Canadian Journal of Surgery
Journal canadien de chirurgie

2021 October 5;64 (5 Suppl 1)
DOI: 10.1503/cjs.014121

Trauma 2021

TRAUMA ASSOCIATION OF CANADA
ANNUAL SCIENTIFIC MEETING

VANCOUVER, BRITISH COLUMBIA (VIRTUAL)

APRIL 12–16, 2021

Abstracts

Perceptions of a trauma team regarding in situ simulation. ***Olga Bednarek, Sam Jessula, Samuel Minor.* From Dalhousie University, Halifax, NS.**

Background: In situ simulation shows promise as an effective training tool for trauma; however, its disruptive nature is a major downside. Although the benefits of in situ simulation in trauma have been described, the potential perceived harms of running an unscheduled simulation using working staff are unknown. The aim of this study is to assess trauma team members' perceptions regarding the value of in situ simulation relative to its perceived impact on patient care. **Methods:** We conducted a longitudinal survey study including all members of the multidisciplinary trauma team at the Halifax Infirmary, a level 1 trauma centre in Nova Scotia. Following an in situ simulation, participants were given a 10-question survey with answers on a 5-point Likert scale. **Results:** A total of 61 surveys were collected. Survey respondents were grouped into allied health (nurses, paramedics, respiratory therapists; 44%), learners (residents and medical students; 44%) and other (staff physicians, those who did not specify their role; 12%). Respondents felt that participating in the in situ simulation delayed (28%) or compromised patient care (5%) infrequently. No respondents felt that patients were harmed. In situ simulation was felt to identify important safety issues (70%), improve trauma team communication (89%) and improve trauma patient care (89%). The in situ simulation was considered enjoyable (92%) and was identified as a good educational experience (95%). It was felt by participants that simulations should continue to be done in situ in the trauma bay rather than in a sim laboratory (54%). **Conclusion:** The trauma in situ simulation program at the Halifax Infirmary is not felt to cause delays or compromise patient care. The program is considered to be a good learning opportunity that identifies safety issues and improves patient care.

Epidemiology of submersion injuries in Canadian children and adolescents: 1990–2018. ***Mike O'Leary,[1] Jason Emsley,[2] Colleen Sameoto,[3] Eleanor Fitzpatrick.[3]* From [1]Dalhousie University, Halifax, NS; the [2]Department of Emergency Medicine, Dalhousie University and the IWK Health Centre, Halifax, NS; and the [3]IWK Health Centre, Halifax, NS.**

Background: Treatment for submersion injuries ranges from on-scene assessment to emergency department observation to resuscitation and intensive care. Canadian census data show that the number of submersion injuries has increased from 0.38 per 100 000 children in 1991 to 1.15 per 100 000 in 2016. Little is known about the risk factors for submersion injuries, even though for every case of drowning there are an additional 3 cases of submersion injuries, most of which are preventable. **Methods:** This retrospective review of submersion injury data in children and adolescents used the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) database. Collected data were summarized using descriptive statistics. We employed a χ^2 test to test for association between supervision and hospital admission. Binomial and multinomial logistic regression were used to examine associations among hospital admission, location of injury, severity and covariates (age, sex, region and year). **Results:** Data were collected for 1696 patients between 1990 and 2018. There were 1004 males and 692 females, ranging from 0 to 20 years of age with an average age of 5 years 9 months. Analysis of trends in the number of injuries by year yielded an increasing number of total cases and number of cases per capita and was corrected for recruitment of new reporting sites. Ontario had the most incidents (485; 28.6%), with Quebec (395; 23.3%) and Alberta (328; 19.3%) being second and third, respectively. The most common locations were pools (1013; 59.7%), inland water (312; 18.4%) and bathtubs (262; 15.4%). Of all cases analyzed, 282 patients required hospital admission. A χ^2 test for association between supervision and hospital admission in concert with the phi Cramer V test showed a moderate association between lack of supervision and need for hospital admission ($p < 0.001$). Our binomial regression model illustrated that hospital admission was more likely if a submersion injury occurred at an inland body of water ($p < 0.05$), defined as being a lake, river, pond or creek. Multinomial regression identified that males ($p < 0.05$) and children aged 12 years or older ($p < 0.05$) were more likely to suffer more severe injuries than other patients in our study. **Conclusion:** The number and frequency of submersion injuries in Canada has been steadily increasing since 1990. The majority of cases occurred in young children, with older children (particularly males) at higher risk of suffering worse outcomes. Additionally, the absence of supervision increases the risk for children who suffer these injuries to be admitted to hospital. Risk factors for serious submersion injuries, including location and lack of supervision, provide further insight for ongoing prevention activities.

A survey of medical and administrative directors on REBOA use in Canadian trauma centres. ***Sean Hurley,[1] Mete Erdogan,[2] Jacinthe Lampron,[3] Robert Green.[2]* From the [1]Department of Emergency Medicine, Dalhousie University, Halifax, NS; [2]Trauma Nova Scotia, Halifax, NS; and [3]The Ottawa Hospital, Ottawa, ON.**

Background: Resuscitative endovascular balloon occlusion of the aorta (REBOA) has become increasing popular as a bridge to definitive management of severe traumatic noncompressible subdiaphragmatic hemorrhage. No data currently exist on the prevalence of REBOA programs in Canada. The objectives of this study were to determine how many level 1 trauma centres in Canada have REBOA programs in place and to identify factors that contributed to or were barriers to the successful implementation of these REBOA programs. **Methods:** An electronic survey was developed by the research team using SelectSurvey. The survey was administered via email to trauma directors from all level 1 trauma centres across Canada. We invited individuals who would be most knowledgeable on the presence or absence of a REBOA program to participate. We followed up with any nonresponders by email or phone or both on 2 occasions. Survey responses were analyzed using simple descriptive statistics including frequencies and proportions. **Results:** The survey was sent to 33 directors; we received 23 responses (72.7% response rate). Most respondents were medical directors (18/23; 78.4%). There were respondents from trauma centres in all 10 Canadian provinces, with the majority of respondents working at centres in Ontario (9/23; 39.2%). A total of 22 level 1 trauma centres were represented by survey respondents, of which 6 centres (6/22; 27.3%) currently have a

 © 2021 CMA Joule Inc. or its licensors

REBOA program in place, all of which were implemented within the past 3 years. One centre was in the process of training their surgeons. Six other centres were planning on implementing a REBOA program within the next 2 years. Among centres with an existing REBOA program, the number of REBOA cases performed to date ranged from 0 to 30 (median 2). A small number of REBOA cases were also performed at 2 centres that do not currently have a REBOA program. Catheters were predominantly placed by trauma surgeons or trauma team leaders. At institutions with a REBOA program, the factors identified most frequently as contributing to successful implementation were having physician champions and physician expertise, and coordination among multiple specialties. Lack of expertise, lack of proven benefit, and cost were identified as barriers to implementation. **Conclusion:** The findings of this study indicate that currently, there has been limited implementation of REBOA in level 1 trauma centres in Canada, with 27.2% having a program in place. Physician champions and physician expertise were reported to be the most important factors contributing to the successful implementation of these program. Further research is warranted to determine the impact that these programs have had on the outcomes of Canadian trauma patients who are candidates for REBOA.

Cut to the chase: comparing cutting tools in the exposure of simulated trauma patients. ***Caleb Cummings, Aaron Sibley, Trevor Jain, Brent Nicholson, Henrik Stryhn*. From the University of Prince Edward Island, Charlottetown, PEI.**

Background: Trauma shears are commonly used by emergency medical service (EMS) providers to remove clothing from patients and expose underlying traumatic injuries. Other tools exist that may be more effective; however, they are largely untested. This study compared the use of trauma shears versus 2 cutting hooks in the removal of clothing from a simulated trauma patient. **Methods:** In a randomized crossover design, 18 paramedic students used trauma shears with the cut-and-rip technique and S-Cut QE and TRECK+ cutting hooks to remove clothing from a full-body mannequin. We determined tool order using a 3 × 3 Latin square and randomly assigned participants equally between tool orders. We recorded times for total clothing removal and removal of clothing from the upper and lower body. We analyzed results with a mixed-effects analysis of variance. We also surveyed participants concerning tool preference. **Results:** Removal time was significantly faster with the S-Cut QE compared with both the cut-and-rip technique and TRECK+ (mean 78 s, 95% confidence interval [CI] 52–103 s v. 142 s, 95% CI 117–167 s, v. 209 s, 95% CI 184–235 s, $p = 0.001$). The S-Cut QE was significantly faster than the cut-and-rip technique and TRECK+ for upper body clothing removal (mean 47 s, 95% CI 30–64 s v. 92 s, 95% CI 75–109 s, v. 131 s, 95% CI 115–148 s, $p = 0.001$) and the S-Cut QE and cut-and-rip technique were significantly faster than the TRECK+ for lower body clothing removal (mean 25 s, 95% CI 11–38 s, and 44 s, 95% CI 31–58, s v. 71 s, 95% CI 58–85 s, $p = 0.001$). Most (78%) participants preferred the S-Cut QE over other tools. **Conclusion:** The S-Cut QE removed clothing from a simulated trauma patient faster than both the cut-and-rip technique and TRECK+. EMS agencies should strongly consider adding a similar cutting hook to their trauma kit.

Pediatric major trauma. Anaesthesia education: airway, breathing, coffee and cases 2020–2021. ***Ruth Bird, Cengiz Karsli, Rivanna Stubler, Elaine Ng*. From the Hospital for Sick Children, Toronto, ON.**

Background: Trauma calls with substantial injuries are low volume; exposure per fellow is low. A pilot questionnaire demonstrated that fellows were unaware of colleagues' trauma workload. There was no standardized process for departmental case review. With COVID-19 precautions limiting face-to-face time with colleagues, we were concerned that learning may be affected. We aimed to improve education by identifying cases with high potential for shared learning or system improvement and instigating a triannual "Coffee and Cases" meeting. **Methods:** We devised a feedback form for trainees to fill in following each trauma team activation. These data were combined with trauma registry data to provide an overall perspective on the anesthesia workload for trauma and presented via Teams to the entire department. Infographics were used to illustrate cases and highlight important learning points. These were combined with up-to-date literature regarding pediatric trauma management. Trainees were reaudited following the talk. **Results:** During the pilot questionnaire, just 14.3% of fellows agreed with the statement: "I am aware of the number of trauma calls, mechanisms of trauma and injuries sustained, presenting to Sick Kids in the previous month." In total, 71.4% disagreed and 14.3% strongly disagreed. Reaudit in November 2020 following the Coffee and Cases meeting online via Teams showed 100% agreement, with 71.4% strongly agreeing. Because of clinical commitments, it is often not possible for all relevant and interested staff members to attend such meetings, so a supplementary update PDF was provided via hospital email. Issues were identified regarding communication (team briefing), billing and prompt drug availability. These issues were addressed and reaudited. **Conclusion:** The questionnaire allowed us to collect real-time feedback on our trauma service and collate learning points from cases. This was integrated with up-to-date literature. Trauma patients may present critically unwell, yet the environment may be unfamiliar to rotating staff. Education is vital. Infographics helped us to illustrate cases, highlighting important learning points. These are 30 times more likely to be read than text so can successfully improve readership and learning of information.

Geriatric trauma care at a level 1 trauma centre: Are we following best practice? ***Sidney Frattini*,[1] *Angela Coates*,[2] *Paul Engels*.[3] From [1]McMaster University, Hamilton, ON; the [2]Hamilton Health Sciences Trauma Program, Hamilton, ON; and [3]Hamilton General Hospital, Hamilton, ON.**

Background: The elderly population is growing worldwide. Geriatric trauma patients exhibit higher rates of morbidity and mortality and are increasingly presenting to our trauma centre. As a quality assurance initiative to ensure we are providing optimal care to this high-risk population, our study examines current practices and compares them with existing evidence-based guidelines for the care of geriatric trauma patients. **Methods:** Patients aged 65 years and older who presented to our emergency department within a 6-month period (Oct. 1, 2019, to Mar. 31, 2020) were identified via the trauma registry for retrospective review. We reviewed the charts and extracted data

© 2021 CMA Joule Inc. or its licensors

elements according to a standardized report form that included elements listed by the Trauma Quality Improvement Program (TQIP) and Eastern Association for the Surgery of Trauma (EAST) as best practice for geriatric trauma management. **Results:** Of 469 trauma patients during the study period, 105 met our inclusion criteria. Compared with the cohort younger than 65 years, our geriatric cohort had a higher mean Injury Severity Score (ISS) (15 v. 12, $p < 0.05$), a higher proportion of major traumas defined as ISS greater than 15 (47% v. 32%, $p < 0.05$) and a higher mortality rate (12.4% v. 5.8%, $p < 0.05$). Patients aged 85 years and older were less likely to require a full trauma team activation (TTA) compared with those aged 65–84 years (67% v. 90%, $p < 0.05$). TTA was 93% for those with an ISS less than 16 while only 73% for those with an ISS greater than 16. When compared with TQIP and EAST guidelines nearly all patients received care adherent to these guidelines in the emergency department. Only 3 patients received a geriatric consult as recommended in the guidelines, and none occurred within the recommended window of 72 hours after admission. Regarding the recommended liberal use of computed tomography (CT), 18 of 60 transferred patients (30%) had at least 1 CT scan at the sending hospital and 28 (47%) underwent a CT "pan-scan" upon arrival at our centre. For patients coming directly from the scene, 87% were "pan-scanned" on arrival. Of the 92 patients discharged alive, only 40 (43%) went directly home. The remaining 52 (57%) patients were transferred to another acute care facility or general rehabilitation centre. **Conclusion:** Geriatric trauma patients account for a substantial patient volume seen by our trauma centre. They exhibit a high rate of mortality, they place substantial demands on diagnostic imaging services, and a substantial proportion of them are not able to be discharged home. Our geriatric trauma care largely adhered to best practices in the emergency department, but opportunities for improvement were identified in the inpatient domain, specifically regarding the involvement of geriatricians.

Was the introduction of a provincially standardized consensus statement for postintubation analgesia and sedation associated with increased use of associated pharmacological therapies in New Brunswick? ***Stacey McEachern, Susan Benjamin, Ian Watson*****. From Trauma NB, Saint John, NB.**

Background: The NB Trauma Program (NBTP) introduced the "Adult Rapid Sequence Intubation and Post-Intubation Analgesia and Sedation for Major Trauma Patients" consensus statement across New Brunswick emergency departments (EDs) in 2018. The consensus statement included checklists, tools and educational support. This review's purpose was to use NB Trauma Registry (NBTR) data to evaluate whether the provincial consensus statement and related support was associated with improved postintubation pharmacological support among intubated trauma patients across New Brunswick. **Methods:** Postintubation analgesia and sedation infusions while in an ED are captured within the NBTR. Data were extracted for the year before and the year after provincial consensus statement implementation. All patients with intubation listed as an ED procedure were included. Patients who died, had cardiopulmonary resuscitation or were extubated, as well as 1 case intubated for a nontrauma reason, were all excluded. Data were reviewed to determine if they had either, both or no postintubation infusions. **Results:** In 2017 (before the implementation of the consensus statement and related support), 41% of patients received neither analgesia nor sedation infusions. Only 27% of patients received an analgesia infusion either alone or in combination with a sedation infusion. Sedation infusions only were noted in 32% of patients. In 2019 (the year following the release of the consensus statement and related support), only 17% of patients received neither analgesia nor sedation infusions, an absolute reduction of 24%. There was a 43% increase in patients receiving an analgesia infusion either alone or in combination with sedation. Sedation-only infusions were reduced by 19%. Perhaps most importantly, the percentage of patients receiving both recommended infusions increased from 22% to 61%. **Conclusion:** Introduction of a provincial consensus statement, together with supporting tools and checklists, was associated with substantially higher use of both sedation and analgesia postintubation infusions across NB trauma centres. Use of continuous analgesia increased from 27% to 70%, while use of both continuous analgesia and sedation increased from 22% to 61%. These changes represent tangible improvement in the care of intubated trauma patients. Continued application of the consensus statement methodology, including related supports, is encouraged.

Are there important variations in the care of adult trauma patients with isolated, nonoperative subdural hematomas between those admitted to a neurosurgical centre and those admitted to a non-neurosurgical centre for their entire inpatient stay? ***Susan Benjamin, Ian Watson*****. From Trauma NB, Saint John, NB.**

Background: New Brunswick has an aging population; hospital admissions and resulting subdural hematomas among adults who experience a fall continue to rise. To identify optimal practices for the care of these patients in our inclusive, provincial trauma system, we sought to determine if there were important differences in patient composition or outcomes among adult patients with isolated subdural hematomas admitted to a neurosurgical trauma centre (NSTC) versus those admitted to a level 3, non-neurosurgical trauma centre (non-NSTC). **Methods:** Data were extracted from the discharge abstract database for patients admitted between Apr. 1, 2015, and Mar. 31, 2018, with a subdural hematoma as their most responsible diagnosis. A total of 348 cases were identified. A list of appropriate exclusions was then developed, resulting in 241 exclusions. The remaining 107 cases were then stratified by admitting site: NSTCs (group 1) versus non-NSTCs (group 2). These cohorts were then analyzed for similarities and differences. **Results:** Those admitted to NSTCs were similar to those admitted to non-NSTCs with respect to gender, mechanism of injury and presence of preadmission comorbidities. However, patients cared for at an NSTC were often younger (42% were younger that 65 years v. 16%), had less anticoagulant use (41% v. 53.5%), required more intensive care unit (ICU) use (41% v. 14%) and received more support services from physiotherapy, occupational therapy and speech therapy. The average length of stay and number of alternate level of care days were also lower in the patient group admitted to a NSTC (8.4 d v. 10.7 d and 4.3 d v. 6.0 d, respectively). In contrast, 84% of patients cared for at a non-NSTC were 65 years of age or older, 91% had a family physician as their main service provider (v. 33% in NSTCs) and while 86%

 © 2021 CMA Joule Inc. or its licensors

did not require ICU care, those who did have an ICU admission had longer stays (average 4.4 d v. 2.5 d). Despite these differences, in-hospital deaths were similar (16% at NSTCs v. 14.5% at non-NSTCs), and in both groups, 75% of patients or more were able to be discharged home. **Conclusion:** Although outcomes were similar, our review identified some important differences in the care of adult trauma patients with isolated subdural hematoma. Specific exploration of the allocation of limited neurosurgical resources for older adults is warranted, as is the availability of important support services to those with isolated subdural hematoma admitted to a non-NSTC.

Flattening the curve on the negative psychosocial impact of trauma on the family of acute care trauma survivors: a quantitative study. ***Asha Pereira*,[1] *Akke Neel Talsma*,[1] *Michelle Lobchuk*,[2] *Vipavee Thongpriwan*,[1] *Shawn Cahill*.[1] From the [1]University of Wisconsin, Milwaukee, WI; and the [2]University of Manitoba, Winnipeg, MB.**

Background: Surprisingly, few studies have considered the demands and impacts of trauma upon the family members of adult patients outside critical care environments. As a result, little information exists, and few interventions have been developed to support family members in acute care settings. An investigation was conducted into the psychosocial and functional impact of trauma to understand the needs and predictors of coping among the family members of adult trauma patients, to help providers develop interventions aimed at minimizing negative outcomes and capitalizing on positive ones. **Methods:** Using a nonexperimental descriptive, correlational design, 86 family members of adult trauma survivors completed 5 questionnaires, 72 hours after unexpected hospital admission, to assess stress (Impact of Event Scale – Revised [IES-R]), anxiety and depression (Hospital Anxiety and Depression Scale [HADS]), coping (Coping Inventory for Stresful Situations: Situation Specific Coping) and satisfaction with care (Critical Care Family Satisfaction Survey). Previous trauma was assessed using a Life Event Checklist-DSM5. Predictors for coping and satisfaction with care were explored to identify the coping strategies and symptoms of stress, anxiety and depression upon family members, following the unexpected hospital admission of a loved one. **Results:** A total of 86 family members who met eligibility criteria completed and returned the questionnaires. On average, the patients were male (68.6%) and between 18 and 30 years of age (31.4%) or older than 51 years of age (51.2%), and more than half (54.5%) had multiple injuries. Most family members were female (69.8%), urban dwellers (55.8%), between the ages of 31 and 60 years (62.4%), married or in common-law relationships (70.9%) and white/Caucasian (68.6%), and the majority had previous experience with hospital admission (91.9%). A one-way analysis of variance was conducted to explore the relationship between the demographic variables. The findings did not indicate a statistically significant relationship between any of the demographic variables identified and the psychosocial variables. There was a positive correlation between several psychosocial variables, including between stress and anxiety ($r = 0.70$, $n = 81$, $p < 0.01$ [2-tailed]), and between stress and depression ($r = 0.52$, $n = 81$, $p < 0.01$ [2-tailed]), indicating that the higher the levels of stress, the higher the anxiety and depression. A hierarchical linear regression was used to assess the ability of variables of gender, age, number of dependents and previous trauma to predict coping, after controlling for stress (Total IES-R), HADS-anxiety and HADS-depression. In the final model, only anxiety was a statistically significant predictor of coping ($\beta = 0.616$, $p < 0.002$). Anxiety remained independently associated with coping after controlling for family members' age, gender, previous trauma and number of dependents, as well as depression and stress. **Conclusion:** The impact of traumatic injury on the family members of adult trauma survivors is similar to that reported in the critical care literature. This study is the first to distinguish between critical and acute care environments and shows that anxiety is the only variable to have a statistically significant ability to predict coping. The results support the need for the development of support strategies specifically designed for acute care environments to mitigate negative consequences and capitalize on family members' strengths.

