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Abstracts

Characteristics of early analgesia in adults presenting with acute trauma to a level 1 trauma centre. *Casey Petrie*, Tim Chaplin†.* From the *School of Medicine, Queen's University, Kingston, Ont.; and the †Kingston General Hospital, Kingston Ont.

Background: Acute pain is one of the most common symptoms experienced by patients following trauma, yet under two-thirds receive analgesic medication when presenting to the emergency department (ED). Although this may be a result of physician concern about masking symptoms or exacerbating hemodynamic instability, it is unclear if there are any patient or injury features associated with oligoanalgesia. Our study looks to examine the characteristics of analgesic administration to trauma patients in the ED of a level 1 trauma centre. **Methods:** This is a retrospective chart review of 300 sequential patients requiring trauma team activation at our level 1 trauma centre. We included patients who were 18 years or older and who had a complete record of their visit. We recorded details of any analgesic medication that was delivered within 120 minutes of their presentation to the ED. **Results:** We reviewed 346 charts, 46 were excluded due to incomplete data or age < 18. In total 69% of patients received some form of early analgesia. The most frequently administered medication was fentanyl. Patients with an ISS > 15 were more likely to receive analgesia than those with an ISS of 15 or lower. The higher a patient's GCS score on arrival, the more likely they were to receive analgesia, and the longer they would need to wait for first administration. **Conclusion:** Trauma patients with severe injuries were more likely to receive analgesia in the ED. While patients with higher GCS scores were more likely to receive analgesia, they would also wait longer for it to be administered.

Linking acute care to rehabilitation to determine functional outcomes for trauma patients in Canada. *Hugh Anton*, David Evans†, Ellen Randall†, Penny Brasber†.* From the *GF Strong Rehab Centre, Vancouver, B.C.; and †Trauma Services, Vancouver General Hospital, Vancouver, B.C.

Background: Clinicians, administrators and payers require better data about outcomes for trauma patients in Canada to improve quality of care at the patient and system levels. The Canadian Institute for Health Information (CIHI) collects data from acute care and rehabilitation providers that could be used to determine functional outcomes after trauma. The purpose of the current study was to explore the feasibility of linking data from the CIHI National Trauma Registry (NTR) and National Rehabilitation Reporting System (NRS) to evaluate functional outcomes of Canadian trauma patients. **Methods:** CIHI provided data for all trauma patients in the NTR-MDS, NTR-CDS and NRS for the period Apr. 1, 2006, to Mar. 31, 2013. We performed a descriptive analysis of the outcomes of the subset of patients captured in both the NTR and the NRS. Outcomes included were Functional Independence Measure (FIM) at admission and discharge, pre- versus post-hospital discharge living arrangements, and pre- versus post-hospital vocational status. **Results:** We identified 1 113 313 discharge records for potential inclusion. The final trauma cohort involved 680 520 trauma cases; 7.4% and 6.2% had a record in the NRS and CDS, respectively, with < 1% having a record in both. The median (IQR) gain in FIM score was 22 (13–31) points. **Conclusion:** The NRS contains functional outcome data for trauma patients that are potentially useful to trauma care providers, but only a relatively small number of patients receiving acute trauma care are captured in the NRS database.

Accessibility to trauma centres in Oman. *Casey Petrie*, Tim Chaplin†.* From the *School of Medicine, Queen's University, Kingston, Ont.; and the †Kingston General Hospital, Kingston, Ont.

Background: Oman, a country of rapidly developing economy and population, has registered high numbers of motor vehicle collision (MVC)-related deaths and injuries. This study evaluates accessibility to trauma centres in Oman. **Methods:** Data were collected from the Ministry of Health and Armed Forces health services. Electronic data on locations of MVCs were obtained from The Royal Oman Police. One hotspot (i.e., location of the most MVCs in a given governorate) was identified for each governorate in Oman. Health care facilities were identified and classified into 5 classes. Distances between health facilities and hotspots were calculated with Google Maps. Resultant data were plotted using www.scribblemaps.com. **Results:** Thirty-two trauma centres were included, 4 ranked as class 5. Muscat Governorate had 43% of the class 5 and 4 trauma centres. Musandam, Al-Wusta and Al-Buraimi lacked class 5 trauma centres. General surgery and emergency departments were available in 69% and 75%, respectively. Orthopedic surgery was available in 59% and neurosurgery in 13% of the centres. ICUs were available in 11 centres; 4 of them were in Muscat. The mean distance between a hotspot and the nearest health facility was 34.69 km. Furthermore, the mean distance between a hotspot and the nearest class 4 or 5 trauma centre was 83.25 km. **Conclusion:** To build a trauma care infrastructure and reduce MVC-associated morbidity and mortality, certain areas in Oman need upgrading of the available trauma centres and/or building new trauma centres.

Identifying at-risk drivers post-trauma: a retrospective cohort study. *Jacinte Lampron, Sombire Figueira, Melissa Waggott.* From The Ottawa Hospital, Ottawa, Ont.

Background: Elderly drivers (≥ 65 yr) have the highest crash rate and fatal crash rate per mile travelled. They are more susceptible to injuries, have higher ISS and longer recovery times. Fitness to drive is a concern because motor vehicle collision (MVC) is the most common cause of fatal injuries in older adults. Reporting unfit drivers to the Ministry of Transportation (MoT) in Ontario is mandatory. **Methods:** We retrospectively analyzed patient data (January 2009–April 2015) from a level 1 trauma centre database. Patients included were drivers who had MVC as primary mechanism of injury and an ISS ≥ 12 and/or patients with trauma code who died. Comparative analysis between < 65y and ≥ 65 y was conducted. We used Pearson χ^2 and independent t tests for sensitivity measures. **Results:** In total there were 495 participants, and 85.3% ($n = 422$) were ≤ 65 years; an equal proportion were male. There was no significant difference in mean ISS (≤ 65 yr: 24.16 v. ≥ 65 yr: 23.53, $p = 0.78$). Patients ≥ 65 years had more comorbidities (49.3% v. 17.5%, $p < 0.05$) and a higher Abbreviated Injury Score for the head and neck ($p < 0.05$). Mean length of stay (LOS) was twice as long for patients ≥ 65 years ($p < 0.05$); LOS in the ICU was 3 times longer ($p < 0.05$). More unfit to drive recommendations were documented for patients ≥ 65 years (8.57% v. 3.4%, $p = 0.02$), but the MoT reporting rate was lower (33% v. 46.7%, $p = 0.57$). **Conclusion:** Older drivers are more prone to head injuries, longer LOS and more comorbidity. Formal documentation of driving recommendations is limited. Despite being mandatory in Ontario, reporting drivers to MoT by the Trauma Service in our hospital remains low.

Rates and determinants of unplanned emergency department visits and readmissions within 30 days following discharge from the trauma service: the Ottawa Hospital experience. *Maber Matar, Alexandre Tran, Trinh Mai, Julie El-Haddad.* From The Ottawa Hospital, Ottawa, Ont.

Background: Unplanned emergency department (ED) visits and readmissions are costly in terms of morbidity and mortality. A recent multicentre cohort study in Canada identified readmission rates at 5.9% within 30 days. This proposed study aims to compare The Ottawa Hospital (TOH) experience to that national standard and identify nonadmitted ED visits. Determination of risk factors for the above events may allow for more appropriate patient stratification, discharge planning and prevention of unnecessary visits. **Methods:** Single-centre, retrospective cohort study based on adults > 16 years of age admitted to the trauma service at TOH, Civic or General campus from Jan. 1, 2004, to Nov. 1, 2014. Data are collected from TOH Trauma Registry Database, paper chart reviews and Oasis database. Proposed data collection points of interest include age, sex, mechanism of injury, ISS, need for operative intervention, disposition upon discharge and services involved. **Results:** Pending. **Conclusion:** Pending results, conclusions will be made regarding the comparison to the national standard and the identification of risk factors most predictive for 30-day readmission and ED visits. This will allow us to more appropriately identify and intervene pre-emptively before discharge in order to minimize costly bounce backs.

The role of C-reactive protein measurement after traumatic injury: Can you quantify systemic inflammation? A systematic review. *Fatma Albinai¹, Aziza Al Rawabi², Christopher Doig¹.* From the ¹University of Calgary, Calgary, Alta.; and the ²Department of Critical Care Medicine, University of Calgary, Calgary, Alta.

Background: C-reactive protein (CRP) function remains indistinct in the management of trauma patients. Several studies suggested that CRP level reflects the ISS, morbidity and mortality in patients with traumatic injuries. Other studies have raised doubts about these findings. This analysis sought to clarify the contemporary uncertainty regarding the utility of serum CRP measurement in the care and study of injured patients. **Methods:** The PRISMA checklist was followed, and 2 investigators extracted data from included studies in duplicate. It involved studies published from 1985 to 2013 and evaluating the role of CRP in trauma patients. Adult trauma patients admitted within 24 hours were included in this review. The outcomes of multiple organ dysfunction syndrome (MODS), sepsis and mortality were evaluated, in addition to the serum CRP correlation with ISS score. **Results:** This review identified 85 049 citations, of which 16 studies met the inclusion criteria. A total of 1349 patients were included. Despite the heterogeneity, elevated CRP was found to be associated with the incidence of MODS, sepsis and mortality in 6 studies. Furthermore, 7 studies supported the validation of serum CRP as a significant predictor of the ISS. **Conclusion:** Given the demonstrated associations between CRP and the magnitude of surgical trauma patients, and with new information and data becoming available in injured populations, levels of serum CRP may help in assessing patients who necessitate assertive monitoring. The role of CRP measurement in monitoring trauma patients as a prognostic marker requires further attention.

A retrospective examination of current clinical treatment of pediatric blunt spleen and liver injuries at a single tertiary care centre. *Adriana Dekirmendjian^{*}, Bethany Easterbrook^{*}, Henrietta Blinder[†], Karen Bailey[‡].* From the ^{*}McMaster Pediatric Surgery Research Collaborative, Hamilton, Ont.; and the [†]McMaster Children's Hospital, Hamilton, Ont.

Background: The American Pediatric Surgical Association (APSA) has published validated guidelines regarding nonoperative management of pediatric blunt spleen and liver injuries (BSLI) based on injury grade. However, few studies have examined guideline implementation and adherence in a clinical setting. This study aimed to examine current clinical treatment of BSLI and assess practitioner adherence to guidelines at a single centre. **Methods:** A retrospective review was performed of all pediatric patients (< 18 yr) in the Trauma Registry who received nonoperative management of BSLI between Jan. 1, 2004, and Nov. 31, 2014, at a tertiary care centre. Data were collected on demographics, guideline compliance and radiology grade reporting. χ^2 tests were conducted to assess statistically significant differences between spleen and liver injuries and between grades. **Results:** We included 65 of 71 abstracted cases in our analysis. Guideline compliance for ICU admission, length of hospitalization, pre-/postdischarge imaging and physical activity restriction was 29%, 21%, 75%, 75% and 40%, respectively. Radiologists reported organ injury grades in 22% of spleen cases and 15% of liver cases ($p = 0.459$). Additionally, 8% of spleen injuries and 33% of liver injuries ($p = 0.012$) did not have a reported grade of injury. **Conclusion:** At this centre, a substantial number of BSLI cases had no reported grade, and APSA guideline adherence was low for ICU admission, activity restriction and length of hospitalization. In order to emphasize the importance of guideline compliance, future directions include improving radiology reporting and the creation of educational handouts for patients and clinicians.

Differential behaviour of damage-associated molecular patterns (DAMP) with allocated negative peritoneal pressure therapy in open abdomen management. *Andrew Kirkpatrick^{*}, Michelle Malig[†], Derek Roberts[‡], Christopher Doig[‡], Jimmy Xiao[§], Chad Ball[¶], Craig Jenne[¶].* From the ^{*}Departments of Surgery and Critical Care Medicine, Foothills Medical Centre and University of Calgary, Calgary, Alta.; the [†]Departments of Surgery, Community Health Sciences, and Critical Care Medicine, University of Calgary, Calgary, Alta.; the [‡]Department of Critical Care Medicine, University of Calgary, Calgary, Alta.; the [§]Alberta Health Services, Trauma Services, Foothills Medical Centre, Calgary, Alta.; and the [¶]Departments of Surgery and Oncology, Foothills Medical Centre and University of Calgary, Calgary, Alta.

Background: Enhanced negative pressure peritoneal therapy (NPPT) is associated with improved human survival in open abdomen (OA) management through a currently unexplained mechanism. Previous animal work suggests enhanced intraperitoneal (IP) and serum biomediator clearance as a mechanism. High mobility group box 1 protein (HMGB-1) is a damage-associated molecular pattern (DAMP) that is a marker of cellular damage, immune activation, and a potent mediator of systemic inflammation. While IP biomediators are increasingly being recognized in critical illness/trauma, HMGB-1 has not been previously examined in OA management. **Methods:** A

novel assay for HMGB-1 was developed and used to examine both plasma and IP fluid samples from 45 critically ill/injured patients with OA previously enrolled in an RCT comparing either an ABThera NPPT or Barker's NPPT. **Results:** There were no statistically significant differences in HMGB-1 plasma concentrations between survivors and nonsurvivors at baseline, 24 hours, or after 48 hours (Figure). NPPT was applied to patients for a median of 42 hours in the ABThera and 44 hours in Barker's groups. IP HMGB-1 levels were not statistically different at 24 and 48 hours compared with plasma. ABThera allocation decreased mortality by 0.33 times. HMGB-1 peaked in the ABThera cohort at 24 hours and decreased to near baseline at 48 hours, while HMGB-1 levels rose continuously from baseline to 48 hours for both survivors and nonsurvivors in the Barker's NPPT group. **Conclusion:** HMGB-1 is a DAMP that appeared to behave differently in cohorts treated with varying NPPT for OA management. Further studies should elucidate whether enhanced NPPT consistently improves outcomes.

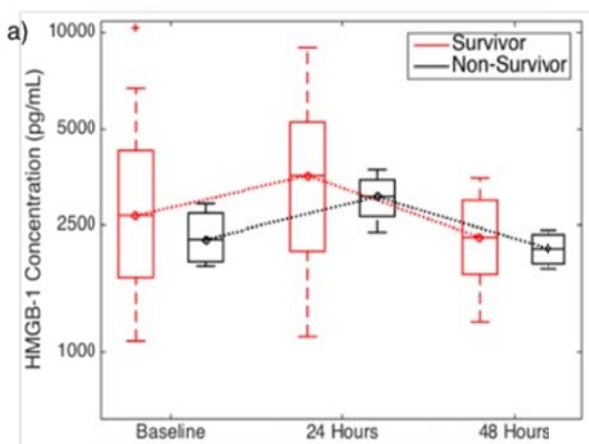
Effect of a new hospital start-up on first 24 hours mortality: a long way toward trauma team-building and Advanced Trauma Life Support (ATLS) introduction. A key role for the human factor? *Stefano Magnone, Marco Ceresoli, Roberto Manfredi, Dario Piazzalunga, Luca Ansaloni.* From the Pope John XXIII Hospital, Bergamo, Italy.

Background: In 2011, ATLS and a trauma team were established in our hospital, and in 2013 we moved to a new building. The aim of this study was to evaluate the impact of ATLS and trauma team introduction on 24-hr mortality. **Methods:** Retrospective study. The control group (CG) comprised patients treated from January 2007 to March 2011. The study group (SG) comprised patients treated from April 2011 to October 2014. **Results:** There were 193 patients in the CG and 396 in the SG. The groups did not differ in sex (79% males in the CG v. 79% in the SG, $p = 0.71$), ISS (median 16, IQR 9–25 in the CG v. median 14, IQR 9–19 in the SG, $p = 0.13$), whereas they did differ in age (median 44, IQR 29–57 yr in the CG v. median 50, IQR 38–63 yr in the SG, $p < 0.003$). Mortality was better in the SG (4.5% v. 14.5%, OR 0.28, 95% CI 0.14–0.54). Mortality in the emergency department was 0.3% versus 8.3% (OR 0.03, 95% CI 0.001–0.2). Mortality in patients with ISS ≥ 15 was 10.4% in the SG and 24.5% in the CG (OR 0.36, 95%

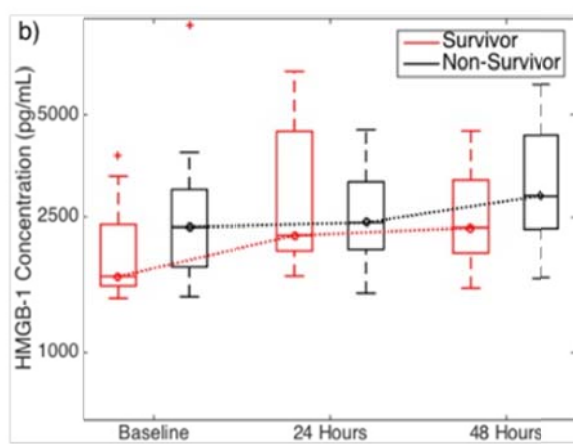
CI 0.20–0.75). Mortality did not differ significantly between 2012 (old hospital) and 2013 (new hospital) (8.5% v. 4.7% respectively, OR 0.25, 95% CI 0.55–6.72) or in patients with ISS ≥ 15 : 20.6% v. 8.5% (OR 0.11, 95% CI 0.64–12.78), respectively. **Conclusion:** ATLS and trauma team introduction produced a huge improvement in 24-hr mortality. Start-up of the new hospital had a minor impact on these results. Room for improvement in learning and teaching is evident.

Creating and evaluating an interrater reliability coding process in a hospital trauma registry. *Amanda McFarlan^{*}, Melody Pubacz[†], Ada Louffat-Olivares^{*}, Chris Zhang^{*}.* From the ^{*}St. Michael's Hospital, Toronto, Ont.; and the [†]Ryerson School of Health Information Management, Toronto, Ont.

Background: Accurate trauma registry data are vital to assessing and improving treatment and outcomes and an essential component of the trauma system. Preserving trauma data integrity requires that data entered by multiple coders use harmonized definitions and consistent processes. We introduced and evaluated a structured, formal trauma coder interrater reliability program. The registry had some data validation processes in place to identify missing or incomplete data, but no structured, formal interrater process. **Methods:** The registry coders were invited to provide feedback on project design, including frequency of re-coding, number and type of data elements. The coders validated a 3-point interrater classification system intended to identify (0) no differences (1) minor differences and (2) significant differences among coders. Cases were randomly selected and stratified by severity of injury and length of stay (LOS). Beta testing began with short LOS cases, weekly coder feedback and an ongoing escalation program adding more complex charts and additional data points. **Results:** Seventy-two cases were recoded and multiple data points were analyzed. Concordance ranged from 42% complete agreement for nonoperative procedures with 55 minor and 10 significant differences to 100% agreement for number of operative procedures. The OR codes had minor differences in level of specificity but not general type. **Conclusion:** Most differences were categorized as minor (1). Opportunities for improvement in source document identification, coding granularity and data definitions were identified, and new data collection processes were introduced. Next steps include ongoing



ABThera patient group



Barkers patient group

evaluation of the interrater process following introduction of these new processes.

Weekend patterns in pediatric road traffic injuries: 10-year analysis of trauma registry data in South Africa. *Brett Burstein**, *Emmanuelle Fauteux-Lamarre**, *Arjan Bastiaan van As†*. From the *The Montreal Children's Hospital, Montreal, Que.; and the †Red Cross War Memorial Children's Hospital, Cape Town, South Africa.

Background: Road traffic injury (RTI) is a significant worldwide cause of pediatric morbidity and mortality, with a disproportionate number occurring in low- and middle-income countries (LMICs). Whether children are at increased risk of RTI on weekends has not previously been investigated in any setting. This study sought to assess weekend patterns in pediatric RTIs using hospital-based data in South Africa. **Methods:** Data were analyzed from Childsafe South Africa's prospectively collected trauma surveillance registry for injured children aged < 13 years presenting to a tertiary pediatric Trauma Department between 2004 and 2013. **Results:** A total of 71 180 patients presented with traumatic injuries, of which 8815 (12.4%) resulted from RTIs. RTI patient median age was 4.5 years, and patients were predominantly boys and pedestrians. RTIs were more common on weekends than on weekdays (2.98 v. 2.19 patients/d; 15.5% v. 11.2%, $p < 0.001$). Moreover, injuries sustained by RTI patients on weekends were more severe on weekdays and when compared with weekend all-cause trauma patients (injury score 1.66 v. 1.46 and 1.43, $p < 0.001$). RTI patients were more likely to require admission to the trauma ward (1.14 v. 0.79 patients/d, $p < 0.001$) and PICU (0.10 v. 0.07 patients/d, $p < 0.05$) on weekends than on weekdays. Most weekend RTIs occurred during the last annual quarter, and they more frequently required admission to the trauma ward and PICU. Weekend Trauma Department mortality secondary to RTI was rare. **Conclusion:** Weekends are associated with greater pediatric RTI morbidity in an LMIC setting. These findings highlight the importance of trauma surveillance data to inform targeted community prevention strategies for improving child road safety.

The impact of the acute care surgery service model on non-clinical outcomes, including health economics, delivery systems, and education: a systematic review. *Kristin DeGirolamo**, *Patrick Murphy**, *Morad Hameed†*, *Kelly Vogt‡*, *Laura Allen‡*, *William Leeper‡*, *Neil Parry§*, *Elliott Haut§*, *Ken Leslie‡*, *Karan D'souza‡*, *Jacques Zhang‡*. From the *University of Western Ontario, London, Ont.; the †Trauma Services, Vancouver General Hospital, Vancouver, B.C.; the ‡London Health Sciences Centre, London, Ont.; and the §Centre for Surgical Trials and Outcomes Research, Johns Hopkins University School of Medicine, Baltimore, Md.

Background: In recent years, the significant workload, high acuity and complexity of emergency general surgery conditions has been a catalyst for hospitals in North America in replacing traditional on-call models with dedicated acute care surgery (ACS) models. **Methods:** A review was conducted to assess the impact of non-patient related outcomes after the implementation of ACS using a systematic, English language-based search in Ovid, EMBASE and MEDLINE databases. From 1827 papers, 2 teams of independent reviewers identified 21 studies that matched the purpose of the systematic review. The evidence-based practice for improving quality (EPIQ) method and the

Newcastle–Ottawa Scale were used to score quality and level of evidence. **Results:** We identified 3 broad themes: economic impacts, systems, and case mix/education. Seven papers discussed the business model of ACS increasing surgeon job satisfaction, billing and department productivity. Eight papers were identified as describing the impact of the ACS model on the service delivery and flow efficiency; they noted increased daytime and decreased after-hours operating, improved patient transit from ED to OR to home, and decreased length of stay. The 6 remaining papers focused on case mix and education points. The trend indicated an increase in case volumes and variety, which subsequently manifested in an improvement in resident education and case tallies. **Conclusion:** The ACS model has successfully been implemented in hospitals around the world, reaping significant improvements in such areas as timeliness of care, trainee learning, and diversity of case mixes.

The economic burden and potential years of life lost from fire deaths in residential homes. *Joanne Banfield, Sarah Rehou.* From the Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: Fire deaths in residential homes are devastating and preventable. The objective of our study was to describe the potential years of life lost (PYLL) and the cost of fire deaths in residential homes. **Methods:** We conducted a retrospective cohort analysis of all adults (age ≥ 16 yr) who died in homes without fire sprinklers between 1998 and 2012. Patient demographics and injury characteristics were collected from coroner investigation statements and autopsy reports. PYLL was calculated by subtracting age at death from age 75. The number used for the value of statistical life was \$6.5 million. **Results:** Of 1640 coroner investigations reviewed, 1176 were included in the study, and the medical cause of death was smoke inhalation in 846 (72%) cases. In 1114 (95%) cases, deaths occurred within 1 day after injury. There was a loss of 24 051 years of life, and the cost of PYLL due to residential fires totaled \$7 644 000 000. **Conclusion:** This study indicates that deaths due to residential fires result in significant economic loss. It also demonstrates that the overwhelming majority of deaths after a fire occurred either on scene or within 1 day. These deaths result in numerous health care costs and costs incurred from the coroner investigation process. Continued increases in fire prevention combined with advances in burn injury treatment have led to fewer life years lost over time; however, this study shows that considerable measures still need to be taken in terms of fire prevention strategies.

A systematic review of the risks and benefits of venous thromboembolism prophylaxis in traumatic brain injury. *Joseph Margolick**, *Charlotte Dandurand**, *David Evans†*, *Myrinder Sekhon‡*, *Naisan Garraway†*, *Peter Gooderham§*, *Donald Greisdal‡*, *Morad Hameed†*. From the *Division of Neurosurgery, Vancouver General Hospital, Vancouver, B.C.; the †Trauma Services, Vancouver General Hospital, Vancouver, B.C.; the ‡Division of Critical Care, University of British Columbia, Vancouver, B.C.; and the §Division of Neurosurgery, University of British Columbia, Vancouver, B.C.

Background: Patients suffering from traumatic brain injury (TBI) are at increased risk of venous thromboembolism (VTE). However, initiation of chemoprophylaxis (VTEp) may cause further intracranial hemorrhage (ICH). We reviewed the literature to determine the postinjury time interval at which VTEp can be administered without risk of TBI progression. **Methods:** MEDLINE and EMBASE databases were searched. Inclusion criteria were studies

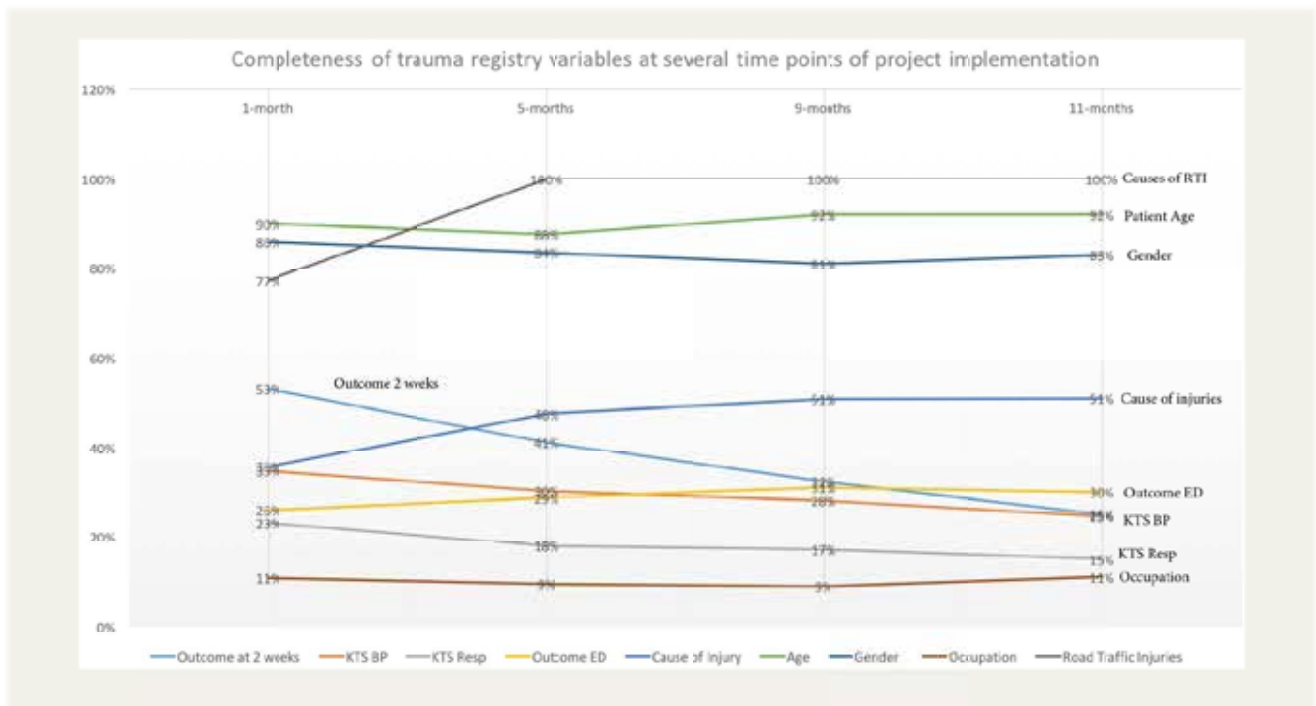
investigating timing and safety of VTEp in TBI patients not previously on oral anticoagulation. Two investigators extracted data and graded the papers based on levels of evidence. **Results:** A total of 408 studies were screened. Forty-five studies were reviewed in entirety, and 21 were included in the systematic review. There were 2 prospective randomized trials and 19 comparative studies. Eighteen studies demonstrated that VTEp postinjury in patients with stable head CT scan does not lead to radiographic or clinical TBI progression. Fourteen studies demonstrated that VTEp administration specifically 24–72 hours postinjury is safe in patients with stable injury. Four studies suggested that administering VTEp within 24 hours of injury in patients with stable TBI does not lead to progressive ICH. One study — a retrospective review of 1215 patients — suggested low-molecular weight heparin is a risk factor for TBI progression. **Conclusion:** Literature suggests that administering VTEp 48 hours postinjury may be safe for patients with low-hemorrhagic risk TBIs and stable injury on repeat imaging. A clinical practice guideline was developed at our level 1 trauma centre and will be subjected to prospective analysis.

