overall performance for adult CPR, compressions, and ventilation. This demonstrates and advantage of the RQI program over traditional methods of CPR training with hospitals in regards to CPR skills. Further work will investigate casual reasons for why the individual components of infant CPR (compressions and ventilation) improved significantly from baseline to assessment one but overall CPR score did not. Additional work in this evaluation will review user experiences and cost-utility of the RQI program.
References available upon request
Full disclosures for all authors and coauthors available upon request

NO TIME TO TRAIN? THE USE OF SIMULATION TO DEVELOP A PATHWAY AND DELIVER TRAINING FOR EMERGENCY SURGERY IN MATERNITY DURING THE COVID-19 PANDEMIC.

Sally Shiels, MBChB, Other,[1] Helen Higham, MBChB, Other, SFHEA, FRCA,[2] Desiree Choi, MBBS, FRCA,[3] Linden Baxter[4]

[1]Oxford University Hospitals NHS Trust, Oxford, United Kingdom; [2]Oxford University, Oxford, Oxfordshire, United Kingdom; [3]Oxford University Hospitals NHS Foundation Trust, Oxford, United Kingdom; [4]Oxford University Hospitals, Oxford, Oxford, United Kingdom

Introduction: The COVID-19 pandemic presented healthcare workers with a challenge to provide safe clinical care to patients while also protecting staff who were coping with a dynamic and evolving situation. The use of simulation to model pathways and devise standard operating procedures (SOPs) is now more common in healthcare(1-4) . However, the COVID-19 pandemic presented the world with a very tight timeline to deliver and test SOPs. This was further complicated in labor and delivery units where there was no reduction in workload and minimal published experience during the preparatory phases. We sought to test the hypothesis that a combination of table-top and in-situ simulation could be used to devise a coherent multi-disciplinary team (MDT) approach to emergency surgery in maternity. Focusing on the highest risk operation to the parturient, fetus and staff we sought to answer the question: Can we safely perform an emergency cesarian section under general anesthetic in a parturient with COVID-19?

Methods: This program involved three phases each using a simulation technique: SOP development, SOP testing and team training. The first phase developed an SOP using a simulated table-top case informed by the current local and national guidance(5). The case was a parturient requiring a emergency Caesarean Section requiring GA. Each department contributed to the discussion by focusing on team-based requirements and those areas that were different from standard practice due to COVID-19. An in-situ simulation scenario was then designed to test this SOP. The debrief, run by experienced faculty in our simulation center, explored three themes: 1) timing and logistics 2) SOP feasibility and 3) candidate feedback. The modified simulation scenario was then used for regular in-situ simulation team training in our maternity unit. The aim was to run up to 2 sessions per day across 1-2 weeks.

Results: Table-top: 10 team members from obstetrics, operating department, midwifery, neonatology, and anesthesia. Areas highlighted: • importance of early escalation of emergency care and strong multidisciplinary cooperation • rationalization of staff and equipment • the need for training in personal protective equipment (PPE) and increased staffing In-situ simulation: 17 participants (+ actor patient), 6 data collectors (+ infection control experts) and 7 passive observers. Outcomes included: • Good evidence of overall feasibility of the new protocol • Delivery of the simulated baby within the 30 min guideline (28 mins) • Recognition that neonatology team could be outside theatre • increased stress in team members using level 2 PPE in a critical clinical situation • limitations in communication in level 2 PPE • Patient feedback was positive despite the communication challenges The modified protocol was used in further in-situ simulations to train the 151 multidisciplinary staff over 2 weeks.

Conclusion: The initial phases of the COVID pandemic provided fertile ground for team consolidation and planning. Successful implementation of new SOPs requires engagement from all team members(3) and this was no exception. Early engagement at all levels of the MDT meant that deficits in training were identified, changes were adapted rapidly and innovations applied quickly. The in-situ simulations demonstrated to staff that it was possible to deliver a baby safely within the accepted timeframe and allowed the neonatal team to be distant from any aerosol generating procedures in theatre. Simulation has a great deal to offer in the improvement of system safety and is now more widely used in healthcare for this purpose(4,5). Our study has shown that a combination of simulation modalities can be used to design, test and embed new SOPs in a rapidly evolving and uncertain landscape. It is surely a technique that should become part of the "new normal".
References available upon request
Full disclosures for all authors and coauthors available upon request

NURSING STUDENTS' PERCEIVED EFFECTIVENESS OF DIFFERENT TYPES OF VIRTUAL SIMULATIONS

Amy Clemens, DNP, MSN, RN, ACNS, CCRN, CHSE, CNE[1]

[1]Curry College, Hanson, MA, USA

Introduction: Question: What is the undergraduate nursing students' perceived learning effectiveness of 3 formats of virtual simulations? Background The impact of CDC regulations due to Covid 19 required separation from simulation labs and elimination of live simulations as curriculum turned to virtual formats mid-semester. Faculty had to revise simulation experiences to achieve course objectives using online methods without additional cost to students. Literature review produced no published studies comparing perceived or measured learning effectiveness of virtual simulation formats for nursing students.

Methods: Descriptive qualitative study of 77 undergraduate nursing courses at a small college who were transitioned to virtual simulation mid-semester. Three virtual simulation formats with no additional cost to the students were adopted: Lippincott Coursepoint VSim Pre-assigned gaming sim that incorporated videos portraying an unfolding case study and interactive care choices with responsive videos supplying immediate feedback and opportunity to reselect answer - Group debriefing occurred for both these sim types during the live class. Instructor led activity during class with prebrief, video of simulation with students being observers, and group debriefing. All students submitted reflection journal on perceived learning effectiveness of the virtual simulation methods in which they participated DASH survey was completed by each student after sim classes and outcome rating results were calculated by Qualtrics.

Results: A total of 77 nursing student responses were collected and analyzed. Fifty-eight students participated in 3 different types of virtual simulation. Eighteen students participated in gaming and video simulation experiences. Results indicated, though live simulation was identified by all but 1 student as the most effective simulation, each type of virtual simulation with debriefing was reported to be effective for learning. Student preference ranked gaming format as perceived best effective with positive comments for real life video portrayal and immediate feedback to student actions. VSims ranked second. Students liked individual participation, being able to select actions, and need for clinical reasoning. The video simulations offered role modelling visuals to emulate but required passive observation. Debriefing enhanced learning for all sims. This sample found games engaging, live videos offered realism over avatars, and scenarios requiring critical thinking and reasoning were desired.

Conclusion: Overall students reported being very satisfied with virtual simulations. Study participants were a convenience sample of primarily young adults familiar using computer and internet applications. Limitations are related to sample size, demographics, and types of scenarios used. As no previous comparison of effectiveness of virtual simulation formats are available, these findings, especially attributes attractive to students as game, individual participation and realism may be considered by simulation faculty when designing future virtual simulations. Further quantitative study needs to assess virtual simulation formats for effectiveness in learning and application of learning to patient care delivery.
References available upon request
Full disclosures for all authors and coauthors available upon request

OBSTETRIC SIMULATION TRAINING AND TEAMWORK (OB-STAT) TO REDUCE POSTPARTUM HEMORRHAGE: SHORT-TERM CLINICAL OUTCOMES

Joy Greer, MD, CHSE,[1] Monica Lutgendorf, MD,[2] Christopher Ennen, MD,[3] Lauren Welsch, BS, MS, PhD,[1] Adrian Modzik,[1] Dominick Salas, BA,[2] Jessica Fish, BA, MS,[4] Andrea McGlynn,[1] Shad Deering, MD[5]

[1]Naval Medical Center Portsmouth, Suffolk, VA, USA; [2]Naval Medical Center San Diego, San Diego, CA, USA; [3]University of Virginia, Chesapeake, VA, USA; [4]Leidos Inc; Naval Medical Center San Diego, San Diego, CA, USA; [5]Baylor College of Medicine, San Antonio, TX, USA

Introduction: Pregnancy-related care accounts for 49% of the inpatient care provided to female beneficiaries within the Military Health System(1). Postpartum hemorrhage (PPH) complicates up to 6% of deliveries.2 Simulation training has been show to improve patient outcomes in resuscitation and obstetric emergencies such as shoulder dystocia (3-4). However, minimal evidence is available related to simulation-based obstetric training to improve patient outcomes for PPH(5-7). The objective is to determine the initial impact of the Obstetric Simulation Training and Teamwork (OB-STaT) curriculum on PPH rates, associated clinical outcomes, team performance, and patient satisfaction in U.S. Navy military treatment facilities (MTFs). The investigators hypothesize that OB-STaT, focusing on resiliency, error detection, and error mitigation, will: (a) decrease PPH rates, (b) improve PPH management, (c) improve perceptions of teamwork, (e) improve team performance, and (e) improve overall patient satisfaction.

Methods: We conducted an IRB-approved multi-site prospective cohort study. Retrospective chart review was performed to collect baseline PPH rates and clinical outcomes over the 6 months preceding training. A 4-hour interprofessional education (IPE) simulation-based curriculum, OB-STaT, was then implemented at all sites with the goal to train all team members that may respond to an obstetric emergency. Following completion of training, an additional 6 months of clinical data was collected retrospectively for all sites. At the end of each 6 month block of data collection, a random sample of deliveries were observed to evaluate team performance using the Clinical Teamwork Scale (max 150 points) and assess patient satisfaction with the Patient Perception Scale (max 15 points). The change in PPH rates and other clinical outcomes before and after OB-STaT were compared to determine the initial impact of training on patient outcomes.

Results: Analysis included 10,043 deliveries: 5,059 before and 4,984 after OB-STaT. There was no significant difference in mode of delivery or birthweight between the groups. More subjects that delivered after OB-STaT were at risk for PPH (8.7% v 41.7%, p.05).

Conclusion: Although overall rates of PPH did not significantly decrease, OB-STaT, a standardized IPE simulation-based curriculum, improved PPH management and contributed to decreased length of stay and composite maternal morbidity by increasing doses of uterotonic medications, use of tranexamic acid, blood transfusion, and hysterectomy.
References available upon request
Full disclosures for all authors and coauthors available upon request

OBSTETRIC SIMULATION TRAINING AND TEAMWORK (OB-STAT): IMMEDIATE IMPACT ON KNOWLEDGE, TEAMWORK AND ADHERENCE TO HEMORRHAGE PROTOCOLS

Joy Greer, MD, CHSE,[1] Monica Lutgendorf, MD,[2] Christopher Ennen, MD,[3] Lauren Welsch, BS, MS, PhD,[1] Adrian Modzik,[1] Dominick Salas, BA,[2] Jessica Fish, BA, MS,[4] Carmen Spalding, PhD, RN, CHSE-A[2]

[1]Naval Medical Center Portsmouth, Suffolk, VA, USA; [2]Naval Medical Center San Diego, San Diego, CA, USA; [3]University of Virginia, Chesapeake, VA, USA; [4]Leidos Inc; Naval Medical Center San Diego, San Diego, CA, USA

Introduction: The Obstetric Simulation Training and Teamwork (OB-STaT) curriculum was designed as an in situ Interprofessional Education (IPE) program to provide standardized simulation training throughout a health system. While simulation training has been shown to improve patient outcomes in resuscitation and obstetric emergencies, data on the clinical benefit of postpartum hemorrhage (PPH) training is lacking (1-4). The goal of this program is to decrease PPH rates and improve associated clinical markers by providing training to delivery teams focusing on resiliency, and error detection and mitigation. The investigators hypothesized that OB-STaT would: (a) improve team member knowledge in diagnosis and management of PPH, (b) improve team communication and performance, (c) increase adherence to established PPH protocols, and (d) increase patient satisfaction.

Methods: OB-STaT curriculum was implemented at eight participating U.S. Navy military treatment facilities (MTFs) over the course of three to five days with a mobile training team. The in-situ sessions occurred over four hours and included: completion of pretest instruments, two 40-minute scenarios with structured debriefs, and completion of posttest instruments. Participant knowledge was assessed pre- and post-training via an 11-item test related to proper treatment of postpartum hemorrhage and maternal/neonatal resuscitation. Discipline specific proctors (obstetric, nursing, anesthesia, and pediatrics) rated teamwork on the 15-item Clinical Teamwork Scale (CTS) and determined adherence to local PPH protocols via a checklist. Standardized patients provided feedback on the 3-item Patient Perception Score.

Results: We trained 1,049 team members (54 teams), and 399 people (38%) enrolled in the study. Participants included nurses (n=129), pediatric team members (n=43), and providers from obstetrics (n=102), anesthesia (n=47), and family medicine (n=31). Over 70% treated PPH at least twice a year and 59% participated in simulations at least twice a year. Knowledge test scores were similar from pre- to post-training for Anesthesia (8 v 8.07), Family Medicine (8.74 v 8.23), Nursing (7.10 v 7.05), Obstetrics (8.23 v 8.31) and Pediatrics (7.03 v 6.48), all p>.05. CTS scores improved (85.7±20.1 v 106.5± 13.34, p=.008). PPH protocol adherence did not statistically improve (73% v 80%, p>.05), but the teams did reach 80% compliance on the second scenario. Similarly, standardized patient satisfaction did not significantly improve between scenarios (3.52±.77 v 3.73±.72, p=.07), but there was significant improvement noted in feeling well-informed by the medical team (3.40±1 v 3.76±.82, p<.01).

Conclusion: A standardized IPE program is able to improve participant's ability to communicate and work as a team. Further study is needed to determine if improvements in teamwork can reduce PPH rates and improve clinical outcomes.
References available upon request
Full disclosures for all authors and coauthors available upon request

OPTIMIZING NURSING SURGE CAPABILITIES FOR COVID-19

Jennifer White, BSN, MEd, RN,[1] Rebecca Kiser, BSN, MSN, RN, C-EFM, CHSE, RNC-OB,[2] Michael Mitchell, BSN, MS, RN, CEN, CPEN, EMT-P/NRP,[3] Clinton Rombaoa, None Received, LPN, NREMTP,[1] Donald Delorey, PhD,[1] Robert Reynard, AA, BA, CHSOS,[1] Christopher Smith, MD, FACS,[1] Joy Greer, MD, CHSE[1]

[1]Naval Medical Center Portsmouth, Portsmouth, VA, USA; [2]Naval medical center, Suffolk, VA, USA; [3]The SALUS Group, INC - Naval Medical Center Portsmouth, Portsmouth, VA, USA

Introduction: With the advent of COVID-19, our hospital developed staffing plans to accommodate anticipated surges in inpatient demand to ensure institutional preparedness. Nurses that regularly supported specialty clinics and elective procedures were identified as part of the surge capacity for inpatient staffing. Our hospital assigned just-in-time training (JITT) for these staff members to refresh them on basic inpatient nursing skills. The JITT that was chosen was a continuation of the ongoing NESST (Nursing Education Simulation and Skills Training) that has been in place for over four years. NESST was designed as refresher training for nurses new to the command to ensure currency. COVID19 NESST featured additional modules which included Personal Protective Equipment (PPE) and Stress Management, recommended from previous pandemics.1-3 We expected increases in participant's self-efficacy after course completion.

Methods: Prior to the course, participants self-assessed their ability and skills in each module. Modules included venipuncture and basic intravenous (IV) therapy; Life Pak and Crash cart familiarization in a Code Blue scenario; IV pumps and medication administration; communication and stress management; room of errors/root cause analysis; PPE; respiratory care, and patient assessment. Topics and skills were rated on a 3-point Likert scale (1=minimally able to 3=extremely able). Most modules lasted 30-45 minutes with a student: proctor ratio of 2:1. The room of errors module was 2 hours. The learner's knowledge and psychomotor skills were assessed. Learners completed a post-course Likert survey and evaluated the simulation component using the Simulation Design Scale (SDS). An additional post-course survey was emailed to participants 6-8 weeks after training to determine if they were part of the hospital's surge plan and how the COVID19 training prepared them to function in their new roles.

Results: Over a 5-week period, 70 nurses participated in the COVID19 NESST program. Of all the rated skills, only 2 (IV Pump and participating as part of a root cause analysis for a sentinel event) were rated as minimally able (median 1) at the start of the course. Only medication administration was rated as "extremely able" (median 3). All the rest of the skills were rated as "moderately able" (median 2) before the learners participated in the COVID19 NESST program. All learners reported significant improvement in their self-rated ability in all modules ($p<0.05$) except for medication administration which remained high with median score of 3 ($p=0.07$). The course was well received with a mean SDS score of 4.72 (max 5) (90% response rate). The results from the 6-8 week post-course survey are still pending at this time.

Conclusion: Just in time training is feasible to prepare nursing staff to augment surge capabilities and improves participant self-efficacy overall. The COVID19 NESST training met its expected outcomes. Participant self-efficacy increased significantly for all modules except medication administration. This result is likely as outpatient nurses still administer some medications as part of their daily outpatient duties. We anticipate the 6-8 week post-course survey will continue to show course benefit but also provide more specific feedback on individual module components in terms of training for surge capabilities.
References available upon request
Full disclosures for all authors and coauthors available upon request

PAIRED VERSUS INDIVIDUAL EPINEPHRINE INJECTION PROCEDURAL SKILLS TRAINING, COMPARED EFFECTIVENESS IN AN ANAPHYLAXIS SIMULATION

Ann Kaminski, MD,[1] Nkechi Dike, BS, MD,[1] Heidi Felix, DHSc, MPAS, PA-C,[1] Leslie Simon, DO[1]

[1]Mayo Clinic, Jacksonville, FL, USA

Introduction: To investigate the effect of practicing on a peer versus individual practice on time to action and correctness of delivery of an epinephrine autoinjector training pen on a standardized patient demonstrating signs of anaphylaxis.

Methods: Hospital volunteers and local college simulation center visitors participated in small group lectures on the management of anaphylaxis from July 2018-August 2019. Groups were randomly assigned to hands-on autoinjector training through individual or paired practice with a group peer. Each learner then participated in an anaphylaxis simulation scenario with a standardized patient. Outcomes included time and correctness of epinephrine injection in an anaphylaxis scenario with a standardized patient, and self-reported comfort administering epinephrine.

Results: Significantly more paired learners delivered the injection correctly, 88% (43/49) vs. 61% (28/46), difference of 27%, (95% confidence interval 10%-43%), p=0.003. The difference in time to action for individual learners, median 10 (4,25) seconds, and paired learners, 10 (4,33) seconds, was not statistically significant, p=0.21. When learner age was included in regression modeling, delivery correctness remained significant, and time to action was statistically significant; paired learners administered the injection 26% (95% CI 4-48%) faster than individual learners, p=0.002. Post-study procedural comfort survey data did not differ significantly between learner groups, median 9/10 and 10/10 respectively, p=0.14.

Conclusion: Paired-practice may be superior to practicing alone for a high-risk procedural skill such as epinephrine injection administration in the setting of anaphylaxis, and that learner age is associated with differential performance in a scenario that should be age neutral.
References available upon request
Full disclosures for all authors and coauthors available upon request

PARTNERS IN PREVENTION: REDUCING CAUTI RATES USING TWO MODALITIES OF SIMULATION TO TRAIN PARTNERS TO DETECT INDWELLING URINARY CATHETER INSERTION ERRORS.

Renada Rochon, BSN, DNP, MSN, RN, ACNS,[1] Debra Bartoshevich, MSN, RN, CEN, CHSE,[2] Roxanne Colazo, MSN, RN[3]

[1]South Texas Veteran's Healthcare System, San Antonio, TX, USA; [2]Audie L. Murphy VA Hospital, STVHCS, San Antonio, TX, USA; [3]Audie L. Murphy VA Hospital, South Texas Veterans Health Care System, San Antonio, TX, USA

Introduction: Will simulation training for preparing registered nurses to serve as partners to detect errors during catheter insertion reduce CAUTI rates? UTIs are identified as the most common healthcare-associated infection with 75% of hospital acquired UTI's being associated with indwelling urinary catheter use.2. An estimated 13,000 deaths annually, is attributed to CAUTI as well as increased length of stay (LOS) by 2-4 days.1 Patients with CAUTIs may experience increased costs for their hospitalization of up to $2,800.3A Medical-Surgical unit at a 242 bed hospital experienced an increase in their CAUTI rate from 0 to 2.35 over a 6 month timeframe. The ICU is where catheters are commonly used and placed versus Medical Surgical areas leading to a gap in practice and knowledge for nurses working in those areas.4 . Engaging in different learning formats including videos, and high-fidelity simulations has proven to be an effective EBP approach to reducing CAUTI rates.3

Methods: A sample of 23 registered nurses were trained to properly insert indwelling urinary catheters using appropriate sterile technique via simulation as part of a quality improvement initiative. Two different modalities of simulation was used to conduct the training via this case study including simulation mannequins, labeled insertion kits, and videos. Participants were required to perform indwelling urinary catheter insertion independently and again with a partner while being observed by simulationist and unit's CNS. A checklist was used to ensure consistency in variables being measured. The same 23 participants then watched two videos (one correct, one with errors) of the simulationist and CNS inserting a urinary catheter. The participants used the same checklist to indicate errors detected in the video to garner if the simulation training was effective at preparting the registered nurses to serve as partners to their peers during indwelling catheter insertion.

Results: Unpartnered subjects had an average total of 5.4 errors while partnered subjects had an average of 3.0 errors. A t-test for the difference in means yields a significance level ($p<0.05$) which supports the hypotheses that partnering subjects decreases the number of errors committed. On average, partnered subject decrease their errors by 2.4 per procedure. The next intervention involved participants watching a video and having to be able to identify errors made by the clinician inserting the indwelling catheter on video. Subjects detected on average 71% of the errors. Out of the 23 nurses who watched the video 11 ( ) of them identified 15 or more errors, 3 nurses identified more than 15 errors.

