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Abstracts

An assessment of the current state of procedural skills training in Canadian undergraduate medical education. *Frank Battaglia, Céline Sayed, Maria Merlano, Meghan McConnell, Christopher Ramnanan, Jennifer Rowe, Hao Wang, Vishesh Patel, Nikhil Rastogi.* From the Faculty of Medicine, University of Ottawa, Ottawa, Ont. (Battaglia, Sayed, Merlano, McConnell, Ramnanan, Rowe, Wang, Patel, Rastogi); and The Ottawa Hospital, Ottawa, Ont. (Rastogi). Corresponding author: Céline Sayed; csaye089@uottawa.ca.

Background: The objectives of the study were to characterize the procedural skills education currently included in preclerkship and clerkship curricula, to determine what skills physician-educators believe medical students should know upon graduation and to identify physician-educator perceptions regarding the development of preclerkship procedural curriculum. **Methods:** A Web-based survey was distributed to 201 clinician-educators across Canada's 17 medical schools. Respondents were directed to an individualized survey on the basis of their self-identified roles at their institution. The survey collected respondent demographics, details on the procedural skills currently taught at each institution and physician opinions on the value of preclerkship procedural training. **Results:** Of the 17 schools surveyed, 8 schools confirmed having clerkship procedural training, while only 4 schools had preclerkship procedural training. The 5 procedural skills identified as most important for medical students to know upon graduation included intravenous access, airway management/ventilator management, local anesthesia/field block, casting and spontaneous vaginal delivery. Clinician-educators strongly supported the implementation of a preclerkship procedural program, which they believed would decrease anxiety, increase confidence and increase the technical ability of incoming clerks. **Conclusion:** Across Canada, the state of procedural skills education in undergraduate medical education is inconsistent; however, there is overwhelming support for the implementation of a standardized training program at the preclerkship level of education. With the identification of the top 10 procedural skills medical students should know upon graduation gleaned from this study, a formal curriculum can be developed. Such a program is poised to redefine the landscape of procedural training for a new generation of physicians.

Understanding the interactions between surgeons and residents in the setting of intraoperative challenge and their impact on surgical education. *Megan Cashin, Sayra Cristancho, Kori LaDonna.* From Western University, London, Ont. Corresponding author: Megan Cashin; megan.cashin@lhsc.on.ca.

Background: The collaborative processes that occur intraoperatively between surgeons and residents are the key to the intraoperative decision-making that occurs throughout the procedure. This study will aim to explore the interactions between surgeons and senior surgical residents when a challenging intraoperative situation is encountered. An understanding of these interactions and their influencing factors can enhance the effectiveness and efficiency of intraoperative teaching. **Methods:** Ten orthopedic surgeons and senior residents were recruited as 5 pairs. Each pair was composed of 1 consultant surgeon and 1 resident who had

encountered a challenging situation while operating together. Five pairs resulted in 5 cases. Participants were interviewed separately to explore decision-making processes and the factors that influenced them in the context of the pair's shared operative experience. We used each pair as an analytical case in a multiple case study design and used thematic data analysis to develop major themes into overarching stories about consultant-resident interactions. **Results:** The 5 cases are presented as 5 descriptive accounts. Four overarching themes emerged from our analysis: engagement, assumption, performance and debriefing. These themes were developed into 2 major stories pertaining to consultant-resident intraoperative interactions: vulnerability in the operating room and missed educational opportunities. Consultants and residents experienced vulnerability differently, which may lead to missed opportunities for teaching. These missed opportunities included lack of intraoperative teaching during the moment of surgical challenge and limited postoperative discussion between the consultant and resident. **Conclusion:** We explored the experiences of consultants and residents by highlighting our novel findings of vulnerability in the operating room and the related missed educational opportunities. We suggest that intraoperative surgical education would benefit from being more deliberate, with specific attention paid to intraoperative discussion and debriefing, to minimize these missed opportunities.

A surgical photogrammetry camera dome: a new way to create photography-based 3D models for surgical education and virtual reality. *Sachin Doshi, Albert Fung, Paul Kelly, Paul Greig, Ian McGilvray.* From the University of Toronto, Toronto, Ont. (Doshi, Fung, Kelly, Greig, McGilvray); Toronto General Hospital, Toronto, Ont. (Fung, Kelly, Greig, McGilvray); and the Multi-Organ Transplant Program, University Health Network, Toronto, Ont. (Greig, McGilvray). Corresponding author: Sachin Doshi; sachin.doshi@mail.utoronto.ca.

Background: Highly realistic, interactive 3-dimensional (3D) models will play a powerful role in the future of surgical education. Stationary video and still-image cameras lack valuable spatial data inherent in 3D reconstructions. Photogrammetry combines many 2-dimensional photographs into a realistic 3D reconstruction. However, existing multicamera photogrammetry rigs are large and impractical to use in operating rooms. We report a novel proof-of-concept photogrammetry device developed to rapidly capture steps of an open surgical procedure. The 3D models produced may be used for various educational purposes. **Methods:** We developed an independent, wireless communications network using microcomputers to trigger simultaneous image captures from a camera array. We designed multiple arrays and manufactured them using 3D printing, while considering the sterilizability of the ultimate design. Three camera array prototypes (linear, rotating arch, radial) captured images of objects with varying geometries, colours and reflective surfaces, simulating challenges of intraoperative anatomy. Photogrammetry software (3DF Zephyr) was used to reconstruct these objects. Each 3D render was evaluated using qualitative metrics. A hardware feasibility analysis was conducted. **Results:** Our prototypes successfully produced 3D renders with geometries as small as 1 mm. Reconstructions were produced using select photo combinations, and qualitative analysis was conducted

by a medical illustrator. Radial arrays produced the most accurate geometric reconstruction, and a 32-camera system had the optimal quality-to-feasibility assessment. **Conclusion:** This series of experiments validated the proof-of-concept design of a novel photogrammetry device with the potential to capture an intraoperative surgical field in 3D. A full-scale device can now be fabricated for testing in a live operating room. These reconstructions have tremendous potential in surgical education and can be used to create accurate 3D models for virtual reality surgical training.

Assessing mastery of laparoscopic skills for a junior resident prior to entering the operating room — master's thesis in progress. *Stephanie Johnston.* From the University of Manitoba, Winnipeg, Man. stephanie.johnstonmd@gmail.com.

Background: Learning laparoscopic surgery is a complex task requiring the integration of multiple skills that are not required for traditional surgical methods. Simulation of laparoscopic procedures can improve performance and patient safety. The ongoing shift to competency-based medical education in Canada is bringing greater attention to the assessment of outcomes within training. Now is an appropriate time to start integrating outcome expectations for laparoscopic simulation based upon mastery learning into the assessment of residents about to start participating in laparoscopic surgery. The purpose of this study was to determine the level of skill mastery that well-prepared junior residents in obstetrics and gynecology at the University of Manitoba should be expected to demonstrate on a predefined set of 5 simulated, economic laparoscopic tasks, the CanTAB test, before they begin to participate in laparoscopic surgery. **Methods:** Consent was obtained from participating residents and attending physicians. Laparoscopic cases were chosen on the basis of the Royal College of Physicians and Surgeons' List A of laparoscopic surgical procedures, which itemizes the procedures that specialists in obstetrics and gynecology are expected to be able to perform competently. Operating room (OR) performance of residents and attending physicians was assessed using the Ottawa Surgical Competency Operating Room Evaluation (O-SCORE) tool. Participants completed the CanTAB test within 1–2 weeks of the OR case and results were recorded via an iPad. CanTAB tests were scored on the basis of a predetermined time-based matrix. Using the borderline regression method, I will determine a cut score for the CanTAB test on the basis of an O-SCORE of 2.0 (explicit instructions). **Results:** Results are pending as data collection is scheduled to be completed in late 2019.

The impact of surgeon experience on script concordance test scoring. *Nada Gawad, Anabita Malvea, Timothy Wood, Lindsay Cowley, Isabelle Raiche.* From the University of Ottawa, Ottawa, Ont. Corresponding author: [Nada Gawad; ngawad@toh.ca](mailto:ngawad@toh.ca).

Background: The Script Concordance Test (SCT) is a test of clinical decision-making that relies on an expert panel to create its scoring key. Existing literature demonstrates the value of specialty-specific experts, but the effect of experience among the expert panel is unknown. The purpose of this study was to determine if surgeon experience affects SCT scoring. **Methods:** An SCT was administered to 29 general surgery residents and 14 staff surgeons.

