

2017 Emergency Medicine Research Day

Submitted Abstracts

2017 Award Recipients

Best Student Project: Dana Stewart - *Are EMS offload delay patients at increased risk of adverse outcomes?*

Best Resident Project: Mohammad AlNajjar - *Patients' reported experience at the emergency department*

Clinical Faculty Mentorship Award: Catherine Patocka - *The use of point-of-care resources in the Emergency Department: a developmental model*

Best Clinical Faculty Project: Charles Wong - *The Calgary Stampede: Effects on emergency and urgent care department utilization during a Canadian mass gathering*

Amanda Wang – Medical Student

Amanda Wang, Kevin Lonergan, Dongmei Wang, Eddy Lang

Are we transfusing wisely? An analysis of transfusion practices among hemodynamically stable patients with iron deficiency anemia in four hospitals.

Introduction: To help mitigate risks associated with red blood cell transfusions, CWC guidelines recommend practicing restrictively. Transfusion Medicine recommends a Hgb threshold of 70 g/L, and ordering a single unit at a time (with reassessment after). The purpose of this study was to investigate Emergency Department (ED) compliance with these more restrictive thresholds among hemodynamically stable patients.

Methods: A retrospective analysis was performed on data from all emergency visits to 4 adult urban ED sites from July 1 2014 to July 1 2016. We excluded unstable patients (CTAS1, temperature >38c, HR>100bpm, RR>20rpm, systolic BP<90mmHg, and O2 sat <85%), patients with normal or high MCV levels (<80fL) and certain others (patients without a Hgb level, patients who left without being seen, and orders cancelled via patient discharge). After applying exclusion factors, we examined transfusions ordered. Appropriateness was assessed using the stratified Choosing Wisely Canada Guidelines for Transfusion. As an adjunct, IV iron therapy data was also analyzed for the same period between July 1 2014 and July 1 2016, excluding patients who did not have a Hgb level.

Results: We identified 445 eligible patients (62% female), with a mean age of 61 and average first hemoglobin of 81 g/L. 40 of the 445 patients had an indication for transfusion of acute blood loss of more than 15% blood volume. Across all groups, 16% of patients received only 1 unit of blood. 26% of transfused patients had a hemoglobin less than 60 g/L, 60% had a Hgb <70g/L, 27% had a Hgb 70-80 g/L, 9% had a Hgb 81-90g/L, and 4% had a Hgb >90 g/L. Over the same two-year period, only 178 patients received IV iron. The average Hgb for those patients was 82 g/L.

Conclusions: A retrospective analysis documents a significant likelihood of pRBC over-transfusion among Emergency Department physicians and an underutilization of IV iron therapy for certain hemodynamically stable and anemic patients. The development of audit and feedback methods, and creation of a clinical pathway may help address the rate of over-transfusion.

Andrew McRae- Emergency Physician

Andrew McRae, Iram Usman, Grant Innes, Eddy Lang, Brian Rowe, Michael Schull, Rhonda Rosychuk

A comparative evaluation of ED crowding metrics and associations with patient mortality

Introduction: Over 700 different input, throughput and output metrics have been used to quantify ED crowding. Of these, only ED length-of-stay (ED LOS) has been shown to be associated with mortality. No comparative evaluation of ED crowding metrics has been performed to determine which ones have the strongest association with patient mortality. The objective of this study was to compare the strength of association of common ED input, throughput and output metrics to patient mortality.

Methods: Administrative data from five years of ED visits (2011-2014) at three urban EDs were linked to develop a database of over 900,000 ED visits with patient demographics, electronic time stamps for care processes, dispositions and outcomes. The data were randomly divided into three partitions of equal size. Here we report the findings from one partition of 253,938 ED visits. The remaining two data partitions will be used to validate these findings. Commonly-used crowding metrics were quantified and aggregated by day or by shift (0800-1600, 1600-2400, 2400-0800), and the shift-specific metrics assigned to each patient. The primary outcome was 7-day all-cause mortality. Multilevel logistic regression models were developed for 7-day mortality, with selected ED crowding metrics and a common set of confounders as predictors. The strength of association between the crowding metrics and mortality was compared using Akaike's Information Criterion (AIC) and the Bayesian Information Criterion (BIC): ED crowding metrics with lower AIC and BIC have stronger associations with 7-day mortality.

Results: Of 909,000 ED encounters, 124,679 (16.5%) arrived by EMS, 149,233(19.7%) were admitted, and 3,808 patients (0.5%) died within 7 days of ED arrival. Of input metrics, the model with ED wait-time was better (i.e. had a smaller AIC and BIC) than models for daily census, ED occupancy or LWBS proportion for predicting 7-day mortality. Of throughput metrics, the model with mean ED LOS was better than the model for mean MD care time. Of output metrics, the model with daily inpatient hospital occupancy was better than the model with mean boarding time.

Conclusion: Based on one data partition, regression models based on the average wait-time, ED LOS and inpatient occupancy best predicted 7-day mortality. These results will be validated in the two other data partitions to confirm the best-performing ED input, throughput and output metrics.