Trauma surveillance and registry development in Mozambique: results of a 1-year study and the first phase of national implementation. *Fadi Hamadani[†], Assis de Costa[†], Prem Yonaban[†], Ivandra Magaia[†], Catarina Magun[‡], Paloma Maripiba[†], Ezio Massinga[§], Monica Muataco[¶], Vania Muripa[¶], Mario Jacobe[†], Shailvi Gupta^{**}, David Bracco^{††}, Cybil Abou-Rizk^{**}, Ipsbita Prakash^{**}, Dan Deckelbaum^{††}, Tarek Rizek^{††}, Otilia Neves^{**}.* From the [†]McGill University Health Centre, Montreal, Que.; the [‡]Central Maputo Hospital, Maputo, Mozambique; the [¶]Mavalene General Hospital, Maputo, Mozambique; the [§]Jose Macamo Hospital, Maputo, Mozambique; the [¶]Matola General Hospital, Maputo, Mozambique; the ^{**}Centre for Global Surgery, McGill University, Montreal, Que.; ^{††}McGill University, Montreal, Que.; and the ^{**}Ministry of Health, Maputo, Mozambique.

Background: Mozambique, a low-income country, has no active injury surveillance program. After a successful pilot in 2014, we introduced a trauma registry in 4 hospitals in Maputo serving approximately 18 000 patients yearly. **Methods:** On-site training and implementation of the registry occurred from June to July 2014 at the main academic hospital and was expanded in October 2014 to 3 more university-affiliated community hospitals. Demographic and injury epidemiology data, with an integrated ISS (Kampala Trauma Score; KTS), were collected through a standardized registry form. **Results:** By September 2015 there were 10 992 patients in the new registry (Figure). Males represented 62%, and the mean age of the cohort was 26.2 years. Most patients arrived to the hospitals by private vehicles (38%) or by foot (27%). Less than 5% arrived by ambulance. The most common mechanism of injury was fall (30%) followed by motor vehicle collisions (18.6%). Injury scoring (KTS) was possible on less than 50% of patients. Emergency department disposition and 2-week outcomes were collected on 25.57% and 30.30% of patients, respectively. **Conclusion:** Implementing a trauma registry is feasible in Mozambique and is the fundamental step in the creation of improved trauma surveillance and capacity. The results have highlighted the importance of registries in driving awareness, education, and policy development. Strategies for improving data collection completeness and the development of injury prevention policies are in place.

Exploratory laparoscopy and cholecystectomy for penetrating thoracoabdominal injury: case report and literature review. *Erika Schmitz[†], Maber Matar[†], Joseph Mamazza[†], Jacinthe Lampron[†].* From the [†]Faculty of Medicine, University of Ottawa, Ottawa, Ont.; and the [†]The Ottawa Hospital, Ottawa, Ont.

Background: Traumatic injury to the gallbladder is an uncommon phenomenon due to its small size and anatomic protection by surrounding structures. Penetrating trauma is



the most commonly reported cause of injury. Since intra-abdominal wounds usually accompany gallbladder injuries, reparative surgical interventions are standardly conducted via laparotomy. However, due to its inherent minimal invasiveness, exploratory and therapeutic laparoscopy is feasible and favourable for cholecystectomy in the stable patient with penetrating thoracoabdominal injury. **Methods:** Case report of penetrating trauma to gallbladder treated by laparoscopy and review of the current relevant literature. **Results:** A 19-year-old female who sustained stab wounds from a 9-inch nonserrated blade to the right flank and lumbar back presented hemodynamically stable with diffuse but mostly right upper quadrant pain. Pan-CT scan showed a small pneumothorax, twelfth rib fracture, grade 4 renal laceration, hemoperitoneum, and a questionable penetration of the gallbladder and liver. The patient underwent exploratory laparoscopy, which confirmed gallbladder and liver lobe laceration. Laparoscopic cholecystectomy was successfully performed. Traumatic gallbladder injury treated by laparoscopy is rare, with only 2 cases of penetrating trauma and 4 cases of blunt trauma reported across the literature. All patients were stable and associated with no other injury or solely with liver injuries and hemoperitoneum. **Conclusion:** Exploratory laparoscopy and cholecystectomy is a rare intervention in a multisystem trauma patient with thoracoabdominal penetrating injuries. Minimally invasive surgery can be safely and successfully completed in the hemodynamically stable patient.

Avoiding unnecessary intubations of combative trauma patients with use of medications. *Farid Muakkassa*, Robert Marley*, Ileana Horattas†, Adam Fenton‡, Ann Salvador*.* From the *Akron General Medical Centre, Akron, Ohio; the †Northeast Ohio Medical University, Rootstown, Ohio; and the ‡Ohio State University, Columbus, Ohio.

Background: Trauma patients are intubated in the emergency department (ED) for combativeness due to intoxication or closed head trauma and not necessarily due to respiratory compromise. We hypothesized that some of these intubations may be avoidable with the use of sedative and/or antipsychotic medications. **Methods:** Data were retrospectively collected on combative patients who presented to the ED between Jan. 1, 2011, and Dec. 31, 2014, and divided into 3 groups: given sedatives and not intubated (DRUG; $n = 56$), immediately intubated (INTUB; $n = 29$), and trial of DRUG and eventually intubated (DRUGINTUB; $n = 12$). **Results:** Mean age was 37.2 ± 16.9 years (73% males). There were no statistically significant differences in age, sex, respiratory rate and toxicology in the 3 groups. The DRUGINTUB group had higher percentage of patients with ISS > 15 than the DRUG and INTUB groups (67% v. 28% v. 55%, $p = 0.01$) and significantly more intracranial hemorrhages than the DRUG and INTUB groups (58% v. 23% v. 37%, $p = 0.04$). The DRUGINTUB and INTUB groups had a higher percentage of patients with a GCS score < 8 than the DRUG group (33% v. 34% v. 4%, $p < 0.0001$). The DRUG group had a higher percentage of patients with blood alcohol levels > 80 than the DRUGINTUB and INTUB groups (73% v. 42% v. 41%, $p = 0.007$) and a shorter hospital length of stay (LOS) than the DRUGINTUB and INTUB groups (4.1 ± 6.8 v. 8.9 ± 6.4 v. 8.6 ± 7.8 , $p = 0.008$). **Conclusion:** A trial of sedative medications is recommended in combative, intoxicated trauma patients to lower the incidence of unnecessary intubations and to decrease LOS. Low GCS scores and high ISS are predictors of the need for intubation in combative patients.

Magnitude of geriatric burn injury abrogates the unwarranted optimism seen in surrogates of general ICU patients with severe illness. *Natalia Partain*, Erica Hodgman†, Claire Isbell‡, Steven Wolff‡, Brett Arnoldo‡, Karen Kowalske‡, Herb Phelan‡.* From the *University of Texas Southwestern, Dallas, Texas; the †UT Southwestern Medical Centre, Dallas, Texas; and the ‡Scott and White Department of Surgery, Dallas, Texas.

Background: Previous literature demonstrates that as illness severity increases in ICU populations, stakeholders become inappropriately optimistic in assessing prognosis despite counselling to the contrary. This impacts end-of-life planning. Geriatric burns are unique with their gripping presentation in a group with intuitively less reserve. We assessed whether end-of-life planning is affected by magnitude of geriatric burn. **Methods:** We reviewed the end-of-life planning of all patients ≥ 65 years who died on our burn service from April 2009 to date. All stakeholder decisions were made in real time without the benefit of knowing the quantitative mortality risk. Mortality risk was calculated retrospectively for this study using a geriatric-specific tool recently developed by our group. The Fisher exact test and analysis of variance (ANOVA) with the Tukey post hoc test were used. **Results:** In the sample of geriatric burn deaths ($n = 57$), stakeholders were significantly more likely to initially choose partial or full code status (48%) for patients whose probability of death was later calculated to be $\leq 50\%$ than for those calculated to be $> 50\%$ (7%, $p = 0.003$). When risk of death was categorized by quartile, omnibus ANOVA for differences in the rates of choice for full/partial code status was significant ($p = 0.002$) and the Tukey test found differences between patients with 26%–50% death probability (63% full/partial code) and both patients with 51%–75% death probability (7% full/partial code, $p = 0.004$) and 76%–100% death probability (8% full/partial code, $p = 0.007$). **Conclusion:** Despite not having real time information about quantitative death probability, stakeholders were significantly more likely to choose less aggressive options as actual risk of death increased after geriatric burns.

Sarcopenia in geriatric trauma. *Mabdi Malekpour, Kelly Bridgham, James Dove, Joseph Blansfield, Mohsen Shababang, Denise Torres, Jeffrey Wild.* From the Geisinger Medical Centre, Danville, Pa.

Background: Geriatric trauma patients are at high risk of morbidity and mortality. Several trauma frailty indices have been developed in an attempt to predict outcomes, but data point collection can be cumbersome. Sarcopenia is shown to be an appropriate objective measure for frailty that can be readily assessed in CT imaging. It is shown to be an independent predictor of morbidity in multiple areas of surgery, yet our data in the trauma setting is scarce. We aimed to evaluate if sarcopenia is associated with worse outcomes in geriatric trauma patients. **Methods:** Sarcopenia was calculated by the semiautomated measurement of the left psoas area (LPA) at the level of the third lumbar vertebra in the axial CT images. LPA was normalized for height using body composition measurements (LPA mm^2/m^2). Patients were stratified by sex, and the lowest quartile was defined to be sarcopenic. Multivariate analysis was used to determine the effect of sarcopenia on patient outcome. **Results:** A total of 1175 patients (597 males and 578 females) were included and were found to have an average LPA of 303.7 mm^2 and 237.7 mm^2 , respectively. LPA $< 242.6 \text{ mm}^2$ in males and $< 187.8 \text{ mm}^2$ in females was considered to be sarcopenic, which

was found in 149 males and 145 females. Sarcopenic patients were older (80.5 v. 77.4, $p < 0.0001$) and were found to be different in the mechanism of injury (more falls) and lower GCS score from nonsarcopenic patients ($p = 0.03$ and $p = 0.02$, respectively). Nonsarcopenic patients had a higher frequency of obesity ($p < 0.0001$), had thicker abdominal wall fat ($p = 0.0002$), and had more frequently undergone orthopedic intervention ($p = 0.0001$). In the multivariate analysis, sarcopenic patients were found to have a higher risk of in-hospital mortality (OR 1.608, 95% CI 1.009–2.564) and were less likely to be discharged to home or to rehabilitation centres (OR 0.704, 95% CI 0.519–0.954). These patients were found to have a longer length of stay in the hospital (HR 1.208, 95% CI 1.043–1.4). **Conclusion:** Sarcopenia is independently associated with in-hospital mortality, extended length of stay and unfavourable discharge destinations in the geriatric trauma patients.

Experiences of older adult trauma patients discharged home from a tertiary trauma centre. *Nathalie Rodrigue.* From McGill University, Montreal, Que.

Background: The number of patients ≥ 65 years has been rising steadily every year at our tertiary trauma centre. Our clinical experience demonstrated that once discharged, some of these patients were not managing well. Postdischarge portrait is difficult to ascertain since this information is not captured in the trauma registry database. The purpose of the study was to describe the experiences of patients ≥ 65 years discharged home following hospitalization for a traumatic injury. **Methods:** A descriptive study conducted to interview patients 1 month post-discharge using PREPARED patient and SF-36 Health-Related Quality of Life questionnaires. Data were analyzed with SPSS and NVivo. **Result:** A convenience sample of 33 patients was recruited (mean age 73 yr, 70% male); 79% were admitted after a fall and 58% sustained rib fractures. Participants felt confident (80%) to be discharged home because of support or previous experience with illness. About 53% felt very prepared to return home, and 40% had unexpected problems occurring at home. Participants scored below 50% on most categories related to discharge preparation and reported not having received enough information about their medication, available resources and permitted activities. They had worries about managing at home. Patients' quality of life scores were lowest for "role limitation due to physical health" (16%) and highest for "emotional wellbeing" and "general health" (around 70%). **Conclusion:** Having support and previous experience with illness seems to help a patient be confident with discharge home. There is room for improvement on specific aspects of discharge planning and preparedness.

The influence of spatial access to trauma care on mortality for severely injured patients in Nova Scotia. *Gavin Tansley*, Natalie Yanchar*, Nadine Schuurman†, Mark Asbridge*, Matt Bowes†.* From *Dalhousie University, Halifax, N.S.; and †Simon Fraser University, Vancouver, B.C.

Background: Trauma is a leading contributor to the global burden of disease, accounting for nearly 10% of all deaths. Although caring for injured patients at designated trauma centres is associated with a consistent survival benefit, it is currently unclear how spatial access to these centres influences outcomes. This study aimed to evaluate the association between spatial access to district or tertiary trauma centres and mortality in a retrospective cohort of severely injured patients. **Methods:** Victims of penetrating trauma (PT) or motor vehicle collisions (MVCs) injured in Nova

Scotia between 2005 and 2014 were identified from a retrospective database. Cost distance analyses were conducted in a geographic information system to quantify the potential spatial access of each injury location to either district (DTC) or tertiary trauma care (TTC). Adjusted associations between trauma centre access and mortality were subsequently estimated using logistic regression. **Results:** Spatial access to TTC was not associated with mortality risk for victims of MVCs, but poor spatial access to DTC was associated with a 1.7-fold increased odds of death ($p = 0.01$). For victims of PT, poor spatial access to both DTC and TTC was associated with a > 3 -fold increased odds of death ($p = 0.01$). Potential explanations for these findings were subsequently explored. **Conclusion:** Poor spatial access to trauma care is associated with worse outcomes for victims of PT and MVCs. Understanding how spatial access influences outcome will be important for improving trauma care for rurally injured patients.

The impact of trauma case management on IVCF retrieval rates: experience from a level 1 trauma centre. *Rachel Nadeau.* From the McGill University Health Centre, Montreal, Que.

Background: Prior to 2011, there was no systematic process in place in our level 1 trauma centre to track IVC filter insertions and retrievals. One large multicentre study evaluated 446 patients and demonstrated a mean retrieval rate of 22%, with 31% of the nonretrieved filters attributed to loss of follow-up. **Methods:** In 2011, a databank was developed by the trauma case manager (TCM) to track all IVCFs inserted by the trauma team. Patients were flagged during trauma clinical rounds, collected through the TCM's chart review and entered into her databank. Every effort was made to remove the IVCF before discharge. Whenever not possible, telephone follow-ups were conducted by the TCM. Doppler, angiography and follow-up appointments were made in collaboration with the treating physicians. **Results:** From July 2011 to July 2015, a total of 113 patients were followed by the TCM. A global retrieval rate of 84.96% was achieved, with 1.77% of the nonretrieved filters attributed to loss of follow-up; 6.19% were left as permanent filters. One patient (0.88%) refused filter removal, 2 patients (1.77%) have ongoing follow-up and 5 patients (4.42%) died before removal. **Conclusion:** The introduction of a databank, improvement in identifying and tracking patients, and coordinated care by the TCM improved the efficiency and effectiveness of retrieval of IVCFs in trauma patients.

1000 consecutive in-hospital deaths following severe injury: What has changed over the years? *Christina Harzan*, Paul McBeth*, Andrew Kirkpatrick*, Sean Grondin†, Gilaad Kaplan†, Chad Ball‡.* From the *Departments of Critical Care Medicine, Foothills Medical Centre and University of Calgary, Calgary, Alta.; the †Department of Surgery, University of Calgary, Calgary, Alta.; and the ‡Departments of Surgery and Oncology, Foothills Medical Centre and University of Calgary, Calgary, Alta.

Background: A wide range of factors have traditionally led to early in-hospital death following severe injury. Given numerous recent medical innovations, the goal of this study was to evaluate the specific etiologies of all early post-traumatic inpatient deaths over an extended period. **Methods:** One thousand consecutive severely injured (ISS > 12) patients who died while in hospital (2005–2013) were analyzed. Pre-existing medical conditions, medical events preceding injury, sudden unexpected in-patient events and

specific primary/secondary causes of death were evaluated. Standard statistical analyses were used ($p < 0.05 =$ significance). **Results:** Of 9941 severely injured patients (mean age 59.7 yr, 72.0% male, median ISS 29, blunt mechanism 94.3%), 1000 (10.1%) died in hospital. Primary causes of death included severe traumatic brain injury (77.0%), acute hemorrhagic shock/exsanguination (18.3%), sepsis (2.4%), sudden unexpected in-patient events (2.1%) and other etiologies (medical event preceding injury, other; 0.2%). Withdrawal of care occurred in 21.2% of cases. Deaths secondary to adult respiratory distress syndrome and sepsis, as well as the overall death rate, decreased significantly over the study interval ($p < 0.05$). Mean age at death increased ($p < 0.05$). The precise timing of death varied and was based on etiology (< 6 h 13.0%, 6–24 h 15.3%, 24–48 h 16.3%, > 48 h 55.3%). **Conclusion:** Early post-traumatic in-hospital death remains multifactorial. Severe traumatic brain injuries represent the dominant etiology but have also increased in proportion over time. Withdrawal of care is a significant secondary cause of death. Other etiologies of mortality have decreased secondary to improved clinical care.

Monitoring recovery of open tibial fractures using objective functional measures with preliminary data from a combined orthoplastic research clinic. *Rhys Morris**, *Sharon Maggs†*, *Owen Bodger‡*, *Ian Pallister‡*. From *Swansea University, Swansea, Wales, U.K.; the †Morrison Hospital, Swansea, Wales, U.K.; and the ‡College of Medicine, Swansea University, Swansea, Wales, U.K.

Background: Open tibial fractures are severe injuries and can be associated with severe, possibly life-changing, complications, such as osteomyelitis and amputation. Assessing recovery from these injuries is helpful in monitoring progress and developing better patient treatment. **Methods:** This study evaluates objective functional outcome measures over a 1-year period for open tibial fracture patients attending a combined orthoplastic research clinic. These include traditional tests, such as range of movement (ROM) of adjacent joints, and functional measures of agility and balance, such as comfortable gait speed (CGS) and the “timed up and go test” (TUAG). A principal component analysis (PCA) was used to determine the correlation of different variables in predicting recovery. **Results:** An analysis was carried out on 22 patients, with follow-up periods ranging from 74 to 390 days and results that met our inclusion criteria. Many of the functional measures could be transformed into linear paths when both axes were plotted logarithmically. Traditional measures did not show these clear trends, and PCA strongly suggested functional tests showed a stronger correlation and, are therefore a better indicator of recovery than tests such as ROM. **Conclusion:** Measures of agility and balance, such as CGS, show markedly clearer trends in terms of reflecting patient progress than more traditional measures, such as ROM, which don’t show much variation and are therefore limited in assessing recovery. The ability of functional tests to indicate, at an earlier stage, a patient’s recovery from these injuries could be important in helping detect problems sooner.

Predictability of a prehospital tool used for identification of major trauma patients. *M. Azam Majee*, *Asif Naveed*. From the University Hospital Birmingham, Birmingham, U.K.

Background: To measure the positive predictive value (PPV) of a trauma triage tool (TTT) used in the prehospital setting

for identification of major trauma patients presented to a level 1 major trauma centre, Birmingham University Hospital (UHB). **Methods:** Retrospective database review using TARN database of 353 trauma patients presented to the emergency department, UHB, during a 6-month period (January–June 2013). **Results:** The study showed that 189 out of 353 trauma patients had an estimated ISS > 15 (PPV 0.535, 95% CI 0.48–0.59). Only 56.7% of these patients were alerted. The TTT consists of 4 components (physiology, anatomy, mechanism of injury and special conditions). The physiology component had the highest PPV (0.824, 95% CI 0.75–0.89), while the special conditions component had the lowest PPV (0.421, 95% CI 0.35–0.49). The PPV of the mechanism of injury component was higher than the anatomy component (0.655, 95% CI 0.55–0.76 v. 0.543, 95% CI 0.46–0.63). There was a significant difference between patients with ISS > 15 and patients with ISS ≤ 15 with regards to age ($p < 0.001$); of interest, the lower the age the higher the severity of the injury. **Conclusion:** Despite the high PPV of the physiology component alone, the overall ability of the current TTT to positively predict major trauma cases remains low. This gap needs to be considered when evaluating this TTT in order to increase its predictive value and avoid over- and under-triage of trauma patients.

Meta-analysis on the impact of the acute care surgery model of disease-specific and patient outcomes for appendicitis and biliary disease. *Patrick Murphy**, *Kristin DeGirolamo**, *Theunis Jean Van Zyl†*, *Laura Allen†*, *William Leeper†*, *Neil Parry†*, *Ken Leslie†*, *Morad Hameed‡*, *Kelly Vogt†*, *Elliott Haut§*. From *Western University, London, Ont.; the †London Health Sciences Centre, London, Ont.; the ‡Trauma Services, Vancouver General Hospital, Vancouver, BC; and the §Centre for Surgical Trials and Outcomes Research, Johns Hopkins University School of Medicine, Baltimore, MD.

Background: The acute care surgery (ACS) model was developed to acknowledge the complexity of a traditionally fractured emergency general surgery patient population; however, there are variations in the design of ACS service models. Little evidence exists to define the optimal ACS service model. This meta-analysis was undertaken to determine the impact of different ACS models on outcomes of the 2 most often studied ACS conditions: appendicitis and biliary disease. **Methods:** A systematic, English-language search of major databases was conducted. From 1827 papers, 2 independent reviewers identified 24 studies that reported on outcomes for patients with appendicitis and biliary disease before and after implementation of an ACS service. The Newcastle–Ottawa Scale (NOS) was used to score quality. Similar outcomes were analyzed using random-effect methodology. **Results:** Significant heterogeneity existed among studies and ACS designs. The overall study quality rating was fair to poor with a moderate risk of bias. There was an overall reduction in length of stay by 0.54 days (0.15–0.94) for appendicitis and 0.83 days (0.49–1.17) for biliary disease. Complications were less common after cholecystectomy under the ACS model (OR 0.47, 95% CI 0.34–0.63). There was no difference in after-hours operating for appendicitis except in ACS models with dedicated theatre time (OR 0.58, 95% CI 0.36–0.94) **Conclusion:** The ACS model has been shown to benefit ACS patients with improved access to care, fewer complications and decreased length of stay for appendicitis and biliary disease. The design and implementation of an ACS service can impact the magnitude of effect.

Pelvic pressure changes after a fracture: a pilot cadaveric study assessing the effect of pelvic binders and limb bandaging. *Rhys Morris**, *Andrew Loftus[†]*, *Anna Lygas[‡]*, *Rozina Mahmood[‡]*, *Ian Pallister[‡]*. From **Swansea University, Swansea, Wales, U.K.*; *†Queen Elizabeth University Hospital, Glasgow, Scotland, U.K.*; and *‡College of Medicine, Swansea University, Swansea, Wales, U.K.*

Background: Pelvic binders are a life-saving intervention for hypovolaemic shock following displaced pelvic fractures. This cadaveric study assesses intrapelvic pressure changes with different binders, augmented by bandaging the thighs to aid effect. Also, access to femoral vessels via an in situ binder was assessed. **Methods:** Unstable pelvic injuries were created in 2 embalmed cadavers by disrupting the pelvic ring. A suprapubic catheter connected to a water manometer measured intravesical pressure, which reflects intrapelvic pressure. The femoral vessels were dissected in the left groin for each specimen before any intervention to allow inspection following binder application. Different binder designs were used for each cadaver, with each applied following lower limb bandaging with the knees slightly flexed. Inspection of the groins then determined if the femoral vessels were visible. A paired samples *t* test in SPSS assessed any differences between the initial and final pelvic pressures. **Results:** Bandaging the lower limbs alone significantly increased steady mean intrapelvic pressure compared with the baseline, (12.38 cmH₂O v. 8.73 cmH₂O, *p* = 0.001). Additional binder application further increased steady mean intrapelvic pressure compared with baseline (15.13 cmH₂O, *p* = 0.003). Steady mean pressures between bandaging alone and bandaging with the binder applied were not significantly different (*p* = 0.09). The improvised binder and trauma pelvic orthotic device both required cutting to access the femoral vessels, which reduced efficacy. **Conclusion:** Intrapelvic pressure was significantly increased through bandaging the lower limbs alone, and this represents a simple measure to increase intrapelvic pressure. Access to the femoral vessels varied with binder type and represents an important consideration in polytrauma patients.

Suspect pelvic injuries based on mechanism alone or in conjugation with physiologic parameters. *M. Azam Majeed, Asif Naveed.* From the University Hospital Birmingham, Birmingham, U.K.

Background: Pelvic fractures represent 3%–6% of all fractures in adults and occur in up to 20% of all polytrauma cases. Unstable pelvic fracture is estimated to occur in up to 20% of pelvic fractures. About 10% of patients with hemodynamically unstable fractures of the pelvis will die. Our objective was to estimate the predictive value (positive and negative) of mechanism in isolation or in combination with physiologic parameters, identifying pelvic fractures. **Methods:** We did the retrospective analysis of 540 major trauma patients who attended the emergency department (ED) of University Hospital Birmingham from January 2013 to June 2013. All major trauma patients who were suspected to have pelvic injuries based on mechanism were included in this study. Patients with age < 16 years and who were not suspected to have pelvic injuries were excluded. **Results:** We found the mechanism to be a good tool to exclude (negative predictive value 98.77%, 95% CI 93.29%–99.79%) pelvic injuries but extremely poor to diagnose them (positive predictive value 15.24%, 95% CI 11.17%–20.10%). When combined with physiologic parameters the PPV (56%, 95% CI 43%–68%) and NPV

(99.29, 95% CI 96%–99.9%) had significantly improved. Similarly, the specificity had improved from 25% to 84%. **Conclusion:** Using mechanism and physiologic factors is better than mechanism alone at predicting pelvic fracture.

Distal radial ultrasound guided fracture identification and manipulation. *M. Azam Majeed, Asif Naveed.* From the University Hospital Birmingham, Birmingham, U.K.

Background: Trauma triage tools are widely used by pre-hospital teams to divert patients to the major trauma centres. It is evident from our results that mechanism on its own is a poor indicator to diagnose pelvic fracture. We believe its diagnostic accuracy will improve when joined with physiologic triggers. Distal radial fracture is one of the common presentations in the emergency department (ED). X-ray is still the standard diagnostic tool for such fractures, although some recent studies have shown that in children, fractures can be diagnosed safely and reliably by ultrasound (US) alone. The objective of our study is to evaluate the reliability of US in the diagnosis and postreduction alignment assessment in distal radial fractures. **Methods:** This is a prospective cohort diagnostic study done at Queen Elizabeth Hospital, Birmingham, from January 2014 to March 2014. All patients aged > 16 years with distal radial fractures secondary to trauma were included. In suspected patients, the senior emergency physician then confirmed the presence or absence of a fracture, measured its angle, and did the same postreduction. Then both US pictures were compared, and both were then compared with classical pre- and postreduction x-rays. **Results:** In our pilot study we enrolled 20 patients. The emergency physician-performed US assessment for the presence of a fracture has a sensitivity of 94%, specificity of 100%, PPV of 100%, NPP of 75% and accuracy of 95%. The reduction success has sensitivity of 94%, specificity of 75%, PPV of 94%, NPP of 75%, and accuracy of 90%. **Conclusion:** Our study corroborates the results of previous studies that reported emergency physicians can reliably detect the presence and adequacy of realignment for distal radial fracture using US in the ED with high sensitivity and specificity.

The predictive value of the Canadian Study of Health and Aging Clinical Frailty Scale on adverse outcomes among geriatric trauma patients. *Annie Cheung*, Barbara Haas[†], Thom Ringer[‡], Amanda McFarlan[†], Camilla Wong[‡].* From the *University of Ottawa, Ottawa, Ont.*; and *St. Michael's Hospital, Toronto, Ont.*

Background: Age and injury severity alone are inadequate at predicting outcomes in the geriatric trauma population because they fail to consider physiologic age and frailty state. The Canadian Study of Health and Aging Clinical Frailty Scale (CFS) is a validated judgment-based scale that assigns a frailty score based on clinical data. We hypothesized that the CFS will predict outcomes following injury in geriatric patients. **Methods:** We performed a retrospective cohort study of geriatric patients (age ≥ 65 yr) admitted to a level 1 trauma centre between 2011 and 2014. The preadmission CFS score was assigned to each patient by a geriatrician in their initial assessment or was abstracted by manual chart review. The primary outcome of interest was discharge destination, either adverse (death or discharge to a long-term, chronic care or another acute care facility) or favourable (home or rehabilitation). Logistic regression was used to evaluate the relationship between these outcomes and the CFS. **Results:** In total, 260 patients met the inclusion criteria. The mean age was 77 and mean ISS was 19. Moderate or severe frailty (CFS

6 or 7) was strongly associated with adverse discharge destination (OR 5.3, 95% CI 2.1–13.5), compared with age (OR 1.1, 95% CI 1.0–1.1) and total number of comorbidities (OR 2.8, 95% CI 1.1–7.3). **Conclusion:** Frailty independently predicts adverse discharge destination in geriatric trauma patients. The CFS can be used as a clinical tool to triage resources and expertise to mitigate adverse outcomes in this population.

Who, what, where: a critical assessment of helicopter emergency medical services transport and transfer times on patient outcomes at two level 1 trauma centres. *Brodie Nolan**, *Homer Tien†*, *Bruce Sawadsky‡*, *Sandro Rizoli§*, *Amanda McFarlan§*, *Andrea Phillips†*, *Alun Ackery§*. From the *University of Toronto, Toronto, Ont.; the †Sunnybrook Health Sciences Centre, Toronto, Ont.; ‡Ornge, Toronto, Ont.; and §St Michael's Hospital, Toronto, Ont.