Staff surgeons were stratified as either junior or senior experts on the basis of the number of years since they completed residency training (< 15 v. > 25 yr). The SCT was scored using the full expert panel, the junior panel and the senior panel. A 1-way analysis of variance was used to compare the scores of first-year (R1) and fifth-year (R5) residents using each scoring scheme. **Results:** There was no statistically significant difference between the average score of R1s and R5s when the full expert panel was used (R1 69.08 v. R5 67.06, $F_{1,9} = 0.10, p = 0.76$) or the junior faculty panel was used (R1 66.73 v. R5 62.50, $F_{1,9} = 0.35, p = 0.57$). However, the average score of R1s was significantly lower than that of R5s when the senior faculty panel was used (R1 52.04 v. R5 63.26, $F_{1,9} = 26.90, p = 0.001$). **Conclusion:** SCT scores are significantly affected by the responses of the expert panel. Expected differences between R1 and R5 residents were demonstrated only when an expert panel consisting of senior faculty members was used. When an SCT expert panel is being constructed, consideration must be given to the years of experience of panel members.

YouTube as a source of patient information for abdominal aortic aneurysms. *Aleksandar Radonjic, Nicholas Ng Fat Hing, John Harlock, Faysal Naji.* From the University of Ottawa, Ottawa, Ont. (Radonjic, Hing); and McMaster University, Hamilton, Ont. (Harlock, Naji). Corresponding author: [Nicholas Ng Fat Hing; nngfa030@uottawa.ca](mailto:nngfa030@uottawa.ca).

Background: Patients are increasingly referring to the Internet after a diagnosis of vascular disease to further inform themselves. This study was performed to quantitatively define the accuracy and reliability of information on YouTube regarding abdominal aortic aneurysms (AAA). **Methods:** A systematic search of YouTube was conducted using multiple AAA-specific keywords. The default YouTube search setting of "relevance" was used to replicate an average search attempt, and the first 50 results from each keyword search were reviewed and analyzed by 2 independent reviewers. Descriptive characteristics, JAMA criteria, a modified DISCERN score, the video power index (VPI) and a novel scoring system for the management of AAA, the AAA-Specific Score (AAASS), were used to record data. Interrater agreement was analyzed using intraclass correlation coefficient (ICC) estimates and the Kruskal–Wallis test was used for intergroup comparisons. **Results:** Fifty-one videos were included in the analysis. The mean JAMA, DISCERN and AAASS values among videos were 1.74/4 (standard deviation [SD] 0.84), 2.37/5 (SD 0.97) and 6.63/20 (SD 3.23), respectively. Videos were categorized as educational (78%), patient testimonials (14%) and news programs (8%). On the basis of the AAASS, videos were categorized as poor (41%), very poor (31%), moderately useful (25%), very useful (2%) and exceptional (0%). Videos by nonphysicians were significantly more popular ($p < 0.05$) than videos by vascular surgeons. **Conclusion:** Our results suggest that vascular surgeons should recognize that there is a current lack of complete and reliable information on YouTube about AAA diagnosis and treatment, which may distort the expectations of their patients.

Testing the efficacy of self-study videos for the surgery clerkship rotation: a project in innovation of undergraduate

medical education. *Nikhile Mookerji, Julie El-Haddad, Thin (Peter) Vo, Elysia Grose, Christine Seabrook, Buu-Khanh Lam, Robert Feibel, Sean Bennett.* From the University of Ottawa, Ottawa, Ont. Corresponding author: Sean Bennett; sean.bennett@dal.ca.

Background: Computer-based educational videos have become valuable resources in medical education and can address some of the pitfalls of traditional learning. To ensure clerkship students have adequate exposure to the required curriculum objectives, a series of objective-aligned self-directed video podcasts were developed covering core concepts in various surgical disciplines. The objective of the study was to evaluate the efficacy of enhanced video podcasts in the surgery clerkship rotation. **Methods:** Nineteen video podcasts were created: 10 in general surgery, 5 in urology and 4 in orthopedic surgery. The video podcasts were housed on www.surgicaleducationportal.com and distributed to clerkship students at the University of Ottawa. For each video, a 10-question multiple-choice quiz was developed, which was administered both before and after viewing. A participant satisfaction survey was also completed after viewing. Paired *t*-test analysis was conducted to test the efficacy of these videos by comparing pre- and post-test results. **Results:** A total of 302 paired pre- and post-test scores were compiled. There was an average increase in score from the pretest to the posttest of 2.6 points ($p < 0.0001$). On a Likert scale from 1 to 5, with 5 being excellent and 1 being poor, students rated the usefulness of the videos as 4.3, the quality of the content as 4.3 and the quality of the videos as 4.2. Ninety-eight percent of students reported they would recommend these videos to their classmates, and 81% preferred this modality over more traditional methods. **Conclusion:** Video podcasts are an effective modality for engaging medical students and may provide another dimension of learning during their surgical clerkship.

You cut like a girl: how female surgical residents at the University of Calgary experience gender-based discrimination during postgraduate training. *Allison Brown, Gabrielle Bonneville, Sarab Glaze.* From the University of Calgary, Calgary, Alta. (Brown, Bonneville, Glaze); and Alberta Health Services, Calgary, Alta. (Glaze). Corresponding author: Allison Brown; allison.brown@ucalgary.ca.

Background: Gender-based discrimination (GBD) has been described in the literature throughout medical school and residency and into professional practice. Despite the increasing number of women pursuing surgical specialties, no studies have examined how female surgical residents experience GBD during residency. **Methods:** To explore how female surgical residents at the University of Calgary experience GBD, a sequential explanatory mixed-methods design was used to combine insights from quantitative and qualitative strands. First, residents of all genders across surgical programs completed a cross-sectional survey. Afterward, we conducted interviews with surgical residents who identified as female to explore their experiences of GBD, intending to further explain the initial findings. **Results:** Female residents had more frequent and severe experiences of GBD than male residents. Nurses and patients were the most prominent sources, and the emergency department and operating room were the most frequent settings, with large effect sizes detected. Common experiences included overall lack of respect, harassment and

bullying, and ongoing fear of reporting because of the threat of future consequences. GBD affected wellness, educational quality and patient safety. **Conclusion:** Female surgical residents commonly experience GBD that permeates all aspects of training. Although some may deny that these experiences are common and problematic, others feel they do not have the ability to address the systematic oppression that medicine and medical education have historically imposed on trainees. Multiple short- and long-term solutions should be implemented to tackle structural barriers to promote equitable training environments.

An interprofessional surgical team perspective of helping behaviours in complex clinical teams. *Erin Kennedy, Sayra Cristancho, Lorelei Lingard, Chris Watling, Roberto Hernandez-Alejandro, Jeanna Parsons Leigh.* From Western University, London, Ont. (Kennedy, Cristancho, Lingard, Watling, Leigh); and the University of Rochester, Rochester, N.Y. (Hernandez-Alejandro). Corresponding author: Erin Kennedy; ekhollin@uwo.ca.

Background: In surgical environments, work is and must be variable and flexible, requiring practitioners to recognize what they don't know and seek help when required. Given that much of care delivery occurs within teams, it can be difficult for surgeons to navigate the complexity of collaborative care while attending to their own knowledge/skill gaps. While help-seeking has been explored from the perspective of the individual surgeon, help-seeking within interprofessional teams — which reflects the reality of clinical practice — is underexplored. Our study aims to understand how helping behaviours are enacted in collaborative interprofessional surgical teams. **Methods:** We conducted 13 semistructured interviews with interprofessional surgical team members, along with follow-up interviews with key informants. Using thematic analysis, we conducted data collection and inductive analysis iteratively. **Results:** We found 2 intersecting features that influenced helping engagement: work context and intrinsic attributes. Work context, including the physical space as well as tacit assumptions the surgical team shared and described, shaped the way helping scenarios were approached, while intrinsic attributes such as professional experience, trust and the communication style of the individual guided the choice of help strategies. Despite the perception that colocation facilitates direct help requests, it did not remove all barriers to help-seeking as participants revealed a number of covert strategies. **Conclusion:** If we desire to create and support surgical teams that effectively and safely deliver quality care, colocation is not enough. We must also consider the intrinsic attributes as well as the work context in which individuals and teams are situated.

The effect of surgical observerships on the perceptions and career choices of preclinical medical students: a mixed-methods study. *Maureen Thivierge-Southidara, Mathieu Courchesne, Steven Bonneau, Michel Carrier, Margaret Henri.* From Université de Montréal, Montreal, Que. (Thivierge-Southidara, Courchesne, Bonneau); the Montreal Heart Institute, Montreal, Que. (Carrier); and Hôpital Maisonneuve-Rosemont, Montreal, Que. (Henri). Corresponding author: Maureen Thivierge-Southidara; maureen.thivierge-southidara@umontreal.ca.

