

Canadian Journal
of **Surgery**

Journal canadien
de **chirurgie**

Vol. 63 (6 Suppl 1) November–December 2020
DOI: 10.1503/cjs.021920

**CANADIAN CONFERENCE
FOR THE ADVANCEMENT
OF SURGICAL EDUCATION
(C-CASE) VIRTUAL
CONFERENCE**

October 29–30, 2020

Abstracts

Intraoperative teaching styles: preferences of surgical residents. *Aaron L. Grant, Jacqueline Torti, Mark Goldszmidt.* From Western University, London Ont. Corresponding author: Aaron Grant; aaron.grant@lhsc.on.ca.

Background: There is variation in the way different surgeons teach in the operating room setting. Surgical residents in training may have preferences and opinions on how these teaching styles affect their learning. While there is likely no single best approach, insight into variability may be useful for reflective practice. We sought to explore supervision practices deemed influential from the resident perspective. **Methods:** An online survey of current surgical residents and recent surgical graduates from 1 medical school in Ontario was completed. The survey was designed to identify excellent intraoperative educators from the resident perspective. Questions were designed to explore the teaching style of the nominated surgeon and why the resident believed it was influential to their learning experience. The narrative data were coded line-by-line and analyzed by 3 reviewers for emerging themes. **Results:** Survey data were collected from 48 residents and recent graduates; the majority of respondents had 4 or more years of surgical training. Thematic coding of narrative data identified 2 groupings of what residents deemed to be excellent supervisory styles. The majority preferred (1) surgeons who maintained a positive learning environment and open communication, but a smaller contrastive group preferred (2) surgeons who maintained high demands and would offer critical feedback. **Conclusion:** This study suggests that not only do teaching styles vary among surgeons, but resident perspectives also differ on how intraoperative teaching is done well. This study provides insight into influential teaching practices and encourages future research to further our understanding.

Canadian vascular surgery education assessment. *Alexa Mordhorst, Kian Draper, Isabelle Lafrance, Jonathan Misskey.* From the University of British Columbia, Department of Surgery, Division of Vascular Surgery, Vancouver, BC (Mordhorst, Draper, Misskey); and Department of Surgery, Division of Vascular Surgery, Université Laval, Québec, Que. (Lafrance). Corresponding author: Alexa Mordhorst; alexamordhorst@gmail.com.

Background: Vascular disease is a major health care burden, but inconsistent and limited vascular surgery (VS) exposure may result in suboptimal education among Canadian medical students. Optimizing VS education throughout medical school may attract more medical students to the specialty and increase knowledge about vascular issues. The purpose of this project was to assess the VS curricula across Canadian medical schools and understand how VS as a specialty can address gaps in education to better prepare future physicians for common and important vascular diseases. **Methods:** A 5-question survey was sent to all Canadian medical schools via email. This survey was translated into French to ensure equal access for all medical schools. **Results:** Eight Canadian medical schools responded to the survey (so far); 75% had VS-specific learning objectives and preclerkship didactic sessions, 37.5% taught VS clinical skills, and 37.5% offered a core clerkship rotation in VS. With respect to assessment, multiple-choice exams (87.5%), workplace-based assessments (62.5%), objective structured clinical exams (37.5%), and other (50%) were recorded. The most common preclinical learning objectives identified were

peripheral vascular disease, aneurysm pathophysiology, and abdominal aortic aneurysms. Clinical education learning objectives focused on the VS history and physical exam as common curricular themes, as well as learning around carotid stenosis. **Conclusion:** There are gaps and inconsistencies in the current VS curriculum in Canadian medical schools. It is prudent to learn about these gaps and to work as a society to address them, thus better serving our future physicians.

Thoracic surgery crisis simulation during the COVID-19 pandemic. *Alexandra McDonald, Mehdi Qiabi, Richard Malthaner.* From London Health Sciences Centre, London, Ont. Corresponding author: Alexandra McDonald; amcdonald2022@meds.uwo.ca.

Background: Coronavirus disease 2019 (COVID-19) puts health care providers at a high risk of infection. Personal protective equipment (PPE) can reduce viral transmission if used properly. To our knowledge, this is the first study to use simulation of an intraoperative crisis involving an infectious outbreak to assess PPE adherence and confidence in PPE use. **Methods:** Three simulations with 12 health care participants (3 thoracic surgery trainees, 3 anesthesia trainees, 6 registered nurses) were conducted at Victoria Hospital. The simulation involved a tracheoinnominate fistula in a patient with COVID-19. PPE, as specified in the London Health Sciences Centre PPE guidelines, was available. Independent evaluators retrospectively reviewed videos to assess PPE adherence. Participants completed questionnaires assessing confidence in PPE use and simulation fidelity. **Results:** Donning adherence was 0% for hand hygiene, 17% for neck protection, 8% for inner gloves, 100% for gown, 83% for N95 mask, 0% for goggles, 92% for face shield, 75% for outer bouffant, and 92% for outer gloves. Doffing adherence was above 85% for all steps. On average, participants completed 57% of donning steps and 92% of doffing steps in the correct sequence. Participant confidence increased in 4 key areas relating to PPE use, with an overall confidence increase from 3.9 to 4.2 out of 5. Participant feedback was positive, with an overall simulation experience score of 4.8 out of 5. **Conclusion:** Simulation of an intraoperative crisis in a patient with COVID-19 revealed gaps in PPE adherence. Simulation training successfully increased confidence in PPE use and received positive feedback, confirming a high fidelity and useful learning model.

The impact of the Surgical Skills and Technology Elective Program (SSTEP) on medical student career choice. *Carter McInnis, Hamza Asif, Stephen Mann, Andrea Winthrop.* From Queen's University, Kingston, Ont. Corresponding author: Andrea Winthrop; Andrea.Winthrop@kingstonhsc.ca.

Background: The Surgical Skills and Technology Elective Program (SSTEP), a voluntary surgical bootcamp for preclerkship medical students, uses simulation learning methodology to provide exposure to surgical specialties and enhance surgical skills before clerkship. Despite the widespread adoption of similar bootcamps, largely in response to declining interest in surgical careers, a lack of evidence exists regarding their impact on surgical career decision-making. Our objective was to examine decisions regarding specialty selection following SSTEP. **Methods:** A survey examining engagement during clerkship rotations and career decision-making was sent to all SSTEP participants since

the program's inception in 2014 ($n = 144$). Additionally, using publicly available residency match data, we compared annual match data among SSTEP and non-SSTEP participants at our institution. **Results:** Seventy-four SSTEP participants (53%) responded to the survey. Of the respondents, the majority agreed or strongly agreed that SSTEP influenced participants to engage in more surgical opportunities during clerkship (73%), and they felt more confident performing procedural tasks during clerkship as a result of SSTEP (92%). Thirty percent indicated that SSTEP influenced them to pursue a surgical career. Overall, 42% of SSTEP participants matched into surgical/procedural specialties compared with 32% of non-SSTEP graduating medical students at our institution since the class of 2016. **Conclusion:** Our analysis supports the utility of preclerkship surgical bootcamps. By providing early exposure to surgical/procedural skills, SSTEP promoted surgical engagement during clerkship. Participation in SSTEP influenced student career choice, which may have contributed to the increased match rate into surgical/procedural specialties for SSTEP participants.

Pitfalls of using Google Glass for surgical video recordings. *Arman Abdalkhani, Ameen Amanian.* From the University of British Columbia, Vancouver, BC. Corresponding author: Arman Abdalkhani; dr.a@ubc.ca

Background: Wearable technology and recording/streaming of surgeries has been shown to be an effective interactive tool in the context of surgical education, surgical logistics and conference presentations. The technology provides students with the surgeon's visual operative perspective, simultaneously having the capability of maintaining verbal teaching. For both open and laparoscopic procedures, the use of Google Glass, a brand of smart glasses, would enable the students to see a first-person view, as seen by the primary surgeon. **Methods:** Through already established and ad hoc surgical educational committee meetings, we recruited faculty surgeons who represent general surgery and their divisions (e.g., thoracic surgery, plastic surgery, otolaryngology, pediatric surgery, urology, neurosurgery, vascular surgery) to deliver content. We aimed to recruit at minimum 1 faculty member per division, totaling 8 faculty members. They were trained on how to use the hardware and software, and on obtaining proper patient consent for surgical recording. **Results:** Several obstacles during implementation became apparent as the project was being developed, including procurement, programming and video quality. A guide for next steps was developed, and a small pilot model at Vancouver General Hospital to assess quality of video production and teaching impact during head and neck surgery was implemented. **Conclusion:** To implement novel technology in the operating room, a structured approach to procurement, programming and informed consent must be taken. A pilot model will be helpful for further expansion into different surgical divisions.

MaxSIMbox: the development and additive manufacturing of portable and inexpensive simulators to support virtual, experiential learning platforms. *Artur Arutiunian, Jennifer Hiley, Geoff Hughes, Adam Dubrowski.* From Ontario Tech University, Oshawa, Ont. (Arutiunian, Dubrowski); and Lakeridge Health Hospital, Oshawa, Ont. (Hiley, Hughes). Corresponding author: Artur Arutiunian; artur.arutiunian@ontariotechu.net.

Background: Acquisition of technical skills, such as intraosseous infusion (IO), requires experiential learning approaches. However, there are limited opportunities to provide this type of learning virtually. There are 2 requirements: instructions and feedback at a distance, and standardized physical bench-top simulators. We describe the development and additive manufacturing of such simulators for acquisition of IO skills. **Methods:** We used expert-informed, iterative, closed-loop design cycles to develop and manufacture the maxSIMBox: IO. There were 3 design cycles, and at each cycle the simulators were assessed by simulation experts (1 neonatal resuscitation and 3 paramedics), feedback was gathered and revisions were made. We used 3D printing to manufacture maxSIMbox: IO. **Results:** In the current design, the unit holds 3 pairs of tibial bone simulators (neonatal, 5-year-old, teenager) with replaceable parts and IO tools. A unique mounting mechanism and casing allow the unit and the simulators to be portable, well organized and placed on any hard surface, and ensure standardized placement and working space. The unit costs \$24, and the replacement parts cost \$0.50 each to produce. **Conclusion:** Additive manufacturing may be a cost-effective method of development of portable simulators for home-based practice of technical surgical skills. The modular and flexible design and manufacturing processes provide an ease of adapting maxSIMbox to practise many other surgical skills. When coupled with any of the emerging online, computer-based video instruction and feedback technologies, maxSIMbox offers an inexpensive, customizable and effective option of learning fundamental surgical skills remotely.

Hemorrhaging laparoscopic partial nephrectomy — feasibility of a novel simulation model. *Avril Lusty, James Watterson, Isabelle Raiche.* From the University of Ottawa, Ottawa, Ont. Corresponding author: Avril Lusty; alusty@qmed.ca.

Background: Intraoperative surgical complications can pose significant potential injury to patients and yet they are infrequently practised. Uncontrolled bleeding during laparoscopic partial nephrectomy is an important scenario that requires excellent communication within the operative team. We aimed to develop a surgical simulation of intraoperative hemorrhage during a laparoscopic partial nephrectomy. **Methods:** A simulation scenario using an uncontrolled bleeding partial nephrectomy model was developed. The scenario progressed to a pulseless electrical activity arrest. The multidisciplinary simulation included anesthesiology and urology residents. The simulation consisted of a functioning, intubated mannequin placed in the lateral decubitus position, a laparoscopic tower and functioning anesthesia monitoring. All urology residents from postgraduate year 3–5 were scheduled to participate in February and March 2020. Participants completed a postsimulation survey assessing their evaluation of the simulated scenario. **Results:** The porcine model was able to be reproduced weekly for 9 consecutive weeks and was able to simulate minor and major bleeding from a laparoscopic partial nephrectomy site. The bleeding was able to be titrated based on resident progression and excision of the simulated tumour. All residents believed there was high fidelity to the model and that the scenario was valuable to assess and improve nontechnical surgical skills. **Conclusion:** Simulating an intraoperative bleeding partial nephrectomy, combined with a subsequent crisis scenario, is a feasible, immersive and reproducible model.

The gap in urology resident understanding of a robotic prostatectomy — what residents do not perceive when assisting. *Avril Lusty, Rodney Breau, Chris Morash, Ilias Cagiannos, Luke Lavallee, Tim Wood, Isabelle Raiche.* From the University of Ottawa, Ottawa, Ont. Corresponding author: [Avril Lusty; alusty@qmed.ca](mailto:alusty@qmed.ca).