Conclusion: Using simulation to train nurses to detect errors in inserting indwelling urinary catheters were effective at reducing the CAUTI rate supporting the original hypothesis question. The data comparing indwelling urinary insertion between unpartnered and partnered participants was statistically significant in favor of the hypothesis. The nurses were able to detect errors and mitigate them after receiving training by use of a code word. The participants had to complete hands on simulation twice using a mannequin and then watch a video. The repeated practice improved participants skill and comfort level with using the new kits and being able to detect errors. After the training the nurses were instructed to accompany one another when inserting urinary catheters. The units CAUTI rate decreased back to zero after the training.
References available upon request
Full disclosures for all authors and coauthors available upon request

PATIENT EXPERIENCE TRAINING FOR NON-CLINICAL STAFF USING SIMULATED PATIENTS

Christine Saracino, DO, FAAP,[1] Amish Aghera, BS, MD, CHSE,[1] Sheetal Sheth, DO, MA,[1] Lois Isaksen[2]

[1]Maimonides Medical Center, New York, NY, USA; [2]Maimonides, Brooklyn, NY, USA

Introduction: Metrics related to Patient Experience (PE) are used as a quality indicator by health care organizations, are publicly reported, and impact public perceptions and reimbursement. In the emergency department (ED), registration clerks (RC) are often the first staff member to engage patients, and can positively or negatively impact PE. Similarly, patient representatives (PR), hired to help patients and families navigate the hospital experience, also have a great impact on the patient experience. Our objective was to evaluate the impact of a simulation based training for RCs and PRs who are unfamiliar with experiential learning.

Methods: This was a mixed methods prospective observational study at an urban academic medical center with a hospital-based Simulation Center. PR and RC participated in a 90 minute session consisting of 3 1:1 encounters with a simulated patient (SP). Each scenario was debriefed individually with the SP and a physician with formal debriefing experience. PR scenarios centered on speaking with an anxious mother in the pediatric ED, an angry family member upset about perceived delays of care, and a frustrated patient waiting for CT scan. RC scenarios centered on registering the mother of a critically ill infant, a patient in pain and worried about his lack of health insurance, and an immigrant anxious about his legal status. Learning goals were to improve PE skills such as de-escalation, empathetic listening, resolving conflict, asking sensitive questions, and managing expectations. The training session was evaluated with anonymous surveys and free-text response of action oriented take away goals.

Results: All available PR (n=34) and ED RC (n=39) participated. Post-participation anonymous surveys used a rating scale of 1 to 5 (1=not effective, 5=extremely effective). Each a priori defined learning goal was rated positively with averages ranging from 4.4 to 4.6 (SD range of 0.5 to 1.0) in the RC group and 4.2 to 4.5 (SD 0.6) in the PR group. SPs and Facilitators were rated positively with respect to educational techniques ranging from 4.5 to 4.7 (SD range of 0.5 to 0.8). Thematic analysis of written take away goals in the PR group focused on communication specifically to engage patients and family members in conversations for updates in their care process and to demonstrate empathy for patients who are ill. Representative themes of personal goals in the RC group included not escalating or reacting back, using eye contact, acknowledging pain and stress, using empathic listening skills, and remembering that the patients are in a state of crisis.

Conclusion: Simulation was an effective method to teach skills related to patient experience to patient representatives and ED registration clerks. Both groups of nonclinical providers reported meaningful take away goals for practice. Furthermore, multiple participants verbally related to their supervisors that the simulation sessions made them feel more like valued staff members given that similar training are typically reserved for nurses and doctors. Given the potential impact on patient experience and staff engagement, simulation should be strongly considered as a preferred modality of training for nonclinical providers.
References available upon request
Full disclosures for all authors and coauthors available upon request

PEDIATRIC CARDIAC ARREST MOCK CODE: IMPACT ON RESIDENT KNOWLEDGE AND CONFIDENCE

Elise Zimmerman, MD, MS, CPhys, FAAP,[1] Melissa Cameron, MD, FAAP,[2] Shannon Wai, MBChB,[3] Kathryn Hollenbach[3]

[1]University of California San Diego-Rady Children's Hospital, San Diego, CA, USA; [2]UCSD Rady Children's Hospital San Diego, San Diego, CA, USA; [3]Rady Children's Hospital, San Diego, CA, USA

Introduction: Will a simulation-based mock code session improves pediatric resident knowledge of current PALS guidelines and confidence in pediatric cardiac arrest?

Methods: Residents in categorical pediatrics, combined medicine-pediatrics, or combined pediatric-neurology at a tertiary children's hospital were assigned to a simulation session. Residents were presented with a scenario using high-fidelity mannequin with initial pulseless ventricular tachycardia and then pulseless electrical activity. The residents worked as a team to manage the simulated patient for 10 minutes. The residents then participated in a 15-minute debrief session. The debrief included review of standardized teaching points. Residents completed a pre- and post- confidence Likert scale assessments and answered open-ended knowledge questions. Pre- and post statistical comparisons

were made on overall median confidence and knowledge, as well as analyzed by pediatric residency track and year of training using Wilcoxon matched-pair rank sum tests. Data were analyzed using STATA 16 (College Station, TX) with alpha = 0.05.

Results: Thirty-two residents participated in a simulation session held between July 2019 and February 2020 with 25/32 (78%) completing both pre and post surveys. The majorities of participants were in their second year of residency (46.9%) and were in general pediatric track (81.3%). Overall median resident knowledge increased from a pre-score of 15/20 (10, 17.5) to post-score 18/20 (17, 20) ($p < 0.0001$), table 1. Overall median confidence increased from a pre-score of 14/25 (12, 17) to post-score 20/25 (16, 25) ($p < 0.0001$), table 2. Significant increases were also seen in both knowledge and self-assessment when examined by each of the post-graduate years (PGY) 1-3. There were insufficient data for PGY 4 analyses.

Conclusion: Participation in a single simulation-based education session significantly improved resident confidence and knowledge in the management of pediatric cardiac arrest and knowledge of PALS guidelines. Further study to examine skill and knowledge retention as well as to determine if they translate to improved performance in real life critical situations is warranted.
References available upon request
Full disclosures for all authors and coauthors available upon request

PEDIATRIC DISASTER SIMULATION AND PARENTS WITH A PHYSICAL DISABILITY

Ilana Bank, MDCM, FAAP, FRCPC,[1] Chloe Gordon,[1] Margaret Ruddy, BSN, Other, RN,[2] Elene Khalil, MDCM, FRCPC,[3] Tamara Gafoor, MDCM, FRCPC,[1] Audrey Dadoun, MDCM, FRCPC,[1] Lily Nguyen,[1] Meredith Young, PhD[1]
[1]McGill University, Montreal, QC, Canada; [2]Montreal Childrens Hospital, Montreal, QC, Canada; [3]McGill University Health Center, Montreal, QC, Canada

Introduction: A manmade or natural disaster poses many threats to society as a whole. Pediatric patients are at high risk in disasters due to their anatomic, physiologic and psychological differences. In addition, children typically need a guardian or parent to accompany them to seek medical care – a task made more difficult in the context of a disaster. Members of society who have physical disabilities are also challenged in times of crisis, and caregivers who have physical disabilities can be increasingly disadvantaged while seeking medical care for their children. To begin to understand the potential challenges of caregivers with disabilities during a disaster, we invited community members with physical disabilities to participate in a large-scale in-situ disaster simulation.

Methods: A large-scale, city-wide in-situ disaster simulation occurred in 2018. All hospital personnel were encouraged to participate. Prior to the simulation, eight community members, each with a physical disability, participated in a focus group to identify anticipated challenges they would face in a disaster. Four focus group participants then participated in the disaster simulation as parents/grandparents of affected pediatric patients, the hot debrief immediately following the simulation and a "cold" debrief three weeks after the simulation activity. All recordings from focus groups and debriefings were transcribed and analyzed using fundamental qualitative description designed to achieve descriptive validity.

Results: Audio data analysis of the initial focus group identified two macro themes of anticipated challenges: (1) communication difficulties and (2) lack of access to care. Subsequently, the cold debrief revealed two macro-level themes; (1) difficulty for healthcare personnel to identify certain physical disabilities (hearing and visual impairment) and (2) communication challenges with the medical team and the simulated parents/grandparents.

Conclusion: Multiple challenges were identified in caring for patients with family members who have a physical disability in the context of disasters. These challenges identify the need to improve rapid identification of communication challenges in patients and family members with disabilities as well as improve effective communication when caring for their loved one.
References available upon request
Full disclosures for all authors and coauthors available upon request

PRE-IMPLEMENTATION MULTIDISCIPLINARY IN-SITU SIMULATION TO REFINE PROPOSED PROCEDURE WORKFLOW

Kristina Goff, BA, MD[1] Ashley Jones[2]
[1]Univ of Texas Southwestern Medical Center, Dallas, TX, USA; [2]University of Texas Southwestern, Dallas, TX, USA

Introduction: Appropriate central line insertion practices are of paramount importance to patient safety. In 2017, our institution developed a standardized approach for the insertion of central venous catheters to create practice uniformity across our hospitals. Unfortunately, despite this effort, clinical practices remain persistently variable. Acknowledging the strong evidence base supporting the implementation of care bundles and checklists in procedural practice to improve patient safety outcomes, we developed a visual cognitive aid and formal procedure checklist to reinforce adherence to our standardized institutional central line insertion technique. We trialed our intervention using in-situ simulation to see if this novel approach to beta testing could help assess feasibility and improve staff buy-in prior to implementation.

Methods: We collected data about current central line insertion practices through a series of one-on-one interviews with physicians, advanced practice providers and nursing staff in the three intensive care units at our academic tertiary care hospital. Considering the gaps identified with this data, we proposed a new procedure checklist, a visual cognitive aid, and a multidisciplinary pre-procedure huddle, all designed to emphasize the critical elements of the procedure and prioritize teamwork and patient safety. In order to assess the feasibility of this workflow, we organized a series of in-situ simulations (ISS), bringing together pairs of nurses and either physicians or advanced practice providers from each of the intensive care units, to review, trial and provide feedback on the proposed intervention. Additionally, each pair completed a Culture of Safety survey at the beginning of their session, as well as pre- and post-simulation surveys about their experiences.

Results: We gathered data during six ISS sessions, focusing on procedural logistics, necessary modifications, and potential communication barriers. In our sessions, we identified discrepancies in the performance of the pre-procedure time out, prompting a hard stop in our pre-procedure huddle to ensure this is performed appropriately. Review of the VCA checklist specifics identified elements warranting clarification, specifically, best practice for sterile procedure, line confirmation and dressing application. We developed a team approach for dressing placement, aimed at decreasing the number of dressing changes required to improve line sterility. After nursing staff voiced hesitancy in providing real time feedback to physicians and advanced practice providers, we incorporated tools to diffuse the perceived authority gradient and promote consideration of patient safety. All participants endorsed this workflow as likely to improve patient care and reported willingness to implement it clinically.

Conclusion: In-situ simulation is frequently used to identify latent safety threats, test processes and improve team dynamics in the clinical environment. We sought to use ISS as a novel approach for feasibility testing. By trialing a proposed workflow in the very environment in which it would be used, with the teams who would eventually be using it, we were able to address logistical challenges, optimize team communication and workflow design, and promote buy-in. In-situ simulation can be an integral part of process development for complex, multidisciplinary procedures, and provides an opportunity to address barriers to success without putting patients at risk.
References available upon request
Full disclosures for all authors and coauthors available upon request

PROGRAM EVALUATION FOR CONTINUOUS IMPROVEMENT: LESSONS FROM NEW SIMULATION PROGRAM

A.J. Kleinheksel, BA, MEd, PhD, CHSE-A[1] Matthew Tews, DO, MS, FACEP[2]
[1]Medical College of Georgia at Augusta University, Augusta, GA, USA; [2]Medical College of Georgia, Augusta, GA, USA

Introduction: The purpose of this study was to evaluate a new and developing simulation program for the process of continuous improvement. Program evaluation is integral to improvement. It is difficult to embed evaluation into nascent activities, though they often need the most targeted development.

Methods: As a new medical simulation program was developed, a program evaluation instrument was designed to capture real-time feedback from both learners and facilitators. After a paper-based pilot, a single evaluation for all participants was designed in Qualtrics using branch logic. The evaluation was designed to identify immediate needs and inform future curriculum design.

Results: The web-based program evaluation instrument was implemented in January 2019 with over 1100 responses recorded. Learners reported excellent or good experiences (95%), level of instruction (97%), and value (90%). Most learners (93%) felt their activity should be offered in the curriculum again. Technical issues were identified by 28% of learners. Faculty reported consistently high levels of learner engagement (99%). Faculty expectations were met for equipment functionality (88%), equipment availability (86%), and room setup (88%). While 35% of faculty identified technical issues, only 15% reported that the issue affected the case.

Conclusion: Embedding an inclusive program evaluation early in the development of a new simulation program allowed for the resolution of immediate needs, responsive improvements, and accurate reporting. As the program continues to grow, the evaluation data will be used in curriculum design, and additional data will be collected. Lessons were learned from the development of the evaluation, including a consideration of a wider range of stakeholders, measurement of additional learner characteristics, and activity differentiation. Developing and refining a program evaluation for multiple users and uses of simulation is feasible. Continuous improvement is necessary for an evaluation in addition to the program itself.
References available upon request
Full disclosures for all authors and coauthors available upon request

PRONE POSITIONING FOR COVD-19-RELATED ARDS: A TASK-SHARING INTERVENTION

Priscilla Loanzon, BSN, EdD, MA, MEd, RN, CHSE[1] Joseph Mathew, MD, FACP[2]
[1]Mount Sinai West-Mount Sinai Morningside (AKA St. Luke's) Hospitals, New York, NY, USA; [2]Mount Sinai West and Mount Sinai St. Luke's, Oradell, NJ, USA

Introduction: In patients with severe acute respiratory distress syndrome (ARDS), prone positioning (proning) has shown to improve alveolar recruitment, gas exchange and decrease 28-day mortality.(1) As many as a third of patients with confirmed Covid-19 infection developed ARDS requiring tracheal intubation.(2) The enormous volume of patients requiring mechanical ventilation in New York City hospitals led to a major gap in performing prone ventilation, a process typically performed by ICU staff.(3) Using the principles of task-sharing, we created an interdisciplinary team of clinical professionals with readily transferable skills to meet the demand for proning COVID-19 patients with ARDS. We seek to evaluate the benefits of simulation training (ST) of an interdisciplinary team with readily transferable skills to meet a large demand for prone ventilation. We hypothesized simulation-based training is an effective modality for safe implementation of prone ventilation performed by an non-ICU team.

Methods: We conducted ST for an interdisciplinary prone ventilation team which was organized for the COVID-19 pandemic. Led by our critical care attendings, the prone team included surgeons and physician assistants (PA) from Neurosurgery and Orthopedics with prior experience in proning patients in the operating room, physical and occupational therapists (PT,OT), ICU physicians, nurses and respiratory therapists (RT). Four phases included planning with leadership from each discipline, recruitment, training, and implementation. To simulate realistic obstacles encountered during proning in the ICU setting, monitoring devices, mechanical ventilator, and vascular access devices were attached to a high fidelity mannequin. A previously implemented prone ventilation simulation program for ICU staff members was utilized to train the interdisciplinary team.(4) A post-course questionnaires using a Likert-scale was completed by participants. A Redcaps database was utilized for data collection and analysis.

Results: A total of 9 prone ventilation simulation sessions were conducted and 33 learners completed the training. The 33 learners included learners from Neurosurgery (11), Orthopedics (7), Rehabilitation Medicine (11), Transfusion Medicine (1), Anesthesiology (1) and Endocrinology (1). The learners consisted of 13 physicians, 7 PT, 4 OT, and 8 PAs. The ICU staff had previously undergone ST and had experience in proning. 5 ST for proning normally takes 2-3 hours per session. Given the composition of an ideal "proning team," the training took <1 hour with 4-6 participants per session. The total time for proning patients was 5 minutes. A post-training survey questionnaire showed 79% strongly agreed and 21% agreed that ST prepared them well for proning. Quantitative and qualitative feedback for the process overall was very favorable, indicating that ST allowed the interdisciplinary team to effectively implement proning skills, leadership and teamwork acquired in ST and into actual proning process.

Conclusion: Facing the unprecedented critical care resource scarcity caused by the COVID-19 pandemic demands collaborative innovation and problem-solving, guided by principles of leadership, effective communication, and interprofessional cooperation. (5) Utilizing effective task-shifting and task-sharing, and integrating simulation training we were able to implement an effective interdisciplinary prone ventilation team to meet the demands of a large pandemic.
References available upon request
Full disclosures for all authors and coauthors available upon request

RAPID CYCLE DELIBERATE CRISIS RESOURCE MANAGEMENT: IMPROVING PEDIATRIC TRAINEE COMPETENCE AND CONFIDENCE WITH A SUSTAINABLE SIMULATION CURRICULUM

Blake Nichols, MD, FAAP,[1] Ali McMichael,[1] Tonia Branche,[2] Aditee Ambardekar, MD, Med[3]
[1]UTSW, Dallas, TX, USA; [2]UT Southwestern, Richardson, TX, USA; [3]UT Southwestern Medical Center, Dallas, TX, USA

Introduction: Pediatrics resident physicians self-report low confidence in approaching and leading acute crisis scenarios1. A specific needs assessment of our pediatric residency program found that the residents lack crisis leadership experience and skills. Crisis resource management (CRM) principles focus on non-technical skills which help the team leader manage a crisis2. We sought to impart these skills upon the resident physicians to address the specific needs of the program. However, the residency program has minimal time to devote to this specific education. We turned to rapid cycle deliberate practice (RCDP), a debriefing method where learners cycle between deliberate practice and directed feedback, to efficiently educate the learners about these skills3-5. We hypothesized that a simulation-based medical education curriculum using RCDP focusing on CRM principles would fill the void of experiential learning and improve pediatrics resident confidence and competence in leading crisis scenarios

Methods: We created a simulation of a crisis on a pediatric ward which requires interventions appropriate for the expected skill set of a pediatrics resident. We previously developed and externally validated a task list with high internal consistency emphasizing CRM principles as the expected interventions. The scenario is divided into 3 stages with a total of 25 tasks: 6 in stage 1, 13 in stage 2, and 6 in stage 3. Stage 1 involves the care of an unresponsive patient by a pediatrics intern. In stage 2, the senior resident arrives and the patient subsequently develops status epilepticus. In stage 3, the simulated patient develops acute respiratory failure. The scenario ends with the arrival of the rapid response team. The residents participated in the simulated scenario in groups of 6. We debriefed using RCDP with the task list as a guide. Each stage encompassed 5 rounds of RCDP. We measured performance of each group in a simulated scenario prior to, and immediately following, the curriculum

Results: Thirty-eight residents have completed the curriculum. Following participation, resident physicians showed improvement in mean task completion from 17% to 87% ($p<0.001$), with each individual resident group showing improvement. Additionally, there was improvement in task completion in each individual stage with stage 1 having mean task completion improvement from 24% to 95%, stage 2 with 20% to 81% mean task completion improvement, and stage 3 with 5% to 90% mean task completion improvement ($p<0.001$ for all stages). All respondents reported improved confidence in being team leader, being the first responder to a crisis, and in evaluation of a sick patient

Conclusion: This simulation-based medical education curriculum universally improved pediatric resident confidence in responding to, triaging, and leading a crisis scenario. Focusing on CRM principles directly addressed the specific needs of our pediatric resident physicians. RCDP debriefing allowed for rapid acquisition of CRM skills with all residents demonstrating significant improvement in CRM-focused task completion immediately following the curriculum. This proof of concept allows for further investigation of this simulation-based medical education curriculum which will focus on retention of skills and application to broader crisis scenarios.
References available upon request
Full disclosures for all authors and coauthors available upon request

RAPID TRANSITION TO TELE-OSCE ASSESSMENT: COVID-19 EFFECTS ON CLINICAL SKILLS SUMMATIVE ASSESSMENT USING AN ONLINE PLATFORM

Mariano Loo, BBA[1] Sean Gnecco, MD[1]
[1]Ross University School of Medicine, Coral Gables, FL, USA

Introduction: Objective Structured Clinical Examination (OSCE) is an assessment tool commonly used in Medical schools for academic progression and as a confirmation of minimal clinical skill (CS) competency. Social distancing policies and mandatory quarantine due to the COVID 19 pandemic meant that in-person OSCE was no longer a safe option. Medical schools around the world who utilize this tool were forced to urgently adjust their curriculum. Several Medical Schools have adapted TeleOSCE model as a temporary solution. We will share our observations during this transition, which took place in the middle of a two-week OSCE CS assessment at Ross University School of Medicine. The purpose of this study is to retroactively analyze and compare if student assessment of CS competency differed between in-person OSCE and TeleOSCE. Our study demonstrates minimal differences in the scoring of the subcomponents (CIS, SEP, and ICE) and their respective competencies in preparation for the USMLE Step 2 CS.

Methods: There were two cohort of a total of 273 students with similar academic background. The first cohort consisted of 175 students with 2.87 GPA. This group was assessed during the in-person OSCE during week 7 of the clerkship. The second cohort consisted of 98 students with 2.91 GPA. This group received the same mix of OSCE cases, represented by the same SPs and graded by the same clinical skills faculty. A one-way ANOVA was applied to test within-subject effects of the means between each group in the categories of communication and interpersonal skills (CIS), spoken english proficiency (SEP), and the integrated clinical encounter (ICE) which consisted of the physical exam and the patient note, where F test of significance, $P \leq 0.05$, was applied to test the null hypothesis that there were no differences within-subject. Assumption of normality of the distributions of scores and homogeneity of variances (using Levene's test statistic) was tested with an alpha of 0.1.

Results: Results of ANOVA indicated that the means between each group in the categories of communication and interpersonal skills (CIS), spoken english proficiency (SEP), and the integrated clinical encounter (ICE) were not statistically significantly different. However, for physical exam, results of ANOVA indicated statistically significant [$F(1,271) = 235.32$, $p=.00$] differences for each group. Students in the OSCE group (mean 49.81, SD±.10) performed lower on physical exam than students in the TeleOSCE group (mean 70.64, SD±.11).