Background: Helicopter emergency medical services (HEMS) have become an engrained component of trauma systems to expedite transportation to a trauma centre. Ornge is a provincially run, paramedic-staffed HEMS that is responsible for all air ambulance service within Ontario, Canada. They provide transportation for trauma patients through 1 of 3 ways: scene call, modified scene call or interfacility transfer. In this study we report the characteristics of patients transported by each of these methods to 2 level 1 trauma centres and assess for any impact on morbidity or mortality. **Methods:** A local trauma registry was used to identify all patients transported to our 2 trauma centres by HEMS over a 36-month period. Data surrounding patient demographics, arrival characteristics, transport times and in-hospital course were abstracted from the registry. Statistical analysis was used to compare methods of transport and characterize any association between mode of transport and mortality. **Results:** From Jan. 1, 2012, to Dec. 31, 2014, HEMS transferred a total of 981 patients to our trauma centres with an overall mortality of 12%. Of these patients 137 were scene calls with a mortality of 5%, 118 were modified scene calls with a mortality of 14% and 726 were interfacility transfers with a mortality of 13%. **Conclusion:** Identifying any association between the type of HEMS transport and morbidity and mortality, we may be able to predict those that need more urgent transfer to a trauma centre and find ways to decrease our overall pre-trauma centre time.

Is your data telling you what you think it is? An assessment of BC Trauma Registry completeness. *Nori Bradley, Naisan Garraway, Nasira Lakha, Jennifer Li, Jeremy Hamm, Morad Hameed.* From Trauma Services, Vancouver General Hospital, Vancouver, B.C.

Background: Trauma registry data quality is often evaluated by percent completeness and interrater reliability (IRR) using Cohen κ . However, these values may inadequately represent data quality. The known limitations of κ — prevalence and bias effects — can influence estimates of IRR. Our objective was to assess completeness of the British Columbia Trauma Registry (BCTR). **Methods:** Major trauma patients transferred to a level 1 trauma centre over 1 year were identified using BCTR ($n = 243$). Completeness of 8 BCTR variables (7 primary survey variables and 1 scene variable) was assessed by physician audit of 100 charts from this patient cohort. Calculations for each variable included positive agreement, κ , Prevalence Index (PI), Bias Index (BI), and Prevalence and Bias Adjusted κ (PABAK). The χ^2 test assessed significance of

bias. **Results:** Positive agreement was high ($\geq 85\%$) for all variables except temperature (76%) and FAST (52%). κ was moderate for 5 variables (BP, HR, RR, Temp, FAST), substantial for 1 (EHS Form), and fair or slight for 2 (GCS, Airway). Five variables had high PI (BP, HR, RR, Airway, GCS); PABAK increased κ from moderate to near perfect for BP, and moderate to substantial otherwise. Significant bias (5 variables) had less effect on κ than prevalence but revealed disagreements upon review of raw data. **Conclusion:** The BCTR is highly complete, with room for improvement. The limitations of κ require PI, BI, and PABAK to optimize data interpretation. We recommend including prevalence and bias analysis in systematic data audit and reporting these parameters for broader understanding of trauma registry quality.

Introducing e-FAST training to Trinidad and Tobago (TT). *Brian Brewer**, *Annika Storey**, *Alex Sinanan†*, *Grace Rozycki†*, *Jameel Ali‡*. From the *Indiana University School of Medicine, Indianapolis, Ind.; the †Eric Williams Medical Complex, Trinidad & Tobago; and the ‡University of Toronto, Toronto, Ont.

Background: Tertiary care facilities receive most acutely ill patients in TT. District health centres also receive patients requiring triage and disposition decisions. Expanded focused assessment sonogram for trauma (e-FAST) training could potentially facilitate this patient disposition process. We tested the feasibility, acceptability and potential application of this training in TT. **Methods:** e-FAST instructor training in TT for 9 physicians (1 radiologist, 2 surgeons, 1 anesthetist, 5 primary care physicians) and provider training for 15 physicians were conducted by faculty from the Indiana University School of Medicine Surgery Department. After a precourse multiple choice questionnaire examination (MCQE) the courses consisted of didactic ultrasound (US) physics sessions, hands-on training, clinical scenarios and evaluation using videos and live models for assessing neck, thyroid-vascular access, thorax and standardized FAST. The instructor candidates were proctored during the provider course. The participants completed a postcourse MCQE, were tested on their ability to complete US tasks using live models, and evaluated the program using a 5-point Likert scale on the teaching effectiveness of the components, relevance and applicability. **Results:** Mean MCQE postcourse scores improved (76%–96%, $p < 0.001$); 91% successfully completed all tasks in the test stations and 100% were successful overall. Twenty-one of 24 participants (87.5%) completed the evaluation questionnaire; 100% strongly agreed that the objectives were met with effective teachers; 91% rated didactic sessions and skill stations very good to excellent; 100% agreed or strongly agreed the course was relevant, improved skills, was applicable in TT, and should be continued and further developed as a free-standing program. **Conclusion:** Based on participant performance and evaluation of the course, this e-FAST program was very successful, highly evaluated and recommended for continued propagation in TT, with potential application to other developing countries using appropriately trained faculty.

Resilient despite childhood trauma experiences. *Monica Hinton.* From the Department of National Defence, Ottawa, Ont.

Background: Research does not seem to reflect the experience of those who do well following traumatic events. As a clinician, I believe that people are resilient despite trauma and I wanted to

find out how people do well regardless of distressing life events. The purpose of my qualitative grounded theory research was to uncover what participants believed fostered their resilience despite trauma. **Methods:** Self-identified resilient volunteers were interviewed, and the research data were analyzed using grounded theory. This included open, axial and selective coding. **Results:** The chosen central phenomenon was the perception that the participants' childhood experiences were traumatic. Strategies used by the research participants to address this phenomenon included enlisting important individuals/pets, spirituality and regulating the traumatic experience. Regulation strategies included humour, self-preservation, imagination, intelligence, self-direction and "unhealthy" behaviours (e.g., addiction, self-harm, risky behaviours). The results indicate that there are degrees of resiliency, resiliency is a process and each participant moved beyond periods of using unhealthy strategies in regulating their experiences. **Conclusion:** Implications for practice stem from these findings. If we hope to nurture socially competent people who have a sense of their own identity and who are able to make decisions, set goals and believe in their future, our primary focus as clinicians must be on meeting patients' basic human needs for respect, caring, connectedness, challenge, power and meaning.

Prognostic value of serum procalcitonin measurements in critically injured patients: a systematic review. *Aziza Al Rawabi**, *Fatma Albinai†*, *Christopher Doigt†*, *Chad Ball‡*, *Elijah Dixon§*, *Jimmy Xiao¶*, *Andrew Kirkpatrick.*** From the *University of Calgary, Calgary, Alta.; the †Department of Critical Care Medicine, University of Calgary, Calgary, Alta.; the ‡Departments of Surgery and Oncology, Foothills Medical Centre and University of Calgary, Calgary, Alta.; the §Departments of Surgery and Community Health Sciences, Foothills Medical Centre and University of Calgary, Calgary, Alta.; ¶Alberta Health Services, Trauma Services, Foothills Medical Centre, Calgary, Alta.; and the **Departments of Surgery and Critical Care Medicine, Foothills Medical Centre and University of Calgary, Calgary, Alta.

Background: Major trauma is associated with high incidence of septic complications and multiple organ dysfunction (MOD), which markedly influence the outcome of injured patients. Early identification of patients at risk of developing post-traumatic complications is crucial to provide early treatment and improve outcomes. We sought to evaluate the prognostic value of plasma procalcitonin (PCT) levels after trauma as related to severity of injury, sepsis, organ dysfunction and mortality. **Methods:** We searched PubMed, MEDLINE, EMBASE, the Cochrane Database and references of included articles. Two investigators independently identified eligible studies and extracted data. We included original studies that assessed prognostic value of PCT after trauma. **Results:** Among 1462 citations, 18 studies (16 prospective, 2 retrospective) met inclusion criteria. Methodological quality of included studies was moderate. All studies showed a strong correlation between initial peak PCT levels and ISS. Eleven out of 15 studies demonstrated significant elevation of initial PCT levels in patients who later developed sepsis after trauma. PCT level appeared a strong predictor of MOD in 7 studies out of 9. While 2 studies did not show association between PCT levels and mortality, 4 studies demonstrated significant elevation of PCT levels in nonsurvivors versus survivors. One study reported that PCT level of ≥ 5 ng/mL was associated with significantly increased mortality (OR 3.65, 95% CI 1.03–12.9, $p = 0.04$). **Conclusion:** PCT seems to hold promise as a

surrogate biomarker for trauma. Initial peak PCT level may be used as an early predictor of sepsis, MOD, and mortality in the trauma population.

Application and evaluation of knowledge retention related to Advanced Trauma Care for Nurses (ATCN) course content: a preliminary study. *Sonya Canzian, Jessica Nanni, Amanda McFarlan, Katbryn Chalkin, Anne Sorvari, Lisa Horton, Lee Barratt, Shirley Ann Blanchette, Yangmei Li, Jane Topolovec-Vranic.* From St. Michael's Hospital, Toronto, Ont.

Background: The Advanced Trauma Care for Nurses (ATCN) course was designed to help nurses increase their knowledge in management of the multiple trauma patient. The study aimed to determine whether the trauma-related knowledge of ATCN course-takers differed from nontakers, assess the factors associated with ATCN content knowledge among course takers, and explore the extent to which the ATCN content was used by course takers in their clinical practice. **Methods:** A cross-sectional online survey of 78 ATCN takers (nurses who had successfully completed the ATCN course within the previous 4.5 yr) and 58 ATCN nontakers (nurses who had not taken the course, but who worked in comparable clinical settings) was conducted. The survey consisted of demographic questions and a 15-item knowledge test spanning the ATCN course content. ATCN takers were also asked about the frequency with which specific ATCN content had been used in their practice since taking the course. **Results:** ATCN takers had significantly higher (mean 10.6 ± 2.2) total scores on the study test than the ATCN nontakers (mean 6.4 ± 2.6 ; $t_{134} = -10.0$, $p < 0.001$). A shorter time since course completion was associated with higher knowledge scores. The ATCN takers rated the clinical relevance and applicability of the course content as high. **Conclusion:** Completing the ATCN course was associated with increased knowledge levels of trauma patient management, and nurses indicated that ATCN course content was clinically relevant. However, higher knowledge scores were observed for the most recent study participants, suggesting that booster sessions for ATCN course participants may be warranted.

Risk of blunt cerebrovascular injury in association with mandible fractures: pilot study at a Canadian level 1 trauma centre. *Olivia Lo, Jeremy Grushka, Nicholas Makhoul.* From McGill University, Montreal Que.

Background: Trauma literature suggests that certain injury patterns resulting from blunt trauma are indications for additional imaging with CT angiography (CTA) to screen for blunt cerebral vascular injury (BCVI). Recently the criteria expanded to include mandible fractures (MF). The studies, however, do not review all cases of MF, and thus fail to determine the prevalence of BCVI in MF and the yield. The purpose of this study was to investigate the yield of the expanded criteria to include MF in diagnosing BCVI and whether screening isolated MF is necessary. **Methods:** Cases of BCVI and/or MF admitted to the Montreal General Hospital between January 2010 and February 2015 were reviewed. Data were obtained from the trauma registry and operating room records. **Results:** During the study period, 49 BCVI and 348 MF were admitted; 16% ($n = 8$) of BCVI had concomitant MF and all were associated with high-energy mechanisms and severe concomitant injuries. Prevalence of BCVI in MF was 2% (8 of 348). In all, 20% (69 of 348) of MF underwent CTA screening and of those, 55% ($n = 38$) were screened for indications other than MF. Of the 45% ($n = 31$) screened with CTA for MF as an isolated trigger, 2 cases of BCVI were diagnosed but had

other significant injuries. Screening isolated MF ($n = 17$) did not identify any cases of BCVI. **Conclusion:** Our data show that including MF as an absolute criteria for BCVI screening has limited yield and recommend against CTA for isolated MF. Rather than focusing on individual screening triggers, clinicians should consider the mechanism and severity of associated injuries in their decision to screen for BCVI.

Improving the documentation of the rate of arrival time for trauma team leaders through the use of low-cost interventions and awareness in a trauma centre. *Mathieu LeBreton, Alanna Keenan, Jacinthe Lampron, Heather Knight.* From the Ottawa Hospital, Ottawa, Ont.

Background: The trauma team leaders' arrival time (TTL-AT) to a trauma team activation is recognized as an important element in reducing mortality in trauma¹. Provincial stakeholders initiated mandatory reporting of TTL-AT with a benchmark < 20 minutes. Undocumented arrivals or arrivals > 20 minutes were considered late. Discrepancy existed between successful TTL-AT collected by the trauma centre (89.3%) and provincial results (69.8%). The goals of this study were twofold: to identify undocumented times versus late arrivals and to determine if low-cost interventions would improve documentation of arrival times. **Methods:** Three low-cost interventions (trauma documentation pack, streamlined clerical documentation, TTL awareness) were implemented in July 2015. TTL arrival times were compared before (October 2014–July 2015) and after these interventions. **Results:** Provincial data were analyzed, with 49 of 172 (28.4%) occurrences not meeting target. Of these, times were undocumented in 73.5% of cases, whereas TTL-AT was late 26.5% of the time. Following the interventions the percentage of failed targets remained stable (28.5%). A positive impact was noted in documentation compliance, as the undocumented arrival time dropped to 45% (from 73.5%). Unfortunately, this revealed that TTL-AT was late in 55% (from 26.5%) of cases. **Conclusion:** The implementation of 3 low-cost interventions improved the documentation of TTL-AT. This more accurately reflects data forwarded provincially. Further interventions will focus on identifying strategies to improve TTL-AT.

The reliability of DAD ICD-10-CA codes for injury reporting. *Recep Gezer^{*}, Jaimini Thakore^{*}, Jennifer McMillan[†], Scott Robinson[‡], Dori Williams[‡].* From ^{*}Trauma Services, Provincial Health Services Authority, Vancouver, B.C.; the [†]BC Trauma Registry, Provincial Health Services Authority, Vancouver, B.C.; and the [‡]Provincial Health Services Authority, Vancouver, B.C.

Background: Injury data from all hospitals are required to understand volumes, triage decisions, and resource allocation. Due to limited resources, it is not reasonable to have specialized trauma registrars in nontrauma hospitals, therefore the Discharge Abstract Database (DAD) is often used for injury reporting. Due to time constraints and restrictions on the documents reviewed, DAD coders may not review medical records to the level of detail required for accurate and complete injury coding. **Methods:** We compared the ICD-10-CA codes assigned by DAD coders to those in the BC Trauma Registry assigned by trauma registrars for the same patient cohort. We reviewed the correlation and level of agreement at various levels of aggregation, including presence of injury codes, assigned primary cause of injury code, and body regions affected by injury. **Results:**

Preliminary results indicate that there is relatively high correlation at a wider level of aggregation, such as the presence of injury codes. The correlation decreases as the aggregation gets more specific, such as the body regions affected by injury. **Conclusion:** We expect the results from this study to inform the various institutions that report injury statistics using DAD. DAD ICD-10-CA codes can be useful to report on basic descriptive statistics; however, when a finer level of detail on injury is required, the reliability of DAD data begins to suffer from a lack of completeness and accuracy in coding.

Implementing an ICD-10-to-AIS 2005 crosswalk in a provincial inclusive trauma system. *Recep Gezer^{*}, Jennifer McMillan[†], Jaimini Thakore^{*}, Dori Williams[‡], Scott Robinson[‡].* From the ^{*}Trauma Services BC, Vancouver, B.C.; the [†]BC Trauma Registry, Vancouver, B.C.; and the [‡]Provincial Health Services Authority, Vancouver, B.C.

Background: An ICD-10-to-AIS crosswalk using AIS 98 was developed by B. Haas, W. Xiong, M. Brennan-Barnes, D. Gomez and A. Nathan. The crosswalk can aid in trauma system surveillance and possibly help with assessing appropriateness of triage decisions using the Discharge Abstract Database (DAD). We sought to validate the implementation of an updated ICD-10-to-AIS crosswalk using AIS 2005 in the province of British Columbia. **Methods:** We linked DAD data to BC Trauma Registry (BCTR) data for the same trauma patient cohort, giving us 2 sets of ICD-10-CA codes. We then calculated ISS for each ICD-10-CA set using the crosswalk. We reported on the correlation of those ISS values with the BCTR registrar-coded ISS (reference ISS). **Results:** Preliminary results indicate that there is a medium level of correlation between the ISS derived from BCTR ICD-10-CA codes and the reference ISS. The correlation to reference ISS reduces further when DAD ICD-10-CA codes were used to calculate ISS. Approximately 90% of the time, the difference between the calculated ISS and reference ISS was less than 10. On the other hand, more than 10% of the cases with reference ISS ≥ 16 had a calculated ISS < 16. **Conclusion:** The results show that the ICD-10-CA-to-AIS 2005 crosswalk algorithm may work better for categorizing patients into larger injury severity groups or filtering certain groups of patients rather than assigning an accurate ISS for each patient.

Compliance of tranexamic acid administration to trauma patients at a level 1 trauma centre. *Abeer Gbawanni^{*}, Julian Owen[†], Angela Coates[‡].* From ^{*}Hamilton Health Sciences, Hamilton, Ont.; [†]McMaster University, Hamilton, Ont.; and the [‡]Hamilton Health Sciences Trauma Program, Hamilton, Ont.

Background: Hemorrhage accounts for about 30% of all trauma deaths. Studies show that early administration of tranexamic acid (TXA) reduces mortality due to traumatic bleeding. TXA has become the standard of care in managing patients with significant bleeding. The aim of this study was to audit compliance of TXA administration at our level 1 trauma centre. **Methods:** We conducted a retrospective study of consecutive trauma patients reported to the Hamilton General Hospital Trauma Registry between Jan. 1, 2012, and Dec. 31, 2014. Compliance of TXA administration was assessed using Crash-2 and MATTERS Trials criteria (tachycardic ≥ 110 bpm or hypotensive ≤ 90 SBP or blood transfusion in the emergency department [ED] ≥ 1 unit of PRBCs). **Results:** A total of 534 of 2475 trauma patients met the inclusion criteria for TXA administration; 155 patients received

TXA, representing a compliance rate of 30%. Mean time from arrival to TXA administration was 47 minutes. A comparison of patients who received or did not receive TXA found no differences in age, sex or mechanism of injury (all $p > 0.05$). Patients who received TXA had a higher mean ISS (23 v. 17, $p < 0.001$) and higher rates of emergency surgery (65% v. 43%, $p < 0.001$). Overall mortality was higher for patients receiving TXA (25% v. 16%, $p < 0.05$). Deaths within 24 hours of admission showed no differences (43% for TXA v. 56% for no TXA, $p = 0.325$). **Conclusion:** Our audit demonstrates that quality improvement strategies aimed at the use of TXA in critically injured trauma patients at risk for severe hemorrhage are warranted.

Intra-abdominal hypertension and mortality in critically ill patients with sepsis: a prospective observational study. Jimmy Xiao^{*}, Paul McBeth[†], Derek Roberts[‡], Chad Ball[§], John Kortbeek[¶], Roban Lall^{**}, Andrew Kirkpatrick^{††}. From ^{*}Alberta Health Services, Trauma Services, Foothills Medical Centre, Calgary, Alta.; the [†]Department of Surgery, Foothills Medical Centre and University of Calgary, Calgary, Alta.; the [‡]Departments of Surgery and Community Health Sciences, University of Calgary, Calgary, Alta.; the [§]Departments of Surgery and Oncology, Foothills Medical Centre and University of Calgary, Calgary, Alta.; the [¶]Department of Surgery, University of Calgary, Calgary, Alta.; the ^{**}University of Calgary, Calgary, Alta.; and the ^{††}Departments of Surgery and Critical Care Medicine, Foothills Medical Centre and University of Calgary, Calgary, Alta.

Background: Patients with sepsis often require massive fluid resuscitation, which risks elevating intra-abdominal pressure (IAP), developing intra-abdominal hypertension (IAH) or abdominal compartment syndrome (ACS). IAH and ACS are associated with substantial morbidity and mortality among critically ill adults. We sought to prospectively monitor IAP in ICU patients with sepsis to investigate the incidence of IAH/ACS and its association with outcomes. **Methods:** Over a 3-year period starting in September 2012, adult patients with sepsis admitted to the ICU for a stay of 24 hours or greater were enrolled. Patients with bladder ruptures were excluded. Monitoring IAPs involved intermittent measurement of intravesical pressure after instilling 25 mL of saline into the bladder when patients were positioned supine. **Results:** In total, 290 patients were enrolled, and 87 (30%) were monitored with IAP. Among the 87 patients, 21 were medical and 66 were trauma, burn, or surgical patients. The mean age was 55 (range 18–87) years, median ICU stay was 9 days, median 24-hour fluid balance was 7353 mL, 63 patients (72.4%) had IAH (2 consecutive IAPs ≥ 12 mm Hg), and 15 developed ACS, including all 5 burn patients. Among the 45 ICU deaths (51.7%), median fluid balance was 8904 mL, compared with 6448 mL in ICU patients who survived ($p = 0.05$); 11 had ACS (4 among ICU patients who survived, $p = 0.08$). Age, acute kidney injuries, and vasoactive requirement were significantly higher in patients who died. **Conclusion:** The majority of patients with sepsis and who received vigorous fluid resuscitation had IAH. The incidence of ACS is common in patients with severe burn, and is closely related to ICU death.

Clot amplitude measurement at 10 minutes predicts blood products transfusion and hospital mortality. Precilla Veigas^{*}, Jeannie Callum[†], Sandro Rizoli[†]. From ^{*}St. Michael's Hospital, Toronto, Ont.; and the [†]Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: Hemorrhage is a common cause of death following trauma, particularly if the patient is coagulopathic. Early coagulopathy occurs in 25% of all severely injured patients. Viscoelastic assays (e.g., ROTEM) are increasingly being used to diagnose and manage early coagulopathy. We hypothesize that ROTEM clot amplitude (measured at 10 min) predicts fresh plasma and cryoprecipitate transfusion and hospital mortality. **Methods:** Retrospective analysis of adult patients with blunt and penetrating trauma admitted to a level 1 trauma centre between August 2011 and March 2013. The following variables were analyzed: age, sex, injury type, ISS, SBP, temperature, INR, hemoglobin, platelet count, ROTEM A10 EXTEM and A10 FIBTEM. Multivariable logistic regression with manual backward selection was used to identify independent predictors of blood products transfusion and mortality. **Results:** A total of 1146 patients were included. Median age was 41 (IQR 26–58) years, 73% ($n = 836$) were men and median ISS was 17 (IQR 9–26). Variables independently associated with plasma transfusion were SBP (OR 0.98, 95% CI 0.97–0.99, $p < 0.0001$), ISS (OR 1.10, 95% CI 1.07–1.13, $p < 0.0001$), hemoglobin (OR 0.97, 95% CI 0.96–0.99, $p < 0.0001$) and A10 EXTEM (OR 0.97, 95% CI 0.95–1.0, $p = 0.038$). Variables independently associated with cryoprecipitate transfusion were ISS (OR 1.09, 95% CI 1.05–1.14, $p < 0.0001$) and A10 FIBTEM (OR 0.77, 95% CI 0.68–0.87, $p < 0.0001$). **Conclusion:** Clot amplitude (A10 EXTEM and A10 FIBTEM) measured at 10 minutes is capable of predicting the need for fresh plasma, cryoprecipitate transfusion and hospital mortality. Abnormal clot amplitude may be clinically relevant and useful to the clinical decision-making process during early resuscitation.

Variations in length of stay for major trauma across Canadian trauma centres. Lynne Moore^{*}, David Evans[†], Morad Hameedi[†], Natalie Yanchar[‡], Henry Thomas Steffox[§], Richard Simons[¶], John Kortbeek[¶], Julien Clement^{**}, François Lauzier^{††}, Avery Nathens^{††}, Alexis Turgeon^{††}. From ^{*}Laval University, Quebec, Que.; the [†]Trauma Services, Vancouver General Hospital, Vancouver, B.C.; the [‡]University of Calgary, Calgary, Alta.; the [§]Department of Surgery, University of Calgary, Calgary, Alta.; the [¶]CHU de Québec, Quebec, Que.; the ^{**}Axe Santé des Populations — Pratiques Optimales en Santé, Traumatologie — Urgence — Soins intensifs, Quebec, Que.; the ^{††}Sunnybrook Health Sciences Centre, Toronto, Ont.; and the ^{††}CHU de Québec Research Centre, Université Laval, Quebec, Que.

Background: Injuries represent 200 000 hospital admissions per year in Canada and are second only to cardiovascular diseases in terms of acute health care costs. Benchmarking patient outcomes across trauma centres and systems is key to national improvements in the quality and efficiency of injury care. Little is known about variations in hospital length of stay (LOS) for injury admissions across Canada or the determinants of variations in LOS. We aimed to assess the variation in risk-adjusted LOS across Canadian trauma centres and provinces and to assess the relative contribution of patient level of illness, discharge delays, treatment intensity and complications to LOS variations. **Methods:** We conducted a retrospective cohort study of all adults admitted for major injury to level 1 and 2 trauma centres across Canada (2006–2012) using Canadian National Trauma Registry data linked to the Discharge Abstract Database. Multi-level linear models were used to compare LOS across trauma centres and provinces, adjusted for patient-level illness, and Cohen F^2 were used to quantify the proportion of variation in

LOS explained by potential determinants. **Results:** Mean LOS was 10.9 days. Risk-adjusted LOS varied significantly from 9.6 to 15.5 days across provinces ($p = 0.02$) and from 8.5 to 15.5 days across trauma centres ($p = 0.001$). Patient-level illness, discharge delays, treatment intensity and complications explained 12%, 1%, 18%, and 12%, respectively, of variations in hospital LOS. **Results:** We observed significant variation in mean LOS across Canadian trauma centres and provinces after adjustment for patient level of illness on arrival. Variations were largely explained by treatment intensity and complications. Results suggest that there is potential for reducing hospital days for Canadian injury admissions. Future research should assess the influence of system and hospital-level structures of care and adherence to recommended clinical processes on LOS.

Evolution of guidelines for definitive emergency airway management in adult major trauma. Bentley Waller*, Jan Trojanowski†, Andrew Meikle†, Naisan Garraway‡, Lyne Filiatrault†, John Tallon*, Chad KimSing†, Alana Flexman†, Morad Hameed#. From the *University of British Columbia, Vancouver, B.C.; the †Vancouver General Hospital, Vancouver, B.C.; and the ‡Trauma Services, Vancouver General Hospital, Vancouver, B.C.

Background: Definitive airway management in major trauma is a time-critical, high-risk, multidisciplinary team endeavour. The failure to apply a structured approach may result in delivery of suboptimal, delayed care. We aimed to develop a process for the timely transition of current evidence and expert opinion into practical guidelines for emergency airway management in adult major trauma. **Methods:** Guidelines in trauma airway management at a provincial level 1 trauma centre served as the basis for review and updating. A web-based survey of emergency physicians and trauma surgeons was conducted to assess current practices and opinions on checklists and guidelines. A literature review, including published and unpublished international guidelines, was undertaken. Based on this review, guidelines were developed and reviewed in a multistep, multidisciplinary consensus process. **Results:** The survey identified variations in airway management practices and attitudes to guidelines and checklists. The literature review identified civilian, military, pre-hospital and in-hospital, airway management guidelines and checklists from North America, Europe and Australia. This body of literature, including studies of airway management complications, was condensed into guidelines and point of care education modules for definitive airway management in trauma. These were designed to be used on a mobile electronic platform in real time. The consensus process revealed broad acceptance of this guidelines framework, although with key refinements for the local context. **Conclusion:** A wealth of evidence and expert opinion can be incorporated into practical, useful guidelines with broad-based, multidisciplinary appeal, and tailored to local practice patterns and environments.

Concussion patients in the emergency department: assessing a new triaging tool for follow-up and prompt long-term management. Daniel Abourbib*, Sukbmeet Bedi*, Cindy Hunt*, Melissa McGowan†, Donna Ouchterlony†, Alum Ackery†. From the *University of Toronto, Toronto, Ont.; and †St. Michael's Hospital, Toronto, Ont.

Background: Concussion is a common emergency department (ED) presentation. Most patients improve with expectant management. A subset with risk factors for postconcussion syndrome

(PCS) may require closer outpatient follow-up. A novel ED/head injury clinic (HIC) triaging system has been created to allow concussed patients rapid access to educational information and specialized consultant services. This system has been well received by patients and physicians alike; however, objective measures are needed to determine if this system decreases excessive health care utilization (HCU) and improves PCS symptoms. **Methods:** Single-centre prospective observational study. Control population of 42 mTBI patients referred to the HIC through the Ontario Acquired Brain Injury (ABI) Network within 3–12 months of injury. These patients have received little concussion education or treatment and will be compared with 50 concussion patients triaged from the ED. Rivermead scores, a validated Likert scale of PCS symptoms (1–4, maximum score of 64) and HCU (patient reported number of health care visits postinjury) will be collected on their initial clinic visit and subsequent follow-up phone interview. **Results:** Control ABI Network patients were 50% male and had a mean age of 40 ± 16.3 (range 18–90) years; 83% (35 of 42) reported > 1 subsequent visit to ED or family physician and 39% (16 of 42) visited a neurologist. Mean Rivermead Score was 32.6 ± 12 (range 7–58). **Conclusion:** A significant proportion of control patients used multiple health care resources and were still symptomatic 3–6 months following injury. Data collection is currently ongoing to determine if rapid outpatient follow-up and education decreases HCU and PCS symptoms.

