Canadian Journal of Surgery

Journal canadien de chirurgie

Post-Pandemic and Beyond
Virtual Conference Abstracts

CONFÉRENCE CANADIENNE POUR L'AVANCEMENT DE L'ÉDUCATION CHIRURGICALE

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CANADIAN CONFERENCE FOR THE ADVANCEMENT OF SURGICAL EDUCATION

Abstracts

Blended learning using augmented reality glasses during the COVID-19 pandemic: the present and the future. *Zeeshan Ahmed, Brian Fahey, Adeel Zafar, Amy P. Worrall, Elrasheid Kheirelseid, Seamus McHugh, Daragh Moneley, Peter Naughton.* **From the Beaumont Hospital, Royal College of Surgeons in Ireland, Dublin, Ireland. Corresponding author: Zeeshan Ahmed; doczeeshan@msn.com**

Background: The COVID-19 pandemic has caused major disruption to a normal way of life. It has also affected medical education, and traditional methods of delivering learning have not been possible because of various restrictions. We devised novel methods of teaching and endeavoured to provide as much clinical exposure as possible to medical students, keeping the safety of all parties involved paramount. **Methods:** We incorporated augmented reality glasses into our teaching to provide clinical exposure to final year medical students. Most students were present in a remote location while the teaching was imparted. Following the teaching sessions, students were emailed a survey requesting their feedback on the experience. Statistical analysis of the responses was done to formulate an objective assessment of the effectiveness of the blended learning. **Results:** The overall response was satisfactory, with the majority of students satisfied with the new techniques. There were reservations regarding technological setbacks we experienced with the equipment and delivery. It was also noted that most students preferred ward-based traditional teaching compared to augmented reality learning. **Conclusion:** We concluded that augmented reality blended learning provides an alternate to traditional teaching, especially at times when the latter is not logistically feasible. There is scope for further utility of this technology in medical education, and further trials and refinements are necessary to make its use widespread.

Activating emotions enhance surgical simulation performance: a cluster analysis. *Clarissa H.H. Lau, Ali M. Fazlollahi, Mohamad Bakhaidar, Ahmad Alsayegh, Recai Yilmaz, Rolando F. Del Maestro, Jason M. Harley.* **From McGill University, Montreal, Que. (Lau, Fazlollahi, Bakhaidar, Alsayegh, Yilmaz, Del Maestro, Harley); and the Research Institute of the McGill University Health Centre, Montreal, Que. (Harley). Corresponding author: Clarissa Lau; clarissa.lau@mail.mcgill.ca**

Background: Bimanual psychomotor skills are essential to surgical education, therefore medical trainees require multiple opportunities to master their skills. However, developing these technical skills can be a highly stressful and emotional experience. Therefore, we sought to investigate the impact of emotions on performance outcomes in surgical simulation training through the following research questions. Do emotions measured at baseline group students in a meaningful way? Do students' membership in emotion groups predict students' change in performance? **Methods:** Participants completed 5 practice simulated brain tumour resections followed by 1 realistic virtual reality simulated brain tumour resection; after each simulation, an expertise score was generated. Students also completed a survey on emotions prior to simulations. We used a multivariate clustering approach to group students by their emotions and then conducted regression analysis to examine the predictive relationship between emotion groups and performance change. **Results:** Seventy-two medical students participated in the study. Cluster analysis identified 3 distinct emotion groups: high positive- and negative-activating emotions (group 1, n = 31), high positive-activating and -deactivating emotions (group 2, n = 22), and low emotions (group 3, n = 19). Regression analysis revealed membership in group 1 significantly predicted positive performance change from fifth practice expertise score to sixth realistic simulated tumour resection expertise score (R^2 = 0.05, $F_{1,70}$ = 4.023, p = 0.049). **Conclusion:** Our study showed that students who experienced more activating emotions tended to show positive performance change as they shifted from practice to realistic simulations. Students' emotions should be considered during surgical simulation to promote better learning and transfer of skills.

Training in soft-tissue resection using real-time visual computer navigation feedback from the Surgery Tutor: a randomized controlled trial. *Meredith Poole, Tamas Ungi, Gabor Fichtinger, Boris Zevin.* **From McMaster University, Hamilton, Ont. (Poole); and Queen's University, Kingston, Ont. (Ungi, Fichtinger, Zevin). Corresponding author: Meredith Poole; meredith.poole@medportal.ca**

Background: In competency-based medical education (CBME), surgery trainees are often required to learn procedural skills in a simulated setting before proceeding to the clinical environment. The Surgery Tutor computer navigation platform allows for real-time proctorless assessment of open soft-tissue resection skills; however, the use of this platform as an aid in acquisition of procedural skills is yet to be explored. **Methods:** In this prospective randomized controlled trial, 20 final-year medical students were randomized to receive either training with real-time computer navigation feedback (intervention group, n = 10) or simulation training without navigation feedback (control group, n = 10) during resection of simulated nonpalpable soft-tissue tumours. Real-time computer navigation feedback allowed participants to visualize the position of their scalpel relative to the tumour. Computer navigation feedback was removed for postintervention assessment. The primary outcome was the positive margin rate. Secondary outcomes were procedure time, mass of tissue excised, number of scalpel motions and distance travelled by the scalpel. **Results:** Training with real-time computer navigation resulted in a significantly lower positive margin rate compared with training without navigation feedback (0% v. 40%, p = 0.025). All other performance metrics did not differ significantly between the groups. Participants in the intervention group showed significant improvement in positive margin rate from baseline to final assessment (80% v. 0%, $p < 0.01$), whereas participants in the control group did not. **Conclusion:** Real-time visual computer navigation feedback from the Surgery Tutor resulted in superior acquisition of procedural skills than training without navigation feedback.

SonoGames: delivering a point of care ultrasound curriculum through gamification. *Danielle Arshinoff, Eva Stolz.* **From the Royal College of Surgeons in Ireland, Dublin, Ireland. Corresponding author: Danielle Arshinoff; daniellearshinoff@gmail.com**

Background: Point of care ultrasonography (POCUS) is a topic of interest for medical students, but many medical schools do not address it despite its common use in patient assessment and residency. We aimed to address this educational gap during the COVID-19 pandemic using methods effective in resident teaching. **Methods:** A prospective cohort study (Sept. 1, 2020 to Apr. 30, 2021) was performed to determine if an extracurricular, online, student-led POCUS curriculum delivered to clinical-year medical students was effective in terms of student performance, confidence in their POCUS skills, and appreciation of the course. **Results:** Eighteen students at our institution participated in an 8-month extracurricular, online POCUS curriculum. Nine students completed the end-of-curriculum internal competition, which assessed student performance. On average, participants correctly answered 2.9 POCUS questions per minute, obtained 33.4/40 points available (83.4%) interpreting POCUS videos, and attained a score of 7.8/10 during virtual simulations. Judges assessed participants on their POCUS knowledge, including indications and protocols, pathological signs and artifacts, probe placement, scanning method, video interpretation, and patient management. Student appreciation of the course and confidence in their POCUS skills was assessed on an interval scale in a post-course survey. Student appreciation was assessed through their perceived improvements in their POCUS knowledge (8.9/10) and skills (7.6/10). Students' confidence in their POCUS skills was assessed on multiple POCUS aspects (overall 7.3/10). **Conclusion:** This prospective cohort study showed that an extracurricular, student-led curriculum delivered electronically in accordance with governmental and institutional COVID-19 regulations was effective for teaching students the basics of POCUS.

Teaching heart valve surgery techniques using simulators: a review. *Ryaan El-Andari, Sabin J. Bozso, Jimmy J.H. Kang, Corey Adams, Jeevan Nagendran.* **From the University of Alberta, Edmonton, Alta. (El-Andari, Bozso, Kang, Nagendran); and the University of Calgary, Calgary, Alta. (Adams). Corresponding author: Ryaan El-Andari; elandari@ualberta.ca**

Background: The apprentice model has been the primary method of teaching cardiac surgery trainees. Limitations of the apprentice model include insufficient time to learn all necessary skills, minimal exposure to rare cases, complex repair techniques, limited number of patients in small centres, high cost, and absence of objective measures of feedback. In recent years, simulation-based training (SBT) has been used to address the gaps left by the apprentice model. **Methods:** This review aimed to summarize the current literature regarding the use of SBT for trainees learning surgical valve repair and replacement techniques. PubMed was searched for all articles investigating the use of SBT in teaching surgical valve techniques published in 2020 or earlier. Data showing the impact of SBT on time to completion of tasks, number of mistakes, skills scores, and theoretical knowledge were compiled in this study. **Results:** Studies that evaluated the outcomes after SBT showed significant improvement in time to completion of tasks, number of mistakes, skills scores, and theoretical knowledge after participation in SBT. **Conclusion:** In recent years, SBT has become increasingly prevalent and has shown a remarkable ability to improve the surgical skills of trainees in a relatively short period of time. As hands-on experience in the field of cardiac surgery is invaluable and often difficult to reproduce effectively, it is likely that a combination of hands-on training and SBT will be adopted to provide optimal exposure for surgical trainees.

Portable, adjustable simulator for cardiac surgical skills. *Abigail White, Dongjun Li, Simon R. Turner, Michael C. Moon, Bin Zheng.* **From the University of Alberta, Edmonton, Alta. Corresponding author: Abigail White; awhite2@ualberta.ca**

Background: A recent needs assessment on use of simulation in Canadian cardiac surgery programs identified the desire for a coronary artery bypass and aortic valve replacement model for trainee home practice. Practising at home increases training opportunities for residents; it also allows for self-paced practice that can maximize training outcomes. The goal of the study was the production and validation of a portable and adjustable simulator for cardiac surgical skills. **Methods:** Intraoperative patient measurements were taken to recreate a chest cavity that resembles the mediastinal constraints of a patient undergoing coronary artery bypass and aortic valve replacement. An aortic root model was created using 3D printing and silicone casting. The model was created by segmenting patient computed tomography scans. The face and content validity of the entire model was evaluated by cardiac surgeons. **Results:** An adjustable, portable chest cavity was created using plexiglass. Three levels of adjustability were created: size of the incision, depth of the chest, and relative position of coronary arteries and aortic valve annulus within the chest. A 3D silicone model of aortic root and coronary vessels was produced. Coronary artery anastomosis and aortic valve replacement were performed by a content expert, and participants evaluated the model with high face and content validity as an educational training tool. **Conclusion:** We produced a cost-effective, patient-specific, adjustable simulator for training in coronary artery bypass and aortic valve replacement. The next step will be to prove the construct validity of our model.