Does ACLS belong in ATLS? Seeking evidence during resuscitative thoracotomy. ***William Brigode*, *Justin Mis*, *Fredric Starr*, *Faran Bokhari*. From the John H. Stroger, Jr. Hospital of Cook County, Chicago, IL.**

Background: Advanced trauma life support (ATLS) advocates for the use of advanced cardiac life support (ACLS) algorithms for the patient who undergoes traumatic cardiac arrest. The Western Trauma Association (WTA) currently includes epinephrine, vasopressin and defibrillation during the resuscitation of patients undergoing resuscitative thoracotomy. There is currently minimal research supporting many of the manoeuvres empirically used during a resuscitative thoracotomy for the patient in traumatic arrest. **Methods:** This is a 4-year (Jan. 1, 2016, to Dec. 31, 2019) retrospective single-centre review of adult patients (aged greater than 13 years) undergoing resuscitative thoracotomy at John H. Stroger, Jr. Hospital of Cook County (JHSHCC) in Illinois. Demographics, admission data, resuscitative medications, surgical manoeuvres and outcomes were collected from the trauma database and electronic medical record of JHSHCC. Univariate and logistic multivariate analyses of factors associated with return of spontaneous circulation (ROSC) and survival were performed. **Results:** Five patients of 121 survived in the study period. Survivors were younger (23.8 v. 29.9 yr, $p < 0.01$) and more likely to have been stabbed (40% v. 3.3%, $p < 0.001$) but were equally injured by Injury Severity Score (ISS, $p = 0.42$). On univariate analysis, survivors had equal blood product transfusion ($p > 0.11$ for all), equal use of clamshell thoracotomy, aortic cross-clamping, hilar twist and cardiac defibrillation ($p > 0.24$ for all), and equal administration of ACLS medications including sodium bicarbonate, calcium, magnesium, atropine, amiodarone and lidocaine ($p > 0.39$ for all). Survivors had similar rates of usage of epinephrine (80% v. 91.4%, $p = 0.3$) but fewer doses of epinephrine (1.4 v. 3.5, $p = 0.003$) and less frequent administration of tranexamic acid (TXA, 40% v. 10.3%, $p = 0.04$). On multivariate analysis, each dose of epinephrine was associated with an odds ratio of survival of 0.24 (95% confidence interval [CI] 0.06–0.954, $p = 0.043$). Packed red blood cell (PRBC) administration was associated with ROSC in the resuscitation bay (odds ratio [OR] 1.30 per unit transfused, 95% CI 1.00–1.69, $p = 0.05$) but a non-significant trend toward overall survival (OR 1.95, 95% CI 0.89–4.28). Approximately one-third of patients (41 of 121) had

© 2021 CMA Joule Inc. or its licensors

presentation laboratory results, most commonly a blood gas, blood count, coagulation profile or chemistry. None were statistically associated with ROSC or survival. There were no survivors among patients who received 3 or more doses of epinephrine. There were no survivors among patients with a pH of 6.8 or lower. **Conclusion:** Resuscitation of the patient in traumatic arrest with blood products is associated with better outcomes. Administration of ACLS medications including limited (0–2) doses of epinephrine appears acceptable. A patient who remains acidotic and requires ongoing resuscitation with epinephrine is unlikely to have ROSC or survive.

Autologous omental harvest for microvascular free flap reconstruction of a severe traumatic scalp degloving injury: a case report. ***Alyssa MacLean*[1] *Adil Ladak*[2] *Ryan Snelgrove*[3] *Haili Wang*[3] *Hollie Power*[2] *Nori Bradley*[1] From the [1]University of Alberta, Edmonton, AB; the [2]Division of Plastic Surgery, University of Alberta Edmonton, AB; and the [3]Division of General Surgery, University of Alberta, Edmonton, AB.**

Background: Traumatic scalp degloving injuries are associated with substantial morbidity and profound psychosocial impacts. Injury management is complicated by extensive surface area of exposed calvarium and limited availability of local vascularized tissue for coverage. Reconstructive options include advancement of local periosteal, muscle or fascial flaps, regional pedicled flaps or free tissue transfer flaps. Vascularized omental free flaps have been described with good results, but rarely outside the plastic surgery literature. **Methods:** We present a case of severe traumatic scalp degloving and describe the multidisciplinary operative management approach. Following wound bed preparation, autologous omentum was harvested laparoscopically and used as a vascularized free flap to support a split-thickness skin graft and successfully cover a near-total scalp avulsion injury. **Results:** A 29-year-old female presented to our level 1 trauma centre following blunt head trauma from agricultural equipment. During advanced trauma life support assessment, secondary survey revealed near total scalp degloving encompassing the forehead and circumferential scalp to the superior nuchal line. The avulsed scalp was fragmented, precluding reimplantation. The patient underwent multiple operative débridements. Wound management consisted of saline-soaked dressings, then negative pressure wound therapy once the wound base was clean. Despite elevation of local periosteal and temporalis muscle advancement flaps, incomplete calvarial coverage rendered primary skin graft reconstruction impossible. Plastic and general surgery teams collaborated to plan for autologous omentum as a vascularized free tissue transfer flap. In a combined procedure, the plastic surgeons prepared the skull and left superficial temporal vessels for free flap transfer, while the general surgeons performed laparoscopic omentectomy with preservation of right gastroepiploic artery and vein. The omentum was removed via laparoscopic retrieval bag and primed with heparinized saline, and a microvascular anastomosis of gastroepiploic to superficial temporal vessels was completed. Indocyanine green confirmed perfusion, and non-illuminating segments were resected. The omental flap was inset along the defect. A split-thickness skin graft was harvested from the patient's thigh, meshed and secured over the omental flap. Neurosurgery applied a halo device to offload the posterior flap/graft for optimal healing. Graft take was excellent with complete coverage and an aesthetic scalp contour. **Conclusion:** We report a case using laparoscopic retrieval of autologous omentum for successful microvascular free tissue transfer flap reconstruction in a severe traumatic scalp degloving injury. Collaboration between plastic, general and neurosurgery colleagues facilitated this reconstructive technique and yielded excellent functional and cosmetic results for the patient. Omental free flap is an uncommon but useful approach and should be considered part of the management algorithm for traumatic scalp degloving injuries.

Derivation and validation of actionable quality indicators targeting reductions in complications for injury admissions. ***Lynne Moore.*** **From Laval University, Quebec City, QC.**

Background: Around 22% of patients admitted to hospital for injury will develop in-hospital complications, more than 3 times the incidence for general admissions. The quality indicators (QI) targeting complications that have been proposed to date are difficult to act on because conditions are generally modelled as a composite despite their different risk factors, and we lack tools to flag patients with unexpected complications for chart review. We aimed to develop individual QI for targeted complications and algorithms to identify cases for review. **Methods:** We included all patients with an Injury Severity Score greater than 9 admitted to a level 1 or 2 trauma centre in the province of Quebec (2014–2018). We developed QI for deep vein thrombosis (DVT) and pulmonary embolism (PE), decubitus ulcer, delirium and pneumonia. Prediction models were derived and validated using Transparent Reporting of a multivariable prediction model for Individual Prognosis or Diagnosis guidelines. A committee of clinical experts were involved throughout the iterative model derivation and validation process. **Results:** The predictive performance of the models developed was excellent (area under the curve [AUC] = 0.84) and better than the composite model (AUC = 0.80). QIs identified 4 hospital outliers (higher than expected incidence of complications). One hospital was flagged for DVT and PE, delirium, and pneumonia. Another was flagged for decubitus ulcers, delirium and pneumonia. Two other centres were flagged for a single complication: DVT and PE in 1 centre and decubitus ulcers in the other. Patient-level algorithms identified on average 50 and 20 cases of unexpected complications to be reviewed per year for level 1 and 2 centres, respectively. **Conclusion:** We propose 4 actionable QIs targeting reductions in hospital complications. Our approach targets complications directly related to care, provides complication-specific benchmarks and provides lists of cases to facilitate chart review in line with local and system quality improvement initiatives. A pilot implementation project is underway in a level 1 Canadian trauma centre.

ASA dosing practices in the management of blunt cerebrovascular injury: a retrospective review. ***Amy Makish*[1] *Laura Allen*[1] *Rob Leeper*[2] *Neil Parry*[1] *Ian Ball*[2] *Kelly Vogt*[1] *Brad Moffat.*[2] From the [1]London Health Sciences Centre, London, ON; and [2]Western University, London, ON.**

Background: The focus of blunt cerebrovascular injury (BCVI) management has been on screening and treatment with

 © 2021 CMA Joule Inc. or its licensors

antiplatelet agents to prevent stroke. In the cardiology and neurology literature, acetylsalicylic acid (ASA) 81 mg has been suggested to be as effective as higher doses for thrombosis prevention, yet 81 mg has not been assessed in trauma. This study aims to determine if BCVI management with ASA 81 mg is associated with a higher rate of stroke than management with 325 mg. **Methods:** This retrospective cohort study was conducted at a Canadian level 1 trauma centre. Patients with a BCVI between 2015 and 2019 were identified from the local trauma registry. Dosing of ASA was at the discretion of the most responsible physician, with a similar distribution between doses of 325 mg and 81 mg. Doses were categorized on the basis of the strength received for the majority of doses (> 95%) and rates of stroke were compared using the Fisher exact test. **Results:** A total of 66 patients with BCVI were included in the analysis. The mean age of patients was 44 years (standard deviation [SD] 18.6 yr), and 48 (73%) were male. Among the studied patients, 47 (71%) received 81 mg of ASA and 19 (29%) received 325 mg of ASA for the majority of doses. The overall stroke rate was 24%, and this was not statistically different between those receiving 81 mg of ASA and 325 mg of ASA (21% v. 32%, $p = 0.38$). The overall mortality rate in this population was 11%. **Conclusion:** Early and aggressive treatment with ASA is indicated to prevent cerebrovascular accidents, as the consequences of BCVI can be devastating. This study suggests that 81 mg of ASA may be as effective as 325 mg of ASA for stroke prevention in this population. Further prospective research is warranted to confirm this finding.

A retrospective analysis of bicycle lane collisions in Vancouver, British Columbia, from 2012 to 2017. ***Joanne Sadler,[1] Danielle Rawls,[1] Philip Dawe,[1] Geoff Ramler,[2] Ellie Andres.[2]*** **From the [1]Vancouver General Hospital, Vancouver, BC; and [2]Vancouver Coastal Health, Vancouver, BC.**

Background: Cycling is an important recreational activity and mode of transportation in the City of Vancouver. However, traumatic crashes involving cyclists can lead to serious injuries or fatalities, particularly when collisions with automobiles occur. The purpose of this study was to determine specific high-risk cycling areas within the City of Vancouver and the severity of injuries at these locations. **Methods:** Data on the frequency of collisions involving cyclists over the study period were mapped across Vancouver to identify trends of injury as associated with time of day, day of the week, likelihood of commuting, seasonality, lighting and bicycle lane use. Additionally, BC Trauma Registry (BCTR) data were used to quantify the severity of injury. Results were also linked with community survey data to assess perceptions and reported frequency of cycling. **Results:** Over 2300 bicycle collisions were reported between April 2012 and March 2017 in the City of Vancouver. Twenty-three high-risk intersections were also identified with collision counts ranging from 7 to 26. A majority of collisions at these sites occurred at evening commute times, during the day and in the summer. The severity of crashes increased during dusk and dawn and when there was a greater patient count. Additionally, results from the community survey indicate that the majority of collisions occurred in areas where residents reported having amenities within cycling distance, having many lanes for cyclists, less commuting and errand running by automobile and seeing regular visible cyclists. **Conclusion:** Given this analysis, potential interventions will be tailored for the 23 high-risk intersections and will be prioritized by the research team in collaboration with the City of Vancouver to identify the viability of implementation. For example, creating new bike lanes, connecting disjointed bike lanes, changing speed limits to 30 km/h and promoting safe practices within bicycle rental stores are plausible interventions.

Evaluating the Screening, Brief Intervention and Referral to Treatment (SBIRT) process at Vancouver General Hospital. ***Joanne Sadler,[1] Danielle Rawls,[1] Nasira Lakha,[1] Angie Brisson,[2] Jennah Merchant.[1]*** **From the [1]Vancouver General Hospital, Vancouver, BC; and [2]Vancouver Coastal Health, Vancouver, BC.**

Background: Screening, Brief Intervention and Referral to Treatment (SBIRT) is a tool used to identify patients at Vancouver General Hospital (VGH) who exceed Canada's low-risk drinking guidelines. Through universal screening of admitted trauma patients at VGH, individuals with hazardous drinking patterns are identified and receive a brief intervention from a social worker. The individual may be referred for further treatment depending on their level of substance use. The purpose of this evaluation was to assess the continued effectiveness of SBIRT and identify future program improvements. **Methods:** The evaluation was conducted through phone interview surveys for all trauma patients who scored a 5 or above on the SBIRT Audit-C screening tool between Jan. 1, 2016, and Feb. 28, 2018. Patient answers were recorded in an Excel document with data validation coding to determine if their score had decreased from their initial baseline and contained questions regarding the value of SBIRT. **Results:** Of the total population (187), 13 patients completed the survey (11 males, 2 females). The average age of participants was 45.7 years, ranging from 17 to 87 years. Only 15% of patients remembered being screened using SBIRT, 84% did not remember anyone talking to them about their alcohol use and none remembered or received any information about the low-risk drinking guidelines. The majority of participants did not associate alcohol use with their overall health or their risk of injury; however, 61.5% of participants reduced their SBIRT score from admission and 77% said they had set limits for alcohol consumption and were more cautious when drinking. **Conclusion:** Owing to the small sample size, little can be concluded from the survey but future efforts toward better survey collection methods (at trauma clinic, 6-month follow-up, etc.) are being considered. Additionally, since the low-risk drinking guidelines were not memorable to most patients, every patient screened who scores over a 5 will now be provided with a low-risk drinking guideline brochure for their reference.

Alcohol use and trauma in Alberta after COVID-19 lockdown: overrepresentation and undertreatment are opportunities for improvement. ***Samantha Albacete,[1] Hayley Forbes,[1] Sandy Widder,[2] Nori Bradley.[1]*** **From the [1]University of Alberta, Edmonton, AB; and the [2]University of Alberta Hospital, Edmonton, AB.**

© 2021 CMA Joule Inc. or its licensors

Background: Alcohol is a major factor in traumatic injuries. Accreditation bodies recommend alcohol screening and intervention programs as trauma quality indicators. Previous research in Alberta reported increasing alcohol use prevalence in major trauma. The COVID-19 pandemic has also been linked to increased alcohol consumption. Our objective was to characterize injury characteristics and their relationship to alcohol use during the summer trauma season after the COVID-19 lockdown, and compliance with alcohol misuse screening, at a level 1 trauma centre in Edmonton, Alberta. **Methods:** We conducted a retrospective chart audit for trauma patients aged 18–64 years who were admitted to the University of Alberta Hospital Trauma Service from June 1 to Aug. 31, 2020. Variables included demographics, injury characteristics, ethanol level on presentation, history of substance use and screening or intervention. Tertiary surveys as well as psychiatry and addictions consultations were reviewed to assess compliance with screening and intervention. Frequencies and basic descriptives were calculated. Logistic regression was performed to identify relationships between alcohol use and injury patterns. **Results:** A total of 176 patients met the inclusion criteria. The mean age was 40 (standard deviation [SD] 13.8) years, and 128 (72.7%) were male. Blunt injuries were most common (144 patients [81.8%] had a blunt injury, 27 [15.3%] had a penetrating injury and 3 [1.7%] had a burn), with average Injury Severity Score 13 (1–45) and average length of stay 10.6 (SD 14.6) days. Motor vehicle crashes (MVCs) predominated (66 patients, 37.5%) followed by falls (33 patients, 18.8%), sport-related injuries (30 patients, 17.1%) and stabbings (17 patients, 9.7%). A total of 156 patients (88.6%) had an ethanol level drawn on presentation; 50 (32%) were positive, and 33 of these (66%) were legally intoxicated. Forty-five patients (25.6%) had a documented addiction history with alcohol use disorder, 29 of whom presented with a positive ethanol level. Of the 50 patients with elevated ethanol level on presentation, the average age was 36 (SD 12.1) years and the mean ethanol level was 36.9 (SD 23.3) mmol/L. MVCs were the most common mechanism (18 patients, 36%). Screening for alcohol use disorder was performed in 39 (78%) of these 50 patients who presented with a positive ethanol level (unclear documentation in the remainder). Addiction services were offered to 10 of 50 patients (20%). Positive ethanol level was associated with younger age (36 v. 41 yr, $p = 0.02$). Logistic regression revealed that positive ethanol level was significantly associated with stab mechanism of injury (odds ratio [OR] 3.75, 96% confidence interval [CI] 1.1–11.6, $p < 0.05$); intoxication further increased association with stab injury (OR 4.4, 95% CI 1.4–15, $p < 0.01$). **Conclusion:** The prevalence of positive ethanol level in trauma patients is rising: 32% currently, compared with 24% from Alberta 2010 data. Over one-quarter of MVC patients had a positive ethanol level, and intoxication increased the odds of stab injury. Compliance with alcohol misuse screening was 78% with only 20% of patients offered intervention, despite 58% having alcohol use disorder. Interventions to reduce preventable injuries and alcohol misuse at the population and hospital levels are needed.

Mental health and addiction diagnoses are linked to increased violent injuries and gaps in provision of resources during the COVID-19 pandemic. ***Hayley Forbes,[1] Nori Bradley,[1] Sandy Widder,[2] Samantha Albacete.*[1] From the [1]University of Alberta, Edmonton, AB; and the [2]University of Alberta Hospital, Edmonton, AB.**

Background: The COVID-19 pandemic has been linked to increased mental health issues and interpersonal violence. Both psychiatric diagnoses and young males are overrepresented in the trauma population. Our objective was to characterize injury characteristics and their relationship to psychiatric diagnoses after the COVID-19 lockdown at a trauma centre in Edmonton, Alberta. Specifically, we queried relationships between gender, age, length of stay and intentionally violent injuries, and we reviewed access to inpatient and outpatient mental health and addiction resources. **Methods:** We performed a retrospective chart audit for trauma patients aged 18–64 years admitted to the University of Alberta Hospital Trauma Service from June 1 to Aug. 31, 2020. Variables included demographics, injury characteristics, psychiatric history, substance use disorder history and presence of psychiatry and addictions consultations. Treatment plans and follow-up were assessed. Frequencies and basic descriptives were calculated. Univariate analyses were performed to identify relationships between psychiatric or addiction diagnosis (or both) and injury patterns. **Results:** A total of 176 patients met the inclusion criteria. Patients were young (mean age 39.7 yr) and male (73%), and blunt injury was most common (82%). Sixty-three patients (36%) had a psychiatric (29 patients) or addiction (59 patients) history. Twenty-eight patients (15%) received consults to the psychiatry service. At discharge, follow-up included mental health team (10 patients, 36%), family physician (2 patients, 7%) or self-referral resources (8 patients, 29%). Eight patients were not provided follow-up. Fifty-nine patients (34%) had 1 or more addictions history. Nineteen patients (32%) received consultations to psychiatry (18 patients) or addictions (1 patient). Otherwise, 6 patients (10%) were provided community resources at tertiary survey, 6 patients (10%) declined offered resources and 6 patients (10%) had traumatic brain injury (addiction resources deferred). Twenty-five patients (42%) either were not offered resources or documentation was unclear. On univariate analysis of patients with psychiatry consult, age was similar, but females were more likely to be represented (42% v. 24%, $p = 0.06$). Average length of stay was 17 days versus 9.7 days ($p = 0.05$). Having a psychiatric consultation or addictions history (or both) was associated with a violent mechanism of injury (35% v. 18%, $p < 0.02$). **Conclusion:** Over one-third of trauma patients aged 18–64 years had a psychiatric or addiction history (or both) and were significantly more likely to have a violent injury mechanism. Psychiatric consultation was common, more so in female patients, and linked to increased length of stay. Community follow-up was suboptimal, especially for patients with addiction history. Resource access and provision must be optimized to improve care, reduce recidivism and target interpersonal violence during this time of increased individual and system stress.