Pseudoaneurysm of the profunda femoris artery following blunt trauma treated by endovascular coil embolization. Review of 2 cases and relevant literature. Saptarshi Biswas. From the Forbes Allegheny Hospital, Monroeville, Pa.

Background: Profounda femoris artery pseudoaneurysm after blunt trauma without associated femur fracture is a rare occurrence. Usually the PFA develops after penetrating trauma, surgical procedures and femur fractures. **Methods:** We present 2 cases of such injuries after fall and without any associated long bone injury. **Results:** CT angiography confirmed pseudoaneurysm of the branch of the PFA. Both these patients were subsequently treated with emergent coil embolization of the bleeding vessel. **Conclusion:** Pseudoaneurysms typically present late, and signs of persistent hip pain, thigh swelling, presence of a pulsatile mass and even unexplained anemia all may suggest the diagnosis. Recognition of PFA pseudoaneurysm requires a high index of suspicion and it is often difficult to diagnose clinically because of its location.

Carotid cavernous fistula: an easily missed complication of head trauma. Saptarshi Biswas*, Arpit Amin†. From the *Forbes Allegheny Hospital, Monroeville, Pa; and the †Westchester University Medical Center, Valhalla, N.Y.

Background: Carotid cavernous fistulas (CCFs) are abnormal communication between the carotid arterial system and the cavernous sinus. Traumatic CCFs are almost exclusively type A, which are direct high-flow shunts between the ICA and the cavernous sinus. Trauma in type A CCFs causes a rent in the intracavernous portion of the ICA, allowing arterial blood to enter the venous system of the cavernous sinus and its tributaries, the orbital venous complex and the inferior petrosal sinus. **Methods:** We present a case of a young woman who was involved in a motor vehicle rollover accident and presented a week later with worsening symptoms of left-sided headache, blurry vision with diplopia, photophobia, dizziness, drooping of her left eyelid and progressive

inability to open her left eye for the last 2–3 days. **Results:** Her CT scan from outside hospital from the week before showed closed skull fracture, subarachnoid hemorrhage, possible arachnoid cyst and right orbital fracture extending through sella turcica. An MRI of the brain showed basilar skull fracture, left ICA pseudoaneurysm and CCF. The patient underwent right ICA angiography and balloon-assisted coil embolization of the left CCF. **Conclusion:** Carotid cavernous fistula is a rare and easily missed complication of head trauma.

Development of a provincial patient episode of care. *Jennifer McMillan**, *Scott Robinson†*, *Jaimini Thakore†*. From the *BC Trauma Registry, Vancouver, B.C.; and the †Provincial Health Services Authority, Vancouver, B.C.

Background: Understanding the path of a trauma patient through acute care is essential for assessment of triage decisions, access to care, resource management, outcomes, and the impact of trauma on the acute care system. An episode of care algorithm is an important tool used to achieve this. Without a full episode of care, key metrics and volume statistics may be inaccurate. We saw a need to create a trauma episode of care algorithm to support stakeholders, particularly those working toward Trauma Distinction from Accreditation Canada. **Methods:** We initially applied CIHI's episode of care algorithm to Discharge Abstract Database (DAD) data. We then modified the algorithm to account for data quality issues and trauma-specific data entry practice. We also developed an episode of care algorithm for internal use on BC Trauma Registry (BCTR) data. **Results:** Positive results from our DAD algorithm have allowed us to develop Accreditation Canada's Field Triage (core) and Time to Definitive Care (optional) indicators, with data validation taking place at this time. We are currently testing our BCTR episode of care, with preliminary results showing promise that it will allow us to report on a patient's journey through trauma hospitals in BC. **Conclusion:** It is possible to build a patient episode of care for both DAD and BCTR data for use in reporting, metric development, and Accreditation Canada Trauma Distinction indicators.

Mechanism of injury and trauma-related outcomes in the geriatric population over 10 years in the United States. *Lily Tung**, *Kenji Inaba**, *Tobias Haltmeier†*, *Elizabeth Benjamin†*, *Lydia Lam†*, *Kazubide Matsushima†*, *Aaron Strumwasser†*, *Demetrios Demetriades**. From the *Division of Trauma and Surgical Critical Care, University of Southern California, Los Angeles, Calif.; and the †LAC & USC Medical Center, Los Angeles, Calif.

Background: As the population ages, how injury demographics will be impacted is unclear. The aim of this study was to examine changes in the mechanism of injury and injury-related outcomes in the aging population over time. **Methods:** This retrospective study used the US National Trauma Data Bank (2002–2012). All injured geriatric patients ≥ 65 years were included. Injury characteristics (ISS) and outcomes (in-hospital mortality, hospital length of stay [HLOS]) were analyzed using univariate regression analysis. **Results:** A total of 4 372 229 geriatric patients were analyzed. Median (IQR) age was 79 (12) years, 58.2% were male, median ISS was 9. The most common mechanism overall was ground level fall (464 675, 42.5%), blunt mechanism was motor vehicle collision (163 292, 14.9%), and penetrating mechanism was gunshot wound (2924, 0.3%). Both the incidence of blunt (RC -0.0002, 95% CI -0.0003 to -0.0002, $p < 0.001$) and pene-

trating (RC -0.012, 95% CI -0.012 to -0.012, $p < 0.001$) injuries decreased significantly over time. The overall injury incidence (RC 1.26, 95% CI 0.82–1.69, $p < 0.001$), as well as motorcycle accidents (OR 1.06, 95% CI 1.06–1.07, $p < 0.001$), bicycle accidents (OR 1.05, 95% CI 1.04–1.06, $p < 0.001$), and sports-related injuries (OR 1.02, 95% CI 1.00–1.03, $p = 0.014$) significantly increased over the 10-year study period. Overall in-hospital mortality (OR 0.98, 95% CI 0.97–0.98, $p < 0.001$) and HLOS (RC -0.058, 95% CI -0.10 to -0.016, $p < 0.05$) significantly decreased over time. **Conclusion:** Injuries resulting from activities, such as motorcycle, bicycle and sports, increased while mortality and HLOS decreased. This may reflect a more active, healthier aging population at risk of injury with improved trauma care. Further analyses of life trends is warranted.

The FAITH Score — early predictors of inpatient mortality in adult trauma patients. *Cassandra Uy*, *Paul Lysecki*, *Kamyar Kabnamoui*, *Forough Farrokhyar*, *Niv Sne*, *Laura Vanderbeek*. From McMaster University, Hamilton, Ont.

Background: Scoring systems have the potential to assist in prognostication, research, and decision-making in the management of trauma patients; however, they often include an extensive list of factors not easily evoked by clinicians at time of arrival. We aimed to develop a score easily recalled and applied by clinicians that would address significant predictors of inpatient mortality in adult trauma patients. **Methods:** A retrospective review of a single centre trauma database of patients was performed to identify variables contributing to mortality. Initial univariate analysis was performed on 19 candidate variables on a patient cohort within the database (2002–2006; $n = 2425$). Variables reaching statistical significance at $p < 0.10$ were entered into a stepwise multivariate logistic regression model, and those retaining significance at $p < 0.05$ were kept in the final score. For validation, the final score was then applied to a subsequent cohort of patients (2009–2013; $n = 2750$), whereby predicted versus actual mortality were compared. **Results:** Five variables were found to be significant and were used to create the FAITH (Fifty, Airway, INR, Tachycardia/bradycardia, Hyperglycemia) score. These included age > 50 years, presence of endotracheal intubation, INR > 1.3 within the first 24 hours, abnormal heart rate (< 60 or > 100 bpm) on arrival, and hyperglycemia > 11.0 mmol/L on arrival. Application of the FAITH score to the validation cohort showed concordance of 82.4% between predicted and observed mortality. **Conclusion:** The FAITH score can be a straightforward model used to predict mortality and provide support in decision-making and prognostication of adult trauma patients.

Geriatric burn patients who survive to discharge have reasonable recovery of function at 1-year follow-up. *Kristen Arnold†*, *Erica Hodgman**, *Steven Wolf**, *Karen Kowalske**, *Radha Holavanahalli**, *Brett Arnold†*, *Colleen Ryan†*, *Jeffrey Schneider†*, *Tam Phan†*, *Herb Pbelan†*. From the *UT Southwestern Medical Center, Dallas, Texas; the †Harvard Medical School, Boston, Md.; and the †Harborview Medical Centre, Seattle, Wash.

Background: Our group previously created a decision aid for geriatric burn patients and their surrogates to impart information regarding probability of outcomes after injury. We sought to supplement this tool with prognostic information related to function at 1 year postdischarge. **Methods:** The Burn Model System (BMS) database was queried for all burned patients aged ≥ 65 years admitted to a BMS centre between Jan. 1, 1994, and

Sept. 29, 2015, with 1-year postdischarge follow-up data. Patients were grouped into deciles using the well-established Baux score (age + total body surface area [TBSA] burned; e.g., 65–69, 70–79, ... ≥ 110). Preburn (PRE), and 1-year follow-up (POST) Short Form 12 (SF-12) questionnaires were used to assess functional status. **Results:** The sample was 84 patients (mean age 73.3 ± 6.0 yr, 65.4% men, mean TBSA 15.2 ± 11.7%, 72.8% flame burn, 77.8% home discharge disposition). Overall mean difference between PRE/POST SF-12 scores was -8.5 ± 17.1; there was no difference between PRE and POST SF-12 scores among Baux deciles on analysis of variance (Figure). Only male sex increased odds of failure to return to PRE score on logistic regression; when differences between PRE and POST scores were assessed as continuous variables using linear regression, male sex and PRE score predicted lower probability of return to baseline function. **Conclusion:** In this sample of burned seniors who were primarily discharged home postinjury, functional recovery was high at 1 year postinjury and was not related to severity of injury.

Proof of principle in a Canadian level 1 trauma centre: the use of resuscitative endovascular balloon occlusion of the aorta (REBOA). *Timothy Rice, Najma Ahmed, Joao Rezende Neto, Mark Wheatcroft, Vikram Prabbudesai, Sandro Rizoli.* From St. Michael's Hospital, Toronto, Ont.

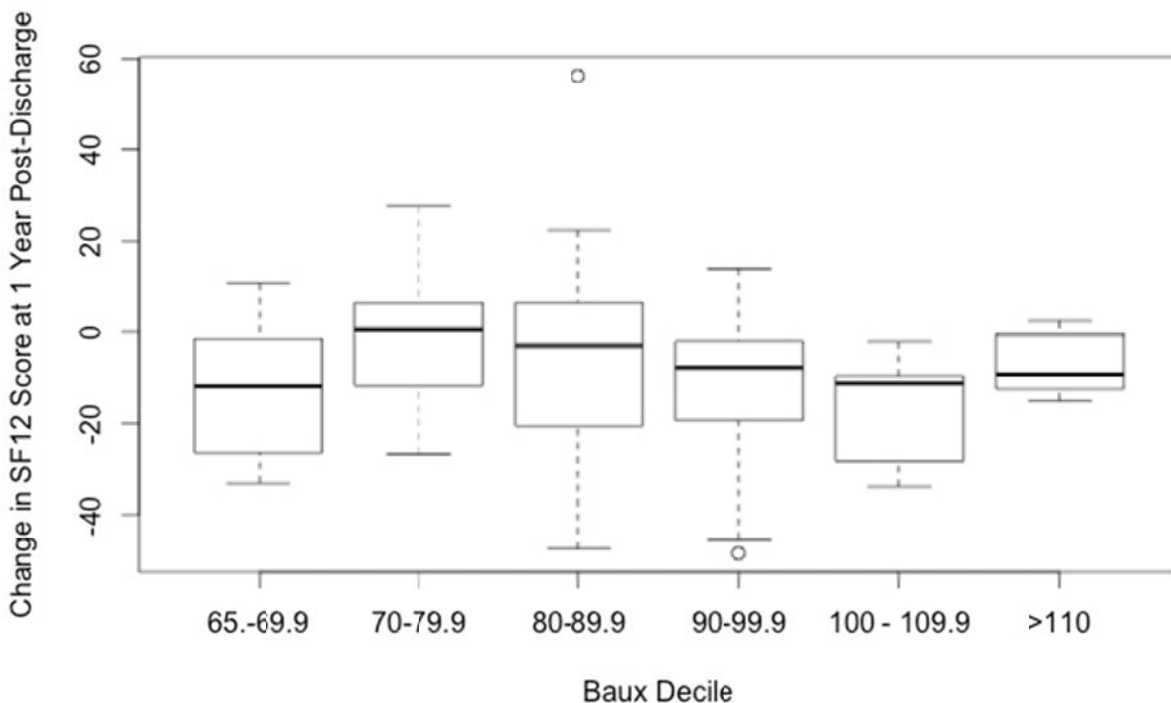
Background: The use of REBOA may have potential as an adjunct for treating hemorrhagic shock. We describe our REBOA protocol and its first application in a Canadian level 1 trauma centre. **Methods:** We report the use of REBOA in hemorrhagic shock from a pelvic fracture. Criteria for protocol activation is FAST-negative blunt pelvic trauma with sustained SBP < 100 mm Hg. Key aspects of the protocol involve transferring

patient with REBOA kit to multipurpose operating room (MPOR) and the vascular surgeon being present. **Results:** Arterial access was obtained by left common femoral artery cutdown. A 12-Fr sheath and 32 mm Coda balloon were positioned in Zone III. Time from protocol activation to MPOR was 59 min, from MPOR to cutdown was 63 min, from cutdown to balloon insertion was 9 min, and for arterial repair was 35 min. REBOA was in situ for 37 min. Mean SBP pre-REBOA was 113 ± 18 mm Hg. REBOA increased mean SBP by 11.3 ± 6.9 mm Hg. Hemoglobin increased 18%. There were no complications. **Conclusion:** Implementation of REBOA at a Canadian level 1 trauma centre is feasible. Arterial access was established quickly. Time from protocol activation to balloon insertion was longer than expected and attributed to perioperative airway management.

	Pre-REBOA	2 h post-REBOA	24 h post-REBOA
Lactate, mmol/L	7.3	7.1	4.0
Base excess, mmol/L	-19.6	-19.1	-2.2

Isolated physiologic indications are associated with failure to achieve primary fascial closure in the open abdomen: an analysis of physiologic subgroups. *Timothy Rice*, Dave Paskar*, Sandro Rizoli†, Najma Ahmed†, Ori Rotstein†, Rosane Nisenbaum†, Joao Rezende Neto†.* From the *University of Toronto, Toronto, Ont.; and †St. Michael's Hospital, Toronto, Ont.

Background: The Rezende Classification described 3 indications for the open abdomen (OA): physiologic (P), anatomic (A), and logistical (L). Physiologic reasons were highly prevalent and associated with a higher risk of failure to achieve primary fascial closure



(PFC). This study examined a cohort of patients with physiologic indications for OA and sought to identify a subgroup that may be at increased risk for failure to achieve PFC. **Methods:** A single-centre retrospective review of prospectively collected data on patients participating in an OA study. Patient-level characteristics, outcomes, and PFC rates were compared among 4 groups: those with isolated physiologic (iP) indications and those with multiple indications (physiologic in combination with other indications [PA, PL, PAL]). Data were analyzed using χ^2 , Kruskal-Wallis, and logistic regression. **Results:** There were 39 (11 P, 8 PL, 10 PA, 11 PLA) patients studied. Sex distribution (76.3% male), mortality (47.4%), median age (32.0 [IQR 25.8–47] yr), mean ISS (22.7 \pm 5.5), median ICU LOS (5.0 [IQR 1.0–26.3]), and median hospital LOS (7.0 [IQR 1.0–36.3]) were similar among groups. iP indications had the lowest rate of PFC and the highest mortality. The largest discrepancy was between iP and PL for both PFC (9.1% vs 75.0%, $p = 0.006$) and mortality (81.3% v. 12.5%, $p = 0.006$). On logistic regression, the odds of PFC compared with iP were PL (30.0, 95% CI 2.21–406.0, $p = 0.011$) PA (2.5, $p = \text{NS}$) and PLA (8.0, $p = \text{NS}$). **Conclusion:** Patients with iP indications for OA are at high risk for failure to achieve PFC. The addition of a logistical indication conferred an increased likelihood of PFC.

The anticoagulated trauma patient: the Ontario experience in the era of direct oral anticoagulants. *Brendan Wood*, Sandro Rizoli†, Melissa McGowan†, Andrea Phillips‡, Barto Nascimento‡, Alun Ackery†, Michelle Sholzberg†.* From the *University of Toronto, Toronto, Ont.; †St. Michael's Hospital, Toronto, Ont.; and the ‡Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: The anticoagulated trauma patient is a particularly vulnerable population. Our current practice is guided by experience with patients taking vitamin K-dependent antagonists (VKA; e.g., warfarin). However, it is currently unknown how the increasing use of direct oral anticoagulants (DOACs) will change our trauma population. We collected data about this new subset of patients to compare their clinical characteristics to patients on preinjury VKA therapy. **Methods:** A retrospective review of anticoagulated trauma patients presenting to Toronto's 2 adult trauma centres, St. Michael's Hospital and Sunnybrook Health Sciences Centre, from June 2014 to June 2015 was undertaken. Patients were recruited through the 2 institutions' trauma registries and were eligible if they suffered a traumatic injury and were taking an oral anticoagulant preinjury. Clinical and demographic data were extracted by a trained reviewer and analyzed with descriptive statistics. **Results:** Our study recruited 85 patients, 33% were taking DOACs and 67% VKAs. Trauma patients on DOACs & VKAs, respectively, had similar baseline characteristics, such as age (75.9 v. 77.4 yr), initial ISS (16.9 v. 20.6) and concomitant antiplatelet use (7.1% v. 5.4%). Both groups' most common mechanism for injury was falls, and the most common indication for anticoagulation was atrial fibrillation. Patients on DOACs tended to have lower average INR (1.25 v. 2.3) and serum creatinine (94.9 v. 127.4). **Conclusion:** Patients on DOACs preinjury now account for a significant proportion of orally anticoagulated trauma patients. Patients on DOACs tended to have less derangement of basic hematological parameters complicating diagnosis and management of coagulopathy.

The effect of a public transit strike on a provincial trauma system. *Michael Butler*, Mete Erdogan†, Beth Sealy*, Robert Green‡.* From *Dalhousie University, Halifax, N.S.; the †Nova Scotia Trauma Program, Halifax, N.S.; and the ‡CDHA, NS Trauma Program.

Background: Disruptions in public transportation (PT) may result in increased motor vehicle traffic and collisions. In 2012, the Halifax Regional Municipality (HRM) experienced an interruption in PT due to a strike situation. The objective of this investigation was to determine the impact of PT interruptions on MVCs. **Methods:** Using data from the Nova Scotia Trauma Registry, we compared trauma patients seen in HRM hospitals during the PT strike with those who presented during the same periods before and after (2010–2011 and 2013–2014). We assessed for differences in number of presentations, proportion of trauma team activations (TTAs) as well as admission to hospital or special care unit, requirement for ventilator support, and in-hospital mortality. **Results:** Overall, there were 35 trauma patients in the strike interval (16 TTAs) and 108 in the non-strike interval (51 TTAs). There was no difference in in-hospital mortality (31.4% v. 31.5%), ventilator requirement (14.3% v. 15.7%), admission to hospital (65.7% v. 71.3%) or admission to a special care unit. There was no statistically significant difference in number of presentations or outcomes between the 2 groups. **Conclusion:** In our study, the disruption of PT did not result in increased rate of trauma or patient outcomes. Further investigations are warranted to confirm the finding of this investigation.

A novel device to control bleeding in penetrating cardiac injuries. *Joao Rezende Neto*, Timothy Rice*, Howard Leong-Poi*, Dylan Pannell†, Andrew Beckett†, Sandro Rizoli*.* From *St. Michael's Hospital, Toronto, Ont.; and the †Division of General Surgery, University of Toronto, Toronto, Ont.

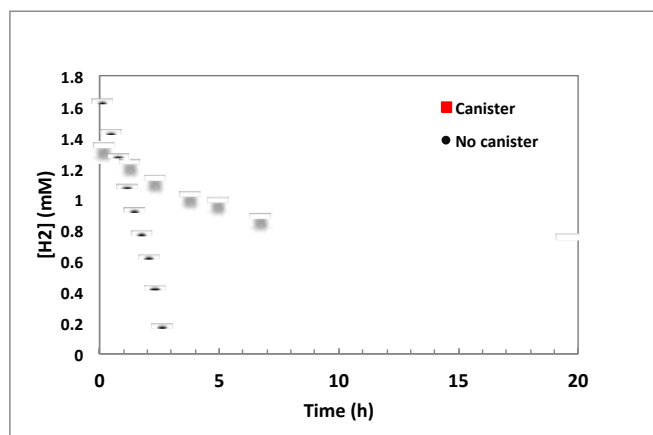
Background: Expedient hemorrhage control is vital in cardiac injuries. The Foley catheter is frequently used for that purpose, but increases wound size and interferes with cardiac function. A novel device was compared with the Foley catheter in an animal model of ventricular injuries. **Methods:** Yorkshire pigs ($n = 6$) underwent 1.5 cm ventricular stab wounds. The device consists of 2 membranes attached to a flexible shaft and is self-fixating. The shaft, inserted through the wound, automatically deploys the inner membrane occluding the injury from inside. The outer membrane sandwiches the ventricle and occludes externally. Biochemical and clinical characteristics were assessed. **Results:** Compared with baseline, there was a decrease in fibrinogen, INR/PTT, and hemoglobin and an increase in lactate and troponin (all $p < 0.005$) post-stab wounds. The device resulted in decreased right ventricular and left ventricular bleeding ($p = 0.022$ and $p = 0.030$, respectively), decreased wound size ($p = 0.005$), and a smaller reduction in stroke volume ($p = 0.020$; Table). **Conclusion:** The device outperforms the Foley catheter, negligibly interferes with cardiac function, is user-friendly, and controls bleeding in ventricular injuries.

	Device	Foley
LV BL, mL	81.7 \pm 11.9	187.5 \pm 40.3
RV BL, mL	58.7 \pm 11.3	147.7 \pm 30.9
Wound size, cm	1.5 \pm 0.1	1.8 \pm 0.1
SV, % change	-2.09	-12.48

Overcoming the challenge of intravenous infusion of hydrogen-enriched lactated Ringer's: a scavenger solution for reactive oxygen species in hemorrhagic shock. *Joao Rezende Neto*, Mohamed Serban Hamam†, Liqun Qiu‡, Chung Leung§, Carlos Semprun¶, Cynthia Gob‡, Richard Loo**, Schubert Pereira Júnior**, Eduardo Santos**.* From the *St. Michael's Hospital, Toronto, Ont.; the †University of

Toronto, Toronto, Ont.; the [‡]Department of Chemistry, University of Toronto, Toronto, Ont.; the [§]Keenan Research Centre for Biomedical Sciences, Toronto, Ont.; the [¶]Sunnybrook Health Sciences Centre, Toronto, Ont.; the ^{**}Department of Chemistry, Universidade Federal de Minas Gerais Brazil, Minas Gerais, Brazil.

Background: Reactive oxygen species (ROS) play a major role in the development of multiple organ failure in traumatic hemorrhagic shock. Hydrogen dissolved in resuscitation fluids has recently emerged as free radical scavenger in several experimental conditions that lead to ROS production. However, hydrogen (H₂) does not readily dissolve in aqueous fluids, hindering intravenous delivery of adequate intravascular levels in hemorrhagic shock (HS) resuscitation. **Methods:** We devised a novel technique to dissolve hydrogen gas in Lactated Ringer's (LR) solution at high pressure (4 atm) in a custom-built canister. The canister stores and delivers the LR/H₂ solution intravenously during HS resuscitation in an animal model. **Results:** Supersaturated levels (> 0.78 mM) of H₂-enriched LR (up to 1.3 mM) were produced and delivered intravenously to the animals. No gas embolism was detected and an adequate response to resuscitation was shown in all animals. Moreover, H₂ levels in LR solution remained supersaturated for up to 7 hours, allowing for prolonged resuscitation periods in HS (Figure). **Conclusion:** This is a novel technique to deliver high H₂ concentrations intravenously in a clinically relevant and stable solution. This approach does not result in gas embolism and is promising as a free radical scavenger in HS resuscitation.



Time dependent hydrogen concentration in LR/Hydrogen solution.

ABS QE and CE performance by a general surgery program with a surgical critical care fellowship. *Praveen Chatani, Joshua Ramjist, Christopher Pennell, Loren Harris.* From the Maimonides Medical Centre, Brooklyn, N.Y.

Background: Graduating surgical residents must pass both the American Board of Surgery (ABS) Qualifying (QE) and Certifying (CE) examinations. To examine the educational structures within surgical residency programs, we investigated the relationship between presence of an accredited Society of Critical Care Medicine (SCCM) fellowship and surgical trainee QE and CE performance. **Methods:** QE/CE performance data from 2009 to 2014 were collected from the ABS website and program information from the American Medical Association database. A Mann-Whitney test was used to compare overall exam performance. A

2-way analysis of variance was used to evaluate mean pass rates between programs with and without an SCCM fellowship at their institution. **Results:** Of 229 programs evaluated, 101 had a SCCM fellowship. Programs with and without SCCM fellowships had a mean passing percentage of 87.99% and 85.4%, respectively, ($p = 0.195$) on the QE; 84.32% and 77.13%, respectively, ($p = 0.00$) on the CE; and 75.69% and 68.5%, respectively ($p = 0.00$) on the QE/CE. University programs with an SCCM fellowship had a higher pass percentage on the CE than those without (85.01% v. 78.72%, $p = 0.02$). This difference was not reflected in exam performance for any other program type. **Conclusion:** Programs with an SCCM fellowship had significantly higher CE and QE/CE pass rates. Improvement in mean pass rates stratified across program type was not uniformly observed or significant. ABS examination performance may be the result of educational structures inherent to program types rather than routine resident exposure to high-acuity patients. These results highlight the need to further characterize training structures in place across multiple institutions.

Does the use of an RSI checklist and equipment silhouette in simulated emergency scenarios improve team performance and operational safety? *Devon McLean*, James French*, Jacqueline Fraser†, Susan Benjamin†, Paul Atkinson†.* From the *Emergency Medicine Department, Saint John Regional Hospital, Saint John, N.B.; and the †NB Trauma Program, Saint John, N.B.

Background: Rapid sequence induction (RSI) is an essential skill for emergency physicians, yet is not performed on a regular basis. It is a difficult procedure that poses risks for numerous complications. Evidence has shown procedural checklist to be effective in reducing complication rates. This study aims to determine the impact of a procedural checklist and standardized equipment placement on team performance and operational safety in simulated trauma scenarios. **Methods:** This prospective matched interventional study evaluates 40 teams. Teams that use the checklist and equipment silhouette are matched and compared with teams of equivalent competency that do not use these tools. Teams complete 1 high-fidelity simulated trauma scenario. Situational awareness, performance of safety-critical events, and crew resource management behaviours will be assessed using a collection of evaluation tools. **Results:** Hypothesis testing will be used to compare simulated patient and team characteristics, as well as to identify which performance errors are affected. κ values will be derived to reveal consistency between simulation assessments. The control and experimental event rate (events being safety critical errors, or significantly different mean VAS values for each action of behaviour) will be used to calculate the actual and relative risk reduction, and number needed to treat with an RSI checklist to avoid 1 simulated adverse outcome. **Conclusion:** RSI is inherently difficult to perform and is frequently the cause of adverse events. We have developed a procedural checklist and equipment silhouette in order to reduce the negative outcomes associated with this procedure.

Exposure to major trauma patients and safety-critical procedures. Part I: risk and reliability. *Susan Benjamin*, Ann Hogan*, Ian Watson*, James French†.* From the *NB Trauma Program, Saint John, N.B.; and the †Department of Emergency Medicine, Saint John Regional Hospital, Saint John, N.B.

Background: The mandate of the New Brunswick Trauma Program (NBTP) includes supporting excellence in trauma care. Exposure to major trauma has been shown to influence safety and effectiveness. This study aimed to understand true physician exposure at the province's level 1 trauma centre to cases and

high-risk procedures. Estimates of complication rates were also considered. **Methods:** A review of the NB trauma registry was performed for fiscal years 2012–2014. Data extraction identified the emergency physicians providing the initial patient assessment at the level 1 trauma centre for all patients with ISS > 12. A physician survey was conducted to further understand individual exposure, training and confidence. **Results:** A total of 196 patients had their initial patient assessment performed by 31 different emergency physicians. Patients who were transferred and bypassed the emergency department (ED) or were transferred and initially assessed by another specialist were excluded. Only 7 (23%) emergency physicians assessed more than 10 patients with ISS > 12 during the study period. When reviewing for age < 15, only 6% of these same ED physicians performed initial assessment on pediatric patients with ISS > 12. In addition, significant complication rates with high-risk procedures (e.g., RSI and chest drains) were considered. **Conclusion:** This information highlights the need to continue and further enhance competency-based training, simulation and systems design for all of the province's trauma centres. Maintenance of initial assessment skills and critical intervention competency for all ages of trauma patients needs to be supported within all provincial trauma centres, even the most resourced.

Impact of a prealert program for air ambulance response to major trauma patients in a provincial, inclusive trauma program: the New Brunswick experience. *James Orchard^{*}, Cathy Cormier^{*}, Allison Chisholm^{*}, James French[†], Tusbar Pische[†], Ian Watson[‡].* From the ^{*}New Brunswick Emergency Medical Services, Moncton, N.B.; the [†]Department of Emergency Medicine, Saint John Regional Hospital, Saint John, N.B.; and the [‡]NB Trauma Program, Saint John, N.B.