Design and validity evidence for a unique endoscopy simulator using a commercial video game. *Garrett Johnson, Ashley Vergis, Bertram Unger, Jason Park, Lawrence Gillman.* **From the University of Manitoba, Winnipeg, Man. Corresponding author: Garrett Johnson; umjoh529@myumanitoba.ca**

Background: Procedural simulation enhances early endoscopy training. Multiple commercial endoscopic simulators are available; however, their application is limited by cost and poor user compliance. First-person shooter (FPS) video games are popular. Our aim was to show that a novel colonoscope controller designed in house and used to play an FPS video game shares similar constructs with real-life endoscopy. **Methods:** Participants completed the first 3 levels of an FPS video game (Portal Valve Corporation, Bellevue, WA), first using a conventional controller and then using the modified endoscope controller. Twelve expert

endoscopists and 12 surgical residents with minimal endoscopy experience participated. Participants were evaluated based on completion time, number of button presses, and hand motion analyses. **Results:** Experts outperformed novices for time to study completion (expert 944 seconds v. novice 1515 seconds; $p = 0.006$) and number of hand movements (expert 1263.1 v. novice 2052.6; $p = 0.004$) using the novel colonoscope controller. There was no difference in number of button presses or total path length travelled. Performance did not differ using conventional game controls. **Conclusion:** Experts outperform novices using the endoscope but not the conventional controller with respect to economy of movement and completion time. This result confirms that our endoscope-controlled video game shares similar constructs with real-life endoscopy and serves as a first step toward creating a more enjoyable and cheaper alternative to commercially available endoscopy simulators.

Comparison of a novel silicone flexor tendon repair model to a porcine tendon repair model. *Veronique M. Doucet, Christian J. Petropolis.* **From the University of Manitoba, Winnipeg, Man. Corresponding author: Veronique Doucet; doucetv@myumanitoba.ca**

Background: Surgical simulation has become an important component of plastic surgery residency. Several animal and synthetic flexor tendon repair simulators have been described, with variable levels of simulator fidelity and realism. The purpose of this study was to determine the effectiveness of a novel silicone flexor tendon repair model in comparison to a porcine tendon repair model. **Methods:** A pilot study was completed to compare our flexor tendon repair model and a porcine tendon repair model. The flexor tendon repair model was created using polypropylene fibres bound in cured silicone with a Shore A Hardness of 2. Deep flexor tendons were harvested from porcine forelimbs. Participants tested the models by completing core and epitendinous tendon repairs. The models were evaluated with a questionnaire consisting of identical 5-point Likert scale questions and a comment section. **Results:** Nine plastic surgery residents and 3 plastic surgeons participated in the study. Simulation realism was 3.9/5 for the silicone model and 4.6/5 for the porcine model ($p = 0.001$). Educational utility was 4.6/5 for the silicone model and 4.6/5 for the porcine model ($p = 0.546$). Overall, the silicone model scored 4.3/5 and the porcine model 4.6/5 ($p = 0.078$). **Conclusion:** We created a moderate-fidelity tendon repair model that is convenient to use, easily reproducible, and of equal educational utility to a porcine model based on our pilot study results. This model has considerable potential for simulation learning in postgraduate surgical education. Further validation is required to confirm its efficacy in resident education and skill transfer to the operating room.

Assessment system using deep learning. *Recai Yilmaz, Alexander Winkler-Schwartz, Nykan Mirchi, Ali Fazlollahi, Sharif Natheir, Rolando Del Maestro.* **From the Neurosurgical Simulation and Artificial Intelligence Learning Centre, The Montreal Neurological Institute and Hospital, McGill University, Montreal, Que.. Corresponding author: Recai Yilmaz; recai.yilmaz@mail.mcgill.ca**

Background: In procedural-based medicine, technical ability is a critical determinant of patient outcomes. Psychomotor performance occurs in real-time, hence a continuous assessment is necessary to provide action-oriented feedback and error avoidance guidance. Current continuous technical skill assessment systems are lacking expert performance-based assessment and accurate detection of trainee skills. This study outlines the development of a deep learning application for continuous monitoring of surgical technical skills and predictive validation on surgical trainee performance who are at different training stages. **Methods:** Fifty participants from 4 expertise levels (14 experts/neurosurgeons, 14 senior residents, 10 junior residents, 12 novices/medical students) performed a simulated tumour resection 5 times and a complex simulated brain tumour operation once on the NeuroVR simulation platform. A deep neural network was built using neurosurgeon and medical student data, learning the composites of expertise comparing expert and novice skill levels. **Results:** The trained algorithm continually tracked the surgical performance utilizing 16 performance metrics generated and provided an expertise score every 0.2 seconds. The average performance score was statistically compared among 4 expertise levels and differentiated trainee performance from expert and novice level performance. It also provided a differentiation between trainee levels, with the performance score correlated with the year of training in surgery. **Conclusion:** This work, to our knowledge, is the first technical skills continuous assessment application built using expert surgeon data, with predictive validity on surgical trainee performance. AI-powered surgical simulators offer a generalizable and objective continuous assessment of surgical bimanual skills in the aid of competency-based approach in surgery.

Challenges addressed with solutions, simulation in undergraduate and postgraduate surgical education, innovative education or research in surgical education. *Ge Shi, Edward Wang, Ryan Waterman, Andrew Kokavec, Edward Ho, Kiera Harnden, Rahul Nayak, Richard Malthaner, Mehdi Qiabi.* **From Western University, London, Ont. (Shi, Wang, Waterman, Kokavec, Ho, Harnden, Nayak, Malthaner, Qiabi); and London Health Sciences Centre, London, Ont. (Shi, Nayak, Malthaner, Qiabi). Corresponding author: Ge Shi; Ge.Shi@lhsc.on.ca**

Background: New extended reality (XR) technologies (augmented, mixed, and virtual realities) are increasingly utilized to enhance surgical education. We describe the development and validation of the first interactive MR Thoracic Surgical Anatomy Atlas. **Methods**: We obtained a deidentified computed tomography scan of the thorax from The Cancer Imaging Archive and used segmentation and development software to create our application for Microsoft's HoloLens 2, an MR platform. Medical students and residents were recruited and guided through a 20-minute session. An anonymous modified Michigan Standard Simulation Experience Scale questionnaire (5-point Likert scale) assessing the application was administered. Parametric and non-parametric statistical analyses were performed. **Results:** Thirty-seven volunteers were included (ages 23–34 yr; M/F = 16/21). The device was felt to be safe (100%), and did not cause nausea (92%) or eye strain (92%).

Nearly all would recommend the application (97%). Eighty-four percent felt increased motivation to study with XR compared to conventional methods, and 94% thought it was an asset for learning anatomy. MR was the second preferred approach to learning anatomy after cadaveric dissection. Pregraduate learners enjoyed the application (5.0 v. 4.7, $p = 0.023$) and felt it was an asset for teaching (5.0 v. 4.5, $p = 0.005$) more than postgraduate learners. Surgical residents felt the device was more comfortable (4.7 v. 3.7, $p = 0.018$) and were more likely to use it for more than 15 minutes (4.8 v. 3.5, $p = 0.01$) than nonsurgical residents. **Conclusion:** We showed the successful development and validation of an MR Thoracic Surgical Anatomy Atlas as a comfortable and desirable modality for learning thoracic anatomy.

Machine learning distinguishes between skilled and less-skilled psychological performance in virtual neurosurgical performance. *Sharif Natheir, Sommer Christie, Recai Yilmaz, Alexander Winkler-Schwarz, Khalid Bajunaid, Abdulrahman J. Sabbagh, Penny Werthner, Rolando Del Maestro. From the Neurosurgical Simulation and Artificial Intelligence Learning Centre, McGill University, Montreal, Que. (Natheir, Christie, Yilmaz, Winkler-Schwarz, Del Maestro); and the Department of Surgery, College of Medicine, University of Jeddah, Jeddah, Saudi Arabia. Corresponding author: Sharif Natheir; sharifnatheir@gmail.com*

Background: Virtual reality surgical simulators have facilitated surgical education by providing safe training environments. Electroencephalography (EEG) has been used to assess neural activity during surgical performance. Machine learning (ML) has been applied to analyze EEG data split into frequency bands. We hypothesized that ML could distinguish between skilled and less-skilled surgeons based on EEG recordings. **Methods:** Twenty-one participants performed 3 simulated brain tumour resection procedures on the NeuroVR platform (CAE Healthcare, Montreal, Que.) while EEG data were recorded. Participants were divided into less-skilled (medical students and postgraduate year [PGY] 1–3) and skilled (PGY4+) groups. Thirteen EEG frequency band metrics (e.g., alpha, beta, theta:beta ratio) were generated and statistically compared across expertise groups. ML models were trained using these metrics to differentiate between skilled and less-skilled groups. Metrics were arranged in order of importance using model interpretability methods. **Results:** An artificial neural network achieved a testing accuracy of 100% (area under the receiver operating characteristic = 1.0). Model interpretation identified low alpha (8–10 Hz), which is associated with neural efficiency, as the most important metric for classifying expertise, with skilled surgeons exhibiting higher low alpha than those who were less skilled ($p = 0.044$). Furthermore, skilled surgeons displayed significantly lower theta:beta ratios ($p = 0.048$) and significantly higher beta (13–30 Hz, $p = 0.049$), beta1 (15–18 Hz, $p = 0.014$), and beta2 (19–22 Hz, $p = 0.015$), which are associated with technical expertise, attention, memory formation, and anxiety, respectively. **Conclusion:** This novel methodology elucidates the psychological profile of expert surgeons and the relative contribution of each EEG band to expertise, allowing the development of a neurofeedback protocol for surgical training.

A powerful new tool for learning anatomy as a medical student. *Jonathan Hampshire, Ioana Bratu, Michelle Noga. From the University of Alberta, Edmonton, Alta. (Hampshire, Bratu, Noga); and Stollery Children's Hospital, Edmonton, Alta. (Bratu, Noga). Corrresponding author: Jonathan Hampshire; jdhampsh@ualberta.ca*

Background: In this study we describe a medical student's learning through creating 3D virtual models of abdominal tumours and surrounding structures in pediatric patients using preoperative imaging data. We also relate the experience of this student from first receiving the patient data to finally observing the surgery. **Methods:** The student used 3D segmentation software to highlight and colour-code the tumour and relevant arteries, veins, and abdominal organs from patient imaging data to present the resulting virtual and 3D-printed models to the surgeons and patients preoperatively. **Results:** The student described their knowledge of imaging interpretation as being very limited before the 3D segmenting exercises. The student can now readily identify abdominal structures, predict their locations in space relative to other structures and recognize abnormalities and variations among patients. They also learned how surgeons use imaging and the new models to plan surgeries. They recounted the positive reaction by a patient's family when presented preoperatively with a 3D-printed model of the patient's liver mass and how it facilitated a discussion about the patient's anatomy. The student was then able to observe the resection of the tumour and connect what they saw from the imaging to live patient anatomy. **Conclusion:** Medical students currently rely on anatomical illustrations and cadaveric dissections to learn anatomy. Unfortunately, medical students have limited experience with identifying anatomy from imaging data. Creating 3D virtual models can help students develop an intimate understanding of anatomy and prepare them for medical practice by improving their ability to interpret imaging.