Conclusion: Our initial data demonstrates that summative assessment of CSs is not significantly different between OSCE and TeleOSCE for areas that involve data gathering, data interpretation, and data reporting. This was demonstrated by showing no difference in CIS, SEP, and Patient note scores. The notable exception to this finding was a significant difference with the assessment of physical exam skills. TeleOSCE has a set of new skills that are valid in the telehealth environment. These skills require an adaptable training that is different from the traditional OSCE, and medical schools may be missing an opportunity to leverage valid components of telehealth models for CS assessments. As a result, medical students are scoring higher in the Physical Exam shown in the results above. Further study is needed to find out if medical students are meeting their CS competency requirements

and demonstrating proficiency during times of restricted person to person interaction in medical education.
References available upon request
Full disclosures for all authors and coauthors available upon request

REAL-TIME OBJECTIVE FEEDBACK FOR INFANT CPR USING A NOVEL NEW INFANT MANIKIN – A PILOT STUDY¬ WITH PAEDIATRIC NURSES.

Anna Abelsson, PhD, RN, CCEMT-P, CCRN, EMT-P/NRP,[1] Lukasz Szarpak,[2] Jonathan Smart,[3] Rob Morrison[4]
[1]Jönköping University, Jönköping, Sweden; [2]Lazarski University, Warsaw, Poland; [3]Innosonian Europe, Westerham, Kent, United Kingdom; [4]Dartford & Gravesham NHS Trust, Kent, United Kingdom

Introduction: Cardiac arrest in infants is rare but is associated with an overall mortality of up to 90%.1 The majority of infants suffering from cardiac arrest have a poor chance of survival compared with older children. Providing adequate chest compressions and correct ventilation technique is essential during infant CPR but has been reported to be challenging to achieve in practice.2 Previous studies have found that frequent use of real time feedback can improve infant CPR performance.3,4 CPR feedback devices are recomended during CPR training to help improve skills.5 The hypothesis for this pilot study is to investigate whether it is possible to identify components of infant CPR that improve with practice (using objective and visual feedback). The objective was to investigate which components of infant CPR improve with practice with objective feedback from an infant manikin.

Methods: Using a realistic simulation environment, 10 paediatric nurses were assessed whilst performing infant CPR using ERC Guidelines.6 This was done in 3 steps. The infant manikin was Brayden Baby ProTM intended to represent a 6kg infant in this scenario. 1. Five rescue breaths followed by three cycles (15:2) of infant CPR. No feedback from the manikin was provided and no debrief. The overall CPR quality (%) and individual numeric CPR component data were recorded. 2. A short period (max 3 minutes) of guided and free practice with the real time feedback from the manikin switched on for the nurse. 3. Repetition of 1. A questionnaire to assess ease of use of the manikin was completed by each nurse individually at the end of Stage 3 using a Likert 10 point score. The manikin objective data collected for Stage 1 and 3 was analysed with descriptive (central tendency and distribution) and inferential statistical analysis (paired samples t-test). The level of significance used was set at α=.05.

Results: The result shows that the overall mean infant CPR score improved from 64% at Step 1 to 82% at Step 3 (p=.00). The mean value for good compression depth (approximately 3,8 to 4 cm) improved from 34% to 72% (p=.01). The mean value for 'over compression' decreased from 61% to 5% respectively (p=.00). Good compression rate, 100–120 comp/min, increased from 23% at Step 1 to 47% in Step 3 (p=.02). Good compression release (0 mm), increased from 80% at Step 1 to 90% at Step 3. Correspondingly, incomplete compression release decreased from 20% to 10% from Step 1 to 3. Accuracy of finger (or thumb position when hand encircling technique was used) was 100% in both Step 1 and 3. The ventilation volume of 3-7 ml per kg of infant weight, (approx. to 5 ml x 6 kg = 30 ml), decreased from 46 ml to 43 ml (p=.04). The mean value for over ventilation volume decreased from 82% to 65% between Step 1 and 3. The mean score for ease of use obtained from the completed questionnaires was 9.2 (SD 1.9).

Conclusion: Continual quality assurance of CPR performance using real time objective feedback via visual and numeric means, together with repetitive practical training, enhances the quality of infant CPR.7,8 The results show guided and free practice with visual feedback (which is easy and quickly understood by the student) when used for infant CPR training improves the overall performance (i.e correct compression depth, rate, release and ventilation volume). These key components of the paediatric CPR guidelines ensure high-quality infant CPR9 as they are essential for maintaining vital organ perfusion.10 Infant CPR is difficult to perform within the correct parameters, even for highly skilled providers, so training manikins that help improve and optimize performance and are easy to understand and use should be employed where applicable. This result is consistent with this statement and the questionnaire results suggest the new manikin helped improve performance and is easy to understand and use.
References available upon request
Full disclosures for all authors and coauthors available upon request

REARRANGING THE WHEEL FOR IMPROVED MOBILITY: A HYBRID APPROACH TO SYSTEMS INTEGRATION THROUGH HI FIDELITY TELE-SIMULATION

Carla Pruden, BS, MD, MPH, CHSE,[1] Mariann Kelley, MD, FAAP,[1] Andrew Heggland, BS, MD, FAAP, FACEP,[1] Erin Bailie, BSN, MSN, RN[1]
[1]Connecticut Children's Medical Center, Hartford, CT, USA

Introduction: An implicit benefit of in situ simulation is the ability to assess preparedness from a systems integration perspective. Many centers have offered their processes to utilize hard wired AV systems and simulators to support telesimulation planning only involving the simulation team staff on site (1-4). Smaller programs without dedicated simulation space or hardwired AV infrastructure might encounter barriers to applying the approaches offered. Additionally, there remained a need to evaluate newly developed processes and procedures from a systems integration perspective in the actual clinical setting. To meet institutional needs for continued systems integration simulations, while respecting social distancing recommendations, we utilized a PDSA (Plan, Do, Study, Act) approach to optimizing participant engagement during telesimulation sessions for systems integration.

Methods: Three PDSA cycles were completed and embodied the iterative process. All sessions were recorded to allow future access for participants. In the first cycle, we used the baseline platform of commonly available teleconferencing software (Zoom Meetings) and one video input within the exam room. During the second iteration, we utilized the webinar platform of the teleconferencing software to optimize participant viewing of multiple video inputs. Embedded cameras in existing devices were assigned "panelist" status, and placed in the hallway to provide a more comprehensive view of the system integration process. Video integration software (ManyCam ©, Visicom Media, Inc) incorporated multiple cameras into 1 video output, thus maximizing the viewable area while minimizing the number of "panelists". In the final cycle, these same mobile devices became the primary video source to facilitate mobility through the department.

Results: Social distancing requirements were met in the first cycle, but one AV source limited evaluation of the interface of on-site participants with the work system beyond the exam room. The webinar format used in the second cycle improved remote viewing of the clinical setting without the distraction of multiple participant screens in the standard meeting format. Real-time verbal interaction between remote and on-site participants was limited, though the question and answer feature could be utilized for this purpose. In the third iteration, tablet camera resolution was suboptimal compared with USB webcams, though the two could be combined through the video integration software. Audio quality during the transport process requires optimization to prevent pauses and feedback in the audio output.

Conclusion: We present the adaptation of free software platforms to meet the needs of performing systems integration simulations through a telesimulation format. The change from in-person simulation sessions to remote sessions via video platform initially required additional facilitators, equipment, software, and set-up considerations. However, finding the appropriate video integration software and video-conferencing platform as a webinar platform allowed us to optimize the audio-visual experience for participants. Re-evaluating the functionality of existing equipment may help programs balance available human and physical resources to optimize telesimulation.
References available upon request
Full disclosures for all authors and coauthors available upon request

RECOGNITION OF CENTRAL LINE COMPLICATION IN NICU MEDICAL EMERGENCY THROUGH RAPID CYCLE DELIBERATE PRACTICE

Jackie LeVan, DO, CPhys, FAAP,[1] Gillian Gonzaba, BSN, MSN, NP, ARNP-BC,[2] Renee Cadena, BSN, RN, CCRN,[3] Shelley Solis, BSN, RN,[3] Heather Delaney, MD, CHSE, FAAP[4]
[1]Mednax, San Antonio, TX, USA; [2]Pediatrix Medical Group San Antonio; MEDNAX, Helotes, TX, USA; [3]Baptist Health System, San Antonio, TX, USA; [4]North Central Baptist, San Antonio, TX, USA

Introduction: Central lines are routinely used in the Neonatal Intensive Care Unit (NICU) to provide intravenous access for premature and critically ill neonates. There are several known complications of central lines including infection, thrombosis, occlusion, migration, and displacement potentially causing medical emergencies requiring immediate recognition and intervention. Emergent central line complications are an infrequent, but high-risk event in the NICU that could lead to morbidity and/or mortality if not quickly identified. Our hypothesis is that Rapid Cycle Deliberate Practice (RCDP) Simulation would improve the team's recognition of central line misplacement, improve the time to identification of the central line complication, and improve the time to medical intervention.

Methods: A total of 37 simulations were performed between September 2019-January 2020 for two level IV NICUs and two level II NICUs at the BHS Perinatal Simulation Program Simulation Center in San Antonio, Texas. The blinded participants included 143 neonatal nurses, 21 respiratory therapists, 21 neonatal nurse practitioners, and 4 physicians. There were 3 simulations with an un-blinded provider. Teams participated in a RCDP simulation involving one of two different scenarios involving a central line complication. The first simulation involved a UVC infiltration with hyperkalemia. The second simulation involved a PICC line infiltration with pleural effusion requiring needle aspiration/chest tube insertion. The main objectives were similar for both scenarios: 1) Team recognition of critical labs/central line location on XRAY 2) Recognition and verbalization of central line complication 3) Time to medical intervention depending upon the complication.

Results: Identification of abnormal lab results were noted by 43% of teams in the initial cycle and improved to 100% by the final cycle. Only 24% of teams during the initial cycle noted the inappropriate location of the central line on XRAY with 33% of teams notifying the provider immediately concerning abnormal lab or XRAY findings. Immediate improvement in team ability to review XRAY and lab results was noted with 100% of teams

completing these tasks in the final cycle. For the PICC line scenario the time to needle aspiration was decreased by 39 sec by the final cycle. The time to verbalization of the central line complication was 4 min 30 sec in the PICC line scenario vs. 11 min 27 seconds in the UVC scenario possibly indicating that a UVC infiltration may be more difficult to identify. The time to recognition of central line complication was decreased by 2 min 53 sec and 9 min 24 sec respectively in the PICC line and UVC scenario.

Conclusion: The ability to quickly recognize a central line complication in a medical emergency is critical to provide appropriate life-savings interventions . These events are not common in the NICU and require additional training for medical personnel. Simulation based education, particularly Rapid Cycle Deliberate Practice offers an important educational experience for medical teams to review and practice these emergent situations.
References available upon request
Full disclosures for all authors and coauthors available upon request

RELIABILITY EVIDENCE AND PHARMACIST PERFORMANCE ON THE VACCINE ASSERTIVENESS ASSESSMENT

Chelsea Renfro, PharmD, RPh, CHSE[1] Kuan Xing, PhD[1]
[1]University of Tennessee Health Science Center, Memphis, TN, USA

Introduction: Despite available, efficacious vaccinations, the most recent rates of adults being immunized against pneumococcal disease remain below goals set by Health People 2020. As the passive offering of vaccinations to patients has stifled efforts to improve rates, we contend that improved counseling that is personalized and includes a strong, evidence-based recommendation improve immunization efforts. To address this gap, research is needed to equip pharmacists with tools and training that can lead to more effective vaccine promotion and increased immunization rates. Therefore, the research questions for this study are: (1) What is the reliability of the Vaccine Assertiveness Rubric? (2) Do different raters agree with each other about their ratings? Is there any difference in the learner assessment score between stations? (3) What is the overall reliability of learner assessment score across raters, stations, and rubric items?

Methods: Twenty-three pharmacists participated in this study and completed two assessment stations on the topic of vaccine assertiveness. Both stations focused on pneumococcal vaccination. Three faculty members rated each pharmacist's performance using the Vaccine Assertiveness Rubric, which was developed by multiple pharmacy faculty. It has 6 items (focusing on presumptive recommendations made, the pharmacists' patient care process, and communication) per station and is on a 5-point behavior-anchored scale, where 1 – Not done, 3 – Partially done, and 5 – Well done (2 is between 1 and 3 while 4 is between 3 and 5). We conducted a generalizability study using a fully crossed rater design, which means each learner was evaluated by each rater in each station on all rubric items.

Results: We examined the internal consistency for the Vaccine Assertiveness Rubric using Cronbach's α (n=23). It was acceptable (.74) for station 1 and was excellent in station 2 (.90). The interrater reliability was examined among three raters by calculating intraclass correlation (ICC) coefficient. The lowest and highest ICC in station 1 were on items 4 (.51) and 6 (.81) and station 2 were on items 1 (.65) and 6 (.86). We averaged ratings to create a final score for each learner. T-tests were conducted to detect any difference between learner performance for station 1 and station 2. The only significant difference between stations was their performance on item 1 ($p<.01$). Participants performance in station 2 performed higher than in station 1. Finally, we conducted a Generalizability study to examine the overall reliability. The Generalizability coefficient was .42. The two largest variance components were from person x station (26.1%) and person x station x item (20.6%).

Conclusion: We found the Vaccine Assertiveness Rubric was a reliable tool for assessing pharmacists' competency for making a presumptive pneumonia vaccine recommendation. Future research is warranted to determine if this tool is reliable for assessing pharmacists' competency to make presumptive recommendations for other vaccinations. Good interrater reliability results were obtained from each station. A future study may focus on how to improve the overall reliability through better rater evaluation training.
References available upon request
Full disclosures for all authors and coauthors available upon request

RESILIENCE IN THE MIDST OF A PANDEMIC: IN SITU SIMULATION TO EVALUATE COVID-19 PREPAREDNESS AT A PEDIATRIC HEALTH SYSTEM IN NEW ENGLAND.

Carla Pruden, BS, MD, MPH, CHSE,[1] Mariann Kelley, MD, FAAP,[1] Erin Bailie, BSN, MSN, RN[1]
[1]Connecticut Children's Medical Center, Hartford, CT, USA

Introduction: The science of human factors and ergonomics (HFE) has the primary goal of optimizing technology design and care systems to achieve productivity, safety, efficiency, and quality in the care delivery process (1). Using mixed-methods research, healthcare simulation provides a platform on which to evaluate the impact of organizational design, policies, procedures on an individual or team performance, and safety through the human-centered design approach (2). This pediatric health system employed a multidisciplinary, inter-professional task force to evaluate preparedness levels. In parallel, the simulation program performed systems integration simulations to inform one patient's journey through the institution. The primary purpose of the sessions was to assess and inform the status of preparedness in each area concerning COVID-19. A second purpose was to provide an outlet to express underlying apprehensions, and reveal the problem solving/resilient abilities inherent to the system.

Methods: In keeping with the human-centered design to systems integration, the simulation team invited an inter-professional and multidisciplinary collaborative group to help develop, and facilitate the simulation sessions. Existing practices were evaluated for readiness and adaptation by utilizing one primary scenario involving a 5-year-old meeting the initial patient under investigation (PUI) case definition - as she progressed from emergency department assessment to definitive management with ECMO. In parallel to institutional progression, an iterative approach was employed to session delivery, and the original scenario was adapted to embody specific patient populations or to assess newly developed practices. Debriefings utilized the PEARLS Systems Focused Debriefing process and were mapped to our institutional report out tool. A modified risk severity score was developed regarding staff comfort with the established solution, and anticipated work required to address issues.

Results: Results A total of 209 issues were investigated during the debriefings of the 10 sessions. Staff endorsed comfort with 44 of the solutions devised during the debriefing, or previously established (21.3%). Minor feasibility confirmations were required for an additional 88 issues (42.5%). A moderate amount of discussion was necessary for 65 (31.4%) of the issues, while only 10 (4.83%) issues required further evaluation and correction by stakeholders and workgroup leaders. Findings revealed during the debriefing sessions were mapped to 7 of 9 assessment areas highlighted by the CDC document regarding hospital preparedness for COVID-19. Accordingly, these findings directly informed multiple institutional policies and procedures.

Conclusion: Systems Integration simulations were relatively comprehensive in their ability to identify, address, and reaffirm the COVID-19 preparedness process. Solutions developed a priori, or de novo during the simulation process were well matched to the needs of the frontline staff 63.8% of the time. Complete solution innovation was necessary for less than 5% of the time. This substantiates that systems integration simulations can not only identify latent safety issues, but also the resilience of the system, and the individuals that work within it.
References available upon request
Full disclosures for all authors and coauthors available upon request

SELF-DEBRIEFING AFTER VIRTUAL SIMULATION: MEASURING STUDENTS' DEPTH OF REFLECTION

Valorie MacKenna, PhD, RN, CHSE, CNE,[1] Desiree Diaz, BSN, MSED, MSN, PhD, RN-BC, ANEF, BC, CHSE-A, CNE,[2] Victoria Loerzel[2]
[1]University of Connecticut, Storrs Mansfield, CT, USA; [2]University of Central Florida, Orlando, FL, USA

Introduction: Educators are turning to virtual simulations to expand experiential learning opportunities. The asynchronous nature of virtual simulation presents a challenge to provide facilitator-led debriefs immediately afterward, as recommended by best practice standards. Another core recommendation for any debrief is the promotion of reflection. Facilitator presence is not required, therefore self-debriefing may be a solution for immediate debriefing after virtual simulation, but evidence is lacking as to what extent students can reflect when using self-debriefing. This research sought to answer the following question: What is the depth of reflection found in undergraduate nursing students' written responses to a self-debriefing activity after a virtual simulation?

Methods: The aim of this descriptive study was to explore the depth of reflection found in students' responses to questions from a self-debriefing activity. Mezirow's definitions of reflective thinking informed the development of a 4-level rating rubric: L-1=habitual action, L-2=understanding, L-3=reflection, L-4=critical reflection. Following two required virtual simulations, 120 junior-level nursing students were assigned a researcher-developed self-debriefing activity, based on Gibbs' Reflective Cycle. The self-debriefing activity contained six questions (Description, Emotion, Evaluation, Analysis, Conclusion, and Future Plan). Students accessed the activity and submitted written responses via Qualtrics. The rubric underwent inter-rater reliability testing prior to analysis.

Results: Data from 176 submissions were rated using the reflection rubric. Over 76% (n=135) of the submissions contained a majority of responses (4 or more out of 6) rated at Reflection (L-3 or L-4). The mean rating for all submissions was identified at 2.92 (.42). The two highest questions' means were Description (3.40) and Analysis (3.10). The lowest questions' means were Evaluation (2.64) and Future Plan (2.66). Fewer than 8% ($n < 13$) responses were rated as L-1 (habitual action).

Conclusion: Students showed varying levels of reflective thinking as a result of using the self-debriefing activity, with higher levels of reflection during describing and analyzing the event and lower levels of reflection while evaluating actions and planning for future action. These results lend support to the use of a theory-based self-debriefing activity as a method of debriefing that adheres to the best practice recommendation of promoting reflection.
References available upon request
Full disclosures for all authors and coauthors available upon request

SIMULATED AEROSOL RETENTION OF COVID INTUBATION BOXES

Jan Hirsch, MD,[1] Rich Fidler, MSN, PhD, CRNA, CRNP, CHSE,[1] Mary Sturgeon, BA, DMD, RDH,[2] Christopher Niedek,[3] David Robinowitz, MD, MHS, MS,[4] Justin Teng, MD,[4] Qi Zhang, PhD[5]

[1]San Francisco VA Medical Center, San Francisco, CA, USA; [2]San Francisco Veterans Affairs Health Care System, Rohnert Park, CA, USA; [3]University of California Davis, Davis, CA, USA; [4]UCSF, San Francisco, CA, USA; [5]UC Davis, Davis, CA, USA

Introduction: Data that disease severity in COVID-19 may be correlated with inoculation dose has triggered interest in airway barrier devices. While recent work demonstrated reduced droplet exposure (1-6), aerosol protection is not understood.

Methods: Aerosol containment within barrier devices was investigated: (1) "Glove Box" : Box sealed with gloves and caudal drape, (2) "Drape Tent", drape placed over a frame at the patient's head, (3) "Slit Box", armholes covered by a vinyl slit diaphragm and caudal covering, (4) Original "Aerosol Box", (5) "Interlocking Box", a collapsible polycarbonate box, (6) "Simple Drape", a clear drape over the patient with the laryngoscopist's hands beneath the drape, and (7) No Barrier. Containment was investigated using a Laerdal ALS man manikin by (1) installation of vapor with video-assisted visual examination (2) submicrometer ammonium sulfate aerosol particles ejected through the manikin's mouth with simulated ventilation and coughs. Samples taken at standardized locations were evaluated using a condensational particle counter and an aerosol mass spectrometer. Smoke evacuation with hospital suction, a smoke evacuator and a ShopVac were investigated.