Background: Students are increasingly choosing nonsurgical specialties. Observership programs can address factors influencing

medical students toward surgical careers by allowing pre-clerkship exposure, mentorship and changing misconceptions in the field. **Methods:** A quasiexperimental convergent mixed-methods questionnaire study design was used to determine the influence of a peer-initiated observership program on the career choices of preclinical medical students and the factors pertaining to a positive experience. A McNemar test was used to evaluate the impact on students' career choices. An inductive data-driven thematic analysis was used to analyze students' reasoning. **Results:** Of 204 participating students, 85 (54.1%) answered both questionnaires. Most students were interested in a surgical specialty before (84.7%, $n = 72$) and after (84.0%, $n = 68$) the observership. There were no statistically significant differences according to the change of interest ($p > 0.99$). However, most students (80.9%, $n = 68$) reported being more interested in a surgical career as a result of the observership, which allowed them to determine that the type of practice they considered was congruent with a surgical career. Their perceptions of the surgical field became positive, particularly towards its pace, its climate and the humanistic patient–doctor relationship it required. The experience was influenced by surgeons' and teams' attitudes towards students, knowledge sharing and the quality of the exposure. Students mentioned that their own willingness to participate was crucial for a successful experience. **Conclusion:** This student-led observership program allowed an early positive introduction of students to surgery while challenging stereotypes. It provided a better understanding of surgery, enabling students to consider this field and potentially influencing their residency application.

Implementation and effectiveness of coaching for surgeons in practice: a mixed-studies systematic review. *Sofia Valanci, Noura Albassan, Liane Feldman, Julio Fiore, Lawrence Lee, Gerald Fried, Carmen Mueller.* From the Montreal General Hospital and McGill University, Montreal, Que. Corresponding author: Carmen Mueller; carmen.mueller@mcgill.ca.

Background: Surgical training remains largely based on the apprenticeship model, yet personalized observation with feedback is rarely a feature of traditional continuing medical education modalities. Recently, peer coaching has been proposed to enable skill refinement for practising surgeons but it remains underutilized. The purpose of this study is to summarize the characteristics and barriers to implementation of coaching programs for surgeons in practice. **Methods:** A systematic review was conducted to identify all studies describing or investigating coaching for practising surgeons up to June 2019. Quantitative and qualitative features of coaching programs were analyzed and summarized in a mixed-methods manner. **Results:** Of 5020 citations, 28 were included for final synthesis. Twenty-six (93%) articles described implementation of a coaching program, and 2 (7%) examined perceptions of coaching through qualitative analysis. Program structure and skills coached varied widely. Thematic analysis identified 2 major topics: outcomes of programs and barriers to participation. Uptake of skills learned was high, with 42%–100% of participants across studies reporting changes in clinical practice directly associated with coaching. Reported barriers to coaching participation emerged along 3 main themes: logistical (including time and remuneration constraints), surgical culture (including feelings of negative judgment by peers) and perceived lack of need for skill refinement. Satisfac-

tion with coaching participation was reported by 82%–100% of participants. **Conclusion:** Coaching is highly rated by participants and often results in clinical practice changes, but important barriers to participation remain. Consideration of these factors may be beneficial when planning future programs.

REACT: Career exploration program increases self-perceived knowledge and confidence in acute care and trauma surgery. *Neraj Manhas, Vignesh Sethuraman, Frank Battaglia, Jamie Ghossein, Celina DeBiasio, Rbiannan Pinnell, Nikbil Rastogi.* From the University of Ottawa, Ottawa, Ont. Corresponding author: Neraj Manhas; nmanh095@uottawa.ca.

Background: To better address the minimal exposure to trauma and acute care surgery in preclerkship curricula, we implemented an intensive 1-week critical care program for preclerkship students. The goal was to increase preclerkship students' knowledge of, interest in and confidence in the critical care specialties including trauma and acute care surgery. **Methods:** Fifteen Preclerkship students participated in the REACT pilot program, consisting of observerships, career discussions and skills simulation across the selected acute care specialties. This prospective cohort study evaluated the effectiveness of the REACT program in improving the critical care knowledge of the participating students and facilitating their career planning, in comparison with a control group of students ($n = 14$). At baseline and completion, students completed a survey assessing specialty interest, knowledge and confidence in the simulated skills. Independent-samples t tests compared differences in means between control and REACT groups. Paired-sample t tests were used to compare differences between pretest and posttest means for both control and REACT groups. **Results:** No significant differences in study measurements were noted between the study arms at baseline. At program conclusion, REACT participants showed increases in nearly all study outcomes compared with baseline and the control group. Significant increases were noted in self-perceived specialty knowledge of acute care and trauma surgery along with knowledge of and confidence in chest tube placement ($p < 0.05$) compared with baseline. **Conclusion:** The REACT program was effective in increasing self-perceived knowledge and confidence in acute care and trauma surgery. This program can inform surgical career decision-making and can be expanded to other medical schools to grant earlier exposure to acute and critical care specialties.

Factors influencing medical student perception of a career in general surgery. *Ashley Eom, Savannah Silva, Qian Shi, Danyal Saeed, Jeffrey Grab, Patrick Ciechanski, Deepak Dath.* From McMaster University, Hamilton, Ont. (Eom, Silva, Shi, Saeed, Dath); and the University of Alberta, Edmonton, Alta. (Grab, Ciechanski). Corresponding author: Ashley Eom; ashley.eom@medportal.ca.

Background: Canadian Resident Matching Service (CaRMS) data show fluctuation in applications to general surgery. Exploring the current factors affecting medical students'

perceptions of general surgery can guide curriculum changes and staff activities to promote student interest. **Methods:** This grounded theory qualitative research study used semi-structured, individual interviews. Ten medical students from all years of medical school at 2 institutions were interviewed to explore the appeals and deterrents of entering a career in general surgery and how these factors may affect their career choices. The interviews were recorded and transcribed and underwent coding by 2 independent coinvestigators for data analysis. **Results:** As described previously, students appreciated tangible outcomes, impactful work and fast-paced workflow but struggled with rigorous training and the potential poor work-life balance in general surgery. Students expected egregious behaviours from residents and staff but reported mostly experiencing a willingness to teach, provision of clinical opportunities and offers of research. Sometimes, students rationalized egregious behaviours to factors like fatigue and lack of agency. **Conclusion:** Work hours, tangible outcomes and fast-paced work define surgery. Early clinical exposure can help students understand these specialty-defining factors for career choice. Negative stereotypes about personality and culture still exist, but exposure to surgical ambassadors in early years can counteract the negative stereotypes at the outset. Students need a more productive clinical experience for making their career choices.

Tips for effective intraoperative teaching: lessons learned from observing excellent educators. *Aaron L. Grant, Jacqueline Torti, Mark Goldszmidt.* From Western University, London, Ont. Corresponding author: Aaron Grant; aaron.grant@lhsc.on.ca.

Background: Teaching in the operating room setting can be a challenge for surgical educators. Finding a balance between patient safety, time constraints and adequate trainee “cutting time” is difficult. Some surgeons seem to do this effectively and are respected as excellent educators. As part of a master’s thesis project, observations and interviews of surgical educators from a variety of surgical specialties were completed with the intent to explore intraoperative teaching practices. From this process, insight has been gained into a number of educational techniques used that may be useful to other surgical educators. The purpose of this study was to elucidate methods or teaching tips from surgeons deemed excellent intraoperative educators. **Methods:** Online surveys of current surgical residents with a 36% response rate identified a number of surgeons working at Western University who were deemed excellent educators. Ten surgeons from a variety of specialties participated. Thirty-two hours of intraoperative observation and 209 minutes of semistructured interviews were analyzed for themes or unique teaching tactics. **Results:** A number of educational techniques and tips were identified that surgeons employed including setting expectations, lightening the cognitive load, checking in and verbal control. **Conclusion:** Valuable educational tips from surgeons deemed to be excellent educators may be helpful in personal or faculty development endeavours.

Exploring the impact of the Surgical Exploration and Discovery (SEAD) Program on medical students’ perceptions of gender biases in surgery: a mixed-method evaluation. *Mimi Deng, Anabita Malvea, Emily Nham, Christine Seabrook, James Watterson.* From the University of Ottawa,

Ottawa, Ont. Corresponding author: Mimi Deng; mdeng073@uottawa.ca.