Development and effectiveness of a telementoring approach for neurosurgical simulation training of medical students. *Ali M. Fazlollahi, Mohamad Bakhaidar, Ahmad Alsayegh, Alexander Winkler-Schwartz, Jason M. Harley, Rolando F. Del Maestro. From the Neurosurgical Simulation and Artificial Intelligence Learning Centre, Montreal, Que. (Fazlollahi, Bakhaidar, Alsayegh, Winkler-Schwartz, Del Maestro); and McGill University, Montreal, Que. (Fazlollahi, Bakhaidar, Alsayegh, Winkler-Schwartz, Harley, Del Maestro). Corresponding author: Ali M. Fazlollahi; ali.fazlollahi@mail.mcgill.ca*

Background: Lack of surgical apprenticeship caused by the COVID-19 pandemic has limited learners' preparation for residency and may impair their psychomotor competence. Using virtual reality simulation and videotelephony technology, we designed a telementoring opportunity for medical students interested in surgery to receive expert coaching for technical skill acquisition. The following report outlines this innovative approach and investigates its effectiveness. **Methods:** In a 3-week workshop, senior neurosurgery residents were trained to teach brain tumour resection techniques using the Objective Structured Assessment of Technical Skills (OSATS) rating scale and the

Promoting Excellence And Reflective Learning in Simulation (PEARLS) debriefing guide for assessment and feedback, respectively. Medical students were recruited to participate in neurosurgical simulation training. Participants performed 5 tumour resections for practice and 1 complex tumour resection for skill evaluation. The intervention's effectiveness was measured and compared with a no-feedback control grroup using the final resection's blinded OSATS rating in a randomized controlled trial. **Results:** Good interrater reliability (intraclass correlation coefficient = 0.84) was achieved, and the OSATS scale demonstrated good internal consistency ($\alpha = 0.82$). Forty-seven medical students from 4 institutions were randomly assigned to instructor ($n = 23$) and control ($n = 23$) groups. In the instructor group, live on-screen performance of participants was assessed remotely with verbal debriefing provided upon completion of each practice resection. No performance assessment or feedback was provided to the control group. Blinded OSATS assessment showed that instructor feedback significantly enhanced respect for tissue ($p = 0.027$), economy of movement ($p = 0.024$), and instrument handling ($p = 0.012$). **Conclusion:** Residents were engaged in providing effective assessment and feedback in remote-based simulation training for undergraduate medical students.

A team based learning approach to general otolaryngology in undergraduate medical education. *Fatemeh Ramazani, David Côté.* **From the University of Alberta, Edmonton, Alta. (Côté); and the University of Calgary, Calgary, Alta. (Ramazani). Corresponding author: Fatemeh Ramazani; framazan@ucalgary.ca**

Background: Otolaryngology – head and neck surgery (Oto-HNS) exposure is known to be deficient in undergraduate medical education (UGME) across Canada despite the fact that 20%–50% of primary care patient concerns are linked to Oto-HNS. Team-based learning (TBL) is a whole-class interactive teaching approach using cooperative learning, real-time feedback, and reciprocal teaching. This approach encourages students to discuss challenging clinical cases in small groups, followed by large class discussions facilitated by a content expert; it allows for immediate application and assimilation of knowledge. These discussions are preceded by directed pre-session review material as well as pre-session Individual readiness assurance (IRAT) and Group readiness assurance (GRAT) tests ensuring that all learners have a baseline understanding of the concepts that will be covered during the session. This study aimed to develop a TBL session designed to provide medical students with an approach to common Oto-HNS presentations in general practice. **Methods:** In phase I, family physicians identified common primary care Oto-HNS presentations, clinical scenarios, and corresponding assessment questions. Content was validated by literature review and consultation with staff otolaryngologists, then reassessed by family physicians for clarity and relevance. Phase II involved piloting the TBL session with 162 medical students, with pre- and post-session questionnaires assessing students' level of comfort with the content covered during the session. **Results:** We developed a 2-hour TBL session that increased students' perceived comfort with approaching common Oto-HNS presentations in primary care. **Conclusion:** TBL is an easily reproducible tool that's proven to help address deficiencies in Oto-HNS competencies at the UGME level.

Student-led surgery interest group outreach for high school mentorship: a diversity driven initiative. *Lina Elfaki, Lukas Mortensen-Truscott, Sean McKellar, Dan Budiansky, Michael Lee.* **From the University of Toronto, Toronto, Ont. Corresponding author: Michael Lee; michaelh.lee@mail.utoronto.ca**

Background: Social capital, mentorship, representation, institutional racism, and finances are systemic barriers for underrepresented groups applying to medical school. We can foster high school students' interest for medicine and surgery, but they may be disadvantaged in regards to a host of skills beneficial for a successful medical school application. These inequities are further exacerbated during the pandemic shift to online learning and loss of opportunities. **Methods:** The University of Toronto Surgery Interest Group developed an equity, diversity and inclusivity–focused working group. With the Toronto District School Board, through the Specialist High Skills Major Program (SHSM), we hosted 2 sessions ($n = 45$ students) for schools in racialized and lower socioeconomic status neighbourhoods. We provided interactive sessions on the CanMEDS roles, curriculum vitae development, and scientific literature interpretation. These were small-group scenario-based activities followed by large-group discussions. **Results:** We provided students with a credited session for their SHSM diploma. The interactive teaching of multiple classes located in different areas allowed for informal mentorship and skill-building. These skills are useful for the pursuit of a scientific undergraduate degree as well as for a competitive medical school application. The feedback from the students and teacher organizers were extremely positive, with both groups enjoying the workshops and requesting additional sessions. **Conclusion:** Promoting diversity within the surgical fields begins when students are considering career paths. Medical students preparing for residency should be aware of inequities and equipped to address them. Volunteering at a grassroots level is a privilege for future surgeon leaders and a responsibility in medical education.

Retrospective evaluation of novel case-based teaching series for first year otolaryngology residents. *Lily Wang, Jessica Henley, Justine Philteos, Alexander Gabinet-Equihua, Garret Horton, Marc Levin, Ahmed Saleem, Eric Monteiro, Vincent Lin, Yvonne Chan, Paolo Campisi.* **From the University of Toronto, Toronto, Ont. (Wang, Philteos, Gabinet-Equihua, Horton, Levin, Saleem, Monteiro, Lin, Chan, Campisi); Mount Sinai Hospital, Toronto, Ont. (Monteiro); Sunnybrook Health Sciences Centre, Toronto, Ont. (Lin); The Hospital for Sick Children, Toronto, Ont. (Campisi); and St. Michael's Hospital, Toronto, Ont. (Chan). Corresponding author: Lily Wang; lily.wang@mail.utoronto.ca**

Background: First-year resident physicians began training in July 2020 in an environment of decreased clinical case exposure and increased feelings of discomfort because of the COVID-19 pandemic. To improve specialty learning, the University of Toronto Department of Otolaryngology – Head and Neck Surgery piloted a novel virtual case-based teaching intervention for first-year residents. **Methods:** A weekly virtual resident-led case-based discussion series was designed. Six residents and 4 staff otolaryngologists participated. A Likert-type survey administered

retrospectively evaluated the effect on resident confidence. The survey rated participant comfort level on a scale of 1 to 5, from "not well prepared or comfortable" to "very well prepared or comfortable," in 7 different areas at the beginning of postgraduate year (PGY) 1 in July 2020, and in April 2021. Qualitative data collected assessed strengths and weaknesses of the intervention. **Results:** Residents reported increased comfort level in all areas assessed, including overall emergency department consults, inpatient consults, and specific epistaxis consults by 28%; triaging consults and addressing peritonsillar abscess consults by 24%; addressing pediatric otolaryngologic and airway concerns by 20% each; and addressing otologic concerns by 32%. All respondents agreed the intervention would benefit residents of other programs. **Conclusion:** The studied intervention can potentially improve both resident education and patient care. It facilitated real-time discussion of topics relevant to self-perceived knowledge deficits and timely advice on management of a new and changing population of patients with COVID-19. The intervention described could be applied to benefit residents in otolaryngology and other surgical specialty programs nationwide during and after the pandemic.

Harassment in surgery: assessing differences in perception. *Tristan Desrosiers, Léamarie Meloche-Dumas, Erica Patocskai, Adam Dubrowski, Michèle Beniey, Pamela Bélanger.* From Université de Montréal, Montreal, Que. (Desrosiers, Meloche-Dumas, Patocskai, Beniey, Bélanger); and Canada Research Chair in Health-Care Simulation, Oshawa, Ont. (Dubrowski). Corresponding author: Tristan Desrosiers; t.desrosiers@umontreal.ca

Background: Individuals in surgical rotations are at risk for professional harassment. This study aims to compare perceptions of harassment among members of the surgical team using simulated scenarios in surgical settings. **Methods:** An online survey was distributed to clerks, surgical and anesthesiology residents, surgeons, and anesthesiologists affiliated with a Canadian medical school. The survey included questions relating to the prevalence of professional harassment as well as 8 scenarios in which participants were asked to identify the presence/absence of harassment using a 5-point Likert scale. **Results:** Among the 1060 survey respondents were 100 clerks, 215 residents, 431 surgeons from 11 specialties, and 314 anesthesiologists. Of all participants, 47% reported experiencing workplace harassment, with the most common type being psychological harassment (68%). Residents were the group with the highest prevalence (54%). One-third of the participants said they had engaged in behaviour that could have been perceived as harassment. Several scenarios suggested discrepancy among surgical staff perceptions of harassment. For example, in a scenario in which 2 male surgeons criticize the departure of a colleague on maternity leave, the respondent's age, gender, role in surgical team and specialty (residents and surgeons) had a statistically significant impact on their perception of harassment ($p < 0.001$). In other scenarios, surgeons tended to perceive less harassment than other participants. **Conclusion:** Almost half of respondents said they had experienced workplace harassment. Perceptions of harassment seem to vary according to role in the surgical team, gender, and age. This could become a future target for university programs to decrease the prevalence of this problem.