Results: Vapor experiments demonstrated leakage via arm holes and edges. . With all barrier devices aerosol counts at the operator outer side were significantly elevated above baseline ($p<0.001$). Glove Box and Drape Tent reduced aerosol at the operator's mouth and chest 10-fold compared to no barrier, with risk of leakage upon movement for laryngoscopy. With not fully enclosed devices aerosol at the operator's body was equal or higher than without barrier, especially when used with a caudal drape. Aerosol evacuation to baseline required 15 min with suction and ShopVac, and 5 min with smoke evacuator

Conclusion: Glove Box and Drape Tent can retain most aerosol during airway management, different from all other devices. Not fully enclosed devices may direct aerosol toward the laryngoscopist. Aerosol evacuation for fully enclosed devices is advantageous.
References available upon request
Full disclosures for all authors and coauthors available upon request

SIMULATING SAFE AIRWAY MANAGEMENT PRACTICE IN PEDIATRIC CARDIAC ICU PATIENTS WITH COVID INFECTION

Gregory Yurasek, MD, CHSE,[1] Justine Fortkiewicz,[2] Christina Duelley, MSN, RN, CCRN, CPN,[1] Cara Pleau, BSN, RN, CPN,[3] Martha Goldberg, MSN, RN, CCRN[1]

[1]Children's National Medical Center, Silver Spring, MD, USA; [2]Children's National Health System, Washington, DC, USA; [3]Children's National Hospital, Washington, DC, USA

Introduction: Patients in the pediatric cardiac intensive care unit (CICU) frequently have limited cardiorespiratory reserve and are particularly vulnerable to the sequelae of infection. In light of this, as Covid cases began to appear in pediatric ICUs nationally in March 2020, we elected to transiently replace our weekly in situ simulation exercises with a scenario involving the intubation of a patient with Covid infection. Our objectives were to instruct teams to perform a detailed pre-procedure huddle, ensure best practices regarding minimizing aerosol exposure among members, and foster proper use of available barriers to infection and personal protective equipment (PPE).

Methods: A scenario was written involving an infant with repaired congenital heart disease with impending respiratory failure who was en route to a CICU. Participants were instructed to assemble, decide which members would enter the room, discuss medications and equipment, and don PPE. After 5 minutes the team was informed that the patient was now in the room, at which point the designated team members entered, assessed the simulated patient and performed endotracheal intubation. A debrief ensued which focused on how well the team followed current best practices for this procedure (1). The discussion targeted the completeness of the pre-procedure huddle, proper use of PPE, and clarity of role assignments and responsibilities. Special attention was paid to appropriate use of aerosol barriers such as a video laryngoscope, high efficiency particulate air filter(s), a cuffed endotracheal tube, and minimizing bag-mask ventilation before and after intubation. Participant responses were collected.

Results: Over a 7-week period, we conducted 10 simulations for a total of 51 participants comprising of 24 nurses, 17 physicians and 10 respiratory therapists. All exercises proceeded through patient intubation and participant responses were collected for each session using a Likert Scale with a score of 4 equating to "agree" and a score of 5 equating to "strongly agree". Participants either agreed or strongly agreed that the sessions will change the way they practice (median 5, IQR 1), improved their confidence to perform their role during the actual intubation of patient with Covid infection (median 4, IQR 0), helped them demonstrate proper use of PPE (median 4, IQR 1), and helped them identify the proper personnel and equipment required for the procedure (median 4, IQR 1). During the debriefs, a number of latent safety threats were identified related to appropriate use of bag-mask ventilation, correct filter and adapter choice, and proper use of a video laryngoscope.

Conclusion: Tailoring simulation content to match the educational needs of patients and staff during the Covid era helped us provide airway management practice and instruction to a large number of CICU personnel. This effort illustrates the power and flexibility of in situ simulation when preparing staff to perform high-risk procedures on high-risk patients.
References available upon request
Full disclosures for all authors and coauthors available upon request

SIMULATION AND RESOURCE STEWARDSHIP: PREVENTING FURTHER DISTANCING FROM RESIDENT EDUCATION DURING A SOCIALLY DISTANCED ERA.

Dana Saleh, MD[1] Ghazwan Altabbaa, MD, CHSE[1]

[1]University of Calgary, Calgary, AB, Canada

Introduction: Cost-effective decision making as a competency is not commonly incorporated into structured curriculum design deliverables in residency programs. The growing emphasis on patient harm from unnecessary medical interventions, coupled with commonly identified non-technical performance gaps among medical trainees such as information sharing, make evident the need to address the training gap on resource stewardship in medical education (Lass et al., 2015). The use of simulation to bridge this knowledge gap amongst Internal Medicine (IM) residents has been described in the works of Saleh, Campbell, and Altabbaa (2018). In the Coronavirus disease (COVID) era of social distancing, simulation can still be an effective modality for teaching residents resource stewardship to foster safer healthcare practices. Inappropriate prescribing of blood products, antibiotics, and telemetry can further compound the financial strain imposed by COVID on our healthcare system and lead to patient harm.

Methods: A cross-sectional study on cost-effective medical practices of 27 IM residents transitioning into the senior resident role participating in the program's pre-established simulation curriculum was completed. The sessions included standardized case scenarios in addition to four separate telephone calls from resident or staff simulation educators that tested decision-making around selected Choosing Wisely Canada recommendations: avoidance of antibiotics in simple asthma exacerbations, blood product transfusion restrictions, and discouraging telemetry overuse. Data was collected by the resident or staff administering the phone call during the simulation session and was protected in a folder with password access. Participant identifiers were not collected. The indications and local costs of ordered tests and interventions were discussed during the facilitated reflection by simulation educators.

Results: Twenty-seven IM residents transitioning into the senior resident role participated in simulation composed of multiple, and simultaneous stations deigned to replicate a busy night on call. Telemetry was unnecessarily ordered three out of six times (50%) during the simulation sessions, thereby incurring costs as high as $700 per patient stay. Unnecessary orders for platelets and blood units were observed in 16% (1/6 times) and 33% (2/6 times) of the cases, respectively. Antibiotics were correctly withheld 100% of the time (6/6).

Conclusion: Simulation is a cost-effective strategy for incorporating resource stewardship training into medical education and maintaining the delivery of medical curricula during social distancing. This quality improvement initiative is still in progress with the aim of expanding the data collection pool to include upcoming simulation sessions. Our anticipated hypothesis is that residents' overuse of telemetry and blood products will continue to be observed at an anticipated rate of 30%. The anticipated date of completion of this study is November 2020.
References available upon request
Full disclosures for all authors and coauthors available upon request

SIMULATION FOR OPERATING ROOM SAFETY (SIMORS): INTERDISCIPLINARY TEAM TRAINING IN NONTECHNICAL SKILLS AND OR SAFETY

Kimberly Buholtz, MSED, RN-BC,[1] Wendy Bernstein, MBA, MD,[2] Katherine Jackson, MD,[2] Patricia James, BS, MS, RN, CNOR,[3] Derek Wakeman, BS, MD, CPhys, FAAP, FACS,[1] Amy Butts[4]

[1]University of Rochester, Rochester, NY, USA; [2]University of Rochester Medical Center, Rochester, NY, USA; [3]F F Thompson, Canandaigua, NY, USA; [4]URMC Strong Memorial Hospital, Rochester, NY, USA

Introduction: Safety in the operating room (OR) involves integral collaboration and coordination between surgery, anesthesia and nursing disciplines. However, surgical teams are especially susceptible to breakdowns in information sharing. While intraoperative

errors and personnel factors such as fatigue and inexperience frequently contribute to OR errors, a reported 43% of adverse events are attributable to communication failures (2). Our team sought to develop a simulation program that would teach the importance of sign out completion and promote teamwork. We hypothesized that a simulation program designed to encourage interdisciplinary teamwork and highlight potential areas of communication breakdown would improve attitudes of utilizing the surgical safety checklist (SSC) and OR safety culture. We also hypothesized that simulation is an effective teaching tool for interdisciplinary OR teams.

Methods: Simulation sessions were conducted with an interprofessional surgical team consisting of an attending and resident anesthesiologist, attending and resident surgeon, and 2 OR nurses (circulator and scrub nurse/tech). Using a high-fidelity simulation mannequin, an advanced 3D printed model, and a mock operating room, each team completed a surgical case divided into 3 phases. Unexpected events including a crisis (intra-abdominal hemorrhage) occurred throughout the phases, requiring cooperation and communication to prevent harm to the patient. The anesthesiologists were asked to respond to vital sign changes with appropriate medications and resuscitative therapies. The surgeons were asked to resect a retroperitoneal lymph node and tumor, aided by electrocautery and suction. Investigators administered a survey before, immediately after, and approximately six months after participation in the simulation experience to elicit opinions of OR safety culture, SSC usage, and OR team simulation.

Results: One hundred forty participants completed the pre- and post- simulation experience survey, and 40 completed the interval survey. At the interval survey, consistently performing the debriefing (sign out) portion of the SSC was reported by 94% of surgeons, but only 50% of anesthesia participants ($p<0.001$). Participants reported feeling more empowered after the experience ($p<0.01$), which was sustained on the 6 months inquiry. Before the experience, 82% of participants agreed that simulation is an effective tool to teach OR safety, which improved to 100% afterward ($p<0.001$) and 95% after six months.

Conclusion: Simulation can be an effective teaching tool for interdisciplinary OR teams. Overall, participants felt empowered after completing the simulation, but differences remain between disciplines. Members of the surgical team reported differing levels of engagement in sign-out and debriefing activity, suggesting a need for additional simulation experiences to improve collaboration and communication. Education of OR teams as an interprofessional group rather than singular disciplines can provide opportunity for teamwork and shared decision making. Participants discussed the need for realistic high-fidelity simulation activities to practice skills and the need for ongoing simulation experiences.
References available upon request
Full disclosures for all authors and coauthors available upon request

SIMULATION TRAINING WITH TELE-FEEDBACK ACHIEVES A HIGHER RATE OF STUDENT APPROVAL THAN A TRADITIONAL BOOTCAMP ON TECHNICAL PROCEDURES EXAMINATION

Marcia Corvetto, MD,[1] Javier Vela, MD,[1] Ignacio Villagran,[1] Caterina Contreras, MD,[1] Catalina Ortiz, MD,[1] Francisca Belmar, MD,[1] Gabriel Escalona,[1] Francisco Molina, MD,[1] Julian Varas[1]
[1]Pontificia Universidad Catolica de Chile, Santiago, Chile

Introduction: Medical students must acquire skills to perform basic procedures such as paracentesis (PCT) or thoracentesis (TCT). These skills are usually trained in medical simulation laboratories. However, traditional undergraduate simulation workshops do not achieve individualized teaching due to the high number of students per teacher and low tutor availability.(1) Through tele-simulation (video-recording of exercises and their assessment with remote and asynchronous feedback by an expert teacher through an online platform), we have demonstrated the effectiveness of skills acquisition in laparoscopic surgery without the need of an in-person tutor.(2) This study aims to assess whether the implementation of a digital platform (called C1DO1), which enables and optimizes the tele-feedback, is a suitable teaching alternative to traditional simulation workshops. RQ: Is a remote and deferred feedback as effective as in-person feedback for simulation training in undergraduate medical students?

Methods: Third-year medical students were included and randomized into two groups: TCT and PCT. These groups were again randomized to two more groups: training through tele-simulation (C1DO1 Group) and traditional workshop (Control Group). The C1DO1 Group had to execute up to 2-training sessions (approx 1 hour each session) through tele-simulation and received feedback by a group of 10-certified instructors. The Control group trained only once with in-person feedback for a 4-hour session intensive Bootcamp. After training, both groups were assessed in an onsite evaluation. Every group had the same theoretical and audiovisual content available. Students were assessed using the OSATS global scale and a direct observation of procedural skills (DOPS) checklist. An OSATS score of ≥21 points was established as approval criteria based on the performance of experts (80% in the model). Nonparametric statistical analysis was performed using Mann-Whitney and Fischer exact test.

Results: One hundred and twenty students were included, 30 on each group. Twenty students of the TCT-C1DO1 Group and 23 of the PCT-C1DO1 group completed the two tele-simulation training sessions. On both Control Group, all 30 students completed the traditional workshop. On the onsite evaluation, the C1DO1 group on both procedures achieved a significantly higher proportion of approval than the control group (TCT 80% vs. 43%, PCT 91% vs. 67%, p-value 0,05).

Conclusion: Individualized simulation training with tele-feedback through C1DO1 achieved a higher rate of approval than our traditional workshop. C1DO1 appears as a valid teaching platform for training technical procedures.
References available upon request
Full disclosures for all authors and coauthors available upon request

SIMULATION USE IN OUTREACH SETTING: A NOVEL APPROACH TO BUILDING SUSTAINABILITY

Samsun Lampotang, PhD[1] Anthony DeStephens, MS[1]
[1]University of Florida, Gainesville, FL, USA

Introduction: Simulation is a well-studied teaching tool for multi-disciplinary teamwork, crisis resource management and communication skills. These elements are essential for successful international medical missions which include health care providers with different areas of expertise, levels of training, or familiarity with the outreach setting and each other's roles. The effect of immersive simulation on team dynamics remains poorly studied in similar settings. We hypothesize that incorporating simulation into the workflow of international medical missions will result in enhanced team preparedness for addressing the innate challenges of working in the outreach setting.

Methods: We used a one-group pre-intervention/post-intervention quasi-experimental design to measure the effectiveness of simulation training in improving overall team performance during patient resuscitation. Visiting and local health care providers in pediatrics, pediatric anesthesiology, surgery and nursing were included in our study. On day 1 of a 7 day long mission, participants received a brief crash course focusing on major PALS algorithms, followed by a simulated resuscitation exercise using a pediatric low fidelity simulator. A debriefing session focused on crisis resource management, with special emphasis on role assignments and successful team dynamics was then performed. The simulation exercise was repeated on day 3. Team performance was measured on both day 1 (baseline) and day 3 (post-intervention) using the Clinical Teamwork Scale (CTS) by Guise et al. (2008). The difference between baseline and post-intervention performances was compared using Wilcoxon Signed Rank Test.

Results: Post-intervention performance scores significantly increased from baseline in 13 out of 16 criteria defined in CTS with large effects sizes: overall communication, transparent thinking, directed communication, closed loop communication, overall situational awareness, resource allocation, overall decision making, prioritization, overall role responsibility, role clarity, performance as a leader, performance as a helper and overall evaluation. The score improvement for the remaining two criteria, orientation of new members and patient friendliness, was not statistically significant. In fact, both items were marked as "not relevant" by the raters on multiple occasions. Although non statistically significant, the rate of target fixation decreased post-intervention.

Conclusion: Considering the importance of solid team dynamics in crisis resource management, our results provide a strong incentive for incorporating a rigorous and standardized simulation curriculum into high-risk medical missions. The simplicity of the proposed platform overcomes the limitations of time and resources inherent to outreach mission work. Further research with larger sample sizes may be needed to fully assess the benefits of simulation in global health.
References available upon request
Full disclosures for all authors and coauthors available upon request

SIMULATION-BASED ASSESSMENT OF PEDIATRIC PROVIDERS: A GENERALIZABILITY STUDY

Samsun Lampotang, PhD[1] Anthony DeStephens, MS[1]
[1]University of Florida, Gainesville, FL, USA

Introduction: The educational role of simulation is expanding with its use as a tool used in low stake formative assessments or higher stake summative assessments. However, the use of checklists, rating scales and clinical cases can result in different measurement errors which should be accounted for when studying the score reliability of the tool in question. Available reliability coefficients like Cronbach alpha or inter-rater reliability are very useful but insufficient in these situations. When building a simulation curriculum with multiple cases, it is primordial to evaluate the consistency of the participant's performance during different scenarios. We hypothesize that the Generalizability (G) theory can address multiple sources of measurement error at once to reach powerful reliability coefficient.

Methods: We conducted generalizability (G) and decision (D) studies from the G theory to analyze data obtained from a simulation based formative assessment of crisis resource

management skills during pediatric resuscitation. Participants were divided into groups of five to ten. A 15 minutes crash course focusing on major PALS algorithms was followed by a 25 minutes simulated resuscitation exercise using a low fidelity simulator. A 20-minute debriefing session was then performed. The exercise was repeated three days later. The participants were video-recorded and then independently evaluated by two raters using the Ottawa Global Rating Scale (O-GRS) by Kim et al. (2006). We used that data to (1) examine the psychometric characteristics of the O-GRS, (2) illustrate the use of the G theory in measuring multiple sources of error variance in a study design and (3) define the number of cases, raters and items needed for optimal reliability of O-GRS as an assessment tool.

Results: The G study estimated the largest proportion of total variance at 25.9% for both participant-case and participant-case-rater interactions. 16.1% of the total variance was due to the object of measurement. Although the variances attributed to cases, raters, rating scale items and "case-rater-item interaction" were almost zero; the interaction of participants to those facets was estimated as larger than zero. The D study suggests that the effect of the number of items in the rating scale on the reliability coefficient of the latter is lower than that of the number of cases or raters. However, minimizing the number of raters while maximizing reliability coefficient improves adaptability and implementation potential. We estimated that 0.70 for a D study including two cases, two raters and six items was an appropriate threshold. This reliability coefficient is adequate for formative assessments.

Conclusion: Our results suggest adequate reliability of the O-GRS when using two cases, two raters and six items for formative assessment of healthcare provider's performance in a simulated pediatric resuscitation. This study demonstrates the ability of G theory to determine the number of cases, raters and sources of error required to obtain optimum reliability for assessment.
References available upon request
Full disclosures for all authors and coauthors available upon request

SIMULATION-BASED CLINICAL SYSTEMS TESTING OF A PEDIATRIC EMERGENCY DEPARTMENT DURING THE COVID-19 PANDEMIC

Chris Kennedy, MD, FAAP,[1] Shautonja Woods, BS, RRT, RRT-NPS,[2] Lisa Ell, BSN, RN, CCRN,[2] Marc Sycip, MD, FAAP[2]
[1]Children's Mercy Hospital Center for Excellence in Pediatric Resuscitation, Kansas City, MO, USA; [2]Children's Mercy Hospital, Kansas City, MO, USA

Introduction: The viral pandemic COVID-19 prompted children's hospital emergency departments (ED) to prepare for a surge from both pediatric and adult patients. In response, guidelines developed represent "work as imagined" and may not reflect work as done.1-2 In situ simulations could provide the opportunity to fill gaps in education, practice protocols, reduce cognitive load, and help to mitigate errors in times of pressure and exhaustion.1 Simulation-based clinical systems tests (SbCST) are useful to detect gaps and latent safety threats in systems design.2-4 Our aim was to use SbCST combined with rapid cycle training to test hospital system modifications for ED preparation.2-5 If effective this method could represent a new application of SbCSTs. The research questions were in 2 frames: 1. Would front line providers consider rapid SbCSTs acceptable in improving preparedness and 2. Can rapidly deployed SbCSTs identify gaps/latent safety threats and provide recommendations for improvement?

Methods: This observational study took place in a children's hospital ED and was approved by the IRB as a QI project. Our aim was to conduct COVID-19 SbCSTs combined with training. SbCST scenarios were 60 minutes, tested guidelines for workflow, equipment, and care to mitigate potential exposure of staff and patients. We used Gamaurd mannequins and portable tablet-based "monitors" (SimMon). Each case used "tipping-point"(s) in care to emulate workflow changes. Short debriefs reviewed guidelines and staff input, and then staff repeated the simulation. After each simulation, participants using a brief web-based survey to evaluated the SbCST for knowledge (novice to expert), feasibility, acceptability, and suggestions for improvement. Three sim staff observed, reviewed recorded video, and took notes on a standardized form. The reporting process included which guideline/process/job-aide was tested, staff response, any gaps/LSTs identified. A Failure mode event analysis is underway.

Results: 22 SbCSTs were conducted with 64 staff, 53 (83%)(17- MDs, 16-RNs, 9-RTs, 7 -Techs, 4- pharmacists) filled out an evaluation. For question 1: Results for evaluation of feasibility (strongly disagree, SD to strongly agree, SA): Worth the time it took: 14% somewhat agreed, 86% strongly agreed. An acceptable way to improve staff readiness/knowledge: 8% somewhat agreed, 92 % strongly agreed. An effective way to test changes/provide solutions, 8% somewhat agreed, 92% strongly agreed. The debriefing process allowed staff to share ideas–average 6.% somewhat agreed 8%, 86% strongly agreed. For question 2: From the 22 simulation sessions staff identified 95 total LSTs. Preliminary results: each LST was categorized for cause as follows: 35 were related to the COVID-19 PPE process, 32 communication/personnel, 15 equipment, and 13 a needed workflow change. A formal failure mode effect analysis (FMEA) is underway and the results from this process will rate each according to FMEA scoring system.

Conclusion: his study demonstrated that simulation-based clinical systems testing (SbCST) methods are adaptable for use in a children's hospital ED for preparedness evaluation and training. Results from participant evaluations demonstrate a high regard for this method for going through and testing adaptions to the care process required for COVID-19 preparedness. The process detected many LSTs but further data analysis with a formal FMEA process will be required to better understand the results. This work highlights a new application of SbCST that could be applied to increase system preparedness and reduce errors.
References available upon request
Full disclosures for all authors and coauthors available upon request

SIMULATION-BASED EDUCATION FOR INTERRUPTION MANAGEMENT TRAINING: AN INTEGRATIVE REVIEW

Peggy Hill, AS, BSN, MSN, RN, CHSE[1]
[1]University of Central Florida, Orlando, FL, USA

Introduction: Question. Interruptions are associated with medical errors, which cost nearly 200,000 American lives each year. Novices are particularly vulnerable to interruptions, resulting in more errors, higher stress, and a propensity to quickly leave jobs, thus increasing costly turn-over rates. Simulation-based education (SBE) is useful for helping nursing students gain interruption management skills. However, to create effective SBE, a thorough understanding of the current evidence is needed. The goal of this integrative literature review was to critically appraise the available literature. The specific aims were to: 1. Identify the number and types of studies using simulation-based education for interruption management training; 2. Critique the quality of the research evidence and simulation designs; and 3. Identify limitations and gaps within the literature to inform nursing education.