Background: Robotic surgery, and the robotic prostatectomy, has been adopted into urology training programs internationally. With the need for dedicated robotic training programs, we sought to explore the knowledge gap in understanding robotic prostatectomy among residents compared with urologists. **Methods:** A 16-question survey was developed to document the difference in understanding between residents and urologists. The survey contained items pertaining to patient anatomy, procedural steps and surgical decision-making. Urology residents, performing as bedside assistants, and urologists were surveyed directly after a robotic prostatectomy. Statistical analysis of the quantitative questions was performed using κ scores, and thematic analysis was performed to analyze the qualitative responses. **Results:** Forty-two surveys were administered to urology residents and urologists at The Ottawa Hospital over 10 weeks. There was disagreement between urology resident and urologist responses. Disagreement was noted with the comparison of the following procedural steps: vesicourethral anastomosis (κ 0.138), apical dissection (κ 0.149), and seminal vesicle dissection (κ 0.342). The qualitative responses found discrepancies between resident and urologist understanding. When asked to describe challenges during the procedure, urologists described causal factors leading to challenges and how to manage these issues intraoperatively. The residents' responses focused on readily visible aspects of the procedure, like bleeding or difficult exposure, without describing the causes of these challenges. **Conclusion:** There is a gap in urology resident knowledge and understanding of robotic prostatectomy. This information is key to expand the understanding of robotic prostatectomy surgical decision-making and training in this procedure.

What am I training for? A qualitative exploration of surgical trainees' educational and employment expectations in Canada. *Anuj Arora, Lesley Gotlib Conn, Francis Wright, Jamie Escallon, Ashlie Nadler.* From the Division of General Surgery, University of Toronto, Toronto, Ont. (Arora, Wright, Escallon, Nadler); and the Sunnybrook Research Institute, Toronto, Ont. (Conn). Corresponding author: [Ayesha Tasneem; ayesha.tasneem@mail.utoronto.ca](mailto:ayesha.tasneem@mail.utoronto.ca).

Background: Unemployment or underemployment after graduation from residency is a known issue in general surgery (GS) in Canada. The aim of the current study was to explore graduating residents' educational and employment expectations. It is crucial to ascertain not only the quantitative reality of this issue, but also to gain an in-depth appreciation of the personal experiences involved and issues faced by graduating residents. **Methods:** An online questionnaire was distributed to graduating GS residents at a national review course in 2018. A total of 48 of 110 (44%) residents responded, representing 14 of 17 Canadian GS programs. We also designed a follow-up qualitative study in which we interviewed 9 graduating GS residents from across Canada. **Results:** Sixty-nine percent of respondents felt ready for practice, yet only 15% of respondents stated they

had secured a full-time job. Sixty-four percent of participants thought there should be a mandatory retirement age or a decrease in the number of residency spots to increase employment. Ninety-two percent of respondents thought the best ways to find jobs were by having local connections. More than 84% thought job sharing could result in a smooth transition to practice. Most respondents ranked location of practice as the most important factor in a job. We are currently deriving themes from interviews and grounding this work in an interdisciplinary framework. **Conclusion:** We suggest a multi-pronged approach to ameliorate this issue, including investment in career planning and counselling at the GS program level, use of the new transition to practice year to create job-finding networks, and increased use of shared-practice models.

Effect of peer-assisted workshops on suturing and knot-tying techniques on the self-reported confidence level in skills and interest in surgical specialties for preclinical medical students. *Maureen Thivierge-Southidara, Lan Dao, Charles Meunier, Gabriel S. Dayan, Nick J. Lee, Jessica Cyr, Madeleine Poirier, Frédéric Mercier, Margaret Henri, Michel Carrier.* From the Faculty of Medicine, Université Laval, Québec, Que. (Thivierge-Southidara); Faculty of Medicine, Université de Montréal, Montreal, Que. (Thivierge-Southidara, Dao, Meunier, Dayan, Lee, Cyr, Poirier, Mercier, Henri, Carrier); Department of General Surgery, Hôpital Maisonneuve-Rosemont, Montreal, Que. (Poirier, Henri); Department of Surgical Oncology, Centre Hospitalier de l'Université de Montréal, Montreal, Que. (Mercier); and Department of Cardiac Surgery, Montreal Heart Institute, Montreal, Que. (Carrier). Corresponding author: [Charles Meunier; charles.meuniercm@gmail.com](mailto:charles.meuniercm@gmail.com).

Background: Preclerkship curricula include little to no basic surgical skills training, hence failing to strengthen the confidence level of students. Surgically inclined interest groups may grant crucial exposure, promote interest in surgery, and increase the confidence level in these skills. **Methods:** Preclinical medical students were recruited to determine the effect of a single event — a peer-assisted suturing and knot-tying workshop — on their self-reported expertise in these skills and their interest toward a surgical career. A survey was distributed before, immediately after, and 6 weeks following the workshop. **Results:** A total of 139 participants attended the workshops, of whom 134 answered both pre- and post-workshop surveys. Of those, 39 participants also submitted their 6-week follow-up survey. Following the workshop, statistically significant increases were observed for self-reported expertise in suturing and 1-handed and 2-handed surgical knots (mean increases 1.80 ± 1.03 , 2.05 ± 1.16 , and 1.95 ± 1.26 , respectively; $p < 0.001$), though such effects were not as consistent when measured 6 weeks later. Additionally, participants' interest for surgical careers was found to be increased immediately following the workshop (mean 0.15 ± 0.54 ; $p = 0.006$). **Conclusion:** Student-led workshops promote an early positive introduction to various basic surgical techniques, which correlates with an increase in the students' self-reported ability to perform the techniques and a higher interest in surgical careers. Long-term effects of such workshops on the abilities of the participants and their interest to seek opportunities to learn more technical skills remain to be assessed.

LearnENT: a novel otolaryngology – head and neck surgery virtual learning tool. *Corliss Best, Elysia Grose, Scott Kohlert, Ryan Rourke.* From the University of Ottawa, Ottawa, Ont. (Best, Grose, Rourke); Ear, Nose, and Throat Associates of East Texas, Tyler, Texas (Kohlert); and Children’s Hospital of Eastern Ontario, Ottawa, Ont. (Rourke). Corresponding author: Elysia Grose; egros043@uottawa.ca.

Background: Otolaryngology – head and neck surgery (OHNS) is underrepresented in Canadian medical school curricula. Thus, an interactive smartphone app and website, LearnENT, was designed to help learners develop approaches to clinical problems in OHNS. **Methods:** The app was initially created using the Apple iOS platform in 2012. From 2015 to 2018, the app underwent a redesign that included the creation of a website, an instructor portal, and a web-based content management system. LearnENT was included as an adjunctive component to the OHNS curriculum for third-year clinical clerks at the University of Ottawa during the coronavirus disease 2019 (COVID-19) pandemic. An anonymous survey, which included questions rated on a 5-point Likert scale, was distributed to medical students to assess learner satisfaction. **Results:** LearnENT is currently an open-access OHNS e-learning resource consisting of interactive clinical cases and a plethora of other study resources. Medical students indicated that the LearnENT cases improved their knowledge (mean 4/5) and that the content was appropriate for their level of training (mean 4.2/5). Eighty percent of students indicated that they would recommend LearnENT to other students, and 68% indicated that LearnENT was a valuable addition to their clerkship curriculum. However, 52% of students reported minor technical glitches associated with the platform itself, particularly with the interactive components of the app. **Conclusion:** LearnENT is a novel, virtual learning resource that is well-received by medical students. The development of LearnENT, including successes and pitfalls, can serve as a model for other e-learning platforms in surgical education.

Design, fabrication, and quality improvement of a novel 3D-printed knee injection task trainer. *Evan Walters, Kristina Roche, Eugene Krustev, Craig Martin, Adam Dubrowski, Proton Rahman, Shaina Goudie, Sam Aseer.* From Memorial University of Newfoundland, St. Johns, NL (Walters, Martin, Rahman, Goudie, Aseer); Dalhousie University, Halifax, NS (Roche); University of Calgary, Calgary, Alta. (Krustev); and Ontario Tech University, Oshawa, Ont. (Dubrowski). Corresponding author: Evan Walters; etw148@mun.ca.

Background: Knee joint injection and aspiration are common procedures in the modern clinical setting, and training in these skills is necessary for all medical learners to ensure competence and confidence. Task trainers, which simulate the experience of a medical procedure, are a promising adjunct to traditional trainee practice on real patients. Our objective was to develop a low-cost knee injection task trainer to serve as an alternative to standard commercially available models and to gather preliminary data on its suspected utility in medical training curricula. **Methods:** Our model was inspired by assessment of a commercially available task trainer and was updated and constructed via 3D printing. A quality-improvement process was undertaken that involved presentation of the model to 8 content experts (orthopedic surgeons

and rheumatologists) already well-versed in knee injection and arthrocentesis. Content experts were asked to provide feedback on the estimated utility of the task trainer in training medical learners in knee injection and arthrocentesis. **Results:** Through analysis of collected evaluation questionnaires, areas requiring improvement were identified. Results showed that evaluators viewed the model construction as fairly realistic, but that some modifications were required to improve experiential realism. Further modifications were made, leading to the development of a final model, which we feel is more realistic and applicable to medical training curricula than previous, commercially available task trainers. **Conclusion:** Through this work, we have developed a cost-effective task trainer, which we expect to be useful in medical learner training, and that is now ready to undergo a formal validation process.

“Transition Tuesdays” for junior surgical residents: teaching surgical decision-making through a screen. *Farhana Shariff.* From the Department of Surgery, University of Toronto, Toronto, Ont. Corresponding author: Farhana Shariff; farhana.shariff@mail.mcgill.ca.

Background: The transition from junior to senior resident involves a critical role change that includes a shift from information gathering to higher-level decision-making, with increasing independence and leadership. During coronavirus disease 2019 (COVID-19), residents have been redistributed to minimize personnel exposure and provide necessary clinical coverage. Consequently, exposure to emergency consults and the operating room have been significantly reduced during a time where these trainees would be working to practise skills necessary for senior residency. **Methods:** A pilot program of case-based teaching sessions was offered by videoconference to all postgraduate year 2 general surgery trainees weekly for 6 sessions. Attendance was voluntary. Interactive discussion focused on clinical decision-making, informed procedural consent and basic surgical principles, with an emphasis on operative exposures, surgical anatomy and operating room (OR) “danger zones.” **Results:** All participants agreed or strongly agreed that sessions were safe for learning, level appropriate, and provided content not currently covered in junior resident educational programming. Specifically, residents commented that sessions “reinforced knowledge” and that “understanding of clinical scenarios was deepened greatly through these sessions.” **Conclusion:** This adaptation of surgical skills teaching has been useful as a bridge for technical teaching in the OR. Keys to the success of this pilot included explicit establishment of a “safe space” by the near-peer instructor, as well as absence of summative assessment by the facilitator. This early exploration of ways in which teaching of surgical and technical skills can be optimized outside of the clinical setting will continue, with the goal of preparing trainees to capitalize on in-person surgical experiences throughout their training.

The nature of learning from simulation: “Now I know it, now I’ll do it, I’ll have to work on that.” *Farhana Shariff, Rose Hatala, Glenn Regehr.* From the Department of Surgery, University of Toronto, Toronto, Ont. (Shariff); Department of Medicine, University of British Columbia, Vancouver, BC (Hatala); and Centre for Health Education Scholarship, University of British Columbia, Vancouver, BC (Regehr). Corresponding author: Farhana Shariff; farhana.shariff@gmail.com.

Background: Ongoing learning in complex clinical environments requires health professionals to assess their performance and modify their practices based on self-monitored progress. Self-regulated learning (SRL) theory suggests that learners may be capable of such learning, but often need guidance to enact it effectively. Simulation debriefings may be an ideal time to prepare learners for SRL in targeted areas, but may not be optimally fostering these practices. This study aims to explore and characterize the nature of the learning by participants after team-based simulation training. **Methods:** A qualitative study informed by grounded theory methodology was conducted during interprofessional in situ trauma simulations at a level-1 trauma centre. Participants were interviewed immediately after and 4–6 weeks after the experience. Thematic analysis was performed focusing on the types of learning present in and after simulation. **Results:** There were many examples of acquired knowledge and straightforward practice change plans during initial interviews; however, more sophisticated examples of SRL were lacking early on. Some participants appeared to have more specific learning goals and rudimentary plans for self-regulated implementation and improvement by the follow-up interviews, but often suggested this was prompted by the interviews rather than the simulation debriefing itself. **Conclusion:** Overall, participants did not engage in full development of SRL plans based on the simulation debriefing; however, there were elements of SRL present, particularly in follow-up discussions after participants had time to reflect on the interview questions and their own goals. This is an encouraging sign that simulation training can support development of this skill. However, debriefing approaches would need to be better optimized to take full advantage of the opportunity to encourage and foster SRL in practice after the simulation is over.