Background: The number of female surgeons is rising and several factors may play a role. The objective of the study is to assess the role of the Surgical Exploration and Discovery (SEAD) program on surgical interest and gender biases in surgery. **Methods:** Students’ gender biases in surgery were assessed using a modified version of the Gender Bias in Medical Education Scale (GBMES) administered pre- and post-SEAD. Mean difference for each item pre- and post-SEAD was calculated and differences between SEAD and non-SEAD participants as well as between male and female SEAD participants were analyzed using the Student *t* test. Students’ free-text responses were qualitatively assessed to further determine experiences and attitudes regarding gender bias in surgery. **Results:** Levels of interest in surgery did not significantly change between groups ($p = 0.325$) before and after SEAD. However, program participants had significant reductions in the strength of the following beliefs compared with controls: “Surgery is male dominated,” “Medical studies are mainly done in males,” “Gender discrimination is more pronounced in surgery than other medical professions” and “Consideration of my gender is an important factor in whether or not to pursue surgery as a career” ($p < 0.05$). Stratified analysis revealed that the significance of these reductions was owing to female participants. Qualitative analysis revealed variable attitudes and experiences regarding gender biases in surgery. **Conclusion:** Early surgical exposure through SEAD reduces gender bias in surgery, particularly in female medical students.

Surgery ABCs: a health care podcast for kids. *Natalie Marsden, Jenni Marshall, Jonathan White.* From the University of Alberta, Edmonton, Alta. Corresponding author: Jonathan White; jswhite1@ualberta.ca.

Background: Surgery ABCs is an educational health care podcast targeted at preschool- and elementary-aged kids to provide basic information on the body and medicine. Podcasts are becoming increasingly popular as an educational tool for children. While many science-based podcasts are available for this age group, podcasts focused on health care are lacking. This gap provided a unique opportunity to create a podcast to empower kids to learn about their bodies, to prepare them for encounters with the health care system and to encourage them to consider careers in health care. This project allowed exploration of unique intersections between surgical education and patient education. **Methods:** In association with the Surgery 101 project, we produced 11 Surgery ABCs episodes to address questions kids have about the body. The topics were “What happens if I break a bone?,” “Why does my stomach rumble?,” “Where do farts come from?,” “Why do my teeth fall out?,” “Why is my pee yellow?,” “Why am I ticklish?,” “Why does food taste good?,” “Why do I need to get my shots?,” “Why does my heart beat?,” “How can I blow out a birthday candle?,” and “Why do I feel sad sometimes?” During each episode, the host, her daughter and a medical student discuss a part of the body and highlight a practitioner who works on that area of the body in the “Doctor of the Day” segment. **Results:** The podcast is available on Spotify and iTunes and has been downloaded more than 11 500 times; the episode on sadness has proven most popular among listeners. **Conclusion:** This project demonstrates that children and their parents are interested in learning more about the human body and that

podcasts can be used as an educational tool to address children's curiosity about their bodies.

The Patient as Teacher program: an undergraduate medical education initiative in surgery. *Jory Simpson, Emilia Kangasjarvi, Farah Friesen, Stella Ng.* From St. Michael's Hospital and the University of Toronto, Toronto, Ont. Corresponding author: Jory Simpson; simpsonjo@smh.ca.

Background: The Patient as Teacher (PAT) program has so far educated more than 300 undergraduate MD students at the University of Toronto, aiming to bolster compassionate, humanistic and patient-centred care among medical learners. Prior research has shown that similar programs in medical schools can have a positive influence both on the medical students and on the patient teachers. However, Patient as Teacher programs have not been studied sufficiently in the context of surgery. Hence, this study examines the experience and impact of the Patient as Teacher initiative in surgery. **Methods:** The program consists of 2 patient-driven interactive workshops, led by breast cancer survivors, and a third workshop that includes an arts-based reflection creation. After these 3 workshops, semistructured interviews were conducted with 7 patient teachers, and focus groups were held with students, asking about motivations, perceptions and experiences in relation to the Patient as Teacher program. We conducted a thematic analysis until saturation of key codes and themes was reached. **Results:** Patient teachers felt empowered and had a sense of contributing to medical education and the future of health care. Patient teachers tended to be motivated by a desire to "give back" and found that sharing their stories was cathartic and emotionally healing. They also expressed feeling optimistic about their stories having a lasting impact on medical students. Students felt that having protected time (compared with clinic patient encounters) to listen to and learn in depth from patient teachers' stories on how their illness and the treatment of it have impacted their lives was very educational. **Conclusion:** This education innovation supports extant evidence that sharing one's story can be psychologically healing for patients and that listening to patient stories can be educationally powerful for students. Our preliminary evaluation showed that becoming a patient teacher can have a positive healing effect for patients. We hope similar curricula can be incorporated into surgical clerkships throughout Canada.

Immersive virtual reality demonstrates improved and efficient surgical skill acquisition in senior orthopedic residents: a prospective blinded randomized controlled trial. *Danny Goel, Ryan Lohre, Aaron Bois, George Athwal.* From the University of British Columbia, Vancouver, B.C. (Goel, Lohre); the University of Calgary, Calgary, Alta. (Bois); and Western University, London, Ont. (Athwal). Corresponding author: Danny Goel; danny@precisionostech.com.

Background: There are no studies on immersive virtual reality (VR) simulation in orthopedic education. The purpose of this multicentre, blinded, randomized controlled trial was to determine the validity and efficacy of immersive VR training in senior orthopedic residents. **Methods:** Nineteen senior orthopedic residents and

7 consultant shoulder arthroplasty surgeons participated in a trial comparing immersive VR with traditional learning methods using a technical journal article as a control. The examined task focused on achieving optimal glenoid exposure. Participants completed demographic questionnaires, knowledge tests and a surprise glenoid exposure on fresh frozen cadavers while examined by blinded shoulder arthroplasty surgeons. Outcome measures included objective structured assessment of surgical skills (OSATS) score, a developed laboratory metric and time to task completion. **Results:** Immersive VR had greater realism than the control and was superior in teaching glenoid exposure ($p = 0.005$). The surgeon group outperformed the resident group on knowledge testing ($p = 0.04$). The VR group completed the learning activity and knowledge tests significantly ($p < 0.001$) faster than control (11 ± 3 min v. 20 ± 4 min), performing 3–5 VR repeats for a reduction in learning time of 570%. The resident VR group completed the glenoid exposure significantly ($p = 0.04$) faster than control (14 ± 7 min v. 21 ± 6 min) with superior OSATS instrument handling scores ($p = 0.03$). The VR group produced verbal answers to questions faster than control ($p = 0.03$), with equivalent written knowledge scores ($p > 0.99$). **Conclusion:** Face, content, construct and transfer validity were demonstrated for VR in orthopedic training for the first time. Immersive VR demonstrated substantially improved translational technical and nontechnical skills over traditional learning in senior orthopedic surgery residents. **Competing interests:** Dr. Danny Goel is the chief executive officer of PrecisionOSTM, a VR technology company specializing in novel orthopedic operative planning and educational software. He has direct financial interest and involvement in the company and projects relating to the use of PrecisionOSTM proprietary information. Dr. Ryan Lohre has a positional interest with the project and PrecisionOSTM as an unpaid research consultant. Dr. George Athwal has a positional interest with the project and PrecisionOSTM as an unpaid research and validation consultant.

Safe in my hands: procedural variation and the entrustment of surgical practice. *Mary Ott, Tavis Apramian, Sayra Cristancho, Lorelei Lingard, Kathryn Roth.* From Western University, London, Ont. Corresponding author: Mary Ott; mott2@uwo.ca.

Background: Surgeons practise their own variations on a procedure. This variability has implications for surgical education, but the impact is not well understood. This is a critical problem to investigate as programs work to define procedures as entrustable professional activities (EPAs) for competency-based medical education (CBME). Our study explores the experience of procedural variation in a surgical program that is an early adopter of CBME. **Methods:** We conducted a situational analysis of tonsillectomy, a foundation procedure in this program. After identifying variations through 67 operative notes and 7 intraoperative observations, we interviewed 4 surgeons and 3 residents about the effects of these variations on teaching, learning and entrustment. The interview data were analyzed in concert with EPA feedback and competency committee field notes to form a ground theory of the relationship between procedural variation and entrustment. **Results:** We found even a basic procedure resists standardization and that surgeons entrust people, not procedures. Entrustment is a temporal, relational, embodied process

that accounts for variability within procedures and across training. Residents begin their training as an extension of surgeons' hands and end with the assurance they have safe hands. **Conclusion:** Entrustment is best understood as a gradual and holistic release to competent practice. However, residents may perceive entrustment to be the sum of their EPAs, and programs may seek to standardize EPAs in ways that unintentionally constrain adaptive expertise. Our results contribute insight on the affordances of procedural variation for emerging competency and entrustment, suggesting important directions for surgical education as CBME continues to be developed.