Pain management strategies after orthopedic trauma in a level 1 trauma centre: a descriptive study with a view of optimizing practices. ***Sonia Grzelak,[1] Melanie Berube,[2] Marc-Aurèle Gagnon,[1] Stéphane Pelet,[3] Étienne Belzile.*[3] From [1]Université Laval, Quebec City, QC; the [2]Faculty of**

 © 2021 CMA Joule Inc. or its licensors

Nursing, Université Laval, Quebec City, QC; and the [4]Centre hospitalier universitaire de Québec – Université Laval, Quebec City, QC.

Background: Nearly half of patients experiencing orthopedic trauma make the transition from acute to chronic pain, leading to a substantial individual and social burden. However, few studies have described pain management strategies and the consequences associated with opioid use in this population. We conducted a cohort study, with the aims of examining pain management strategies used for patients with acute orthopedic trauma, and the adverse effects associated with opioid use in these patients. **Methods:** This descriptive study was conducted at a level 1 trauma centre. Data were collected from July to December 2020 for patients with an orthopedic trauma before their discharge from hospital. Pain intensity and pain interference with activities were measured with the Brief Pain Inventory. Questionnaires were also administered to examine the use of nonpharmacologic pain management strategies and their perceived effectiveness, as well as adverse effects of opioids. A sample of 67 patients was recruited. **Results:** Most participants were male (89.6%) and their mean age was 45.0 (standard deviation [SD] 14.9) years. Injury mechanisms were motor vehicle collision (37.3%), sports (34.3%) or falls (19.4%). Surgical intervention was needed in 85.1% of participants. Spine fractures (47.7%) were the most common diagnosis at admission, followed by upper limb fractures (23.8%) and pelvic fractures (22.4%). Patients were generally admitted with 3.0 (SD 2.2) fractures; 29.0% had rib fractures and 28.8% had head trauma. In the last 7 days before questionnaire administration, the mean most intense pain, the mean average pain intensity and the mean pain interference with general activities (Numerical Rating Scale of 0–10) were 9.3 (SD 1.1), 5.3 (SD 1.7) and 9.1 (SD 2.0), respectively. The mean oral morphine equivalence doses given in the last 24 hours before discharge were 33.6 (SD 23.1) mg. Dry mouth (62.6%), tiredness (50.8%), drowsiness (45.3%) and constipation (25.0%) were the most frequently reported opioid side effects. Most participants (85.1%) received coanalgesics on a regular basis over the 3 days before discharge, namely acetaminophen (98.3%), nonsteroidal anti-inflammatory drug (15.5%) and pregabalin (13.8%). Several nonpharmacologic strategies were also applied by health care providers or used by patients including physical positioning (89.1%), comfortable environment creation (87.5%), breathing technique (76.6%), reassurance (76.6%), distraction (64.1%), relaxation (56.3%) and mental imaging (51.6%). According to patients, comfortable environment creation (50.0%), physical positioning (45.6%), massage (44.4%) and reassurance (36.7%) were the most efficient nonpharmacological strategies. **Conclusion:** Acetaminophen, ensuring comfort, breathing technique and distraction were the most commonly used nonopioid strategies. Participants reported moderate pain intensity and severe pain interference with activities. Hence, to foster a judicious use of opioids and minimize their adverse events, coanalgesia and nonpharmacologic strategies perceived as the most effective by patients must be reinforced. The use of these strategies as well as the newly legalized cannabis still needs to be evaluated longer term after orthopedic trauma.

Study to Actively Warm Trauma Patients (STAY WARM): a feasibility pilot evaluation. ***Rachel Strauss,[1] Amie Kron,[1] Jeannie Callum,[1] Chantal Armali,[1] Dimpy Modi,[1] Lowyl Notario,[1] Pablo Perez,[1] Bourke Tillmann,[1] Dylan Pannell,[1] Andrew Beckett,[2] Homer Tien,[3] Avery Nathens,[1] Luis Da Luz.[1]*** **From the [1]Sunnybrook Health Sciences Centre, Toronto, ON; [2]St. Michael's Hospital, Toronto, ON; and [3]Ornge, Toronto, ON.**

Background: Hypothermia is a well-known predictor of unfavourable outcomes in trauma. Despite efforts to implement hypothermia prevention and treatment into our institution's massive hemorrhage protocol (MHP), a large proportion of bleeding trauma patients arrive hypothermic to our intensive care units (ICUs). The Ready-Heat chemical blanket has been used in the prehospital military setting. However, little is known about its effectiveness in hospital. We sought to understand its feasibility at our institution to improve management of hypothermic MHP patients. **Methods**: This was a quality improvement project assessing blanket use during initial care of MHP patients through arrival to ICU. The primary outcome was the feasibility of successfully using the blankets, defined as follows: placement of the blanket on admission, blanket remaining on patient until next or final phase of care, and at least 2 temperature recordings (1 upon admission and another at the phase of care where the blanket was removed). Secondary outcomes included improvement of hypothermia and self-reported patient comfort. **Results:** Five MHP patients were included. The blanket was placed on all 5 patients soon after activation of the MHP. Complete temperature recordings were obtained for 4 patients (mean admission and ICU temperatures were 35.3°C ± 1.5°C and 35.4°C ± 0.9°C, respectively). Two patients had the blanket removed in the operating room before arrival to the ICU. Initial challenges identified included the following: (1) no application of standard cotton blankets underneath the Ready-Heat blanket (required for patient safety); difficulty measuring and registering temperatures as the patient transitioned from 1 care area to another (e.g., from computed tomography suite to the operating room); and keeping the blanket on the patient across the different areas of care before patient arrival at the final destination. The following measures have been implemented to address the described challenges: additional and ongoing education sessions for nurses, physicians and other relevant staff, reinforcing reminders for temperature recordings, and signage reminding staff how to appropriately apply the blanket. **Conclusion:** Preliminary results demonstrate that the Ready-Heat self-warming blanket appears feasible to use in the initial care of MHP patients. However, this pilot feasibility study demonstrated implementation challenges. A second phase will enrol another 5 to 10 patients with a fluid approach involving prespecified iterations of outcome assessments and modifying intervention procedures to promote proper implementation and sustainability of the Ready-Heat blanket.

Prehospital trauma care in civilian and military settings including cold environments: a systematic review and knowledge gap analysis. ***Rachel Strauss,[1] Laure Perrier,[2] Isabella Menchetti,[1] Erik Blondal,[3] Henry Peng,[4] Wendy Sullivan-Kwantes,[4] Homer Tien,[5] Avery Nathens,[1] Andrew Beckett,[6] Jeannie Callum,[1] Luis Da Luz.[1]*** **From the [1]Sunnybrook Health Sciences Centre, Toronto, ON: the [2]University Health Network, Toronto, ON; the [3]Li Ka Shing Knowledge Institute, Toronto, ON; [4]Defence Research**

© 2021 CMA Joule Inc. or its licensors

and Development Canada, Toronto, ON; [5]Ornge, Toronto, ON; and [6]St. Michael's Hospital, Toronto, ON.

Background: The Tactical Combat Casualty Care (TCCC) guidelines, initiated in the United States, comprise resuscitation practices in prehospital and other austere environments. However, cold environments pose additional challenges to optimal care and have not been considered within these guidelines. We sought to characterize the knowledge gap in this setting and offer recommendations and directives for future research. **Methods:** Medline, Embase, CINAHL and Cochrane Central Register of Controlled Trials were searched for studies assessing interventions performed in cold and austere environments, and in the prehospital setting. Screening and data extraction were performed according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Quality appraisal was conducted using appropriate tools for specific study designs. We considered interventions, devices, techniques and any outcome that could be applied to the TCCC guidelines. **Results:** We identified 48 studies, 92% of which were observational. One study assessed an intervention in a cold environment. Most randomized controlled trials (n = 5) had a fairly low risk of bias. Observational studies were of poor to moderate quality. Interventions of massive hemorrhage control (n = 17) were wound dressings and tourniquets, suggesting effective hemodynamic control. Airway management interventions (n = 7), such as supraglottic airway techniques, had high rates of success with improved outcomes, such as in-hospital mortality. Interventions of respiratory management (n = 12), focused on needle decompression and tube thoracostomy, reported low success, in particular with needle decompression. Studies assessing transfusion in general, hemostatic component therapy and tranexamic acid administration were grouped within interventions addressing circulation (n = 18) and had a higher quality of evidence. Although there is a strong suggestion of improved outcomes with the use of component therapy or fresh whole blood, most studies were nonrandomized and preclude robust conclusions. Only 2 studies addressing hypothermia prevention interventions were identified, 1 reporting on warmed intravenous fluids and the other on a chemical heating pad during transport. Both studies were of low quality. Other studies assessed the use of extended focused assessment with sonography in trauma (n = 3), reporting overall the use of this technology to be a useful tool in austere air and prehospital environments. Three studies reported on multiple or mixed interventions including intubation techniques, tourniquet use and spinal stabilization techniques. **Conclusion:** We were only able to identify 1 study assessing combat casualty care in a cold environment, highlighting a key gap in knowledge. The evidence was largely nonrandomized with heterogeneity among populations, interventions and outcomes, precluding robust conclusions in most areas. We also highlight other gaps in knowledge of care in the austere environment. Rigorous randomized and prospective research is necessary to generate evidence regarding the management of trauma patients in austere and cold environments.

Antibiotic administration in open fractures: adherence to guidelines at a Canadian trauma centre. ***Yashita Upadhyaya,[1] Neal Irfan,[2] Angela Coates,[3] Paul Engels.[4]* From [1]McMaster University, Hamilton, ON; [2]Hamilton Health Sciences, Hamilton, ON; the [3]Hamilton Health Sciences Trauma Program, Hamilton, ON; and [4]Hamilton General Hospital, Hamilton, ON.**

Background: Open fractures are a cause of substantial morbidity and mortality in trauma. Early administration of antibiotics in open fracture management minimizes risk of infection. The Eastern Association for the Surgery of Trauma (EAST) published recommendations on appropriate prophylactic antibiotic use. Our study examines the management of patients who presented to our level 1 trauma centre with a Gustilo type I, II or III open fracture and compares our practice with evidence-based guidelines. **Methods:** Data from the Hamilton Health Sciences trauma registry identified trauma team activations that had an open fracture from Jan. 1, 2019, to Mar. 31, 2020. Electronic records were reviewed using a standardized report form to abstract details related to the type of open fracture, Gustilo classification and administration of antibiotics. For those charts with no documented classification we used wound size, extent of soft tissue injury and contamination to infer their Gustilo class. **Results:** Of 1140 trauma activations, 60 (5.3%) presented with an open fracture. Males comprised 44 (73.3%) of the sample, the median age was 44.5 years (interquartile range [IQR] 25–64 yr) and the median Injury Severity Score was 15.5 (IQR 9–22). The mechanism of injury was motor vehicle collision (32 cases), motorcycle (14 cases) and machinery related (5 cases). Lower extremity fractures accounted for 40 (66.7%) cases, with 13 being tibia or fibula and 12 being femur. Upper extremity fractures (20 cases) included 12 forearms. Gustilo class was documented explicitly in 34 cases (56.7%). After determining classification from charts requiring interpretation, there were 8 (13.3%) class I fractures, 32 (53.3%) class II and 20 (33.3%) class III. Tetanus immunization was administered in 49 (81.7%), 7 (11.7%) had insufficient documentation to determine, and 4 (6.7%) did not require immunization. Compared with EAST guidelines, 87.5% (35/40) of patients with Gustilo I and II fractures appropriately received gram-positive coverage in the form of cefazolin, clindamycin or vancomycin. The remaining patients of this group received both cefazolin and tobramycin. For the 20 patients with Gustilo class III fractures, 75.0% received the recommended gram-positive and gram-negative antibiotic coverage but only 35.0% used cefazolin with an aminoglycoside as recommended. No adverse events were noted from antibiotic administration. Patients arriving to the emergency department directly from the scene received their antibiotics within 1 hour in 82.9% of cases; 18 of 25 patients (72%) transferred from another hospital received antibiotics at the sending hospital. **Conclusion:** Our study demonstrates some inconsistencies in adherence to EAST guidelines for antibiotic administration in open fractures. Specifically, it identifies the lack of aminoglycoside addition to a first-generation cephalosporin in the treatment of Gustilo class III open fractures as a more targeted treatment option. Clear documentation of Gustilo classification is often lacking. This has important implications for practice change and quality improvement at our centre.

 © 2021 CMA Joule Inc. or its licensors

Are we meeting massive transfusion protocol activation and blood product delivery times in trauma patients? A retrospective review from 2014 to 2018. ***Vivian Leung,[1] Tarek Razek,[2] Ann Wilson,[2] Andrew Beckett.[3]*** **From [1]McGill University, Montreal, QC; [2]McGill University Health Centre, Montreal, QC; and [3]St. Michael's Hospital, Toronto, ON.**

Background: Massive transfusion protocols (MTP) have been developed to improve and standardize resuscitation. Delays to activating or receiving blood products as part of an MTP have been associated with worse outcomes. The aim of our study was to determine average times for MTP activations in the emergency department at the Montreal General Hospital, a level 1 trauma centre, and compare those times with the distribution, pick-up and transfusion of blood products. **Methods:** This is a retrospective database and chart review observational study. All patients who required the activation of an MTP from 2014 to 2018 were identified from the institution's blood bank database. Trauma patients who required the activation of an MTP were isolated by cross-referencing the results with the Montreal General Hospital trauma database registry. Further data were subsequently retrieved via chart review from Oacis. **Results:** A total of 342 patients admitted to the trauma unit required MTP activation and transfusion of blood products between 2014 and 2018. On average, patients who were admitted had a mean age of 45 years (standard deviation 19.6 yr) and were predominantly male (78.7%). Once the MTP requisition was submitted to the blood bank, the average delay was found to be 15.8 minutes (SD 12.5 min, median 13 min). The shortest delay was 0 minutes, while the longest was 108 minutes. Following MTP activation, the average time between the preparation and distribution of blood products, compared with the pick-up time, was approximately 6 minutes for the first cooler. However, this time increased to 15–30 minutes for the second, third, fourth and fifth coolers. We then dichotomized time between MTP activation and first cooler pick-up as greater, and less than, 10 minutes. Approximately 60% of those initial pick-ups were considered to be delayed. There was a small but statistically significant difference whereby the average time to first cooler pick-up following MTP activation was slightly higher for those who survived (mean 17.1 min, SD 13.1 min) relative to those who died (mean 12.5 min, SD 9.42 min; t test 3.32, degrees of freedom 211.15, $p < 0.001$). Following logistic regression, it was noted that age increased the odds of mortality by 4% (odds ratio 1.04, 95% confidence interval 1.02– 1.06). Glasgow coma scale, a lower pulse and being admitted on the night and evening shifts (relative to the day shift) decreased the odds of mortality. **Conclusion:** As predicted, the majority of MTP activations from 2014 to 2018 had delayed blood product pick-up times. Although our results did not demonstrate increased mortality relative to the delay, we suspect this finding to be a consequence of MTP preactivation before the arrival of the patient in the emergency. We propose the use of a blood product cooler in resuscitation rooms to further standardize and reduce delays in blood product delivery for trauma patients.

Unplanned returns to the operating room: a quality improvement initiative at a level 1 trauma centre. ***Joseph Tropiano, Derek Goltz, Sonshire Figueira, Heather Knight, Jacinthe Lampron.*** **From [1]The Ottawa Hospital, Ottawa, ON.**

Background: Our trauma program provides care for 1.3 million residents. As members of the American College of Surgeons Trauma Quality Improvement Program (ACS TQIP), we receive biannual reports that identified a higher likelihood of unplanned returns to the operating room (OR) in all trauma patients as compared with the "average" TQIP hospital. Therefore, we undertook a quality improvement project to assess our data quality and to inform future targeted initiatives to address this issue. **Methods:** We populated a list of patients admitted to our trauma service between April 2016 and September 2019 who were identified as having had an unplanned visit to the OR as defined by the National Trauma Data Standard (NTDS) Data Dictionary. A chart review was then undertaken by a clinician to determine if these patients met the clinical definition of an unplanned operative intervention. **Results:** A total of 69 records were initially identified from the trauma registry as having had an unplanned visit to the OR between April 2016 and September 2019. One record was excluded because of incomplete documentation. After subsequent revision, 7 patients were identified as having clinical reasons for return to the OR. These included both implicit reasons (such as external fixation of a fracture requiring definite management) and documented reasons (such as returning to the OR to close an abdomen that was temporarily left open). These cases were spread across various subspecialties including orthopedic surgery ($n = 3$), neurosurgery ($n = 2$), general surgery ($n = 1$) and plastic surgery ($n = 1$). Overall, after chart review, approximately 10% ($n = 7$) of records were incorrectly identified as "unplanned return to OR." **Conclusion:** This quality improvement initiative identified discrepancies between the reported and actual number of unplanned visits to the OR. Results from this project inform prospective data collection strategies at our centre and highlight the importance of data accuracy as an initial and crucial step in any quality improvement initiative.

Stopping the bleed: the history and rebirth of Canadian freeze-dried plasma. ***Marcus Moore,[1] Dana Devine,[2] Jeannie Callum,[3] Craig Jenkins,[2] Andrew Beckett.[4]*** **From [1]Queen's University, Kingston, ON; [2]Canadian Blood Services, Vancouver, BC; [3]Sunnybrook Health Sciences Centre, Toronto, ON; and [4]St. Michael's Hospital, Toronto, ON.**

Background: Massive hemorrhage is a major cause of preventable mortality on the battlefield and in remote civilian environments. Access to early resuscitation is critical to patient survival; however, in austere regions it is logistically challenging. Freeze-dried plasma (FDP) has been shown to be an important tool when resuscitating patients with hypovolemic shock. Here we will discuss Canada's history in developing freeze-dried blood and current ingenuity in the production of freeze-dried plasma (CFDP). **Methods:** In partnership with the Department of National Defence, Canadian Blood Services (CBS) have developed a made-in-Canada FDP. Initially, historical data were collected at the Sanofi Pasteur campus in Toronto, Ontario, to provide a Canadian historical prospective. Concerning development, CBS pooled plasma, which was then aliquoted into pliable packaging. The product then underwent lyophilization and sterilization. Samples were reconstituted and tested for concentration of coagulation factors, stability, deployability and comparability to fresh frozen plasma (FFP). **Results:** Canada

© 2021 CMA Joule Inc. or its licensors

produced 430 000 bottles of freeze-dried blood products during World War II for the purposes of resuscitation. Production was discontinued during the Korean War secondary to concerns over hepatitis. The CFDP that Canada is now developing is quick and easy to reconstitute, taking less than 90 seconds. Concentration of clotting proteins, including fibrinogen factors V, VII, VIII, IX and XII, is comparable or superior to both German and French FDP and FFP. Measures of clotting time, including prothrombin time and activated partial thromboplastin time, meet benchmarks set by FFP. The product is stable over 18 months at both 4°C and room temperature. Stability and coagulation factor testing is ongoing. **Conclusion:** Here we present how the Department of National Defence has again engaged industrial and public partners to develop a safe, easy-to-use and efficacious FDP for initial use with Special Operations Forces, and eventually expanding to the greater Canadian Armed Forces and remote civilian environments.