Bradley Stebner – Medical Student

Bradley Stebner, Eddy Lang, Catherine Joseph, Daniel Grigat, Colins Vasquez, Gilaad G. Kaplan, Kerri Novak

Emergency physicians are choosing wisely when transfusing patients with non-variceal upper gastrointestinal bleeding and hemoglobin >70g/L

- 1) Introduction: Acute non-variceal upper gastrointestinal bleeding (NVUGIB) is a common presentation to the Emergency Department (ED) associated with significant mortality and morbidity. Recent evidence suggests that overt-transfusion is associated with poor patient outcomes and that stable patients above a hemoglobin (hgb) above 70g/L should be transfused judiciously. This retrospective health records review aims to determine the proportion of NVUGIB patients with hemoglobin greater than 70g/L who were still appropriately transfused based on clinical parameters.
- 2) Methods: A retrospective review was conducted on randomly selected patients that presented to one of two major tertiary hospitals with a primary diagnosis of NVUGIB who received blood products, despite a presenting hemoglobin >70g/L. Standardized case report forms were developed through chart abstraction using a pilot-tested template. The appropriateness of transfusion was then adjudicated separately by a trained medical student and an emergency physician; discrepancies were resolved by discussion.
- 3) Results: Following independent review of the charts, agreement was met on 94% (45/48) of the charts and after collective discussion 100% consensus was reached and all 48 patients' transfusion appropriateness and categorized into one of three groups: Appropriate, Potentially avoidable, and clearly avoidable. Only in 22.9% (11/48) of the cases was transfusion deemed to be clearly avoidable while emergency physicians appropriately transfused 45.8% (22/48) of patients based on clinical status and other factors. In 31.3% (15/48) of the cases, transfusion was potentially avoidable in favor of other management options. We calculated the mean GBS for the appropriate, potentially avoidable, and clearly avoidable categories yielding 12.8, 12.7, and 10.2 respectively. Mortality occurred in 2 of the 48 cases (4%).
- 4) Conclusions: In most instances, emergency physicians are effectively integrating hemoglobin thresholds and clinical status to determine if a patients with NVUGIB and hgb > 70 require blood products.

Catherine Patocka – Emergency Physician

Catherine Patocka, Jeremy Voros, Michelle Lin, Teresa Chan

The use of point-of-care resources in the Emergency Department: a developmental model

Introduction: Point-of-care (POC) resources have become increasingly popular among health professionals; however very little is known about how, when, and why medical providers use these tools. The aim of this study was to understand POC resource use in the emergency department (ED).

Methods: We used a qualitative methodology with semi-structured interviews of medical providers in the ED (medical students, residents, and attending physicians) to explore how POC resources are used in the ED. Interpretive description was used with continuous recruitment and constant comparative analysis until thematic saturation was achieved. Themes were identified and a coding system was developed by two investigators and merged by consensus. The analysis was audited by a third investigator.

Results: 12 participants were interviewed (3 medical students, 3 residents and 6 attendings) for approximately twenty minutes each in person or video chat. Several themes were identified. Medical students tend to use a variety of POC resources to learn about individual cases. They primarily focus on diagnostic approaches and perform a 'deep dive' on almost every case. Residents tend to use POC resources they are familiar with for quick referencing, calculations, and the occasional 'deep dives'. Attending physicians use POC resources they are familiar with for quick referencing, calculations, a refresh of less common presentations/diagnoses, the occasional 'deep dive' to enhance their knowledge of a topic, and to teach patients and learners.

Conclusions: Our exploration of POC usage by ED medical providers may provide guidance in improving the utilization and the future development of POC resources.

Charles Wong – Emergency Physician

Charles Wong, Jacob Yunqi Ji, Dongmei Wang, Andrew McRae

The Calgary Stampede: Effects on emergency and urgent care department utilization during a Canadian mass gathering

Introduction: The World Health Organization defines mass gatherings as “any occasion that attracts sufficient numbers of people to strain the planning and response resources of the community hosting the event”. The Calgary Stampede is a two-week mass gathering (MG) occurring annually in July. Clinicians have anecdotally attributed the event with a surge in overall emergency department (ED) and urgent care (UC) visits, especially for complaints related to drug and alcohol intoxication, trauma, and sexual activity. Our objectives were: 1) to determine if there is an increase in overall visits to ED and UCs during the Stampede, and 2) to determine if there are specific increases in presentations related to trauma, violence, alcohol and drug intoxication.

Methods: We conducted a retrospective chart review utilizing a citywide electronic database that captures all ED and UC visits in Calgary. We extracted daily census data at each of the five EDs and two UCs in Calgary. Data was further stratified by time of registration, patient gender, CTAS level, CEDIS complaint category, and ICD diagnosis at discharge.

For the years 2013 to 2015, daily average data for the official Stampede event dates were compared to the 21 days immediately preceding and following the event as a comparator. Dates were selected to incorporate a similar proportion of weekends and weekdays in the Stampede and non-Stampede periods. We performed a post-hoc analysis on the same variables, excluding the departments least likely impacted by the mass gathering for demographic and geographic reasons.