Seeing the forest and the trees: how clinical competency committees improve the implementation of CBD in surgical postgraduate education programs. *Rachael Pack, Lorelei Lingard, Chris Watling, Sayra Cristancho.* From Western University, London, Ont. Corresponding author: Rachael Pack; rachael.pack@schulich.uwo.ca.

Background: Programmatic assessment has at its core the ongoing production, review and feeding back of multiple, low-stakes assessment data points. In postgraduate medical education, clinical competency committees (CCCs) serve as the locus of these processes. Despite the proliferation of recent scholarship on CCCs much remains unknown about their inner workings. This constructivist grounded theory study explored these processes. **Methods:** Our sample consisted of 15 CCC meetings in 5 surgical and perioperative postgraduate programs. Data were collected through nonparticipant observations and semistructured interviews ($n = 15$) and analyzed iteratively using a constant comparative method. **Results:** The work of CCCs extends beyond assessing the progression of individual trainees. Committees engage in in-depth data review and analysis work that provides important insights into how programmatic assessment is unfolding locally. Three types of program implementation problems were identified in the data: assessments that require rare events, misalignment between rotations and exposure to required cases, and various implementation "glitches" (e.g., problems with forms). In response, CCCs develop program-level solutions to tailor CBD to their unique contexts. This in-depth review work also enables CCCs to "diagnose" specific performance problems (e.g., performance anxiety) in individual trainees and develop targeted remediation plans. **Conclusion:** While the identification of CBD implementation problems is not an anticipated or expected function of CCCs, this work appears to be vital. However, the ability of CCCs to effectively engage in this work is fragile and is dependent on the willingness of faculty to devote their time. The resourcing of CCCs may have profound implications for translating programmatic assessment theory into practice.

Canadian otolaryngology – head and neck surgery resident caseloads: Does competence by design change operative exposure? *Devin Piccott, David Forner, Paul Hong.* From Dalhousie University, Halifax, N.S. Corresponding author: Devin Piccott; devin.piccott@dal.ca.

Background: With the onset of competency-based medical education (CBME), the traditional residency training framework has changed. Resident caseloads may provide a benchmark for operative exposure. Caseloads have not previously been studied in Canada. Little is known about the impact of competency-based

medical education (CMBE) on operative exposures. **Methods:** A multicentre cohort study examining caseloads in Canadian otolaryngology programs was completed. Participants from the 2021 (traditional framework) and 2022 (CBME framework) graduating cohorts submitted data anonymously via online survey. Caseloads were compared for residents in postgraduate year 1 in each cohort. Quantitative and qualitative methods were used. **Results:** The response rate was 49%. The median overall number of procedures for residents in the traditional framework was higher than for those in the CBME cohort, although no statistically significant difference was observed. Respondents stated they were encouraged to log and had variable confidence in their accuracy. **Conclusion:** Caseload analysis may offer an objective means of determining the impact of CBME on operative experience. Early analysis shows no difference between frameworks.

Quarter-century evaluation of general surgery residency at the University of British Columbia. *Zach Sagorin, Vivian Tsang, Tracy Scott, Abmer Karimuddin.* From the University of British Columbia, Vancouver, B.C. (Sagorin, Tsang, Scott, Karimuddin); and St. Paul's Hospital, Vancouver, B.C. (Karimuddin). Corresponding author: Zach Sagorin; zachsagorin@alumni.ubc.ca.

Background: Over the last quarter century, the demographics, recruitment and training of incoming residents in general surgery programs have changed. Leadership is an important CanMEDS competency and valued in surgeons. It will be meaningful to evaluate both the immediate and long-term indicators of surgical, academic and administrative leadership of residency training alumni. **Methods:** Trainees and alumni from the University of British Columbia general surgery residency program from 1988 to 2013 were studied using routinely collected residency data and data gathered from public databases. Alumni were sent surveys evaluating leadership positions and satisfaction. Comparisons were made across sex and between the 1988–2002 and 2003–2013 cohorts. Statistics were performed using JMP V14.1.0. **Results:** Over the quarter century, 147 of 177 incoming residents completed training (83.5%) with no difference by entering cohort (83.8% in 1988–2002 compared with 83.3% in 2003–2013, $p = 0.9409$) or sex (82.7% of women compared with 84.2% of men, $p = 0.7919$). Female general surgery alumni completed fellowships more often than male general surgery alumni (49 of 62 women [79%] compared with 50 of 85 men [58.8%], $p = 0.0099$). The sex compositions of general surgery trainee cohorts from 1988–2002 (25% women) and 2003–2013 (57.3% women) were different ($p < 0.0001$). Alumni from 1988–2002 completed fewer fellowships than 2003–2013 alumni (53.7% compared with 78.8%, respectively, $p = 0.0013$). A similar number of years to complete residency was identified for men (5.7 ± 0.6) and women (5.9 ± 0.8) ($p = 0.0688$). Of 30 respondents to the alumni survey, 21 (70.0%) obtained leadership appointments. Surgeons were somewhat or extremely satisfied in 82.9% of leadership appointments identified. **Conclusion:** General surgery trainees at this institution complete residency at high rates and there is no difference in residency completion by cohort or sex. The frequency of alumni fellowship completion has risen and women make up more than half of recent general surgery residency alumni. Many alumni obtain leadership positions after graduation with high rates of satisfaction.

Development of a surgical procedures video library for cardiac surgery training in competency-based medical education. *Linda Yi Ning Fei, Munir Boodhwani, Thin (Peter) Vo, Jasmine Mussani.* From the University of Ottawa, Ottawa, Ont. (Fei); the University of Ottawa Heart Institute (Boodhwani, Vo); and Queen's University, Kingston, Ont. (Mussani). Corresponding author: Linda Yi Ning Fei; linda.feiuottawa.ca.

Background: Median sternotomy and saphenous vein graft removal are foundational skills in cardiac surgery. However, there are few comprehensive, reliable educational videos for teaching this procedure in Canadian postgraduate medical education (PGME) programs. As Canadian cardiac surgery PGME programs adopt the competency-based curriculum, there is a need for evolution in surgical teaching to meet this more learner-centred and outcome-focused curriculum. There is significant heterogeneity in the cardiac operative experience of residents. This may lead to insufficient training in certain procedures or a delay in achieving entrustable professional activities (EPAs) in many residents. Video-based surgical learning is 1 part of the educational armamentarium that can complement operating room teaching. **Methods:** A modified Delphi consensus process will be used with cardiac surgery staff to develop a 20-point checklist for the safe performance of a median sternotomy and saphenous vein graft harvest. Junior cardiac surgery trainees from across Canada will be randomly assigned to a no-video group or to watch an instructional video of the procedure. Trainees will perform the procedure immediately after video viewing. Senior cardiac surgery residents will assess the participants on the basis of the checklists. Participants will also fill out entry and exit questionnaires on the value of the videos. **Results:** Participants are currently being recruited for this study. **Conclusion:** This study aims to determine the value of a surgical procedure video library in helping cardiac surgery residents achieve practical EPAs. The results of this project will identify needs in the technical skills training of future cardiac surgery residents.

Effect of teaching session on resident's ability to identify anatomic landmark and ACL footprint: a 3D model study. *Carl Laverdiere, Eric Harvey, Justin Schupbach, Mathieu Boily, Mark Burman, Paul A. Martineau.* From the McGill University Health Centre, Montreal General Hospital, Montreal, Que. Corresponding author: Paul A. Martineau; paul.martineau@mcgill.ca.