Factors associated with medical student interest in pursuing a surgical residency: a cross-sectional survey study. *Michael Lee, Adree Khondker, Emilia Kangasjarvi, Jory Simpson.* From the Faculty of Medicine, University of Toronto, Toronto, Ont. (Lee, Khondker, Simpson); and the Department of Surgery, University of Toronto, Toronto, Ont. (Kangasjarvi, Simpson). Corresponding author: Jory Simpson; jory.simpson@unityhealth.to

Background: Preclerkship medical students rely on various educational experiences to decide on a speciality. We conducted a cross-sectional study to explore which educational factors in pre-clerkship are associated with an interest in pursuing a surgical residency. **Methods:** First- and second-year medical students at the University of Toronto were invited to participate in an online survey. The primary outcome was an interest in pursuing surgery. Year of study and educational factors were also collected (e.g., participating in surgical research, having surgical mentors) and treated as exposures. Student opinions on medical education in surgery were also collected. Odds ratios (ORs) and 95% confidence intervals (CIs) were determined. **Results:** Our survey collected 129 preclerkship student responses. Participation in surgical or technical skills workshops (R: 6.24, 95% CI 2.73–14.26), having a surgeon mentor (OR 3.89, 95% CI 1.81–8.34) and conducting research in a surgical subspecialty (OR 5.28, 95% CI 2.29–12.17) were associated with an interest in pursuing a surgical residency. Lectures and shadowing were not significantly associated with an interest in pursuing surgery. Students believe that preclerkship does not provide enough education on surgical techniques and believe that clerkship will be an important factor in deciding to pursue surgery. **Conclusion:** Identifying high-yield educational experiences — for students to determine if they want to pursue a surgical specialty — is important for educators in curriculum design.

Understanding surgical education experiences: an examination of 2 mentorship models. *Mahrukh Nisar, Abdollah Behzadi, Kerry Kuluski.* From the University of Toronto, Toronto, Ont. Corresponding author: Mahrukh Nisar; mahrukh.nisar@mail.utoronto.ca

Background: Mentorship has been identified as an important factor that can optimize the learning environment and play a critical role in the professional growth and development of students. During clerkship, surgical rotations are primarily based on clinical teaching units where the learners work as a team. Occasionally, students are a part of 1–1 preceptorship model. The structure of the surgical rotation can affect the ability to cultivate a mentor relationship. The purpose of this study is to compare these mentorship models, including the preferences, experiences and learning needs of students for each type of model. **Methods:** An online survey was distributed to all third- and fourth-year University of Toronto medical students. Sudents are assigned to different teaching hospital sites, where some use the clinical teaching unit model and others use the 1–1 preceptorship model. Participants are currently being recruited. We predict that students in the preceptorship model are more likely to identify a mentor, have a

positive operating room learning experience, demonstrate improved perceptions of surgeons and their career, and receive meaningful feedback — important factors in encouraging an interest in surgery. Students in the clinical teaching unit model may have an advantage of receiving guidance from multiple residents. **Results:** Pending. **Conclusion:** This study will allow us to identify the key elements of both mentorship models and learn how to enhance the experience of clerkship students to promote high-functioning surgical teaching environments and encourage a greater number of students to pursue a career in surgery.

Leadership development programs for surgical residents: a narrative review of the literature. *Marina L. Parapini, Tracy M. Scott, Ravi Sidhu, Ahmer A. Karimuddin.* **From the Department of Surgery, University of Toronto, Toronto, Ont. (Hirpara); and the Division of General Surgery, University of British Columbia, Vancouver, BC (Parapini, Scott, Karimuddin). Corresponding author: Dhruvin Hirpara; dhruvinh@gmail.com**

Background: While North American accreditation bodies have included leadership as a core competency for all clinicians, there remains a general lack of strategy and evidence on how surgical residents are expected to achieve that objective. We aimed to systematically review the current body of literature on leadership development programs (LDPs) for surgical residents. **Methods:** Articles pertaining to LDPs for surgical residents were identified through an electronic database search including Medline and EMBASE. Each LDP was stratified by setting, frequency, content, teaching methods and outcomes, and cross-referenced against national accreditation competencies. The Kirkpatrick model and Best Evidence Medical Education (BEME) scale were used to assess curriculum effectiveness and quality, respectively. **Results:** Nine articles were selected for final review. Despite significant content variability, the most common topics included leadership theory (89%) and team building/management (56%). Reported learning outcomes, measured primarily via surveys, included an improvement in understanding leadership ($n = 4$), communication skills ($n = 3$), and team building/management skills ($n = 3$). The overall effectiveness of each program was low, with 67% having a Kirkpatrick effectiveness score of 1, indicating only a change in learners' attitudes. The highest BEME score, achieved by 56% of programs, was 3/5 (i.e., conclusions can probably be based on the results). Only 33% of studies ($n = 3$) framed outcomes in the context of national accreditation competencies. **Conclusion:** The current body of literature on leadership curricula for surgical residents is heterogeneous and limited in effectiveness and quality. Future programs should be rooted in leadership theory and national accreditation competencies.

Validation of knee arthroscopy simulator scoring system against subjective video analysis scoring. *Samuel Larrivée, Alisha Beaudoin, Sheila McRae, Jeff Leiter, Gregory Stranges.* **From the University of Manitoba, Winnipeg, Man. (Larrivée, Beaudoin, McRae, Leiter, Stranges); and University of Toronto, Toronto, Ont. (Larrivée). Corresponding author: Samuel Larrivée; samuel.larrivee@mail.utoronto.ca**

Background: There is a notably steep learning curve to arthroscopy. In a time-constrained residency, simulation provides an additional medium to practice. However, as residents progress through a competency-based program, it is unclear how the simulator scoring system compares to objective resident evaluation by mentors. The purpose of this study was to validate the VirtaMed Arthros simulator scoring system. **Methods:** In a previous study, 30 students performed a knee arthroscopy with partial meniscectomy on a high-fidelity simulator. They were randomized into 3 groups: module-based learning (MBL), practising on the simulator modules; traditional learning (TL) receiving individual teaching by a senior resident; and a control group (C). Both the TL and MBL groups practised weekly for 4 weeks, after which all groups were retested. Each testing session was recorded on video and scored on the Objective Assessment of Arthroscopic Skills score (OAAS) and a Competency-Based Assessment (CBA) scoring sheet by a senior resident and a sports-trained surgeon. Concomitant construct validity was tested using the Pearson test comparing the total simulator score (TSS), OAAS, and CBA. **Results:** The TSS correlated highly with OAAS total score ($r = 0.725$, $p < 0.001$) and moderately with CBA ($r = 0.647$, $p < 0.001$). Factorial analysis of individual elements of each scores yielded 4 common factors: visualisation, meniscectomy, movement accuracy, and probe use accuracy. **Conclusion:** The scoring metrics of the simulator correlate well with objective assessments by a senior mentor and can be used to grade students' performance. Performance on the simulator may be used to assess residents' progress in a competency-based curriculum.

Characterizing the level of autonomy in Canadian cardiac surgery residents. *Abigail White, Devin O'Brien, Gurmeet Singh, Bin Zheng, Michael C. Moon, Simon R. Turner.* **From the University of Alberta, Edmonton, Alta. Corresponding author: Abigail White; awhite2@ualberta.ca**

Background: Previous Canadian literature reported that cardiac surgery residents in their final year of training believed they would not be competent to practise independently. The purpose of this study was twofold: to characterize the operative experience of Canadian cardiac surgery residents, and to identify whether there is a gap between what skills residents are expected to have and what skills they are acquiring. **Methods:** A 15-item questionnaire was administered electronically to all Canadian cardiac surgery residents. The Royal College of Physicians and Surgeons of Canada specialty training objectives in cardiac surgery were used as a guide to identify procedural requirements for graduation. The 4-level Zwisch scale was used to measure autonomy in the operating room. **Results:** Overall, there was a 60% (45/75) response rate, with representation from all academic institutions in Canada, except for 1 university. Operative satisfaction was reported at 88.9% ($n = 40$), but only 77.8% ($n = 35$) felt that by the end of residency they would be comfortable operating independently. In postgraduate years 1 through 5, time is spent in the show and tell phase; in the resident's final year they begin to spend more time in the supervision only phase. Only coronary artery bypass and aortic valve replacement were identified as procedures in which residents were achieving full autonomy by graduation. **Conclusion:** This study identified low levels of autonomy in core and advanced cardiac procedures in Canadian training programs. Further study will look to clarify this perception of autonomy from true autonomy through video analysis of live operations.

Mentorship patterns among medical students successfully matched to a surgical speciality. *Jobanpreet Dhillon, Ali Salimi.* **From McGill University, Montreal, Que. Corresponding author: Jobanpreet Dhillon; jobanpreet. dhillon@mail.mcgill.ca**

Background: Mentorship is regarded as a crucial component in the professional development of medical trainees. Medical students rely on physician mentors for guidance in research, networking, and residency matching. Given the unique nature of individual mentee–mentor relationships, understanding patterns of successful mentorships can be challenging. This study aims to provide insight into the key characteristics of mentor–mentee relationships in a surgical speciality, such as ophthalmology. **Methods:** A questionnaire probing the staff ophthalmologists' (mentors) and residents' (mentees; former medical students) mentorship experiences during medical school was created and distributed to all Canadian ophthalmology programs via the institution's program directors. Responses were collected between June 2020 and June 2021. Data were analyzed both qualitatively and quantitatively with means ± standard deviations where appropriate. **Results:** The principal barrier to mentorship for staff ophthalmologists ($n = 28$) and residents ($n = 17$) was mentor (41.0% ± 4.2%) and mentee (19.5% ± 0.7%) time constraints. The most common means of initial contact was through shadowing experiences (19.5% ± 3.5%), in-person meetings (17.0% ± 1.4%) and via emails (17.0% ± 2.8%). While staff ophthalmologists preferred to meet their mentees once every 3 months (35.3%), most of the residents met their mentors at least once a month (47.1%). The top traits valued in mentees were their capacity to be hardworking (26.8% ± 0.9%), willingness to learn (20.7% ± 4.0%) and openness for constructive feedback (18.2% ± 2.0%). **Conclusion:** Findings of this study highlight that medical students seeking mentorship in surgical domains may benefit from focusing on the realistic availability of mentors, booking early shadowing opportunities, organizing regular in-person meetings, and cultivating their capacity for learning and growth.