Results: The study period yielded data for 263 380 individual ED and UC visits (34 492 Stampede and 228 888 non-Stampede visits). Overall ED and UC visits increased by 2.1% ($p < 0.0001$) during the Stampede period. Increases in utilization were more marked in predicted subgroups: EMS arrival, male, and nighttime arrival between 2000-0400 (all $p < 0.05$). A marked increase (16.2%, $p < 0.01$) in CTAS 1 visits was seen in the Stampede period. Notable increases were also seen in the CEDIS complaints of lacerations (12.4%, $p < 0.0001$) and blunt trauma (19.4%, $p < 0.0001$), and the ICD diagnosis of substance misuse (23.9%, $p = 0.01$). Visits triaged to the minor treatment (or “Fast Track”) areas increased by 9.5% ($p < 0.0001$), again most markedly at night (15.3%, $p < 0.0001$). When the Children’s Hospital and the geographically remote sites were excluded, the same trends became more marked: overall ED visits increased 3.7%, male visits increased 5.5%, and nighttime visits increased 9.4% (all $p < 0.0001$).

No differences were detected for CEDIS complaints of altered level of consciousness, sexual assault, head or neck injury, limb injury, or social problems.

Conclusions: The Calgary Stampede provokes appreciable changes in overall ED and UC utilization, with marked increases in nighttime visits, visits by men, trauma or substance abuse-related complaints, and minor treatment visits. The effects are most pronounced at sites geographically closest to the event grounds.

Dana Stewart – Medical Student

Dana Stewart, Dongmei Wang, Eddy Lang, Grant Innes

Are EMS offload delay patients at increased risk of adverse outcomes?

1) INTRODUCTION: ED and hospital overcrowding cause offload delays that remove EMS crews from service and compromise care delivery to patients. Prolonged ED boarding times are associated with increased hospital LOS and patient mortality, but the impact of offload delays has not been studied. Our objective was to determine whether offload delays are associated with adverse system and patient outcomes.

2) METHODS: From July 2013 to June 2016, administrative data was collated from four Calgary adult EDs. All CTAS 2 and 3 EMS arrivals were studied. Those assigned an ED care space within 15 minutes were considered controls while those with delays of ≥ 60 -minutes were considered 'delayed'. Multivariable logistic regression was used to determine propensity scores, which were used to match delayed patients to nearest neighbor controls. Matching variables for propensity modeling included age, sex, CTAS level, ED site, arrival day and time, living situation (homecare/facility vs. independent), complaint category (medical, cardiovascular, mental health/neuro, GI, trauma/MS, other) and previous ED use (visits within 1 year). The primary outcome was 7-day mortality. Secondary outcomes included hospital LOS and 30-day mortality.

3) RESULTS: A total of 111,743 patients were studied: 70711 controls and 41032 delayed (median time to stretcher of 8 vs. 109 minutes). There was significant baseline covariate imbalance: Delayed patients were more likely to be female, older, have lower CTAS acuity, arrive on weekdays and evenings, to have general medical complaints, and to arrive at the slowest offload site. In the unmatched analysis, delayed patients had lower 7-day mortality (2.1% vs. 2.6%), similar 30-day mortality (3.5% vs. 3.6%), and longer hospital LOS (10.3 vs. 9.8 days). In the propensity-matched analysis (41016 patients per group), covariate balance was substantially improved and outcomes differed slightly. Seven and 30-day mortality were essentially unchanged, but between group differences for hospital LOS disappeared (10.3 vs. 10.2 days).

4) CONCLUSION: Propensity analysis suggests that EMS patients exposed to offload delays have similar 30-day mortality and slightly lower 7-day mortality than patients who receive timely ED access. While offload delays lead to substandard hallway care, patient dissatisfaction, and remove EMS crews from service, the levels of offload delay studied here were not associated with higher mortality or prolonged hospital LOS.

Daniel Grigat – Project Manager, ESCN

Daniel Grigat, James Andruchow, Andrew McRae, Eddy Lang

Implementing Clinical Decision Support for CT order in Emergency

Background: The use of CT imaging in emergency medicine has grown rapidly over the past two decades. However, the existence of significant practice variation in CT ordering and the strain on finite health system resources has generated interest in ensuring the appropriateness of studies ordered. Choosing Wisely Canada has issued recommendations to not order CT scans for Mild Traumatic Brain Injury (MTBI) or Suspected Pulmonary Embolism (PE) without first using validated Clinical Decision Support (CDS) to rule out serious illness in low risk patients.

Objectives: Our objectives are multifaceted: (a) to integrate CDS into computerized order entry for MTBI and PE, (b) to promote physician use of CDS, (c) to provide physicians with quarterly reports of their individual CT ordering practice and use of CDS, (d) to decrease physician variation in CT ordering, (e) to improve the appropriateness of CT studies ordered, and (f) to decrease the ordering of CT scans for very low-risk patients for whom serious illness can be safely ruled out with CDS.