The state of the evidence for emergency medical services (EMS) care of prehospital severe traumatic brain injury: an analysis of appraised research from the Prehospital Evidence-based Practice program. ***Jennifer Greene*[1], *Judah Goldstien*[1], *Yves Leroux*[1], *Jen McVey*[1], *Ryan Brown*[1], *Janel Swain*[2], *Alix Carter*[1], *Dana Fidgen*[3]. From [1]Dalhousie University, Halifax, NS; [2]Emergency Health Services Nova Scotia, Dartmouth, NS; and [3]EHS LifeFlight, Goffs, NS.**

Background: The Prehospital Evidence-based Practice (PEP) program is an online, freely accessible, continuously updated repository of appraised emergency medical services (EMS) research evidence. This report is an analysis of published evidence for EMS interventions used to treat patients suffering from severe traumatic brain injury (TBI). **Methods:** PubMed is continually systematically searched by 1 of the authors, with the latest update in August 2020. Included articles were scored on a 3-point level of evidence (LOE) scale on the basis of study design and quality. A direction of evidence (DOE) scale (supportive, neutral or opposing) was applied for each intervention's primary outcome. The summary LOE and DOE for each intervention were plotted in an evidence matrix. **Results:** Sixty studies were included and appraised for 15 interventions: 5 airway management, 7 fluid and volume resuscitation, 2 drug related (rate control and mannitol) and 1 TBI score. Airway interventions were stratified by critical care transport (CCT) or non-CCT. The majority of primary outcomes were patient focused (n = 51, 85%), with 72% of those investigating subsequent neurologic status or survival. The distribution of LOE for interventions with supportive findings was as follows: high quality (n = 1, 7%) for rapid sequence intubation CCT and moderate quality (n = 2, 13%) for plasma and rate control. The distribution of LOE for interventions with neutral findings was as follows: high quality (n = 5, 33%) for colloid infusion, fluid resuscitation, hypertonic saline, intubation-CCT and mannitol, and moderate quality (n = 3, 20%) for aggressive crystalloids, blood and TBI score. High-quality evidence opposes the use of hyperventilation. RSI or intubation without RSI by non-CCT crews and restricted crystalloids were opposed by moderate-quality evidence. The majority of studies were conducted in the prehospital setting (68% paramedic, 18% CCT). **Conclusion:** EMS interventions for treating TBI are informed by high- and moderate-quality evidence, much of which is conducted in the prehospital setting by paramedics. On the basis of high-quality evidence, hyperventilation is not a recommended practice for EMS. Provision of plasma and critical care level RSI may provide benefit to the patient. The evidence suggests that advanced airway interventions provided by non-CCT clinicians should be avoided.

A mixed methods study of a paramedic falls referral program in Nova Scotia. ***Judah Goldstein*[1], *Suzanne Baker*[2], *Francine Butts*[3], *Scott McCulloch*[2], *Izabella Opra*[3], *Jan Jensen*[4], *Andrew Travers*[5], *Pantelis Andreou*[5], *Marie Earl*[5], *Grace Warner*[5], *Alix Carter*[5]. From [1]Emergency Health Services Nova Scotia, Halifax, NS; [2]Nova Scotia Health, Halifax, NS; [3]Emergency Health Services Nova Scotia, Halifax, NS; [4]Emergency Health Services, Dalhousie University, Halifax, NS; and [5]Dalhousie University, Halifax, NS.**

Background: Older adults commonly call 911 because of a ground-level fall and many of these patients are not transported to hospital. Paramedic fall referral to community-based fall prevention teams can mitigate adverse events for those not transported. Our objective was to describe the paramedic referral rate and barriers to the referral process in a provincial emergency medical services (EMS) system. This study is supported by the Trauma Association of Canada Lerners Grant awarded in March 2020. **Methods:** We will use mixed methods including a retrospective analysis of patients with a ground-level fall and nontransport outcome, and interviews with paramedics. All patients with a fall-related complaint or paramedic-identified fall risk, with nontransport disposition and referral between Feb. 1, 2014, and Feb. 1, 2020, will be included. We will conduct a semi-structured interview with paramedics to understand barriers to offering referral. **Results:** In Nova Scotia, patients who present to paramedics with a fall-related complaint and nontransport disposition can be referred to a fall prevention program in some parts of the province. Previous studies suggest 50% of patients who have fallen will have a relapse call (another 911 call) within 30 days. Paramedic fall referral programs may mitigate this risk. In this study, we will describe the implementation of the program and barriers to referral to develop recommendations to optimize its use. We will determine whether a fall referral leads to a reduction in fall-related EMS use within 12 months of the original call and evaluate factors that may impede fall referral by comparing the characteristics of those offered referral with the characteristics of those who were not. **Conclusion:** Canada's population is aging. This means that aging-related complaints will become more common. Paramedics can play a proactive role in identifying and referring older adults at risk for age-related health care problems such as falls. Identifying a patient at risk for a fall earlier and intervening may prevent future injurious falls.

First presentations of psychiatric illness at a level 1 trauma centre. ***Erika Schmitz*[1], *Mojgan Rezaaifar*[1], *Sonshire Figueira*[2], *Doug Wilkins*[3], *Jacinthe Lampron*[2]. From the [1]Faculty of Medicine, University of Ottawa, Ottawa, ON; [2]The Ottawa Hospital, Ottawa, ON; and the [3]Department of Psychiatry, The Ottawa Hospital, Ottawa, ON.**

Background: Psychiatric illness is a known independent risk factor for intentional, unintentional and recurrent traumatic injury.

 © 2021 CMA Joule Inc. or its licensors

There remains a paucity of data regarding first presentation of psychiatric disorders (PD) in the trauma population. We seek primarily to explore the incidence of trauma as a first presentation of PD, clinical outcomes and trauma recidivism and secondly to expose areas of need for trauma patients with psychiatric comorbidity. **Methods:** The Ottawa Hospital level 1 trauma centre's patient registry was used to review adult trauma admissions between June 2017 and December 2019. Data regarding patient demographics, medical history including psychiatric diagnoses, injuries and their associated Injury Severity Scale (ISS) score, hospital course and disposition were collected. Hospital ethics board approval was obtained. **Results:** Of a total of 1529 trauma patient charts, 33% (n = 513) of patients who were admitted had a documented history of PD, with 18% of these patients undergoing active psychiatric treatment. Seven percent of all trauma admissions (n = 113) were associated with first presentation of a undiagnosed psychiatric illness. While blunt trauma was the most common mechanism of injury among all patients, PD patients were found to have higher rates of penetrating injury than non-PD patients (17.9% v. 8.6%, p < 0.001) and were more commonly victims of assault (5.3% v. 2.1%, p < 0.001). Traumatic injuries in PD patients were more commonly self-inflicted (13.6% v. 0.2%, p < 0.001), with nearly half of self-inflicted injuries related to first presentations (47%, n = 33). ISS score was similar in all groups. PD patients had significantly higher rates of trauma laparotomy (11.7% v. 6.6%, p < 0.001) and increased need for intensive care team consultation during their hospital stay (29.8% v. 24.9%, p = 0.040). Mortality was higher in patients with known PD (8.3% v. 1.8%, p = 0.016) compared with those with first presentation of PD. PD patients had longer length of stay (mean 12.8 v. 9.7 d, p < 0.001) and were more likely to be discharged to a long-term care facility (7.6% v. 3.2%, p < 0.001) compared with their counterparts. Trauma recidivism was more common in patients with PD (8.8% v. 3.2%, p < 0.001). **Conclusion:** Psychiatric comorbidity was present in over one-third of all trauma patients admitted to the study level 1 trauma centre; this statistic far surpasses the Canadian average. In addition, first presentation of PD accounted for 7% of these cases. This retrospective review highlights a substantial need to identify patients with PD, improve care and prevent trauma recidivism in this vulnerable population.

Alcohol and substance abuse screening in pediatric trauma patients: examining rates of screening and implementing a screen for the pediatric population. ***Ioana Bratu,[1] Krista Lai,[2] Aleena Amjad Hafeez.[3]*** **From the [1]University of Alberta, Stollery Children's Hospital, Edmonton, AB; the [2]University of Alberta, Edmonton, AB; and the [3]Department of Surgery, University of Alberta, Edmonton, AB.**

Background: Alcohol and substance use are often factors in trauma presentations to emergency departments, even among pediatric populations. Alcohol use can not only affect trauma severity but may also be related to mechanisms of trauma. Early detection of alcohol and substance use allows for timely intervention to prevent adulthood substance use disorders. This study examined the existing rates of alcohol screening among pediatric patients presenting with major trauma and reviewed pertinent literature. **Methods:** We used the Stollery trauma database for major traumas (Injury Severity Score ≥ 12) admitted to hospital between 2009 and 2019 in children aged 0–18 years. Using descriptive statistics and regression analyses, the rates of alcohol use and its correlations with trauma mechanisms, length of hospital stays and various other demographic variables were examined using SPSS version 24. We also reviewed relevant literature on the pediatric alcohol screening tools and trauma and emergency departments through comprehensive literature searches on Medline and Embase. **Results:** We found that 68.7% of patients over 12 years old had blood alcohol tested as part of the trauma panel. Among these patients, 20.9% tested positive for alcohol use in a major trauma. The most common injury mechanisms were recreational and motor vehicle accidents, where the patient was either a passenger or the driver, and sports-related injuries. Statistically significant and moderate-sized correlations were also found between a positive alcohol screen and patient's age, sex (male), injury severity and length of stay. Since 1 in 5 teens involved in a major trauma were found to have positive blood alcohol levels, a screening alcohol and substance abuse tool such as modified CRAFFT (Car, Relax, Alone, Forget, Friends, Trouble) and intervention algorithm for help was formulated. **Conclusion:** Our study's results highlight that a substantial number of children over the age of 12 who present with significant traumatic injuries to the Stollery Children's Hospital emergency department have used alcohol. Using our data, we will now focus on a targeted pilot of alcohol and substance abuse screening and intervention that will start in January 2021 at the Stollery among all admitted major pediatric patients over the age of 12 years.

Measuring behavioural quality and quantity of team leaders during simulated interprofessional trauma care. ***Abdulrahman Saleh Alballa,[1] Scott Goldberg,[2] Egide Abahuje,[2] Charles Pozner,[2] Steven Yule,[3] Sarah Parker,[4] Roger Dias.[2]*** **From the [1]Prince Sultan Military Medical City, Riyadh, Saudi Arabia; the [2]Department of Emergency Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA; the [3]Department of Behavioural Sciences, Clinical Surgery, University of Edinburgh, Edinburgh, Scotland; and the [4]College of Science and School of Medicine, Virginia Tech, Roanoke, VA.**

Background: Trauma care is highly complex, with the team leader playing a crucial role in team performance and effectiveness. Team leadership skills are critical for patient safety and outcome. Previous studies in the operating room setting have developed qualitative and quantitative measures of leadership skills. This study aimed to investigate the relationship between behavioural quality and quantity measures of leadership skills during simulated trauma resuscitations in the emergency department (ED). **Methods:** Using the Trauma Team Leadership Assessment Tool, a validated behavioural marker taxonomy, 3 experts observed and independently rated a series of interprofessional trauma simulation videos. Two leadership skills measurements were performed. First, behavioural quantity was measured by the frequency of behaviours within each of 8 categories. Then, each category was rated for behavioural quality using an 8-point Likert scale (0.5 to 4.0), ranging from poor to good performance, as it relates to patient safety. **Results:** Twelve videos were assessed using behavioural quality and quantity measures across 8

© 2021 CMA Joule Inc. or its licensors

behavioural categories: maintaining standards, making decisions, managing resources, directing, supporting others, communicating, coping with pressure and sharing mental models. This generated 96 behavioural quality versus 96 behavioural quantity measures per rater. The average between the 3 raters was used for analysis. The overall correlation coefficient between behavioural quality and behavioural quantity measures was 0.46 ($p < 0.001$). Analysis of specific behaviour categories demonstrated that only "supporting others" (correlation coefficient 0.60, $p = 0.040$) and "coping with pressure" (correlation coefficient 0.73, $p = 0.007$) yielded statistically significant correlations. The other behaviour categories did not show statistically significant correlations between behavioural quality and quantity measures. **Conclusion:** This study showed a moderate correlation between behaviour quantity (frequency counting) and behaviour quality (Likert scale rating) measures of leadership skills during trauma simulations. Subanalysis demonstrated that only 2 of 8 specific behaviour categories yielded statistically significant correlations. These findings suggest that behavioural quality and quantity are not necessarily associated, and assessment tools that propose to measure leadership skills may benefit from using both types. Future studies should investigate these assessments during real-life trauma care.

Improving rural trauma outcomes: a structured trauma-training program for rural family physicians with enhanced surgical skills — a pilot project. ***Philip Dawe,[1] Richard Simons,[1] Emilie Joos,[1] Victoria Vogt Haines.[2]*** **From [1]Trauma Services, Vancouver General Hospital, Vancouver, BC; and [2]Queen Victoria Hospital, Revelstoke, BC.**

Background: Rural injury death rates substantially exceed those in urban jurisdictions. Access to early surgical intervention in rural communities is 1 contributor to preventable death, especially due to hemorrhage. Several rural community hospitals in western Canada are staffed by family practice (FP) physicians with additional skills in anesthesia (FPA) or surgery (FPESS). FPESS lack specific training in trauma care and early hemorrhage control. We report on a pilot project designed to enhance trauma skills in FPESS. **Results:** The program was successfully developed and structured as outlined above. Notable gains were identified as follows: enhanced trauma surgical skill set in FPESS; mutual recognition of rural and tertiary capabilities and constraints; development of relationships to ensure ongoing, collegial and supportive network fully embedded in the provincial trauma program; and provision of continuing simulation-based training and telementoring support. **Conclusion:** Reducing rural injury-related death requires a concerted, multifaceted effort. Improved access to early surgical control of hemorrhage is 1 component of this effort. This pilot project has illustrated 1 novel approach to achieving this goal.

Trauma treatment: evidence-based response to psychological needs after a natural disaster. ***Judi Malone,[1] Jacqueline Linder.[2]*** **From the [1]Psychologists' Association of Alberta, Edmonton, AB; and the [2]City University in Canada, Edmonton, AB.**

Background: The Canadian Red Cross (CRC) approved funding to the Psychologists' Association of Alberta (PAA) on Apr. 1, 2017, under their Alberta Wildfires 2016: Community Organization Partnership Program for a program that was completed June 2020. Funding was used to directly resource psychological trauma assessment and trauma treatment for those psychologically affected by this natural disaster. This was a pilot project as the CRC had never previously funded psychological treatment as a postdisaster intervention. **Methods:** Over 3 years, 16 trauma psychologists provided trauma-informed services to 349 clients who were referred by CRC agents in a postdisaster intervention program. Outcome-informed practices (OIP) were employed to empirically validate treatment response. The Outcome Rating Scale (ORS) was the tool used, and it was completed at 5-session intervals. **Results:** Results indicate that referrals (program participants) at intake presented with very low levels of functioning. Scores were compared over the treatment period, generally, with outcomes at intake, at the end of assessment (typically session 5) and at the end of the first treatment period (typically session 10). In total, 29% participants received 5 or more sessions. Among participants receiving at least 5 treatment sessions, 65% demonstrated clinically significant improvements in overall well-being. Among participants receiving at least 10 treatment sessions, 57% demonstrated clinically significant improvements in overall well-being. Among participants receiving at least 15 treatment sessions, 100% demonstrated clinically significant improvements in overall well-being. Perceived well-being among clients at intake and, for adults, overall average functioning and well-being increased over the treatment period with average results indicating a 65%, 57% and 100% reported increase in perceived well-being by the fifth, 10th and 15th sessions, respectively. Results indicate that overall average functioning and well-being increased over the treatment period, with the greatest benefits after 15 sessions. **Conclusion:** Treatment made a substantial difference for clients, which was transferable across disaster conditions. There were 3 primary recommendations. First, trauma-informed screening would have been a considerable asset. Second, treatment considerations must be tailored to address the specific needs and risks of children, youth and men. Third, funding should support sufficient treatment with reduced barrier to access.

How prepared are Canadian trauma centres for mass casualty incidents? ***Arshia P. Javidan,[1] Andrew Cameron,[2] Avery Nathens,[1] Graham Cleghorn.[2]*** **From [1]Sunnybrook Health Sciences Centre, Toronto, ON; and the [2]Department of Medicine, University of Toronto, Toronto, ON.**

Background: Mass casualty incidents (MCIs) are devastating events that require extensive planning to minimize morbidity and mortality. There are 2 broad categories limiting a hospital's response: physical assets (e.g., critical care beds, operating rooms, food, communication devices) and operating procedures (e.g., MCI committees, regional coordination, provider training). The purpose of this study is to provide an examination of MCI preparedness according to these categories in level 1 trauma centres across Canada. **Methods:** This study surveyed all level 1 trauma centres across Canada to assess the physical assets and operating procedures they had in place in the event of a hypothetical MCI on one of the busiest days of the year for trauma care. **Results:** Of the 28 trauma centres contacted, 13 completed surveys (46.4%). Most hospitals had sufficient food

 © 2021 CMA Joule Inc. or its licensors

(9/13) water (9/13), fuel (7/13) and communication assets (8/13) for a hypothetical MCI. A mean of 41 mechanical ventilators could be mobilized. No hospitals mandated physician training for MCIs, and 6 of 13 centres were certain that they had a strategic emergency management plan (SEMP). Only 6 of 13 hospitals had dedicated MCI committees. Overall, 4 of 13 hospitals had explicit plans developed with community hospitals. **Conclusion:** This study demonstrated that physical assets are generally less limiting than operating procedures. Four key areas of potential improvement have been identified: provider training (especially physicians), coordination with small hospitals, mechanical ventilator availability and MCI committees with explicit SEMPs.

The catalytic effect of multisource feedback for trauma teams: a pilot study. ***Leah Allen*, *Tim Chaplin*. From the Kingston Health Sciences Centre, Kingston, ON.**

Background: Providing feedback and assessment to learners in the context of a dynamic trauma resuscitation is challenging. Multisource feedback (MSF) is a workplace-based assessment method whereby each interacting team member provides feedback to a specific individual. Despite the growing use of MSF in team-based medical specialties, it has not been studied in trauma teams. This work aims to measure MSF's impact on the practice change (catalytic effect) of trauma team captains (TTCs). **Methods:** This study took place between July 2019 and January 2020 at a level 1 trauma centre. TTCs were senior postgraduate medical residents and received either MSF from members of the trauma team following trauma cases or standard feedback. Following the reception of feedback, the impact on practice change was captured via questionnaires that were distributed immediately (Q1) and 3 weeks later (Q2). Comments were collected related to the perception of MSF in a trauma context. **Results:** Data collection was stopped after 24 TTCs participated as data saturation was achieved. Twelve received MSF, and 12 received standard feedback. Of the 12 TTCs in the standard feedback group, 7 (60%) reported receiving feedback, and the feedback was always delivered verbally by the faculty trauma team leader. All 12 TTCs in the MSF group received feedback. There was no significant difference in the catalytic effect of MSF compared with standard feedback, as measured by our questionnaires. Q1 found that both groups had positively influenced intention for practice change (4.1 on a 5-point Likert scale for the MSF group v. 4.4 for the standard feedback group, $p = 0.05$). Three weeks later, Q2 found a reduced intention for practice change in both groups (3.5 in the MSF group v. 3.4 in the standard feedback group, $p = 0.64$). Q2 also found a self-reported practice change that was similar in both groups (3.4 in the MSF group v. 3.0 in the standard feedback group, $p = 0.38$). When trauma team members who participated in MSF were questioned about the MSF process for TTCs, Likert scores ranged from 3.5 to 4.6, reflecting overall favourability. Narrative comments by team members who participated in the MSF process identified 4 major themes: "logistics," "usefulness," "applicability" and "team." Although "helpful" was a comment frequently stated, analyses also identified "efficiency" and "feasibility" as MSF's main challenges in trauma. **Conclusion:** This pilot study found that MSF does not result in a self-reported catalytic effect for TTCs when compared with standard feedback. The incorporation of MSF into a trauma-team context is possible, but feasibility and efficiency were identified as substantial challenges.