Staying safe with laparoscopic cholecystectomy: the use of landmarking and intraoperative time-outs. *Shirley Xiaoxuan Deng, Alice Zhu, Melanie Tsang, Brittany Greene, Shiva Jayaraman.* **From the Temerty Faculty of Medicine, University of Toronto, Toronto, Ont. (Deng, Zhu, Tsang, Greene, Jayaraman); and the HPB Service, St. Joseph's Health Centre, Unity Health Toronto, Toronto, Ont. (Greene, Tsang). Corresponding author: Shirley Deng; shirleyxx.deng@mail.utoronto.ca**

Background: Laparoscopic cholecystectomy (LC) is one of the most common procedures in general surgery. Devastating complications of LC include vascular and bile duct injury. Bile duct injury is an especially serious and potentially life-threatening complication that occurs at a reported rate of 0.08%–1.5%. Vasculobiliary injuries can be prevented by following an algorithmic approach to LC. The purpose of this paper was to describe our clinical pathway and highlight the art we have developed to illustrate the algorithmic approach. **Methods:** At our institution, we have devised a culture for safe LC designed around intraoperative time-outs to determine if it is safe to progress. The first intraoperative time-out aims to set the surgeon up for safety and involves landmarking, notably the line of safety (LOS), and assessing for manoeuvres to optimize exposure before starting dissection. The LOS is a theoretical line drawn between the sulcus of Rouviere to the junction of the cystic and hilar plates; it should delineate the inferior boundary of dissection. The second intraoperative time-out serves to determine if the critical view of safety has been achieved. **Results:** This standardized approach and decision tree have been helpful in promoting safe completion of LC even in the most challenging cases. We have disseminated this approach to safe LC to several divisions of general surgery in our region through educational rounds. **Conclusion:** These educational materials may be valuable tools for the broader community of general surgeons to promote a culture of safety for LC.

Endovascular aneurysm repair has changed the training paradigm of vascular residents. *Saad Balamane, Peter Brown, David Zelt, Michael Yacob.* **From Queen's University, Kingston, Ont. (Balamane); and Kingston Health Sciences Centre (Brown, Zelt, Yacob). Corresponding author: Michael Yacob; michael.yacob@kingstonhsc.ca**

Background: The advent of endovascular aneurysm repairs (EVAR) led to an alarming drop in open aneurysm repairs (OAR) performed by surgical trainees. Roughly 25% of patients are not EVAR candidates, and thus require OAR, usually for anatomical reasons. Hence, vascular surgical trainees (VSTs) must continue to undergo rigorous training in OAR in order to continue providing gold-standard care for patients with aneurysms. This study aimed to determine if the mean number of OARs continued to decline and whether, as a result, the operative exposure of VSTs to OAR is affected. **Methods:** All VSTs must log their procedures with the Accreditation Council for Graduate Medical Education (ACGME). The ACGME database served to collect the annual mean number of OAR and EVAR of infrarenal abdominal aortic aneurysms (IAAAs) performed by VSTs from 2008 to 2020. Additionally, a search in PubMed in July 2021 served to find articles pertaining to our secondary aim. **Results:** VSTs remained modestly exposed to elective and ruptured OAR of IAAAs; however, they are exposed to EVAR substantially more. The annual number of elective and ruptured OAR of IAAAs dropped from 16.2 ± 8 in 2008 to 9 ± 6 in 2020 (–44.44%; $p = 2.85 \times 10^{-39}$), and 4.1 ± 4 in 2008 to 2.5 ± 2 in 2020 (–39.02%; $p = 3.61 \times 10^{-8}$), respectively. EVARs for IAAAs remained unchanged (45.8 ± 23 in 2008 to 40.6 ± 16 in 2020; $p = 0.3$). Similar to the findings of this study, the analyzed literature suggested that VSTs are not getting adequate exposure to OAR which could affect their ability to perform high-risk/complex OAR effectively and safely. **Conclusion:** This relentless decline in OAR is compromising the education of VSTs and their patients' safety. Restoring adequate exposure to OAR training is therefore urgent.

Implementation of a standardized handover in pediatric surgery. *Victoria Lee-Wing, Richard Keijzer, Anna C. Shawyer.* **From the Max Rady College of Medicine, University of Manitoba, Winnipeg, Man. (Lee-Wing, Keijzer, Shawyer); and the Division of Pediatric General Surgery, Department of Surgery, University of Manitoba, Winnipeg, Man. (Keijzer, Shawyer). Corresponding author: Anna Shawyer; ashawyer@hsc.mb.ca**

Background: Patient handover in surgery is often informal and done when time permits. Standardized I-PASS handover (Illness severity, Patient summary, Action list, Situation awareness and contingency planning, and Synthesis by the receiver) decreases medical error and improves handover in pediatrics. We assessed the implementation of I-PASS in pediatric surgery. **Methods:** With research ethics board approval, the pediatric surgery handover was audited for 3 months pre- and post-I-PASS implementation. Data collected included time management and assessments of handover quality. Surveys were administered pre- and post-I-PASS implementation to assess satisfaction with handover. Decreases in medical error with I-PASS have previously been documented in large studies. **Results:** Pre-I-PASS handover audits (n = 115) showed an average time per patient discussion of 1.44 minutes (SD 1.12). Post-I-PASS handover audits (n = 72) showed an average time per patient discussion of 2.15 minutes (SD 1.87). Problem lists (76.4% v. 59.1%), illness severity (50.0% v. 14.8%), patient summary (52.7% v. 33.0%) and action lists (61.1% v. 38.3%) were more completely reviewed with I-PASS. Post-I-PASS surveys (n = 22) indicated that overall 63.6% of team members thought standardized handover improved patient safety, and 59.1% thought standardized handover improved communication, although there were differences in opinion between attending surgeons and house staff. Post-I-PASS surveys assessing satisfaction with handover indicated an average overall satisfaction of 6.95 (SD 1.64, mode 7) on a 10-point Likert scale. **Conclusion:** At 3 months after I-PASS implementation, there is an overall satisfaction with standardized handover in pediatric surgery, and the handover is more complete. Standardized handover ensures better transition of care as work hours change and handover frequency increases.

Procedure-specific assessment in cardiothoracic and vascular surgery: a scoping review. *Abigail White, Hellmuth R. Muller Moran, Joanna Ryan, Brett Mador, Sandra Campbell, Simon Turner.* **From the University of Alberta, Edmonton, Alta. (White, Ryan, Mador, Campbell, Turner); and the University of Manitoba, Winnipeg, Man. (Muller Moran). Corresponding author: Abigail White; awhite@ualberta.ca**

Background: Surgical education has shifted from a time-based approach to the achievement and demonstration of procedural competency. This study comprehensively reviewed the literature to identify and evaluate available procedure-specific assessment instruments in cardiothoracic and vascular surgery. **Methods:** A systematic search of 8 databases identified studies containing procedure-specific operative assessment instruments in cardiothoracic and vascular surgery. Generic global rating scales were excluded, unless modified to be procedure-specific. Two reviewers independently evaluated the validity evidence, methodological rigour and educational utility of each instrument using objective scoring criteria. **Results:** There were 2130 studies describing procedure-specific assessment in surgery. Of these, 208 pertained to cardiothoracic and vascular surgery, of which 9 met inclusion criteria. Five instruments were identified in thoracic surgery, 2 in cardiac surgery and 2 in vascular surgery. Study participants included residents and surgeons, with only 1 instrument designed to evaluate surgeon performance and the remainder designed to evaluate residents. No single instrument scored 15/15 for validity. Though consistently high scores were attained in the content domain of validity, little to no evidence was generally provided regarding the consequences of assessment using a particular instrument. All studies except 1 scored higher than 11 out of a maximum 16.5 points for methodological rigour. Procedure-specific assessment instruments were deemed to have high educational utility, but few reported their educational impact. **Conclusion:** Few procedure-specific assessment instruments in cardiothoracic and vascular surgery demonstrate high levels of validity evidence, emphasizing the need for such instruments to ensure the success of competency-based education models.

Longitudinal mentorship-based programs for junior medical students increases exposure, confidence, and interest in surgery. *David Lee, Kelvin Ng, Abdollah Behzadi.* **From the Temerty Faculty of Medicine, University of Toronto, Toronto, Ont. (Lee, Ng, Behzadi); and the Division of Thoracic Surgery, Department of Surgery, Trillium Health Partners, Toronto, Ont. (Behzadi). Corresponding author: David Lee; davidm.lee@mail.utoronto.ca**

Background: Canadian medical schools have various opportunities for students to make informed career decisions. Although many informal observerships exist, only a few structured programs allow for long-term mentorship. The Surgical Longitudinal Education Program (SurgicLE) facilitates a comprehensive exposure to a surgical career by pairing junior medical students with surgeons. **Methods:** Second-year medical students were recruited and matched with a surgeon depending on their interest. Students performed at least 4 observerships over a 6-month period. Students were asked to complete a survey before and after the program based on their confidence, previous exposure, and perceptions of a career in surgery. In their third year, students were asked if they arranged a fourth-year elective in a surgical speciality as an indicator for applying to a surgical residency program. **Results:** A total of 64 out of 259 (24.7%) second-year medical students participated in the program. Fifty-seven completed the pre-program survey (89%), and 20 (31.3%) the post-program survey. Students who completed the program were more likely to pursue a career in surgery (3.61 v. 4.25, p < 0.01). Students also indicated significantly improved confidence in surgical experiences (3.16 v. 3.99, p < 0.01) and clinical exposure (2.43 v. 3.70, p = 0.04) before versus after the SurgicLE program. Out of the 64 students who participated in the program 33 had arranged a surgical elective. **Conclusion:** A longitudinal structured program involving multiple observerships has been shown to positively influence student decision-making in surgical career choice. This program also provides a means for early identification of medical students interested in a surgical career.

Creating a green-shift in surgical education: a scoping review of initiatives and methods to make perioperative care more sustainable. *Yseult Gibert, Yousra-Imane Benaskeur, Sara Medina Kasasni, Nissrine Ammari, Florence Chiarella, Jeanne Lavallée, Anne-Sophie Lê, Maria Alexandra Rosca, Koorosh Semsar-Kazerooni, Tharaniya Vallipuram.* **From the IFMSA-Québec, Montreal, Que. (Benaskeur, Lavallée, Rosca); the Faculty of Medicine, McGill University, Montreal, Que. (Gibert, Ammari, Semsar-Kazerooni, Vallipuram); the Faculty of Medicine, Université de Sherbrooke, Sherbrooke, Que. (Kasasni, Chiarella); and the Faculty of Medicine, Université de Montréal, Montreal, Que. (Benaskeur, Lê). Corresponding author: Yseult Gibert; Yseult.gibert@mail.mcgill.ca**

Background: The health care sector contributes almost 5% of global greenhouse gas emissions (GHG), with the Canadian health care sector ranking third in the world. From the 33 million tons of carbon dioxide equivalents it generates, it was estimated that 30% of emissions came from the operating room and perioperative care. **Methods:** This significant contribution to climate change and the immense health threat it represents should prompt a reflexion on the sustainability of our health facilities, and on the virtually nonexistent measures to educate the surgical workforce on this pressing issue. A scoping review was performed to identify initiatives and methods to achieve greener perioperative facilities and care. Sixty-two articles were included for full-text screening, and 7 reports and toolkits from the grey literature were also included. **Results:** Out of 7 main contributors to the high ecological footprint of hospitals identified, the most recurring themes were operating rooms and waste management. Recommendations included improved sterilizing methods, optimized operating room protocols limiting unnecessary waste, and implementation of rigorous waste disposal protocols at an institutional level. Above all, active training, education, and increased awareness of the health workforce were most paramount to the promotion of planetary health. Along with directly tackling the first barrier to implementation of the recommendations (i.e., ignorance on the issue), educating trainees and staff also created space for additional spontaneous greening initiatives and efforts from individuals and administration. **Conclusion:** This review demonstrates the emergent need for further education and training of our surgical workforce regarding the environmental impact of perioperative care.