Background: Established in 2010, the NB Trauma Program includes Ambulance New Brunswick (ANB), the province's single EMS provider of land and air ambulance resources, as a formal partner to the program. As a result of this partnership, we undertook to define, implement and evaluate a system of prealerting the provincial dedicated fixed wing aircraft. The goal of prealerting is to reduce the interval between air ambulance notification and "wheels up" as part of the larger effort to reduce time to definitive care for major trauma patients presenting in rural and remote regions of the province. **Methods:** ANB and NB Trauma Program staff and physicians developed qualifying prealert criteria for potential trauma transfers from rural and remote sites in New Brunswick. Prealerting ensured that the flight and clinical crew completed all required weather, aircraft and equipment checks in preparation for departure before the mission was confirmed. Air ambulance response data for trauma patients meeting predefined location and clinical criteria were collected over pre- and post-implementation periods. **Results:** A significant decrease in the interval between patient arrival at first hospital and air ambulance "wheels up" was noted in the postimplementation cohort. **Conclusion:** Prealerting New Brunswick's dedicated fixed wing air ambulance significantly decreased the interval from patient arrival at first hospital to "wheels up." Further study is warranted to evaluate the impact on the total interval to definitive care.

Impact of repeated offering of the Rural Trauma Team Development Course (RTTDC) on trauma transfer intervals in a provincial, inclusive trauma system. *Shelley Woodford, Ann Hogan, Ian Watson.* From the NB Trauma Program, Saint John, N.B.

Background: The NB Trauma Program has provided the American College of Surgeons' Rural Trauma Team Development Course (RTTDC) to level 5 and level 3 designated trauma centres in NB since 2012. As a follow-up to a 2012 study, we reviewed the results from 3 level 5 designated facilities who received an additional RTTDC course in 2015 to determine if repeated offering of the course was associated with shorter intervals to trauma transfer activation. **Methods:** We compared times associated with all calls to the provincial Toll Free Trauma Referral System from these 3 level 5 designated trauma centres in NB during 2013 (after their first RTTDC course) against calls from June, July and August 2015 (after their second RTTDC course). The null hypothesis was that offering a second RTTDC course would not change time to activation of the Toll Free Trauma Referral System. **Results:** Completion of more than 1 RTTDC course per level 5 designated trauma centre in NB was associated with a reduction in time to activate the Toll Free Trauma Referral System. **Conclusion:** Additional RTTDC course offerings and/or targeting specific RTTDC student composition at level 5 sites may be indicated to shorten intervals to trauma transfer activation and total time to definitive care. Other factors contributing to decreased time to activation require further study.

Out in the sticks and stones may break your bones, but does rurality surely hurt you? Are you more likely to die from injury in a rural area? Trauma patient health equality in New Brunswick. *Matthew Kenney^{*}, James French^{*}, Jacqueline Fraser^{*}, Benoit Phelan of Emer[†], Ian Watson[‡], Susan Benjamin[‡], Allison Chisholm[‡], Paul Atkinson[§].* From the ^{*}Emergency Medicine Department, Saint John Regional Hospital, Saint John, N.B.; [†]Dalhousie Medicine New Brunswick, Dalhousie University, Saint John, N.B.; the [‡]NB Trauma Program, Saint John, N.B.; and the [§]Department of Emergency Medicine, Saint John Regional Hospital, Saint John, N.B.

Background: In New Brunswick, major trauma (ISS > 15) is responsible for over 350 deaths each year. The economic burden of injury in New Brunswick has been assessed at \$696 million per year, or approximately \$924 for every resident. Transport accidents alone account for \$120 million per year, thus further investigations into the pre-event, event, and postevent factors is warranted. We wish to examine if there are any differences in mortality and access to care between rural and nonrural motor vehicle collisions. **Methods:** A retrospective observational (registry) study comparing rural and nonrural adult and pediatric major trauma patients (ISS > 15) who were injured in a motor vehicle crash (ICD V20-V99) and presented to a level 1 or level 2 trauma centre in NB by EMS primary or secondary transfer between April 2011 and March 2013. **Results:** A total of 108 cases meet the study criteria and have been separated into rural and nonrural groups. Differences between the rural and nonrural groups will be compared using standard categorical statistical analysis using data points. Further inferential regression analysis will be used to understand what factors are associated with at-risk populations and locations as well as factors that are associated with changes in survival. **Conclusion:** Comparing these cases may expose some disparities that exist between factors that seem to be associated with increased occurrence amenable to injury prevention strategies and the care received by rural and nonrural patients amenable to trauma systems development.

The timely use of tranexamic acid in trauma. *Susan Benjamin, Ann Hogan, Allison Chisholm, Ian Watson.* From the NB Trauma Program, Saint John, N.B.

Background: The CRASH-2 study indicated that for qualifying trauma patients, administration of tranexamic acid (TXA) within the first 3 hours of injury is important to ensure clinical benefit and safety. Following implementation of a provincial massive transfusion protocol that included early consideration of TXA in the setting of major trauma or potential for hemorrhage, we sought to confirm whether TXA administration was completed within recommended timeframes. **Methods:** The New Brunswick Trauma Program's (NBTP) provincial trauma registry allows for review of the use of TXA in trauma patients who were either initially assessed at level 1, 2 and 3 trauma centres or received in transfer to 1 of those centres after resuscitation at a level 5 trauma centre. Trauma nurses reviewed the charts of all trauma patients who presented to hospital between Apr. 1, 2014, and Sept. 30, 2015, and recorded those who received TXA. Time of injury, time of TXA bolus administration and confirmation of intravenous TXA infusion was extracted and analyzed. **Results:** Fifty-two patients received TXA; 75% of those patients received TXA bolus within 3 hours of the best documented time of injury, yet only 29% received TXA infusion. **Conclusion:** A provincial trauma registry enables the review of evidence-based critical interventions as part of a regular quality review. Quality improvement initiatives have been instituted on the basis of analysis of this study to ensure the administration of TXA within 3 hours postinjury immediately followed by an infusion when indicated.

What are they doing now? An SBIRT evaluation. *Safia Mobamed, Zabra Hussein, Nasira Lakba, Richard Simons.* From the Vancouver General Hospital, Trauma Services, Vancouver, B.C.

Background: In October 2014, Vancouver General Hospital's (VGH) Trauma Service implemented a Screening, Brief Intervention and Referral to Treatment (SBIRT) program to identify and intervene with hazardous alcohol users. A preliminary evaluation was conducted in August 2015 to determine the effectiveness of the SBIRT program at reducing patients' alcohol consumption patterns to meet the National Low-Risk Alcohol Drinking Guidelines. **Methods:** Program effectiveness was evaluated through phone surveys with trauma patients. This included repeating the AUDIT-C questionnaire for a pre- and postprogram comparison. Additional quantitative and qualitative questions were asked to learn more about the impact of the brief intervention and referral to treatment components of the program. Patients selected to participate in the survey had been released from the hospital for a minimum of 4 weeks. **Results:** Eighteen out of 60 (30%) individuals consented to participate in the survey. When comparing the AUDIT-C scores from before and after SBIRT, 67% of individuals' AUDIT-C scores decreased. Over 50% of individuals declared they had made changes to their alcohol use since their visit to the hospital: 77% of individuals admitted to setting limits to how much they are drinking post SBIRT, and 83% of individuals declared they do not drink under dangerous circumstances. **Conclusion:** Despite its recent implementation, the SBIRT program at VGH echoes research indicating that alcohol screening, brief interventions, and referral to treatment can have a positive impact on patients' alcohol-related behaviour.

Thrombocytosis following splenic trauma and association with venous thromboembolism: a Toronto trauma registry cohort study. *Tyler Chesney, Tze L. Chia, David Isa, Gevork Mnatzakanian, Errol Colak, Sergio A. Acuna, Precilla Veigas, Joao Rezende Neto.* From St. Michael's Hospital, Toronto, Ont.

Background: While thrombocytosis is common following elective splenectomy and major trauma, there is little known about thrombocytosis after splenic trauma. Extreme thrombocytosis (platelet count $> 1000 \times 10^9$) is associated with increased risk of venous thromboembolism (VTE) in primary thrombocytosis leading to the use of ASA for risk reduction, but the need for this in trauma has not been demonstrated. **Methods:** Retrospective cohort study of all splenic trauma between Apr. 1, 2010, and Mar. 31, 2014, from a level 1 trauma centre registry in Toronto, excluding pregnancy. The association of splenic management type to thrombocytosis was evaluated using a multivariable logistic regression adjusting for potential confounders. As secondary outcomes, unadjusted odds ratios were estimated comparing splenic management type for the outcomes of extreme thrombocytosis and VTE and comparing extreme thrombocytosis and ASA use for the outcome of VTE. **Results:** A total of 162 patients were eligible. Incidence of thrombocytosis was 40.1% (65 of 162). Thrombocytosis was more likely following splenectomy compared with spleen-preserving strategies independent of length of stay, injury grade, ISS, age and transfusion (OR 7.92, 95% CI 2.38–26.31). Splenectomy was associated with extreme thrombocytosis (OR 9.82, 95% CI 3.42–28.20). However, splenectomy was not associated with VTE (OR 1.98, 95% CI 0.53–7.44), and VTE was not associated with extreme thrombocytosis or use of ASA. **Conclusion:** Spleen trauma is associated with thrombocytosis; this is more likely after splenectomy compared with spleen-preserving strategies. Further, splenectomy is also associated with extreme thrombocytosis. However, this is not associated with VTE, suggesting primary prophylaxis with ASA is not needed after splenic trauma.

Relative contraindication to percutaneous tracheostomy: Is it time to revise them? *Marissa Morgan-Cavallaro, Sara Najmeh, Maria Abou Kbalil, Brent Hopkins, Paola Fata, Andrew Beckett, Kosar Khwaja, Tarek Razek, Dan Deckelbaum, Jeremy Grushka.* From McGill University, Montreal, Que.

Background: The percutaneous approach has become the preferred technique for performing a tracheostomy, replacing the open approach in most cases. Several contraindications to the percutaneous approach were initially suggested that are being questioned as we gain more experience with this technique. The purpose of our study was to assess the validity of proposed contraindications to percutaneous tracheostomy and prove that this technique could be safely used in an extended patient population. **Methods:** All patients who underwent percutaneous tracheostomies between 2007 and 2008 in a single centre were identified. Data pertaining to patient demographics, anticoagulation status, cervical spine immobilization, previous neck surgery as well as early and late procedural complications were collected through a retrospective hospital chart review. **Results:** We identified 56 patients who underwent percutaneous tracheostomy (average age 57, male predominance). All procedures were performed in the ICU, anticoagulation was held in 61% of cases and 42% had evidence of coagulopathy before the procedure. Five percent of patients were obese, 10% had C-spine

precautions and 1 patient (< 1%) had a previous tracheostomy. One patient (< 1%) required conversion to the open approach, and 4 patients (2.2%) had evidence of significant bleeding despite holding anticoagulation. **Conclusion:** Thus far, our data demonstrate that with adequate training and planning, percutaneous tracheostomy can be performed safely in an extended patient population, including those with coagulopathies. Apart from its safety, it can offer advantages, including reduced cost and personnel use. We plan to expand our analysis to patients who underwent percutaneous tracheostomies from 2008 to 2015 to expand and validate our results.

Optimization of the medical and surgical management of traumatic spinal cord injury. *Ayoub Dakson, David Brandman, Ginette Thibault-Halman, Sean Christie.* From the Division of Neurosurgery, QEII Health Science Centre, Halifax, N.S.

Background: The optimal surgical and medical management of traumatic spinal cord injuries (SCI) is continually evolving. Studies have suggested improved neurologic outcome with augmentation of the mean arterial pressure (MAP) ≥ 85 mm Hg for 5–7 days post-SCI (class III evidence). Other studies have suggested improved outcomes for patients undergoing early (defined as < 24 h postinjury) surgical intervention. We sought to investigate the extent to which these interventions affected neurologic recovery in a controlled population. **Methods:** The Nova Scotia Trauma Database identified 94 cases of traumatic SCI. Follow-up data were available at 3 different time points (average of 26.7, 115.0, and 252.0 d postinjury). Neurological recovery was assessed using the American Spinal Cord Injury Association (ASIA) Injury Scale (AIS). **Results:** At an average 26.7 days postinjury, patients with MAP < 85 mm Hg for at least 2 consecutive hours during the 5-day period postinjury were 11.7 times less likely to demonstrate an improvement in AIS than patients with MAP ≥ 85 mm Hg ($p = 0.006$). This association was independent of early surgery or the severity of SCI ($p > 0.05$). At a mean of 252.0 days postinjury, a significantly greater proportion of SCI patients treated with early surgical decompression improved neurologically compared with patients in the late surgery group ($p = 0.031$). This was more prominent in the cervical SCI population. **Conclusion:** This study suggests that there may be improved neurologic outcomes in SCI patients who undergo early surgical decompression and maintenance of MAP ≥ 85 mm Hg for at least 5 consecutive days post-SCI.

Investigating the implementation of acute care guidelines for spinal cord injuries. *Ayoub Dakson, David Brandman, Ginette Thibault-Halman, Sean Christie.* From the Division of Neurosurgery, QEII Health Sciences Centre, Halifax, N.S.

Background: The optimal management of spinal cord injury (SCI) has been developing from ongoing clinical research, with best practice guidelines published in the literature. We sought to investigate the implementation of best practice guidelines for the management of traumatic SCI. **Methods:** Patients with SCI were identified using a centralized trauma registry. Data related to their acute interventions were obtained from a retrospective chart review. **Results:** A total of 94 patients were identified; 33% of these patients represented complete injuries. About 69% of patients were initially evaluated in an intermediate institution, which was associated with a significantly longer time to neurosurgical assessment compared with patients directly transported to the trauma centre (11.7h \pm 15.2 v. 2.2h \pm 2.7, $p < 0.001$). Pres-

sure ulcers occurred in 16.0% (95% CI 9.9%–24.7%) of SCI patients and were associated with prolonged time of transportation compared with SCI patients without pressure ulcers (12.2 \pm 28.9 v. 8.3 \pm 7.9, $p = 0.104$). Venous thromboembolism (VTE) occurred in 11 patients (11.7%, 95% CI 6.7%–19.8%), all of whom were in the surgically treated group. DVT prophylaxis was initiated within 24 hours in 73% of cases, with the remainder receiving prophylaxis ≥ 24 hours postoperatively. A higher percentage of patients treated with heparin (75%) was diagnosed with VTE, compared with 26.9% of those treated with low molecular weight heparin ($\chi^2 = 3.6$, $p = 0.058$). **Conclusion:** This study reflects the requirement for further optimization of pre-hospital and hospital management of SCI in order to improve the clinical outcomes in this patient population.

Dural sinus thrombosis after TBI: a description of current management and mortality. *Dafna Somogyi*, Allison Bethune†, Leo Dante Da Costa†.* From the *Sunnybrook Health Sciences Centre, Toronto, Ont.; and the †Department of Surgery, Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: Development of dural sinus thrombosis (DST) after TBI is unpredictable, and consistent treatment protocols are lacking. Our aims were to determine the DST incidence after moderate/severe TBI and describe current approaches in a large urban trauma centre. **Methods:** Retrospective review at a level 1 trauma centre between February 2008 and June 2012. **Results:** A total of 1807 patients (≥ 17 yr) with a GCS score < 13 or AIS head score ≥ 3 were identified; 427 had CT angiography/venography based on suspicion of trauma-related vascular lesion, and 3% (55 of 1807) had confirmed DST. Mortality was 40% when DST was confirmed, which was significantly higher than general TBI mortality (20%). Among those with confirmed DST, age, sex, GCS score and presence of skull fracture were not associated with mortality, while AIS head score of 5 was ($p = 0.01$). Management of DST included conservative (27%), heparin (5%), ASA (11%), or both (56%). Therapeutic approach was associated with mortality ($p < 0.001$): 93% (14 of 15) for conservative management, 100% (2 of 2) for heparin, 33% (2 of 6) for ASA and 13% (4 of 30) for both. **Conclusion:** The incidence of DST after TBI is approximately 3%, and mortality is 40%. No standard approach is available. Mortality with DST seems to be higher, but has to be analyzed with care due to selection bias. Findings suggest that more aggressive therapy for the DST might be considered. We aim to examine time to initiate prophylaxis/treatment after DST confirmation in the context of polytrauma in an attempt to understand appropriate timing of anticoagulation in this population.

64-slice CT compared with MRI to clear cervical spine injury in high-risk obtunded blunt trauma patients. *Jessica McCallum*, Patrick McLaughlin*, Morad Hameed†, Hussein D. Kanji‡.* From the *Department of Radiology, Vancouver General Hospital, Vancouver, BC; the †Trauma Services, Vancouver General Hospital, Vancouver, B.C.; and the ‡Department of Critical Care, Vancouver General Hospital, Vancouver, B.C.

Background: Clearance of cervical spine (CS) injury is of paramount importance. In obtunded patients, CS clearance is challenging. However, maintaining CS precautions until an MRI is obtained is associated with morbidity. This study sought to determine whether a negative 64-slice CT scan is sufficient to clear CS

injury. **Methods:** Consecutive adult blunt trauma patients admitted to a regional level 1 trauma centre from Apr. 1, 2008, to Mar. 31, 2012, were screened for inclusion. High-risk, GCS score < 14, blunt trauma patients admitted to the ICU with a negative 64-slice CT and MRI of diagnostic quality were included. Images were rescreened by a blinded trauma radiologist. Details of missed injuries and clinical impact were collected. The primary outcome was percent missed clinically significant injury. **Results:** A total of 5891 blunt trauma patients were admitted to the ICU, of which 44 met the inclusion criteria. Patients had a median ISS of 36. Eight of 44 patients had a positive finding on MRI. One patient died before documentation of clinical decision, and 5 findings were clinically insignificant. Two patients (5%) with lateralizing findings on clinical examination had missed injuries requiring immobilization with a collar. One of these patients had a congenital anomaly that confounded CT interpretation. **Conclusion:** In high-risk obtunded blunt trauma patients admitted to the ICU, a negative 64-slice CT scan alone had a missed clinically significant injury rate of 5%. When considered with 4-limb motor function, a negative CT scan may be sufficient. A prospective study is required to confirm these findings.

Traumatic injury in the oil industry. *Jerry Dang^{*}, Erica Lester^{*}, Warren Sun^{*}, Mark Dykstra^{*}, Vanessa Fawcett^{*}, Sandy Widder[†], Bonnie Tsang[†].* From the ^{*}University of Alberta, Edmonton, Alta.; and the [†]University of Alberta Hospital, Edmonton, Alta.

Background: The oil industry represents approximately 6% of Canada's GDP, with approximately 80% of revenue generation occurring in the province of Alberta. The industry employs approximately 390 000 people nationally, with 20 000–60 000 people engaged directly in operations and construction. These workers are subject to risks and dangers of an environment wrought with heavy machinery, complicated technology and a harsh climate. Trauma centres in Alberta treat a significant number of industry-related injuries. The number and types of injuries seen has not been analyzed, and modifiable risks and costs associated with these adversities have not been examined. We sought to quantify and describe the injuries and determine predictive factors that may aid in reducing injuries, triaging injured patients and treating injured workers to minimize morbidity, mortality and the economic impact of these traumatic events. **Methods:** A retrospective study was conducted on patients admitted from January 2009 to January 2014. Patients were identified from the Alberta Trauma Registry using data from the Worker's Compensation Board of Alberta. Inclusion criteria are age ≥ 16 years, trauma occurring in Alberta secondary to work related to the oil industry and ISS ≥ 12 or AIS ≥ 3 . Data were collected on basic demographics, details of the trauma, ISS, AIS, Revised Trauma Score, mechanism of injury and operative procedures. Outcome measures were also collected, including length of stay, complications, mortality and unplanned readmissions. Descriptive analysis and cost analysis was performed. **Results:** Pending. **Conclusion:** Pending.

Development and implementation of quality indicators for acute care surgery. *Dave Paskar^{*}, Timothy Rice[†], Amanda McFarlan[†], Najma Ahmed[†], Bernard Lawless[†], John Marshall[†], Joao Rezende Neto[†], Sandro Rizoli[†].* From the ^{*}University of Toronto, Toronto, Ont.; and [†]St. Michael's Hospital, Toronto, Ont.

Background: In trauma, the practice of striving for care excellence through the development and ongoing monitoring of qual-

ity data indicators is well-established. However, in the burgeoning companion field of acute care surgery (ACS), a formalized approach to quality is not as entrenched and in need of development. ACS literature frequently suggests that the presence of ACS experts and dedicated teams result in patients with general surgery emergencies receiving higher quality of care. **Methods:** At our institution (an academic level 1 trauma centre with a dedicated trauma and ACS service), we are building on the early ACS literature and the quality experience in trauma to develop a formal quality mechanism for monitoring and improving our ACS service. This process was initiated by the creation of a prospective ACS patient registry and database, and our current focus is on the development of explicit ACS quality markers, both general (i.e., timeliness of care, complications) metrics as well as disease-specific parameters (i.e., incidence of postappendectomy abscess). **Results:** The development of the indicators included will be informed by scientific evidence and perceived standards of care (i.e., same admission cholecystectomy for gallstone pancreatitis) as well as the incorporation of local inquiries and areas of concern. **Conclusion:** Planned future uses of our ACS registry and quality indicators include clinical research, development of protocolized treatment pathways, manpower scheduling and allocation, as well as the institution of dedicated ACS quality assurance meetings informed by performance data and detection of critical events.

Exploring logistical reasons for leaving the abdomen open in trauma: Does surgeon workload and time of day matter? *Dave Paskar^{*}, Timothy Rice[†], Joao Rezende Neto[†], Amanda McFarlan[†], Sandro Rizoli[†].* From the ^{*}University of Toronto, Toronto, Ont.; and [†]St. Michael's Hospital, Toronto, Ont.

Background: The Rezende-Neto classification for the open abdomen decision-making following trauma/acute care laparotomy (TL) encompasses anatomic, physiologic and logistical factors. The need for sequential intraperitoneal revisions is the main logistical determinant demonstrated to date. This work seeks to explore whether surgeon workload, demands and fatigue are other logistic factors associated with leaving the abdomen open. **Methods:** All patients undergoing TL at our institution between 2008 and 2015 were identified from our trauma registry. Demographics and outcomes, including whether the abdomen was left open after initial TL were assessed. Time of surgery initiation was recorded and used to formulate workload metrics. Data were analyzed using χ^2 , Mann-Whitney and logistic regression tests. **Results:** A total of 453 patients underwent TL; 90 had an open abdomen postoperatively. Patients left open were significantly older, more likely to have sustained blunt trauma (75.6% v. 51.5%), and to have comorbid head injury. Open abdomens were predicted significantly by ISS (37.98 v. 22.69) and physiologic parameters, such as body temperature (35.7°C v. 34.9°C), base deficit (11.1 v. 5.3) and coagulopathy (PTT 37.98 v. 22.69). Night-time surgery and measures of mounting operative trauma workload did not predict the likelihood of a patient's abdomen being left open. **Conclusion:** Fatigue and workload do not influence the decision-making of trauma surgeons in terms of whether or not to leave the abdomen open following TL.

Opinions of practising surgeons regarding the appropriateness of published indications for use of damage control surgery in trauma patients: an international cross-sectional survey. *Derek Roberts^{*}, David Zygun[†], Peter Faris[†], Chad Ball[‡], Andrew Kirkpatrick[§], Henry Thomas Stelfox[¶].* From

the *Departments of Surgery and Community Health Sciences, University of Calgary, Calgary, Alta.; the †Department of Community Health Sciences and the Division of Critical Care Medicine, University of Alberta, Calgary, Alta.; the ‡Departments of Surgery and Oncology, Foothills Medical Centre and University of Calgary, Calgary, Alta.; the §Departments of Surgery and Critical Care Medicine, Foothills Medical Centre and University of Calgary, Calgary, Alta.; and the ¶University of Calgary, Calgary, Alta.

Background: Variation in use of damage control (DC) surgery across trauma centres may be partially driven by the uncertainty that exists as to when the procedure is appropriately indicated. We sought to determine opinions of practising surgeons regarding the appropriateness of published indications for trauma DC surgery. **Methods:** We asked 384 trauma centres in the United States, Canada, and Australasia to nominate 1–3 surgeons at their centre to survey about DC surgery. We then asked nominated surgeons their opinions on the appropriateness (expected benefit:harm ratio) of 43 candidate indications for use of DC surgery in adult civilian trauma patients. **Results:** In total, 232 (64.8%) trauma centres provided a response. These centres nominated 366 surgeons, of whom 201 (56.0%) responded. Respondents assessed 15 (78.9%) preoperative and 23 (95.8%) intraoperative indications to be appropriate. Indications respondents agreed had the greatest expected benefit included a temperature < 34°C, arterial pH < 7.2, and laboratory-confirmed (INR/prothrombin time and/or partial thromboplastin time > 1.5 times normal) or clinically observed coagulopathy; administration of > 10 units PRBCs; requirement for a resuscitative thoracotomy in the emergency department; identification of a juxtahepatic venous injury or devascularized or destroyed pancreas, duodenum, or pancreaticoduodenal complex during operation; and an intraoperative arterial pH persistently < 7.2. **Conclusion:** This study identified 38 indications that practising surgeons agreed appropriately indicated use of DC surgery. The consistent agreement among respondents regarding indication appropriateness suggests that uncertainty regarding when the procedure is indicated may not be the cause of regional variation in its use.

Systematic review of evidence for indications for use of damage control surgery and damage control interventions in civilian trauma patients. *Derek Roberts**, *Niklas Bobrovitz†*, *David Zygun‡*, *Andrew Kirkpatrick§*, *Chad Ball¶*, *Peter Faris†*, *Henry Thomas Stelfox†*. From the *Departments of Surgery and Community Health Sciences, University of Calgary, Calgary, Alta.; the †University of Calgary, Calgary, Alta.; the ‡Department of Community Health Sciences and the Division of Critical Care Medicine, University of Alberta, Calgary, Alta.; the §Departments of Surgery and Critical Care Medicine, Foothills Medical Centre and University of Calgary, Calgary, Alta.; and the ¶Departments of Surgery and Oncology, Foothills Medical Centre and University of Calgary, Calgary, Alta.

Background: Although damage control (DC) surgery may reduce mortality in severely injured patients, survivors often suffer significant morbidity, suggesting that the procedure should be used only when indicated. The purpose of this systematic review was to determine which indications for DC surgery and DC interventions in civilian trauma patients have evidence of supporting that they are reliable and/or valid. **Methods:** We searched 11 electronic bibliographic databases (1950–Mar. 1, 2015) and the grey literature for studies reporting data on the reliability or validity of suggested indications for DC surgery or

DC interventions. Two investigators independently extracted data and assessed study risk of bias. **Results:** Among 31 014 citations identified, we included 33 cohort studies (29 retrospective, 2 retrospective and prospective, and 2 prospective) and 3 cross-sectional surveys in the systematic review. Of the 71 unique indications for DC surgery evaluated, 19 had evidence of face validity or were associated with poor outcomes among patients largely not treated with DC surgery. Six had evidence supporting that they were associated with improved survival when used or when DC was conducted instead of definitive surgery. Three indications (pre- or intraoperative hypothermia or acidosis and unstable patients with combined abdominal vascular and pancreas gunshot injuries) had evidence that they were associated with reduced survival and that survival may be improved with DC surgery. **Conclusion:** Few indications for DC surgery or DC interventions have evidence supporting that they are reliable and/or valid. Adequately designed prospective studies are urgently required.

A retrospective quality control study of goals of care designation in geriatric trauma patients. *Amir Taberi*, *Bobyung Min*, *Vanessa Fawcett*, *Bonnie Tsang*, *Sandy Widder*. From the Department of Surgery, University of Alberta, Edmonton, Alta.

Background: Nonintentional injury is the sixth leading cause of death in Canada among people aged 65–74 and seventh leading cause of death for those aged ≥ 75 years. When adjusted for severity of injury, geriatric trauma patients have a higher mortality in hospital and after discharge. Discussion of goals of care can prevent prolonged and futile care. In this quality assurance study, we reviewed all geriatric trauma patients to determine the compliance and pattern of practice on discussion and documentation of goals of care. **Methods:** In this retrospective study, geriatric (≥ 65 years) trauma patients with an ISS ≥ 12 were identified from the Alberta Trauma Registry. Patients with non-acute (time of injury > 24 h from time of presentation) trauma, submersion or drowning were excluded. Patients' demographics, goals of care designation and their subsequent change during admission were reviewed. **Result:** A total of 336 patients were reviewed. The most common trauma mechanism was fall (70.3%) followed by MVC (19.6%). A total of 109 patients (32%) had their goals of care documented (58% happened in the first 24 h). Goals of care discussions were mostly done by non-surgeon staff or residents. There was a higher rate of goals of care documentation in patients older than 80 years. **Conclusion:** Goals of care designation/documentation needs to be improved, and should occur with every admission. Improvement strategies should include increased education among surgeons, and an increased focus on patient- and family-centred care.

Use of the iTClamp for arrest of hemorrhage after self-inflicted injury: a utilization review. *Jessica McKee**, *Derek Roberts**, *Ian McKee†*, *Chad Ball‡*, *Andrew Kirkpatrick§*. From the †Innovative Trauma Care and the Departments of Surgery, Community Health Sciences and Critical Care Medicine, Calgary, Alta.; the †Edmonton Fire Department, Edmonton, Alta.; the ‡Departments of Surgery and Oncology, Foothills Medical Centre and University of Calgary, Calgary, Alta.; and the §Departments of Surgery and Critical Care Medicine, Foothills Medical Centre and University of Calgary, Calgary, Alta.