Methods: Methods. To include a variety of professions, 11 databases were used including: APA PsycInfo, Applied Science & Technology Source Management, Business Source Premiere, CINAHL, Cochrane Database of Systematic Reviews, Eric, Health & Psychosocial Instruments, Health Source: Nursing/Academic Edition, Medline, Military & Government Collection, and Open Dissertations. The search terms Interrupt* (manag* OR mitigate* OR handl*) AND Simulat* OR (based education training learning) were used. No date limiters were applied to allow for investigation of the evolution and maturation of the concept. While systematic reviews were included due to their rigor, literature reviews were excluded, but their references explored for additional sources. Ten studies were identified from an initial 1,148, and an integrative review of the findings was performed. Studies were evaluated for strength of design, theoretical foundation, simulation fidelity, interruption characteristics, and use of INACSL standards.

Results: Results. The included quantitative studies were quasi-experimental and involved small sample sizes. Methodologic decisions, validity checks, and critical appraisal were not evident within the included qualitative studies, but they did provide subtle difference in voice by highlighting participant quotes. Definitions and theoretical foundations were lacking among the studies. Simulation fidelity varied widely between studies, with medical education providing higher realism than nursing. Predominance of qualitative design in the nursing literature indicates concept immaturity. Additionally, nursing studies focused solely on medication administration, despite the current evidence indicating that nurses are interrupted during all types of tasks. Most studies sought to teach participants how to manage interruptions by experiential learning alone, with only one including any specific interruption management training. INACSL standards were not emphasized in any of the included studies.

Conclusion: Conclusion: To safely transition from academia to practice, nursing students need to gain the skills necessary to prevent errors. The information gleaned from this integrative review can be used to inform future studies. Future research is needed to investigate the best methods for training nursing students to manage interruptions. To improve the level of literature evidence, future studies should define interruptions, include INACSL best standards, be based on sound theories, and demonstrate efforts to control bias. Studies are also needed that compare experiential learning modalities to those using a combination of training and SBE. Furthermore, factors associated with interruption related errors, like increased time on task and cognitive load, should be investigated.
References available upon request
Full disclosures for all authors and coauthors available upon request

SIMULATION-BASED TESTING OF A NEW HELIPAD USING AN ITERATIVE FAILURE MODE AND EFFECTS ANALYSIS FRAMEWORK

Jeffrey Holmes, MD,[1] Erin Graydon Baker, BS, MS, RRT,[2] Leah Mallory, MD, FAAP,[3] Micheline Chipman, BSN, MSN, RN, CCRN, CHSE,[3] Tracie Barbour, AA, CHSOS,[3] Justin Michaud, MSN, RN, RN-BC, NE-BC[3]
[1]Hannaford Simulation Center, Cumberland Center, ME, USA; [2]MaineHealth, Portland, ME, USA; [3]Maine Medical Center, Portland, ME, USA

Introduction: Fundamental changes in critical systems, such as spaces within hospitals, present safety risks. Some of these threats can be identified prospectively, others are latent and are only uncovered once the system goes live. Simulation provides the opportunity to test a system without endangering patients. There is a growing body of healthcare literature describing the use of simulation programs to test and improve new hospitals or units within

hospitals prior to opening [1,2] however none describing the use of simulation to probe a new helicopter landing pad system. Failure mode effect analysis (FMEA) is an approach developed by the U.S. Military in the 1940's to identify possible failures in a design or process. The 'effect analysis' component studies the consequences of the failures.[3] We proposed that the FMEA process can be effectively coupled with simulation to find and mitigate potential safety threats in a new hospital helicopter landing pad system.

Methods: This simulation study was conducted in three phases. In Phase 1, an interprofessional group of stakeholders created a process map, identifying steps that would likely be impacted by the opening of the new helipad. Using a Failure Mode Effect Analysis based Systems Testing Scorecard, each potential failure mode was assigned a hazard score based on its estimated likelihood of occurring and severity of impact on patient safety/or staff experience. Phase II used low fidelity simulation to focus on communications, registration, admitting procedures, and to identify the best paths of travel from the helipad to the most common hospital destinations. In Phase III, high fidelity simulation testing, including landing of two helicopters, was used to probe safety threats identified in earlier phases, including: 1) limited security escort services with near simultaneous patient landings, 2) communication to receiving units, and 3) procedure for a patient who decompensates during transfer.

Results: Over the three phases of simulation systems testing, 28 potential latent safety threats, 25% of which were both high risk and high likelihood, were identified in areas of care coordination, facilities, equipment and devices, and teamwork. Number of threats detected decreased in each subsequent phase (15 in I, 7 in II, and 6 in III). Phase three failure modes included lack of second page to ICU or PICU once a helicopter lands, registration communication, failure to meet registration with the new path of travel, lack of additional security escort during simultaneous landings, helipad icing safety hazard, emergency medicine physician not having access to helipad, patient decompensates pre-arrival, and patient decompensates in hospital during transport.

Conclusion: In conclusion, we found an iterative three-phase simulation systems testing program using FMEA methodology to be an effective tool to develop new helipad workflows and identify and mitigate latent safety threats.
References available upon request
Full disclosures for all authors and coauthors available upon request

SITUATION AWARENESS DIFFERENCES BETWEEN NOVICE AND EXPERT NURSES IN A SIMULATION

Mary Ann Shinnick, PhD, NP, CHSE, CHSE-A[1]
[1]UCLA, Los Angeles, CA, USA

Introduction: Visual scanning has been used to identify cognitive processes such as situation awareness (SA) in pilots in order to improve training and flight safety.1,2 Situation awareness is imperative for healthcare workers in order to make timely clinical decisions. Therefore, this study sought to explore SA differences between Novices (senior prelicensure nursing students from two different schools) and Experts (ICU or ED nurses) in a high-fidelity simulation. The research question for this study was: What are the situational awareness differences between novice and expert nurses in a high-fidelity simulation.

Methods: Using a known groups approach with a comparative design, this study was a prospective, two-group, multi-site investigation of Novice nurses (n = 32) and Expert nurses (n = 30). Participants completed a simulation of a severely dyspneic "patient" individually while wearing eye tracking glasses. Visual scanning data (dwell time, average fixation time and number of fixations) were obtained from an eye tracker for three areas of interest: the pulse oximeter value on the monitor (SpO2), the provider's orders and the patient face.

Results: While there was a difference between the groups on age ($p \leq 0.01$) there was no difference between groups for baseline or post-simulation knowledge ($p = 0.32$ and 0.36 respectively). On visual scanning measures, there was a significant difference between groups in both dwell time and fixation count for SpO2 ($p = 0.05$; $p = 0.03$) and provider orders ($p = 0.01$; $p = 0.02$).

Conclusion: While student nurses are known to have a dependence on provider orders for direction, most concerning is the difference between the groups on their situation awareness as evidenced by SpO2 value dwell time and fixation counts. This indicates a need for further education of nursing students in assessment of physiological parameters pertinent to the patient's condition, especially in the deteriorating patient.
References available upon request
Full disclosures for all authors and coauthors available upon request

ST ELEVATION MYOCARDIAL INFARCTION IN A RURAL HOSPITAL WITHOUT PERCUTANEOUS CORONARY INTERVENTION: AN EMERGENCY MEDICINE RESIDENT SIMULATION CASE

David Simon, DO,[1] Richard Shin, MD,[1] Kallie Combs, DO,[1] Anika Nichlany, MD, FACEP,[1] Anita Lui, DO, CHSE[1]
[1]New York Presbyterian Queens, Astoria, NY, USA

Introduction: Chest pain is the second most common complaint presenting to the ED in the USA. Emergency residents are trained to focus on the immediate recognition of the life threatening causes such as STEMI. Patients diagnosed with a STEMI should receive coronary reperfusion therapy by percutaneous cardiac intervention (PCI), but some rural hospitals do not have access to immediate PCI. While most academic training hospitals have PCI available, physicians graduate and might work at hospitals that do not have the capacity. Thus emergency physicians should also be knowledgeable on when thrombolysis is indicated and the contraindications. The question this research looks to answer is does training in a PCI center make a resident less comfortable when managing a STEMI without the ability to send immediately to the catheterization? We look to answer the question with a simulation case and see if simulation can help increase resident confidence in managing this subset of patients.

Methods: We performed a medical simulation case for our emergency medicine residents to evaluate for their ability to recognize and treat STEMI without immediate access to PCI. The emergency medicine residents were a mix of first, second and third years. Our simulated case was a 58-year-old male with no past medical history who presents to a rural emergency department with a complaint of chest pain. The ECG shows a lateral STEMI but the patient cannot undergo PCI immediately and must be managed with thrombolysis. We assessed the participants comfort level by having them respond on a Likert Scale from 1 (No confidence)-5 (Very confident) to the following questions. 1. How confident are you in interpreting ECGs? 2. How confident are you in managing chest pain? 3. How confident are you in managing STEMIs? We asked the participants to respond to the survey prior to starting the case and after the simulation debrief.

Results: We received 15 responses from our cohort of residents (N=15). The median results prior to starting the case to the question were 1. 3.2, 2. 3.7 and 3. 3.1. After completion of the case, the results showed 1. 3.5, 2. 4. and 3. 4.2. Using a Paired T-test there was a significant increase in questions 1 and 3 with p-values of 0.02 and <0.001 respectively with the 2nd question having no significance with a p-value of 0.09. The Pearon's correlation coefficient when comparing poorly correlated for questions 2 and 3. Question 1 revealed a Pearson's coefficient of 0.79, with a p-value of <0.001.

Conclusion: While the benefit of percutaneous cardiac intervention in the initial management of an acute myocardial infarction is well established, a lot of rural hospitals do not have access to immediate PCI. Emergency physicians must be comfortable in deciding when a patient is not a candidate for PCI and the contraindications to thrombolysis. This study found that in our training facility as a PCI center, residents might not be as comfortable managing STEMI with thrombolysis. Our simulation and debrief helped alleviate that helping the residents feel more comfortable in a management of thrombolysis in STEMI and ECG interpretation. The results of this study highlighted that our simulation can help develop and maintain competency in this field. The resident simulation case can be an effective way to train young physicians in management common outside academics centers.
References available upon request
Full disclosures for all authors and coauthors available upon request

STANDARDIZING QUALITY OF VIRTUAL URGENT CARE: AN EXPERIENTIAL ONBOARDING APPROACH USING STANDARDIZED PATIENTS

Daniel Sartori,[1] Sondra Zabar, MD,[2] Heather Levitt, BA, MHS[3]
[1]NYU Grossman School of Medicine, Brooklyn, NY, USA; [2]New York University School of Medicine, New York, NY, USA; [3]NYU Langone Health, New York, NY, USA

Introduction: Virtual Urgent Care (VUC) is a now a common modality for providing real-time assessment and treatment of common medical problems. However, most providers have not had formal telemedicine training or clinical experience. Faculty have little experience with this new modality of healthcare delivery. We created an experiential onboarding program in which standardized patients (SPs) are deployed into a VUC platform to assess and deliver feedback to physicians in an effort to provide individual-level quality assurance and identify program-level areas for improvement.

Methods: We simulated a synchronous urgent care evaluation of a 25-year-old man with lingering upper respiratory tract symptoms refractory to over-the-counter medications. The SP was trained to strongly request an antibiotic prescription. A mock entry in the electronic medical record, available to providers during the visit, provided demographic, prior medical, pharmacy and allergy information. The encounter was scheduled into a regular 30-minute appointment slot during a routine 8-hour shift. We developed a behaviorally-anchored assessment tool to evaluate core communication, case-specific, and telemedicine-specific skills. Response options comprised 'not done,' 'partly done,' and 'well done.' SPs provided post-encounter verbal feedback to urgent care providers (UCPs), who received a summary report and had an opportunity provide structured feedback regarding the case. A single SP performed 20 / 21 visits.

Results: Twenty-one UCPs, with 2 to 23 years of clinical experience, participated in an announced scheduled visit. UCPs performed 'well done' in Information Gathering

(93%) and Relationship Development (99%) domains. All UCPs provided appropriate management plans and none gave antibiotics. In contrast, Education and Counseling skills were less strong (32% 'well done'). Within this domain, few received 'well done' for checking understanding (14%) or adequately summarizing (9%). Most (71%) collaborated with SPs to discuss next steps. Specific telemedicine skills were infrequently used: only 19% performed a virtual physical exam, 24% utilized the audio/video interface to augment information gathering, 14% optimized sound/video or ensured a backup plan should video fail. A subset of UCPs (n=9) provided feedback regarding the case. 100% 'somewhat or strongly agreed' that the encounter improved their confidence communicating via the video interface and helped improved telehealth skills.

Conclusion: This experiential virtual urgent care onboarding program utilizing standardized announced encounters uncovers several areas for improvement within telemedicine-specific and patient education domains. These findings form the basis for dedicated training for virtual urgent care providers to assure quality across the program.
References available upon request
Full disclosures for all authors and coauthors available upon request

SYSTEMS BASED DISASTER SIMULATION: A LARGE IN-SITU SIMULATION AS A MEANS FOR WHOLE HOSPITAL LEARNING

Ilana Bank, MDCM, FAAP, FRCPC,[1] Elene Khalil, MDCM, FRCPC,[2] Margaret Ruddy, BSN, Other, RN,[3] Tamara Gafoor, MDCM, FRCPC,[1] Audrey Dadoun, MDCM, FRCPC,[1] Lily Nguyen,[1] Meredith Young, PhD[1]
[1]McGill University, Montreal, QC, Canada; [2]McGill University Health Center, Montreal, QC, Canada; [3]Montreal Childrens Hospital, Montreal, QC, Canada

Introduction: An external disaster poses many challenges to both the health care system and to the teams that work within it. In order to prepare these teams and systems, simulation has been demonstrated to be a beneficial educational modality. The systems issues that may be revealed in a disaster context are difficult to predict and could result in significant human cost. Thus, simulating an event can identify, and potentially offer solutions, for latent patient safety defects and systems issues. We report initial findings of system-based challenges identified through the execution of a large multidisciplinary in-situ disaster simulation that occurred in a tertiary care pediatric hospital.

Methods: A large-scale in-situ disaster simulation occurred in 2018 involving multiple community and health care partners. All hospital personnel were encouraged to participate. Following the simulation, a hot debrief was performed including a discussion of identified patient safety concerns and potential latent policy gaps. Audio recordings were transcribed and analyzed using fundamental qualitative description designed to achieve descriptive validity.

Results: Three themes were identified, with multiple subthemes identifying main areas for improvement of disaster response: (1) Documentation and information transfer, (2) Situational awareness and transfer of care, and (3) Human Resources including lack of people and role allocation. Given the challenges faced, suggestions to improve the systems issues were implemented.

Conclusion: Simulation provides a unique opportunity to identify system-based issues and implementing changes to improve quality and safety of patient care before substantial and unnecessary human cost.
References available upon request
Full disclosures for all authors and coauthors available upon request

TELESIMULATIONS WITH A STANDARDIZED PATIENT WEARING A HIGH-FIDELITY BREAST MODEL ENGAGE MEDICAL STUDENTS TO PRACTICE CLINICAL LACTATION SKILLS

Olivia Anderson,[1] Samantha Chuisano, BA, MPH,[2] Anna Sadovnikova, IBCLC, MA, MPH[3]
[1]University of Michigan, Ann Arbor, MI, USA; [2]LiquidGoldConcept, Ann Arbor, MI, USA; [3]UC Davis/LiquidGoldConcept, Inc., Ypsilanti, MI, USA

Introduction: Educators use simulation-based training with standardized patients (SP) to improve learners' competency and supplement limited clinical experiences in maternal-child care.1 In response to COVID-19, educators converted SP scenarios from in-person to virtual settings.1,2,3 It is unknown whether a hybrid telesimulation with an SP wearing a high-fidelity breast model engages learners to acquire knowledge and practice clinical skills relevant to lactation. In the free Lactation Support in a Telehealth Setting Course (the Course), learners complete case-based multiple-choice questions in preparation for a hybrid telesimulation with a SP wearing the high-fidelity Lactation Simulation Model (LSM).4 The primary objective of this pilot study was to determine students' satisfaction with a hybrid telesimulation with a SP. Secondary objectives were to assess students' engagement with the Course and determine whether the Course adequately prepared them to complete the telesimulations.

Methods: Medical students completed the Course over 10 days as part of a Breastfeeding and Lactation elective at a midwestern university. Student satisfaction with the Course and telesimulations was evaluated using two items on a defined 6-pt Likert scale and one open-ended item. Number of attempts, scores, and time spent on multiple-choice questions in the Course were documented. Clinical performance was assessed by the SP via a 19-item Formative Feedback survey. Students participated in a focus group at the end of the Elective for investigators to gain deeper insight into their experience and satisfaction with the course. Descriptive statistics were used to calculate means for quantitative data within surveys. A Mann-Whitney Rank Sum test was used to measure change in time spent on multiple choice questions per attempt. Qualitative data were analyzed using thematic analysis.

Results: Third- and fourth-year medical students (N=13) were satisfied (4.6/6) and agreed (4.6/6) that they would recommend the Course to their classmates. Most students (70%) attempted multiple-choice questions more than once and their score improved (40%, $p<0.0001$) between their first and second attempts. Students received high ratings (5.4/6) from the SPs on their soft skills (eg. communication and interpersonal skills). Learners reported that case-based learning and multiple-choice questions helped them prepare for the telesimulation, with one student writing "The interactive portions of the course were very helpful and probably will make longer lasting knowledge than some of the readings." Students also found that the SP's feedback regarding the learner's communication and interpersonal skills was helpful, with one student writing that, "The SPs were very knowledgeable and did a very good job, better than other simulation experiences I've had so far in medical school."

Conclusion: Medical students in a breastfeeding elective were highly satisfied with hybrid telesimulations where a SP wore a high-fidelity breast model. The asynchronous, virtual case-based learning engaged medical students to learn content in preparation for each telesimulation. Medical and nursing students often leave maternal-child clinical rotations without hands-on experience supporting mothers and newborns. In this work we demonstrate for the first time that a hybrid telesimulation with a SP wearing a high-fidelity breast model is a feasible pedagogical modality that leads to a learners' practice and acquisition of skills relevant to clinical lactation. The findings from this pilot study suggest that even after social distancing restrictions imposed by COVID-19 are lifted, hybrid telesimulation with a SP wearing a high-fidelity breast model will remain a valuable solution for learners to practice their clinical decision-making, technical, and counseling skills relevant to lactation support.
References available upon request
Full disclosures for all authors and coauthors available upon request

THE "SIMTENDING": A NOVEL MODEL FOR SIMULATING THE ATTENDING ROLE IN SENIOR RESIDENTS

Sara Hock, MD, CHSE[1] Kimbia Arno, MD[2]
[1]Rush University Medical Center, Chicago, IL, USA; [2]NYU Langone, New York, NY, USA

Introduction: The transition from resident to attending physician is a stressful and difficult period, due to the new challenges of final responsibility for patient care and educating residents. Very few medical education interventions address this transition. The "Simtending" model seeks to address these elements via the simulated supervision of junior residents during high acuity cases. Our research question is whether implementation of the Simtending model results in increased satisfaction with simulation activities.

Methods: This study included data from residents in a three-year residency program at a tertiary academic center in Chicago, Illinois. The "Simtending" model placed a PGY-3 resident in the role of attending, working alongside junior residents who would staff the case as appropriate. Juniors and faculty provided the "Simtending" feedback. These cases occurred in half of the twice monthly simulation sessions within the curriculum, with the other half of cases in the "traditional" group simulation approach without assigned or structured roles. Data was extracted from anonymous satisfaction survey information from six distinct sessions. Survey responses were compared between "Simtending" and traditional sessions with respect to feedback quality, realism, and achieving objectives. Average scores on each topic were compared using independent samples T-test. Qualitative analysis was used to identify themes from free response questions on the evaluation surveys.

Results: Feedback was collected from six distinct events for a total n of 74. Of these, 44 (59%) were from the Simtending simulation events and the remaining were traditional. On a scale out of 7, residents rated the sessions similarly regarding fulfilling goals and objectives (6.75 +/- 0.61 simtending compared to 6.50 +/-1.14 traditional, p=0.27), realism of scenarios (6.77 +/- 0.52 simtending compared to 6.70 +/- 0.47 traditional, p=0.53); and quality of feedback (6.73 +/- 0.62 simtending compared to 6.67 +/- 0.55 traditional, p=0.66). Qualitative analysis identified a theme related to improved role understanding and satisfaction in the "Simtending" format compared to traditional.

Conclusion: This data shows that residents evaluate the "Simtending" model similarly compared to traditional simulation sessions in terms of realism, meeting goals and objectives, and quality of feedback. The identified theme of improved role understanding and satisfaction indicates that residents have better engagement with the simulation during the structured Simtending model. Future work will include assessment of whether senior residents deem this model to be helpful in their transition to the attending role.
References available upon request
Full disclosures for all authors and coauthors available upon request

THE CALM BEFORE THE STORM: UTILIZING IN SITU SIMULATION TO EVALUATE FOR PREPAREDNESS OF AN ALTERNATIVE CARE SITE DURING COVID-19 PANDEMIC

Gianna Petrone, DO,[1] Andrew Musits, MD,[2] Linda Brown, MD, MSCE[3]
[1]Brown University, Coventry, RI, USA; [2]Brown University, Warren Alpert School of Medicine, Providence, RI, USA; [3]Alpert Medical School of Brown University, Providence, RI, USA

Introduction: The novel coronavirus, SARS-CoV-2, was first identified in Wuhan, China in late 2019. It was soon identified as the cause of a large number of cases of acute respiratory illness leading to severe acute respiratory distress syndrome. As the disease spread rapidly, the health care systems became overwhelmed. This pandemic has increased demands of the healthcare system including the need to rapidly expand hospital capacity. Many regions have utilized alternative care sites (ACS) to mitigate these issues. Establishing an ACS along with management protocols has many unique challenges, since these sites aim to offer hospital level of care in an austere, dynamic environment. In this paper, we describe a simulation based evaluation of a newly established ACS. The primary goal of this session was to perform systems testing to identify areas in need of improvement and suggest changes prior to patient arrival.