Methods: A provincial database of diagnostic imaging orders in emergency was created to define the current practice of CT ordering for MTBI and PE on the level of individual emergency physicians. Within the Calgary Zone, CT ordering for MTBI from 2014-2016 was found to vary from 0-91% between physicians who saw a minimum of ten MTBI patients, with an IQR of 38-61%. CT ordering for possible PE was found to vary between 3-21% between physicians who saw a minimum of ten query PE patients, with an IQR of 6.3-10.7%. In addition to establishing the baseline of practice, this database allows for ongoing evaluation of trends in CT ordering, the impact of CDS implementation, and the provision of personalized physician feedback reports.

An interactive web-based CDS platform was developed for MTBI based upon the Canadian CT Head Rule, and for PE based upon Wells Score, Pulmonary Embolism Rule-out Criteria, and D-dimer. Emergency Physicians were randomized to receive support for either MTBI or PE, and the CDS platform was integrated into Sunrise Clinical Manager and opens into a web browser when a CT order is initiated for an eligible patient. The platform provides an evaluation of pre and post-test probabilities, quantitative outcomes data, a patient information handout, and the ability to print to chart. Since launch the use of CDS has remained relatively steady, with CDS being used prior to 30% of CT orders for MTBI, and prior to 40% of CT orders for suspected PE. Variation between physicians in the use of CDS ranges from 0-100%.

Timeline: Integration of clinical decision support into Sunrise Clinical Manager took place in August of 2016. Physicians were provided with baseline reports of their practice in September 2016, and with four months of post-implementation data in February 2017. It is anticipated that six months of post-implementation data will be available at the time of presentation.

Dillan Radomske – Medical Student

Dillan Radomske, Michael Siarkowski, Emma Pedersen, Eddy Lang

Shiftwork and your health: Findings from an Updated Systematic Review

Introduction: A systematic review published in 2012 suggested that shiftwork put employees at risk of experiencing a number of negative health outcomes, but had little effect on mortality from any cause (Vyas et al., 2012). Since its publication, new research serving to further elucidate the association between shift work and mortality has emerged. The current study sought to conduct an update of the systematic review to determine if recent research reaches new conclusions through increased statistical power.

Methods: Ovid Medline (R), Ovid Medline In-Progress, EMBASE, Science Citation Index Expanded, and Conference Proceedings Citation Index – Science were used to retrieve 6438 articles for review. Two researchers independently examined articles to determine inclusion in the systematic review update. Methodological quality was assessed using the Downs & Black criteria for observational study quality. Data extraction and statistical analysis followed methods outlined in the original publication, pooling multivariable adjusted risk estimates to perform generic inverse variance random effects meta-analysis and meta-regression for previously identified key study characteristics.

Results: Studies assessing the role of shift work in all-cause, cardiovascular, and coronary mortality were included in the update. In total, the three papers increased the number of individuals studied from 2,011,935 to 2,118,030. The data from these studies was combined with the 34 studies included in the initial systematic review conducted by Vyas et al. These new data now demonstrate an appreciable increase in cardiovascular mortality in those who worked shift work (RR 1.154 [95% CI 1.038 to 1.283]), most likely driven by stroke outcomes. Shift work was not significantly associated with an increased risk of all-cause mortality (RR 1.065, P= 0.063). Additionally, coronary mortality was not positively associated with shift work (RR 1.084, P = 0.153).

Conclusions: This updated review is the first to suggest that shift work exposure is an independent risk factor for increased cardiovascular mortality possibly related to stroke. These results highlight some of the hidden risks associated with working shiftwork, calling into question the safety of workplace scheduling practices employed in the field of emergency medicine. Results may have implications for health and public policy development, healthcare legislation, and workplace organization.

Dirk Chisholm – U of C BSc Student & EMT

Dirk Chisholm, Joshua Bezanson, Kevin Hanrahan, Gwynn Curran-Sills

Medical Response to the 2016 Fort McMurray Wildfires –Descriptive Epidemiology of Patients Presenting to a Field Hospital

Introduction: The 2016 Fort McMurray Wildfire (FFMW) was the most economically devastating natural disaster in Canadian history, resulting in the evacuation of over 80,000 citizens, burning of over 1,600 structures, with a cost of over \$9 billion CDN. Canada Task Force 2 (CAN-TF2) is Alberta's all-hazards disaster response team, which includes Heavy Urban Search and Rescue and Disaster Medical Assistance Team capabilities. As part of CAN-TF2's deployment, a field hospital was established to support the incident as a result of the evacuation of local healthcare facilities. The objective of this study is to describe the epidemiology of patient presentation to a physician, nurse, and paramedic staffed field hospital during the 2016 FMMW.

Methods: A retrospective chart review was conducted of all Patient Care Reports from the field hospital to determine chief complaint, organized by Canadian Emergency Department Information System (EDIS) Presenting Complaint List. Disposition and patient demographics were also recorded.