Retrievable inferior vena cava filter for primary prophylaxis of pulmonary embolism in at-risk trauma patients: a feasibility trial. ***R. Mason Curtis*,[1] *Kelly Vogt*,[1] *Neil Parry*,[1] *Fran Priestap*,[1] *Rob Leeper*,[1] *Amol Mujoomdar*,[1] *Stewart Kribs*,[1] *Ian Ball*.[2] From the [1]London Health Sciences Centre, London, ON; and [2]Western University, London, ON.**

Background: Trauma patients are at high risk for the development of pulmonary embolism (PE). Select patients are unable to receive prophylaxis because of concomitant injuries. Guidelines are conflicting on the role of prophylactic retrievable inferior vena cava filters (rIVCF) for prevention of pulmonary embolism (PE). We aimed to determine if insertion of rIVCF for PE prophylaxis in high-risk trauma patients could result in a clinically meaningful reduction (> 24 h) in the time that patients are left unprotected from PEs. **Methods:** In this single-centre, randomized controlled trial of adult (age > 18 yr) trauma patients at high risk for PE by Eastern Association for the Surgery of Trauma (EAST) criteria and unable to receive pharmacologic prophylaxis for at least 72 hours, we randomly assigned 42 patients to receive a rIVCF or to not have a rIVCF placed. Our primary outcomes were time left unprotected to PE development and feasibility. **Results:** The median patient age was 53 years, with a median Injury Severity Score of 33. Random assignment to receive a rIVCF reduced the time left unprotected to PE (control: 78.2 h [53.6–104 h]; rIVCF: 25.5 h [9.8–44.6 h], $p < 0.001$). Two pulmonary embolisms occurred in the control group and 1 in the rIVCF group. Seven deaths occurred in the control group and 8 in the rIVCF group. **Conclusion:** This feasibility study demonstrates a clinically meaningful reduction in time left unprotected to PE. Further investigations powered to demonstrate a reduction in PE incidence are required.

Value of data collected by the medical examiner service on the quality of alcohol and toxicology testing in fatal motor vehicle collisions. ***Karen Ssebazza*, *Crystal Kearley*, *Joshua LeBlanc*. From Trauma Nova Scotia, Halifax, NS.**

Background: Trauma registries across Canada are able to collect data surrounding motor vehicle collision (MVC) deaths by using a variety of information sources such as emergency health services, vital statistics and hospital reports. Our trauma registry has found a substantial advantage to including data from our provincial medical examiner's database for fatal MVC trauma cases. This information provides a more comprehensive data set, as it relates to toxicology testing, which often times is unavailable with other resources. **Methods:** Data were collected from the Nova Scotia Trauma Registry (NSTR) on all MVC deaths in the province between fiscal years 2013 and 2018. We included all major trauma patients who were the driver in an MVC and either expired at the scene, were dead on arrival or had a facility discharge disposition of death. Any duplicate cases were identified and removed. Data on blood

© 2021 CMA Joule Inc. or its licensors

alcohol content (BAC) and toxicology testing were analyzed using descriptive statistics. **Results:** During the study period, a total of 217 major trauma patients died following their involvement in an MVC as the driver of the vehicle. Of these cases, 199 patients (91.7%) had BAC testing performed and 176 patients (81.1%) had toxicology testing performed. Regarding BAC testing, 82.9% (165/199) of patients were tested postmortem for alcohol use by the Medical Examiner Service. There were 34 tests performed in hospital with fewer than 5 performed at provincial sites. Similarly, we observed that the majority of toxicology testing in MVC deaths was performed postmortem (93.2%; 164/176). There were 12 toxicology tests performed in hospital with fewer than 5 performed at provincial hospitals. **Conclusion:** As is evident from the results, collaboration between our trauma registry and the medical examiner services has led to comprehensive data collection of BAC and toxicology testing in the majority of MVC driver death cases. These data have identified an area for quality improvement, and without this partnership we would be unable to capture a realistic vision of intoxication as it relates to MVC driver deaths in our province.

Prehospital narrow pulse pressure predicts need for resuscitative thoracotomy and emergent surgical intervention after trauma. ***Morgan Schellenberg,[1] Natthida Owattanapanich,[1] Joelle Getrajdman,[1] Kazuhide Matsushima,[2] Lydia Lam,[1] Kenji Inaba.[2]*** **From the [1]LAC+USC Medical Center, Los Angeles, CA; and the [2]University of Southern California, Los Angeles, CA.**

Background: The difference between systolic and diastolic blood pressures is termed the pulse pressure (PP). A narrow PP is 1 of the earliest signs of bleeding. Narrow PP in the emergency department (ED) was recently shown to herald hemorrhagic shock after trauma. This study was undertaken to demonstrate the impact of narrow PP in the prehospital setting on outcomes after trauma. **Methods:** Trauma patients presenting to our ACS-verified level 1 trauma centre (2008–2020) were retrospectively screened. Exclusions were unrecorded prehospital and ED vitals, age younger than 16 or older than 60 years, transfers, on-scene cardiac arrest and missing discharge disposition. Prehospital blood pressure defined the study groups: narrow PP (< 30 mm Hg) versus hypotensive (systolic blood pressure < 90 mm Hg) versus others (herein referred to as normotensive). Univariable and multivariable analyses compared outcomes and determined independent predictors of mortality; resuscitative thoracotomy; emergent surgical intervention; and need for trauma intervention (NFTI), a contemporary measure of severe trauma. **Results:** In total, 39 144 patients met the inclusion and exclusion criteria: 5% (n = 1834) in the narrow PP group, 3% (n = 1062) in the hypotensive group and 92% (n = 36 248) in the normotensive group. Patients in the narrow PP and hypotensive groups were more likely to be injured by penetrating trauma than were patients in the normotensive group (23% v. 32% v. 14%, $p < 0.001$). Injury Severity Score (ISS) was higher among patients in the narrow PP and hypotensive groups than patients in the normotensive group (5 [1–14] v. 10 [2–21] v. 4 [1–9], $p < 0.001$). Mortality was highest in the hypotensive group (n = 130, 12%) followed by the narrow PP group (n = 92, 5%) and then the normotensive group (n = 502, 1%) ($p < 0.001$). On multivariable analysis, prehospital narrow PP was independently associated with resuscitative thoracotomy (odds ratio [OR] 1.609, $p = 0.009$), need for emergent surgical intervention (OR 1.356, $p = 0.001$), and NFTI (OR 1.237, $p = 0.009$). **Conclusion:** Although prehospital narrow PP is not currently a trauma team activation (TTA) criterion, these patients have a mortality rate and ISS intermediate to those of hypotensive and normotensive patients. Narrow PP in the prehospital setting independently predicts severe trauma, resuscitative thoracotomy and need for emergent surgical intervention. Prehospital narrow PP should be recognized as a proxy for major trauma in patients with heightened surgical needs so that appropriate in-hospital preparations may be made before patient arrival.

Impact of a geriatric consultation service on outcomes in older trauma patients: a retrospective pre–post study. ***Jacinthe Lampron,[1] Sonshire Figueira,[1] Debra Eagles,[1] Lara Khoury,[2] Marie-Joe Nemnom,[1] Joy Moors.[1]*** **From [1]The Ottawa Hospital, Ottawa, ON; and the [2]University of Ottawa, Ottawa, ON.**

Background: Early geriatric involvement is recommended for older trauma patients. We wished to determine the impact of geriatric consultation on mortality, hospital length of stay and discharge disposition in older patients who were admitted to our level 1 trauma unit. **Methods:** We completed a health records review of trauma unit patients, aged 75 years old and older with Injury Severity Score (ISS) of at least 12, before (November 2015 to October 2017) and after (November 2017 to October 2019) implementation of a geriatric trauma consultation initiative. Primary outcomes were mortality, hospital length of stay and discharge destination. Secondary objectives were adherence to the geriatric trauma consult process and identification of geriatric-specific issues. A multivariable analysis controlling for age, gender, multimorbidity and ISS was undertaken. **Results:** A total of 157 patients before implementation and 172 after implementation with mean age 83.8 years and 53.8% female were included. Geriatric consultation had no impact on in-hospital mortality (odds ratio [OR] 0.70, 95% confidence interval [CI] 0.31 to 1.58) or length of stay (β 0.68, 95% CI –1.35 to 2.72). Patients who received a geriatric consultation were more likely to be discharged back home (OR 2.01, 95% CI 1.24 to 3.24). The adherence to consultation process was 99.4%. Mobility, pain and cognitive impairment were the most common geriatric concerns, identified in 76.6%, 61.1% and 50.0% of older trauma patients, respectively. **Conclusion:** Older trauma patients who receive geriatric trauma consultation are more likely to be discharged home. Collaboration between trauma and geriatric specialists is beneficial and may lead to meaningful improvements in outcomes for older trauma patients.

Exploring physical literacy as a condition of fall mechanism in older adults. ***Brandy Tanenbaum,[1] Dean Kriellaars,[2] Drew Mitchell.[3]*** **From [1]Sunnybrook Health Sciences Centre, Toronto, ON; the [2]College of Rehabilitation Sciences, Faculty of Health Sciences, University of Manitoba, Winnipeg, MB; and [3]Sport for Life, Vancouver, BC.**

 © 2021 CMA Joule Inc. or its licensors

Background: The number of injuries from falls in older adults treated in the Tory Trauma Program at Sunnybrook Health Sciences Centre in Toronto has overtaken the number of injuries from motor vehicle collisions. With a growing population of older adults, these numbers will continue to rise. Physical inactivity is a leading causal factor for falls. This study explores physical literacy as a condition necessary to increase and sustain physical activity in this population. **Methods:** This study used typical case sampling to investigate active older adults recruited from community recreation settings in 3 municipalities in the province of Ontario. As part of a larger project on physical literacy, this study leveraged the opportunity to be present in 3 communities and recruit prospective participants. Screened participants completed physical testing and online surveys. Standard definitions were used to describe categorical variables and categorization of continuous variables according to tests that assess normality. **Results:** A total of 51 participants completed both the physical literacy circuit as well as the online surveys. The age of participants ranged from 58 years to 90 years with a mean of 70.98 years and there were more females (66.7%) than males (33.3%). The physical testing was developed in consultation with geriatric specialists; however, the actual level of competence among the sample population was much higher than anticipated. The participants were able to complete all parts of the physical circuit at a very high level of competence with little variability. Tests for balance, agility and obstacle avoidance confirm this finding. The online surveys provided insight into constructs such as confidence, coping, planning and physical literacy self-assessment. All participants were classified as "actors" according to the Physical Activity Staging Algorithm. Participants reported high physical literacy measures with respect to their ability to learn new skills and confidence when doing physical activities. Both standard measures of fitness used in this study (5 times sit to stand and hand grip strength test) support the above average activity level of this cohort. A number of participants (43.1%) responded that ice and slippery surfaces limit their participation in some activities and some (37.2%) that it would affect their ability to spend time outdoors in the winter. Variability was more prominent in responses to coping and strategies for when things interfere in physical activity planning. **Conclusion:** Although this study population was meeting the World Health Organization recommendations for physical activity and the participants were physically fit, there are opportunities for improvement. Physical literacy is not presently embedded in health care considerations for understanding why physical activity is so difficult to start and sustain especially in an adult population and how it contributes to fall injury risk factors. More effort is required to understand physical literacy in a health care context and specifically for injury prevention.

Is the use of business intelligence software helpful in planning injury prevention campaigns? ***Allison Chisholm,[1] Ian Watson,[1] Lisa Totton,[2] Leisa Ouelett,[3] Susan Benjamin,[1] Janet Vautour.[4]*** **From [1]Trauma NB, Saint John, NB; [2]Horizon Health Network, Fredericton, NB; [3]Horizon NB, Saint John, NB; and the [4]NB Trauma Program, Fredericton, NB.**

Background: Trauma NB is New Brunswick's single, integrated and inclusive trauma system, with a mandate that includes injury prevention. While the New Brunswick Trauma Registry includes demographic, prehospital, inpatient and outcome data, the ability to display and manipulate data is limited. Recognizing the value of business intelligence software used extensively in private industry, we sought to investigate the potential value of these tools in guiding injury prevention campaign development. **Methods:** In collaboration with the performance analytics unit within a regional health authority that is a partner to Trauma NB, we extracted trauma registry data to Microsoft Power BI for manipulation and analysis. For this initial extract, we sought to analyze GPS incident location data and patient residence data related to all terrain vehicle (ATV) crashes in New Brunswick. Using Power BI, we then mapped and compared these locations. **Results:** A total of 147 ATV crashes occurring between Apr. 1, 2017, and Mar. 31, 2020, where patients were transported to hospital by Ambulance New Brunswick (ANB) paramedics were included in this preliminary data extract, regardless of final disposition. A total of 106 had GPS coordinates associated with the position of the responding ANB vehicle at the time of patient contact, and all had patient residence codes for the same patient cohort. Mapping GPS incident locations confirmed areas of the province with higher rates of ATV crashes. However, mapping residence codes of the patients from these same incidents revealed a very different geographic distribution. This difference is crucial in leading the development and targeting of injury prevention education and enforcement activity. Specifically, these findings can guide the placement of mass media communications such as billboards, more targeted social media communications and planning the location of proactive enforcement activity. **Conclusion:** Extracting trauma registry data into Microsoft's Power BI business intelligence software helped identify important differences between incident locations and residence locations for those involved in ATV crashes in New Brunswick. Further exploration of the utility of Power BI or other business intelligence software is warranted to help guide the development of meaningful injury prevention campaigns. These applications also hold promise in timely and informative analysis of other elements held within trauma registries or other data sets.

Exposure to endotracheal intubation among trauma patients in level 5 trauma centres in New Brunswick — a retrospective review. ***Julie Ringuette,[1] Stacey McEachern,[1] Ian Watson.[2]*** **From [1]Trauma NB, Moncton, NB; and [2]Trauma NB; Saint John, NB.**

Background: Exposure frequency to critical psychomotor and cognitive trauma skills in rural settings is often challenging. As a system of care, Trauma NB has an interest in supporting all 12 level 5 designated trauma centres in the province. During a retrospective review evaluating the impact of 2017 provincial clinical guidelines and checklists related to postintubation sedation and analgesia, we analyzed the frequency of endotracheal intubation among trauma patients at the province's 12 level 5 trauma centres. **Methods:** The NB Trauma Registry (NBTR) captures data on all patients arriving at a level 5 trauma centre who require subsequent transfer to a larger hospital for definitive care. Data are entered and reviewed by registered nurses with Trauma NB. Data were gathered from 2017 and 2019 from the NBTR. All patients with intubation listed as an emergency department procedure in a level

© 2021 CMA Joule Inc. or its licensors

5 trauma centre were included. No patients were excluded. **Results:** A total of 21 intubations were performed on trauma patients in the 12 level 5 trauma centres in 2017. Two of these centres had 4 intubations, 1 centre had 3 intubations, 3 centres had 2 intubations, 4 centres had 1 intubation and 2 centres had no intubations for the year. In 2019, 9 intubations were performed on trauma patients in the 12 level 5 trauma centres. One centre performed 5 intubations, while 4 centres had 1 intubation and 7 centres had no intubations for the year. All intubations were recognized regardless of the health care provider who performed the skill. Of the 21 intubations done in 2017, 20 were done by physicians and 1 was done by a respiratory therapist. Of the 9 intubations done in 2019, 7 were done by physicians and 2 were done by a respiratory therapist. **Conclusion:** Intubation of the major trauma patient is a skill requiring recurrent exposure for ongoing competency. Very infrequent exposure in level 5 trauma centres in our trauma system makes it unlikely that some providers had opportunity to intubate a trauma patient during either study period. As a system of care, we have a responsibility to support these centres with other means of optimizing their performance of critical skills, including endotracheal intubation of the major trauma patient.

Are early specialist consultations helpful predictors of those who require care in level 1 or 2 designated trauma centres? ***Ian Watson*[1] *Leisa Ouelett*[2] *Julie Ringuette*[1] *Allison Chisholm*[1] *Tushar Pishe*[3]** **From [1]Trauma NB, Saint John, NB; [2]Horizon NB, Saint John, NB; and the [3]NB Trauma Program, Saint John, NB.**

Background: Trauma NB is New Brunswick's single, integrated and inclusive trauma system. We sought to better understand the care experience of trauma patients who were admitted to the intensive care units (ICUs) of the province's 6 level 3 designated trauma centres. Required specialist consultations during the emergency phase of care were considered as potential predictors of important clinical opportunities, of appropriate level 3 ICU admission and of inpatient mortality. **Methods:** Data from the NB Trauma Registry identified all patients admitted to the ICU of a level 3 trauma centre between Apr. 1, 2018, and Mar. 31, 2019. Using a blinded methodology, 2 experienced trauma coordinators assessed each case for important clinical opportunities and appropriateness of the ICU admission. The provincial medical director adjudicated divergent opinions. Resulting rates and inpatient mortality were considered for various combinations of specialist consults noted during the emergency phase of care. **Results:** A total of 90 admissions to level 3 ICUs were considered. Of these, 78 (86.7%) were deemed to have been appropriate. When stratified by early specialist consultations, those cases with only nonsurgical consults, only general surgery (n = 18) or only orthopedic surgery (n = 4) consults were found to have the highest rates (91.7%, 88.9% and 100%, respectively) of appropriate level 3 ICU admissions, and all had low rates of both important clinical opportunities and inpatient mortality. Patients with multiple surgical and nonsurgical specialist consultations (n = 33) had the lowest rate of appropriate level 3 ICU admission (78.8%) and the highest rate of both important clinical opportunities (39.4%) and inpatient mortality (6.1%). **Conclusion:** Admission to level 3 ICUs presented the highest rates of important clinical opportunities, of trauma mortality and of assessed inappropriate admission when multiple surgical and nonsurgical specialist consultations were required during the emergency phase of care. Trauma control physicians and Trauma NB are encouraged to consider early transfer of these patients to level 1 or 2 designated centres. Similar research in other centres is welcome to further validate our findings.

Neurologic outcomes after traumatic cardiac arrest: a systematic review. ***Daniel Shi*, *Christie McLaren*, *Chris Evans*. From Queen's University, Kingston, ON.**

Background: Despite appropriate care, most patients do not survive traumatic cardiac arrest, and many survivors suffer from permanent neurologic disability. Although previous literature has focused on mortality rates, no strong evidence is available for the neurologic outcomes of these patients. Hence, the aim of the current review is to summarize the neurologic outcomes of patients who survive traumatic cardiac arrest. **Methods:** A systematic review of Embase, Medline, PubMed, CINAHL and ProQuest databases was performed. The inclusion criteria were observational cohort studies that reported neurologic outcomes for patients surviving traumatic cardiac arrest. Reviews, case reports and case series studies were excluded. The quality of the included studies was assessed using the Risk of Bias in Non-Randomized Studies of Interventions (ROBINS-I) tool for observational studies. **Results:** From 4295 retrieved studies, 42 were included (n = 25 492 patients). Of these 38 were retrospective cohort studies and 4 were prospective cohort studies. The overall mortality was 96.0%. Blunt trauma (n = 10 270 patients) and penetrating trauma (n = 3 698 patients) were the main mechanisms of traumatic arrest. Neurologic status was recorded primarily at patient discharge, but some studies reported outcomes up to a 4-year follow-up period. The majority of studies used physician-reported neurologic outcomes (n = 18 studies). Other scales include the Glasgow Outcome Scale (n = 14 studies), cerebral performance categories (n = 8 studies), pediatric cerebral performance categories (n = 1 studies) and functional independent scale (n = 1 studies). Overall, 30.2% of the survivors had good neurologic recovery, 20.6% had moderate disability, 19.6% had severe disability and 8.8% were in a persistent vegetative state. A total of 20.4% of patients in the included studies had missing neurologic outcomes. In the quality assessment, 31 studies were judged to be at serious risk of bias, while 11 were at moderate risk of bias. The confounding domain was the primary source of bias in most studies. **Conclusion:** Good and moderate neurologic recovery are frequently reported in patients who survive traumatic cardiac arrest. However, the existing literature is characterized by a high risk of bias, which limits our ability to prognosticate in this patient population. Prospective studies focused on quality of survivorship in traumatic arrest are urgently needed.