Background: We sought to report the capabilities of residents to identify femoral landmarks and the native anterior cruciate ligament (ACL) footprint before and after a structured formal teaching session performed in fall 2018 as a reflection of overall surgical skills training for orthopedic surgery residents in Canada. **Methods:** Thirteen senior orthopedic residents were asked to identify a femoral landmark and an ACL footprint on 10 3D printed knee models before and after a teaching session. The 3D models were made on the basis of real patients with different anatomic morphology. The training session comprised a 4-hour didactic component and a 3-hour practical component. ImageJ software was used to quantify the measurements, which were then analyzed using descriptive statistics and Student *t* tests. **Results:** Before and after the teaching session, residents attempted to identify a specific anatomic location (bifurcate and

intercondylar ridges intersection) with a mean error per participant ranging from 5.00 to 10.95 mm and from 4.97 to 12.13 mm in magnitude, respectively. Furthermore, before and after the teaching session, residents identified the specific position to perform the surgical procedure (ACL femoral footprint) with a mean error per participant ranging from 4.58 to 8.80 mm and from 3.87 to 11.07 mm in magnitude, respectively. The teaching session resulted in no significant improvement in identifying both the intersection of the bifurcate and intercondylar ridges ($p = 0.9343$ in the proximal-distal and $p = 0.8133$ in the anteroposterior axis) as well as the centre of the femoral footprint ($p = 0.7761$ in the proximal-distal and $p = 0.9742$ in the anteroposterior axis). **Conclusion:** Although a formal teaching session was combined with a hands-on session with real surgical instrumentation and fresh cadaveric specimens, there seemed to be no direct impact on the ability to demonstrate the material taught and improve the performance of senior residents. This puts into question the format and efficacy of present teaching methods. Also, it is possible that the 3D spatial perception required to perform these skills is not something that can be taught effectively through a teaching session or at all. Further investigation into the effectiveness and application of surgical skills laboratories and simulations in improving orthopedic residents' competencies is required.

Development, manufacturing and initial assessment of validity of a 3D printed bowel anastomosis simulation training model. *Katie Oxford, Greg Walsh, Jonathan Bungay, Stephen Quigley, Adam Dubrowski.* From the Memorial University of Newfoundland, St. John's, Nfld. (Oxford, Walsh, Bungay); Eastern Health, St. John's, Nfld. (Quigley); and Ontario Tech University, Oshawa, Ont. (Dubrowski). Corresponding author: Katie Oxford; kpoxford@mun.ca.

Background: It is critical that junior residents are given opportunities to practise bowel anastomosis before performing it on patients. Simulation via 3D printing is an affordable way to provide realistic and reusable intestinal models that can be adapted for laparoscopic anastomosis training, hand sewing and stapling procedures. The aim of this study was to test face and content validity of 3D printed simulators for bowel anastomosis. **Methods:** This model was designed and assembled using desktop 3D printers and silicone solutions. Input from a general surgeon was used to design and assess the validities. Experts ($n = 9$) were asked to perform an anastomosis and provide feedback in the form of a survey assessing face and content validities. **Results:** Experts indicated that the model showed good face and content validities. Specifically, they gave it a score of 3.77/5 for realism (e.g., flexibility and texture of the model). They commented that the model would be improved by adding extra layers to simulate mucosa. They rated it 4/5 for educational value. When asked if the model will be a valuable contribution to simulation-based medical education, participants provided an average rating of 4.1 out of 5. **Conclusion:** Experts found the 3D-printed bowel anastomosis training model to be an appropriate tool for the education of surgical residents, on the basis of the model's texture, appearance and ability to undergo an anastomosis. This model provides an affordable (\$15 production cost) way for surgical residents to learn the important skill of bowel anastomosis. Future research will focus on proving educational efficacy, effectiveness and transfer.

Point of care ultrasound (POCUS) for the diagnosis of testicular torsion: a practical resident curriculum. *Leandra Stringer, Ernest Pang Chan, Frank Myslik, Alex Jiang, Sara Cocco, Gary Brahm, Hassan Razvi, Sumit Dave, Peter Zhan Tao Wang.* From Western University, London, Ont. Corresponding author: Leandra Stringer, leandra.stringer@lhsc.on.ca.

Background: Scrotal Doppler ultrasound (DUS) is an adjunct for the diagnosis of testicular torsion (TT) when clinical assessment is equivocal. Our group found that acquiring a DUS results in a 48-minute delay. POCUS may be used to negate this delay. The purpose of this study was to develop and evaluate a scrotal POCUS curriculum for urology and emergency medicine (EM) residents. **Methods:** Experts from urology, EM and radiology collaborated in a modified Delphi method to design a practical and didactic curriculum for scrotal POCUS to identify TT. The study followed a pre/post/retention design. The Objective Structured Assessment of Ultrasound (OSAUS) scale was used to evaluate competency in scrotal POCUS skills. Residents were also asked to rate their comfort and confidence with scrotal POCUS before and after the curriculum. **Results:** Twenty-four urology ($n = 12$) and EM ($n = 12$) residents participated in a scrotal POCUS curriculum. Pre-post testing showed significant improvements in knowledge (6.3 versus 8.0, $p < 0.001$) among the residents. Residents were more comfortable (pre 0.6 v. post 3.6, $p < 0.001$) and confident (pre 1.0 v. post 2.1, $p < 0.001$) using scrotal POCUS to assess for TT after the curriculum. A 5-point Likert scale was used to assess comfort and a 3-point scale for confidence. These effects were maintained at our assessment 3 months after the curriculum. Lastly, only 1 resident was deemed not competent at scrotal POCUS. Twenty-three residents were deemed competent by our POCUS experts. **Conclusion:** Our scrotal POCUS curriculum was effective and acceptable to both urology and EM residents. The application of this skill may potentially reduce delays in diagnosing TT and improve testicular salvage rates.

Characterizing medication errors on a surgical service: a quality improvement initiative. *Justine Ring, Shannon Zhang, Jesse Maracle, Michelle Methot, Boris Zevin.* From Queen's University, Kingston, Ont. (Ring, Zhang, Maracle, Zevin); and Kingston Health Sciences Centre, Kingston, Ont. (Methot). Corresponding author: Justine Ring; jring@qmed.ca.

Background: Medication prescription errors are a common source of morbidity, accounting for 8%–16% of adverse events on Canadian surgical wards. However, at academic centres where most prescriptions are written by residents, neither the most common types of medication prescription errors or the classes of medications involved have been described. Therefore, our objective was to characterize the type and frequency of medication errors made by surgery residents at an academic hospital. We will then design, implement and evaluate a prescribing curriculum on the basis of these results. **Methods:** We conducted a retrospective observational study examining medication prescription errors collected between July 2018 and June 2019. Pharmacists identified the errors and 2 reviewers extracted the data using a taxonomy of medication prescription errors, which included 31 categories of decision-making (DM) and prescription-writing (PW) errors. Prescribed medications were grouped into 11 general categories. **Results:** There were 1050 medication prescription errors identified. There were significantly more errors related to PW ($n = 615$, 59%) than to DM ($n =$

435, 41%; $p < 0.001$). The most common errors were “not specifying frequency/prn” ($n = 152$, 15%), and “prescribing 1 tab/1 puff of a medication available in more than 1 strength” ($n = 139$, 13%). The most common classes of medications incorrectly prescribed were for gastrointestinal ($n = 116$) and respiratory ($n = 106$) conditions, followed by narcotics ($n = 101$). The highest number of errors occurred in July and the lowest number in November. **Conclusion:** The majority of medication prescription errors made by surgical residents are related to PW rather than medical DM. A curriculum for surgical residents specifically addressing these topics may decrease errors, improving patient safety.

The HIVE: a hackspace for innovation and visualization in education. *Ge Shi, Claudia Krebs.* From the University of British Columbia, Vancouver, B.C. Corresponding author: Ge Shi; shige@alumni.ubc.ca.

Background: Medical education is evolving and we are continuously moving away from approaches focused on didactic lectures and textbooks. Technology is key in developing meaningful didactic resources that can be integrated flexibly into the classroom. Emerging media such as xR (augmented, virtual and mixed reality) technologies afford possibilities for visualization that allow us to tackle difficult challenges. Not only can we develop 3D models of difficult-to-visualize structures such as the brain or pelvis, but we can also develop user interfaces and experiences that are interactive and focused on pedagogical aims. The HIVE is a space where these types of innovative approaches to visualization can be developed with a multidisciplinary team. **Methods:** A multidisciplinary team of students with backgrounds in computer science, engineering, health professions and science came together at the HIVE to create interactive media for medical education. The HIVE provides the space, expertise and access to a wide selection of tools such as 3D printers, 3D scanners, modelling and 3D game-development software. **Results:** This multidisciplinary team leverages the innovation potential of software development pipelines, and the collective experience and knowledge of all team members, to provide solutions to some of the most tricky visualization challenges in medical education. **Conclusion:** Slow creation of innovative resources in medicine may not be due to lack of interest or skill, but rather to the lack of spaces that provide access to expensive tools and expertise required to facilitate production of these powerful resources. When these environments are provided, such as at HIVE, innovation is fast and effective.

Evaluating the suturing ability of medical students through-out clerkship: Does interest in a surgical career influence performance? *Eric Walser, Jake Davidson, Robin Ralph-Edwards, Nathalie Carey, Brendan McNeely, Sarah Jones, Andreana Bütter.* From Western University, London, Ont. Corresponding author: Eric Walser; eric.walser@lhsc.on.ca.