Preliminary Results: A total of 162 patients were seen over a 14-day period. Medical force protection accounted for 32/162 (20%) of patient presentations, with the remainder being patients external to CANTF. Evacuation to higher levels of care was required for 23/162 (14%) patients. The leading presenting complaint was prescription / medication request (n=47), followed by foreign body eye injury (n=14), GI complaints (n=11 and n=9), and foot care (n=9).

Conclusion: The majority of patients presented with primary care complaints. While CAN-TF2's primary mission was to provide medical care to CANTF members, most of the patients treated were external to the agency. Of the incident responders who presented for care, the majority were able to return to work. A major medical challenge encountered was responding to a serious GI illness outbreak. Future medical planning will focus on provision of pharmacy services and promoting the use of eye personal protective equipment in wildfire hazard zones.

Emma Pedersen – Medical Student

Emma Pedersen, Eddy Lang

Evaluation of the effect of nightshifts on patient outcomes: a multi-center study

Introduction: Nightshifts may represent a more challenging work environment due to staff fatigue. Our objective was to determine if an association exists between health outcomes for patients seen in Calgary Zone Emergency Department (ED) during nightshifts as compared to other time periods.

Methods: Administrative data from a city-wide electronic health record was collected from four urban EDs on all discharged patients during a 2-year period: January 2015 - December 2016. A total of 454,125 patient visits were included and patients with a scheduled return to the ED were excluded. Three primary outcomes were selected to assess the effects of night shifts on the quality of care received by patients in the ED at night; (i) unscheduled returns to the ED within 7 days resulting in admission, (ii) mortality within 48hrs and, (iii) mortality within 7 days of being triaged or seen by a physician. Non-night shifts were defined as patients seen during the day and evening or 700 - 2300. The data was analyzed using a multivariate logistical regression analysis and precision reported via 95% confidence intervals. All outcomes were adjusted for patient age, ED length of stay (LOS) and Canadian Triage and Acuity Scale (CTAS) scores.

Results: For the outcome of returns resulting in admission, age was an effect modifier and the risk of exposure to nights was increased for those under the age of 42.5, OR of 1.23 (95% CI 1.07 – 1.42). However, for older patients (>42.5) there was no significant increase in the risk of exposure to nights for those who returned and were admitted OR 0.92 (95% CI 0.81 - 1.06). Conversely, when triage time was used instead of physician assessment time, age was no longer an effect modifier, and there was an overall increase in risk of exposure to nights for all ages with an OR of 1.13 (95% CI 1.09 – 1.21). For mortality within 48hrs and 7days respectively, there was no significant increase in the risk of exposure to physicians at night OR of 0.75 (95% CI 0.28 -2.04) and 1.16 (95% CI 0.74 – 1.83). However, when the 8hr night shift was calculated using triage time rather than physician assessment time, there was a significant risk of exposure to night shifts for both 48hr and 7day mortality groups, with ORs of 1.55 (95%CI 1.01 – 2.41) and 1.29 (95% CI 1.00 – 1.67) respectively.

Conclusions: Our study identified presenting to the ED at night as a potential risk factor for adverse patient outcomes using 3 primary quality of care indicators after adjusting for LOS, patient age and disease severity. When physician assessment time was used to evaluate quality of care at night, only the younger population appeared to be at risk for an adverse outcome. Further investigations are needed to determine why being triaged at night or assessed by a physician at night puts patients at a greater risk for an adverse outcome.

Grant Innes – Emergency Physician

Grant Innes, Erin Grafstein, Eddy Lang, Kelsey Innes, Heidi Boyda, James Andruchow

Which kidney stone patients require early referral for urological intervention?

Introduction: Recent data show that 5.5% of Vancouver ED patients with acute renal colic undergo early surgical intervention, but that by 60 days, 20% ultimately require one, suggesting that more patients might benefit from early referral. Calgary data from the same period show that 39% of Calgary patients undergo early intervention, substantially higher than the 20% seen above. Indications for early referral of ED patients with acute renal colic are unclear and highly variable between sites. The objective of this study is to identify patient and stone characteristics that predict the need for urgent urological referral, based on the likelihood of rescue hospitalization or surgical intervention within 30 days of the index ED visit.

Methods: We collated administrative data summarizing patient demographics, ED management and disposition from all Calgary and Vancouver region patients with an ED diagnosis of renal colic in 2014. Those who had no intervention within 72 hours, hence were deemed to have a trial of spontaneous passage, were eligible for study. Research assistants reviewed imaging reports and documented stone characteristics. We accessed regional hospital and procedure databases to identify ED revisits, hospital admissions, and surgical procedures. The primary outcome was need for hospitalization or rescue intervention within 30 days of index visit discharge. Multiple logistic regression was used to determine the association of key predictors (patient and stone characteristics) with 30-day outcomes.