Methods: Four simulation cases were developed for the preparedness evaluation session. These cases were designed to depict common situations as well as low frequency, high acuity situations that would likely be encountered in the ACS. The cases included: acute hypoxic respiratory failure, cardiac arrest, and patient fall in the bathroom, and provider syncope. Participants were identified prior to the scenarios and given assigned clinical roles within their typical scope of practice. A high fidelity simulator was used as well as a standardized patient. Observers were given debriefing forms listing the objectives, critical actions and specific areas to focus their attention. The data was collected for review. The observer group was multidisciplinary including physicians, nursing, pharmacy, infection prevention and emergency medical services personnel.

Results: Many logistical, operational and patient safety issues were identified during the simulation. Data was collected from the debriefing forms and compiled into a Simulation Event Report and distributed to key personnel. Proposed solutions and protocol changes were made in response to the identified issues.

Conclusion: Simulation was successfully utilized for systems testing, supporting efforts to maximize patient care and provider safety in a rapidly developed ACS. The simulation event report identified operational deficiencies and safety concerns directly resulting in equipment modifications and protocol changes.
References available upon request
Full disclosures for all authors and coauthors available upon request

THE SAFEST TRANSITION: USING IMMERSIVE DYNAMIC SIMULATION TRAINING AS A STANDARD FOR NEW ELECTRONIC HEALTH RECORD (EHR) TRANSITIONS IN HIGH RISK ENVIRONMENTS WITHIN A LARGE FREE STANDING CHILDREN'S HOSPITAL.

Tara Lemoine, DO[1] Kimberly Bilskey, MSN, RN, CHSE[2]
[1]PAAMG, Fresno, CA, USA; [2]Valley Children's Healthcare, Madera, CA, USA

Introduction: Does the addition of real time simulation enhance the standard baseline classroom training for high risk environments? Will integrating simulation based initiatives potentially lead to decrease patient harm from lack of competence and improve provider confidence within a new EHR.

Methods: Study Design: This is a descriptive study that used a survey developed by the investigators. Study Sample: All nurses who completed classroom training and passed a competency examination for their understanding of the new Electronic Healthcare Record system were included. The nursing staff with responsibility for Code Blue and Trauma documentation across the hospital were included. They completed an 8 hour course on the new EHR and a brief introduction to all documentation. Patient cases were created in the EHR environment and real time simulated events either as a trauma or a code blue environment were executed with interprofessional staff. Nurse documentation was done in real time with each case having specific elements of airway management, medication administration and lab ordering. Data Collection: A survey was completed by the nursing staff at the end of the cases focused on their experience with EHR documentation of code or trauma events.

Results: Multiple sessions were held over a month long period prior to the transition to the new EHR. This was a dramatic change from paper documentation of code blue/ trauma events held for over 25 years in our healthcare network. A total of 75 nurses completed the simulation sessions with real time documentation. Over 60% of the participants had never used any EHR to document code blue /trauma events. 95% of those who participated, never worked within this specific EHR and had no experience in electronic documentation of these events. Less than 25% of the participants felt prepared after the classroom learning session despite every staff nurse having passed the end competency test with 100% results asserting they were proficient in the EHR. The EHR simulation experience was met with positive participant results with almost all participants showing improved confidence in navigating the documentation and demanding repeated sessions prior to go-live.

Conclusion: Our simulation experience, used a training environment replicating the dynamic clinical experiences seen within our center. This high-fidelity simulation facilitated exposure to high risk low volume code situations prior to the implementation of an entirely new EHR across our organization. The adaption to a foreign documentation system in a new EHR is complicated and laden with potential error translating to lapses in adequate patient care. The redundant opportunity to practice and navigate the EHR has potential mpacts to patient safety and provider confidence. Additionally, there remains a large gap in classroom education for EHR and the skills required to translate that information into real world practice. Our assessment for evaluating confidence in skills showed the traditional format of learning is insufficient for adopting and working in high intensity environments without the opportunity to navigate the system in realtime experiences with the cognitive and psychomotor demands.
References available upon request
Full disclosures for all authors and coauthors available upon request

THE USE OF COMMERCIAL AND FACULTY DEVELOPED ESCAPE ROOMS TO IMPROVE COMMUNICATION AND TEAMWORK SKILLS

Mary Mckay, DNP, FNP, CNE,[1] Jill Sanko, BSN, MS, PhD, NP, ARNP-BC, CHSE-A,[1] Beatriz Valdes, MBA, MSN, PhD, RN, CHSE[1]
[1]University of Miami School of Nursing and Health Studies, Miami, FL, USA

Introduction: Ineffective communication and a lack of leadership skills have been identified as significant contributing factors in the commission of healthcare errors (Agency for Healthcare Research And Quality [AHRQ], 2019). Typically, emphasis in healthcare education has focused on technical skills rather than the acquisition of non-technical skills including communication and teamwork. One approach to address this issue is to provide learners with interactive educational opportunities such as escape rooms. Escape rooms (ER) have been found to be an engaging experiential teaching method which promote the attainment of the critical skills needed to work as an effective member of a team (Hermanns et al., 2017; Monaghan & Nicholson, 2017). The aim of this study was to evaluate the use of a commercial and faculty developed ER as an innovative educational method to improve leadership, communication, teamwork, and delegation skills in RN-BSN nursing students.

Methods: As part of a RN-BSN course, two cohorts of students participated in an ER activity. One cohort (n=10) participated in a non-clinical commercial ER with a Sherlock Holmes theme. The second cohort (n=8) engaged in a faculty-developed ER activity with a medically based scenario involving a patient with a deep vein thrombosis. All participants were given clues, riddles, and puzzles to solve as a team. To measure a change in behaviors, participants were asked to complete a pre and post traditional simulation scenario. Pre and post ER simulation scenarios were rated by 3 trained raters using University of Miami Crisis Resource Management (UM-CRM) tool, which measures observed behaviors in the areas of teamwork, communication, leadership, situational awareness, resource management, and delegation (Sanko, Shekhter, McKay, Gattamorta, & Birnbach, 2015).

Results: Commercial Escape Room: Inter-rater reliability using interclass correlation found excellent agreement among the 3 raters, $r = 1.0$. A significant intervention effect was found, pre-Mean = 6.5; post-mean = 23.0, $p > .000$. Faculty Developed Escape Room: Inter-rater reliability using interclass correlation found moderate agreement among the 3 raters, $r = 0.667$. A significant intervention effect was found, pre-Mean = 21.5; post-mean = 24.5, $p = .003$.

Conclusion: Nursing students in the USA (U.S.) have allotted hours in the clinical setting for practice, but shortages of clinical placements and overloaded curriculum has created limited experiences to teach teamwork, communication, leadership, resource management, and delegation. Enhancing nursing programs with ER educational activities can bridge the gap of these limited experiences and may be able to useful in honing observable teamwork and leadership skills as was found in our pilot study regardless of the type of ER (commercial or faculty developed) utilized. Effective teamwork and leadership skills are critical in the provision of safe patient care.
References available upon request
Full disclosures for all authors and coauthors available upon request

THE USE OF HIGH-FIDELITY SIMULATION IN THE SETTING OF PEDIATRIC ADVANCED LIFE SUPPORT TRAINING TO IMPROVE RESIDENT CHOREOGRAPHY OF CODES

Ruchika Jones, MD, MS, FAAP[1] Carla Pruden, BS, MD, MPH, CHSE[2]
[1]UConn- Connecticut Children's, Hartford, CT, USA; [2]Connecticut Children's Medical Center, Hartford, CT, USA

Introduction: Simulation-based resuscitation programs have shown to increase resident confidence and improve outcomes in pediatric cardiopulmonary arrests (CPAs);

however, less evidence exists on its use in teaching code choreography to prioritize interventions and communicate clearly within Pediatric Advanced Life Support (PALS) courses. Thus, we sought to determine if additional instruction in specific code choreography and action-linked phrases (ALPs) during initial PALS certification courses is associated with improved skill acquisition and retention when compared to residents taking the traditional course. Secondary aims include assessing resident confidence and medical knowledge in pediatric resuscitation.

Methods: First-year pediatric and emergency medicine residents completing the PALS course in summer 2019 participated in this prospective, randomized, pilot study. During the course, intervention groups were given a brief additional didactic session introducing specific code choreography and ALP techniques. Participants completed pre-/post-tests evaluating medical knowledge and a self-assessment regarding perception of one's confidence during codes and effectiveness of the training. PALS testing scenarios used high-fidelity simulation and were recorded for review by blinded faculty. Resident groups were re-evaluated using similar assessment tools and recorded simulation scenario at 6 weeks and 3 months. Comparative tests for data analysis included independent t-test and ANCOVA.

Results: 20 pediatric and 14 emergency medicine interns participated. Resuscitation medical knowledge increased in all residents upon completion of the course (P=0.005). However, this was not sustained at 6 weeks or 3 months, as demonstrated in prior studies. Confidence assessment was similar between groups. Videos revealed shorter time to certain critical steps by the pediatric intervention groups. Mean time to start of compressions in pediatric control and intervention groups was 55 seconds and 32 seconds, respectively, though not statistically significant (P=0.168). Mean time to administration of first dose of cardiac arrest reversal agent was significantly shorter among pediatric intervention groups at 107 seconds, compared with the control groups at 183 seconds (P=0.025).

Conclusion: PALS training courses represent a unique opportunity to incorporate high-fidelity simulation to teach residents choreography and communication skills for the management of pediatric cardiopulmonary arrests.
References available upon request
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TRAINING IN EN-ROUTE CRICOTHYROIDOTOMY: SKILL DURABILITY AT 6 MONTH FOLLOW UP

Joseph Lopreiato, MD, MPH, CPhys, BC, CHSE-A,[1] Gerardo Capo, MD,[2] Rachael Dampman, BS,[3] Joseph Lopreiato, MD, MPH, CPhys, BC, CHSE-A,[1] Mark Bowyer, MD, FACS, FRCS[4]
[1]Uniformed Services University of the Health Sciences, Bethesda, MD, USA; [2]USU, Auburn, WA, USA; [3]Henry M Jackson Foundation, Silver Spring, MD, USA; [4]Uniformed Services University, Fairfax, VA, USA

Introduction: Airway obstruction ranks third as a preventable cause of death on the battlefield and accounts for 1-2% of total combat fatalities. Therefore, one of the vital skills that must be mastered by combat first responders is the ability to recognize the need for and perform a surgical cricothyroidotomy (SC). We had previously reported results on training 89 novices on how to perform a SC to expert level in a helicopter en-route care environment. The purpose of this study is to assess the durability of this skill in a cohort of participants six months after initial training in the same environment.

Methods: A random sample of 22 subjects (15 first year medical students and 7 hospital corpsmen) who previously underwent SC training were selected to return at 6 months after training to re-test in the same helicopter scenario. Participants did not receive any refresher training between initial training and follow-up testing. All attempts were captured via head mounted video recordings and graded by blinded evaluators using the same 10 item standardized checklist used in initial training. Our previous work found that expert criteria for performing a SC was ≤ 40 seconds and completion of 9/10 items on the checklist. Outcome measures in this study were time to complete the procedure and percent of subjects who completed at least 9/10 items on the checklist.

Results: Twenty two subjects were re-tested at six months. Eight out of 22 (36.4%) participants met expert criteria for an en-route SC on their first attempt. Two additional subjects met expert criteria after a second attempt. There was a significant increase in time required to complete the procedure compared to initial training ($x\bar{x}$ 46.4 +/- 29.8 sec vs. 25.4 +/- 3.2 sec; $p < 0.05$, and a significant decrease in checklist scores on the 6 month follow up testing ($x\bar{x}$ 9.8 +/- 0.4 vs. 7.8 +/- 1.5; $p < 0.05$). There was no significant differences in mean decay between medical students and corpsmen

Conclusion: This study showed that the skill required to perform a surgical cricothyroidotomy after initial training and practice does decay significantly and may lead to negative outcomes. Next steps are to consider the structure of a brief retraining curriculum for the sustainment of SC skills to maintain competence in this life saving procedure.
References available upon request
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TRANSLATING ADVANCED RESUSCITATION TRAINING INTO PRACTICE AND OUTCOMES

fiona Winterbottom, BSN, DNP, MSN, RN, ACNS, APRN, CCRN[1]
[1]Ochsner, Mandeville, LA, USA

Introduction: In 2016, our facility found that cardiac arrests and emergency events outside ICU were increasing in frequency and were above the benchmark for Get with the Guidelines Resuscitation. The resuscitation committee redesigned the emergency response program and initiated a novel training program. One focused intervention was to implement and new emergency response training program. The research question was "Does implementation of an in-person goal-directed advanced resuscitation training (ART) program result in a decrease in cardiac arrests outside ICU?"

Methods: In 2017, An innovative model Rapid Response Nursing model was initiated. The team was trained as experts in advanced resuscitation training and used a proactive approach to clinical screening, rounding, and response. The same nurses also became trainers for the program in inter-professional simulation and at the bedside. The training program replaced existing ACLS in 2019

Results: By the end of 2019, a total of 22 staff were certified instructors and 1095 staff, including physicians, nurses, residents, and advanced practice providers had been certified with the new advanced resuscitation training program. Post program evaluation surveys found that 22% of staff had only taken an online ACLS course, 16% had taken an in-person class, and 46% had taken both types of class. Average scores (0-6 scale)for the new classes were above 4.5 The hospital saw a 60% decrease in cardiac arrests outside ICU from 2017 to 2020 that was in part due to the innovative training program

Conclusion: Implementation of an in-person goal-directed advanced resuscitation training (ART) program can result in a decrease in cardiac arrests outside ICU as part of a well designed resuscitation program.
References available upon request
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URGENT SYNCOPE EVALUATION FOR THE YOUNG PATIENT IN THE EMERGENCY DEPARTMENT: A EMERGENCY MEDICINE RESIDENT SIMULATION CASE

Kallie Combs, DO,[1] Richard Shin, MD,[1] Anika Nichlany, MD, FACEP,[1] Anita Lui, DO, CHSE,[1] David Simon, DO[1]
[1]New York Presbyterian Queens, Levittown, NY, USA

Introduction: A common complaint in the Emergency Department is syncope. While many of these patients are not found to have life threatening features, identification of those with concerning pathology is of utmost importance. This simulation case was designed to assess ability of emergency medicine residents interpret electrocardiograms (ECG) suggestive of life-threatening conditions. Objectives for case included: 1. Understanding and evaluation of young patients with arrhythmia that need urgent follow up. 2.ECG evaluation and interpretation in young patients with syncope and examine for concerning features. 3.Ensure resident is able to identify findings on the ECG concerning for actionable arrhythmias including hypertrophic cardiomyopathy (HOCM), arrhythmogenic right ventricular dysplasia (ARVD), Brugada, Wolf Parkinson White(WPW) and prolonged QT syndrome. 4. Understand and initiate emergent management for Ventricular Tachycardia 5. Correctly disposition patient with symptomatic serious arrhythmia

Methods: We performed a simulation case for our emergency medicine residents to evaluate their ability to recognize and treat concerning causes of syncope in young patients. Our case was a 20 year old presenting with syncope. The case progresses to symptomatic ventricular tachycardia requiring treatment with synchronized cardioversion. The ECG shows an epsilon wave suggestive of arrhythmogenic right ventricular dysplasia. During the debriefing of the case, we review characteristic ECG findings of other concerning causes of syncope in a young patient. Our critical actions include identification of abnormal ECG with an epsilon wave, timely treatment of symptomatic VT and appropriate disposition to CCU. We asked the participants to respond on a Likert Scale of 5 questions to assess their comfort with identification, and management of these types of patients after performing the simulation.

Results: We received 19 responses from our cohort of residents 1. Does this case improve your understanding and evaluation of young patients for arrhythmia that needs urgent follow up? 17/19 selected Agree or Strongly Agree, 2. Evaluate and interpret an ECG in young patients with syncope and examine for concerning features. 16/19 selected Agree or Strongly Agree 3. Identify findings on the ECG concerning for actionable arrhythmias including Hypertrophic Cardiomyopathy (HCM), Arrhythmogenic Right Ventricular Dysplasia (ARVD), Brugada, electrolyte abnormalities and prolonged QT syndrome. 14/19 selected Agree or Strongly Agree 4. Understand and initiate emergent management for Ventricular Tachycardia. 16/19 selected Agree or Strongly Agree 5. Correctly disposition patients with symptomatic ARVD with arrhythmia. 15/19 selected Agree or Strongly Agree

Conclusion: The major learning objectives for this case showed that utilizing a simulation case which illustrates a rare but serious diagnosis for young patients with syncope can serve as a basis to review emergent findings on ECG and strengthen their knowledge obtained during training in an Emergency Medicine Residency. In addition, there are no currently published simulation cases that address the evaluation and diagnosis of ARVD in the Emergency Department setting. Our results were promising, with up to 84% of residents responding that this case strengthened their ability to interpret and identify ECGs with concerning features in patients with syncope.
References available upon request
Full disclosures for all authors and coauthors available upon request

USE OF A DIAGNOSTIC FEEDBACK APPROACH FOR OSCE ASSESSMENT

Chelsea Renfro, PharmD, RPh, CHSE[1] Kuan Xing, PhD[1]
[1]University of Tennessee Health Science Center, Memphis, TN, USA

Introduction: After a college or school of pharmacy adopts entrustable professional activities (EPAs), milestones can be created that span the program continuum to provide a learning roadmap for students.1 As determining whether EPA standard has been met at the appropriate level requires direct observation, objective structured clinical exam (OSCEs) have the potential to observe a student's progress towards meeting the EPA. An emphasis on formative assessment has been addressed in educational research since the 21st century. Rather than offering a total score (usually with pass/fail decision) on an OSCE to the learners without much feedback, assessment with specific feedback can identify students' strengths and weaknesses and advance their learning.2 Therefore the research questions for our study are: (1) What is the validity evidence of the medication history and patient counseling OSCE rubrics? (2) How effectively does each rubric measure tasks students should perform as part of an OSCE?

Methods: First-year pharmacy students from two cohort years completed a skills based course designed to teach students the patient care process through the use of simulation. Formative assessment was provided throughout the semester for medication history and patient counseling skills. At the end of the semester, students participated in a four station OSCE. Two stations used standardized patients (SPs) for gathering a medication history (station 1) and counseling on a medication (station 2). Student performance for each station was assessed using a checklist developed for evaluating core pharmacy competencies. Descriptive statistics and item analysis checklists was conducted. An exploratory factor analysis was conducted to extract significant factors which represented specific domains of pharmacy students' OSCE skills. Content validation on explaining extracted factors was conducted by one pharmacy faculty and one psychometrician. This project was an UTHSC IRB-approved study.

Results: We applied Messick's unified validity framework to study validity evidence. Internal consistency (Cronbach's α) was .76 for medication history and .73 for patient counseling. Exploratory factor analysis was conducted for each checklist, seeking internal structure evidence. A 4-factor model (21 items) was obtained for the medication history checklist with 75% of variance explained. After discussion of the content and statistics results for each factor loading, factor 1 (F1) was named "Medication Review"; factor 2 (F2) was named "Medication Adherence"; factor 3 (F3) was named "Allergies and Adverse Drug Reactions"; factor 4 (F4) was named "Medication Access". A 3-factor model (22 items) was obtained for the Patient Counseling checklist with 54% variance explained. After discussion on content and statistics results for each factor loading, F1 was named "Medication Administration Technique"; F2 was named "3 Prime Questions"; F3 was named "Medication Dosing".

Conclusion: The use of exploratory factor analysis offered meaningful results for assessing pharmacy students' subskills in their OSCEs. Pharmacy faculty can generate factor scores for each student and give specific feedback (diagnostic feedback) based on those scores. By determining specific factors that are mapped to the current curriculum and EPAs, faculty can track pharmacy student progression to meeting specific milestones in the curriculum. Evidence-based OSCE assessment with score-based, subskill feedback may help pharmacy faculty to provide specific instruction for student learning and track progress through the curriculum.
References available upon request
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USE OF SIMULATION TO DESIGN A PROCEDURE AND TRAIN A DEDICATED AIRWAY "SWAT" TEAM FOR COVID-19 INTUBATION

Clement Buleon, MD, MSHS,[1] Erwan Guillouët, Other, CRNA, Nurse Anesthesia,[1] Rebecca Minehart, MD, MHPE[2]
[1]Caen Normandy University Hospital, Caen, France; [2]Massachusetts General Hospital, Boston, MA, USA

Introduction: The occurrence of the Covid-19 pandemic involved adaptations of organizations and healthcare teams to face new risks. Intubation of suspected or confirmed Covid-19 patients was the subject of recommendations aimed at protecting caregivers from the risk of contamination related to the procedure.[1,2] One possible strategy in this context was to set up a team dedicated to Covid-19 intubation.[3] This makes it possible to concentrate expertise, benefit from a codified procedure, optimize the safety of caregivers and preserve ICU time and resources. Simulation was, for us, the ideal tool for the design of the procedure and the training of this "swat" airway team.

Methods: A dedicated team strategy implied to guarantee its safety, its efficiency and also allowed the use of more complex equipment (suit) and more advanced training. For this we used an intensive simulation program for the development (2 days) and training (2 days) of this team (5 anesthesiologists and 6 CRNA). The team members developed this program. They were dual skills as simulation instructors and anesthesiology staff. This had the advantage of a mastery of non-technical skills, which was an important element in the success of the program in its development, training and application stages; and that also allowed merging the development and the training stages.

Results: During development stage the team designed the steps of the intubation procedure in procedural simulation, adapted a difficult intubation algorithm, adapted the management in case of cardiac arrest, built the checklists for material, donning, procedure sequence and doffing. The 2 days of training in high-fidelity trinomial simulation (airway manager, ventilator and drug manager, and indoor runner) allowed final adaptations and the appropriation of the procedure by the whole team. Feedback from the simulation helped to reinforce the concepts of "clean and dirty hands" and the distribution of tasks between the workers to limit the risks of contamination. The role of the indoor runner, monitoring the situation, was reinforced even though it had not initially appeared so crucial.