Closed-loop communication in the trauma bay: identifying opportunities for team performance improvement through a video review analysis. ***Avneesh Bhangu*[1] *Lowyl Notario*[2] *Dylan Pannell*[3] *Will Thomas-Boaz*[2] *Corey Freedman*[2] *Homer Tien*[4] *Avery Nathens*[2] *Luis Da Luz*.[2]** **From the [1]School of Medicine, Queen's University, Kingston, ON; [2]Sunnybrook Health Sciences Centre, Toronto, ON; [3]Trauma Program, Sunnybrook Health Sciences Centre, Toronto, ON; and [4]Ornge, Toronto, ON.**

 © 2021 CMA Joule Inc. or its licensors

Background: Communication among trauma team members while a patient is assessed and managed in the trauma bay (TB) is vulnerable to errors. Examples of miscommunication include misunderstanding, parallel conversations and a hesitation to speak up, which may negatively affect patient care. We used the trauma nontechnical skills (T-NOTECHS) scale to identify communication gaps during assessment and management of severely injured trauma patients in the TB and develop strategies to improve team performance. **Methods:** Two reviewers independently assessed nontechnical skills of team members for 55 trauma activations at Sunnybrook Health Sciences Centre through video footage. Team performance was measured by the T-NOTECHS scale across 5 domains: leadership; cooperation and resource management; communication and interaction; assessment and decision-making; and situation awareness and coping with stress. Secondary outcomes looked at number of call-outs (CO), closed-loop communications (CLC) and parallel conversations. Team perception of communication was also collected. **Results:** Injury Severity Score (ISS) was used as a measure for trauma severity. A case with an ISS score of 16 was considered to be more severe. ISS was 16 in 37% of cases. A Kruskal–Wallis test showed a statistically significant difference between the mean ranks of the 5 T-NOTECHS domains ($p < 0.001$). Post-hoc Dunn pairwise tests were used to compare all pairs of domains. Communication and interaction had a significantly lower score ($p < 0.001$, adjusted using the Bonferroni correction) compared with all other domains. No other domains were statistically significantly different from one another. More severe cases tended to score a higher median number on secondary outcomes. Cases deemed to be more severe had 6 (interquartile range [IQR] 5–10) COs, 8.5 (IQR 5–13.75) completed CLCs and 2 (IQR 1–3.75) incomplete CLCs. Less severe cases had 4 (IQR 2.25- 7) COs, 5 (IQR 3–8) complete CLCs and 1 (IQR 0–2) incomplete CLC. Alternatively, there were more parallel conversations in less severe cases compared with more severe cases (2 [IQR 1–4.75] and 1 [IQR 0–3]), respectively. Sixty-six questionnaires were completed by team members. Overall, there was a slightly positive impression on current communication and presence of CLC (1 [IQR 0–3]); however, there was also a desire for better standardized CLC within trauma team interactions (2 [IQR 0–4]). **Conclusion:** A lower communication score in the tool was identified, caused by incomplete CLCs and parallel conversations. This is reflected in the survey results, which emphasized the need for improved CLC. Future initiatives will include CLC training using the prebriefing checklist before patient arrival, in situ simulations, trauma team video reviews and a mandatory educational video on crisis resource management for all incoming trainees. Sustainability and cultural change will be addressed in further plan-do-study-act (PDSA) cycles.

Embolization in nonsplenic trauma: outcomes at a Canadian trauma hospital. ***Brad Moffat,[1] Christine Li,[2] Kelly Vogt,[1] Laura Allen,[1] Cathy Yoshy,[1] Amol Mujoomdar,[3] Daniele Wiseman.[1]***
From the [1]London Health Sciences Centre, London, ON; the [2]University of Alberta, Edmonton, AB; and [3]Western University, London, ON.

Background: Angiography and embolization for hemorrhage control is first-line treatment for solid organ and pelvic injuries in hemodynamically stable trauma patients. We undertook this study to evaluate outcomes in trauma patients who underwent angiography with or without embolization for nonsplenic injuries over a 7-year period. **Methods:** After obtaining research ethics board approval, we accessed the Interventional Radiology and Trauma Registry databases at London Health Sciences Centre to identify patients between 2010 and 2017 who underwent angiography with or without embolization for nonsplenic injuries. Data were extracted for demographics, injury details, hospital course and outcomes. **Results:** We identified 5161 adult patients in the trauma registry, 59 of whom met the study inclusion criteria. On arrival, 26 patients were hemodynamically unstable (44.1%). Embolization occurred for the pelvis (45.8%), liver (15.3%), kidney (8.5%), gluteal region (8.5%), abdominal wall (6.8%), thorax (5.1%) and other (8.5%). Active arterial bleeding was the most common indication for embolization (84.7%). Embolization was successful in 95% of patients and none required repeat embolization. The most common embolization technique was coil with gel-foam (22%), and many procedures combined at least 2 techniques (45.7%). Twenty-one patients (35.6%) required surgery on a related body area and 7 patients (33.3%) underwent surgery before embolization. Only 2 patients (3.4%) had complications from their procedures. Nine patients died, with 2 deaths secondary to bleeding (22.2%). **Conclusion:** Transarterial embolization procedures are being used successfully in cases of nonsplenic traumatic injury. These procedures have high rates of success in our institution with low rates of complications.

The matrix: grouping ICD-10-CA injury codes by body region and nature of injury for reporting purposes. ***Deanna Fong.*** **From the BC Trauma Registry, Vancouver, BC.**

Background: Trauma Services BC (TSBC) provides data reporting via a number of holdings including the BC Trauma Registry, the Disharge Abstract Database, the National Ambulatory Care Reporting System, Vital Statistics and BC Emergency Health Services. To better understand and report on all injured patients, there was a need to classify codes of the enhanced Canadian version of the 10th revision of the *International Statistical Classification of Diseases and Related Health Problems* (ICD-10-CA) into predefined categories on the basis of body region and nature of injury. This would allow for efficiency in reporting, consistency in report parameters and greater understanding of the injuries sustained annually in British Columbia. **Methods:** The injury matrix project was led by TSBC and involved Provincial Health Services Authority public health injury data experts to create a version of an international tool specific to Canadian classification systems. Each ICD-10-CA injury code was categorized by the nature of injury and body region affected, such as fractures to extremities or organ injuries to the torso, and therefore allows us to identify injury patterns more readily. **Results:** The ICD-10-CA Injury Diagnosis Matrix project resulted in a tool that allows for more streamlined reporting of injuries based on the classification of coded data into predefined categories. **Conclusion:** The tool is significant because it provides a standardized method of reporting the thousands of injuries coded in hospital databases into

© 2021 CMA Joule Inc. or its licensors

categories based on body region and nature of injury that can be easily understood by clinicians, researchers and the public. It has the potential to simplify complex reporting and enhance injury surveillance to support injury prevention and trauma system reporting.

Evaluation of low-value clinical practices in acute trauma care: a multicentre retrospective study. ***Lynne Moore.*** **From Laval University, Quebec City, QC.**

Background: Reductions in low-value clinical practices have been identified as 1 of the most promising ways to improve patient outcomes and reduce excess health care spending. The objectives of this study were to identify low-value practices in injury care guidelines, estimate how frequently they are used in practice and evaluate interhospital variations in their use. **Methods:** We identified low-value clinical practices from internationally recognized clinical guidelines. We then developed algorithms to measure the frequency of these practices using trauma registry data and validated them with clinical experts. Finally, we conducted a population-based retrospective cohort study using data from an integrated regionalized Canadian trauma system (2014 to 2017) to calculate frequencies and assess interhospital variations with intraclass correlation coefficients (ICC: low if < 5%, moderate if 5%–19%, high if ≥ 20%). **Results:** We identified 29 low-value practices of which 12 could be measured and validated using trauma registry data. The 2 low-value clinical practices with the highest absolute and relative frequencies were head computed tomography (CT) in adults with mild traumatic brain injury (TBI) who were negative on a validated clinical decision rule (n = 2456; 21%) and cervical spine CT in adults negative on a validated clinical decision rule (n = 1341; 29%). We observed high interhospital variation for decompressive craniotomy in severe TBI with diffuse injury (ICC 34%) and moderate variation for all practices related to magnetic resonance imaging (MRI) and CT in the emergency department (ICC 5.6%–15.8%). Low interhospital variation was observed for practices related to the management of penetrating injuries and for the surgical management of blunt liver or spleen injuries. **Conclusion:** We have developed and validated algorithms to evaluate 12 potentially low-value clinical practices using trauma registry data. The highest frequencies were observed for imaging in the emergency department and the highest interhospital variation was observed for decompressive craniotomy in severe TBI with diffuse injury. These data can be used to advance the research agenda on low-value care for injury admissions.

Trauma 101: a virtual case-based trauma conference as an adjunct to medical education. ***Simon Farquharson,[1] Randi Mao,[1] Eva Yiguan Liu,[1] Lucy Lan,[1] Takbliq Amir,[1] Jimmy Yan,[2] Kevin Singh,[3] Alexandra Allard-Coutu.[1]*** **From [1]McMaster University, Hamilton, ON; the [2]University of British Columbia, Vancouver, BC; and the [3]University of Toronto, Toronto, ON.**

Background: The COVID-19 pandemic has substantially affected medical school curriculum, limiting access to simulation-based trauma education and core surgical clerkship rotations. Virtual learning has been integrated into medical education as an alternative to live synchronous sessions. However, its effectiveness for teaching critical concepts in trauma resuscitation has not been validated. Moreover, while small-group sessions are an effective pedagogical model in-person, less is known about how they translate to online learning in clerkship. **Methods:** Medical students were invited to attend a 2-day virtual trauma conference organized by student interest groups at McMaster University and promoted on social media. The event included 9 interactive presentations by physicians and residents in 5 specialties, followed by virtual small-group case discussions. A best-match algorithm assigned students to their preferred small-group sessions. Participants completed anonymous pre- and post-conference trauma knowledge tests and feedback questionnaires. Results were analyzed using paired t tests and descriptive content analysis. **Results:** A total of 360 students from over 17 medical schools in 5 countries registered to attend the conference. There was a peak of 167 simultaneous connections during presentations and 68 participants during small-group discussions. A total of 131 students (36%) completed the pretest, with a mean baseline score of 3.4 out of 10 (standard deviation [SD] 2.04). Eighty-six students (24%) completed the posttest, with a mean score of 6.3 out of 10 (SD 2.3, $p < 0.001$). Among students who completed both pre- and post-tests (20%, n = 73), paired t test analysis reveals a substantial improvement of the mean score of 2.7 out of 10 (SD 2.3, 95% confidence interval 2.17–3.23, $p < 0.001$). There were no significant correlations between years of education and school attended with pretest performance. Social media enhanced group engagement, resulting in a total of 147 posts, whereby 37.4% were participant generated. Live polling and a moderated chat box improved participation during presentations, with 74% of participants agreeing that the didactic sessions were interactive. The conference was well received. Overall, 95.2% of participants agreed that the online platform was effective and 78.3% agreed that the conference was helpful preparation for clerkship. The response rate for feedback forms for the small group sessions was 58.8% (40/68). Preliminary descriptive analysis revealed 42.5% (17/40) of participants reflected favourably on group interaction during small-group sessions. Overall, 92.7% of the participants rated the small-group discussions as effective. **Conclusion:** With high participant satisfaction and significantly improved posttest results, this virtual model for trauma education at the medical student level is an effective adjunct to the clerkship curriculum. Virtual small-group case-based discussions and social media were beneficial in enhancing participant engagement. This study has important implications for the future design and implementation of international virtual conferences.

Physiologic considerations, indications and techniques for ECLS in trauma: experience of a level 1 trauma centre. ***Sadiq Al Khaboori,[1] Morad Hameed,[2] Naisan Garraway,[2] Emilie Joos,[2] George Isac,[3] Hussein Kanji,[4] Gordon Finlayson,[3] Gavin Tansley,[5] Alex Lee.[6]*** **From the [1]University of British Columbia, Vancouver, BC; [2]Trauma Services, Vancouver General Hospital, Vancouver, BC; the [3]Intensive Care Unit, Vancouver General Hospital, Vancouver, BC; the [4]Department of Critical Care, Vancouver General Hospital, Vancouver, BC; [5]Dalhousie University, Halifax, NS; and the [6]University of Ottawa, Ottawa, ON.**

Background: Extracorporeal life support (ECLS) is used increasingly in the care of multisystem trauma patients.

 © 2021 CMA Joule Inc. or its licensors

However, to date, clear indications for ECLS deployment in trauma have not been established. Clarity about indications and techniques is essential for timely deployment in critical trauma situations to improve outcomes and ensure good stewardship of an important resource. We reviewed recent ECLS deployments at our level 1 trauma centre to understand indications, techniques, strategies and logistics of ECLS in trauma. **Methods:** The BC Trauma Registry was used to identify trauma patients who got ECLS at the Vancouver General Hospital (VGH), a level 1 trauma centre and Extracorporeal Life Support Organization accredited site. The study period was from January 2014 to October 2020. We reviewed charts for indications, technical factors and outcomes. All cases were presented to trauma and intensive care unit staff involved in ECLS management and consensus was achieved. **Results:** A total of 14 patients underwent ECLS (mean age of 31 yr) within a comprehensive resuscitation strategy. Twelve underwent venovenous (VV) ECLS and 2 got venoarterial (VA) ECLS. Twelve patients sustained blunt injuries and 2 penetrating injuries. The average Injury Severity Score (ISS) was 42 (22–57). The broad indications for ECLS were acute respiratory distress syndrome (ARDS) and pulmonary contusions (PC), cardiac injury, and liver and retrohepatic vena cava (IVC) injury. A variety of cannulation strategies were employed depending on the indication. Systemic anticoagulation for VV ECLS was not used during cannula insertion for 3 of 6 ARDS and PC patients and 5 of 6 liver and IVC patients because of concerns about associated injuries. Of 14 patients, 2 got clots in the circuit causing it to fail; 1 of them received a heparin bolus but no heparin infusion and required complete change of circuit, the other 1 clotted his circuit secondary to ongoing hypovolemia and blood loss in the operating room. The duration of ECLS placement was on average 74 hours (10–185 h) for cardiac and pulmonary indications with mean flow of 4.6 L/min, and on average 2.8 hours for liver and IVC injuries with mean flow of 4.0 L/min. Two patients had major vascular injury secondary to cannula insertion requiring vascular reconstruction and repair. A total of 79% of patients survived the ECLS run. **Conclusion:** ECLS is a useful strategy in the comprehensive care of severely injured patients but clarity about indications (ARDS and PC; cardiac; and liver and IVC) and advanced standardization of corresponding techniques (cannulation, anticoagulation and duration) may assist decision-making, deployment and team activation. In our experience ECLS can change the damage control paradigm to enable the management of complex injuries and to provide earlier definitive surgery.

Engaging patients in the selection of trauma quality indicators. ***Agathe Lorthios-Guilledroit,[1] Catherine Gonthier,[1] Amina Belcaïd,[2] Lynne Moore,[3] Marie-France Duranceau,[1] Catherine Truchon.[1]*** **From the [1]Institut national d'excellence en santé et en services sociaux, Montreal, QC; the [2]Centre hospitalier universitaire de Québec – Université Laval, Quebec City, QC; and [3]Laval University, Quebec City, QC.**

Background: The Trauma and Critical Care Unit of the Institut national d'excellence en santé et en services sociaux (INESSS) has the mandate to monitor and support quality improvement within the trauma care network in Quebec. This study aimed to update the process indicators used for the assessment of acute trauma care facilities. This presentation focuses on the engagement of patients and informal caregivers and its impact on the process of selecting quality indicators for trauma care. **Methods:** A review of scientific and grey literature was carried out to identify process indicators. Six patients and informal caregivers identified, during a preparatory session, important patient-centred aspects of trauma care quality. The selection of indicators was carried out through a 3-round consultation process, adapted from the Delphi method, with 2 advisory committees: 1 was composed of 19 clinical experts and stakeholders and the second consisted of the 6 patients and informal caregivers. **Results:** Twenty-five indicators identified from the literature review were presented to the expert committee and the patient and informal caregiver committee. The consultation process led to a final selection of 18 indicators. These were classified according to the Institute of Medicine quality of care framework. The indicators measure timely access to care (n = 7), safety (n = 5), patient-centred care (n = 3), equity (n = 2) and effectiveness (n = 1). More specifically, patient-centred care indicators concerned coordination of care (communication of patient information during transfer), physical comfort (pain assessment and reassessment) and patient information and communication. These were considered more of a priority by patients but still deemed important by experts. Some patient-centred indicators were retained even though they cannot be measured using existing databases, with the aim of developing capacity to measure them in the future. **Conclusion:** The participation of patients and informal caregivers in the process of selecting indicators has made it possible to develop a more patient-centred vision of trauma care and to gain insights into how to better integrate their perspective in future projects. These updated indicators will be used in future cycles of evaluation of the trauma facilities in Quebec, with the overarching goal of promoting quality, accessible, continuous, patient-centred and effective trauma care and services.

Strategies aimed at preventing chronic opioid use in trauma and acute care surgery: a scoping review. ***Caroline Côté,[1] Melanie Berube,[1] Lynne Moore,[1] François Lauzier,[1] Kelly Vogt,[2] Gregory Berry,[3] Lorraine Tremblay,[4] Marc Martel,[5] Gabrielle Pagé,[6] Étienne Belzile,[7] Anne-Marie Pinard,[1] David Evans,[8] Kadija Perreault,[1] Caroline Sirois,[1] Sonia Grzelak,[1] Alexis Turgeon.[1]*** **From [1]Laval University, Quebec City, QC; the [2]London Health Sciences Centre, London, ON; [3]McGill University Health Centre, Montreal, QC; [4]Sunnybrook Health Sciences Centre, Toronto, ON; [5]McGill University, Montreal, QC; [6]Université de Montréal, Montreal, QC; the [7]Centre hospitalier universitaire de Québec – Université Laval, Quebec City, QC; and [8]Trauma Services, Vancouver General Hospital, Vancouver, BC.**

Background: Chronic opioid use (> 3 mo) has substantial individual and societal impacts and has been documented in up to 60% of patients after trauma or acute care surgery. Despite being a major public health issue, strategies to limit chronic opioid use have not been comprehensively assessed in these populations. Accordingly, we conducted a scoping review to provide an overview of the evidence on strategies to prevent chronic opioid use after traumatic injury and acute care surgery. **Methods:** We searched 7 databases and the grey literature to

© 2021 CMA Joule Inc. or its licensors

identify studies and guidelines on preventive strategies published between 2005 and 2020. Preventive strategies were classified as system-based, pharmacologic, educational, multimodal and others. We considered every outcome measured at least 1 month after trauma or surgery. We summarized the findings with measures of frequency along with *p* values for statistical significance. We also reported the strategies' level of evidence and the strength of recommendations for each strategy. **Results:** Of the 41 453 identified citations, 47 studies and 13 guidelines were selected. Most studies and guidelines concerned orthopedic surgery (62%), trauma (28%) and spine surgery (10%) patients. Among system-based strategies, statistically significant decreases in morphine equivalent doses (MEDs) beyond 1 to 3 months were observed in most studies on hospital-based protocols, prescribing guidelines and prescription monitoring systems. Among pharmacologic strategies, studies on the use of nonsteroidal anti-inflammatory drugs showed statistically significant long-term reductions in MEDs. No statistically significant reduction was observed in studies on nerve blocks or analgesics with an effect on the central nervous system (e.g., gabapentinoids, antidepressants). A study on the use of cannabinoids during the recovery phase from trauma showed a statistically significant increase in the quantity of MEDs used and duration of opioid therapy. Most studies on educational strategies for patients and health professionals and multimodal strategies were associated with statistically significant reductions in MEDs or an increase in opioid-free patients. No study on surgical procedures (e.g., minimally invasive), alternative strategies (e.g., acupuncture) or psychological strategies was associated with statistically significant reductions in opioid use. Most studies that assessed the pain experience concomitantly with opioid use reduction did not show a statistically significant difference in pain intensity between groups that received a preventive strategy compared with control groups. The majority of the recommendations made in guidelines were based on low-quality evidence. **Conclusion:** Our scoping review advances knowledge on the evidence of existing strategies to prevent chronic opioid use in trauma and acute surgery patients. We observed that system-based, educational and multimodal strategies appeared promising. Future research should focus on determining which strategies should be adopted and evaluating their effect on relevant patient-reported outcomes, including adverse events related to opioid use and quality of life, and social outcomes, including lost productivity and services utilization.