Results: In the two cities, 2563 patients had well-characterized stones and outcomes documented. Mean age was 50 years and 70% of patients were male. Of these, 6.8% required an admission, 14.1% required a procedure, and 15% required an admission or procedure within 30 days. Depending on stone size, passage success was 92% (<2mm), 93% (2-5mm), 75% (5-7mm), 59% (7-10mm) and 55% (>10mm). In multivariable models, the strongest predictors of the need for intervention were proximal stone (OR=7.8), middle stone (OR=5.5), moderate or severe hydronephrosis (OR=1.6) and stone size (OR=1.2 per mm increase). Other potential predictors, including age, sex, arrival mode, CTAS level, WBC, creatinine, stranding and EDLOS were not associated with 30-day outcomes.

Conclusion: These data provide guidance for ED physicians in determining which patients are likely to require hospitalization or surgical intervention—therefore which patients are most appropriate for early surgical referral.

Ian Blanchard – Critical Care and Community Health Sciences / Emergency Medical Services

IE Blanchard, A Ahmad, K Tang, D Lorenzetti, PE Ronksley, ES Lang, CJ Doig, TS Stelfox

The Effectiveness of Prehospital Hypertonic Saline for Hypotensive Patients: A Systematic Review and Meta-Analysis

INTRODUCTION: The Emergency Medical Services (EMS) system is staffed by paramedics who are trained to provide transport and emergency treatment on-scene and enroute to more definitive care. One such intervention is intravenous (IV) isotonic fluid therapy for patients who may present in shock with low blood pressure (hypotension). Hypertonic saline (HS), meaning that the composition of solutes is higher to that of the human body, may exert a dual role of increasing circulatory volume without requiring large volumes of fluid, and muting the pro-inflammatory response of the body. It is this dual role that has led to the hypothesis that in shock states from low blood pressure, HS may be superior to isotonic fluid. The objective of this study was to assess if patients in a hypovolemic state who received HS in the pre-hospital setting, compared to isotonic fluid, changed survival to hospital discharge and secondary outcomes, as reported from randomized controlled trials.

METHODS: Searches were conducted in four electronic databases including Medline, Embase, CINAHL and CENTRAL. Bibliographies of included articles were hand searched. Two reviewers independently selected randomized control trials of hypotensive human participants' administered HS in the prehospital setting compared to isotonic fluid. HS was defined as non-colloid combined formulations; Isotonic fluid included normal saline and other near isotonic fluids such as Ringer's Lactate.

RESULTS: Two reviewers screened 1,145 non-duplicate citations for inclusion. Thirty seven full-text articles were assessed for eligibility, and five trials were included. Data were extracted on a total of 1,162 study participants. All studies administered 7.5% HS and used a non-weight based 250 ml dose, except one that administered 300 ml. Two studies used normal saline, two Ringer's Lactate, and one Ringer's acetate as control. Routine care co-interventions included isotonic fluid, with two studies also administering a colloid. Five studies were included in the meta-analysis (n= 1,162 patients) with minimal statistical heterogeneity ($I^2=0.00$). Using a fixed effect model, the relative risk (RR) of survival to hospital discharge with HS was 1.02 times that of isotonic fluid (95% CI 0.94, 1.10), suggesting no demonstrable difference in effect. There were no consistent statistically significant differences in secondary outcomes such as longer term survival, vital signs, fluid requirements, Multi-Organ Dysfunction Score (MODS), length of hospital stay, adverse events, and disability and neurological scales. These results must be interpreted in the context that a non-weight based dose of one concentration of HS were used in all trials, followed by routine treatment comprising largely of isotonic fluid.

CONCLUSIONS: Studies assessing the administration of HS in the pre-hospital setting have not demonstrated significant differences in mortality or secondary clinical outcomes compared to isotonic fluids.

Ian Blanchard - Critical Care and Community Health Sciences / Emergency Medical Services

IE Blanchard, AB Patel, D Lane, A Couperthwaite, D Chisholm, D Yergens, G Lazarenko, D Lorenzetti, ES Lang, CJ Doig, WA Ghali

Emergency Medical Services Response Time and Survival: A Systematic Review

INTRODUCTION: Emergency Medical Services (EMS) is a coordinated system of response for those critically ill or injured in the prehospital environment. EMS operational response time, often defined as the time from 911 call to first EMS unit arriving on-scene, has been used as a measure of EMS system quality for many decades with the assumption that a faster response saves lives. Maintaining response time is a challenge in the face of increasing EMS call volume and Emergency Department offload delays. The purpose of this study was to conduct a comprehensive systematic review of the peer reviewed literature assessing the association between EMS system operational response time and mortality.

METHODS: Medline, EMBASE, and CINAHL were searched for articles describing original data that explicitly associated ground ambulance operational response time (time from emergency call to first vehicle arrival on-scene) and mortality at hospital discharge. Conference abstracts and non-english language articles were removed. Two independent assessors reviewed the candidate titles, abstracts, and full text with discrepant reviews resolved by consensus.