A prospective interventional study on the efficacy of a newly developed application in the improvement of patient handoffs by medical students during their surgical rotations. *Florence Lebel-Guay, Léamarié Meloche-Dumas, Michèle Beniey, Adam Arcaro, Myriam Abbas, Malek Dhane, Myriam Elraheb, Natasha Guérard-Poirier, Adam Dubrowski, Frédéric Mercier, Érica Patocskai.* From Université de Montréal, Montreal, Que. (Lebel-Guay, Abbas, Dhane, Elraheb, Guérard-Poirier, Meloche-Dumas, Beniey); Concordia University, Montreal, Que. (Arcaro); Ontario Tech University, Oshawa, Ont. (Dubrowski); and Centre Hospitalier de l'Université de Montréal, Montreal, Que. (Mercier, Patocskai). Corresponding author: Florence Lebel-Guay; florence.lebel-guay@umontreal.ca.

Background: The decreasing number of surgical residents has led to a greater involvement of clerks in various tasks surrounding patient care, including handoffs to attending surgeons. The main objective of this study is to compare the efficiency and quality of handoffs performed by clerks using the ChirX application with that of a control group. **Methods:** A mobile application, ChirX, was created by our research group. Twenty-four clerks in their core surgery rotation were randomized to the group using the app or to the control group. An objective structured clinical examination (OSCE) took place at the end of their rotation to assess the clinical reasoning as well as the efficiency and quality of their handoffs to the evaluators. A second cohort of 18 clerks is currently underway, in order to increase statistical

power. A virtual OSCE via the Zoom platform will take place at the end of their rotation. **Results:** The experimental group (with application access) performed better during the OSCE, with no statistically significant difference between the groups. The majority of application users said it improved the accuracy of their transfer and had the potential to improve patient care. **Conclusion:** This first cohort of clerks lays the foundation for the use of this mobile application in the clinic. The results are encouraging and the enthusiasm of medical students demonstrates that the application has academic potential. This second cohort will hopefully demonstrate a statistically significant difference between the 2 groups, making this mobile application an important tool to offer to medical students.

Broadcasting clinical activities of the mandatory surgical rotation to clerks in the light of COVID-19 on the Gamified Educational Network (GEN) platform, a pilot study. *Myriam ElRaheb, Florence Lebel-Guay, Michèle Younan, Adam Dubrowski, Frédéric Mercier, Erica Patocskai, Rami Younan.* From Université de Montréal, Montreal, Que. (Lebel-Guay, ElRaheb); Jean-de-Brébeuf CEGEP, Montreal, Que. (M. Younan); Ontario Tech University, Oshawa, Ont. (Dubrowski); and Department of Surgical Oncology, Centre Hospitalier de l'Université de Montréal, Montreal, Que. (Mercier, Patocskai, R. Younan). Corresponding author: Florence Lebel-Guay; florence.lebel-guay@umontreal.ca, and Myriam ElRaheb; myriam.elraheb@umontreal.ca.

Background: The decrease in clinical activities in surgery due to coronavirus disease 2019 (COVID-19) leads to the decrease of clinical exposure for clerks during their surgery rotation, including exposure to the operating room (OR). This pilot study aims to provide remote access for medical clerks during their surgery rotation through the Gamified Educational Network (GEN) in order for them to have a proper exposure of day-to-day surgical practice. **Methods:** The most frequent and important surgeries that clerks are less exposed to due to the pandemic are recorded in the OR via the HoloLens and uploaded on the GEN platform. Thirty clerks navigate the platform during the 6 weeks of their surgery rotation. Clerks are able to communicate among themselves through the chat option in the platform encouraging peer teaching. An expert (surgeon) answers the clerks' questions and clarifies the important concepts of each surgery. Clerks and surgeons share their experience of using this new teaching tool and their perception of its quality, which is measured through a survey. **Results:** Unfortunately, due to COVID-19, the process of recording the surgeries has been delayed to the end of September 2020. We believe that clerks will demonstrate a keen interest toward this teaching tool. **Conclusion:** This pilot study will lead to a randomized controlled trial that involves using the HoloLens in a synchronous versus asynchronous method in order to put to the test the added value of this new teaching method to the actual medical curriculum versus the traditional teaching of clerkship.

NOBL FIIISTT: Framing concepts for the beginner learner in surgery. *Geoffrey Blair.* From the University of British Columbia, Vancouver, BC. Corresponding author: Geoffrey Blair; geoffrey.blair@ubc.ca.

Background: Teaching and learning the concepts of surgery, like in any specialized field, can be hard work. Its technical language, diagnostic and procedural ideas, unique problems and solutions, and even the surgeon's mindset can easily confuse and intimidate the beginner surgical learner. Most medical students are reduced to memorizing an overwhelming list of words and facts rather than developing a meaningful understanding of the underlying principles. NOBL FIIISTT is a conceptual framework of the basic elements of surgical disease for the early surgical learner who is at the threshold of the more intensive surgical education they will encounter in their clinical years of training. NOBL FIIISTT is an acronym for the elements of diagnosis and care in which surgeons may play a key role: neoplasms, obstructions, bleeds, leaks, function disorders, inflammatory conditions, infections, ischemia, structural disease, trauma/tissue damage. These elements of surgical disease are not confined within organ systems or surgical disciplines, nor are they mutually exclusive. **Methods:** This framework was used as an educational tool in print, seminar, lecture and virtual formats at our medical school for students in the preclinical and clerkship years and as a pregraduation surgery review course. **Results:** NOBL FIIISTT served as a useful surgical teaching tool for medical students at various levels of training who also commented favourably on it as a conceptual learning framework. **Conclusion:** The educational use of the NOBL FIIISTT framework helps create meaning for the early surgical learner, connecting surgical elements that might initially appear conceptually far apart.

Study habits of surgery clerkship medical students at the University of Alberta. *Allison Rau, Ioana Bratu.* From the University of Alberta, Edmonton, Alta. Corresponding author: Ioana Bratu; bratu@ualberta.ca.

Background: The aim of this study was to gain a better understanding of how medical students find their surgical rotation study habits during year 3 of clerkship. The transition from preclerkship to clerkship can be overwhelming for students, and finding time to study for Objective Structured Clinical Examinations (OSCE) and Licentiate of the Medical Council of Canada (LMCC) examinations can be challenging. **Methods:** A survey was sent to year 3 students who completed their surgical rotation (SURG546). Questions focused on the type of study strategies used, whether they felt the learning objectives of the rotation were met, how they felt their performance was and how well prepared they felt for their LMCC exams. **Results:** A total of 45 surveys were completed. The top 3 resources used for the clinical/ward component were Toronto Notes ($n = 33$), UpToDate ($n = 32$) and the SURG546 Google Drive ($n = 26$). For the operating room the top 3 were *Surgical Recall* by Lorne Blackbourne ($n = 25$), UpToDate ($n = 15$) and Toronto Notes ($n = 12$). The most helpful resources for consults were UpToDate ($n = 32$), Toronto Notes ($n = 25$) and the SURG546 Google Drive ($n = 13$). The most common resources used to prepare for the multiple choice exam were Toronto Notes ($n = 33$), the SURG546 Google Drive ($n = 27$) and suggestions from prior clerks ($n = 17$). For the OSCE, the SURG546 Google Drive ($n = 24$), Toronto Notes ($n = 22$) and suggestions from prior clerks ($n = 22$) were most common. Seventeen students had surgical clinical exposure through shadowing, 12 through electives before the SURG546 rotation and 6 from research projects. Surgical skills were learned through a previous rotation in the operating room ($n = 39$), online

videos and tutorials ($n = 35$), and a suturing session during link block ($n = 23$). Overall, the majority felt that the face-to-face assessments, OSCE and multiple choice exam reflecting abilities was "average." **Conclusion:** Medical students in their third year of the program and starting their clerkship rotations experience challenges adjusting to the practical component of their training while managing multiple resources to prepare for examinations. Overall, the most common resources used by students were UpToDate, Toronto Notes and the SURG546 Google Drive. This information will help guide the SURG546 coordinators to streamline resources for students so that they are able to maximize their learning and study time effectively.

A needs assessment of Canadian general surgery post-graduate trauma training. *Joanna Ryan, Patrick Murphy, Brett Mador.* From the University of Alberta, Edmonton, Alta. (Ryan, Mador); and the Medical College of Wisconsin, Milwaukee, Wis. (Murphy). Corresponding author: Joanna Ryan; jfr@ualberta.ca

Background: Canadian general surgery trainees have seen a marked decrease in operative trauma exposure over recent decades. Despite this, graduates are expected to provide high-quality trauma care independently. **Methods:** This study used a prospective survey-based design based on preliminary qualitative analysis of interview and focus group data. Canadian general surgery educators, trauma surgeons and residents were invited to participate. Participants were asked about trauma training experience, educational resources within training programs and support for inclusion of various initiatives in an ideal trauma curriculum. **Results:** The survey response rate was 47.8% (33/69) and 16.0% (65/405) for educators and trainees, respectively. Perceived deficiencies were identified by educators and trainees in the operative management of thoracic (12.5%, 29.0%), mediastinal (3.1%, 14.5%), neck (15.6%, 32.3%), and vascular (25.8%, 48.4%) injuries. Additional educational deficiencies were identified in trauma systems and epidemiology, research and quality improvement, and community initiatives. Faculty more frequently endorsed inadequate operative and nontechnical skills training than trainees. Both educators and trainees supported participation in radiology (77.4%, 84.5%) and guideline (74.2%, 89.7%) reviews, journal clubs (83.9%, 81.0%), education rounds (90.3%, 87.9%), leading trauma resuscitations (93.5%, 98.3%), and trauma resuscitation simulations (90.3%, 94.8%) as valuable educational initiatives. **Conclusion:** Trauma training in Canada is perceived as insufficient to meet the needs of the graduating general surgery resident. Development of educational initiatives within the new competency-based training model will be critical to correct the identified deficiencies. The data collected in this study will help facilitate development of a nationally standardized curriculum and educational innovations to optimize trauma training.

Interventions to improve empathy among surgical trainees: a systematic review. *Shawn Khan, Flora Jung, Abirami Kirubarajan, Khizar Karim, Adena Scheer, Jory Simpson.* From the Faculty of Medicine, University of Toronto, Toronto, Ont. (Khan, Jung, Kirubarajan, Karim); and the Department of General Surgery, St. Michael's Hospital, Toronto, Ont. (Scheer, Simpson). Corresponding author: Jory Simpson; jory.simpson@utoronto.ca.

Background: Humanism in surgery is an emerging priority in surgical education. Its emphasis on the patient experience is a key component of the therapeutic relationship between surgeons and their patients. However, the documented high rates of compassion fatigue and burnout among surgical trainees and staff can serve as a barrier in delivering care with empathy and compassion. As such, this systematic review seeks to characterize the outcomes regarding interventions that aim to broadly improve humanism within surgery. **Methods:** A systematic search of 4 electronic databases (EMBASE, MEDLINE, PsycINFO, and Cochrane CENTRAL) was conducted through an independent double selection and extraction process from database inception to Mar. 20, 2020. The inclusion criteria consisted of interventional studies aiming to improve humanism in surgery at all levels of training. A qualitative synthesis and thematic analysis were performed. **Results:** A total of 19 studies (1 randomized controlled trial, 14 prospective cohort studies and 4 cross-sectional studies) with 20 intervention arms were included from the initial 745 studies that were eligible for title screening. Studies included a total of 1763 surgical trainees at varying levels of training. Two major strategies for improving humanism were identified: directly through the development of empathetic communication skills ($n = 11$), and indirectly through programs aimed at reducing levels of compassion fatigue and emotional exhaustion by addressing trainee burnout ($n = 9$). A total of 70% (14/20) of the studied interventions were successful in improving empathy in surgical trainees. **Conclusion:** Interactive workshops around the principles of empathetic communication with patient simulations and small group learning were effective at improving empathy in surgical trainees. Furthermore, mindfulness-based training and the provision of physical resources to support trainee well-being consistently improved rates of burnout among surgical trainees. Overall, further investigation is necessary to better understand methods of improving empathy in surgery.

From skillful to empathetic: shifting medical students' perceptions of surgeons through a patient as teacher program. *Gurjot Gill, Stella Ng, Emilia Kangasjarvi, Jeff Crukley, Arno Kumagai, Jory Simpson.* From St. Michael's Hospital, University of Toronto, Toronto, Ont. Corresponding author: Jory Simpson; jory.simpson@utoronto.ca.