Augmented reality surgical telementoring for leg fasciotomy. ***John McPherson,[1] Max Talbot,[2] Christopher Kennedy,[3] Rich Hilsden,[4] Gerard Slobogean.[1]*** **From the [1]Department National Defence, Ottawa, ON; the [2]Canadian Armed Forces, Ottawa, ON; the [3]Division of Orthopaedic Surgery, The Ottawa Hospital, Ottawa, ON; and [4]Western University, London, ON.**

Background: Prolonged field care is required when casualty evacuation to a surgical facility is delayed by distance or tactical constraints. This can occur in both civilian and military environments, including remote locations in Canada. In these circumstances, there are no established treatment options for extremity compartment syndrome. One solution is to remotely mentor the tactical clinician to perform surgical compartment release. **Methods:** Six military clinicians were recruited to perform a 2-incision leg fasciotomy on a synthetic model under the remote guidance of an orthopedic surgeon. The operators wore smartglasses that allowed synchronous communication and the display of anatomic holograms in their field of view. Three control legs were created: 1 complete fasciotomy and 2 with major errors. The experimental and control legs were evaluated by 2 blinded surgeons according to criteria described by Kucera and colleagues. **Results:** All 6 study participants were Canadian Armed Forces physician assistants. They had extensive experience as military clinicians but minimal experience performing surgical procedures. None had performed a fasciotomy previously. The study was conducted over 3 days, during which bandwidth varied widely at the study site: ping ranged from 12 to 338 ms, download speed from 0.93 to 3.48 Mbps and upload speed from 0.44 to 0.64 Mbps. The mentor, located 300 km away from the study site, had a stable Internet connection with sufficient bandwidth. The average duration of the procedure was 53 minutes (standard deviation 12 min). All 6 procedures were completed without major errors: release of all 4 compartments was achieved through full-length incisions in the skin and fascia. The only minor error was a laceration of the saphenous vein (n = 1). All 3 control specimens were correctly assessed by the evaluators. None of the participants experienced adverse effects from wearing the AR headset. Four dropped calls occurred. In all cases, the connection was reestablished, and the procedure was completed successfully. **Conclusion:** Despite limited bandwidth, we were able to successfully perform 2-incision leg fasciotomy in all cases. We attribute the dropped calls to a mismatch between the size of the graphic files and the available bandwidth. A better technical understanding of the software by the mentor would have avoided this problem. Important considerations for future research and practice include protocols for dropped communications, communications training for mentoring surgeons and surgical skills training for the operators.

Identification of high-risk trauma patients requiring major interventions for traumatic hemorrhage: a prospective study of clinical gestalt. ***Alexandre Tran,[1] Tyler Lamb,[1] Jacinthe Lampron,[2] Maher Matar,[2] Shannon Fernando,[1] Jeffrey Perry,[1] Christian Vaillancourt.[2]*** **From the [1]University of Ottawa, Ottawa, ON; and [2]The Ottawa Hospital, Ottawa, ON.**

Background: Uncontrolled hemorrhage remains the primary cause of preventable death following traumatic injury, often because of the fallability of clinical gestalt and delays in recognizing injury severity. We sought to investigate current practice patterns for risk stratifying bleeding patients and causes of preventable delays in activation and delivery of life-saving interventions. **Methods:** This is an ongoing prospective cohort study at the Ottawa Hospital Civic Campus. Eligible patients are 16 years of age and older, with blunt or penetrating thoracoabdominal trauma and requiring trauma team activation. The emergency physician and trauma team leader are asked to complete electronic data collection forms after the initial assessment to describe clinical suspicion for substantial bleeding requiring major interventions such as surgery, embolization or massive transfusion. Occurence and causes of preventable delays are identified. **Results:** This interim analysis includes 385 patient encounters with a 75% response rate for physician assessment

 © 2021 CMA Joule Inc. or its licensors

forms. The majority of patients were men (78%) with a median age of 39 years. We identified a 28% penetrating injury rate and 125 cases requiring major intervention for hemorrhage. In cases with sufficient bleeding to require an intervention, up to one-third were initially designated to be at the lowest level (< 10% risk) as determined by clinical gestalt after 60 minutes of assessment and investigation. In such cases, the clinician's initial impression at the 15-minute mark was superior to that at the 60-minute mark. The median time to pathway activation was 21 minutes and the median time to delivery of intervention was 33 minutes. Preventable delays were encountered in 15% of cases and were most commonly related to clinical indecisiveness. **Conclusion:** This study identifies challenges in the risk assessment of potentially bleeding trauma patients. During cases with severe bleeding, the initial clinical gestalt demonstrated superior performance to the follow-up impression, despite additional assessment time and investigations. Limitations to clinical gestalt may include potential for confirmation bias, difficulty reaching clinical certainty, as well as the resultant delays in pathway activation and delivery.

Evaluating best practices in trauma care of older adults. ***Matthew Guttman*,[1] *Justin Nathens*,[2] *Rachel Strauss*,[2] *Bourke Tillmann*,[2] *Andrea Phillips*,[2] *Barbara Haas*.[2] From the [1]Department of Surgery, University of Toronto, Toronto, ON; and the [2]Sunnybrook Health Sciences Centre, Toronto, ON.**

Background: Older adults (age ≥ 65 yr) represent more than a third of adults admitted to hospital with severe injury. While many institutions have implemented geriatric-specific trauma protocols, these changes have not improved hospital-level outcomes. We hypothesized that proxy measures for senior-friendly care (protocol implementation) may not translate into changes in direct measures of care. The objective of this study was to evaluate how implementation of best practice protocols in geriatric trauma correlates with direct measures of senior-friendly care. **Methods:** This was a prospective cohort study at a level 1 trauma centre. We included older adults admitted for at least 72 hours (September 2019 to August 2019). Intubated patients were excluded. Primary outcomes were 2 measures of early mobilization defined in geriatric trauma and geriatric medicine best practice guidelines: mobilization within 48 hours of admission and mobilization thrice daily. Secondary outcomes included receipt of physiotherapy and geriatric assessment. Outcomes were assessed in the context of institutional geriatric trauma protocols. **Results:** Multiple senior-friendly trauma protocols had been implemented at the study centre, including a proactive geriatric trauma consultation service and an early mobility policy. We identified 203 patients who met the inclusion criteria. Mean age was 78 years, 48% (n = 98) were male and 90% (n = 183) were living at home before injury. Median Injury Severity Score was 14 and 29% (n = 59) underwent surgery within 72 hours of admission. Almost all patients received a physiotherapy assessment (95%, n = 193); however, only 61% (n = 118) were assessed within 72 hours of admission. Most eligible patients received a geriatric assessment (87%, n = 144); 70% (n = 101) were assessed within 72 hours of admission. However, only 41% (n = 59) of geriatric assessments included formal documentation of frailty status. Among patients cleared for mobilization, only 48% (n = 72) were mobilized within 48 hours of admission and only 46% (n = 69) achieved 3 mobility moments per day within 72 hours of admission. One-third (32%, n = 48) of patients never mobilized in the first 3 days of their hospital admission. There was no difference in the attainment of mobility targets between patients who received early physiotherapy or early geriatrics assessments and those who did not. **Conclusion:** At our institution, we identified no association between indirect measures of quality of care, such as early physiotherapy and geriatric assessment, and direct measures, such as early mobilization. Although assessing direct measures of senior-friendly care is resource intensive, indirect measures of care may not identify critical gaps in quality of care. As has been done in geriatric medicine, studies focused on assessing quality of care in geriatric trauma should focus on direct measures of care.

Between paradigms: comparing patient and parent experiences of injured adolescents treated at pediatric or adult trauma centres. ***Matthew Yeung*, *Brent Hage*, *Natalie Yanchar*. From the University of Calgary, Calgary, AB.**

Background: Injured adolescents may go to pediatric (PTC) or adult (ATC) trauma centres. Although there appears to be little difference in mortality when adolescents are managed in PTCs versus ATCs, evidence suggests differences in clinical processes (e.g., computed tomographic scanning, operative intervention). Moreover, there is little information on nonclinical outcome variation. We aimed to examine differences in nonclinical outcomes of injured adolescents admitted to the lead PTC or ATC within a regional Canadian trauma system. **Methods:** After injury-related hospital admission at the PTC or ATC, adolescents (15–17 yr, inclusive) and parents completed the following: the Quality of Trauma Acute Care Patient-Reported (or Parent-Reported) Experience Measure (QTAC-PREM), examining clinical care, information delivery, education and social supports, and opioid exposure; the Pediatric Quality of Life Inventory; and the Brief Symptom Inventory, a psychological distress measure. Data were collected on clinical outcomes and processes. Descriptive bivariate analyses compared outcomes by trauma centre type. **Results:** Twenty-six ATC and 32 PTC patients have been enrolled to date. Survey response rates were 69% (patients) and 75% (parents) at the PTC and 58% (patients) and 54% (parents) at the ATC. There was a similar age and sex distribution between the 2 centres. Injury severity was higher at the ATC, reflected by greater mean lengths of stay (PTC 2.3 d [standard deviation (SD) 2.1 d], ATC 13.3 d [SD 23.7 d]), and lower mean Glasgow Coma Scale scores (PTC 15.0, ATC 13.8) at the ATC. There were also 3 critical care admissions at the ATC and none at the PTC among recruited patients. No differences were observed in patient- or parent-reported clinical care and follow-up experiences. There was also no difference in patient- or parent-reported social and educational support, although subscales were limited by visitor restrictions because of the COVID-19 pandemic, and the majority of injuries occurring during summer months when students were out of school. Parents at the ATC reported fewer opportunities to stay with or near their child compared with those at the PTC (100% v. 69.2%). Parents reported better information provision at the PTC (mean 17.3 [SD 1.3] v. 13.9 [SD 5.2], out of 18 as measured by the QTAC-PREM). Patients

© 2021 CMA Joule Inc. or its licensors

and parents were more likely to report receiving opioid prescriptions on discharge at the ATC (55.6% v. 14.3%). There was no difference in quality of life or psychological distress between the PTC and ATC. **Conclusion:** Injured adolescents and their parents indicated similar clinical and follow-up experiences, although parents felt better informed at the PTC and reported better opportunities to stay near their child. Parents and patients reported higher opioid exposures at the ATC. Sharing of communication, accommodation and opioid prescribing practices may allow for improved experiences and reduced opioid exposures in injured adolescents presenting to ATCs. Multivariable analyses are necessary in the future to adjust for injury severity differences.

Early outcomes after implementation of chest trauma management protocol in Vancouver General Hospital. ***Renée-Anne Poirier*[1], *Emilie Joos*[2], *Angie Brisson*[3], *James McKay*[4]. From the [1]University of British Columbia, Vancouver, BC; [2]Vancouver General Hospital, Vancouver, BC; [3]Vancouver Coastal Health, Vancouver, BC; and the [4]Department of Trauma Services, Vancouver General Hospital, Vancouver, BC.**

Background: Rib fractures are a common problem in trauma: 10% of blunt trauma patients sustain at least 1 rib fracture. The multimodal management of these patients, including monitoring, chest physiotherapy and pain control, has substantially improved over the past few years. At Vancouver General Hospital (VGH), 1 such management algorithm was introduced in the standardized trauma admission orders. The aim of this study is to measure patient outcomes before and after Chest Trauma Protocol (CTP) implementation. **Methods:** This is a prospective observational before–after cohort study centred around the CTP implementation on Sept. 21, 2020. Patient outcomes were analyzed as follows: length of stay was analyzed with the Welch *t* test and rate of pneumonia was analyzed with the Fisher test. All statistical tests were 2-sided and *p* values less than 0.05 were considered statistically significant. **Results:** The pre- and post-implementation groups included 28 and 15 patients, respectively. The groups were similar in their main characteristics (age, sex distribution, mechanisms). The mean Injury Severity Score was 23.7 in the pre-implementation group and 22.7 in the post-implementation group. The outcomes showed the following results. The mean intensive care unit (ICU) length of stay was significantly shorter in the post-implementation group (3.0 v. 12.4 d, $p = 0.005$). The same significant difference was shown for length of stay in the monitored beds of the Burn, Trauma and High Acuity (BTHA) unit (2.38 v. 6.17 d, $p = 0.007$). The rate of pneumonia was lower in the post-implementation group, although this difference was not significant (0/15 v. 6/28, $p = 0.08$). **Conclusion:** The early analysis of the CTP implementation at VGH shows promising results regarding ICU and BTHA length of stay. Owing to small numbers, we were unable to show a statistically significant difference in the rate of pneumonia between the 2 groups. However, as we collect more data prospectively, we hope to be able to confirm that CTP reduces patient morbidity. Further studies will focus on the adherence to the protocol.

Utility of diagnostic peritoneal lavage versus focused abdominal sonography for trauma in penetrating abdominal injury. ***Mahwash Siddiqi, Francesca Bryan, Teresa Evans, Asma Qureshi, Ghulam Saadat, Andrew Khalifa, Faran Bokhari, Matthew Kaminsky*. From the John H Stroger, Jr. Hospital of Cook County, Chicago, IL.**

Background: Diagnostic peritoneal lavage (DPL) is sensitive for detecting free intraperitoneal fluid. However, it is invasive and carries some risk of complications. Focused abdominal sonography for trauma (FAST) is noninvasive and enhances the speed of the primary trauma assessment. The purpose of this study was to evaluate the recent experience at a level 1 trauma centre to determine which diagnostic modality is the most accurate in penetrating abdominal trauma. **Methods:** This study uses a level 1 trauma centre's database from January 2018 to August 2020. Patients who sustained abdominal penetrating injuries and received DPL, FAST, or both in initial assessment were included. A positive DPL was considered over 10 000 red blood cells (RBCs) for gunshot wounds or 100 000 RBCs for stab wounds. Confirmatory test was either computed tomography (CT) of the abdomen or laparotomy–laparoscopy depending on the patient. **Results:** Sixty-seven cases of penetrating intra-abdominal injuries were assessed. Mean age of the study population was 29 years and 60 (90%) patients were male. Mean Injury Severity Score (ISS) was 7.09 (standard deviation 8.04). Median hospital length of stay was 2 days. Forty-three patients (64%) had gunshot wounds and 24 (36%) had stab wounds. DPL was performed in 59 patients (88%). Two patients had false-negative results (laparoscopy found peritoneal violation or injury) and 1 patient had a false-positive result (blood per peritoneum from a DPL needle complication but no organ injury). Sensitivity, specificity, positive predictive value and negative predictive value of DPL were 83%, 98%, 91% and 96%, respectively. Twenty-one patients had FAST with 1 false-positive result (diagnostic laparoscopy found no intraperitoneal injury) and 1 false-negative result (injury was discovered on laparoscopy and the patient needed a laparotomy). For the FAST examination, sensitivity, specificity, positive predictive value and negative predictive value were 80%, 94%, 80% and 94%, respectively. Diagnostic laparoscopy was done in 13 patients (19%). Laparoscopy was positive in 4 patients who had diaphragm or bowel injuries and negative in 9 patients. Exploratory laparotomy was done in 15 patients while 2 were negative for intraperitoneal injuries. Forty-two (63%) patients had a CT scan, with 33 negative and 9 positive for intraperitoneal injury. **Conclusion:** In our centre, sensitivity, and specificity of DPL in diagnosing intra-abdominal free fluid was higher than FAST. In patients who do not have an immediate indication for laparotomy, DPL is a more reliable indicator of injury.

Time to definitive surgery and survival in pediatric patients younger than 18 years with gunshot wounds. ***Teresa Evans, Keren Guiab, Andrew Khalifa, Faran Bokhari*. From the John H Stroger, Jr. Hospital of Cook County, Chicago, IL.**

Background: Little is known about the impact of a delay for an emergent abdominal procedure following blunt or penetrating trauma, particularly in pediatric patients. The purpose of this study is to determine if the time to emergent abdominal procedure has an impact on the survival of pediatric patients with gunshot wounds. **Methods:** The National Trauma Data Bank (NTDB) was analyzed for patients aged less than 18 years from

 © 2021 CMA Joule Inc. or its licensors

2007 to 2015 who sustained a gunshot wound (GSW) and required an abdominal operation. Overall, 522 patients were included. Regression analysis was performed to determine if time to abdominal procedure had an impact on survival while also controlling for age, gender, systolic blood pressure (SBP), heart rate (HR), respiratory rate (RR), Glasgow Coma Scale (GCS) score, Injury Severity Score (ISS), the presence of shock (SBP < 90), performance of a thoracotomy, hospital length of stay (LOS), intensive care unit (ICU) LOS and ventilator days. **Results:** Of 522 patients included in the study population, 457 (87.5%) were male and 90.9% were older than 10 years of age, with 78.4% falling between 15 and 18 years and 12.5% in the 10- to 14-year age group. Overall 365 (69.9%) patients had an ISS above 16, and 186 (35.6%) of them had an ISS greater than 25. The vast majority (90.4%) had a GCS score of 14–15. Seventy-two (13.8%) presented in shock. Twenty-one (4.0%) required a resuscitative thoracotomy. The median time to abdominal procedure was 0.72 hours (43.2 min), with an IQR of 0.48–1.17 hours. The median hospital LOS, ICU LOS and ventilator days were 12 (IQR 8–20), 5 (IQR 2–8.25) and 2 (IQR 1–5), respectively. Overall, 502 (96.2%) survived. Bivariate regression analysis for patients older than 15 years revealed that an ISS greater than 25 (odds ratio [OR] 3.532, 95% confidence interval [CI] 1.384–9.015, $p = 0.008$), an increased HR (median 17.180 beats/min, IQR 4.762–29.597 beats/min, $p = 0.007$) and the need for an ED thoracotomy (OR 4.745, 95% CI 1.275–7.665, $p = 0.020$) were significantly associated with mortality. Multiple logistic regression for patients older than 15 years suggested increased time to abdominal procedure (OR 0.096, 95% CI 0.011–0.818, $p = 0.032$), increased ISS (OR 1.117, 95% CI 1.016–1.228, $p = 0.022$) and increased hospital LOS (OR 0.129, 95% CI 0.032–0.516, $p = 0.004$) were associated with a higher chance of mortality. The odds of mortality were increased by 10.416 for every hour delay to abdominal procedure, translated to 2.604 increased odds of mortality for every 15-minute delay. **Conclusion:** In pediatric patients older than 15 years of age who sustain gunshot wounds in which an abdominal procedure is necessary, our analysis suggests that increased ISS is a significant independent predictor for mortality and that in those who require an abdominal procedure, even a slight delay may be associated with higher mortality. More data are needed to determine if these conclusions apply for patients younger than 15 years of age.

The effect of chronic obstructive lung disease on post-traumatic acute respiratory distress syndrome: predictors of morbidity and mortality. ***Keren Guiab, Aly Aly, Teresa Evans, Andrew Roberts, Andrew Khalifa, Matt Kaminsky, Faran Bokhari.*** **From the John H Stroger, Jr. Hospital of Cook County, Chicago, IL.**

Background: Acute respiratory distress syndrome (ARDS) contributes substantially to morbidity and mortality in trauma patients. In this study, we aimed to determine whether patients with previously diagnosed chronic obstructive pulmonary disease (COPD) have a worse prognosis when subsequently diagnosed with trauma-induced ARDS. **Methods:** This retrospective analysis used the Trauma Quality Improvement Program (TQIP) database (2012–2016) to identify patients with COPD and without COPD who developed ARDS after a traumatic injury to the chest. The primary outcome was hospital mortality. The secondary outcomes were duration of mechanical ventilation, intensive care unit (ICU) length of stay (LOS), hospital LOS, inpatient complications and final disposition. **Results:** A total of 4013 patients with traumatic chest injury developed ARDS; 91.3% sustained blunt trauma. Median Glasgow Coma Scale (GCS) score and mean Injury Severity Score (ISS) were 13 (interquartile range 3–15) and 27.65 (standard deviation 12.24), respectively. A total of 36.6% required respiratory assistance in the emergency department (ED). Pneumonia was the most common complication (43.5%), followed by unplanned intubation (12.2%) and deep vein thrombosis (10.9%). COPD patients ($n = 354$) were older (57.8 v. 46.2 yr, $p < 0.05$), had a lower median GCS score (8 v. 12, $p < 0.05$), had a lower ISS (23 v. 28, $p < 0.05$) and received less respiratory assistance in the ED (25.4% v. 37.7%, $p < 0.05$). They also had an increased rate of unplanned return to the ICU (8.5% v. 5.2%, $p < 0.05$), unplanned intubation (17.2% v. 11.7%, $p < 0.05$) and severe sepsis (12.4% v. 8.6%, $p < 0.05$). Of the COPD patients who developed sepsis, 68% had pneumonia, of whom 46% subsequently died ($p < 0.05$). After adjusting for confounders, COPD was associated with a statistically significant increase in the development of pneumonia (odds ratio [OR] 1.37, 95% confidence interval [CI] 1.04–1.81, $p < 0.05$). COPD did not have a statistically significant effect on sepsis (OR 1.43, 95% CI 0.96–2.13, $p = 0.08$) or mortality (OR 1.05, 95% CI 0.73–1.50, $p = 0.86$). On a second analysis, respiratory assistance in the ED and the development of sepsis correlated with an increased likelihood of mortality in patients with COPD (OR 1.97, 95% CI 1.07–3.53, $p < 0.05$; and OR 8.84; 95% CI 4.26–18.35, $p < 0.05$, respectively). **Conclusion:** Patients with COPD should be identified early and monitored aggressively for pneumonia and sepsis if at risk for ARDS in the trauma setting. Medical bracelets may be useful for patients who present with comorbid conditions that may amplify their risk of mortality.