RESULTS: A total of 10,151 articles were considered for title and abstract review, with 199 articles considered for full text review, and 49 articles meeting inclusion criteria. All articles were observational study designs reporting on the following patient populations: 38 (77.6%) cardiac arrest, 5 (10.2%) general EMS population, 4 (8.2%) trauma, 1 (2.0%) respiratory arrest, and 1 (2.0%) acute myocardial infarction/cardiac arrest. The publication years were: 17 (34.7%) 2010-2015, 12 (24.5%) 2000-2009, 11 (22.4%) 1990-1999, 7 (14.3%) 1980-1989, and 2 (4.1%) 1970-1979. There were 14 (28.6%) studies where response time was the primary exposure of interest, with the remainder of included articles reporting response time as part of a descriptive multivariable model or secondary analysis. Of the 14 primary exposure studies, EMS systems varied, but included basic life support, advanced life support and combined systems. There were multiple approaches to assessing the association, including hypothesis testing between survivors and non-survivors and between response time dichotomous cut-points, and regression using response time as a measured variable and at dichotomous cut-points. Studies finding statistically significant associations suggesting shorter EMS response time improves survival were reported as follows: cardiac arrest (5/7 studies), general EMS population (1/5 studies), and trauma (0/2 studies).

CONCLUSIONS: There is a substantial body of literature describing the association between EMS operational response time and mortality, but evidence informing this relationship is heterogeneous and complex. Shorter EMS operational response time is associated with improved survival for cardiac arrest patients, but is less clear in other patient conditions. Important details such as patient population, EMS system characteristics, and analytical approach must be taken into consideration to appropriately translate these findings to practice. These results will be important for health care leaders wishing to create evidence-based EMS response time policies.

Chandandeep Kaur Bal / Ian Wishart – Medical Student / Emergency Physician

Chandandeep Kaur Bal, Steve Lopushinsky, Sherry MacGillivray, Ian Wishart

Determining the utility of laboratory tests ordered in the trauma lab workup for emergency patients that meet Code 77 or trauma team activation

Background: In 2007, a standard trauma panel for emergency department patients that met Code 77 guidelines or trauma team activation criteria at the Alberta Children's Hospital (ACH) was developed. A list of serological labs (Type and Screen, CBC, Electrolytes panel (including, Ca²⁺ PO₄, Mg⁺), Glucose, Urea, Creatinine, Lipase, ALT PTT/INR) were included. However, the diagnostic utility of these labs has been shown to be limited when it comes to clinical decision making or changing the course of the patient's care. Additionally, such panels have been shown to increase overall cost as well as time to discharge in adult patients. This analysis will allow us to determine whether or not the lab protocols used at the Alberta Children's Hospital are effective and contribute to patient management and care .

Objectives: To retrospectively determine the proportion of abnormal serological tests that are clinically significant in a standard trauma panel and prompt an intervention in the emergent care of the pediatric trauma patient at Alberta Childrens Hospital .

Methods: All patients that have had a Code 77 or trauma team activation from 2010-2017 will be anonymously identified using the ACH Trauma registry trauma database. The age and gender of the patient, initial vital signs , mechanism of injury, investigations ordered as well as the emergent management of the patient will be collected through retrospective chart review. The laboratory investigations ordered from the trauma panel will be assessed for their utility by determining the proportion of abnormal results from these tests that resulted in specific interventions related to the abnormal lab value. Demographic information will be described using medians with interquartile ranges with 95% Confidence Intervals (CI). We will be using a sample size of approximately five hundred patients and using bivariable analysis and regression modelling to examine potential associations between abnormal results and patient outcomes.

Timeline:

February 2017: Submit Ethics Application to the University of Calgary Conjoint Health Research Ethics Board

March 2017- April 2017: Retrospective chart review and data collection

April- May 2017: Statistical Analysis and review

James Andruchow – Emergency Physician

James Andruchow, Andrew McRae, Tasnima Abedin, Dongmei Wang

Validation of a 2-hour accelerated diagnostic protocol to rule out acute myocardial infarction in ED chest pain patients using an hs-cTnT assay

Introduction: Chest pain is one of the most common presenting complaints to emergency departments (EDs) across the world, and the exclusion of acute myocardial infarction (AMI) using troponin testing is central to the care of many of these patients. Testing strategies using conventional troponin assays require repeat testing over many hours to avoid missed diagnoses. This study attempts to validate a 2-hour accelerated diagnostic protocol to exclude AMI in ED chest pain patients using a high-sensitivity troponin-T assay.

Methods: This prospective cohort study was conducted at a single urban tertiary centre and regional percutaneous coronary intervention site in Calgary, Alberta. Patients were eligible for enrolment if they presented to the ED with chest pain, were 25-years or older and required biomarker testing to rule out AMI at the discretion of the attending emergency physician. Patients were excluded if they had clear acute ischemic ECG changes, new arrhythmia or renal failure requiring hemodialysis. High-sensitivity troponin-T (Roche Elecsys hs-cTnT) results were obtained in all patients at presentation and 2-hours later. Relevant outcomes were obtained from administrative data. The primary outcome was AMI within 30-days of ED visit, the secondary outcome was 30-day major adverse cardiac events (MACE). The study was REB approved.