Background: This study aimed to measure the effects of a combined patient as teacher (PAT) and arts based reflection (ABR) program on students' perceptions of surgeons. Third year surgical clerkship students attend patient-driven teaching sessions in which patients share their personal stories, experiences with the health care system, and perspectives on how their illness has affected their lives. Students listen, engage in dialogue, and then use art as a means to reflect on how the patient perspective influenced their outlook during their rotations. **Methods:** Students were asked to list the top 5 attributes of a surgeon, in order of perceived importance, both before their surgical rotation and participation in the PAT program and after completion of their rotation. The attributes identified by students were coded as either "humanistic" or "nonhumanistic." Results were analyzed through an innovative model of qualitative data generation and Bayesian statistical approaches. **Results:** After participation in the PAT program the mean

predicted probability of students ranking a humanistic characteristic as the most important attribute of a surgeon had increased by 17%, and the predicted probability of students ranking a humanistic characteristic among their top 3 attributes for a surgeon had increased by 21%. **Conclusion:** The lived experiences of patient-teachers and reflection through art may offer an effective combined intervention in helping to shift student perspectives regarding surgeon characteristics. The PAT program acts as an invaluable tool in furthering surgical education toward a patient-centred approach, and our new evaluative model supports the success of this initiative in encouraging humanism in medicine.

Spaced-repetition with electronic flashcards to supplement curricular objectives: preliminary results from the UBC clerkship Anki initiative. *Joshua Piemontesi, Aiyden Martindale, Zach Sagorin.* From the University of British Columbia, Vancouver, BC. Corresponding author: Joshua Piemontesi; joshpiemontesi@gmail.com.

Background: Surgical education challenges clerks to balance clinical requirements and curricular objectives. The testing effect, active recall and spaced repetition via electronic flashcards has been shown to improve standardized test scores among medical students. The UBC clerkship Anki initiative aims to use these principles to develop an accessible resource that supplements curricular learning for third-year medical students. **Methods:** We used spaced-repetition software to create electronic flashcards for third-year medical students. Medical students volunteered to collaborate with physicians and residents to construct electronic flashcards based on curricular objectives. **Results:** Thirteen UBC 2021 medical students volunteered as "specialty leads" and created 3629 flashcards covering 120 clerkship learning objectives across 11 specialties and 5 surgical specialties. Of the specialty leads, 9 (69%) completed our quality assurance survey. All specialty leads thought the resource would be useful to clerkship students, 8 attributed usefulness to resource accessibility/efficiency (89%). Specialty leads rated content confidence 2.89/5 before completion and 4.22/5 after completion. Most frequent motivations for involvement were contributing to learning of future classes (4, 44.4%) and enhancing own learning (5, 55.6%). Three specialty leads (33%) partnered with an expert reviewer. At least 70 students have interacted with the resource thus far. **Conclusion:** Developing a spaced-repetition learning resource improved content confidence in content creators. Medical students value accessibility and efficiency in education and are self-motivated to learn and develop resources for peers. Content creation was limited by access to expert reviewers. Faculty support may enhance content quality and implementation.

The glaring gender bias in the operating room: a qualitative study of factors influencing career selection for first-year medical students. *Kimia Sorouri, Shawn Khan, Sylvie Bowden, Stephanie Searle, Lauren Carr, Jory Simpson.* From the Faculty of Medicine, University of Toronto, Toronto, Ont. (Sorouri, Shawn, Bowden, Searle, Carr); and the Department of Surgery, St. Michael's Hospital, Toronto, Ont. (Simpson). Corresponding author: Kimia Sorouri; kimia.sorouri@mail.utoronto.ca

Background: Despite more female- than male-identifying Canadian medical graduates, women continue to be underrepresented in surgical specialties. The aim of this study was to explore the role of lifestyle challenges and gender-specific considerations in career selection among first-year medical students following early exposure to surgery. **Methods:** A single-institution, qualitative study was completed consisting of structured focus groups with 30 first-year medical students before and after completion of a 2-week surgical program. The program consisted of shadowing, surgeon-led talks and surgical skills workshops in all direct-entry surgical specialties within the Department of Surgery at the University of Toronto. Six entry and exit interviews were conducted by 2 authors. Interviews were recorded, transcribed and coded for thematic analysis. **Results:** Four prominent themes emerged: gender imbalances in the work environment, the importance of female mentors, gender-specific challenges of parenting, and the importance of flexible work hours for both male and female students. Greater exposure to female surgeons improved the outlook of medical students on work-life balance. Medical students are concerned with the challenges of pregnancy in a surgical profession. Both male and female students consider parenting, supportive partners, and flexibility of work hours in their career selection. **Conclusion:** This study shows the prevalence of gender bias in surgical specialties, raising gender-specific challenges that affect career selection for first-year medical students. It supports efforts to implement mentorship programs for women in surgery early in medical education. Furthermore, concerns surrounding child-bearing further support the need for parental leave policies in Canadian residency programs.

Surgical resident perceptions of a virtual bootcamp. *Krista Lai, Brett Mador.* From the University of Alberta, Edmonton, Alta. Corresponding author: Krista Lai; klai1@ualberta.ca.

Background: At the University of Alberta, a surgical foundations bootcamp for first-year surgical residents was delivered every Wednesday morning during July and August. This format was optimized to better meet needs, and a 3-day bootcamp was implemented in July 2020. The bootcamp was planned to be in person, but because of the coronavirus disease 2019 (COVID-19) pandemic, adaptations were made to transition to a mostly remote delivery bootcamp. Resident preparedness and feasibility of a virtual bootcamp were assessed through pre- and post-bootcamp surveys. **Methods:** Before bootcamp and 1 month after, a survey was distributed to first-year surgical residents to assess their level of preparedness and their perceptions of a virtual learning bootcamp. **Results:** At total of 23/28 (82%) residents responded to the pre-bootcamp survey. Fifty-two percent felt neutral toward their preparedness for residency. Free text comments cited recent experiences with virtual orientation as sources of worry for bootcamp. Nearly 50% strongly agreed they worried about virtual delivery negatively affecting their learning. While roughly 50% agreed they could learn just as well virtually compared with in-person sessions for lectures, the vast majority disagreed pertaining to small group/simulation sessions. A total of 11/28 (39%) responded to the post-bootcamp survey. Fifty-five percent felt better prepared and ready for residency after bootcamp, 36% felt virtual delivery negatively affected their learning, and 64% stated they would prefer fully in-person bootcamps in the future. Free text comments cited challenges

with engagement and socialization. **Conclusion:** This study highlights the perceptions of first-year surgical residents toward a virtual learning bootcamp. While technically feasible, resident learning and preferences need to be considered for ongoing remote delivery learning.

Undergraduate medical education curricula during the COVID-19 pandemic: lessons learned. *Maham Bushra, Abdollah Behzadi.* From the University of Toronto, Toronto, Ont. (Bushra, Behzadi); and Trillium Health Partners, Mississauga, Ont. (Behzadi). Corresponding author: Maham Bushra; maham.bushra@mail.utoronto.ca.

Background: Owing to the coronavirus disease 2019 (COVID-19) pandemic, there has been an unprecedented disruption in medical education. Subsequently, academic institutions across Canada have rapidly developed and implemented virtual learning strategies for undergraduate medical education (UME). The objective of this study was to compare the content of the virtual surgical curriculum developed at the University of Toronto to other specialties, namely family medicine, internal medicine and obstetrics and gynecology (OB/GYN), and to explore opportunities to advance virtual UME in surgery. **Methods:** The UME virtual curriculum content in the online platform for surgery, family medicine, internal medicine and OB/GYN clerkship courses were examined. The content was analyzed and compared based on the Royal College CanMEDS roles of professional, communicator, collaborator, leader, health advocate, scholar and medical expert using a subjective rating scale of 0 to 10. **Results:** The curriculum for surgery focused on video-recorded seminars, synchronous lectures via videoconferencing, recorded surgical videos and text-based online resources. OB/GYN and family medicine had resident-led small-group teaching sessions in addition to videoconferencing. Content delivery for internal medicine was primarily via synchronous, staff-led lectures. On the rating scale, the surgery curriculum averaged 8 on medical expert, 6 on scholar and less than 5 on all other CanMEDS roles. **Conclusion:** Emphasis on the medical expert role of the CanMEDS framework of physician abilities required to meet health care needs of patients is widely covered in virtual curricula of UME. However, for virtual medical education to effectively cover other roles, more advanced virtual technology platforms and other innovative learning solutions are required.

Evaluating the impact of the COVID-19 pandemic on Canadian medical clerks and identifying student-based solutions. *Malek Dhane, Myriam Abbas, Michèle Beniey, Léamarie Meloche-Dumas, Natasha Guérard-Poirier, Myriam El-Raheb, Florence Lebel-Guay, Adam Dubrowski, Erica Patocskai.* From Université de Montréal, Montréal, Que. (Abbas, Dhane, Beniey, Meloch-Dumas, Guérard-Poirier, El-Raheb, Lebel-Guay, and Patocskai); and Ontario Tech University, Oshawa, Ont. (Dubrowski). Corresponding author: Malek Dhane; malek.dhane@umontreal.ca.

Background: This study aims to assess the impact of the coronavirus disease 2019 (COVID-19) pandemic on the well-being, training, and career choices of Canadian medical clerks within the first 3 months of the pandemic as well as their appreciation of potential solutions to common academic stressors. **Methods:** An

electronic survey composed of 4 sections — demographics, stressors experienced during the pandemic, World Health Organization (WHO) well-being index, and stress management and resources — was distributed to Canadian clerks. **Results:** Clerks from 10 of the 17 Canadian medical faculties participated in this study ($n = 627$). Forty-five percent of clerks reported higher levels of stress than usual, 22% reconsidered their residency choice, and 19% reconsidered medicine as a career. The most stressful factors among clerks were the means of return to rotations, decreased opportunities to be productive in view of residency match, and taking the national licensing exam after the beginning of residency. The mean WHO well-being index was $14.8/25 \pm 4.5$, indicating a poor level of well-being among a considerable proportion of students. Most clerks agreed with the following solutions: training sessions on the clinical management of COVID-19, being allowed to submit fewer reference letters when applying to residency positions, and having protected time to study for their licensing exam during residency. Clerks were less concerned with contracting COVID-19 than with the impact of the pandemic on their future career and residency match. **Conclusion:** The COVID-19 pandemic had a considerable impact on the medical curriculum and well-being of clerks. A number of student-identified solutions were proposed to reduce stress.

Form vs formative: faculty and resident experiences of feedback on EPAs. *Mary Ott, Rachael Pack, Tavis Apramian, Melissa Chin, JulieAnn VanKoughnett, Michael Ott, Kathryn Roth, Sayra Cristancho.* From Western University, London, Ont. (Ott, Pack, Chin, VanKoughnett, Ott, Roth, Cristancho); and McMaster University, Hamilton, Ont. (Apramian). Corresponding author: Mary Ott; mott2@uwo.ca.

Background: Actionable feedback is required to support surgical learners' growth toward competencies defined as entrustable professional activities (EPAs). Results from studies in 2 surgical programs demonstrate the promise and pitfalls in developing system capacity for providing formative feedback on EPAs. **Methods:** We interviewed residents ($n = 19$) and surgeons ($n = 14$) in general surgery and otolaryngology head and neck surgery programs at Western University about their experiences giving and receiving feedback on EPAs. Interviews were analyzed using constructivist and situational approaches to grounded theory to identify both social and material factors that make feedback more or less formative. **Results:** Faculty and residents in both programs highly valued the informal, direct feedback that happens during surgical procedures. This coaching model of feedback is formative, leading to changes in learner performance. Conversely, faculty and residents agreed that a variety of workarounds to manage social and technical issues, such as delays in completion and inconsistencies in reporting feedback on EPAs, effectively reduce EPA feedback to a form-filling exercise. However, while these workarounds appear to thwart the aims of EPAs, participants reported that the workarounds preserve pre-existing opportunities for coaching while addressing unmet documentation needs. **Conclusion:** These studies highlight the importance of coaching in surgical education and the need to implement competency-based medical education in a way that supports this practice. Iterative refinements to the EPA process are necessary to support formative assessment and facilitate documentation of teaching and learning.

Harassment in surgery: interactive training based on roleplay to raise awareness about diverging perceptions among the different members of a surgical team. *Myriam ElRaheb, Michèle Beniey, Léa Marie Meloche-Dumas, Myriam Abbas, Malek Dhane, Natasha Guérard-Poirier, Florence Lebel-Guay, Adam Dubrowski, Erica Patocskai.* From Université de Montréal, Montreal, Que. (ElRaheb, Beniey, Meloche-Dumas, Dhane, Guérard-Poirier, Lebel-Guay); the Department of Surgical Oncology, Centre Hospitalier de l'Université de Montréal (CHUM), Montreal, Que. (Patocskai); and Ontario Tech University, Oshawa, Ont. (Dubrowski). Corresponding author: Myriam ElRaheb; myriam.elraheb@umontreal.ca.