Background: In recent years there were over 800 000 suicide attempts and over 41 000 deaths by suicide in the US. While firearm, suffocation and poisoning are reported as the most common/

most lethal methods of suicide, cutting is reported as the second leading method of attempted suicide, meaning hemorrhage control in this population can be a challenge for first responders. **Methods:** We conducted a utilization review of iTClamp use for the treatment of self-inflicted hemorrhage. **Results:** Of the 192 cases that were reported, 14 cases (7.3%) were suicide/self-inflicted injury. In total, 85.7% of the iTClamps were placed on the scene on laceration(s) to the arm ($n = 9$, 75%), neck ($n = 2$, 16.7%) or groin ($n = 1$, 8.3%). Bleeding was successfully controlled on the scene by the iTClamp in 91.7% of cases, and in 1 case the iTClamp was removed from the arm in favour of a tourniquet. Alternatively, direct pressure ($n = 4$, 33.3%) and tourniquet use ($n = 1$, 8.3%) were abandoned on the scene in favour of iTClamp placement. The remaining 14.3% of the iTClamps were placed in the emergency department (ED) on the neck ($n = 1$) and arm ($n = 1$). Of the 2 ED cases, 1 resulted in tourniquet conversion. During the second ED case wound packing was abandoned in the neck due to fear of occluding the airway when the hemostatic gauze was seen disappearing down the trachea. No deaths were reported. **Conclusion:** Completed and attempted suicide are a concern both in the US and worldwide. The iTClamp may offer an additional tool for first responders to use in this special population.

iTClamp use in anticoagulated patients. *Jessica Mckee^{*}, Ian McKee[†], Derek Roberts[‡], Chad Ball[§], Paul McBeth[¶], Tony LaPorta^{**}, Andrew Kirkpatrick^{††}, Alan Molaff^{**}, Edward Tan^{**}.* From ^{*}Innovative Trauma Care, Edmonton, Alta.; the [†]Edmonton Fire Department, Edmonton, Alta.; the [‡]Departments of Surgery, Community Health Sciences, and Critical Care Medicine, Calgary, Alta.; the [§]Departments of Surgery and Oncology, Foothills Medical Centre and University of Calgary, Calgary, Alta.; the [¶]Department of Surgery, Foothills Medical Centre and University of Calgary, Calgary, Alta.; and the ^{**}Departments of Surgery and Critical Care Medicine, Foothills Medical Centre and University of Calgary, Calgary, Alta.

Background: Anticoagulation is now ubiquitous in the general population and is an emerging challenge for trauma care providers attempting to stop the bleeding. Traditional hemorrhage control strategies (direct pressure, packing, hemostatic agents) rely on the body's ability to form a blood clot. **Methods:** Since May 2013, 207 clinical cases of the iTClamp have been reported. We examined these cases for patients who were anticoagulated to ascertain the effectiveness of iTClamp application in this patient population. **Results:** Six patients were reported as being anticoagulated, including 1 patient on rivaroxaban, 2 on warfarin and 3 unknown at the time of iTClamp application. All patients were male with a mean age of 77.0 ± 18.5 years. Each patient required the use of 1 iTClamp. Wound locations included the scalp (33.4%), neck (33.4%), leg (16.6%) and groin (16.6%). In all, 66.7% ($n = 4$) of the iTClamps were applied in hospital and the remaining 33.3% ($n = 2$) were applied in the field. Mechanisms of injury included falls (33.3%), iatrogenic (33.3%), self-inflicted (16.6%) and unknown (16.6%). After device application 66.8% ($n = 4$) of the cases reported no rebleeding, in 1 case (16.6%) rebleeding was unknown and in another case there was rebleeding but device reapplication was not required. The majority ($n = 5$, 83.4%) of respondents felt bleeding was adequately controlled with the iTClamp (including the case of rebleeding), and 1 respondent did not answer. In 50% of cases ($n = 3$) packing/direct pressure was abandoned in favour of the iTClamp when bleeding could not be controlled. **Conclusion:** This case series demonstrates that the iTClamp may be an appropriate tool for hemorrhage control in anticoagulated patients.

iTClamp 4-month training retention demonstrated by tactical police. *Jessica Mckee^{*}, Ian McKee[†], Paul McBeth[‡], Chad Ball[§], Andrew Kirkpatrick[¶].* From ^{*}Innovative Trauma Care, Edmonton, Alta.; the [†]Edmonton Fire Department, Edmonton, Alta.; the [‡]Department of Surgery, Foothills Medical Centre and University of Calgary, Calgary, Alta.; the [§]Departments of Surgery and Oncology, Foothills Medical Centre and University of Calgary, Calgary, Alta.; and the [¶]Departments of Surgery and Critical Care Medicine, Foothills Medical Centre and University of Calgary, Calgary, Alta.

Background: Providing hemorrhage control training and tools to nonmedical providers should save lives in trauma. However, it remains difficult to retain both technical and didactic skill sets unless used on a frequent basis. This is particularly problematic for nonmedical responders. **Methods:** Tactical police officers were initially trained in the use of the iTClamp with these skills tested immediately following training using a simulated wound (acquisition phase) with both dry and wet (to simulate blood) latex gloves. Four months after the original acquisition phase, officers were retested (retention testing) replicating the original scenario used during acquisition testing. **Results:** A total of 65% ($n = 15$) of tactical police officers completed both the acquisition and retention phases of the study, and 14 of 15 officers demonstrated proficiency 4 months after original training with no re-training or exposure to the device. A single officer could not perform the task. The first application during the acquisition phase was significantly faster ($p = 0.001$) than the first application during the retention phase. However, there was no significant difference with the second application between the phases. When comparing all applications during acquisition to all applications during retention, acquisition was significantly faster ($p = 0.009$). However, median retention application time was still only 9.5 (IQR 7.75) seconds, and officers reported no significant difference in their user feedback between acquisition and retention, with a median positive user satisfaction of 10 out of 10 (IQR 1). **Conclusion:** The iTClamp was considered easy to use, and initial training was time-durable even in nonmedical personnel.

The Canadian Prehospital Evidence-based Practice (PEP) Project: program description of a contemporary knowledge translation resource. *Alix Carter^{*}, Jan Jensen^{*}, Jennifer Greene^{*}, Judah Goldstein[†], Jolene Cook[†], David Petrie[†], Janel Swain[†], Fidgen Dana[†], Andrew Travers[†], Ed Cain[†].* From ^{*}Dalhousie University, Halifax, N.S.; and [†]Emergency Health Services, Halifax, N.S.

Background: Emergency medical services (EMS) leaders and practitioners need to translate research evidence into safe and effective clinical practice. The Canadian Prehospital Evidence-based Practice (PEP) Project is an online, freely accessible, continuously updated repository of systematically searched and critically appraised evidence specific to EMS. **Methods:** The purpose of PEP is to identify, catalogue and critically appraise relevant studies, with summary recommendations of the state of evidence for each EMS intervention. On a regular schedule by topic, PubMed is systematically searched using medical subject headings and title/abstract keywords. The project coordinator conducts searches and reviews titles and abstracts for relevance. Selected articles are distributed to trained appraisers from across Canada and other countries. Two appraisers independently review each full-text article, assigning a score on 3-point level of evidence (LOE) scale and a 3-point direction of evidence (DOE) scale for each intervention, based on the study findings for the primary outcome. Senior appraisers summarize the evidence for

each clinical intervention in a 3×3 (LOE \times DOE) evidence table. **Results:** Pending. **Conclusion:** The Canadian PEP project is an effective knowledge translation tool, specific to EMS. End-users can easily identify which clinical interventions are, or are not, supported by evidence. Gaps in the literature are exposed by PEP. PEP can be used for developing or updating EMS clinical practice guidelines and protocols.

State of the evidence for Emergency Medical Services (EMS) care of blunt spinal trauma: an analysis of appraised research from the Canadian Prehospital Evidence-based Practice (PEP) Project. *Alix Carter^{*}, Jan Jensen^{*}, Jennifer Greene^{*}, Judah Goldstein[†], Jolene Cook[†], Janel Swain[†], Fidgen Dana[†], Ed Cain[†].* From ^{*}Dalhousie University, Halifax, N.S.; and [†]Emergency Health Services, Halifax, N.S.

Background: The Canadian Prehospital Evidence-based Practice (PEP) project is an online, freely accessible, continuously updated EMS evidence repository. The summary of research evidence for EMS interventions used to care for blunt spinal trauma is described. **Methods:** PubMed was systematically searched. One author reviewed titles and abstracts for relevance. Included studies were scored by trained appraisers on a 3-point level of evidence (LOE) scale (based on study design and quality) and a 3-point direction of evidence (DOE) scale (supportive, neutral, or opposing results). Second-party appraisal was conducted for included studies. Interventions were plotted on a 3×3 table (DOE \times LOE) for the spinal injury condition based on appraisal scores. The primary outcome was identified for each study and categorized. **Results:** Seventy-seven studies were included. Evidence for adult and pediatric blunt spinal trauma interventions was as follows: supportive-high quality ($n = 1, 7\%$), supportive-moderate quality ($n = 3, 21.4\%$), supportive-low quality ($n = 1, 7\%$), neutral-high quality ($n = 1, 7\%$), neutral-moderate quality ($n = 5, 35.7\%$), neutral-low quality ($n = 1, 7\%$), opposing-high quality ($n = 0, 0\%$), opposing-moderate quality ($n = 0, 0\%$), opposing-low quality ($n = 1, 7\%$). One (7%) intervention had no evidence. Interventions with supportive evidence were steroids, cervical spine clearance, scoop stretcher, self-extrication and “leaving helmet in place.” The evidence weakly opposed use of short extrication devices. Leading study primary outcomes were spinal motion, diagnostic accuracy, and pressure/discomfort. **Conclusion:** EMS blunt spinal trauma interventions are informed by moderate quality supportive and neutral evidence. Future research should focus on high-quality studies filling identified evidence gaps using patient-oriented outcomes to best inform EMS care of blunt spinal injury.

Simulation scenarios: effective learning tool in the Think-First Injury Prevention Strategy for Youth (TIPSY). *Elizabeth Butorac^{*}, Kayleigh Faulkner[†], Vasuki Paramalingam^{*}, Adrian William^{*}.* From ^{*}St. Michael’s Hospital, Toronto, Ont.; and [†]St. Michael’s Hospital, University of Toronto, Toronto, Ont.

Background: Youth (age 16 – 19) are at highest risk of being killed in a motor vehicle crash (MVC), the leading cause of death for this age group. Since 2006, St. Michael’s Hospital (SMH) has provided an educational program called ThinkFirst Injury Prevention Strategy for Youth (TIPSY). Ongoing improvements are made based on evaluation data collected, such as the addition of interactive simulation activities in SMH’s simulation centre. To address injury prevention strategies, TIPSY brings teenagers into the hospital setting to witness potential consequences of risk-

taking behaviours: **Methods:** TIPSY is offered bi-weekly throughout the school year. It includes interactive sessions with critical care and emergency nurses, simulation specialists, Toronto Police Services, and Mothers Against Drunk Driving — all of whom share their expertise and experience. The day concludes with the students talking with a VIP (Voice of Injury Prevention), an individual who has sustained a life-changing head or spinal cord injury. Activities include tours of the emergency department and the trauma/neurosurgery intensive care unit as well as acting out scenarios in the simulation centre. **Results:** Since the addition of the simulation centre activities in 2014, high school students from 17 schools throughout the Toronto District School Board have attended TIPSY. A total of 213 completed evaluations indicated 97% found the simulation centre exercise an effective learning tool. **Conclusion:** Ongoing evaluations reveal the addition of new learning tools is effective in increasing student awareness of their personal risk and consequences of injury.

Hemostatic dressings for external bleeding: a systematic review using GRADE methodology. *Jan Jensen, David Zideman, Eunice Singletary, Richard Bradley.* From the Department of Emergency Medicine, Saint John Regional Hospital, Saint John, N.B.; the NB Trauma Program, Saint John, N.B.; and the Department of Emergency Medicine, Saint John Regional Hospital, Saint John, N.B.

Background: Hemostatic agents and dressings have been used by the military as an additional means to control severe bleeding; their use is becoming more common in the civilian sector. This review synthesized the evidence for topical hemostatic dressings for severe external bleeding in first aid and emergency care. **Methods:** This International Liaison Committee on Resuscitation (ILCOR) First Aid systematic review informed the 2015 Consensus on Science and Treatment Recommendations. Two investigators followed GRADE methodology. Structured search strategies were executed. Articles were included by consensus. Two investigators independently completed study quality assessments. Outcomes were identified a priori: mortality, hemostasis, complications and time to bleeding cessation. Data were pooled using GRADEpro software. **Results:** The electronic database search retrieved 1237 citations and the hand-search retrieved 19. Twelve articles were included: 4 human case series and 8 animal studies (7 were randomized trials). In total, 24% (27 of 112) of subjects who received hemostatic dressings died versus 66% (54 of 82) who did not receive hemostatic dressings. Hemostasis occurred in 88% (141 of 161) of subjects versus 50% (13 of 26) of those who did not receive hemostatic dressings. Complications from hemostatic dressings occur in 3% (3 of 96) of subjects (no comparison group). In total, 73% (25 of 34) achieved hemostasis in under 3 minutes with hemostatic dressing. **Conclusion:** These dressings may be effective for rapid hemostasis and lead to reduction in mortality. Evidence for the use of hemostatic dressings is largely from low-quality animal and uncontrolled descriptive human studies. Further human research is required to determine the clinical effectiveness and safety of hemostatics for severe external bleeding.

Tourniquet application for severe limb bleeding: a systematic review using GRADE methodology. *Jan Jensen, Michael Reilly, David Zideman, Eunice Singletary.* From the Department of Emergency Medicine, Saint John Regional Hospital, Saint John, N.B.; the NB Trauma Program, Saint John, N.B.; and the Department of Emergency Medicine, Saint John Regional Hospital, Saint John, N.B.

Background: Guidelines supporting or opposing tourniquet use by first aid and emergency medical services (EMS) providers have fluctuated. Research has been sparse. This review synthesized evidence for tourniquet application out-of-hospital for severe limb bleeding. **Methods:** This International Liaison Committee on Resuscitation (ILCOR) First Aid systematic review informed the 2015 Consensus on Science and Treatment Recommendations. Two investigators followed GRADE methodology. Structured search strategies were executed. Articles were included by consensus. Two investigators independently completed study quality assessments. A priori-identified outcomes were hemostasis, mortality, vital signs and complications. Data were pooled using GRADEpro software. **Results:** The search retrieved 1021 citations. After selection, 13 nonrandomized human studies included 2 from the EMS setting, 8 from combat settings and 3 with volunteers. Tourniquets used were a mix of improvised and commercial devices. In total, 83% (35 of 42) of patients who had a tourniquet applied achieved hemostasis versus 61% (17 of 28) who did not have a tourniquet (RR 10.54, 95% CI 6.55 – 16.96); 75% (560 of 750) of case series patients with tourniquet achieved hemostasis. Twelve percent (91 of 791) of patients who had a tourniquet applied died versus 9% (89 of 977) who did not (RR 1.08, 95% CI 0.82 – 1.43). Ten percent (92 of 903) of case series patients with tourniquet died. No difference was found in vital signs. Complications were reduced with tourniquet: 6% (6 of 67) versus 9% (9 of 98) (RR 0.19, 95% CI 0.06 – 0.55); 4% (36 of 846) of case series patients with tourniquets had complications. **Conclusion:** Evidence is low quality and heterogeneous. Tourniquet application may effectively stop severe limb bleeding. Well-controlled studies on tourniquets by first aid and EMS providers are required.

A retrospective quality audit regarding the incidence and treatment of hypothermia in severely injured trauma patients who undergo emergent surgery. *Asim Alam, Rafael Olarte, Barto Nascimento, Claude Laflamme, Homer Tien, Jeannie Callum.* From the Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: Hypothermia (< 36°C) exacerbates trauma-induced coagulopathy and worsens morbidity and mortality among severely injured trauma patients; there is a paucity of data on how this is recorded and managed during initial hospital admission. **Methods:** We completed a retrospective quality audit of all severely injured trauma patients who had urgent surgery at Sunnybrook between 2010 and 2014. Information regarding temperature monitoring was recorded during different periods of initial resuscitation and admission. **Results:** A total of 922 trauma patients went to the OR shortly after coming into the trauma bay (TB) at Sunnybrook. The median ISS was 25 (IQR 14–34). Only about one-fifth of patients (18%) received a temperature measurement in the prehospital phase. Within the TB, 612 (66%) patients had their temperature recorded on arrival. In the OR, approximately 80% of patients had their temperature measured on both arrival and discharge. Almost all (98%) patients had their temperature measured on arrival in the ICU or specialized ward. A large proportion of patients (641, 70%) were hypothermic at least once during throughout their initial admission. Warming initiatives were documented in only 56 (6%) patients in the TB, yet documented in almost all patients in OR (866, 94%). **Conclusion:** A large proportion of patients are hypothermic during their initial resuscitation and admission. Quality-improvement initiatives should strive for ongoing temperature measurement and early prevention and treatment of hypothermia during initial resuscitation.

Application and validation of the Kenyatta National Hospital–University of Alberta orthopedic trauma assessment (KUOTA) tool. *Zia Saleh*, Paul Okutoyi*, Khaled Almansoori†, Abdullab Saleh‡, Harvey Hawes‡, Jessica Hogan‡, Julie Kromm‡, Matthew Menon†.* From the *Moi Teaching and Referral Hospital, Eldoret, Kenya; the †University of Alberta, Calgary, Alta.; and ‡Innovative Canadians for Change, University of Alberta, Calgary, Alta.

Background: A novel assessment tool named KUOTA was developed to provide a criteria-referenced method for evaluating orthopedic trauma services (OTS). The development process of this instrument has been previously reported, and its application and validation has been recently completed. **Methods:** The KUOTA tool's application and validation were undertaken at the University of Alberta (UA) Hospital and the Moi Teaching and Referral Hospital (MTRH) in Kenya. A retrospective collection of 37 indicators among the 11 most common orthopedic injuries were collected over a standardized 120-day period within the year. Components were divided into structural, process and outcome categories with subgroups for item scoring. Comparisons between the sites are reported. **Results:** The UA Hospital obtained a KUOTA score of 25 out of 30 (10 structural, 9 process, 6 outcome) compared with the MTRH with a score of 21.8 out of 30 (9.3 structural, 4.5 process, and 8 outcome). No significant differences between sites were found regarding structural items ($p < 0.05$). Multiple process inefficiencies were identified at the MTRH, including longer time-to-surgery, time to dislocated hip-reduction, and time to antibiotic initiation for open fractures ($p < 0.01$). No significant outcome differences were demonstrated regarding trauma capability, educational development, mortality, reoperation rates, infection rates and major complication rates ($p < 0.05$). Finalized scores of both centres rate their ability to provide level 1 orthopedic trauma care and category-evaluations contrast their differences. **Conclusion:** In early application, the KUOTA tool serves as a novel criteria-referenced method for reliable and comprehensive evaluation of OTS and to efficiently identify structural, process, and outcome deficiencies within a hospital system.

Data quality targets in a provincial trauma registry. *Jennifer McMillan*, Jaimini Thakore†, Scott Robinson†, Dori Williams‡.* From the *BC Trauma Registry, Vancouver, B.C.; and the †Provincial Health Services Authority, Vancouver, B.C.

Background: Since 2014, the BC Trauma Registry has been developing a robust system of validation checks and chart auditing to ensure data quality in the provincial registry. The next step is to set data quality targets. Building on CIHI's work on data quality targets in the Discharge Abstract Database, we will develop achievable targets for data quality in a Canadian trauma registry. **Methods:** We have reviewed the results from our bi-monthly data checks to develop a data validation target. We also reviewed our findings from chart abstraction to develop targets for data accuracy. These targets are based on aggregations of data, including nonclinical elements (e.g., time values and demographic data), clinical elements (e.g., vital signs), and diagnosis coding (ICD-10-CA and AIS 2005). We will develop targets on data completeness using similar aggregations of data elements. **Results:** We are close to achieving 95% of records with no data validation errors. These findings indicate that a target of 95% may be an achievable ongoing target. Data completeness varies from 40%–100%, with transferring facility data being the least complete. Chart audits indicate that abstracted data elements are

98% correct, and diagnosis coding is at 88% agreement (with ISS not varying > 1). **Conclusion:** Developing achievable data quality targets is essential for ensuring that high-quality trauma registry data are available for research, performance improvement and administrative use. By collaborating with other provincial registries, it is possible to develop benchmarks for national trauma registry standards.

Factors influencing emergency medical service response time to fatal motor vehicle crashes. *James Byrne**, *David Gomez Jaramillo†*, *Stephanie Mason**, *Avery Nathens‡*. From the *University of Toronto, Toronto, Ont.; the †Department of Surgery, University of Toronto, Toronto, Ont.; and the ‡Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: Survival after a motor vehicle crash (MVC) is dependent on access to trauma care. Timely access requires rapid response from Emergency Medical Services (EMS), yet factors influencing EMS response times (RTs) to serious MVCs are unclear. We explored the factors influencing EMS RTs to fatal MVCs across the US over the last 20 years. **Methods:** Data from all MVCs resulting in at least 1 death in the US over 1994–2013 were derived from the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS). Multiple linear regression was used to determine the relationship between RT and 20 variables characterizing the county, precipitating events, timing, location, road and environmental conditions of the crash. **Results:** We identified 385 920 fatal MVCs during the study period. Median RT was 11 minutes (IQR 7–18). Multiple linear regression identified 18 variables significantly associated with RT. Crash location on rural (+3.6 mins) or unpaved (+5.5 mins) roads, dark unlit conditions (+ 2.74 minutes), adverse weather, and time between midnight and 6 am (+1.37 mins) were associated with longer RTs. Rural or wilderness counties (+1.7 mins) were associated with longer RT, while counties with high population density (> 100 ppl/mile²) were most associated with short RT (–5.0 mins). Interestingly, later years were significantly associated with decreased RT (2009–2013 v. 1994–1998, –1.24 mins). After adjusting for incident county, the coefficient of determination (R^2) was 0.23, with county explaining 11% of the observed variability in RT. **Conclusion:** Rurality and factors indicating poor access to infrastructure are strongly predictive of prolonged RT. Differences in county systems should be examined with a focus on improving access to emergency trauma care.

Evaluating the impact of the Rural Trauma Team Development Course. *Heather Knight*, *Alanna Keenan*, *Melissa Waggott*. From The Ottawa Hospital, Ottawa, Ont.

Background: In the spring of 2013, our level 1 trauma centre introduced a rural trauma course (RTTDC) to our catchment area. Over the next 27 months, our team travelled to 7 of 15 primary referring hospitals to explore how to better manage trauma. The purpose of this study is to determine the impact. **Methods:** A retrospective comparison of trauma registry data was performed pre- and post-RTTDC from January 2010 to June 2015. Data elements obtained were ISS, age and patient outcome, transfers per site, time at primary site, emergency department procedures for primary site and lead trauma hospital (LTH). **Results:** A total of 370 patients were transferred by hospitals receiving the course. Analysis pre- (266 patients) and post-RTTDC (104 patients) indicated increased ISS, mortality at LTH and age, while length of stay (LOS) in primary hospital

remained stable. Procedures done at the primary site pre- and post-course showed significant decreases for CT scans (43.7 v. 31.7) and significant increases in FAST (8.8 to 19.2) and the use of tranexemic acid (0.5% v. 3.8%). **Conclusion:** RTTDC positively impacts trauma care by enabling appropriate use of investigations and adjuncts for resuscitation. This suggests increased awareness of the urgency for patient transfer. Transfer despite increased ISS and age may reflect increased capacity of rural sites to stabilize patients, ensuring survival to LTH, as reflected by increased mortality at LTH. Further analysis is needed to determine why LOS at primary sites did not decrease.

Characteristics and patterns of major traumatic brain injury in Nova Scotia: a 12-year retrospective analysis. *Nelofar Kureshi**, *Lynne Fenerty**, *Ginette Thibault-Halman†*, *Mete Erdogan‡*, *Simon Walling**, *Robert Green†*, *David B. Clarke†*. From the *Division of Neurosurgery/QEII Health Sciences Centre, Dalhousie University, Halifax, N.S.; †Dalhousie University, Halifax, N.S.; and the ‡Nova Scotia Trauma Program, Halifax, N.S.

Background: TBI is a leading cause of death and disability in Nova Scotia. It occurs in approximately 50% of major trauma seen annually in the province. The purpose of this study was to describe the characteristics and patterns of major TBI seen in Nova Scotia over a 12-year period. **Methods:** This was a retrospective case series. Data were obtained from the Nova Scotia Trauma Registry for all patients presenting with major TBI (AIS head \geq 3) between 2002 and 2013. Injury rates were calculated on the basis of 100 000 population (all ages) using population estimates from Statistics Canada. **Results:** Overall, 4152 major TBI patients were seen in Nova Scotia hospitals during the study period. Mean age of TBI patients was 51 \pm 25 years; 73% were male. The majority of injuries were the result of blunt trauma (93%), with relatively few major TBIs resulting from penetrating trauma (7%). The most common mechanisms of injury were falls (44%) and motor vehicle crashes (27%). Analysis of census-based subpopulations of the province showed that injury rates varied significantly among counties (from 25 to 63 per 100 000 population). We observed an increase in the number of major TBI patients over 12 years. **Conclusion:** Our findings suggest significant regional variation in major TBI rates in Nova Scotia. There are ongoing needs for prevention and intervention efforts that focus on unintentional falls and motor vehicle crashes, especially in older adults. These results also suggest that geographically targeted efforts may be warranted.

The effect of blood alcohol on outcomes in patients with major traumatic brain injury in Nova Scotia. *Nelofar Kureshi**, *Lynne Fenerty**, *Ginette Thibault-Halman†*, *Mete Erdogan‡*, *Simon Walling**, *Robert Green†*, *David B. Clarke†*. From the *Division of Neurosurgery, Dalhousie University, QEII Health Sciences Centre, Halifax, N.S.; the †Nova Scotia Trauma Program, Halifax, N.S.; and ‡Dalhousie University, Halifax, N.S.

Background: Although alcohol use increases the risk of experiencing a TBI, it remains unclear whether outcomes in alcohol-impaired patients are different from those of unimpaired patients. The objective of this study was to evaluate the effect of alcohol on length of stay (LOS) and mortality in patients with major TBI. **Methods:** Using data collected from the Nova Scotia Trauma Registry, we performed a retrospective analysis of all patients with major TBI (defined as having an AIS head \geq 3) seen

in Nova Scotia hospitals between 2002 and 2013. Patients were compared by blood alcohol concentration (BAC) at time of injury: negative (0–1.9 mmol/L), low (2–21 mmol/L), and moderate/high (≥ 22 mmol/L). A logistic regression model was constructed to test for outcomes and adjusted for the effects of age, sex, location, ISS, and BAC level. **Results:** In a 12-year period, there were 4152 major TBI patients in Nova Scotia. Alcohol testing was performed in 43% of cases (80% male, mean age 44 ± 20 yr), with 48% having a positive BAC. Mean acute LOS was similar for all 3 BAC groups. Increasing age (OR 1.01, $p < 0.001$), high ISS (OR 4.92, $p < 0.001$), injuries occurring outside of Halifax Regional Municipality (OR 1.72, $p < 0.001$), and having a lower BAC level (OR 0.99, $p < 0.001$) independently predicted mortality. **Conclusion:** Our findings suggest that low BAC levels are associated with increased mortality in major TBI patients. Further study is warranted to elucidate alcohol's mechanism in TBI outcomes.

Creating a culture of safety — pediatric emergency department injury prevention. *Jane Edwards, Brandon Batey, Tanya Charyk Stewart.* From the London Health Sciences Centre, London, Ont.

Background: Injury is the most important health issue for youth. At the Children's Hospital, LHSC, there are approximately 10 000 injury-related pediatric emergency department (PED) visits/year, with 600 pediatric injury admissions. An injury prevention opportunity exists. Most of these patients will spend time in our PED waiting room and are a captive audience. The walls, waiting rooms and patient care areas in the PED present an opportunity to promote a culture of safety. **Methods:** We created safety scenes on the walls for children and parents to enjoy and learn safety messaging. Emphasizing injury prevention, we worked with I'm Safe to produce interactive wall-mounted educational activities for the PED. Displays feature activities related to injury (child passenger safety, pedestrian safety). Activity sheets provide the opportunity to colour a safety scene and learn recreational activity safety, and they contain parental education information. **Results:** Three murals were created with staff and Patient Advisory Council input in the waiting room, ambulatory care area and patient rooms. An interactive display featuring safety messaging for children was mounted in the PED with information sheets for parents to continue the conversation. There is also a tabletop activity centre produced with a city scene with different safety messages (cross-walk safety, school bus safety, cycling safety). **Conclusion:** Our vision is a culture of safety for children and their families. We use our voice to educate families through use of interactive teaching, which facilitates dialogue and promotes behavioural change in our patients and community. Replacing traditional wait room displays with injury prevention-focused activities and resources can be fun, interactive and inform families.

Understanding your audience: creating an injury prevention website for teens. *Brandon Batey, Tanya Charyk Stewart, Kelly Vogt, Neil Parry, Neil Merritt, Jane Edwards.* From the London Health Sciences Centre, London, Ont.