Conclusion: The use of simulation for the design of a specific intubation procedure linked to the constraints of the Covid-19 pandemic made it possible in a very short time to develop, test, evolve according to the experience gained in simulation and finally to standardize a high-risk procedure whose mastery was important. This would not have been possible without simulation (and the linked debriefing) and would have required exposing caregivers to imperfectly controlled risks. We have shown that the use of simulation allows new procedures to be developed and made operational quickly. It therefore seems appropriate in the future to consider using simulation at an early stage to deal with new situations even when time is short.
References available upon request
Full disclosures for all authors and coauthors available upon request

USE OF SIMULATION TO IDENTIFY LATENT SAFETY THREATS AND INTEGRATE A COMBINED HEALTHCARE TEAM INTO A NEW ADVANCED DELIVERY PROGRAM

Maria Carmen Diaz, MD, FAAP, FACEP[1] Susan Coffey Zern, MD, CHSE[2]
[1]Nemours/Alfred I. duPont Hospital for Children, Wilmington, DE, USA; [2]Christiana Care Health System, Newark, DE, USA

Introduction: Babies with prenatally diagnosed conditions often require swift intervention after birth. This can be challenging when the delivery occurs in an adult hospital and the baby needs emergent transfer to a quaternary care freestanding children's hospital without delivery capabilities. An Advanced Delivery Program (ADP) in a freestanding children's hospital allows both the delivery and specialized care of the high-risk baby to occur in one location. This ADP requires the integration of an obstetric team to manage the delivery and pediatric subspecialists to manage post-delivery interventions. Seamless integration of two separate teams in this new location requires new processes and repeated practice and analysis of performance. We hypothesized that simulation will: identify latent safety threats within the new ADP; identify processes that need improvement prior to opening; allow for successful integration and communication between two teams that have not previously worked together.

Methods: Adult partner hospital obstetric (OB) and OB anesthesia teams and the freestanding children's hospital neonatal teams took part in this study. During Phase 1, participants experienced routine and emergent simulated scenarios that focused on identifying latent safety threats (LSTs) within the space as well as process improvement needs. Participants filled out a National Aeronautics and Space Administration Task Load Index (NASA-TLX) to assess perceived workload after each simulation and before debriefing. Study investigators assessed team behaviors during each simulation using the Mayo High Performance Teamwork Scale (MHPTS). After phase 1, ADP leadership categorized LSTs according to criticality. Necessary changes to the space, flow and processes were made. During Phase 2, four weeks later, participants experienced repeat routine and emergent simulations. Repeat NASA-TLX and MHPTS were obtained and compared to prior scores and further LSTs identified.

Results: A total of 178 participants took part in this study; 103 in Phase 1 and 75 in Phase 2. 356 LSTs were identified; 17 were categorized as critical and 123 high. Obstetrician's NASA-TLX mental, physical and temporal demand and effort scores improved from Phase 1 to Phase 2 for the routine delivery/baby with congenital heart disease scenario (62%, 77%, 65%, 67% respectively). Neonatologist's scores improved in all NASA-TLX elements except mental demand for this scenario and the team's MHPTS improved by 67%. Obstetrician's NASA-TLX scores improved up to 85% in all elements for the maternal arrest scenario and the team's MHPTS improved 400% comparing Phase 1 to Phase 2 performance.

Conclusion: Our simulations identified LSTs and processes that were addressed and improved upon prior to opening the new space. Two separate teams from two institutions were successfully combined to deliver care as evidenced by improved NASA-TLX and MHPTS scores over time. We believe that this model of using simulation to integrate teams into a new space was successful and encourage this approach with future endeavors.
References available upon request
Full disclosures for all authors and coauthors available upon request

USE OF VIDEO SIMULATION TO EDUCATE EMERGENCY MEDICINE RESIDENTS ON INTUBATION PROTOCOL FOR PATIENTS UNDER INVESTIGATION FOR COVID-19

Kelly Roszczynialski, MD, MS[1] Ashley Rider, MD[1]
[1]Stanford University, Palo Alto, CA, USA

Introduction: The novel coronavirus (COVID-19) has caused a widespread strain on healthcare systems worldwide since the declaration of the pandemic on March 11th, 2020 by the WHO. Healthcare teams have had to continually adapt to changing recommendations on patient management and protection measures. There is particular concern around the intubation of these patients as an aerosolizing generating procedure with a high risk of transmission to healthcare providers. (1) There is a distinct need to close any knowledge gaps for intubation procedures for the critically ill COVID-19 patient. With the current recommendations for social distancing, remote learning educational content is necessary. A video recorded in-situ simulation to develop a best practice video was created to increase knowledge and improve adherence to policies for patient and staff safety. We hypothesize that it would be an effective remote learning tool to prepare emergency medicine residents on the COVID airway procedure.

Methods: All third and fourth-year emergency medicine residents at a single site were sent a pre-assessment on the understanding of institutional recommendations for safe intubation practices for potential COVID-19 patients. After completion of the pre-assessment, they were sent a 10-minute video of an in-situ simulation demonstrating the intubating provider's role in gathering the team, checking equipment, limiting in-room personnel, and unnecessary aerosolizing procedures during intubation of a COVID-19 patient which was represented by a high fidelity mannequin. The simulation included common adverse events such as failed intubation and hypotension. The residents then completed a post-assessment to review their understanding of key concepts in order to determine their preparedness to perform intubations on COVID-19 patients in the Emergency Department. The six-question pre-assessment and post-assessment were the same and were analyzed using Microsoft Excel with student t-test.

Results: The six-question pre-assessment and post-assessment were the same and were analyzed using Microsoft Excel with a 2 tailed T-test. A total of 32 individuals participated in the educational intervention for 100% completion by all PGY-3 and PGY-4 residents. The median for the pre-assessment scores was 5. There was a significant improvement in post-assessment scores with a median of 6 ($p<0.05$). A total of 69% of residents achieved a perfect score on the post-assessment, improved from 25% on the pre-test. The residents also rated their comfort level with managing COVID intubations on a 10-point Likert scale and reported improvement in comfort from a median of 6.5 during the pre-assessment to a median of 8 on post-assessment ($p<0.05$).

Conclusion: Our education team strategized to determine the best and safest practices to train emergency medicine residents at Stanford University on the airway management of potential COVID-19 patients. Simulation is a widely accepted and effective format for procedural and team management training. The emergency medicine residents were highly motivated with the current COVID-19 pandemic to educate themselves on appropriate management of these patients, coupled with the consistent communication of institutional protocols likely contributed to 25% of the residents able to score perfectly on the pre-assessment initially. The increase in resident comfort with the management of these complex intubations was also improved. We conclude that during the COVID-19 pandemic with restrictions on in-person training, the use of a remote learning video simulation was effective in educating residents on necessary patient and provider safety protocols during intubation as well as increasing provider comfort.
References available upon request
Full disclosures for all authors and coauthors available upon request

USING A QUALITATIVE INTERVIEW TO EVALUATE PEDIATRIC INTERNS USE OF EMR IN SIMULATION

Stefan Malin,[1] Kamal Abulebda, MD, CPhys, FAAP,[1] Nathan Swinger, BS, MD,[2] Emily Meanwell, PhD,[3] Amelia Hawbaker, BA, MA[2]
[1]Riley Hospital for Children at Indiana University, Indianapolis, IN, USA; [2]Indiana University, Indianapolis, IN, USA; [3]Indiana University Bloomington, Bloomington, IN, USA

Introduction: The ubiquity of electronic medical records (EMR) makes training inclusive of their use important for medical education. Various approaches to this education have been utilized, but most of them rely on passive learning methods such as instructor-led didactics and online learning modules (1,2). The amount of training learners receive is also inadequate (3,4). Providers have performed poorly when asked to utilize the EMR to identify patient safety issues using the EMR (5). Recent studies showed that simulation-based training was effective in improving pediatric trainees use of EMR, however little is known about its utility in the clinical setting and its impact on the process of care (2,5). Therefore, we aim to explore the benefit of and the perceived challenges of utilizing the EMR in the evaluation of a simulated pediatric patient with sepsis through qualitative interviews and a post-simulation survey among a sample of pediatric interns.

Methods: This was a mixed-methods study using qualitative and quantitative data to evaluate EMR use among pediatric interns in a simulated setting. Each session used a standardized information sheet to introduce the research team, describe the rationale of the study, and communicate the rules and expectations related to the participants. To mirror the actual clinical team, each team was composed of a bedside nurse and a pediatric intern. Participants were oriented to the functionality of the simulator, SimJunior (Laerdal Medical, Wappinger Falls, NY). Following the simulation, a standardized debriefing was conducted by the study's main facilitator (principal investigator). Each intern and nurse completed a brief 6-item survey to evaluate their experience of the simulation session. Structured interviews with the interns were analyzed for emergent themes, drawing on thematic analysis and grounded theory.

Results: Surveys showed that interns and nurses felt the simulation was reflective of a patient they would care for and that the simulation was relevant to their daily practice. Both groups also felt they would be more likely to utilize the EMR in a similar clinical scenario and that their comfort utilizing the EMR increased. During the simulation, no intern correctly performed all of the tasks required for caring for a patient with sepsis (e.g. starting IV, giving fluids, starting antibiotics), with a significant variation in time to achievement between participants. In interviews, the interns reported learning about the EMR through simulation, especially through the hands-on practice required during the simulation or debriefing. They reported either being unaware of data visualization tools within the EMR, or re-learning about these tools. They also reported that incorporation of the EMR enhanced the realism of the simulation, making it a better approximation of a real-life patient encounter.

Conclusion: EMR utilization among first year pediatric interns in the evaluation of a simulated pediatric patient with sepsis is variable. Interview responses supported that current training methodologies for the EMR and its clinical use are only partially effective, and some of that effect is lost over time. Incorporation of the EMR into simulation also improves the realism of the simulation and has the potential to increase the duration that learning and knowledge is maintained. Our study highlights the need for continued and improved training around EMR and its use in the evaluation of acutely changing patients and supports the use of simulation as an important mode of EMR education.
References available upon request
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USING DIGITAL BIOMARKERS TO MEASURE FLUCTUATIONS IN INSTRUCTORS' COGNITIVE LOAD BETWEEN HIGH-FIDELITY SIMULATIONS AND DEBRIEFING SESSIONS

Egide Abahuje, MD,[1] Egide Abahuje, MD,[1] Steven Yule, MA, MS, PhD, Cpsychol,[2] Christian Miccile, BS, MS,[1] Charles Pozner, MD, Fellow of SSH,[3] Roger Daglius Dias, MBA, MD, PhD[3]
[1]BRIGHAM AND WOMEN'S HOSPITAL, Boston, MA, USA; [2]University of Edinburgh, Edinburgh, United Kingdom; [3]STRATUS Center for Medical Simulation, Boston, MA, USA

Introduction: Facilitating simulation training is a complex activity that requires trained instructors to perform multiple tasks throughout the session.(1) These activities generate substantial cognitive load to instructors, and if the mental demand exceeds an instructor's cognitive capacity, it may negatively impact performance during scenario observation and subsequent debriefing. Although previous research has highlighted the critical role that instructor's cognitive load plays in conducting simulation-based training, to date, no study has investigated objective measures of instructor cognitive load.(1) The aim of this study was to analyze cognitive load fluctuations among simulation instructors during high-fidelity interprofessional training sessions.

Methods: Data were collected during a team training program involving residents, nurses, and physician assistants. Each 2-hour session was composed of 5 phases: prebrief, scenario 1, debriefing 1, scenario 2, and debriefing 2. Each scenario comprised one of six possible emergency conditions: ventricular fibrillation, pulseless electrical activity, hyperkalemia, tension pneumothorax, opioid overdose, and hemorrhagic shock. Instructors (subjects) were simulation fellows. Each wore a chest strap with a heart rate sensor that detected continuous electrical heart signals, calculated interbeat intervals in milliseconds (Heart Rate Variability Analysis – HRV), and transmitted data to a smartwatch via Bluetooth. The validated low frequency/ high frequency (LF/HF) ratio was used as a proxy for the cognitive load.(2) The LF/HF ratio was calculated using a 1-minute time window, allowing comparison across different phases of the program. The Friedman's two-way analysis of variance was performed.

Results: Five fellows debriefed 15 sessions. Eleven had 1 debriefer and 4 had 2 debriefers (co-debriefing), totaling 19 measures over the 5 phases of the session. The LF/HF ratio, expressed as median (1stIQ-3rdIQ), in each phase were: prebrief = 3.7 (2.8-6.1); scenario 1 = 4.5 (2.8-6.1); debriefing 1 = 3.5 (2.6-4.9); scenario 2 = 4.1 (3.4-5.2); debriefing 2 = 3.0 (2.2-4.4). There was a statistically significant relationship between the simulation phase and LF/HF ratio ($p = 0.001$). Post-hoc pairwise comparisons showed that debriefing 2 posed the lowest LF/HF ratio compared to scenario 1 ($p = 0.001$) and scenario 2 ($p = 0.048$). Other comparisons were not statistically significant. Grouped analysis for prebrief vs scenario vs debriefing showed that instructors presented the lowest LF/HF ratio during the debriefing phase: 3.1 (2.6-4.9), compared to prebrief: 3.7 (2.8-6.1); p=0.028 and scenario: 4.3 (3.0-5.5), p=0.017. The difference between prebrief and scenario was not statistically significant.

Conclusion: This study used HRV to investigate instructor cognitive load during different phases of simulation. The cognitive load during all phases was higher than the normal range (i.e LF/HF ratio: 1.5-2.0). We found that the cognitive load of instructors was higher during scenarios than during debriefing and prebrief, and that cognitive load tends to decrease during the second debriefing phase, although not to baseline levels. By identifying phases of simulation that pose the highest cognitive load to instructors, supporting strategies such as the use of co-debriefers or cognitive aids, can be used to avoid cognitive overload and potential negative impact on performance.
References available upon request
Full disclosures for all authors and coauthors available upon request

USING IN SITU SIMULATION TO REDUCE FEAR AND INSECURITY AMONG HEALTHCARE PROFESSIONALS DURING THE COVID-19 PANDEMIC

Neel Toxvig, Master Certificate of Healthcare Management, RN,[1] Magnus Bie, BSN, RN,[2] Rune Dall Jensen, BS, MS, PhD[3]
[1]Koncern HR - Region Midtjylland, Aarhus N, Denmark; [2]Corporate HR ▪ MidtSim, Central Denmark Region, Aarhus N, Central Denmark Region, Denmark; [3]Aarhus University, Aarhus, Denmark

Introduction: The Covid-19 pandemic calls for immediate response against the fast spreading virus. At Aarhus University Hospital in Denmark, this led to the establishing of four new covid-19 wards which changed the daily routines for hundreds of healthcare professionals. Many healthcare professionals suddenly faced new, unfamiliar tasks and a high personal risk of getting infected or spreading this new virus to their own family. The rapidly increasing numbers of covid-19 patients left no time to ask how the healthcare workers felt, and to comply with the situation, hence an immediate need for covid-19 related education as well as redefining safety among the staff occurred. The aim of this research project was to examine whether in situ simulation helped supporting the healthcare professionals in dealing with the emotional strain of Covid-19 and create a set of guidelines for using in situ simulation in future pandemic responses.

Methods: An interdisciplinary in situ simulation program was conducted to rapidly facilitate the covid-19 related education of 277 healthcare professionals at the four new covid-19 wards. The focus areas of the in situ simulation program were: 1: To deal with the fact that several of the healthcare professionals were unfamiliar with new working practices and enhance team communication within the ward. 2: All the healthcare professionals needed education related to personal protective equipment (PPE) to avoid spreading the virus. 3: All simulation participants needed education, about how Covid-19 affects the patient. These areas were moderated into the following learning objectives: - ABCDE approach to the patient with covid-19. - Team work and communication. - Correct use of PPE. In total, 69 simulations were conducted in situ in order to ensure that the staff could get familiar with their new clinical setting, achieve a mutual communication strategy, and help redefining safety among the staff.

Results: Subsequently four healthcare professionals from each Covid-19 ward participated in qualitative focus group interviews. Each interview lasted about 90 minutes, were recorded, and three researchers captured the themes emerging from the data. Our research show that several participants reported feelings of fear, insecurity and chaos related to the involvement in the covid-19 response. The interviews showed that in situ simulation could not change the feeling of chaos due to the major organizational changes, but all the participants reported positively about the learning gained from the simulation. Most importantly, the findings showed how in situ simulation generated a feeling of safety. Based upon the personal and joint experience with PPE, experience gained during team training, and an important demystification regarding the treatment of patients with this new unknown virus.

Conclusion: It cannot be neglected that Covid-19 generates fear and insecurity among healthcare professionals and further negative consequences of the emotional strain will probably emerge. The important lesson from this study is that in situ simulation can be used to redefine safety among healthcare professionals and to incorporate in situ simulation in the early stages of a pandemic response will be recommended.
References available upon request
Full disclosures for all authors and coauthors available upon request

USING INTERPROFESSIONAL SYSTEM SIMULATION TO IDENTIFY GAPS AND SOLUTIONS FOR COVID19 CLINICAL CARE RESPONSE AND MAINTENANCE OF READINESS

Lillian Emlet, MD, MS, CHSE,[1] Mary Ellen Elias, MSN, RN,[2] Holly Curinga,[3] Scott Simpson, BS, DO,[4] Amy Lenigan, BSN, RN,[2] Megan Vennero, BSN, CRNP, APRN,[2] Deanna Blisard[5]
[1]VA Pittsburgh/ UPMC, Pittsburgh, PA, USA; [2]VA Pittsburgh Healthcare System, Pittsburgh, PA, USA; [3]VAPHS, Pitsburg, PA, USA; [4]University of Pittsburgh Medical Center, Abilene, TX, USA; [5]VA Pittsburgh, Pittsburgh, PA, USA

Introduction: In novel emerging infectious disease outbreaks (example: Ebola), in situ interprofessional team simulation has been described in the training and iterative refinement of local guidelines and expertise of clinical teams. In situ system simulation allows different interprofessional clinical teams to rehearse, troubleshoot, and improve clinical care processes, donning and doffing of personal protective equipment, and drills to identify system gaps in care. Interprofessional team simulation is a vehicle to identify process and system latent threats, gaps in knowledge or skill, and identify solutions to problems by front-line clinical and non-clinical staff. We hypothesized that interprofessional team simulations of a wide variety of COVID19 patient presentations would result in increased comfort and knowledge of clinical teams, identify gaps in suggested incident command center protocols, and recommend solutions for providing safe clinical care.

Methods: A team of critical care clinicians and simulation educators were identified by the Critical Care and Emergency Department service lines to ensure safe collaborative care of COVID19 patients in early March 2020.Seven scenarios of varying acuity and challenges were created for the different presentation possibilities of COVID19 patients throughout our system. Simulation cases and post-simulation gap analyses were reported back to clinical leadership for rapid cycle improvement. Participants were all available clinical staff on both day and evening shifts at differing times based on availability of the educator team. We used QCPR Annie mannequin (Laerdal) in situ in Emergency Department, Radiology, Critical Care, and hospital floors at VA Pittsburgh. We used RRT mock code processes to capture non-clinical response providers (Police, Environmental Services, Staff Assistants). Recurring themes identified were organized into major areas Latent Safety Threats, Communication, and System Process.

Results: We performed 14 COVID19 System Simulations from March-May 2020, involving 168 staff for a total of 312 learning hours. Our 3 major areas of concern identified were Donning/ Doffing PPE for Conservation Education, RRT Response, and Clinical Process. In an iterative fashion, we developed solutions for communication and process at the junctions of care between ED-Radiology, ED-ICU, and during RRT activations. We created new policy for RRT performance with team role modification, including the role of safety officer outside the clinical room to ensure staff PPE safety in donning and doffing, medication and communication adjuncts, and new PPE just-in-time video and static visual aids at point of care. We incorporated feedback and ideas from front line non-clinical and clinical staff, changed usual responsibilities in order to mitigate risk, developed protective plastic shields for transport, and identified communication concerns.

Conclusion: Using simulation as both the process (identification of latent threats and process improvements) and solution (just-in-time educational interventions and interprofessional team suggestions) for high stakes novel emerging pathogen clinical response is vitally important for all healthcare systems to maintain clinical preparedness. Inter-departmental and multi-specialty involvement increases the success of identifying system latent threats, testing new innovations in care, and enhancing staff engagement in a culture of safety. We hope that continued system simulation stemming from our COVID19 system analysis simulations will engender a new culture of using simulation as the vehicle for process improvement as the VA progresses in the culture of safety and a high-reliability organization.
References available upon request
Full disclosures for all authors and coauthors available upon request

USING SIMULATION TRAINING TO TEACH RESIDENTS HOW TO WRITE READABLE AND ACCURATE INCIDENT REPORTS

Yoshitaka Maeda, PhD[1]
[1]Jichi Medical University, Shimotsuke, Tochigi, Japan

Introduction: When an incident occurs at the clinical site, involved parties have to promptly submit an incident report. The Multi-Professional Patient Safety Curriculum Guide (1) states that it is important to consider what happened, why it happened, and what can be done to prevent the incident from happening again. To scientifically investigate an incident, it is vital to understand the facts. However, reports from health care providers often lack sufficient information about the facts, especially since medical incidents tend to be complicated. They are also often written subjectively since their reporting documents tend to be open-ended. As a result, incident reports are difficult to read and it is challenging to collect facts accurately (2). In Japan, medical students and residents have little opportunity to be educated on how to write incident reports accurately. In this study,

we developed simulation training to improve incident report writing and evaluated the effectiveness of the training.