Background: This study aims to raise awareness about harassment among members of a surgical team through interactive roleplay training. A previous study from our group demonstrated differences in perception of harassment in behaviours based on age, sex and interest in surgery as a specialty. **Methods:** Surgeons and residents in all surgical specialties, as well as medical clerks are invited to an interactive workshop based on roleplay where a panel consisting of members of a surgical team discuss different scenarios and encourage participants to share their opinions. These scenarios were developed by a focus group and include behaviours that can be considered as harassment by certain members of the surgical team. A first questionnaire addresses demographics and prevalence of harassment. A second questionnaire administered before and following the panel discussions identifies behaviours that can be interpreted as harassment within the scenarios. **Results:** Unfortunately, owing to the coronavirus disease 2019 (COVID-19) pandemic, the training session was delayed until end of September 2020. We believe there will be a significant difference in the responses to the questionnaires following the interactive panel discussions. This would be due to the now increased awareness leading to the perception of behaviours as harassment that were previously unrecognized by members of the team. **Conclusion:** The workshop has the potential to raise awareness about diverging perceptions of harassment in a surgical team. This interactive method may ultimately be incorporated as training in the medical curriculum.

A gamified network for surgical education during COVID-19: a randomized controlled trial. *Natasha Guérard-Poirier, Michèle Beniey, Léa Marie Meloche-Dumas, Andrei Torres, Malek Dhane, Bojana Misheva, Adam Dubrowski, Frédéric Mercier, Erica Patocskai.* From the Faculty of Medicine, Université de Montréal, Montreal, Que. (Guérard-Poirier, Dhane); the Department of General Surgery, Université de Montréal, Montreal, Que. (Beniey, Meloche-Dumas, Misheva, Mercier, Patocskai); Faculty of Health Sciences and Faculty of Business and Information Technology, Ontario Tech University, Oshawa, Ont. (Torres, Dubrowski); and Department of Surgical Oncology, Centre Hospitalier de l'Université de Montréal, Montreal, Que. (Mercier, Patocskai). Corresponding author: Natasha Guérard-Poirier; natasha.guerard-poirier@umontreal.ca.

Background: Shrinking educational resources during the coronavirus disease 2019 (COVID-19) pandemic require the development and implementation of innovative online learning tools in surgical training. We examined the efficacy of a compound online educational intervention through the Gamified Educational Network (GEN) platform in the acquisition of running subcuticular suturing. **Methods:** Training had 3 phases: instructions (traditional computer-based video instruction [CBVI] consisted of a video of the skill performed by an expert, while interactive CBVI consisted of 8 videos with and without errors and the task was to identify the errors); feedback and performance (students uploaded their first practice attempt to GEN for assessment). We tested pre- and post-procedural knowledge as well as postacquisition performance. Sixty preclinical medical students from L'Université de Montréal were randomized to 4 groups: control (practised alone with traditional CBVI), self-learning (alone with interactive CBVI), peer-learning (interactive CBVI, peer-to-peer feedback), and peer-learning with expert feedback (interactive CBVI, peer-to-peer and expert feedback). **Results:** Procedural knowledge analyses showed no differences between the groups on pre- ($p = 0.182$), and post-tests ($p = 0.120$). The analysis of postacquisition performance showed that students in groups 3 and 4 outperformed those in groups 1 and 2 ($p = 0.0007$). **Conclusion:** The nature of instruction (traditional versus interactive CBVI) did not affect procedural knowledge or acquisition. Feedback was the only contributor to learning; however, the presence of an expert in addition to the feedback from peers did not improve acquisition. The practical implications of these findings are that standardized, self-regulated practice is effective if combined with peer-to-peer feedback mechanisms.

“The most crushing thing:” resident perspectives on EPA implementation. Rachael Pack, Mary Ott, Sayra Cristancho, Julie Ann VanKoughnett, Melissa Chin, Tavis Apramian, Kathy Roth, Michael Ott. From Western University, London Ont. (Pack, Ott, Cristancho, VanKoughnett, Chin, Apramian, Roth, Ott); and London Health Sciences Centre, London, Ont. (VanKoughnett, Chin, Roth, Ott). Corresponding author: Rachael Pack; rachael.pack@schulich.uwo.ca.

Background: Surgery programs have recently begun to implement a new competency-based curriculum organized around entrustable professional activities (EPAs). The new curriculum is intended to provide learners with increased formative feedback to support their development of competencies and a degree of educational control and ownership. **Methods:** We interviewed residents ($n = 19$) in surgical foundations and otolaryngology head and neck surgery programs at Western University about their experiences requesting and receiving feedback on EPAs. Interviews were analyzed using constructivist and situational approaches to grounded theory. **Results:** Surgical residents endorsed the aims of competency-based curriculum and expressed a desire for more information about their progression and skills development. Despite their optimism for the new curriculum, residents reported that the day-to-day administration of their EPAs has left them feeling overwhelmed, frustrated and powerless to drive their own learning. Residents described navigating a variety of barriers to request and obtain completed EPAs and their disappointment with the quality of the feedback they received. While residents questioned the educational value of EPAs, they consistently identified verbal intraoperative coaching as a valuable source of feedback that had a tangible impact on their skills devel-

opment. **Conclusion:** These studies raise concerns that the implementation of EPA-based curriculum may have negative, unintended consequences on residents' training experiences. As the curriculum continues to be refined, resident perspectives should be taken into account to ensure that the overarching aims of competency-based medical education can be realized.

Immersive virtual reality (iVR) improves procedural duration, task completion, and accuracy in surgical trainees: a systematic review. Randi Q. Mao, Lucy Lan, Jeffrey Kay, Darren de SA. From Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Ont. (Mao, Lan); and Division of Orthopaedic Surgery, Department of Surgery, McMaster University, Hamilton, Ont. (de SA). Corresponding author: Randi Mao; randi.mao@medportal.ca.

Background: With limitations on operating time for surgical trainees and concerns for patient safety, immersive virtual reality (iVR) has emerged as a portable, low-cost, high-fidelity addition to competency-based surgical education. This review explores current literature, applications and effectiveness of iVR in surgical skills training. **Methods:** A systematic search was performed on MEDLINE, EMBASE, CENTRAL, Web of Science and PsycInfo for primary studies published between Jan. 1, 2000, and May 13, 2020. Two reviewers independently screened citations, extracted data, and assessed methodological quality using the Medical Education Research Study Quality Instrument (MERSQI). **Results:** The literature search yielded 8939 citations, with 13 articles included for qualitative synthesis. Ten studies (3 pre-post, 7 controlled trials) measured time to completion. Four controlled trials reported that iVR groups completed the following procedures significantly faster than control: pedicle screw placement (43% faster), glenoid exposure (33%), tibial intramedullary nailing (19%), and total hip arthroplasty (18%). Two of 4 controlled trials that used task-specific checklists found that iVR groups completed significantly more steps than control. In one study, the iVR group scored 14 points higher on a 30-point checklist ($p < 0.001$). Four studies reported on implant placement accuracy. In 2 studies iVR groups placed significantly more successful grade I pedicle screws than controls (89.6% versus 60.4%, and 69.6% versus 55.4%). The mean MERSQI score was 11.88 ± 1.60 . **Conclusion:** Given these promising results and robust user satisfaction, iVR shows high potential for incorporation into surgical training curricula.

Where can virtual technologies benefit undergraduate medical education most? A survey to uncover areas of need in clinical and technical skills training in medical students across the US and Canada. Regina Leung, Kyle R. Wanzel. From Queen's University, Kingston, Ont. (Leung); and the University of Toronto, Toronto, Ont. (Wanzel). Corresponding author: Regina Leung; rleung@qmed.ca.

Background: With limited hands-on training time, which has been exacerbated by the coronavirus disease 2019 (COVID-19) pandemic, novel augmented reality/virtual reality (AR/VR) technologies may provide alternative training avenues to better prepare medical students for surgical residencies. To find application areas, we identified top areas of need within clinical and technical skills training through a survey of US and Canadian medical students. **Methods:** Through an online survey, medical students rated their

confidence in various clinical and technical skills covering knowledge, technique, and practical application using a 5-point Likert scale. To guide development, students also rated the importance of desired types of educational resources and features using a 5-point Likert scale. **Results:** To date, 100 responses from medical students (55 pre-clerkship: 36 US, 19 Canadian; 45 clerkship: 24 US, 21 Canadian) across 6 different medical schools were collected. Overall, 62% of clerkship students were fairly/strongly confident in their overall clinical/technical skills versus 9% of pre-clerkship students ($\Delta 53\%$). The areas with the lowest percentage of fairly/strongly confident clerkship students and smallest comparative change from pre-clerkship students were identifying/recognizing positive findings (31%, $\Delta 29\%$), applying technical skills (31%, $\Delta 31\%$), and technical skills technique (40%, $\Delta 40\%$), with no differences between US and Canadian students. Top wanted resources were feedback on skills, better resources for identifying positive findings, and more opportunities to practise. Feedback was the top-rated resource among all subgroups (pre-clerkship/clerkship/US/Canadian). **Conclusion:** AR/VR resource development for clinical/technical skills training in undergraduate surgical education should focus on helping students identify positive findings and tools to provide feedback for learning hands-on skills.

The development of a robust SARS-CoV-2/COVID-19 phase 1 curriculum for third-year medical students: the ABCs of successful faculty engagement and implementation. *Robert J. Feibel, Marie-France Rancourt, Laurie McLean, Michelle Anawati, Philippe Rousseau.* From the University of Ottawa, Ottawa, Ont. Corresponding author: Robert J. Feibel; rfeibel@toh.ca.

Background: The global coronavirus disease 2019 (COVID-19) pandemic has had a significant impact on surgical clerkship education. For example, owing to the inability of clerkship students to enter clinical facilities at the beginning of the pandemic, it was necessary to create a new curriculum and convert clerkship activities, including academic sessions, to an online platform. The purpose of this study was to evaluate the new online curriculum in the surgical clerkship rotation and look for new avenues for ongoing improvement. **Methods:** At the University of Ottawa, following the onset of COVID-19, clerkship rotations were divided into phase 1 and phase 2 components. Phase 1 included online academic sessions, while phase 2 provided clinical exposure in clinical settings. Third-year surgery students received phase 1 curriculum facilitated instruction over a period of 2 weeks for 3 hours per day via Microsoft Teams. Students were provided online resources to prepare for each session. Sessions ranged from general principles of surgery to subspecialty surgical care and included interprofessional sessions as well as a session focused on social accountability. In the initial phase 1 curriculum, 90% of sessions were delivered in a flipped classroom format, and this increased to 100% for the second phase 1. An Excel spreadsheet was used and populated with video links as well as links to PDF documents from the American College of Surgeons. The free online edition of *Schwartz's Principles of Surgery* was used as a source document for additional reading mainly because of the excellent summative notes preceding each chapter. All sessions were moderated by the director of undergraduate surgical education as well as 2 student moderators. Prior to the newly introduced phase 1 curriculum, students had been exposed to 1 week of bootcamp, which involved

1 day of surgical skills followed by 4 days of multiple-choice questions. In the new curriculum, 2 bootcamp cohorts were combined to instruct 40 students instead of the usual 20, which reduced the overall time commitment for faculty involvement. **Results:** A total of 121 students participated in the course, and ratings were received from 97. Feedback assessments were very positive, with a mean overall rating of the program of 4.0 (\pm SD 0.8). Students particularly enjoyed the case-based presentations and interaction between the surgeon moderator and instructor. Students who had completed the conventional bootcamp favoured the new format. Students did not favour more than 3.5 hours of prereading or videos of longer than 15 minutes length. In addition, videos directed at junior surgery residents were not well received and were replaced in later sessions. Some students expressed dissatisfaction with being singled out for questions or by their peers — an issue which later required clarification from the clerkship committee. **Conclusion:** The transition to flipped classroom and case-based learning involved a significant time commitment in order to add appropriate digital content. However, student satisfaction was high, and a final formative examination involving 20 questions was well received.

Impact of COVID-19 on surgical education and training. *Maria Fernanda Parada Perez, Florencia Lucero Serrano, Claudia Rosalia Medina Campos, Maria Cristina Ornelas Flores, Sofia Valanci-Aroesty.* From ABC Medical Center, Mexico City, Mexico. Corresponding author: Sofia Valanci; sofia.valanci@mail.mcgill.ca.