Background: Basic surgical skills training is an essential component of medical student education. The learning experience may differ on the basis of the timing of training and opportunities available. This study examined the change in suturing ability throughout clerkship. **Methods:** This was a prospective cohort study evaluating the

suturing skills of third-year medical students from the Schulich School of Medicine and Dentistry, London campus. Suturing ability was tested at orientation, before the surgery rotation and after the surgery rotation. A validated suturing score was calculated on the basis of time and number of errors. Performance was evaluated in person and by video recording. **Results:** In total, 115 students were enrolled in the study, with 87 having completed all study components to date. The median age was 24 years (interquartile range: 24.0–26.0 yr), half of the students were male (54.8%) and 34.4% desired a surgical specialty before their surgical rotation. There was no significant difference in suturing score between orientation and before the rotation ($p = 0.4282$). However, scores significantly improved from orientation to after the rotation ($p < 0.0001$) and from before to after the rotation ($p < 0.0001$). Clerks who desired a surgical specialty at orientation had significantly higher suturing scores at orientation ($p = 0.0002$) and after the rotation ($p = 0.0073$) than clerks who were not interested in surgery. The ratings of performance between the in-person evaluation and the video recordings were significantly correlated across all 3 time points: orientation ($r = 0.88$; $p < 0.0001$), before the rotation ($r = 0.92$; $p < 0.0001$) and after the rotation ($r = 0.78$; $p < 0.0001$). **Conclusion:** Suturing ability fluctuates throughout clerkship and improves during the surgical rotation. A teaching session before starting surgery may be beneficial.

Critical fail items in third year UGME training: using novel techniques to address knowledge gaps. *Arman Abdalkhani, Geoffrey Blair.* From the University of British Columbia, Vancouver, B.C. Corresponding author: Arman Abdalkhani; dr.a@ubc.ca.

Background: Given the expanse of surgical knowledge transmitted to surgery clerkship students, the authors have determined that certain learning objectives carry more clinical significance than others and could result in potential medical hazards if not understood by clerkship students. The desired outcome of maximizing learning should be balanced within a system that creates safe practising clinicians. The authors have therefore selected several critical fail (CF) learning objectives that carry the highest clinical importance and sought to implement curriculum changes that would increase students' ability to assimilate these objectives. **Methods:** CF items were identified and addressed through a midcycle multiple-choice questionnaire with explanations (MCQE). Results from the corresponding CF questions from the surgical clerkship examination were evaluated before and after the rollout of the midcycle intervention. **Results:** A dramatic increase in the number of students answering CF items was seen after the midcycle intervention was implemented. Before implementation, the average correct score for CF questions was 70%, and after the intervention the average score increased to 82%. **Conclusion:** Identification of CF learning objectives and a directed MCQE to guide the students' study habits resulted in improved examination performance at the conclusion of the surgical clerkship. Further studies and follow-up testing implemented in 12 months will help to reveal if the assimilation of information is long term.

Break out of the classroom: the use of escape rooms as an alternative teaching strategy in surgical education. *Anna Eva Kinio, Laurence Dufresne, Tim Brandys, Prasad Jetty.* From the University of Ottawa, Ottawa, Ont. (Kinio,

Dufresne, Brandys, Jetty); and The Ottawa Hospital, Ottawa, Ont. (Dufresne, Brandys, Jetty). Corresponding author: Anna Eva Kinio; anna.kinio@mail.mcgill.ca.

Background: Escape rooms are immersive games in which participants are locked into a room and required to solve a series of riddles to escape. We postulate that escape rooms can be used as a tool to transform medical learners from passive spectators to active participants. The objective of this study was to implement and assess the impact of a vascular escape room on medical student motivation, satisfaction and engagement in CanMEDS roles. **Methods:** We designed an escape room for medical students combining vascular surgery objectives, knowledge-based problems and technical skills into vascular surgery-themed stations. The data collected included time to escape, CanMEDS roles covered during the activity, a debriefing interview session and a satisfaction survey. **Results:** Thirteen medical students participated in the escape room. Stations tested knowledge and practical skills, including anatomy, ultrasound use and wire manipulation. Despite minimal prior exposure, 92% reported an increased interest in vascular surgery following the experience. Two teams used a collaborative strategy to complete the activity and successfully "escaped" in the given time limit. Following the experience, 83% stated that the experience motivated them to prepare beforehand and consolidated the knowledge they had read. Participants reported that the experience encouraged the use of the CanMEDS communicator and collaborator roles. As well, the majority of students claimed to enjoy the experience and asked that the escape room format be included in the medical curriculum. **Conclusion:** By combining knowledge-based problems, learning objectives, technical skills and CanMEDS themes into the escape room, we have developed a learning platform that may provide an adjunct to traditional didactic lectures.

Can an online module help medical students gain confidence and proficiency in writing orders? *Tishara Wijayanayaka, Jacob Davidson, Andreana Butter.* From Western University, London, Ont.. Corresponding author: Tishara Wijayanayaka; tishara.wijayanayaka@lhsc.on.ca.

Background: The introduction of computerized physician order entry raised concerns about the quality of undergraduate education regarding medical students' ability to learn appropriate patient care and medication orders. An online module, which included an instruction section and 4 mock cases, was created to help surgical clerks practise writing case-based mock orders. **Methods:** This was a randomized controlled trial that included third-year clerks. Order-writing ability was tested using an identical order-writing task (scored out of 40) at the start and end of their surgery rotation. Clerks were randomly assigned to either receive the order-writing module during their rotation or not. **Results:** To date, 37 clerks have completed all study activities and were included in this preliminary analysis. A total of 19 clerks received the learning module and 18 did not. There was no significant difference between groups on age or confidence in completing patient care or medication orders before completing the task. At the start of the study 65% of clerks indicated that they had previous experience writing orders. There was no significant difference in premodule scores between the module group (median score 11.5, interquartile range [IQR] 9.0–14.5) and the

control group (median 12.5, IQR 9.0–16.5; $p = 0.55$). At the end of their surgery rotation, clerks who received the module had significantly higher scores (median 24.0, IQR 13.0–28.5) than clerks who did not receive the module (median 17.0, IQR 12.5–19.5; $p = 0.047$). **Conclusion:** This study demonstrates that an online order-writing module can increase medical clerks' ability to write accurate patient care and medication orders.

Procedural skills training for left-hand dominant medical students. *Dhruv Krishnan, Mebras Motamed, Boris Zevin, Louie Wang, Steve Mann, Andrea Wintbrop.* From Queen's University, Kingston, Ont. Corresponding author: Dhruv Krishnan; kdhruv@qmed.ca.

Background: Left-handed (LH) physicians and trainees cite many unique challenges to which they must adapt. Studies suggest that LH students perform as well as right-handed (RH) students if instructed in an "LH-friendly" environment. The goal of this study was to assess the impact of handedness-specific training in suturing and knot tying in LH preclerkship medical students. **Methods:** LH and RH preclerkship students completed a baseline online survey assessing their confidence in suturing and knot tying. Nineteen students (4 LH, 15 RH) enrolled in a preclerkship surgical skills elective program (SSTEP) were provided handedness-specific training for suturing and knot tying. Their performance was compared with that of 19 participants (3 LH, 16 RH) from previous iterations of SSTEP using an objective structured assessment of technical skills (OSATS) checklist. Interviews were conducted with the 4 LH students after SSTEP. **Results:** Survey results revealed that all LH respondents encountered handedness-related difficulties during medical school, whereas RH students encountered no such challenges. LH students in SSTEP 2019 took significantly longer ($p = 0.024$) to suture. Other comparisons between handedness and SSTEP years revealed no significant differences. LH participants expressed appreciation for the targeted instruction and see themselves as equally capable if equipped with adaptive strategies. **Conclusion:** LH students perceived benefit from handedness-specific training, although quantitative analysis showed no significant effect on performance. We recommend further study with larger sample sizes to evaluate the impact of handedness-specific training on the learning curves of novice learners for acquisition of suturing and knot-tying skills.

Intimidation in perioperative settings: diverging perceptions between hospital staff and trainees. *Léa Marie Meloche-Dumas, Kerianne Boulva, Adam Dubrowski, Michèle Beniey, Camélie Deschamps, Rémi Coignard-Friedman, Saima Hassan, Erica Patocskai.* From Centre hospitalier de l'Université de Montréal, Montreal, Que. (Meloche-Dumas, Boulva, Beniey, Deschamps, Coignard-Friedman, Hassan, Patocskai); and the Ontario Tech University, Oshawa, Ont. (Dubrowski). Corresponding author: Léa Marie Meloche-Dumas; leamarie.meloche@gmail.com.