Background: The Impact program is the flagship injury-prevention program at the London Health Sciences Centre. Since inception 27 years ago, Impact has been educating teens about risk-taking behaviours through hospital and in-school presentations. The key to the program's success has been continuous improvement and adaptations to meet the needs and inter-

ests of its audience. Today's teenagers have been raised with technology, they have never known a time without the Internet, and in fact 95% of teens use the Internet regularly. For Impact to remain a relevant, interesting, and effective injury-prevention program it was imperative to go online. **Methods:** Using input from a diverse focus group of teenagers facilitated by the expertise of a website firm we were able to create a resource that speaks to teens. Comparisons of our corporate hospital website to websites frequented by teens were made to decide format. Website content was developed by professionals, patients, and the injury-prevention team. Additionally, relevant content was developed by local teens for teens. **Results:** Creating a website external from the corporate infrastructure proved to be challenging; however, our team prevailed and created a useful resource for teens. This website keeps the conversation going outside of the classroom and provides youth with a reliable, accurate, and most importantly, attractive medium to prevent teen injury. **Conclusion:** Understanding your audience is essential to conveying any message. Although challenging, it was important to provide a resource that will actually speak to the intended audience; this website does that.

Complications associated with angioembolization (AE) in unstable pelvic fracture: a systemic review. *Luis Teodoro Da Luz, Rafael Olarte, Jose Estrada-Codécito, Chris Dey, Homer Tien, Avery Nathens, Barto Nascimento.* From the Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: Bleeding is the leading cause of death among patients with unstable pelvic fractures. Angioembolization has taken a place in the control of bleeding in unstable pelvic fractures in the last 4 decades. Current literature suggests increment of complications among unstable pelvic fractures post-AE. We conducted a systematic review to determine whether complications post-AE are increased in patients with unstable pelvic fractures. **Methods:** MEDLINE, EMBASE, ClinicalTrials.gov, WHO International trials, and Cochrane were searched for observational and experimental studies conducted in humans. Findings were reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) statement. We extracted data about indication of embolization, vessel embolized, type of complication, and comparison to patients treated without AE. Critical appraisal of the included studies was conducted using different tools tailored to the different designs in the included studies. **Results:** We included 21 studies. All studies were observational prospective or retrospective cohorts. Randomized controlled trials were not found. The Newcastle-Ottawa scale for cohort studies highlighted a moderate quality according to the screened domains. Three studies had low risk of bias, 6 studies had moderate and 12 had high risk. Overall, studies demonstrated an increase in the complications post-AE in patients with unstable pelvic fractures, such as infection, impotence, bladder necrosis, gluteal necrosis, among others. **Conclusion:** AE is safe and effective in patients with unstable bleeding pelvic fractures. Complications post-AE have been described, but not consistently, in all included studies. Properly designed studies are still warranted.

Cryoprecipitate in trauma: a systemic review of its effects on reversal of trauma coagulopathy, exposure to allogeneic blood products and mortality. *Luis Teodoro Da Luz, Ayman Moahammed, Avery Nathens, Homer Tien, Barto Nascimento.* From the Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: Hypofibrinogenemia may happen early in bleeding trauma patients and is associated with massive transfusion and mortality. Current literature suggests that high fibrinogen levels exert a protective effect with regards to blood loss, and as consequence cryoprecipitate (CRYO) use in trauma has increased. We performed a systematic review of the literature on the use of CRYO in trauma, examining its effects on coagulation profile, exposure to allogeneic blood products, mortality and adverse effects. **Methods:** Observational and experimental studies in humans, animals, and in vitro were included. MEDLINE, EMBASE and Cochrane databases were searched up to September 2015. Data on CRYO effect on fibrinogen concentration, coagulopathy, exposure to allogeneic blood products, mortality and adverse effects were extracted. Methodological quality was assessed separately for observational (Newcastle–Ottawa), experimental (Cochrane Collaboration Risk of Bias Tool) and laboratory/animal (ARRIVE guidelines) studies. **Results:** Twelve studies met the inclusion criteria. In humans there was 1 experimental study ($n = 43$) and 7 observational studies ($n = 5031$). We found 3 in vitro studies and 1 randomized animal study ($n = 72$). Methodological quality was moderate. Studies in humans demonstrated increase in fibrinogen levels, lower exposure to allogeneic blood products and reduction of mortality after administration of CRYO. In vitro studies demonstrated improvement of fibrinogen level, thrombin generation and thromboelastometry parameters. No data about adverse effects were found. **Conclusion:** CRYO improves trauma coagulopathy and reduces bleeding when administered early in bleeding trauma patients. It also appears safe; however, current clinical evidence about the use of CRYO in trauma is still insufficient. Better methodological studies are still warranted.

A 15-year review of pediatric trauma mortality: a descriptive analysis. *Shaylan Govind, Tanya Charyk Stewart, Neil Merritt.* From the London Health Sciences Centre, London, Ont.

Background: In Canada, injuries are the leading cause of mortality in children under 18. The objective of our study was to provide an epidemiological analysis of in-hospital pediatric trauma deaths. **Methods:** A retrospective cohort of fatally injured children 0–17 years old treated at our trauma centre between Jan. 1, 2000, and June 1, 2015. Cases with an ISS ≥ 12 and/or meeting criteria for trauma team activation were included from our trauma database ($n = 1268$). **Results:** The mortality in our population was 8%. The majority of non-survivors fell into 2 age groups: 0–2 (27%) and 15–17 (35%). The leading mechanism associated with death in the 0–2 age group was intentional injury (36%), whereas in the 15–17 age group, MVCs (81%) were the leading mechanism. Overall, MVCs (35%) were the most common mechanism of fatal pediatric injury, with 38% of patients involved as passengers, 28% as drivers and 28% as pedestrians. Of note, safety restraints were not used in 37% of fatal MVCs. The mean ISS for non-survivors was 35.7 (9–75). Autopsy and organ donation rates were found to be 60% and 32%, respectively. **Conclusion:** Our study finds that the in-hospital mortality in pediatric trauma is higher than previously reported. Overall, MVCs continue to be the leading cause of death in this population; however, in the infant/toddler subpopulation (age < 3 yr), intentional trauma emerges as the leading mechanism. These findings provide continued support for our injury-prevention programming for abusive head trauma and teen road safety.

Pediatric patients requiring urgent surgery in an adult trauma centre. *Diane Bradford, Janice Dawson, Jennifer Smith, Suzanne McKenzie.* From the Windsor Regional Hospital, Windsor, Ont.

Background: The need was identified at an adult level 2 trauma centre for a policy and procedure development for a small but significant pediatric population. It was recognized that role clarity and policy clarity was required for those pediatric trauma patients who were critically injured and required urgent surgical intervention before being transferred out to a pediatric trauma centre. **Methods:** Literature review revealed a significant gap in any resources to guide the development of this unique need. Key stakeholders were contacted and a rough template was devised to identify needs for the care of this pediatric population. Based on a case debrief involving all care providers, these roles and policy were further defined. **Results:** Initial discussions and planning identified equipment needs for standardization, educational needs for staff in multiple departments, and policy and procedure development requirements. A debrief with all staff and areas involved from a case with positive outcomes led to a definitive policy, clear role and responsibility descriptions, postoperative bed spacing designation awaiting transfer, as well as an identified debrief tool and video conference communication procedure with the associated pediatric trauma centre. **Conclusion:** With key stakeholders, including the entire trauma team, senior leadership, and transferring pediatric trauma facility educators, a unique and clear policy and procedure with identified roles and responsibilities has been defined to provide for excellent standardization and outcomes for those pediatric patients who require urgent surgery before transfer.

Does N-acetylcysteine (NAC) improve outcome in traumatic brain injury? A systemic review in human and animal literature. *Luis Teodoro Da Luz*, Junaid Bhatti†, Homer Tien*, Avery Nathens*, Barto Nascimento*.* From the *Sunnybrook Health Sciences Centre, Toronto, Ont.; and the †Sunnybrook Research Institute, Toronto, Ont.

Background: Recent work suggests that NAC may improve neurologic outcome after TBI. It is hypothesized that reactive oxygen species (ROS) released after TBI could be neutralized by N-acetylcysteine as it replenishes glutathione (GSH), an endogenous antioxidant. This systematic review critically assessed the biomedical literature assessing the neuroprotective role of N-acetylcysteine in TBI. **Methods:** In this review, both animal and human studies published in peer-reviewed, English-language journals indexed in MEDLINE, EMBASE and Cochrane were identified using a specific search strategy. The relevant studies were screened by 2 reviewers. Information about study design, effects of NAC on the brain tissue and on neurologic outcome was extracted. Critical appraisal was conducted using specific tools according to each study design. **Results:** We found 24 studies, including 22 experimental studies in animals and 2 studies in humans. Animal studies assessed the effects of NAC on TBI in rats ($n = 18$), mice ($n = 2$), rabbits ($n = 1$), and cats ($n = 1$). Only 1 of the 2 human studies was a randomized controlled trial and was conducted in patients with blast injuries. Few animal studies ($n = 3$) also assessed the effectiveness of NAC amide, a form of NAC that has better permeability through the blood–brain barrier. The studies assessed NAC effects on brain tissue, motor function, and cognition. Nearly all experiments ($n = 22$) suggested improved TBI outcomes with NAC compared with controls. **Conclusion:** NAC appears to be a promising drug to improve outcome in TBI. However, current literature lacks phase II and III studies. Furthermore, future trials should focus on the efficacy of NAC amide.

Trauma scoring systems. *Deanna Fong, Rocio Martinez, Erin Shanguan.* From the BC Trauma Registry, Vancouver, B.C.

Background: The AIS is the most commonly used injury scoring system leading to quality improvement in trauma care. In many parts of the world, standard AIS coding is done by trauma registrars. Resources are limited in other areas. With the emerging electronic health record, a variety of electronic injury severity scoring systems have been developed and applied. **Methods:** Literature reviews have been performed to assess the reliability and accuracy of the newly developed electronic trauma scoring systems. Participation in a comparative study offered a unique insight. **Results:** All electronic injury severity scoring systems are valuable, but they also have disadvantages. Comparison between the standard AIS coding by registrars to alternative trauma coding software is very limited. However, some preliminary studies demonstrated that the electronic trauma scoring system and standard AIS coding may be comparable. **Conclusion:** More research is needed to assess these electronic trauma scoring systems and their impact. Cost-efficient trauma scoring systems are in high demand in developing countries. A universal scoring system is ideal to perform critical evaluation and continual refinement of trauma management. Consideration must be given to the availability of resources as well as the accuracy of the data and scores calculated.

The timing of initiation of venous thromboembolism prophylaxis after traumatic solid organ injury: a national survey of practice. *Kelly Vogt*, Kevin Mabiri†, Patrick Murphy‡, Neil Parry*, Daryl Gray*, Brad Moffat*, Sandro Rizoli§, Morad Hameed¶.* From the *London Health Sciences Centre, London, Ont.; the †London Health Sciences Centre, Victoria Hospital, London, Ont.; ‡Western University, London, Ont.; the §Sunnybrook Health Sciences Centre, Toronto, Ont.; and ¶Trauma Services, Vancouver General Hospital, Vancouver, B.C.

Background: The need for chemical prophylaxis against venous thromboembolism (VTE) after trauma is well accepted; however, there may be reluctance to initiate prophylaxis early in patients who have suffered blunt trauma with solid organ injury (SOI) for fear of increased bleeding. Emerging data suggest the risk of bleeding with early VTE prophylaxis in patients with blunt SOI is minimal, and early VTE prophylaxis should be strongly considered. The impact of this emerging evidence is unclear, and therefore we undertook this survey to evaluate the practice of Canadian trauma practitioners with respect to the timing of initiation of VTE prophylaxis after blunt SOI. **Methods:** An electronic survey of the clinician membership of the Trauma Association of Canada was undertaken during December 2015 using a modified Dillman approach. The survey was created by consensus among trauma experts, and was pilot-tested on additional trauma experts. The survey addressed the timing of initiation of VTE prophylaxis for patients undergoing nonoperative management of splenic or liver injuries, as well as the impact of clinical status and imaging findings on this timing. Data were presented as frequencies and compared using χ^2 . **Results:** Pending. **Conclusion:** The results of this survey will be used in conjunction with the emerging literature on the safety of early initiation of VTE prophylaxis to guide the development of a protocol for early initiation of VTE prophylaxis after blunt SOI. This protocol will then be evaluated using a national multicentre prospective cohort study.

Reversal strategies for the novel oral anticoagulants (NOAC) in trauma: a systematic review of human, animal and in vitro studies. *Mylene Marchand, Barto Nascimento, Homer Tien, Avery Nathens, Luis Teodoro Da Luz.* From the Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: The use of NOACs for prevention or treatment of thrombosis in different specialties is expanding. Currently, there is no antidote capable of immediately reversing NOACs, in case of severe bleeding, including trauma. We conducted a systematic review of the literature on the drugs used to reverse NOACs and the outcomes when they are used in bleeding trauma patients. **Methods:** We searched on PubMed, EMBASE and Cochrane and reported our findings according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines. We extracted data on the type of drug used, doses, reversal of anticoagulation measured by laboratory or viscoelastic tests, exposure to allogeneic blood products, mortality and adverse effects. Critical appraisal of the studies was conducted using different tools tailored to the design of the studies. **Results:** We included 39 studies: 25 in animals, 10 in vitro and 4 in humans ($n = 314$). Meta-analysis was not conducted. Methodological quality and risk of bias were low to moderate. Studies quantified blood loss and anticoagulation reversal measuring thrombin time, ecarin clotting time, thromboelastometry, and anti-factor Xa activity. Prothrombin complex concentrate (PCC) and activated PCC are the drugs often used and moderately improve coagulation in animals and in vitro studies (for rivaroxaban and apixaban). For dabigatran, idarucizumab produced complete reversal and fully corrected coagulation. **Conclusion:** Currently there is no validated antidote for NOACs in trauma. However, in healthy humans, andexanet α significantly reduced anti-factor Xa activity. Idarucizumab and andexanet α seem to be the new avenue for reversal of NOACs but still need to be validated in larger, well-designed studies in humans.

Flail chest management: a survey of Canadian traumatologists. *Yasir Al-Zubaidi*, David Paskar†, Angela Coates‡, Samir Faidi§.* From the *Hamilton Health Sciences and McMaster University, Hamilton, Ont.; and the †Hamilton Health Sciences Trauma Program, Hamilton, Ont.

Background: The treatment of flail chest, including the role of operative intervention, continues to be controversial. The optimal treatment pathways for flail chest are debated among trauma care providers, and definitive practice guidelines have yet to be established. We hypothesize that significant variability exists in the clinical management of flail chest. The purpose of this survey is to elucidate current practice patterns among Canadian traumatologists in the management of flail chest injury. **Methods:** An extensive review of the literature, together with key informants from trauma, orthopedics and critical care guided development of the questionnaire. Questions address issues relevant to practice patterns in the management and treatment of flail chest, including existence of a protocol for the management of flail chest injury, annual volume of flail chest injuries, factors used to define flail chest, diagnostic modalities, preferred analgesic techniques, factors influencing the initiation of ventilator support and use of operative management. **Results:** We will present the results of our national survey as well as a current literature review regarding the clinical management of flail chest. **Conclusion:** The results of this survey will inform the development of a pilot randomized controlled trial to study early intervention of conservative measures of flail chest injuries.

Endovascular stenting for traumatic common iliac pseudoaneurysm as an adjunct following exploratory laparotomy in a stab injury patient. *Saptarshi Biswas, Nishan Nagarakanti.* From the Forbes Allegheny Hospital, Monroeville, Pa.

Background: Traumatic iliac vessel injuries, especially secondary to penetrating wounds, are often associated with high mortality. The patients usually present in shock due to massive blood loss, which in turn triggers hypothermia, coagulopathy and acidosis. **Methods:** We report a case of a 17-year-old female who was brought in for a stab wound in the right lower quadrant. **Results:** On exploratory laparotomy, there was a duodenal perforation along with retroperitoneal hematoma along the right gerotas fascia and right colon. But medial rotation of the right-sided viscera did not reveal any obvious injury to the IVC and the iliac veins. CT performed postlaparotomy after stabilizing the patient revealed pseudoaneurysm on the right common iliac. A pelvic angiography was performed followed by endovascular placement of a covered stent on the right common iliac artery. We discuss an interesting case along with discussion of relevant literature. **Conclusion:** Angiography and endovascular stenting can be a useful adjunct post exploratory laparotomy.

Descriptive epidemiology of all-terrain vehicle-related injuries in British Columbia's Interior Health Authority. *Lisa Whitman, Heather Wilson, Brianne Howell, Zonia Rurka, Cindy Bouwsema.* From the BC Interior Health Authority, Vancouver, B.C.

Background: Nestled in beautiful British Columbia (BC), with 215 sq. km of mountains, lakes and valleys, Interior Health Authority (IHA) is a popular recreation destination for off-road motor sports, including all-terrain vehicle (ATV) use. ATVs are 4-wheeled vehicles weighing 100–800 lbs and achieving speeds of 100 km/hr. The purpose of this study is to explore the epidemiology of ATV-related injuries in IHA. **Methods:** Retrospective analysis of data abstracted from the Discharge Abstract Database (DAD), BC Trauma Registry (BCTR; 2006–2015) and the BC Coroner's service (2007–2014). Abstracted data included admission to hospital, transfer in, transfer out, trauma team activation, pediatric (< 15 years old), or death. The BC Coroner's service provided data on scene deaths. **Results:** ATV use resulted in 388 trauma admissions, with 6 in-hospital deaths and more than 40 out-of-hospital deaths for this same time period. These patients were of both sexes and ranged in age from under 9 to over 80; most were males aged 45–60 with predominant injury patterns of chest, head and neck, and extremities. They spent an average of 9.5 days in hospital, with an ISS over 13. Helmet use was documented in approximately 61% of ATV-related trauma, alcohol was involved in many cases, and alcohol or drugs were felt to be a contributing factor in 55% of deaths at the scene. **Conclusion:** Currently, BC has no legislation regarding mandatory safety gear, driving age or drivers training. ATV legislation could reduce injuries and mortality.

Characterization of pelvic bleeding in trauma: implications for research and management. *Rachel Strauss, Rafael Olarte, Jose Estrada-Codecito, Carlos Semprun, Luis Teodoro Da Luz, AnaMaria Garzon, Barto Nascimento.* From the Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: Traumatic hemorrhage may originate from different sources and have different degrees of severity. The timeframe for clinical deterioration and interventions in pelvic bleeding is poorly characterized. This study aims to characterize bleeding associated with pelvic fractures as compared with other sources of bleeding. **Methods:** We conducted a retrospective cohort study from November 2002 to February 2015 in isolated pelvic injury patients (pelvis AIS ≥ 3 , nonpelvis AIS ≤ 2) and nonisolated pelvic injury patients (nonpelvis AIS ≥ 3) who required ≥ 1 unit of PRBCs within 24 hours of admission, and urgent interventions were identified. "Crashing" was defined by the presence of shock and/or coagulopathy or the need for vasopressors or transfusion. Time to "crashing" from injury time was compared between groups; a time to event analysis was used. **Results:** Isolated and nonisolated cohorts ($n = 185$, $n = 402$) were identified; preliminary data ($n = 10$ each) showed similar baseline vital signs, pH, and coagulation, but different ISS (36.9 ± 13.4 v. 21.4 ± 7.4). Time to "crashing" in isolated and nonisolated groups was at 6 hours and 4 hours after injury, respectively. The nonisolated group had steeper drop in blood pressure at 4 hours (slope -14.03 v. -2.75). Nonisolated patients were more acidotic at 2 hours (pH 7.09 v. 7.37). Nonisolated patients had worse fibrinogen at 3 hours (0.85 v. 2.83). The amount of fluid at 4 hours was greater in the nonisolated group (3850 mL v. 938 mL). **Conclusion:** Our preliminary data suggest that time to "crashing" in isolated pelvic bleeding is at 6 hours after injury. If this finding is confirmed, management strategies should consider this timeline for deterioration, and researchers should address the heterogeneity of this population of bleeding trauma patients.

Introduction of a longitudinal competency-by-design trauma rotation into a block-based surgical residency program — a solution to providing adequate trauma case volume in competency-based education. *Matthew Menon, Robert Chan, Angela Scharfenberger.* From the University of Alberta, Calgary, Alta.

Background: Case volume is a necessary component of surgical training. Opportunities to encounter Trauma cases are limited in evolving models of competency-based residency programs. Many experiences relating to surgical competencies are encountered on-call and not in prescheduled rotations. We introduced a longitudinal competency-by-design (CBD) rotation in orthopedic trauma surgery that runs concurrently within a subspecialty block system. We hypothesize that the rotation will provide the case volume required to develop surgical expertise in trauma and will capture those competencies related to trauma care that are not available in scheduled-hours rotations. **Methods:** Competencies corresponding to clinical encounters commonly experienced after hours were reorganized under a longitudinal rotation that spans 2 senior years of a 5-year residency program. The rotation runs concurrently with preceptor-based subspecialty rotations during the after-hours and weekend call shifts. A 3-month study period was identified. Surveys were designed to assess the clarity of the objectives of the rotation and to identify unexpected challenges to integrating the longitudinal rotation into a block-based surgical program. **Results:** Subspecialty rotations contributed to the content. Eight senior residents are enrolled in the rotation. Descriptive results of the experience are presented. Challenges included timeframes for assessment, coordinating the process between faculty and defining competency milestones within set objectives. **Conclusion:** A longitudinal rotation can be incorporated into CBD programs to address objectives commonly encountered outside scheduled

hours. This new concept in surgical trauma education is adaptable among programs and provides a venue in which adequate case volume is ensured within a CBD framework.

Physicians' satisfaction with trauma system factors influencing transfer of trauma patients in 4 regional trauma systems. *Payam Tarighi*, David Gomez Jaramillo†, Chris Evans‡, Jill Shermann‡, Oxana Mian‡, Avery Nathens‡.* From the *Sunnybrook Health Sciences Centre, Toronto, Ont.; †Department of Surgery, University of Toronto, Toronto, Ont.; and ‡Laurentian University, Sudbury, Ont.

Background: Prompt access to definitive care for major trauma patients is a significant challenge in rural environments. Trauma system factors influencing transfer of trauma patients might impact access to such care in any regional trauma system. We sought to better understand the mechanisms by which 4 different regional trauma systems might impact on physicians' perceptions and satisfaction with transferring trauma patients to a higher-level trauma centre (TC). **Methods:** We used data from a survey fielded in 2011 and 2012 in British Columbia, Alberta, Ontario, New Brunswick, Newfoundland and Labrador, Nova Scotia and Prince Edward Island. The survey was designed to explore physicians' perception and satisfaction with patient transfer to a level 1/2 TC from emergency departments (EDs) of facilities at least 30 km from the nearest TC. A survey on Canadian trauma system components and official reports of regional trauma systems were other sources of data processed. **Results:** We received 466 responses out of 2563 mailed surveys. The participants were practising in 256 facilities out of 382 selected hospitals. Physicians' perceptions and satisfaction with trauma system factors were compared in 4 regional trauma systems across Canada (Table). Feedback from TCs about care was reported as very limited across all regions; however, most ED physicians were satisfied with the interaction with TCs during the transfer process. While there is a kind of lead agency in every assessed regional

trauma system, only the Alberta Provincial Trauma Committee has actively overseen an inclusive trauma care system since its initiation in 2008. **Conclusion:** Although system-level factors contributing to transfer trauma patients in rural areas might be influenced by specific characteristics of any regional trauma system in terms of geography, population and resources, ED providers in the Alberta regional trauma system were found to be more satisfied with those system-level factors. Development of effective regional trauma system leadership in Alberta may reflect the difference through providing better resource integration and facilitating communication between all nontrauma and TCs. Yet, feedback still remains an area for improvement.

The natural history of traumatic central cord syndrome as compared with other incomplete cervical cord injuries. *Ayoub Dakson, David Brandman, Ginette Thibault-Halman, Sean Christie.* From the Division of Neurosurgery, QEII Health Sciences Centre, Halifax, N.S.

Background: The natural history of traumatic central cord syndrome (CCS) seems to follow a unique pattern. The purpose of this study was to compare neurologic recovery in traumatic cervical spinal cord injury (SCI), both with and without CCS. **Methods:** Patients with SCI were first identified through the Nova Scotia trauma registry. Cases with CCS were identified through a retrospective chart review. Improvement was measured using the American Spinal Injury Association (ASIA) motor scores (AMS). **Results:** Sixty-six cases with cervical SCI were identified and grouped into cases with AIS grade A ($n = 18$), non-CCS with AIS grades B-D ($n = 24$) and CCS ($n = 24$). About 83% of the non-CCS and 71% of CCS patients underwent surgical decompression, with operations occurring at a mean of 48.2 ± 64.3 hours and 219.2 ± 277.6 hours, respectively, postinjury ($p = 0.031$). Follow-up AMS was available at a mean of 26.7 days postinjury. The mean total AMS in CCS cases improved significantly by about 30% ($p = 0.013$) compared with a nonsignificant change in non-CCS cases. In CCS, there was significant

	AB, n = 91*	BC, n = 101*	ON, n = 181*	AC, n = 93*	p value
Interaction with trauma centres					
Somewhat/completely satisfied with "Consultation with specialists at TC during the initial stages, including determination to transfer"	95.6	80.2	88.9	81.7	0.025
Somewhat/completely satisfied with "Support from specialists at TC in evaluating a trauma patient"	93.4	76.2	77.2	73.1	0.015
Somewhat/completely satisfied with "Support from specialists at TC in managing a trauma patient when immediate transfer is not possible"	83.5	68.3	65.0	60.2	0.027
Somewhat/strongly agree with "The physicians at the receiving institution always listen to my concerns about the trauma patient"	91.2	84.2	87.2	76.3	NS
Somewhat/strongly agree with "I feel supported by my TC"	96.7	79.2	83.9	80.6	0.016
Somewhat/strongly agree with "For the most part, I feel TC specialists provide appropriate recommendations given my context and constraints"	94.5	81.2	84.4	76.3	NS
Feedback from trauma centres					
Somewhat/completely satisfied with "Feedback from the TC after a transfer"	46.2	13.9	21.1	20.4	< 0.001
Mutual awareness of transfer criteria and capacity/beds at trauma centres					
Somewhat/completely satisfied with "Ease in arranging transfers"	87.9	37.6	54.4	61.3	< 0.001
Somewhat/strongly agree with "For the most part, I feel it takes a lot more convincing and proof than necessary before I can get a patient accepted for transfer to a TC"	20.9	33.7	32.2	29.0	0.001
Somewhat/strongly agree with "I feel the criteria for identifying the type of patient to transfer to a TC are very clear"	74.7	47.5	56.7	57.0	0.013
AB = Alberta; AC = Atlantic Canada; BC = British Columbia; ON = Ontario; NS = nonsignificant. *Pearson χ^2 test for independence. All results show % of satisfied/agreed.					

improvement in AMS scores of both the upper and lower extremities ($p < 0.05$); however, lower-extremity AMS scores improved at a higher rate than the upper extremities ($r = 0.99$, $p < 0.001$ v. $r = 0.87$, $p = 0.012$, respectively). There was no significant improvement in total, upper- or lower-extremity AMS among non-CCS patients. **Conclusion:** The natural history of CCS differs from other incomplete cervical cord injuries and tends to be associated with a higher rate of neurologic recovery, with improvement more prominent in lower extremity motor power within about 1 month postinjury.

An evaluation of trauma data collection in Latin American low- and middle-income countries. *Béatrice Bouchard**, *Tarek Razek†*, *Dan Deckelbaum**, *Joaquin Bado†*. From the *McGill University Health Centre, Montreal, Que.; and the †Hospital Maciel, Montevideo, Uruguay.

Background: This study focused on how to improve trauma data collection in low-and middle-income countries (LMICs). We also assessed the possibility of developing a universal trauma database for LMICs by evaluating the needs and challenges for trauma database implementation in LMIC hospitals. **Methods:** A 15-question “strengths, weaknesses, opportunities and threats” (SWOT) questionnaire was distributed to physicians from Latin American LMICs working in trauma departments to evaluate any database currently used at their hospital. If their hospital did not use such a database, the questionnaire evaluated the main reasons why they did not have one. **Results:** A total of 20 questionnaires from 12 different Latin American LMICs were collected. The SWOT questionnaire demonstrated that all individuals who do not have a database at their hospital would favour its implementation. For those with access, the main obstacles that they are facing are lack of personnel, funding and infrastructure. All of the individuals surveyed believe that the development of a global trauma database would allow for benchmarking and better comparison of data between countries. **Conclusion:** The SWOT analysis and the questionnaires will allow us to improve iTrauma and work on the development of a potential universal data set with the collaboration of different Latin American countries. The questionnaire will enable us to better understand the main obstacles that Latin American hospitals are facing with regards to trauma database implementation. We will continue to distribute these questionnaires to reach a greater number of participants and try to obtain results from every country in Latin America.