A novel plastic surgery residency bootcamp: structure and utility. *Valérie Gervais, Detlev Grabs, Émilie Bougie, G. Emmanuel Salib, Patricia Bortoluzzi, Dominique Tremblay.* **From the Université de Montréal, Montreal, Que. (Gervais, Bougie, Salib, Bortoluzzi, Tremblay); and Université du Québec à Trois-Rivières, Trois-Rivières, Qué. (Grabs). Corresponding author: Valérie Gervais; valerie.gervais.6@umontreal.ca**

Background: Transitioning from medical school to surgical residency is a difficult endeavour. To facilitate this period, the Université de Montréal's plastic surgery program developed and implemented an intensive 1-month "bootcamp" rotation. It is the only one of its kind among plastic surgery residency programs in North America. It includes didactic teachings in anatomy, cadaveric dissections and surgical approaches for an array of procedures from basic ones to free flaps. Technical skills are reviewed with senior residents and attending surgeons. Research opportunities and case scenarios are also covered. **Methods:** An anonymous online 29-question survey was created and sent to all residents who participated in the bootcamp between 2013 and 2020. Questions evaluated residents' knowledge of anatomy, basic surgical skills, common approaches, flaps and calls, before and after the bootcamp. **Results:** Seventeen residents responded to this questionnaire (81%). The majority confirmed that the bootcamp helped them prepare for residency, research and calls, as well as expand their knowledge of anatomy, surgical skills and flaps, much more so than medical school. The residents responded positively to the bootcamp's structure and set-up. **Conclusion:** This study proposes that surgical programs could benefit from a bootcamp rotation early in their curriculum. The purpose is to facili-

tate the transition between medical school and postgraduate training and ensure a levelling of the junior residents' preparedness. This rotation serves to train versatile, confident, collaborative junior residents in plastic surgery. Further prospective studies could demonstrate the bootcamp's impact in board certification rates and acceptation into fellowship programs.

Video-based coaching for surgical residents: a systematic review and meta-analysis. *Ryan Daniel, Colin C. Kruse, Tyler McKechnie, Cagla Eskicioglu.* **From the University of Toronto, Toronto, Ont. (Daniel); and McMaster University, Hamilton, Ont. (Kruse, McKechnie, Eskicioglu). Corresponding author: Cagla Eskicioglu; eskicio@mcmaster.ca**

Background: Video-based coaching (VBC) is used to supplement current teaching methods in surgical education and may be useful in competency-based frameworks. The objective of this systematic review and meta-analysis was to pool previously published data and provide an update on the evidence for preoperative and postoperative VBC in postgraduate surgical education. **Methods:** Medline, Embase, and CENTRAL were systematically searched. Articles were included if they were randomized controlled trials comparing surgical residents receiving and not receiving VBC. A pairwise meta-analysis using inverse variance random effects was performed. Standardized mean differences (SMDs) were used as the primary outcome measure to account for differences in objective surgical skill evaluation tools. **Results:** From 2727 citations, 12 studies involving 179 residents receiving VBC and 159 residents receiving standard surgical teaching without VBC were included. There was no significant difference in post-coaching scores on objective surgical skill evaluation tools between groups (SMD 0.53, 95% confidence interval [CI] –0.05 to 1.11, $p = 0.07$, $I^2 = 77\%$). However, residents receiving VBC were significantly more likely to improve upon their pre-coaching scores (SMD 1.96, 95% CI 0.74 to 3.19, $p = 0.002$, $I^2 = 85\%$). Results were unchanged with leave-one-out sensitivity analysis and subgroup analysis according to operative setting (i.e., simulation, operating room). **Conclusion:** VBC is effective at improving objective surgical skills in postgraduate surgical trainees of various levels across both simulation and live-operative settings. The benefit may be most substantial for trainees with lower baseline levels of objective skill. Further study is required to determine the long-term benefits of this intervention as well as its impact on patient outcomes.

Virtual patient cases aligned with EPAs provide innovative e-learning strategies. *Sam Minor, Nancy Posel, David Fleiszer.* **From Dalhousie University, Halifax, NS (Minor); and McGill University, Montreal, Que. (Posel, Fleiszer). Corresponding author: Nancy Posel; nancy.posel@mcgill.ca**

Background: Competency-based medical education is a framework of organized representations of sets of interrelated knowledge and procedural skills. Each competency is aligned with entrustable professional activities (EPAs). These are specified by regulatory bodies. Undergraduate medical education knowledge and their associated EPAs are designed to prepare learners for the first year of their residencies. **Methods:** This oral presentation will provide an overview of a project that used a virtual patient case (VP) to highlight and address specific postgraduate medical

education EPAs. Supported by the Canadian Association of General Surgeons, a VP was developed by a clinical content expert and then integrated into a virtual patient case application by developers with strong pedagogical and clinical backgrounds. The clinical narrative was initially constructed using a template that was then followed by online discussions, reviews and modifications. The completed case will be peer-reviewed prior to publication. **Results:** The resulting case provides an online standardized exercise for learners that can be made available irrespective of geographical limitations. This process permits wide distribution of clinical content expertise. The addition of individualized metrics and data allows for objective assessment of competencies and EPAs and permits formative identification of strengths and weaknesses that can then be addressed. The authors will present examples of several Canadian EPAs as well as associated CanMEDS roles that can be related to specific elements of the case. **Conclusion:** VPs aligned with EPAs provide an innovative teaching strategy for on-site and remote learning. They permit self, formative and summative assessment and provide educators with innovative evaluation methodologies.

Achieving competency in the CanMEDS roles for surgical trainees in the COVID-19 era: What have we learned and where do we go?

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The COVID-19 pandemic has significantly changed the practice of medicine, with a shift to virtual clinical encounters, alternative management of surgical diseases due to restrictions on elective operations, and physician redeployment to other medical services requiring coverage. These changes may limit opportunities for trainees to gain surgical expertise with the potential to drastically impact postgraduate surgical education. However, the pandemic has also created a number of opportunities to navigate these challenges and enhance how surgical education is delivered. This presentation highlights some considerations in adapting postgraduate surgical training to achieve competency in the CanMEDS roles in the COVID-19 era.

Profiles of burnout and response to the COVID-19 pandemic among general surgery residents at a large academic training program.

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Background: The COVID-19 pandemic has placed additional demands on general surgery residents, who are already at high risk of burnout. This study examined the pandemic's impact on burnout and wellness among Canadian general surgery residents at a large training program. **Methods:** General surgery residents at the University of Toronto completed a survey focused on self-reported burnout and mental health concerns, perceptions of wellness resources, and changes in activities during the pandemic. Burnout was measured using the Maslach Burnout Inventory (MBI). Unsupervised machine learning (k-means clustering) was used to identify profiles of burnout, and comparisons between profiles were made. **Results:** Of 82 eligible residents, 51 completed the survey (62% response rate). During the pandemic, 63% of residents had self-described burnout, 43% had depression, 18% acknowledged binge drinking/drug use, and 8% had anxiety. There were no significant differences from pre-pandemic levels (all $p > 0.05$). Few residents perceived available wellness resources as effective (6%). Based on MBI scores, the clustering analysis identified 3 unique groups: "overextended," "engaged," and "ineffective." Engaged residents had the least concerning MBI scores and were significantly more likely to exercise and retain social contact during the pandemic, and had less self-reported anxiety or depression. Research residents were overrepresented in the ineffective cluster (46.2%), which had the highest rates of self-reported burnout (76.9%) and was characterized by the lowest personal achievement scores. **Conclusion:** General surgery residents have high rates of self-reported burnout and depression that did not significantly worsen during the COVID-19 pandemic. Unique clusters of burnout may offer targets for individualized wellness interventions.

Learner-driven telemedicine curriculum during the COVID-19 pandemic.

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Background: With the COVID-19 pandemic declared in March 2020 by the World Health Organization (WHO), many undergraduate education programs were disrupted, and some quickly transitioned to online learning. Medical students were left without crucial clinical experiences. A learner-driven telemedicine curriculum was implemented to provide learners with clinical experiences, knowledge, and skills in teleurology via the Ontario Telemedicine Network (OTN) between February and May 2021. **Methods:** Six volunteer Northern Ontario School of Medicine (NOSM) learners enrolled for 12 weeks. A needs assessment was completed. Learning contracts were used in the design and evaluation. Five modules were developed. Informed consent for students to participate in confidential care was received from patients. Expected activities included 2 patient encounters per month, a summary of experiences, and a "learner–faculty feedback loop." Small-group discussions were held. OTN was the platform of care for videoconferencing. Curriculum feedback and faculty and learner evaluations were completed via online surveys. **Results:** Of 6 enrollees, 5 completed the curriculum. Patient encounters varied from consultation, postoperative care, counselling, and education. Students gained a better understanding of how telemedicine may be utilized. All participants set learning goals, reflected on these, had successful patient encounters, and learned about office tele-urology. The participant satisfaction rate was 100%. One learner withdrew owing to excess workload. Limitations included small numbers, a solo urologist, time factor, use of only the OTN hub, and lack of formal structure. **Conclusion:** A learner-driven telemedicine curriculum provided medical students an opportunity to learn about telemedicine with a focus on office tele-urology. Learners gained useful telemedicine competencies. A telemedicine curriculum for undergraduate medical students is recommended.