Background: Despite widespread implementation of policies to address medical student mistreatment, studies continue to report increasing rates of intimidation in hospital settings, with a higher prevalence in surgical departments. Intimidation can have lasting repercussions for surgical trainees and increase medical errors.

We sought to compare perceived definitions of intimidation among medical students, residents and nurses in the surgical field, as well as among consultant surgeons and anesthesiologists, to develop and validate clinical case scenarios that can be used for raising awareness. **Methods:** A sociologist conducted individual interviews with surgical team members in which participants characterized workplace intimidation. Interview reports were analyzed and 8 recurring themes related to intimidation were identified to generate a survey composed of 8 scenarios. Surgical team members were asked to identify which scenario involved intimidation, using a 5-point Likert scale. **Results:** Seventeen participants were interviewed. Among the 188 survey respondents were 77 students, 56 surgeons, 24 residents, 17 nurses and 14 anesthesiologists. Two scenarios suggested discrepancy in surgical staff's perceptions of intimidation. In a scenario that depicts a surgeon speaking abruptly to an operating room nurse during a critical stage of a surgery, the respondent's age, role in the surgical team, teaching status and interest in a surgical career had a significant impact on their rating of intimidation ($p < 0.001$). Specifically, in this scenario, older surgeons rated less intimidation than a novice nurse. **Conclusion:** These findings suggest that a gap may exist between surgical team members and could result in diverging perceptions of intimidation. Our scenarios could be used as tools in simulation-based education programs.

Use of a smartphone application in the surgical clerkship rotation: perceptions and opinions of medical students. *Nathalie Carey, Jacob Davidson, Bandeep Kaur, Andreana Butter.* From Western University, London, Ont. Corresponding author: Nathalie Carey; ncarey2016@meds.uwo.ca.

Background: The transition from the preclinical years of medical school to the clinical, or clerkship, years is a critically intense learning period. The use of targeted clerkship orientation and handbooks can improve preparedness. To our knowledge, there are no data on transitioning the clerkship handbook to a smartphone application (app) and its effect on usage or the medical student experience. **Methods:** A new app was created, which was based on the previous printed handbook, with improved navigability and ease of usage. All third-year medical students were granted access to the app during clerkship orientation. At the end of their surgery rotation, they were given a questionnaire as well as the option to participate in a focus group. **Results:** Among our clerkship students, 93% used their smartphone for a variety of different medical apps. Initial feelings toward our app were encouraging, with 54% of students expressing positive feelings and 35% reporting the app improved their level of preparedness. Usage of the app was highest at the beginning of the surgery rotation, but a third of students never used the app. The "Things to Know" section of the app was the most used; it contained information on writing medical orders and common surgical postoperative issues. Barriers to use were a difficult interface and lack of Internet access. Overall, 90% would recommend the use of this app. **Conclusion:** Although medical students had mostly positive feedback on the content of our app, improvements to the interface and additional content are required for its next iteration.

A preclerkship procedural curriculum for future Canadian medical education: a pilot study. *Frank Battaglia, Maria*

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Background: Procedural skills training during preclerkship varies significantly across Canadian medical schools. There is currently no standardized program or evaluation tool to guide and assess medical student performance of procedural skills. This project therefore aims to develop a training program for second-year medical students using a flipped-classroom, near-peer model of education. We predict decreased student anxiety and increased confidence in procedural skills performance, ultimately facilitating the transition of medical students into clerkship. **Methods:** Twelve second-year medical students participated in the study, each of whom completed a State-Trait Anxiety Inventory Questionnaire and a Confidence Questionnaire before training. Over a 5-month period, students participated in 4 skill training sessions taught by expert physicians. At each session, students learned a new skill while having the opportunity to practise all previously learned skills. Anxiety and confidence questionnaires were repeated after the program. **Results:** There was a significant decrease in mean anxiety in the program group ($n = 12$) from before the program to after the program (2.48 to 1.74, $p < 0.01$). Students in the program also showed increased self-assessed knowledge and confidence in suturing (7.75 to 17.25, $p < 0.01$), intravenous insertion (6.71 to 18.29, $p < 0.01$) and local anesthesia (6.71 to 18.29, $p < 0.01$). No significant changes in anxiety or confidence were observed in the control group ($n = 4$). **Conclusion:** Integration of a pre-clerkship procedural skills training program within Canadian medical school curricula provides students with a technical foundation for further learning in clerkship, thus easing student anxiety and improving confidence for an easier transition into clerkship and optimal patient care.

Surgical Skills and Technology Elective Program (SSTEP): success of a student-run program. *Juliana Sunavsky, Charlotte Coleman, Andrea Winthrop, Steve Mann.* From Queen's University, Kingston, Ont. Corresponding author: Juliana Sunavsky; sjuliana@qmed.ca.

Background: The Surgical Skills and Technology Elective Program (SSTEP) is an entirely student-conceived, student-run, week-long program offered to second-year medical students. SSTEP aims to enhance the core curriculum by facilitating learning of foundational surgical skills, before students transition to clerkship. Now in its sixth year, SSTEP has undergone multiple changes to continuously meet student needs and further enhance learning. **Methods:** The student team consists of 2 directors, 1 finance lead, 1 research lead and 1 first-year member, facilitating transition planning, continuity and ongoing yearly improvement. Support from university faculty and the dean has permitted SSTEP to receive external funding through alumni donors, thus creating a more sustainable program. To promote mentorship, a safe learning environment and more one-on-one instruction for students, residents have been included in leading workshops.

Educational research is an integral component, promoting SSTEP's academic mission. SSTEP is now an academic enrichment program (AEP), allowing interested students to receive formal recognition on their dean's letters upon completion of a culminating project related to surgical education. **Results:** Through effective fundraising efforts, university support and strategic planning, SSTEP was able to double enrolment, while cutting costs by half. There have been numerous scholarly presentations at the Canadian Conference on Medical Education and 2 SSTEP publications. The newly approved AEP has encouraged students to engage with surgical education literature and research initiatives. **Conclusion:** The structure of SSTEP's team encourages the development of student leadership skills, while longitudinal planning has ensured SSTEP's ongoing success as an enrichment program that facilitates student transition into clerkship.

The influence of undergraduate medical education cadaveric dissection exposure on choice of surgical specialty: a national survey of Canadian surgical residents. *Tyler McKechnie, Jeremy Springer, Aristithes Doumouras, Travis Schroeder, Cagla Eskicioglu, Susan Reid.* From McMaster University, Hamilton, Ont. (McKechnie, Springer, Doumouras, Schroeder, Eskicioglu, Reid); St. Joseph Healthcare, Hamilton, Ont. (Doumouras, Eskicioglu); and Juravinski Hospital, Hamilton, Ont. (Reid). Corresponding author: Tyler McKechnie; tyler.mckechnie@medportal.ca.

Background: The number of Canadian Resident Matching Service (CaRMS) applicants ranking surgical specialties as their first choice has declined over the past 20 years. Concurrently, there has been a reduction in the number of hours spent teaching undergraduate medical education (UGME) anatomy, particularly with cadaveric dissection. The aim of this study was to determine the factors that had the most impact on selecting a surgical specialty, with specific focus on the impact of UGME anatomy training. **Methods:** A 36-item, bilingual cross-sectional survey was designed by experts in medical education. It was distributed to all current surgical residents in Canada. Responses were recorded using a 5-point Likert scale or list ranking. Univariable outcomes were analyzed with a t test for continuous outcomes and χ^2 test for dichotomous outcomes. **Results:** Two hundred and twenty-eight surgical residents responded to the survey (15.27% response rate). Experiences on core rotations, elective rotations and mentorship were cited as the most important factors in deciding to pursue surgical residency. Anatomy training with or without cadaveric dissection was moderately influential in residents' first-choice CaRMS discipline (5-point Likert score: 2.97 and 2.87, respectively), with cadaveric dissection having the greatest impact on learning. General surgery residents' CaRMS applications were more likely to have been influenced by UGME anatomy training ($p = 0.0003$). The impact of UGME anatomy did not vary between postgraduate years and gender. **Conclusion:** Canadian surgical residents' decision to apply to a surgical specialty did not seem to be strongly influenced by their UGME anatomy training, but rather by factors such as clinical experience and surgical mentorship. Further evaluation of groups that were more positively affected by their UGME anatomy training, such as general surgery and orthopedic surgery residents, may elicit strategies to enhance medical students' interest in surgery.