Background: When the World Health Organization declared coronavirus disease 2019 (COVID-19) a pandemic, elective surgeries around the world were cancelled to make space for COVID-19 patients and save personal protective equipment. Surgical departments had to be rearranged so residents could be deployed to the front lines. Because of this, the number of surgeries per resident decreased at an alarming rate. The purpose of this study was to determine the impact and effects COVID-19 had on general surgery residents' training at a private university-affiliated medical centre in Mexico City. **Methods:** In a retrospective manner, surgical procedure lists of 31 general surgery residents (postgraduate year [PGY] 1–4) were compared for the periods of March to June 2019 and March to June 2020. Statistical analysis was carried out with the Student *t* test, SPSS version 17. **Results:** Starting with the March medical emergency declaration in Mexico until June 2020 at least 52% of general surgery residents were deployed to the emergency department and the intensive care unit. Preliminary results show a surgical productivity decrease at all PGY levels. Individual comparisons show that the most affected level, with a 58% decrease, occurred in PGY2, followed by 57% for PGY4, and 44% for PGY3. Additionally a group and year comparison showed a decrease of 77% for PGY1, 71% for PGY2, and 46% for PGY3. **Conclusion:** In our surgical training environment, the resident hierarchy plays an important role in surgical productivity. During the last 2 years of residency, trainees operate the most as primary surgeons. Since the COVID-19 pandemic was declared, productivity decreased significantly, which could result in a longer learning curve and higher complication rates. The highest priority should be given to implementing strategies that can counteract the loss of contact time in the operating room. Our recommendations include scheduling residents in

simulation centres so they can maintain social distancing measures, implementing low-cost and high-fidelity simulators for practice at home, using gaming models to practise teamwork, enforcing the Halsted model with telementoring, and scheduling normal academic days via virtual platforms. It is imperative that we find solutions to counteract the negative impact of COVID-19 negative impact on surgical education.

Clicking before cutting: interactive, case-based surgical modules for medical students. *Sorush Rokui, Geoffrey Blair, Arman Abdalkhani.* From the University of British Columbia, Vancouver, BC. Corresponding author: Sorush Rokui; s.rokui@alumni.ubc.ca.

Background: Students entering clinical rotations in surgery may feel underprepared and lack clinical confidence as a function of inadequate exposure to clinical cases during their preclinical curricula. To address this, we created and subsequently evaluated online, interactive, case-based surgical modules for third-year medical students enrolled in core surgery clerkship rotations. **Methods:** Interactive, case-based modules were created for each of 5 surgical disciplines, consisting of 2–3 cases each, with the assistance of content experts. Modules were then disseminated to clerkship-level medical students at the time of their surgical rotations. Modules were completed by students on a voluntary basis. Post-module surveys were used to gather student comments and identify strengths and weaknesses of the modules. **Results:** Thirty-five surveys were completed. Students found modules to be useful (5.7/7) and were likely to complete further modules in the series (5.8/7). Students reported a 50% subjective improvement in clinical confidence after completing a module. Length and difficulty were deemed appropriate by users. Respondents demonstrated a preference for the modules compared with traditional educational reading resources. **Conclusion:** Overall, this pilot of clinical interactive surgical modules delivered self-paced, relevant learning materials to a group of third-year medical students completing clinical training in general surgery, plastic surgery, vascular surgery, urology and otolaryngology. This may serve as a model for future surgical educational modalities.

Perspectives on virtual ophthalmology education among Canadian medical students. *Stuti Tanya, Bonnie He, Sanjay Sharma.* From Memorial University of Newfoundland, St. John's, NL (Tanya); University of British Columbia, Vancouver, BC (He); and Queen's University, Kingston, Ont.(Sharma). Corresponding author: Stuti Tanya; stanya@mun.ca.

Background: The post-coronavirus disease 2019 (COVID-19) era will be defined by heightened safety protocols, presenting numerous logistical issues with in-person clinical teaching. Medical students may not experience any patient interaction in surgical subspecialties, including ophthalmology, resulting in a cohort of medical graduates with little to no exposure. This raises the need to recreate a clinically immersive learning experience while respecting social distancing. **Methods:** MEDSKL (medskl.com) is a free, open-access medical education platform with online modules and weekly live sessions to help learners continue with their clinical education during COVID-19. An online quality assessment survey was distributed to undergraduate medical learners to assess perceived efficacy of MEDSKL as a platform for ophthalmology

skills education compared with traditional, in-person clinical learning. Data were summarized using descriptive statistics, *t* tests, and nonparametric Spearman correlations. **Results:** Seventy-five percent ($n = 15$) of respondents felt that MEDSKL improved their confidence in clinical ophthalmology, 80% ($n = 16$) felt that MEDSKL was an effective medium for learning clinical ophthalmology, and 95% ($n = 19$) felt that MEDSKL improves equity and social inclusion in medicine. Clerks gave a higher rating for overall efficacy of the webinars than preclerks (9.1 ± 0.7379 versus 7.1 ± 1.567 ; $p = 0.0198$). There was a strong correlation between students who reported feeling socially isolated and the number of webinars they attended ($\rho = 0.813$, 95% confidence interval [CI] 0.56–0.93, $p < 0.0001$). **Conclusion:** We assessed medical students' perceptions of the efficacy of a novel virtual learning platform for clinical ophthalmology education. Our findings suggest that MEDSKL is a useful and equitable model for undergraduate ophthalmology training.

Université de Montréal objective and structured checklist for assessment of audiovisual recordings of surgeries/techniques (UM-OSCAARS): a validation study. *Ségolène Chagnon-Monarque, Owen Woods, Apostolos Christopoulos, Eric Bissada, Christian Ahmarani, Tareck Ayad.* From the Faculty of Medicine, Université de Montréal, Montreal, Que. (Chagnon-Monarque); Department of Otolaryngology – Head & Neck Surgery, Hôpital Maisonneuve-Rosemont, Montreal, Que. (Woods, Bissada, Ahmarani); Department of Otolaryngology – Head & Neck Surgery, Hôpital Sainte-Justine, Montreal, Que. (Woods, Ayad); Department of Otolaryngology – Head & Neck Surgery, Centre Hospitalier de l'Université de Montréal, Montreal, Que. (Christopoulos, Ahmarani, Ayad); and Centre de Recherche du Centre Hospitalier de l'Université de Montréal, Montreal, Que. (Christopoulos, Ayad) Corresponding author: Tareck Ayad; tareck.ayad@umontreal.ca.

Background: Use of videos of surgical and medical techniques for educational purposes has grown over the last years. There is no validated tool to specifically assess the quality of these types of videos. Our goal was to create an evaluation tool and study its intrarater and interrater reliability and its acceptability. We named our tool UM-OSCAARS (Université de Montréal-objective and structured checklist for assessment of audiovisual recordings of surgeries/techniques). **Methods:** UM-OSCAARS is a grid containing 10 criteria, each graded on an ordinal Likert-type scale of 1–5 points. We tested the grid with the help of 4 volunteer otolaryngology surgeons who individually viewed 10 pre-selected videos. The evaluators graded each criterion on a scale of 1–5 for every video. The evaluation took place in 2 different phases 4 weeks apart to evaluate the intrarater reliability. Inter-rater reliability was assessed by comparing the 4 best videos of each evaluator. **Results:** There was almost perfect agreement among the evaluators regarding the 4 best videos according to the overall score obtained. The excellent test-retest correlation also confirms the intrarater reliability. **Conclusion:** The UM-OSCAARS is the first self-sufficient evaluation checklist for videos depicting medical and surgical techniques. It has proven to be reliable and acceptable to use, but its validity needs to be more thoroughly assessed. We hope this tool will lead to an improvement in the quality of the technical videos used for educational purposes.

Bioengineered SMaRT human neural stem cells to degrade scar and enhance regeneration in chronic spinal cord injury. *Christopher S. Ahuja, Mobamad Khazaei, James Hong, Vjura Senthilnathan, Ali Hasan, Maryam Dadabboy, Nitya Gulati, Nibarika Aiyar, Nayaab Punjani, Inaara Walji, Amirali Toossi, Michael G. Fehlings.* From the University of Toronto, Toronto, Ont. Corresponding author: Christopher Ahuja; christophersahuja@gmail.com.

Background: Human-induced pluripotent stem-cell-derived neural stem cells (hiPS-NSC) have the capacity to replace neural circuits, remyelinate denuded axons and provide trophic support, making them an exciting regenerative approach after traumatic spinal cord injury (SCI). Unfortunately, most individuals are in the chronic phase of their injury, where dense perilesional chondroitin sulfate proteoglycan (CSPG) scarring significantly impairs neurite outgrowth and regenerative cell migration. Scar-modifying enzymes can enhance NSC-mediated recovery, however, nonspecific administration via an intrathecal catheter increases the risk of off-target central nervous system effects. We aimed to generate a novel, genetically-engineered line of hiPS-NSCs, termed spinal microenvironment modifying and regenerative therapeutic (SMaRT) cells, capable of locally expressing a scar-degrading enzyme to enhance functional recovery without the risk of nonspecific administration. **Methods:** Using nonviral techniques, a scar degrading enzyme was genetically integrated into hiPS-NSCs under a doxycycline-inducible promoter (Tet-ON), and a monoclonal line was generated by fluorescence-activated cell sorting. Enzyme expression and activity was extensively characterized in vitro by biochemical and cell culture assay. T-cell deficient RNU rats ($n = 60$) with chronic (9 week) C6-7 clip-contusion injuries were randomized to receive (1) NSCs, (2) activated SMaRT NSCs (dox+), (3) inactive SMaRT NSCs (dox-), (4) vehicle (media alone) control, or (5) sham surgery (laminectomy alone). All animals received delayed treadmill rehabilitation (13–20 weeks) and a biweekly battery of neurobehavioural assessments, including open-field locomotor scales (BBB), confined locomotor assessment (CatWalk digital gait analysis), forepaw-specific tasks (grip strength, IBB, Montoya staircase), trunk stability (inclined plane), and sensory tests (Von Frey, tail flick), until sacrifice at 20 weeks. A subset of nonbehavioural animals underwent lineage tracing by transplanting different colors of fluorescent cells into the injury epicenter, rostral sites, or caudal sites respectively. An additional subset of animal cords underwent high-throughput single-cell RNA sequencing (scRNAseq) of both host rat and grafted human cells. **Results:** The scar-degrading enzyme and fluorescent reporter are inducibly expressed by transgenic SMaRT cells. SMaRT cells retain key human NSC characteristics, including the capacity to spontaneously form neurospheres and differentiate along all 3 neuroglial lineages. The expressed enzyme appropriately degrades human CSPGs and allows neurons to extend into CSPG-rich scar-like regions in vitro. Conditioned SMaRT cell media also rapidly degrades in situ rodent CSPGs in ex vivo injured spinal cord cryosections. While neurobehavioural analyses are ongoing, activated SMaRT cells have demonstrated the ability to significantly improve forelimb grip strength (751 ± 58 v. 404 ± 55 g vehicle; $p < 0.01$). Grafted human cells are also extending remarkably long (cervicomedullary junction to mid-thoracic) axons through rodent white matter. Lineage tracing shows that grafts can extend across the injury site. Numerous

human cells stain for mature neuron marker NF200 and growth-associated protein GAP43, suggestive of active axonal growth long after transplant. Grafted cells also demonstrate differentiation to oligodendrocytes, which are necessary for remyelination of host axons and de novo circuits. Preliminary scRNAseq results suggest that SMaRT oligodendrocytes express higher levels of myelin-assembly protein and anilin, and that SMaRT neurons express higher galectin-3, a key axon pathfinding protein. **Conclusion:** This work provides exciting proof-of-concept data that genetically engineered SMaRT cells can degrade CSPGs in vitro and that human NSC grafts can form long axonal processes in the typically inhibitory chronic cervical SCI niche. SMaRT cells hold the potential to be the first effective regenerative therapy for individuals with chronic spinal cord injury where even modest motor recovery can have tremendous implications for quality of life.