Centralized basic orthopaedic surgery virtual examinations — assessment of examination environment. *Valérie Lemieux, Jonathan Doyon, Jong Min Lee, Douglas Archibald, Veronica Wadey.* **From the University of Toronto, Toronto, Ont. (Lemieux, Doyon, Lee); the University of Ottawa, Bruyère Research Institute, Ottawa, Ont.(Archibald); and the University of Toronto, Holland Bone and Joint Program, Sunnybrook Health Sciences Centre, Toronto, Ont. (Wadey). Corresponding author: Valérie Lemieux; valerie.lemieux@mail.utoronto.ca**

Background: Centralized examinations are key to competency-based curricula as they are carried out by neutral assessors who are not involved in teaching the learner and allow for evaluation of trainees against their peers. The COVID-19 pandemic has limited the ability to gather to perform in-person evaluations. We sought to assess the effectiveness and end-user experience of virtual centralized Objective Structured Clinical Examination (OSCE) for basic orthopedic surgery modules. **Methods:** A virtual evaluation process including assessor training followed by online OSCE for basic orthopaedic surgery modules (arthroplasty and trauma) were developed. Surveys were used to assess the effectiveness of the assessor training and the overall examination environment. **Results:** All 14 assessors completed the post-training survey and agreed that the training session was useful and should be repeated prior to all virtual centralized examinations. Seventy-four percent of residents (*n* = 17) responded to the survey. Most trainees (59%) recommend that some, but not all, examinations be conducted virtually. The online platform generally did not alter trainees' preparation, comfort levels, stress levels prior to or during the examination, or ability to demonstrate their skills. Technical difficulties were rare, though when they did occur, the trainees perceived it to negatively impact their score. **Conclusion**: Most residents wished for increased frequency of formative examinations, which is in keeping with the Competence by Design education framework. Given the minimal perceived difference between the virtual and in-person assessment environments, and with the added convenience of virtual examinations, the virtual platform may be a useful tool to facilitate increased frequency of formative assessments for any learner.

Effects of the COVID-19 pandemic on surgical resident training: a nationwide survey of Canadian program directors. *Eileen Roach, Azusa Maeda, Timothy Jackson, Allan Okrainec.* **From the University of Toronto and University Health Network, Toronto, Ont. Corresponding author: Eileen Roach; eileen.roach@uhn.ca**

Background: In March 2020, hospitals in North America adjusted their practices in response to the novel COVID-19 pandemic, ushering in extreme restrictions on elective surgical and interventional procedures. We sought to elicit surgical program directors' (PD) opinions on the impact of these restrictions on their residents' training. **Methods:** A 16-item electronic questionnaire was delivered to all PDs of English-speaking, Royal College of Physicians and Surgeons of Canada surgical training programs. Questions elicited demographic data, opinions on the short- and long-term effects of the pandemic, and thoughts on strategies for mitigating the educational impact to residents. Data were analysed using descriptive statistics. **Results:** Thirty-four PDs completed the questionnaire (29.8% response rate), with orthopedic surgery PDs making up the highest percentage (17.6%). Most respondents were from Ontario (32.4%), followed by Alberta (23.5%). Cessation of elective operations negatively affected educational opportunities for residents during the first and second waves of the pandemic (82.4% and 55.9%, respectively). Senior residents were identified as being most affected (47%). Most PDs did not feel the effects of the pandemic would have a lasting negative effect (55.9%). In addition to identifying a need for more operating room time, support for telesimulation was identified as a potential strategy to offset the negative effect of pandemic-related restrictions. **Conclusion:** While Canadian surgical PDs report a short-term negative impact of pandemic-related practice restrictions on resident training, few believe that a long-term detrimental effect will be observed. Moving forward, strategies like telesimulation may help to mitigate some of the negative educational effects of reduced operative exposure.

Exploring the transition to virtual care in surgery and its impact on clinical exposure, teaching, and assessment during the COVID-19 pandemiec. *Jessica Ho, Rebecca Leclair, Heather Braund, Jennifer Bunn, Ekaterina Kouzmina, Samantha Bruzzese, Sara Awad, Steve Mann, Ramana Appireddy, Boris Zevin.* **From Queen's University, Kingston, Ont. Corresponding author: Boris Zevin; boris.zevin@kingstonhsc.ca**

Background: The COVID-19 pandemic resulted in a rapid shift from in-person to virtual ambulatory care delivery for surgical residencies across Canada. This transition has necessitated changes to clinical encounters for surgery residents within the competency-based medical education model. The purpose of this study was to explore the lived experiences of surgery residents and faculty related to teaching, learning, and assessment during virtual ambulatory care encounters. **Methods:** Residents (*n* = 10) and faculty (*n* = 9) were recruited from the Department of Surgery at Queen's University to participate in this phenomenological study. Interviews and focus groups were conducted to understand participants' experiences related to the transition to virtual ambulatory care. Interviews and focus groups were audio-recorded and transcribed verbatim. Qualitative data were analyzed thematically. **Results:** Four themes emerged from the data: teaching/learning, assessment, logistical considerations, and recommendations. Barriers to teaching included the lack of direct observations and ability to perform physical exams, while barriers to assessment included an absence of clinic-specific entrustable professional activities (EPAs) and lack of feedback focused on virtual-care-related competencies. Faculty and residents highlighted logistical challenges and limited time for clinic-related learning in comparison to resident responsibilities on in-patient wards and operating rooms. Recommendations included access to video-conferencing technology and development of virtual-care-specific EPAs in surgery. **Conclusion:** Surgical faculty and residents highlighted challenges related to the transition to virtual ambulatory care during the COVID-19 pandemic. Specific suggestions were offered for improving the teaching and learning during virtual care, given its ongoing role in medical education and practice.

Impact of COVID-19 on procedural skills training and career preparation of medical students. *Ishita Aggarwal, Peter Gariscsak, Kiera Liblik, Andrea Winthrop, Steve Mann.* **From Queen's University, Kingston, Ont. (Aggarwal, Gariscsak, Liblik, Winthrop, Mann); and Kingston Health Sciences Centre, Kingston, Ont. (Winthrop, Mann). Corresponding author: Ishita Aggarwal; iaggarwal@qmed.ca**

Background: The COVID-19 pandemic has significantly disrupted clinical/procedural skills training of Canadian medical students. Pandemic-related restrictions on in-person learning have affected academic/professional preparedness and emotional coping skills of medical students. We aimed to delineate these effects on medical students' exposure to clinical/procedural skills training and to determine whether reductions in practical experiences affected career indecision and anxiety. **Methods:** All medical students (*n* = 400) were invited to anonymously complete an online survey. The survey consisted of 27 questions divided into 5 subsections: demographics, clinical/procedural skills exposure, informal career advising, level of career indecision, and level of career anxiety. **Results:** Recruitment is ongoing. To date, the survey has been completed by 37 students. Early data show that 22 respondents participated in 0–2 in-person sessions and 29 participated in 0–2 virtual events since March 2020. Of the 19 students who reported participating in 1 or more virtual curriculum-related procedural skills sessions, 12 rated them as either "somewhat" or "extremely" ineffective for building knowledge/skills. Although 16 of 37 respondents indicated they are either "somewhat more" or "much more" decisive regarding their career path than before the pandemic, 12 indicated they are either "somewhat less" or "much less" decisive, comparatively. Finally, 22 students indicated that they are either "somewhat more" or "much more" anxious regarding their career path than before the pandemic. **Conclusion:** Early results suggest that the pandemic has decreased exposure and quality of procedural skills training according to medical students. Levels of career indecision have been less affected; however, there has been an increase in career-related anxiety levels.

Virtual surgical shadowing for undergraduate medical students amidst the COVID-19 pandemic. *Max Solish, Bryan Abankwah, Michael Weinberg.* **From the Temerty Faculty of Medicine, University of Toronto, Toronto, Ont. (Solish, Weinberg); and Trillium Health Partners, Missisauga, Ont. (Abankwah, Weinberg). Corresponding author: Max Solish; max.solish@mail.utoronto.ca**

Background: Physician shadowing is an important mechanism of career exploration for medical students. Because of the COVID-19 pandemic, in-person shadowing has been restricted at many institutions, limiting opportunities to observe surgical procedures. We therefore sought to fill this gap by introducing a novel virtual surgical shadowing experience to expose medical students to surgical specialties. **Methods:** In compliance with the *Health Insurance Portability and Accountability Act*, 2 video cameras were placed in a small procedure operating room at Trillium Health Partners, Queensway Health Centre hospital in Mississauga, Ont., to stream plastic surgery procedures live through Zoom to medical students at home. Patients who opted into the program filled out a consent form, and students signed a confidentiality agreement and underwent privacy training. **Results:** Two sets of 5 first- and second-year medical students attended the 2.5-hour virtual surgical shadowing experience, and 9 provided feedback through an anonymous survey. The survey consisted of 6 Likert scale questions (scored from 1, strongly disagree, to 5, strongly agree) and 2 short-answer questions. Participants (*n* = 9) scored an average of 4.6 ± 0.52 regarding the technology being conducive to their learning, 4.7 ± 0.50 regarding the session meeting their learning objectives, and 4.8 ± 0.44 regarding the knowledge and skills gained being useful for clerkship. Areas of improvement included providing case information prior to the sessions (*n* = 4) and improving camera quality (*n* = 3). **Conclusion:** Virtual surgical shadowing is a promising and innovative solution to limitation of in-person observerships, providing a secure and accessible way for preclerkship students to explore surgical specialties.

Educational impact of the COVID-19 third wave on a competency-based orthopedic surgery program. *Jong Min Lee, Ahmed Cherry, Valerie Lemieux, Jonathan Doyon, Stan Hamstra, Markku Nousiainen, Veronica Wadey.* **From the Division of Orthopaedic Surgery, University of Toronto, Toronto, Ont. (Lee, Cherry, Lemieux, Doyon); and the Sunnybrook Health Sciences Centre, Division of Orthopaedic Surgery, University of Toronto, Toronto, Ont. (Hamstra, Nousiainen, Wadey). Corresponding author: Jong Min Lee; johnjm.lee@mail.utoronto.ca**

Background: The COVID-19 third wave in Ontario from April to June 2021 led to a province-wide cancellation of elective surgeries and the development of policies to minimize in-person patient encounters. We aimed to assess the educational impact of the third wave on the orthopedic surgical trainees in a competency-based program. **Methods:** Qualitative post-third-wave surveys were distributed to residents in postgraduate years (PGY) 1–4 in a competency-based orthopedic training program in Ontario (*n* = 48). **Results:** Thirty-one residents (64.5%) responded to the survey. Overall average work hours per week were reduced from 79.3 to 73.3 hours among the junior residents (*n* = 16) and from 79.7 to 72.5 hours among the senior residents (*n* = 15). More than half of the residents saw their overall patient encounter volume either decrease or significantly decrease. More senior residents (66.7%, *n* = 10) reported significant decreases in their operating volume than the junior residents (43.8%, *n* = 7). Five senior residents (33.3%) and 6 junior residents (37.5%) did not receive credits for their rotation. Of those residents, 4 senior residents (80%) and 2 junior residents (33.3%) perceived that they achieved all expected competencies to pass the rotation. **Conclusion:** Several residents, especially residents in PGY3 and PGY4, perceived that they achieved the necessary competencies to progress to the next level of training despite seeing reduced work hours, decreased patient encounters, and reduced operating volume during the COVID-19 third wave in Ontario. Further studies on identifying and managing discrepancies pertaining to assessment of residents' performance and faculty's perception of their competence in orthopedic surgery training may be warranted.