Methods: Residents attended a 60-minute training. (a) Trainees watched a three-minute video in which the doctor ordered medications without confirming drugs brought by the patient; the nurse ended up dispensing an incompatible drug. (b) Trainees spent 10 minutes creating a report from the standpoints of the doctor and nurse, writing the report in an open-ended document that simulated our hospital reporting system. (c) Trainees commented on each other's report for five minutes. (d) The instructor provided writing tips—include 5W1H (When, Where, Who, What, Why, How); itemize sentences based on time of events; keep each sentence short; include a subject and predicate in each sentence. (e) Trainees spent another 10 minutes improving their report using the tips. (f) The instructor presented a model example against which trainees cross-checked their improved report. Post-training, feedback was obtained using a Likert scale questionnaire and comments collected using ARCS model (3).

Results: Of the 57 trainees who attended the training, 56 agreed to this study and had their feedback analyzed. Ninety-eight percent (n = 55) of them declared that this is their first time receiving training on how to write a report. Results of the feedback based on ARCS model are as follows. Attention and Relevance: All trainees (n = 56) were interested in this training and found it necessary. All trainees found it relevant and useful for their clinical careers. Confidence: Simulation allowed all trainees (n = 56) to visualize how to write incident reports in the future. However, 29% (n = 16) of them were not confident about implementing it. Satisfaction: 98% (n = 55) of them were satisfied with the simulation. 93% (n = 52) of them wish to receive follow-up training. Comments were mostly positive: "It was great to be able to create reports from the perspective of both doctors and nurses." "It was good that the points for improving the report were clarified." "I want to practice a few times."

Conclusion: Simulation training is useful for trainees to learn and visualize how to write readable and accurate incident reports. Since 98% of them had no experience in creating reports, the simulation was novel and was considered to have attracted attention (Attention). The video used in the training presented common errors that trainees can learn from. As residents may face situations where they are required to write incident reports, the training helped trainees become aware of its importance and relevance (Relevance). During the simulation, trainees were given opportunities to improve their reports using the tips and feedback given, allowing them to visualize what it is like to write an accurate and factual report. That said, they had only one practice round, making it hard to build the confidence needed to write reports independently (Confidence). Since Satisfaction was high, it seems Confidence can be enhanced in the future by providing follow-up training using other incident cases.
References available upon request
Full disclosures for all authors and coauthors available upon request

UTILIZING NOVEL FORCE MEASURES TO QUANTIFY DIFFERENCES IN SURGICAL PERFORMANCE: A PILOT STUDY

Nicholas Anton, BA, MS,[1] Dimitrios Athanasiadis,[2] Dimitrios Stefanidis, MD, PhD, FACS[1]
[1]Indiana University School of Medicine, Indianapolis, IN, USA; [2]Indiana University, Indianapolis, IN, USA

Introduction: Recent data have directly linked technical skill of practicing surgeons to perioperative complications.1-5 Such complications increase cost of care by 3-10 times.6,7 Unfortunately, practicing surgeons stop receiving performance feedback and their skill starts decelerating the day they graduate from training. Importantly, no reliable method of surgical skill assessment exists today to identify poor performers. Simulation-based evaluation offers a robust objective assessment method that has been shown in trainees to reliably distinguish performers based on self-reported experience.8,9 However, the current surgical simulation assessment methods lack granularity, which is needed to better distinguish surgeons of varying skill levels. Thus, the research question we hoped to answer in the current study was: can the incorporation of novel sensors of force applied during surgical anastomosis creation on a simulator model quantify differences in surgical performance and experience?

Methods: In order to obtain tissue level metrics, our group has recently developed a simulated elastomeric intestinal anastomosis model. This model allows for the measurement of suture tension along the suture line (provided by puncture resistant piezoelectric sensors). Following IRB approval, a convenience sample of surgical novices and practicing general surgeons were recruited. Participants were asked to perform an end-to-end intestinal anastomosis. The following metrics were captured on participants' performance: time per stitch (in seconds), the maximum force applied to stitches (averaged across all stitches thrown), the final stitch tension (standing tension upon completion of the anastomosis), and the variability in force applied across the suture line (the range beyond/below the mean). All force measures are reported in Newtons. A Mann-Whitney U test was performed to compare differences between groups.

Results: Two surgical novices and six practicing surgeons participated in this study. The novel force sensors embedded in our developed intestinal anastomosis model revealed that experienced surgeons performed stitches significantly faster (p=0.02) and with less maximum force (p=0.006) than novices. Furthermore, experienced surgeons displayed less final stitch tension (p=0.006) and less variability in the force applied during the anastomosis (p=0.006).

Conclusion: We obtained validity evidence that the novel sensors used to assess force in the current study can distinguish between surgeons of varying skill levels. These robust measures of surgical performance may be valuable additions to surgical training curricula to assess trainees and provide them objective feedback on their performance.
References available upon request
Full disclosures for all authors and coauthors available upon request

VETERAN AND PROVIDER SIMULATIONS IMPROVE PAIN SCORES DURING ACUTE REBAB

Bonnie Haupt, DNP, RN, CHSE, CNL[1] Laura Oseghae, BS, BSN, RN[2]
[1]VA Healthcare System, Helotes, TX, USA; [2]Audie L. Murphy Veterans Affairs Hospital, San Antonio, TX, USA

Introduction: In the USA, pain is a widely discussed issue, largely in part, due to the opioid epidemic that stems from a history of mismanagement of pain. Evidence of successful pain management techniques and tools are present in the literature and should be incorporated into the patient care plan. This study synthesized and utilized evidence-based research and applied it to an acute care rehab unit in a Veterans Affairs medical facility. The project aim was to decrease the number of patients reporting moderate to severe pain through low fidelity simulation exercises with Veterans and frontline care providers and enhance staff communication with a goal of improving pain management and the process by which a Veteran's pain is assessed, treated, and reassessed.

Methods: After a simulated tabletop discussion with the interprofessional team members. A pain management protocol template was created for provider use which included an assessment, treatment, and reassessment of the Veterans pain. The template was initiated within 48 hours of admission. If a treatment plan was initiated, the provider reassessed for effectiveness of treatment within five to seven days. This timeline would allow the provider and Veteran to collaborate more closely in managing their pain levels. Pain was included into the daily/weekly interdisciplinary team meetings and huddles. Simulated Case studies were developed along with printed educational materials about pain management for staff. The project manager provided simulated education to the Veterans as well along with education materials to enhance their understanding pain was provided to the patients to enhance their understanding of the pain treatment plan.

Results: As a result of the simulated tabletops and beside case study simulations, there was an identified improvement in recording of the pain severity, interprofessional discussion of pain, increased staff knowledge of pain, pain management and documentation. The Veterans also reported increase satisfaction in their pain knowledge and treatment plan. Outcomes were measured using pre/posttests, a patient roster, data fom the Minimum Data Set 3.0 (MDS 3.0), Computerized Patient Record System (CPRS) to view provider documentation and the Barcode Medication Administration (BCMA) to retrieve data on medication effectiveness. Total data analysis is pending and will be available at time of presentation.

Conclusion: In conclusion, the literature guided this project in choosing a widely researched, valid and reliable pain management framework set forth by the VA guidelines. Incorporating evidence-based guidelines, informatics, simulation educational training, and pain management protocols served as the foundation for the teams' positive outcomes. The simulation-based interventions aided in producing sustainable and successful outcomes focused on improving Veteran pain education with diverse simulated case scenarios and role playing along with provider and staff assessment, treatment, and reassessment, as well. The next phase will be to disseminate data and share methods with other VA's to validate the outcomes in other Acute Rehab Settings in hopes of improving pain outcomes for our unique and vulnerable Veteran population.
References available upon request
Full disclosures for all authors and coauthors available upon request

VIRTUAL SENIOR LEADERSHIP BOOTCAMP AND ITS EFFECT ON EMERGENCY MEDICINE RESIDENTS' PERCEIVED PREPAREDNESS FOR MANAGING CRITICAL CARE SCENARIOS

Esther Kwak, MD,[1] Carolina Camacho, MD, MRes, None,[2] Maria-Pamela Janairo, MD,[3] Jane Kim, MD, CHSE[2]
[1]Kings County Hospital/ SUNY Downstate, Brooklyn, NY, USA; [2]Kings County Hospital/Suny Downstate Medical Center, Brooklyn, NY, USA; [3]SUNY Downstate/Kings County Hospital Center, Sunnyside, NY, USA

Introduction: Poor communication is one of the leading causes of medical error in the USA (US). SUNY Downstate/Kings County Hospital has the largest emergency medicine

(EM) program in the US, with 98 residents. A targeted needs assessment found that many thought simulation could play an important role in honing leadership skills in a safe environment without compromising the quality of patient care. The proposed simulation experience looked to provide a leadership bootcamp that focused on developing teamwork and communication skills for those who will be transitioning from junior to senior resident roles in the critical care/trauma (CCT) area of the ED. The objective of this study was to determine the effect of leadership training on resident perceived preparedness for managing complex critical care scenarios. Due to social distancing guidelines set forth by COVID-19, the project was launched on a virtual platform and thus, benefits and limitations of virtual simulation were also assessed.

Methods: This was a cohort study of 24 junior EM residents in an urban academic hospital with an ACGME accredited residency program, who would be transitioning to senior resident roles in three months from the date of their participation in the study. All providers participated in three to four (depending on group size) carefully curated critical care scenarios. Each scenario provided various communication, teamwork, and leadership challenges such as blindfolding of the leader, wrong medication doses being drawn up by the embedded nurse, and a difficult consultant. Differences in pre and post simulation responses were evaluated using chi square statistical analysis.

Results: After the simulation, participants felt that this session helped them feel more prepared to lead as senior residents in the CCT ($p<0.001$). Prior to the simulation, only 4.2% of residents felt prepared to lead. Initially 25% of participants felt that they were clear communicators and only 12.5% felt confident with role delegation during critical cases. After the simulation, 95.83% ($p<0.001$) felt they would be able to communicate better after the session, and 87.5% ($p<0.001$) felt that they left feeling more confident about role delegation after the session. Additionally, 100% ($p<0.001$) of participants submitted that they would willingly participate in a virtual simulation in the future, and 54% (p 0.029) of participants replied that they would prefer virtual simulation to in person simulation with a mannequin.

Conclusion: This study shows that virtual simulation can effectively be used to improve the perceived preparedness of junior emergency medicine residents waiting to take on leadership roles as senior residents in the emergency department. It also showed that offering a safe and convenient platform for practicing leadership, communication and teamwork skills can help junior residents feel better prepared for their expected transition in taking on leadership roles during critical care scenarios. Though there are some limitations to virtual simulation including the loss of physical and non-verbal cues, virtual leadership training can further encourage residents to utilize and hone other skills such as verbal checkbacks, role delegation, and closed loop communication. Virtual leadership training may offer a great alternative to in person simulation especially during a time where social distancing is encouraged.
References available upon request
Full disclosures for all authors and coauthors available upon request

VIRTUAL SIMULATION SESSIONS: IMPLEMENTATION, FEASIBILITY, EASE OF USE, AND PERSONAL PREFERENCE

Gretchen Hoelscher, BS, MS,[1] Darla Morton, BS, MS,[1] Brittney Sanderson, BS, MPH, MS,[1] Dawn Swiderski, BSN, MSN, RN, CCRN, CHSE, Fellow of SSH[2]
[1]Atrium Health, Concord, NC, USA; [2]Carolinas Simulation Center, Atrium Health, Charlotte, NC, USA

Introduction: The COVID-19 pandemic has provided simulation centers an opportunity to expand their virtual simulation-based education. Implementing this education method may allow educators a new approach to meet learners' needs and provide learners access to sessions on any device. While virtual simulation studies have reported issues with connectivity, videoconference quality, and sound distortion (1), technology is improving. Our objective was to evaluate the implementation of virtual simulation sessions and the personal preference of learners, Simulation Operation Specialists (SOSs), and educators between non-virtual and virtual sessions. Evaluating implementation involves intentional examination of resources (i.e., people, equipment, and location) (2). We hypothesize that while virtual education sessions will be feasible and easily deployed, the preference between non-virtual and virtual sessions will vary in that SOSs and educators will prefer in-person while learners will prefer virtual.

Methods: Educators and SOSs completed an Implementation survey (Table 1) using a 4-point Likert Scale at the following times relative to the first simulation session: 1) the day prior, 2) the day after, and 3) three weeks after. To obtain simulation preference (virtual vs non-virtual), learners, educators and SOSs completed a survey following 4 styles of virtual simulation, each designed using a combination of LearningSpace and Zoom: 1) hybrid: some learners are in-person and others on Zoom, 2) observer: all learners are on Zoom and full debrief follows a video-recorded scenario, 3) vignette: all learners are on Zoom and with a flipped debrief model, specific teaching points are covered before and after watching short video-recorded vignettes, 4) demo: all learners are on Zoom and an instructional discussion follows a live procedural demonstration. There were 2-4 sessions per style and 12 or fewer learners per session.

Results: Implementation survey results (Table 1) were analyzed using the Mann-Whitney Rank test but showed no significance between the opinions of the educators and the SOSs at the 3 time points. In addition, the results displayed a general feeling of preparedness for deploying virtual simulation sessions. Overall, educators and SOSs overwhelmingly preferred non-virtual sessions (84%) whereas the learners were equally split (virtual 40%; non-virtual 43%). The Fisher's Exact test was used to further analyze learner preference and showed that those who participated in the hybrid and demo styles of simulation significantly ($p<0.05$) preferred non-virtual compared to those who participated in the observer and vignette styles. (Fig. 1). More than 85% of learners as well as all educators and SOSs had participated in non-virtual simulation prior to this study.

Conclusion: As predicted in our hypothesis, educators and SOSs felt that deploying virtual simulation was not only feasible but was easily attainable. With the use of Zoom and LearningSpace, the teammates felt well equipped to provide virtual simulation to our learners. On the contrary, our hypothesis was not entirely correct for the simulation preference. As predicted, educators and SOSs overwhelmingly preferred non-virtual to virtual. However, learners who participated in the hybrid and demo styles of simulation significantly preferred non-virtual, unlike those who participated in the observer and vignette styles. More data is required to see if this trend continues during future virtual sessions and help determine potential explanations for these findings. As a result of the COVID-19 pandemic, moving forward will require learners to participate in many virtual educational sessions. Therefore, it will be critical to ensure learners become more comfortable with virtual sessions.
References available upon request
Full disclosures for all authors and coauthors available upon request

WHEN A PANDEMIC HANDS YOU LEMONS, MAKE LEMONADE: JUST IN TIME SIMULATIONS TO ENSURE ONGOING COMPETENCY AND PROFICIENCY FOR NEONATAL EMERGENCIES

Gillian Gonzaba, BSN, MSN, NP, ARNP-BC,[1] John Isaac, MD, BC,[2] Glenda Weidendorf,[3] Nancy Salgado, BSN, MSN, NP, ARNP-BC,[4] Heather Delaney, MD, CHSE, FAAP,[5] Jackie LeVan, DO, CPhys, FAAP[4]
[1]Pediatrix Medical Group San Antonio; MEDNAX, Helotes, TX, USA; [2]Baptist Medical Center, San Antonio, TX, USA; [3]Mednax Medical Group, San Antonio, TX, USA; [4]Mednax, San Antonio, TX, USA; [5]North Central Baptist, San Antonio, TX, USA

Introduction: Skill degradation is a significant concern for high risk low volume procedures. Learning from the aviation and space industry1, healthcare professionals have utilized simulation to prevent skill degradation2-4. With the onset of a novel coronavirus pandemic many hospitals shifted ambulatory and well patient services such as obstetrics in an effort to prepare for the expected surge of the acutely ill. One local facility experienced a similar shift in obstetrical services, resulting in a sharp decrease in delivery volume. We strategized for a solution to ensure ongoing proficiency and competency for neonatal resuscitation through Just in Time (JIT) Simulations. We hypothesized through the use of JIT simulations, we could provide unique simulation based education in 1) standardized preparation of basic delivery resuscitation equipment through behavioral and cognitive learning and 2) skill performance with directed JIT feedback for airway recovery and troubleshooting interventions.

Methods: Two cycles of Just in Time Simulation were conducted from May 1-20, 2020. A total of 154 simulations were conducted over the two cycles (80 and 71 for cycle 1 and 2 respectively). These simulations were conducted with individual staff members and a dedicated facilitator due to social distancing concerns. Staff members participated multiple times during the course of the 2 cycles to hardwire behaviors and knowledge. The initial cycle focused on a standardized approach to preparation for basic resuscitation equipment. There were five basic items deemed essential for all delivery resuscitations, with a focus on thermoregulation, airway clearance and recovery. The second cycle focused on the initial stages of NRP through airway recovery and troubleshooting measures. A Likert Scale pre and post self-assessment was completed by all participants regarding their knowledge and confidence level for skills and information disseminated in the JIT Simulations.

Results: Improvement in skills/knowledge during Cycle 1 for L&D and Couplet staff were noted in the use of the T-Piece resuscitator, appropriate oxygen concentration and methods for heat loss. L&D nurses showed a 27% and 34% improvement in knowledge for appropriate oxygen concentrations (term & preterm respectively) and a 20% improvement in methods of heat loss. Couplet nurses showed 33% improvement in confidence regarding T-Piece set-up, adjusting pressures and appropriate oxygen settings. Lastly, they reported a 23% improvement in knowledge regarding methods of heat loss. Cycle 2 results identified more opportunities for growth in NRP skills. Significant improvement from L&D and Couplet staff was noted in 4 areas: basic questions to be addressed prior to deliveries (31% and 33% respectively), initiating PPV (27% L&D), standardized phraseology for heart rate (28% and 33% respectively) and chest rise (32% and 33% respectively) and troubleshooting techniques for ineffective PPV (33% for both).

Conclusion: Just in Time simulations can be a useful methodology to provide rapid-fire, targeted education. By providing multiple opportunities for learning with directed feedback, confidence and skill level improved. Follow up evaluations will be conducted to assess for knowledge retention with subsequent follow up JIT simulations based on the knowledge gaps identified. Further simulations are needed to demonstrate translation to retained skill with the incorporation of additional members of the resuscitation team.
References available upon request
Full disclosures for all authors and coauthors available upon request

WHEN LIFE GIVES YOU LEMONS, INNOVATE!: A STUDY REVIEWING TECHNICAL NEEDS, OBSTACLES, AND RESIDENT PHYSICIAN EXPERIENCES DURING A NECESSARY TRANSITION TO VIRTUAL SIMULATION DUE TO THE COVID-19 PANDEMIC

Jilian Sansbury, MD, FACP[1] Christopher Bryant, AAS, NRP, EMT-P/NRP[2]
[1]Grand Strand Health Education and Simulation Center, Myrtle Beach, SC, USA;
[2]Grandstrand Health, Myrtle Beach, SC, USA

Introduction: Grand Strand Medical Center is a 371-bed community hospital serving several surrounding counties. Our hospital system supports 6 ACGME accredited residencies (IM, Gen Surg, FM, TY, EM, Anesthesia). As a part of the Hospital Corporation of America system, the Grand Strand Health Education and Simulation Center has been involved in resident simulation training for 5 years. In March 2020, at the onset of the COVID-19 pandemic, HCA determined that in-person simulation scenarios were not safe for resident physicians, so we adapted! With ongoing input from our residents, we implemented virtual simulation on a WebEx platform. This study reviews the technical requirements necessary for virtual simulation, discusses obstacles encountered during the implementation of our virtual simulation journey, and review the experiences of the resident physicians who have been an integral part of the success of our virtual simulation scenario development.

Methods: With limited staff and financial constraints brought on by the pandemic, we were hesitant to transition to virtual simulation. We utilized mobile skills training to relocate task trainers to the learners in a one-on-one environment. In April 2020, our team completed its first virtual simulation activity. We utilized the office of the Sim Coordinator with a 3-screen arrangement. Screen One: Laerdal LLEAP platform viewer, Screen Two: shared screen for patient vitals monitor and supplemental studies (EKG, CXR, patient photo, labs) and Screen Three: operated by educator running the scenario and debrief and is hub for recording. Scenarios are adapted from our case repository to serve the objectives of those involved in each case. The educator notes team performance, strengths and areas for improvement on a PLUS-DELTA-like Debriefing Tool form. Formal debriefing is held and learners complete a post-simulation event evaluation form with 9 questions on a Likert scale and comments.

Results: The consensus from resident learners involved in the use of simulation via a virtual WebEx platform has been unanimously positive. To date, a total of 11 learners have completed feedback forms. 100% of learners feel they are receiving a valuable learning experience and would recommend this modality to their colleagues, while 91% of learners strongly agreed that their skills and competencies were appropriate for the simulation scenario and that the debriefing process provided valuable feedback for the learning process. Learners have commented, "Great environment to work on my weaknesses without the consequences of harming a patient", "Good, efficient use of our time, educational, lifelike", "It was comparable to being in the SIM lab" and "overall, despite being virtual it was still a valuable learning experience".

Conclusion: The Grand Strand Health Education and Simulation Center has been at the forefront of virtual simulation for the past two months in the setting of the COVID-19 pandemic. With a small staff and limited clinical hours, we have been able to provide an alternative to in-person simulation that has proved a powerful learning tool to our learners. Major obstacles we have encountered are twofold. First, resident physician learners have noted inadequate closed loop feedback provided by the educator that has negatively affected resident satisfaction. Mediators were provided additional education and the situation was resolved. Second, learners noted an inability to hear or see certain sound or video recordings provided during scenarios. Technical troubleshooting within WebEx has provided resolution of said issues. In the future, we will expand virtual simulation to the entire hospital. Based on feedback, we will implement AR with virtual simulation to simulate exam findings for learners.

References available upon request

Full disclosures for all authors and coauthors available upon request