Recellularization of xenograft heart valves reduces the xenoreactive immune response in an in-vivo rat model. *Sabin Bozso, Ryaan EL-Andari, Lin Zhu, Benjamin Adam, Michael C. Moon, Darren H. Freed, Jeevan Nagendran, Jayan Nagendran.* From the University of Alberta, Edmonton, Alta. Corresponding author: Sabin Bozso; bozso@ualberta.ca

Background: Current xenograft valve constructs used in cardiac surgery provoke an intense cell-mediated and humoral immune response that is largely believed to be the cause of time-dependent structural valve deterioration (SVD). Autologous cell recellularization has been proposed to improve valvular durability by masking the xenograft scaffold from immune recognition. The purpose of this study was to directly address the role of autologous mesenchymal stem cell (MSC) recellularization of xenogenic valves on the activation of the xenoreactive immune response in an in-vivo rat model. **Methods:** Explanted aortic valve constructs from female Hartley guinea pigs were procured and decellularized, followed by recellularization with syngeneic Sprague-Dawley rat MSCs. The recellularized aortic valve xenografts were then implanted into the infrarenal aorta of recipient female Sprague-Dawley rats. Grafts were implanted as either syngeneic grafts, nondecellularized (fresh), decellularized and recellularized xenografts. Rats were euthanized after 7 days, exsanguinated and the grafts explanted. Total serum immunoglobulin was quantified to assess humoral immunity, while histological analysis for immune cells was used to quantify the cell-mediated immune response. **Results:** Overall survival to endpoint was significantly lower in the decellularized xenografts (67%; 4/6) than fresh (100%; 6/6) and recellularized grafts (100%; 6/6). Similarly, decellularized grafts were more likely to have completely thrombosed (50%; 2/4) than fresh (33%; 2/6) and recellularized grafts (0%; 0/6). Decellularized guinea pig xenografts, when implanted into rats in-vivo, result in significantly reduced total serum immunoglobulin production and significantly reduced graft cellular infiltrate compared to fresh xenografts. Moreover, when decellularized guinea pig xenografts were recellularized with syngeneic rat MSCs there was an additional decrease in total serum immunoglobulin production and graft cellular infiltrate compared to both fresh and decellularized xenografts. Importantly, recellularized guinea pig xenografts had an equivalent total immunoglobulin production and graft cellular infiltrate compared to syngeneic rat aortic valve controls. **Conclusion:** Autologous MSC recellularization of xenogenic valves reduces the xenoreactive immune response with subsequent reduction in total immunoglobulin and immune

cell infiltration in an in-vivo rat model. Autologous MSC recellularization of acellular xenogenic scaffolds may be an effective approach to decrease the progression of bioprosthetic SVD.

A prediction model for pediatric hand fracture triage: derivation and internal validation. *Rebecca Hartley, Robertson Harrop, Maoliosa Donald, Frankie Fraulin, Altay Baykan, Peter Faris, James Wick, Paul Ronksley.* From the University of Calgary, Calgary, Alta. Corresponding author: Rebecca Hartley; rebecca.hartley@ucalgary.ca.

Background: Pediatric hand fractures are common; however, identifying specific fractures requiring referral and care by a hand surgeon remains challenging. The purpose of this study was to create a prediction model for triage of complex pediatric hand fractures requiring care by a hand surgeon. **Methods:** A 2-year retrospective cohort study of consecutively referred pediatric (age < 18 yr) patients with hand fractures was used to derive and internally validate a prediction model for identification of complex fractures requiring care by a hand surgeon. Complex fractures requiring care by a hand surgeon were defined as fractures that required surgery, closed reduction, or 4 or more appointments with a hand surgeon. The model was internally validated using bootstrapping and then translated into a risk index. **Results:** Of 1170 fractures, 416 (35.6%) met the criteria for complex fracture. Multivariate analysis identified 6 significant predictors of complex fracture: open fracture, rotational deformity, angulation, condylar involvement, dislocation or subluxation, and displacement. Internal validation with bootstrapping demonstrated good performance of the model (C-statistic = 0.88, calibration curve $p = 0.935$). A threshold of ≥ 1 point (i.e., any 1 of the predictor variables present) resulted in a simple, easy-to-use tool with 96.4% sensitivity, 45.5% specificity, 1.77 positive likelihood ratio and 0.079 negative likelihood ratio. **Conclusion:** A high-performing and clinically useful decision support tool was developed for emergency and urgent care physicians providing initial assessment and care for children with acute hand fractures. This tool will provide the basis for the development of a clinical care pathway for pediatric hand fractures.

Impact of tricuspid intervention on early outcomes following pulmonary valve replacement in adult congenital patients. *Catherine Deshaies, Helen Trottier, Paul Khairy, Mohammed Al-Aklabi, Luc Beauchesne, Pierre-Luc Bernier, Santokh Dhillon, Sanjiv K. Gandhi, Christoph Haller, Camille L. Hancock Friesen, Edward J. Hickey, David Horne, Frédéric Jacques, Marla C. Kiess, Jean Perron, Maria Rodriguez, Nancy C. Poirier.* From Dalhousie University, Halifax, NS. Corresponding author: Catherine Deshaies; CDeshaies@Dal.Ca.

Background: Tricuspid regurgitation (TR) is common among adults with corrected tetralogy of Fallot (TOF) or pulmonary stenosis (PS) referred for pulmonary valve replacement (PVR). Yet, combined valve surgery remains controversial. This study sought to evaluate the impact of concomitant tricuspid valve intervention (TVI) on postoperative TR, length of hospital stay and on a composite endpoint consisting of 7 early adverse events (death, reintervention, cardiac electronic device implantation, infection, thromboembolic event, hemodialysis and readmission). **Methods:** The national Canadian cohort enrolled 542 patients with TOF or PS and mild to severe TR who underwent isolated PVR (66.8%)

or PVR+TVI (33.2%). Outcomes were abstracted from charts and compared between groups using multivariable logistic and negative binomial regression. **Results:** Median age at reintervention was 35.3 years. Regardless of surgery type, TR decreased by at least 1 echocardiographic grade in 35.4%, 66.9%, and 92.8% of patients with preoperative mild, moderate and severe insufficiency, respectively. In multivariable analyses, PVR+TVI was associated with an additional 2.3-fold reduction in TR grade (odds ratio [OR] 0.44, 95% confidence interval [CI] 0.25–0.77) without an increase in early adverse events (OR 0.85, 95% CI 0.46–1.57) or hospitalization time (incidence rate ratio 1.17, 95% CI 0.93–1.46). Preoperative TR severity and presence of transvalvular leads independently predicted postoperative TR. In contrast, early adverse events were strongly associated with atrial tachyarrhythmia, extracardiac arteriopathy and a high body mass index. **Conclusion:** In patients with TOF or PS and significant TR, concomitant TVI is safe and results in better early tricuspid valve competence than isolated PVR.

Human papillomavirus is associated with improved survival in hypopharyngeal head and neck cancer. *Ciaran Lane, Norbert Viallet, Paul Kerr.* From the University of Manitoba, Winnipeg, Man. Corresponding author: Ciaran Lane; lanec345@myumanitoba.ca.

Background: Human papillomavirus (HPV)-related oropharyngeal carcinoma is a unique disease process and is increasing in prevalence. The prognostic value of HPV in nonoropharyngeal head and neck cancer has not been clearly established. Our objective was to determine the association between HPV status and survival in patients with head and neck cancer originating from each subsite of the pharynx. **Methods:** We performed a population-based retrospective cohort study from the Surveillance Epidemiology and End Results (SEER) Database. Data were collected from patients with head and neck cancer and known HPV status between 2010 and 2016. The 5-year overall survival was calculated using the Kaplan-Meier method for HPV-positive and HPV-negative patients for each subsite of the pharynx. Overall 5-year survival was compared using log rank and Breslow methods for each subsite. Multivariate Cox regression analysis was completed for each subsite to determine the effect of HPV on survival. **Results:** A total of 15 394 patients with HPV status were identified from the SEER database: 4941 HPV-negative and 10 453 HPV-positive patients. Primary sites were distributed: 929 in nasopharynx, 13 294 in oropharynx, and 844 in hypopharynx. The 5-year overall survival was improved by 24.1% and 23.6% in HPV-positive oropharyngeal and hypopharyngeal cancer, respectively. Univariate analysis revealed an association between survival and HPV positivity for oropharyngeal and hypopharyngeal subsites using the log rank ($p < 0.00001$, $p = 0.00003$) and Breslow ($p < 0.00001$, $p = 0.00032$) methods. Similarly, multivariate Cox regression showed an association between HPV status and overall survival in oropharyngeal (hazard ratio [HR] 2.13, 95% confidence interval [CI] 1.96–2.30) and hypopharyngeal subsites (HR 1.64, 95% CI 1.23–2.19), but not nasopharyngeal subsite (HR 0.84, 95% CI 0.62–1.13). **Conclusion:** HPV is associated with improved overall survival in oropharyngeal and hypopharyngeal subsites. The nasopharynx subsite shows no association with overall survival. Given our evolving understanding of HPV and the prognostic value of HPV in the oropharynx, testing should be considered in patients hypopharyngeal cancer.

Preclinical usability study of augmented reality aided sliding hip screw guidewire insertion. *Carl Laverdiere, Jason Corban, Susan M. Ge, Edward Harvey, Paul Martineau, Geoffroy Noel, Rudolf Reindl.* From McGill University, Montreal, Que. Corresponding author: Susan M. Ge; mengxiao.ge@mail.mcgill.ca.

Background: Successful placement of the sliding hip screw (SHS) for hip fracture fixation is dependent on having the lag screw positioned in the femoral head with an optimal tip to apex distance (TAD). To accomplish this, a guidewire is inserted using multiple 2D fluoroscopic images at orthogonal angles to recreate 3D perspective. It requires constantly shifting focus away from the operative field to ensure optimal guidewire trajectory. Moreover, this exposes both the patient and the health care professional to radiation. Thus, we are proposing to leverage the capabilities of augmented reality (AR) to overlay virtual images of the desired trajectory directly on the surgical field to guide the surgeon during SHS guidewire insertion. **Methods:** Preoperative computed tomography (CT) scans were performed on 15 fully encased anatomical femur models. Using a commercially available AR headset and software, preoperative planning was performed using the CT scans to identify the optimal trajectory for SHS guidewire insertion in the femoral neck. With the AR headset images of the scanned femurs containing the virtual guidewire trajectory were overlaid on the physical models such that the user could see a composite view of the computer-generated images and the physical environment. Two junior residents performed the SHS guidewire insertion with the AR headset on these 15 models as well as a control using traditional fluoroscopy. The TAD was calculated post-procedure using fluoroscopy on all insertions as the primary outcome. Time for insertion, deviation of the guidewire from the preplanned entry point and exit point, any perforation of the guidewire out of the femur models through the femoral head or the femoral neck at any point, and number of fluoroscopy shots required were also examined. **Results:** Out of 30 guidewires inserted using the AR headset, 80% were within the femoral neck and 53.3% were fully enclosed within the femoral head. Fifty-seven percent of the perforations were due to insertions that were too deep following the planned trajectory, and 81.25% of successful attempts had a TAD ≤ 25 mm compared to 86.7% using control. It takes significantly less time to perform the procedure using fluoroscopy than AR ($p < 0.05$). However, the control required an average of 18.7 fluoroscopy shots compared to none for AR. **Conclusion:** AR provides an opportunity to aid in guidewire insertion in a preplanned trajectory with less radiation exposure in a sterile environment. Despite this technology being promising, performing SHS guidewire insertion without any fluoroscopic guidance remains a challenge. Further advances in this technology, particularly improvements in surface mapping as well as automated drill tracking, could drastically improve the potential applicability of this technology in orthopedic practice.

The “infodemic” of journal publication associated with the novel coronavirus disease. *Aaron Gazendam, Seper Ekhtiari, Erin Wong, Kim Madden, Leen Naji, Mark Phillips, Raman Mundi, Mobit Bhandari.* From McMaster University, Hamilton, Ont. Corresponding author: Aaron Gazendam; aaron.gazendam@gmail.com.

Background: The World Health Organization (WHO) declared coronavirus disease 2019 (COVID-19) a pandemic in March 2020. Prior to this, however, the WHO had already warned the public of an “infodemic,” described as “an overabundance of information — some accurate and some not.” Most concerning is the potential for misinformation or “disinformation” when publications across scientific journals are used to justify false or misleading claims. We quantified and characterized the scientific literature pertaining to COVID-19 to understand the type of information that is produced and the speed with which it is made available to the scientific community. **Methods:** A systematic PubMed search was performed covering the period from Dec. 1, 2019, to Mar. 31, 2020, to identify all peer-reviewed articles focused on COVID-19. The following data were extracted: country, journal, study type and time to publication. Types of articles published in the top journals (as determined by impact factor) were compared with those in the rest of the journals. **Results:** A total of 1741 articles were included. Studies originated from 59 countries and were published across 447 unique journals. The mean time from submission to publication was 13 ± 12 days (range 0–113 days). When categorized by “primary research” versus all other article types, clinical and basic science research, which included actual patient data, bench work, or mathematical modeling, accounted for 532 publications (30.6%). Commentaries, reviews and other study designs accounted for 1209 publications (69.4%). The number of publications produced weekly over the 13-week query period increased over time. Journals with high impact factors (≥ 40) published a significantly lower proportion of primary research than journals with impact factors < 40 (22.1% v. 31.9%, $\chi^2 = 9.02$, $p = 0.003$). **Conclusion:** Three key findings were identified: (1) an exponential increase in publications over the 13-week period since initial documentation of COVID-19, (2) a rapid time from submission to publication, and (3) a higher proportion of commentaries and opinion papers, especially within high-impact-factor journals. The findings of this review highlight the need for more primary research to overcome this pandemic. A deliberate attempt to focus on basic research, clinical studies, systematic reviews and guidelines from governing bodies may not only help to “flatten” the infodemic curve, but also provide timely and relevant data to guide medical management and policy-making.