Heterogeneity of truncal hemorrhage in trauma. *Rafael Olarte*, *Rachel Strauss*, *Luis Teodoro Da Luz*, *Asim Alam*, *AnaMaria Garzon*, *Homer Tien*, *Barto Nascimento*. From the Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: Truncal hemorrhage is the leading cause of early in-hospital deaths in trauma, and some are potentially preventable. The chest, abdomen and pelvis are sources of substantial bleeding. However, the characterization of bleeding by the AIS anatomic regions (chest, abdomen and pelvis) is lacking. This study aims to characterize bleeding by anatomic regions and their associated outcomes. **Methods:** Retrospective cohort study (September 2004–October 2014) of consecutive trauma patients receiving ≥ 1 unit of PRBCs within 24 hours of admission. AIS was used to isolate pelvis, chest and abdomen bleeds (AIS ≥ 3 , nonrelated regions ≤ 2). Demographics, clinical presentation, transfusion, hospital LOS, and hemorrhage-related and overall mortality were analyzed. χ^2 was used for proportions. **Results:** A

total of 332 traumas (142 isolated pelvis [IP], 124 isolated chest [IC], 66 isolated abdomen [IA]) were included. The IP cohort was older, had more female patients and more blunt trauma patients than the IC and IA groups. The IC group had the highest ISS (24 in IC v. 14 in IP v. 17 in IA). Prehospital time, heart rate, blood pressure, hemoglobin, platelets and INR were similar; time to first unit of PRBCs was shorter in the IA group (3 hours in IA v. 5 hours in IC v. 9 hours in IP). The IA group received more significant (≥ 5 units of PRBCs/4 h) transfusions (29% in IA v. 15% in IC v. 8% in IP). The IC group had the highest mortality (35% in IC v. 15% in IA v. 2% in IP). The IA group had the highest mortality by exsanguination (90% in IA v. 79% in IC v. 33% in IP). Hospital LOS was longer in the IP group. **Conclusion:** Our study suggests that bleeding trauma patients represent a heterogeneous population with diverse severities of injury, rates of bleeding, need for significant transfusion, rates of hospital mortality and potentially hemorrhage-related preventable deaths.

The impact of RoTEM generated coagulation data on the early diagnosis of acute traumatic coagulopathy: a prospective study. *Safiya Al-Masroufi**, *Richard Simons†*, *Naisan Garraway†*, *Tyler Smith‡*, *Penny Brasher‡*, *Margaret Walsh‡*. From *McGill University, Montreal, Que.; the †Trauma Services, Vancouver General Hospital, Vancouver, B.C.; and the ‡Vancouver General Hospital, Vancouver, B.C.

Background: Conventional coagulation tests (CCTs) provide limited data on the hemostatic defects of acute traumatic coagulopathy. Viscoelastic assays (rotational thromboelastometry and thromboelastometry; RoTEM) have been increasingly used to diagnose ATC. Our aim was to assess whether RoTEM assays provide the treating clinicians with more useful data than CCTs and can be obtained within clinically significant timings. **Methods:** A prospective observational study was conducted at Vancouver General Hospital. All patients meeting the trauma team activation criteria were included. Clinical data, laboratory results and blood transfusion requirements in the first 24 hours were recorded. **Results:** A total of 63 patients met inclusion criteria from October 2014 to March 2015. One patient had an INR > 1.2 and 2 patients had fibrinogen levels < 1.5 g/L. EXTEMC-CT and FIBTEM-A10 detected ATC with a sensitivity of 100% and a specificity of 90.3% and 85.2%, respectively. In addition, FIBTEM-A10 potentially detected coagulopathy in severely injured patients that would have been otherwise missed by CCTs. The median turnaround time for RoTEM (35.0 min, IQR 29.0–49.0 min) was longer than for CCTs (31 min, IQR 25.0–42.5 min), but there was a progressive improvement in turnaround time during the study period as the process efficiency improved. **Conclusion:** In stable but severely injured patients, RoTEM appears to be more sensitive than CCTs in detecting subtle coagulation abnormalities. A laboratory-based RoTEM program did not appear to have any timeliness advantage over CCTs, but having a centrally located RoTEM does offer certain practical advantages.

Trauma team leader (TTL) response time to bedside: a strategy to improve documentation. *Barbara Klassen*, *Angela Coates*, *Cathy Masales*, *Samir Faidi*. From the Hamilton Health Sciences Trauma Program, Hamilton, Ont.

Background: In 2012, as part of the Ontario Trauma Advisory Committee (OTAC) strategic objectives, the Performance Management Working Group identified performance indicators (PIs) to assess and monitor trauma care across the province. The OTAC PI Indicator Report for all lead trauma

hospitals (LTHs) are populated with data entered into the Ontario Trauma Registry. Data are submitted on a quarterly basis for reporting by Critical Care Services Ontario. “TTL response time to bedside” was supported as a measure of access to timely care. We will present our quality assurance strategy to improve documentation processes related to this PI. **Methods:** “TTL time to bedside” is defined as the time from patient arrival at the LTH and the arrival of the TTL at the patient’s bedside. The target for this indicator is TTL arrival within 20 minutes 90% of the time. The denominator is all trauma team activations and includes cases with missing arrival times. Approximately 30% of arrival times were missing for Q1 of 2014–15. A series of plan–do–study–act cycles were implemented to improve compliance with documenting TTL arrival times. Interventions included education with stakeholders, audit and feedback, and individual TTL performance reports. **Results:** Documentation of TTL arrival at the bedside has improved. The rate of TTL arrival at the bedside within 20 minutes has increased by approximately 10%. **Conclusion:** Strategies to increase compliance have contributed to improved rates reported in our LTH for this PI.

The effect of Alberta’s new impaired driving legislation on motor vehicle–related trauma. Brenda Nakashima. From The Foothills Medical Centre, Calgary, Alta.

Background: Motor vehicle collisions (MVCs) resulting in injuries and death disproportionately involve impaired drivers. Moreover, those under the influence of alcohol have a much higher rate of presentation and admission to hospital for traumatic injuries. In an attempt to decrease impaired driving and consequently alcohol-related MVCs and injuries, the government of Alberta recently introduced new legislation aimed at harsher and swifter punishments for drivers found to be under the influence of alcohol. However, it has yet to be seen what impact the enforcement of this new legislation has had on traumatic injuries secondary to MVCs and alcohol impairment. The primary aim of this study is to assess the effect of Alberta’s new impaired driving legislation on the proportion of trauma patients with a positive ethanol screen presenting to the emergency department of a major trauma centre following an MVC. Secondary objectives will assess whether the degree of behavioural change resulting from this legislation is related to demographic factors and if the new legislation has influenced the mean blood alcohol concentration of those who do have a positive ethanol screen. **Methods:** A retrospective single-centre cross-sectional chart review will be used, examining all adult patients presenting to the emergency department of a major trauma centre who require trauma team activation or consultation and who have an MVC-related injury. Of those charts meeting these criteria, the proportion of patients with positive ethanol screens will be compared between the year before and after the new legislation being implemented. Patients will be identified using electronic medical record logs (REDIS and Sunrise Clinical Manager). Similar methods will be used for the secondary objectives. **Results:** Pending. **Conclusion:** Pending.

Oncological emergencies in acute care surgery: an analysis of processes and outcomes. Ruqaiya Al-Shebbi^{†*}, Kristin DeGirolamo^{*}, Brian Drake^{*}, Naisan Garraway^{*}, Emilie Joos^{*}, Yarrow McConnell^{*}, Morad Hameed^{*}. From the *Sections of Trauma and Acute Care Surgery and Surgical Oncology, University of British Columbia, Vancouver, B.C.; and [†]Vancouver Coastal Health, Vancouver, B.C.

Background: Colorectal cancer (CRC) is the considered to be the fourth most common cancer in Canada. A significant proportion of patients present with emergencies, including obstruction, bleeding and perforation. The literature suggests worse outcomes for patients presenting on an emergency basis. Little is known about processes of care for or outcomes of these patients on organized emergency general surgery (EGS) services. We compare patient factors, processes and outcomes in the care of colon cancer patients presenting for planned versus emergency surgical interventions. **Methods:** National Surgical Quality Improvement Program (NSQIP) data on patients with colorectal malignancies presenting to EGS at an urban teaching hospital (2010–2015) were linked with billing and administrative data. The merged data were stratified based on planned versus emergency surgical intervention. Patient characteristics and indicators of process and outcome were compared between the 2 groups using descriptive statistics and logistic regression models. **Results:** Almost two-thirds of the nonelective procedures performed on patients presenting with colorectal conditions were surgeries for CRC. CRC patients requiring acute surgical interventions at the time of presentation were relatively older (47% > 75 yr). At the time of surgery, they were less unstable (43% ASA 3/4). Ten percent of them had disseminated disease at the time of emergency presentation, compared with 4% in the elective cases. Surgical site infection was more frequent in the EGS group than elective cases (15% v. 3%). **Conclusion:** CRC patients commonly present with acute emergencies, are relatively older and less stable. They’re more likely to have advanced disease at the time of emergency intervention and have worse short-term outcomes than their elective counterparts. These findings support the need for comprehensive surveillance and quality improvement efforts in the EGS CRC population.

Novel hand-held hematoma detector for the diagnosis of intracranial bleeding. Bhavin Kapadia^{*}, Homer Tien[†], AnaMaria Garzon[‡], Shawn Rhind[‡], Henry Peng[‡], Ramon Barbosa[†], Barto Nascimento[†]. From *Sunnybrook Trauma Research, Toronto, Ont.; the [†]Sunnybrook Health Sciences Centre, Toronto, Ont.; and the [‡]Defence Research and Development Canada — Toronto Research Centre, Toronto, Ont.

Background: TBI remains the leading cause of prehospital and in-hospital deaths in young people. Time to diagnosis and evacuation of intracranial hematomas is determinant of survival and neurologic outcomes in TBI patients. Our research program is evaluating a novel hand-held hematoma detector (HD) using near infrared spectroscopy (nonionizing radiation) for detection of minimal amounts of intracranial bleeding. This is a preliminary report on the first TBI patients to undergo scanning by this novel HD. This trial aims to evaluate the feasibility, performance and safety of this novel HD. **Methods:** Prospective observational trial including 20 TBI patients with known (on CT scan) subdural (SDH), epidural (EDH) and intraparenchymal hematomas. This trial is designed to generate human data in order to calibrate the technology. Ability to obtain full head scanning, scan duration, logistic issues, agreement rates between HD and CT scan are evaluated. Adverse reactions were documented. κ statistics will be used for interrater reliability. **Results:** Nine patients were eligible (September–November 2015); 2 refused and 1 had no substitute decision maker. Six patients have been enrolled; 4 EDH and 2 SDH with a median hematoma volume of 37.4 mL (range 17–101 mL). We documented 100% agreement between tests and raters was documented. Log-rolling is required for patients with spine precautions. Scan duration was on average 3.5 min; no adverse reactions were noticed. **Conclusion:** A novel hand-held

HD is under development and has been successfully applied for the first time in a setting of a human clinical trial for the detection of intracranial hematomas in TBI.

Acute coagulopathy of trauma following isolated brain injury: relationship between coagulofibrinolytic alterations and sympathoadrenal activation. *Brandon Lejniaks**, *Shawn Rbind**, *Arimie Min†*, *Alex Di Battista‡*, *Maria Shiu**, *Sandro Rizoli†*, *Henry Peng**, *Kenji Inaba§*, *Andrew Baker§*. From the *Defence Research and Development Canada — Toronto Research Centre, Toronto, Ont.; †St. Michael's Hospital, Toronto, Ont.; the ‡University of Toronto, Toronto, Ont.; and the §Division of Trauma and Surgical Critical Care, St. Michael's Hospital, Toronto, Ont.

Background: Acute coagulopathy of trauma (ACOT) involves immediate activation of multiple hemostatic pathways, predisposing to dysfunctional systemic coagulation and fibrinolysis. TBI has long been associated with ACOT; however, the underlying pathogenesis and relationship to sympathoadrenal activation remains unclear. This study aimed to elucidate the early time course of coagulofibrinolytic alterations in association with circulating catecholamine levels in moderate-to-severe TBI patients. **Methods:** Head-injured patients ($n = 88$; aged 50 ± 21 yr; 62% male) admitted to 3 level 1 trauma centres were classified as moderate (GCS score 9–12; $n = 21$) and severe TBI (GCS score 3–8; $n = 67$). Plasma concentrations of 6 coagulofibrinolytic biomarkers (tissue factor [TF], TF pathway inhibitor [TFPI], tissue plasminogen activator [tPA], plasminogen activator inhibitor [PAI]-1, thrombin antithrombin complex [TAT], D-dimer [DD]) and 2 catecholamines (epinephrine [Epi], norepinephrine [NE]) were measured by ELISA on admission and 24 hours postinjury. **Results:** Significant elevations in TF, tPA, PAI-1, TAT and DD were observed in the severe TBI cohort at both time points, despite a lack of coagulopathy, as assessed by conventional hemostatic assays. The degree of sympathoadrenergic activation, as measured by Epi and NE levels, was shown to be dose-dependently related to increases in all coagulofibrinolytic markers. The strongest correlations were found between catecholamine levels and TF, tPA, TAT, and DD. Moreover, these 4 markers were shown to be significantly elevated in patients with unfavourable neurologic outcomes and overall mortality. **Conclusion:** These findings support the hypothesis that excessive sympathoadrenergic activation after isolated TBI exacerbates ACOT and is associated with worsened outcome.

A comparative study of functional fibrinogen assays using TEG and RoTEM in trauma patients. *Henry Peng**, *Homer Tien†*, *Shawn Rbind**, *Andrew Beckett‡*, *Jeannie Callum†*, *Asim Alam†*, *Barto Nascimento†*. From the *Defence Research and Development Canada — Toronto Research Centre, Toronto, Ont.; the †Sunnybrook Health Sciences Centre, Toronto, Ont.; and ‡McGill University, Montreal, Que.

Background: Thromboelastography (TEG) and rotational thromboelastometry (RoTEM) are based on similar technologies and commonly believed to provide comparable results. However, different assays using a variety of reagents have been developed for each system, which may produce different results. This study compared TEG and RoTEM fibrinogen assays to determine their interchangeability in bleeding trauma patients. **Methods:** Citrated whole blood was collected at different time points. TEG functional fibrinogen (FF) and ROTEM FIBTEM assays using

standard reagents and procedures were analyzed simultaneously. In addition, TEG FIBTEM assay was performed using the same reagents (EX-TEM and FIB-TEM) and concentrations as used in RoTEM FIBTEM for crossover comparison. Pearson's method, t test and repeat measures analysis of variance were used. **Results:** TEG FF reaction time (RT) and RoTEM FIBTEM coagulation time (CT) ($r = 0.31$, $p < 0.0001$) and TEG FF maximum amplitude (MA) and RoTEM maximum clot firmness had significant correlations (MCF; $r = 0.74$, $p < 0.0001$). When the same reagents were used in both systems a stronger association was observed between TEG FIBTEM R and RoTEM FIBTEM CT ($r = 0.56$, $p < 0.0001$), but there was a similar correlation between TEG FIBTEM MA and RoTEM FIBTEM MCF ($r = 0.69$, $p < 0.0001$). However, TEG FF assay had a longer R (133.0 ± 59.1 s) and larger MA (22.4 ± 7.6 mm) than RoTEM FIBTEM CT (63.4 ± 17.4 s) and MCF (16.8 ± 7.7 mm, $p < 0.001$). In contrast, TEG FIBTEM assay had a shorter R (41.8 ± 21.6 s) and larger MA (20.5 ± 9.4 mm) than RoTEM FIBTEM ($p < 0.001$). **Conclusion:** Although TEG and RoTEM were correlated for functional fibrinogen assays, their parameter values were significantly different. Therefore, TEG and RoTEM guidelines should not be considered interchangeable.

Prolonged transfer times of polytrauma patients to a level 1 trauma centre is a risk factor for PE: a retrospective cohort study. *Mooyad Ahmed**, *Sameena Iqbal†*, *David Bracco‡*, *Dan Deckelbaum‡*, *Jeremy Grushka‡*, *Paola Fata‡*, *Tarek Razek‡*, *Andrew Beckett‡*, *Kosar Khwaja‡*. From the *McGill University Health Centre, Montreal General Hospital, Montreal, Que.; the †Montreal General Hospital, Montreal, Que.; and ‡McGill University, Montreal, Que.

Background: PE is reported to occur in up to 4% of polytrauma patients. Reported risk factors for post-traumatic PE vary widely. The risk of PE due to the delay to definitive care from prolonged transfer time has not been explored thoroughly. We hypothesized that patient transfer time is an independent risk factor for PE. **Methods:** This was a retrospective study using trauma registry data. All trauma patients diagnosed with PE during their hospital stay from 2005 to 2013 at a level 1 trauma centre (Montreal General Hospital) were identified. Incidence of PE was compared between patients transferred from peripheral hospitals off-island and those transported directly to the trauma centre from trauma scene or from hospitals on the island. Student t test and multiregression analysis was conducted. **Results:** Among 19 490 trauma patients in the 2 cohorts ($n = 5519$ transferred from off-island and $n = 13 971$ directly admitted or on-island transfers), a total of 118 patients were diagnosed with PE (0.6%). There was a 2-fold increase in PE occurrence in the transferred cohort from off-island (0.94%, $n = 52$ v. 0.47%, $n = 66$, OR 2.0, 95% CI 1.4–2.88, $p < 0.05$). The median delay of transfer for patients with PE from off-island transfers was 83 (range 2–1527) hours, whereas for patients from on-island was 41 (range 1–1006) hours. **Conclusion:** The overall incidence of PE in our trauma population is comparable to the literature. However, the PE rate is doubled in patients transferred from off-island hospitals, suggesting that trauma patients' transfer conveys an independent risk for PE. The risk might be due to delay in getting definitive care and remaining in a hypercoagulable state. The incidence of early versus late PE needs to be further explored.

Seatbelt laws and seatbelt usage compliance — What is the correlation? Multinational comparative observation. *Nisreen Maghraby*, *David Bracco*. From McGill University, Montreal, Que.

Background: Motor vehicle crashes (MVC) remain one of the leading causes of death and disability worldwide. Noncompliance with seatbelt use plays a major role. Seatbelt laws are a positive step toward the solution. Our primary objective is to determine which factor (high fine alone versus fine and law enforcement) resulted in high compliance rates, determined as > 95% seatbelt usage. Our secondary outcome is to determine how much a fine needs to represent compared with the average income of the region for the seatbelt usage to reach such compliance. **Methods:** A buckle-up app, designed by one of the authors (Dr. David Bracco), has recorded observations from multiple countries on different traffic offences, seatbelt usages being one of them. We will be comparing seatbelt laws from countries with high seatbelt compliance. For a country to be included we need at least 200 observations to yield a 95% CI of 3%. **Results:** The top 3 countries with regards to seatbelt compliance are United Arab Emirates (UAE; 99.22%), Chile (91.27%) and Canada (86.41%). The lowest 3 countries are Kingdom of Saudi Arabia (KSA; 15.57%), Kuwait (25.23%) and Pakistan (26.23%). Comparing the highest country (UAE) with the lowest country (KSA), both have low fines (80\$–100\$), which when compared with their average income represents only 0.0014%–0.0017%, but UAE has a strong law reinforcement component represented by demerit points and camera surveillance for compliance. **Conclusion:** We believe that seatbelt laws and methods for law enforcement (demerit points and video surveillance) are a huge step toward decreasing morbidity and mortality from MVCs, but we also strongly believe fines need to be higher to ensure better compliance, especially if law enforcement measures do not exist in the system.

Is the trauma team leader any good? Evidence from a discrete choice experiment. *Ash Singhal¹, David Mo², Natham O'Hara³, Ross Hengel⁴.* From the ¹BC Children's Hospital, Vancouver, B.C.; and the ²University of British Columbia, Vancouver, B.C.

Background: Trauma hospitals rely on multidisciplinary health-care teams to successfully manage acute patient admissions. An effective trauma team leader is often thought to be self-evident, and there is little formal literature identifying the leadership characteristics and attributes associated with optimal trauma team performance. The purpose of this study was to elicit the trauma team leader traits and characteristics deemed of greatest utility by members of the trauma team. **Methods:** Semistructured interviews with trauma team members in British Columbia, Canada, were conducted to develop attributes and attribute levels for a discrete choice experiment (DCE). The DCE questionnaire contained 10 choice-sets with 6 varying attributes. Multinomial logit modelling was used to determine the relative utility of each attribute included in the experiment, and segmented models were also developed to evaluate differences in preferences between subgroups. **Results:** Twenty semistructured interviews (of trauma team members) allowed saturation around 6 attributes, and generated the attribute levels and language used in their definition. Sixty-four practitioners completed the DCE. The attributes most strongly preferred by the respondents were collaboration, communication, and decisiveness. The attribute of least utility was experience. The specific leadership qualities that provided the most utility to the trauma team were “actively involves input for team” (0.70 ± 0.11) and “concise communications, at time closed-loop” (0.52 ± 0.09). “Hesitant and unclear communication” (−0.88 ± 0.09) and “often indecisive” (−0.68 ± 0.10) were deemed most detrimental to the team's function. **Conclusion:** A starting point for any efforts to improve trauma team leader performance, via initial training and

ongoing education, will necessarily require a more formalized understanding of the language and perceptions of quality leadership attributes. This study will present a framework for understanding how quality trauma team leader performance is perceived by other members of the trauma team.

Understanding trauma in East Africa: investigating the application of a GIS-enabled trauma registry. *Jessica Hogan, Abdullab Saleh, Harvey Hawes.* From the University of Alberta, Calgary, Alta.

Background: Each year, 5.8 million lives are lost from injury. Approximately 90% of those deaths occur in low- to middle-income countries, such as Kenya, where impoverished people have a greater likelihood of dying. Advances in public health informatics and geospatial data afford new insights into trauma burden, while injury surveillance programs have served as a foundation for successful injury control. While there has been sporadic work in Kenya on trauma registry implementation, GIS mapping, and improvements to trauma care, there has not yet been a surveillance system that could consolidate these efforts and direct future care. Objectives of this project are to implement a regional, ministry-sponsored trauma registry around Eldoret in Western Kenya and to combine this registry data with geospatial coordinates into custom ArcGIS modules for systems-based solutions. **Methods:** The Moi Teaching and Referral Hospital (MTRH) has been selected for this pilot study due to its capabilities as a regional hospital and previous assessments as the highest capacity hospital in the area that frequently receives and treats trauma victims. Unique challenges faced by this hospital include those that need to be better quantified and appreciated, such as variable surrounding infrastructure (i.e., poor road access), in order to increase the public's access to trauma care. A trauma registry form will be created and presented for approval by the MTRH and research partners (University of Alberta, research committee members, and Innovative Canadians for Change). A GIS platform will be made ready for input of nonidentifiable patient trauma data. While being collected prospectively over 3 months, patient trauma data will be uploaded and analyzed to appreciate trends in trauma “hot spots” and barriers for those accessing care. Data collection is aimed to begin in September 2016. **Results:** Pending. **Conclusion:** Pending.

The prevalence of alcohol-related trauma recidivism: a systemic review. *Robert Green^{*}, James Nunn^{*}, Mete Erdogan[†].* From ^{*}Dalhousie University and the QEII Health Sciences Centre, Halifax, N.S.; and the [†]Nova Scotia Trauma Program, Halifax, N.S.

Background: Although alcohol is a known risk factor for injury and has been associated with repetitive trauma, the scale of alcohol-related trauma recidivism has not been well described. The primary objective of this review was to determine the proportion of trauma recidivism related to alcohol use. Our secondary objective was to evaluate the association between alcohol and trauma recidivism. **Methods:** A search of 4 databases (MEDLINE, EMBASE, CINAHL, Web of Science) from inception until June 2015 yielded 1839 records for screening. Primary studies that reported repeated admissions for traumatic injuries specifically related to alcohol use were included. Descriptive statistics were used to assess study characteristics and the prevalence of trauma recidivism related to

alcohol use. An aggregate weighted estimate of alcohol-related trauma recidivism was calculated. **Results:** A total of 11 studies met all inclusion criteria. Overall, there were 3350 trauma recidivists among included studies. The proportion of trauma recidivists with evidence of alcohol use on admission ranged from 26.7% to 76.9% (median 47.6%). The aggregated sample produced a weighted estimate of 41.0% (1372 of 3350) for alcohol-related trauma recidivism. In 4 studies, the association between alcohol and trauma recidivism was examined; all 4 found a positive association between alcohol use and repeated admission for traumatic injury. Studies varied in design, population, recidivism periods, and definitions for positive alcohol. **Conclusion:** Our study suggests that 41.0% of trauma recidivism is related to use of alcohol. Due to methodological limitations among included studies, this may underestimate the actual prevalence of alcohol-related trauma recidivism.

Development of a hospital-wide program for simulation-based training in trauma care and management. *Robert Green**, *Samuel Minor**, *Mete Erdogan†*, *Kathy Hartlen†*. From *Dalhousie University and the QEII Health Sciences Centre, Halifax, N.S.; and the †Nova Scotia Trauma Program, Halifax, N.S.

Background: The QEII Health Sciences Centre is a level 1 trauma centre that provides tertiary care services to the province of Nova Scotia and quaternary care services to Atlantic Canada. There are 3 dedicated simulation facilities at the hospital: the emergency medicine simulation bay is designed to mirror a trauma room and provides training using high-fidelity simulators and clinical grade cadavers; the Atlantic Health Training and Simulation Centre includes mannequin-based simulators, a debriefing room and a control room; and the Skills Centre for Health Sciences allows trainees and professionals to practice surgical techniques. **Methods:** This was a descriptive study of the development of an interprofessional hospital-wide environment for training medical students, residents, physicians and hospital staff using trauma-based simulation. **Results:** Training activities between 2013 and 2015 included “in situ” simulations of trauma activities using a sim man; these mock exercises involved assessing the “patient” in the trauma bay and then taking him to the operating room. In 2014, a trauma boot camp for residents was held and involved a surgical skills lab for the development of advanced trauma-related surgical interventions. **Conclusion:** Simulation-based trauma offers a controlled environment for individuals from multiple specialties to safely acquire and practice an array of skills and learn how to work together as a team during critical situations. Further research is required to validate long-term retention of skills and knowledge, to evaluate the effectiveness of simulation-based training on performance and to assess the impact of simulation training on trauma patient outcomes.

Grade V liver trauma involving a liver allograft. *Radoslav Krouchev**, *Morad Hameed†*, *Emile Joos‡*, *Marvin Hsiao§*. From the *University of Laval, Quebec, Que.; the †Vancouver General Hospital, Vancouver, B.C.; the ‡LA County and University of Southern California Medical Center, Los Angeles, Calif; and the §University of Toronto, Toronto, Ont.

Background: Blunt liver trauma is a major cause of morbidity and mortality in the trauma population. Trauma involving orthotopic liver transplantation (OLT) patients is extremely

uncommon. We present the case of a 16-year old female who sustained grade V injury to her transplanted liver. **Methods:** This case report presents the initial investigation and treatment modalities used in the management of this complicated injury. **Results:** The patient had been transplanted twice during childhood. While on her bicycle, she was hit by a truck. CT scan showed an isolated grade V liver laceration. There was an 8 cm pseudoaneurysm and a traumatic arteriovenous fistula. She underwent angiography 24 hours after injury. After successful balloon occlusion of the hepatic artery and hepatic vein, the pseudoaneurysm was embolized with thrombin with a perfect angiographic result. The patient developed hemodynamic instability in the IR recovery unit. Repeat angiography was attempted but unsuccessful due to hepatic artery vasospasm. She was taken urgently to the OR for laparotomy. Aided by the presence of the catheter, the hepatic artery was controlled and a 2 cm tear was repaired with an ABO-compatible cadaveric venous patch. The postoperative course was complicated by abdominal compartment syndrome and liver failure. Liver biopsy showed necrosis on the background of chronic ductopenic rejection and cirrhosis. She was listed for repeat OLT and received it within 3 weeks of admission. **Conclusion:** Major trauma involving an OLT recipient is infrequent. The same therapeutic modalities can be successful in managing these injuries. Repeat OLT remains an option in extreme cases of blunt liver trauma.

Current use and complication rates of prophylactic IVC filters. *Radoslav Krouchev**, *Morad Hameed†*, *Emile Joos‡*, *Marvin Hsiao§*, *Ross Brown†*, *David Evans†*. From the *University of Laval, Quebec, Que.; the †Vancouver General Hospital, Vancouver, B.C.; the ‡LA County and University of Southern California Medical Center, Los Angeles, Calif.; and the §University of Toronto, Toronto, Ont.

Background: Trauma patients are at increased risk for thromboembolic events. They often present with relative contraindications to chemical DVT prophylaxis. IVC filter (IVCf) placement is indicated in trauma patients with documented DVT/PE and contraindications to anticoagulation. However, its use in the prophylactic setting is controversial. Some studies in the literature show a high complication rate from IVCf, as well as a high nonretrieval rate in this population. **Methods:** We studied a retrospective cohort of trauma patients who received an IVCf in our Canadian level 1 trauma centre. The study period extended from December 2011 to December 2014. Trauma registry and electronic charts were reviewed. We tried to identify triggers of IVCf placement in the prophylactic setting. We also measured days with IVCf and retrieval rates. **Results:** An IVCf was placed in 37 patients. Blunt trauma accounted for 97% of these injuries. Prophylaxis was the indication for placement in 16 patients (43%). Two patients died during their initial hospital admission. All 14 of the remaining patients had successful retrieval of their IVCf. Mean number of days with IVCf was 30 days. A single arm DVT developed while an IVCf was in place. There were no cases of PE in the study group. Mean ISS was 41. Polytrauma was present in all patients, with TBI (100%) complicated mostly by long bone (62%), spine (56%) and pelvic fractures (43%). **Conclusion:** The IVCf remains useful for the polytrauma patient. These devices should be removed as soon as the patient resumes chemical DVT prophylaxis.