The association between injury type and clinical outcomes in patients with traumatic renal injury after nephrectomy. ***Keren Guiab, Teresa Evans, Jasmine Zahid, Andrew Roberts, Ghulam Saadat, Thomas Messer, Faran Bokhari.*** **From the John H Stroger, Jr. Hospital of Cook County.**

Background: The kidneys are commonly injured in the trauma setting, which may require life-saving operative intervention. The purpose of this study was to evaluate complications and mortality of nephrectomy following blunt versus penetrating renal injuries. We hypothesized that nephrectomy in patients with blunt injuries is associated with similar outcomes compared with penetrating injuries. **Methods:** We extracted data from the Trauma Quality Improvement Program (TQIP) database between 2011 and 2016 and identified patients who sustained traumatic renal injuries and underwent nephrectomy. Severe head and chest injuries (Abbreviated Injury Scale > 3) led to patient exclusion. The main outcome measures were mortality, length of stay and complications. Univariate, bivariate and multivariate logistic regression were used for data analysis. **Results:** In a cohort of 861 predominantly male (729/861 or 84.5%) patients, the mean age was 35 years (standard deviation 16 yr). Median Glasgow Coma Scale score and Injury Severity Score (ISS) were 15 (interquartile range [IQR] 13–15) and 26 (19–34), respectively. The majority of the

© 2021 CMA Joule Inc. or its licensors

study population (811/861 or 94%) underwent nephroureterectomy. Acute renal failure was the most common complication (106/861 or 12.3%), followed by pneumonia (83/861 or 9.6%) and cardiac arrest (64/861 or 7.4%). Death occurred in 167 of 861 (19.4%) nephrectomized patients. Subjects who presented with blunt trauma (n = 272) were older (41 v. 32 yr, $p < 0.05$) and had a higher median ISS (34 v. 25, $p < 0.05$). The group with penetrating injuries (n = 589) had longer median intensive care unit (ICU) stays (4 v. 5 d, $p < 0.05$) and hospital stays (9 v. 15 d, $p < 0.05$) and longer ventilator requirements (2 v. 3 d, $p < 0.05$). The crude mortality rate was higher in those sustaining blunt trauma (29% v. 14%, $p < 0.05$). Adjusted analysis showed that sustaining blunt renal injuries compared with penetrating injuries was associated with reduced odds of mortality (odds ratio [OR] 0.540, 95% confidence interval [CI] 0.312–0.935, $p < 0.05$) as well as significant increases in length of stay (OR 1.059, 95% CI 1.033–1.085, $p < 0.05$) and significant reductions in ICU days (OR 0.943, 95% CI 0.905–0.983, $p < 0.05$). The rates of deep vein thrombosis (OR 0.401, 95% CI 0.165–0.971, $p < 0.05$) and organ space infection (OR 0.255, 95% CI 0.081–0.804, $p < 0.05$) were significantly lower. **Conclusion:** Our results showed that despite adjusting for injury severity, blunt renal injuries necessitating nephrectomy were associated with a lesser mortality burden, shorter ICU stay and longer hospital stay compared with penetrating renal injuries.

When low complication rates are a bad sign: the negative impact of introducing an electronic medical record on TQIP data completeness. ***Nori Bradley,[1] Robyn Keen,[1] Kyla Hoogers,[2] Sandy Widder.[3]*** **From the [1]University of Alberta, Edmonton, AB; [2]Alberta Health Services, Edmonton, AB; and the [3]University of Alberta Hospital, Edmonton, AB.**

Background: The Trauma Quality Improvement Program (TQIP) provides benchmarking data to allow sites to identify areas for improvement. However, completeness of data variables is dependent on clinical provider documentation. Transitioning from paper chart to electronic medical record (EMR) at our level 1 trauma centre disrupted usual workflow and negatively affected TQIP variable completeness for complications. A local quality improvement initiative was required to return data completeness rates to the pre-EMR level. **Methods:** An aim statement was generated to return TQIP complication completeness rates to pre-EMR levels within 3 months and maintain performance. Multiple stakeholder meetings and plan-do-study-act (PDSA) cycles were initiated to identify barriers to documentation of complications electronically. Interventions including provider education, clarification of EMR language, handouts and EMR embedded forcing functions were employed in serial PDSA cycles. Feedback from local TQIP analysts guided interventions. **Results:** In the 2 months before the EMR introduction, our baseline proportion of patients with a complication was 22% and 23%, respectively. In the month following rollout of the EMR, this dropped to 2% despite a similar case mix. Stakeholder review of processes identified key barriers to completing documentation: initial rollout of the EMR did not include an embedded TQIP complication recording sheet, trauma providers found it difficult to include complications in general documentation without this "front of the chart" prompt, and EMR terminology was not always intuitive for clinical language. Multiple interventions were implemented and reviewed as PDSA cycles. A mini TQIP complication recording sheet handout was replicated with EMR language mapping, given to providers and maintained on trauma ward workstations to provide a quick reference in work locations. Direct provider education regarding EMR language and problem list documentation improved consistency and communication with TQIP analysts. Generation of a standardized discharge summary template with a "TQIP complications" drop-down menu within the EMR provided a memory and documentation aid. Within 2 months of EMR implementation, the proportion of patients with a documented complication was 24%, and it was maintained at 21% and 22% for the subsequent 2 months with similar patient volumes and acuity. **Conclusion:** EMR introduction at a TQIP site can negatively affect data completion rates. A multipronged approach with PDSA cycles, based on provider and analyst feedback and partnerships with EMR developers, can mitigate the impact of workflow disruptions. Sites implementing an EMR should anticipate alterations in data collection; baseline audits are recommended to ensure process consistency. Strategies to minimize impact should be implemented in parallel with the EMR, with frequent PDSA cycles to maintain data integrity.

Clinical handover from paramedic services to the trauma team: a video review analysis of the IMIST-AMBO protocol implementation. ***Cara Elliott,[1] Lowyl Notario,[2] Arshia Javidan,[2] Martin Johnston,[3] Will Thomas-Boaz,[2] Corey Freedman,[2] Dylan Pannell,[4] Homer Tien,[5] Avery Nathens,[2] Luis Da Luz.[2]*** **From the [1]University of Toronto, Toronto, ON: [2]Sunnybrook Health Sciences Centre, Toronto, ON; [3]Toronto Paramedic Services, Toronto, ON; [4]Trauma Program, Sunnybrook Health Sciences Centre, Toronto, ON; and [5]Ornge, Toronto, ON.**

Background: Patient handover between paramedics and the trauma team is vulnerable to communication errors that may adversely affect patient care. This project studied the introduction of a previously validated handover tool, the IMIST-AMBO (abbreviation of handover categories) protocol, in the Canadian setting. This study is the second phase of a larger project at our institution that identified the need for a structured handover tool in trauma to improve handover procedures and enhance interdisciplinary team performance. **Methods:** An educational video demonstrating the IMIST-AMBO tool was developed and disseminated to paramedics, trauma physicians and nurses. Two reviewers, using the Trauma Team Video Review Program, assessed 80 recordings that used the IMIST-AMBO tool. Handover duration, adherence to protocol, frequency of parallel conversations, informal handovers and interruptions were measured on a standardized data collection form. Perceived satisfaction with the tool was surveyed from all team members. Data were compared with phase I of the project. **Results:** Data extraction and analysis is ongoing. Over 12 weeks, 148 handovers were video recorded and those that used the tool were deemed eligible for full review (n = 80), for a compliance rate of 54% (80/148). Total adherence to the IMIST-AMBO handover structure occurred in 70.4% of videos, with paramedics more adherent to the IMIST (82.2%) compared with the AMBO (47.1%)

 © 2021 CMA Joule Inc. or its licensors

section. The mean handover duration was shorter (1 min : 58 s [standard deviation (SD) 44s]) compared with the preimplementation phase (2 min : 47 s [SD 1 min : 14 s]). Frequency of parallel conversations (30% with tool v. 61% prior) and informal handovers (13% with tool v. 65% prior) decreased. On average, the paramedics were asked 1.35 [SD 2.32] questions during the predetermined pause section of the tool and 1.65 (SD 1.37) outside of the pause period, which were perceived as interruptions. Without the tool, a mean of 5.84 questions were asked, and 86% of questions during the formal handover were interruptions. The frequency of reported satisfaction of team members regarding handover duration, amount of information and structure was positive: 80.7%, 89.3% and 85%, respectively. Overall desirability to use the tool again was neutral in 61.3% and positive in 35% of cases; 3.2% of team members did not desire to use the tool again. **Conclusion:** The implementation of the IMIST-AMBO protocol at our institution has been shown to be feasible and efficacious. Preliminary data analysis demonstrates that the handover process between paramedics and the trauma team members has improved with respect to flow, duration, structure and information content. The tool was also received favourably among trauma staff. The IMIST-AMBO protocol may be successful in improving team performance in other trauma centres across Canada.

Geriatric Recovery and Enhancement Alliance in Trauma (GREAT) multidisciplinary quality improvement initiative: improving process and outcome measures for geriatric trauma patients. ***Nori Bradley*,[1] *Kristen Morch*,[1] *Lauren Scott*,[2] *Ni Lam*,[2] *Sandy Widder*.[2] From the [1]University of Alberta, Edmonton, AB; and the [2]University of Alberta Hospital, Edmonton, AB.**

Background: The GREAT (Geriatric Recovery and Enhancement Alliance in Trauma) quality initiative optimized the care of geriatric trauma patients. A dedicated geriatric trauma coordinator identified target areas and coordinated multidisciplinary care throughout the patient's journey. Early injury identification, addressing goals of care, pain control, decreasing polypharmacy, delirium prevention, addressing mental health issues, and mobility needs were addressed. The goal was to improve rates of successful resuscitation, rehabilitation and reintegration of the geriatric trauma patient. **Methods:** Patients aged 65 years or older with a traumatic mechanism were enrolled, excluding isolated orthopedic injuries. GREAT patients followed standardized protocols: order sets, trauma service consult, application of screening tools and specialty consultations. Screening tools helped identify at-risk patients and informed consultations with geriatrics, psychiatry and allied health services. Data evaluation occurred monthly, with quarterly team meetings to review and implement changes. Statistical analysis was performed using Stat59 (STAT59 Services Ltd.). **Results:** Data were prospectively collected over a 9-month interval and compared with control data from the Alberta Trauma Registry and Trauma Quality Improvement Program. A total of 128 patients were enrolled during the study period. The mean age of geriatric patients was 77 years. Over half (55%) were male. Patients had at least 2 comorbidities and were on an average of 5 medications at admission. Almost all patients (90%) were living at home at the time of the trauma. The major mechanisms for injury were ground-level falls (38%) and falls from height (30%). Thoracic injuries were the most prevalent (95%) followed by spine injuries (48%) and extremity injuries (44%). The mean Injury Severity Score (ISS) was 13 (standard deviation 6.9), and 21% were trauma team activations (TTA). Process and outcome measures were compared with 2019 data. After introduction of the GREAT initiative, TTA increased from 21% to 24%. For major trauma patients (ISS ≥ 12), intensive care unit (ICU) admission rates decreased from 29% to 11% during the study period, death in hospital decreased from 39% to 2% and average length of stay went from 16.1 to 15.5 days. More trauma consults were initiated, and the proportion of patients admitted to the trauma service increased by 157%. The number of patients admitted to internal or family medicine decreased by 66%. **Conclusion:** Enrolment of patients into GREAT lowered the threshold for triggering a trauma consult, improving the recognition rate of geriatric trauma. This was reflected in the higher rate of trauma service admissions. Implementation of standardized screening tools and consultations did not increase length of stay. Improvements in unplanned ICU admission rates as well as mortality in hospital provide further evidence that geriatric trauma is best managed by trauma specialists.

Increasing the safety of inadvertent iliac artery device deployment with the COBRA-OS, a novel low-profile REBOA device. ***Adam Power*,[1] *Asha Parekh*,[2] *Neil Parry*.[1] From the [1]London Health Sciences Centre, London, ON; and [2]Western University, London, ON.**

Background: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an emerging technique used in trauma. However, inadvertent iliac artery balloon inflation can lead to complications. The COBRA-OS is a novel 4 French (Fr) device designed to tolerate substantial overinflation with its unique safety shoulder reservoir. This study aims to compare the safety characteristics of the COBRA-OS and a 7 Fr commercially available occlusion device during purposeful iliac artery balloon overinflation in a porcine animal model. **Methods:** We placed 4 Fr and 7 Fr introducer sheaths in bilateral porcine common femoral arteries and we performed a lower midline incision to expose both iliac arteries and aorta. The COBRA-OS and 7 Fr device were advanced into the common iliac arteries, confirmed by palpation and x-ray. The devices were deployed simultaneously until occlusion occurred and then intentionally overinflated until rupture of the balloon or blood vessel. **Results:** A total of 3 adult female pigs (mean weight 67 kg) were tested. The mean common iliac artery diameter was 7.7 mm on the left and 7.3 mm on the right. The COBRA-OS occluded the common iliac artery with a mean volume of 3.5 mL (range 3–4 mL) versus 3.5 mL (range 3–4 mL) with the 7 Fr device. Further inflation resulted in no iliac ruptures with the COBRA-OS at a mean balloon rupture volume of 10 mL (range 9–11 mL, 280% overinflation). Further inflation with the 7 Fr device resulted in 1 iliac artery rupture at 5 mL. The other 2 devices had a mean balloon rupture volume of 5 mL (40% overinflation). Anecdotally, all COBRA-OS devices moved partially up into the aorta during inflation while all 7 Fr devices remained in the iliac artery. **Conclusion:** The COBRA-OS allows for

© 2021 CMA Joule Inc. or its licensors

substantial overinflation when deployed in the common iliac artery of a porcine model because of its unique safety shoulder reservoir. This ultimately may help to prevent balloon and blood vessel rupture during clinical use.

Is it better to watch before or listen while doing? A randomized trial of video-modelling versus telementoring for out-of-scope tube thoracostomy insertion performed by search and rescue medics. ***Andrew Kirkpatrick,[1] Corey Tomlinson,[2] Nigel Donley,[2] Jessica Mckee,[3] Juan Wachs,[4] Mike Kay.[5]*** **From the [1]Departments of Surgery and Critical Care Medicine, Foothills Medical Centre and University of Calgary, Calgary, AB; the [2]Canadian Forces Health Services, Ottawa, ON; the [3]University of Calgary, Calgary, AB; [4]Purdue University, West Lafayette, IN; and the [5]Justice Institute of British Columbia, New Westminster, BC.**

Background: Most trauma deaths occur prehospital before a patient can be transported to definitive care. Remote lifesaving interventions (RLSIs) are thus required to save lives and may need to be performed by nonsurgical providers. Informatics may assist such providers. Theoretical assistance may be provided through expert remote telementoring (RTM) or just-in-time video modelling (VM), a form of behavioural modelling, wherein a video tutorial is reviewed immediately before the RLSI, with no current data to favour either method. **Methods:** Search and rescue technicians (SAR techs) were asked to perform a tube thoracostomy (TT) on a realistic surgical simulator. SAR techs were randomly allocated to RTM or VM. The VM group watched a preprepared video illustrating TT immediately before the procedure. Participants in the RTM group wore a heads-up video camera and were guided by a trauma surgeon giving real-time guidance. Standard outcomes included basic demographics as well as objective measures of success, safety and tube security for the TT procedure. **Results:** Twenty-four SAR techs (23 men, 1 woman), with a median age of 37 years (interquartile range 12 yr) and a median of 16.5 years (IQR 11 yr) of military experience participated. There was no difference in age, gender or years of experience between the groups. Thirteen were randomly assigned to VM with 12 of 13 (92%) being successful, 12 of 13 (92%) safe, and 12 of 13 (92%) secure in their TT placement. Eleven were randomly assigned to RTM with 11 of 11 (100%) being successful, 11 of 11 (100%) safe and 11 of 11 (100%) secure in mentored TT placement. The total trial time was significantly faster using RTM when the time to watch the video was included (VM 290 s [standard deviation (SD) 38 s] v. RTM 244 s [SD 50 s], $p = 0.02$) with mentoring, even despite 3 (27.2%) of the sessions experiencing video disruptions (albeit with intact audio). However, if the time to watch the video was discounted, VM was quicker (VM 114 s [SD 38 s] v. RTM 244 s [SD 50 s], $p < 0.001$). Statistically, there was no difference ($p = 1.00$) between mentored (11) or video-modelled SAR techs in terms of safety, success or tube security when performing the TT. However, with VM, 1 subject cut himself with the scalpel, 1 did not puncture the pleura and 1, while deemed safe, technically successful and secure, had a barely adequate tube placement. There were no such issues in the mentored group. **Conclusion:** Random evaluation of out-of-scope RLSIs aided by just-in-time VM or RTM revealed both have attributes. If VM can be used during travel time, it is quicker, but without the ability to facilitate troubleshooting. While not statistically significant, RTM had no errors in TT placement and facilitated guidance and remediation by the mentor, presumably avoiding failure and increasing safety. Ultimately, both techniques appear to have merit and may be complementary, justifying continued research into the human factors of performing RLSIs.

Indications for prehospital civilian tourniquet application by first responders: an expert consensus opinion of military physicians by the Delphi method. ***Alex Merkle,[1] Seth Holland.[2]*** **From the [1]United States Army, Nevada City, CA; and the [2]United States Army, Brownfels, TX.**

Background: The re-emergence of tourniquet use for injured military members has been accompanied by robust data showing its improvement in mortality and morbidity. Translation of this military practice to civilian settings has not been accompanied by equivalent data but rather is based on recommendations from military populations. We used expert military physicians to create practice recommendations for civilian first responder tourniquet use outside the tactical setting, by those who have trained to use tourniquets in combat environments. **Methods:** Eighteen military physicians agreed to participate in a Delphi questionnaire. Both emergency medicine physicians and surgeons engaged in the iterative process to arrive at consensus about ideas and themes initially identified by the group. **Results:** Our participants were able to achieve consensus on 13 of 18 (72%) indications and 5 of 8 (63%) contraindications for prehospital use of tourniquets by first responders. Anatomic injury patterns that closely mirror combat blast injuries, such as limb amputation or uncontrolled bleeding, were identified as an indication for prehospital tourniquet placement. Participants identified physiologic derangements, such as hemodynamic instability, as additional indications. In our study historic indications of battlefield tourniquet indication, such as open fracture, blast injury or penetrating injury, did not meet consensus as an indication for civilian tourniquet application. Agreed-upon contraindications to civilian tourniquet use included treatment of snake bites and the ability to control bleeding with direct pressure. There was agreement among the group that an anticipated transport time greater than 2 hours should not be a contraindication to civilian prehospital tourniquet use. **Conclusion:** Military members who wear ballistic protective apparel in combat environments while sustaining rifle and blast injuries have substantially different injury patterns than civilian emergency medical services patients in nontactical environments, upon which existing guidelines have been built. A panel of experts, with extensive experience treating both combat and civilian trauma, recommend the use of tourniquet application in the civilian environment for specific indications.

Content licence: This is an Open Access supplement distributed in accordance with the terms of the Creative Commons Attribution (CC BY-NC-ND 4.0) licence, which permits use, distribution and reproduction in any medium, provided that the original publication is properly cited, the use is noncommercial (i.e., research or educational use), and no modifications or adaptations are made. See: https://creativecommons.org/licenses/by-nc-nd/4.0/

 © 2021 CMA Joule Inc. or its licensors