Ovine model of congenital chest wall and spine deformity with alterations of respiratory mechanics: follow-up from birth to 3 months of age. *Jesse Shen, Nathalie Samson, Jérôme Lamontagne-Proulx, Denis Soulet, Yves Tremblay, Jean-Paul Praud, Stefan Parent.* From Université de Montréal, Montreal, Que. Corresponding author: Jesse Shen; jesse.shen@umontreal.ca.

Background: The adverse effects of spine and chest-wall deformities (SCWD) on respiratory mechanics have been suggested. However, there is a paucity of animal studies on this subject, and most models are created postnatally. We sought to develop an ovine model of SCWD induced surgically in utero and to assess the effects of these deformities on lung mechanics and development. **Methods:** An SCWD was induced in utero at mid-gestation in 14 ovine fetuses by resection of the 7th and 8th left ribs. Each untouched twin served as controls. Respiratory mechanics were studied in the first week of life and then each month postnatally. Postmortem respiratory mechanics and lung

histomorphometry were assessed at 3 months. Mann–Whitney *U* tests were performed. **Results:** Eight out of 14 SCWD lambs (57%) and 14 control lambs survived. The causes of death included abortion ($n = 3$), prematurity ($n = 1$), respiratory insufficiency at birth ($n = 1$) and stillbirth ($n = 1$). One severe and 5 mild deformities were induced. The inspiratory capacity was decreased at birth in SCWD lambs (32 v. 35 mL/kg in controls, $p = 0.02$), as well as the static respiratory system compliance (2.0 v. 2.5 mL/cm H₂O/kg, $p = 0.005$). No significant differences in respiratory mechanics were seen thereafter. The alveolar surface area was significantly ($p < 0.05$) decreased in SCWD lambs compared to controls at 3 months of life. **Conclusion:** This is the first study that evaluates the effects of an SCWD induced in utero on respiratory mechanics in an ovine model from birth to 3 months of age that shows significant alterations in lung histomorphometry. This model allows closer replication of congenital SCWD.

Division-wide implementation of an Enhanced Recovery After Thoracic Surgery (ERATS) program — longitudinal impact on postoperative outcomes, processes of care, patient satisfaction and quality of life. *Yaseen Al Lawati, Amanda Mattice, Nazgol Seyednejad, Jan Leaby, Ley-Ann Mondor, Krishna Quinn, Caitlin Anstee, Edita Delic, Anna Fazekas, Alex Lee, Mary-Lou Crossan, Donna E. Maziak, Patrick James Villeneuve, Sebastian Gilbert, Farid Shamji, Sudhir Sundaresan, Sylvain Gagne, Stephane Moffett, Andrew J. Seely, Calvin Thompson.* From the University of Ottawa, Ottawa, Ont. Corresponding author: Yaseen Al Lawati; yaal@toh.ca.

Background: Enhanced Recovery After Surgery has demonstrated impact in multiple surgical domains; however, data on thoracic surgery are sparse and inconsistent. This study aimed at pragmatically yet comprehensively evaluating the effects of implementing an Enhanced Recovery After Thoracic Surgery (ERATS) program on postoperative outcomes, processes of care outcomes, anesthesia management, patient experience and quality of life (QOL). **Methods:** We conducted a prospective, longitudinal study evaluating 9 months before and 9 months after a 3-month implementation of an ERATS program including all surgeons ($n = 5$) in a single tertiary care centre. All consecutive patients undergoing the following major thoracic surgeries were included: lung resections, esophagectomy, gastrectomy, hiatal hernia repair, bullectomy/pleurectomy. The primary outcomes recorded were length of stay (LOS), adverse events (AE), 30-day readmissions, 30-day emergency department (ED) visits, and postoperative 6-minute walk test. In terms of process of care outcomes, the following variables were collected: time to “out-of-bed,” time to independent ambulation, time to successful fluid intake, time to last chest tube removal, and duration of urinary catheterization. We also obtained information related to preoperative multimodal analgesia, intraoperative optimization, and postoperative pain management. Finally, patient experience and QOL scores at 4 weeks and 6 months were analyzed. **Results:** The pre-ERATS ($n = 352$) and post-ERATS ($n = 352$) groups demonstrated no difference in baseline characteristics and surgical procedures, except for gastrectomy and lobectomy. Post-ERATS patients had a significantly shorter LOS (4.7 v. 6.2 days, $p < 0.02$), with no difference in major or minor AEs. Although there was no statistically significant difference in 30-day readmission rate, there were fewer 30-day ED visits in the post-ERATS group (13.7 v. 21.6%, $p = 0.03$). In addition, the distance

walked in 6 minutes was higher in the post-ERATS group (402 + 85 v. 371 + 107 m, $p = 0.0005$). With respect to process of care outcomes, post-ERATS patients experienced shorter mean time to “out-of-bed,” independent ambulation, successful fluid intake, last chest tube removal, and urinary catheter removal. In terms of anesthesia care, ERATS implementation was associated with increased pregabalin and dexamethasone use as part of preoperative and intraoperative optimization. There was an increase in epidural analgesia or patient-controlled analgesia after ERATS implementation. Patient satisfaction and QOL scores were high in both groups, with no statistically significant differences. **Conclusion:** ERATS implementation significantly improved LOS and expedited feeding, ambulation and chest tube removal without increasing adverse events or readmissions. This demonstrates the safety and efficacy of implementing such comprehensive enhanced recovery pathways. Ongoing research will help further refine best ERATS practices.

Oral cavity cancer diagnostic route and survival: a population-based study. *Zubaib M. Mir, Rachel Bentley, Meaghan Mavor, Timothy Phillips, Patti Groome.* From Queen’s University, Kingston, Ont. Corresponding author: Zubaib M. Mir; Zubaib.Mir@kingstonhsc.ca.

Background: Oral cavity cancer (OCC) is a significant global health concern, but research examining the effects of diagnostic route on outcomes for OCC is lacking. This study examined associations between different diagnostic routes and long-term outcomes using routinely-collected health care data. **Methods:** A population-based retrospective cohort study was conducted using patients diagnosed with OCC in Ontario, Canada, between 1991 and 2000. We examined associations between 3 diagnostic routes (dental v. primary care provider [PCP] v. other health care provider [OHCP]) and stage of disease at diagnosis. Additionally, we compared 5-year cancer-specific survival (CSS) among these groups. **Results:** The final cohort comprised 1800 patients, of which 1172 (65.1%) were male. The majority of patients from each diagnostic route had access to a PCP (range 85%–99%) and 65.2% of patients were diagnosed via PCP. Patients diagnosed via dental route had a significantly higher proportion of floor of mouth cancers (53.8% dental v. 36.6% PCP v. 34.2% OHCP, $p < 0.001$). The latter 2 routes had higher odds of advanced stage at diagnosis: ORPCP = 1.21 (0.95–1.54); OROHCP = 1.52 (1.01–2.28). Stratifying for disease stage, we noted survival differences among diagnostic routes; the most pronounced was a significantly lower 5-year CSS for patients with stage IV disease diagnosed by OHCP (41.1% dental v. 40.4% PCP v. 27.1% OHCP, $p < 0.001$). **Conclusion:** To summarize, in this historic cohort, patients diagnosed with OCC via dental route appeared to have increased detection of inconspicuous lesions from deeper anatomic subsites, and better long-term survival for advanced disease. This underscores the role of primary care professionals in the detection of oral cavity lesions among at-risk patients. Further work to characterize these associations in a contemporary cohort is needed.

Patient tendencies regarding resiliency and catastrophizing as it relates to carpal tunnel surgical outcomes. *Sarah McLaren, Laura Sims, Raymond Khan, David Sauder.* From the University of Saskatchewan, Saskatoon, Sask. Corresponding author: Sarah McLaren; sam855@mail.usask.ca.

Background: Outcomes following carpal tunnel release are generally favorable. Understanding factors that contribute to inferior outcomes may allow for strategies targeted at improving results in these patients. Our purpose was to determine if patients' underlying personality traits, specifically resiliency and catastrophization, impact their postoperative outcomes following carpal tunnel release. **Methods:** A prospective case series was performed. Based on our power analysis, 102 patients were recruited. Patients completed written consent, the Boston Carpal Tunnel Questionnaire (BCTQ), the Pain Catastrophizing Scale (PCS) and the Brief Resiliency Scale (BRS). A single surgeon, or his resident under supervision, then performed an open carpal release under local anesthetic. Our primary outcome measure was a repeat BCTQ at 3 and 6 months. Univariate and multivariate analyses were performed to assess the correlation between PCS and BRS scores and final BCTQ scores. **Results:** In total, 43 and 63 participants completed the BCTQ at 3 and 6 months, respectively. All patients showed improvement in their symptoms ($p = 0.001$). There was no correlation between patients' PCS or BRS and the amount of improvement. There was also no correlation between PCS or BRS and the patients' raw scores at baseline. Subgroup analysis showed nondiabetic patients had greater improvement in their BCTQ. **Conclusion:** Patients self-assessed resiliency and degree of pain catastrophization has no correlation with the amount of improvement they have 3 or 6 months postoperatively. Most patients improved following carpal tunnel release, and patients with low resiliency and high levels of pain catastrophization should expect comparable outcomes to patients without these features.

Development and validation of performance metrics for the evaluation of technical skills during simulator training: the impact of posture. *Roxane Heroux-Legault, Patrick Boissy, Frédéric Balg.* From Université de Sherbrooke, Sherbrooke, Que. Corresponding author: Roxane Heroux-Legault; roxane.heroux-legault@usherbrooke.ca.

Background: Arthroscopy simulators are an important part of orthopedic programs. There is no timely and objective way to assess the competence of residents using these devices. We aimed to identify objective performance metrics to discriminate between different skill levels. **Methods:** An exploratory cross-sectional study was conducted to identify performance metrics. Three groups were selected — novices ($n = 18$), intermediates ($n = 13$) and experts ($n = 7$) — to compare movements and posture during a diagnostic knee arthroscopy on a simulator. The performance rating was measured using the gold standard ASSET score. Three trials were carried out. **Results:** The ASSET did not vary among groups. Significant differences were seen between novices and intermediates and between novices and experts in the movement of the head,

trunk, left arm, left hand and thrust centre. The movement of the right hand and right arm differed between novices and intermediates. Novices require more time than intermediates and experts to complete the task. Novices showed a learning curve. **Conclusion:** The simplicity of the task did not allow us to discriminate between the different groups' performance. Different metrics indicate the possibility of developing objective evaluation criteria. A more complex task would clarify the value of the metrics identified.

Standardization of opioid prescription after trauma (STOP-Trauma): a prospective intervention to reduce excessive opioid prescription. *Eric Walser, Amy Makish, Patrick B. Murphy, Laura Allen, Luke Hartford, Daryl Gray, Collin Clarke, Richard Hilsden, Neil Parry, Ken Leslie, Kelly N. Vogt.* From Western University, London, Ont. Corresponding author: Eric Walser; ericwalser@gmail.com.

Background: Opioid abuse is one of the major contemporary issues in health care, and trauma patients are at high risk for post-injury opioid use disorders. We hypothesized that the introduction of a standardized pain management pathway would be associated with (1) at least equivalent pain control and (2) a reduction in opioid prescription among patients admitted to a Canadian level I trauma centre. **Methods:** This was a prospective trial from January 2019 to February 2020, with introduction of a standardized pain management pathway in September 2019. Trauma patients admitted for > 24 hours and discharged to home were eligible. Those with an intensive care unit (ICU) stay > 14 days, age > 85 years, or those using opioids at admission were excluded. The intervention included (1) provider education, (2) multimodal analgesia and (3) patient/family education. Recommendations were for rational prescribing based on inpatient opioid use, but discharge prescriptions were at clinician discretion. Patients completed a modified Brief Pain Inventory at their first trauma clinic visit. The primary outcome was patient-reported pain on a 10-point scale, compared using the 2-sample t test for noninferiority (NI). **Results:** A total of 147 patients were included: 100 preintervention (Pre-I) and 47 postintervention (Post-I). The mean pain scores were 4.7 ± 2.3 Pre-I and 4.3 ± 2.6 Post-I (mean difference -0.4 , 97.5% confidence interval [CI] -1.4 to 0.5 , $p < 0.001$ for NI, $p = 0.34$ for superiority). The median discharge prescription was reduced after intervention (72 [0–144] Pre-I v. 0 [0–144] Post-I, $p = 0.013$), corresponding to a 38% reduction in prescription. There were no differences in the proportion of patients requiring an additional prescription after discharge (22% Pre-I v. 19% Post-I, $p = 0.67$). **Conclusion:** A standardized multimodal pain pathway was NI with respect to postdischarge pain and significantly reduced opioid prescription following trauma. We believe similar protocols will have a significant impact on the opioid crisis.