Virtualization of postgraduate residency interviews: a ransforming practice in health care education. *Luckshi Rajendran, Wanda Marini, Ashlie Nadler.* **From the University of Toronto, Toronto, Ont. Corresponding author: Luckshi Rajendran; Luckshi.rajendran@alumni.ubc.ca**

Background: Traditionally, postgraduate trainee selection in North America relied on in-person interviews. With the COVID-19 pandemic, a pivotal transition toward the virtualization of interviews has occurred. Virtualization has many acknowledged benefits. However, our program encountered multiple challenges with this new interview format. **Methods:** Virtual 1-day general surgery residency interviews were held at a single institution (University of Toronto) for the spring 2021 interview period. The interview structure and logistics were adapted based on prior in-person experiences as well as a fellowship virtualized interview approach. Pre-interview: The program was advertised through social media, virtual information sessions, and media presentations highlighting the program, residency life, and facilities. Interview: Multiple moderators, strong personnel support, clear instructions with schedules/information guides, and back-up plans were integrated. Peri-interview: Applicant files were anonymized and components disaggregated to reduce implicit bias, with an objective scoring system for ranking. **Results:** The social media platform gained more than 800 followers. Virtual information sessions were well received, with approximately 60 applicants at each session. The number of applicants was comparable to previous years, with 189 total applicants. Interview day ran smoothly, with minimal technical errors or delays, and overall positive feedback from reviewers and candidates. Eight of 10 trainees who matched to our program were from our home institution. **Conclusion:** Evidence exists for continuing virtual interviews in the post-pandemic era. However, lack of direct exposure is a challenge, and may contribute to preferential matching of candidates from home institutions. Further survey exploration is required to better understand and address these barriers to virtualization.

An informational podcast about Canadian plastic surgery training programs: "Doctority Canada: Plastic Surgery." *Shaishav Datta, Wafa Khoja, Jenna Stoehr.* **From the Temerty Faculty of Medicine, University of Toronto, Toronto, Ont. (Datta); the School of Medicine, Queen's University, Kingston, Ont. (Khoja); and the Division of Plastic and Reconstructive Surgery, Northwestern University, Chicago, IL (Stoehr). Corresponding author: Shaishav Datta; shaishav.datta@mail.utoronto.ca**

Background: The COVID-19 pandemic has resulted in limited exposure for medical students to plastic and reconstructive surgery (PRS) because of cancellation of away-electives and in-person residency interviews during the 2020/21 Canadian Resident Matching Service cycle. Despite efforts from individual institutions to increase their online presence, it has been challenging for applicants to find relevant information to evaluate and compare programs. The "Doctority Canada: Plastic Surgery" podcast was created to address this need and provide a useful tool for applicants to assess the various Canadian plastic surgery programs. **Methods:** Starting in January 2021, PRS residents and faculty across Canada were recruited to participate in individual podcast episodes. Topics of discussion included program logistics, faculty and leadership, and the general lifestyle of a resident in the program. Questions were asked in a standardized manner to facilitate comparison. The podcast was publicized via social media and published on major podcast streaming platforms. **Results:** As of August 2021, 8 programs had participated in the podcast, with a total of 512 downloads (mean 64 downloads per episode). Individual episodes run between 26 and 59 (mean 42.8 ± 9.8) minutes. Most listeners (83%) are in Canada, but there is international interest in Canadian PRS programs, specifically from the United States, India, and Saudi Arabia. **Conclusion:** Podcasting is an effective tool for engagement between PRS residency programs and prospective applicants. New methods of digital engagement, such as podcasting, have the potential to help medical students make informed decisions as they proceed through the match process.

Virtual versus in-person suture training: an evaluation of synchronous and asynchronous teaching paradigms. *Peter Gariscsak, Ishita Aggarwal, Kiera Liblik, Steve Mann, Andrea Winthrop.* **From Queen's University, Kingston, Ont. (Gariscsak, Aggarwal, Liblik, Mann, Winthrop); and Kingston Health Sciences Centre, Kingston, Ont. (Mann, Winthrop). Corresponding author: Peter Gariscsak; pgariscsak@qmed.ca**

Background: Many components of the undergraduate medical education curriculum (UGME) have been delivered virtually because of COVID-19. Evaluation of the impact of these changes on learning outcomes is limited, especially the impact on teaching procedural skills. To date, asynchronous and synchronous virtual teaching have not been compared to in-person procedural skills training in undergraduate medical education. Our study aims to investigate whether virtual synchronous or asynchronous teaching differ from in-person teaching with respect to novice-learner suturing performance or learner anxiety. Although procedural skills in the UGME curriculum are being taught online, there has been limited evaluation of the effectiveness of these teaching methods. **Methods:** Sixty medical students will be randomly assigned to either in-person synchronous, virtual synchronous, or virtual asynchronous teaching of simple-interrupted suturing. Pre- and post-teaching assessments of suturing performance and anxiety regarding suturing will be compared between groups. Performance will be measured using a previously validated objective structured assessment of technical skills (OSATS) tool. **Results:** Enrolment is ongoing and the trial will take place from August 23–27, 2021. We anticipate having preliminary results by the date of the conference. **Conclusion:** We plan to use our results to optimize suturing training for novice medical learners, and to inform educators, provide guidelines for additional virtual procedural skills program evaluation, and assist in the broad integration of virtual learning initiatives.

Merged virtual reality teaching of the fundamentals of laparoscopic surgery: a randomized controlled trial. *Garrett Johnson, Bryce Lowy, Ashley Vergis.* **From the University of Manitoba, Winnipeg, Man. Corresponding author: Garrett Johnson; mjoh529@myumanitoba.ca**

Background: The COVID-19 pandemic has restricted our ability to gather and train together. High-fidelity simulation platforms have been developed that merge virtual-reality video streams to allow for remote instruction and collaboration. This study sought to validate the use of a merged virtual-reality (MVR) platform for instruction and assessment of the fundamentals of laparoscopic surgery (FLS) skills. **Methods:** This was a prospective randomized controlled noninferiority study.

Thirty participants were randomized among 3 groups to detect a noninferiority margin set at 10% of the mean improvement in expected total FLS scores. Group 1 received "standard" in-person expert instruction. Group 2 received similar training administered via the MVR platform. Group 3 (control) practised on their own, with no feedback. All participants were tested for baseline performance, then immediately after training, and 1 month later. Groups were compared using ordinary 1-way analysis of variance. **Results:** MVR was noninferior to the standard in-person training group for total FLS times on both immediate ($p = 0.632$) and delayed post-testing ($p = 0.829$). Performance was also identical between MVR and standard training groups for each FLS task. All 3 groups improved from baseline after training. Greater improvements were observed in the standard and MVR arms than in controls for all tasks except for peg transfer and pattern cut, which did not reach statistical significance. **Conclusion:** This randomized controlled trial provides validity evidence for the use of an MVR platform as a noninferior alternative to in-person instruction for initial FLS instruction, forming the foundation for future work on remote training and collaboration.

Should surgical skills be evaluated during virtual CaRMS residency interviews? A Canadian survey of CaRMS applicants and selection committee members during the COVID-19 pandemic. *Rosephine Del Fernandes, Nicole Relke, Eleftherios Soleas, Janet Lui, Boris Zevin.* From Queen's University, Kingston, Ont. Corresponding author: Boris Zevin; boris.zevin@kingstonhsc.ca

Background: In 2021, all Canadian Resident Matching Service (CaRMS) interviews for R1 residency programs were conducted in a virtual format for the first time because of the COVID-19 pandemic. We sought to determine perceptions of applicants and members of the selection committee regarding technical skills evaluation during virtual CaRMS interviews. **Methods:** A survey for CaRMS applicants and members of the selection committee containing 5-point Likert scale and open response questions was sent to all English Canadian medical schools via email. Surveys were distributed after match day to CaRMS applicants and after the rank-order deadline to selection committee members. We examined a subset of respondents focused on applicants and committee members from surgery programs. **Results:** There were 36 surgical applicants and 101 selection committee members from surgery programs who completed the survey. Most applicants agreed (33.3%) or strongly agreed (30.6%) that their inability to complete away electives and demonstrate technical skills likely decreased their chance of matching into a surgical specialty outside of their home school. However, most respondents (84.4% of applicants and 82.5% of committee members) believed technical skills should not be evaluated during virtual CaRMS interviews. Their recommendations regarding methods to evaluate technical skills during virtual interviews included suturing over video using suture kits, demonstrating dexterity using common items, and evaluating for coachability. **Conclusion:** Lack of away electives during the COVID-19 pandemic was perceived to negatively affect the success of applicants matching into a surgical program; however, assessment of technical skills during virtual CaRMS interviews was not recommended.

Impact of the COVID-19 pandemic on surgical education for medical students: perspectives from Canada's largest faculty of medicine. *Anser Daud, Markku Nousiainen, Jory Simpson, Melinda Musgrave, Rob Stewart, Jeremy Hall.* From the University of Toronto, Toronto, Ont. (Daud, Nousiainen, Simpson, Musgrave, Stewart, Hall); the Sunnybrook Health Sciences Centre, Toronto, Ont. (Nousiainen); and Unity Health Toronto, Toronto, Ont. (Simpson, Musgrave, Stewart, Hall). Corresponding author: Anser Daud; anser.daud@mail.utoronto.ca

Background: During the COVID-19 pandemic, challenges involving variable lockdowns, physical distancing, and reduced patient volumes necessitated modifications in the surgical clerkship curriculum (SCC) for medical students. As a result, a period of rapid adaptation in the realm of surgical education ensued at the University of Toronto's faculty of medicine, which represents 19% of all newly trained Canadian physicians each year. **Methods:** We offer a qualitative analysis of pandemic-related changes to the SCC, focusing on the impact on learners and educators at Canada's largest faculty of medicine. Our diverse team of faculty and trainee authors were directly involved in the surgical clerkship experience over the last year and a half. **Results:** Adaptation to pandemic restrictions involved a significant increase in digital curriculum delivery and a flipped-classroom approach, while maintaining an emphasis on core competencies defined by the CanMEDS framework. Virtual delivery was a welcome change, and virtual rounds and handovers improved convenience for attendees, often across different sites. For medical students briefly assigned to a service, these changes may have diminished an immersive team experience and reduced opportunities for physical exam, surgical skill development, and career exploration. Nearly all students at our institution were able to complete required components of the SCC. **Conclusion:** An increase in virtual delivery of the SCC was well-tolerated by learners, but a reduction of in-person experiences carried a negative impact on skill development and career exploration. Future studies to evaluate and refine these changes using a CanMEDS framework will be crucial to engender lasting improvements to surgical education.