Results: A total of 551 patients with serial troponin results were enrolled from August 2014 –September 2016, of which 363 (65.9%) were classified as low risk based on the 2-hour algorithm. The sensitivity and negative predictive value (NPV) of the algorithm for 30-day AMI were 90% (95% CI 72.3%-97.4%) and 99.1% (95% CI 97.4-99.8%), respectively. Sensitivity and NPV for 30-day MACE was lower: 64.9% (95% CI 55.4-73.5%) and 90.0% (95% CI 85.2-91.9%), respectively.

Conclusion: Based on administrative outcomes data, a 2-hour accelerated diagnostic algorithm using a high-sensitivity troponin-T assay has lower sensitivity for acute MI and MACE than previously reported in the literature. Results may change when outcomes are formally adjudicated.

James Andruchow – Emergency Physician

James Andruchow, Andrew McRae, Tasnima Abedin, Dongmei Wang

Validation of the HEART score in Canadian ED chest pain patients using an hs-cTnT assay

Introduction: The HEART score is a validated tool created to risk stratify emergency department (ED) chest pain patients using 5 simple criteria (History, ECG findings, Age, Risk factors, and Troponin). Several studies have demonstrated the superiority of HEART over other well known risk stratification tools in identifying low risk chest pain patients suitable for early discharge. All but one of these studies used conventional troponin assays, and most were conducted in European populations. This study aims to validate the HEART score using a high-sensitivity troponin T assay in a Canadian population.

Methods: This prospective cohort study was conducted at a single urban tertiary centre and regional percutaneous coronary intervention site in Calgary, Alberta. Patients were eligible for enrolment if they presented to the ED with chest pain, were age 25-years or older and required biomarker testing to rule out AMI at the discretion of the attending emergency physician. Patients were excluded if they had clear acute ischemic ECG changes, new arrhythmia or renal failure requiring hemodialysis. Clinical data were recorded by the emergency physician at the time of enrolment and outcomes were obtained from administrative data. High-sensitivity troponin-T (Roche Elecsys hs-cTnT) results were obtained in all patients at presentation. The primary outcome was AMI within 30-days of ED visit, the secondary outcome was 30-day major adverse cardiac events (MACE).

Results: A total of 984 ED patients with complete HEART scores were enrolled from August 2014 to September 2016. The 30-day incidence of AMI and MACE in the overall population was 3.3% and 20.6%, respectively. HEART scores were predictive of 30-day AMI incidence: low risk (0-3): 0.77% (95%CI 0.0-1.5%), moderate risk (4-6): 4.3% (95%CI 2.3-6.2%) and high risk (7-10): 12.2% (95%CI 5.5-19.0%). HEART scores also predicted 30-day MACE: low risk (0-3): 5.0% (95%CI 3.1-6.9%), moderate risk (4-6): 31.8% (95%CI 27.2-36.4%) and high-risk (7-10): 61.4% (95%CI 51.2- 71.5%). More than half of patients, 522 (53.0%) could be identified as low risk based on the HEART score using a single troponin result.

Conclusion: Using a single high-sensitivity troponin result collected at ED presentation, the HEART score can rapidly and effectively identify more than half of ED chest pain patients as low risk for 30-day AMI, but is less sensitive for 30- day MACE.

James Andruchow – Emergency Physician

James Andruchow, Andrew McRae, Tasnima Abedin, Dongmei Wang

Very low concentrations of high-sensitivity troponin T at presentation can rapidly exclude acute myocardial infarction in a significant proportion of ED chest pain patients

Introduction: Chest pain is one of the most common presenting complaints to emergency departments (EDs) across the world, and the exclusion of acute myocardial infarction (AMI) using troponin testing is central to the care of many of these patients. Testing strategies using conventional troponin assays require repeat testing over many hours to avoid missed diagnoses. This study aims to validate the ability of very low concentrations of troponin at presentation to exclude AMI in ED chest pain patients.

Methods: This prospective cohort study was conducted at a single urban tertiary centre and regional percutaneous coronary intervention site in Calgary, Alberta. Patients were eligible for enrolment if they presented to the ED with chest pain, were 25-years or older and required biomarker testing to rule out AMI at the discretion of the attending emergency physician. Patients were excluded if they had clear acute ischemic ECG changes, new arrhythmia or renal failure requiring hemodialysis. High-sensitivity troponin-T (Roche Elecsys hs-cTnT) results were obtained in all patients at presentation. Relevant outcomes were obtained from administrative data. The primary outcome was AMI within 30-days of ED visit, the secondary outcome was 30-day major adverse cardiac events (MACE). The study was REB approved.

Results: A total of 1,016 patients were enrolled from August 2014 – September 2016, of which 174 (17.1%) patients had an initial troponin below the limit of blank (<3ng/L) and 369 (36.3%) had a level below the limit of detection (<5ng/L). The sensitivity and negative predictive value (NPV) of a troponin below limit of blank (<3ng/L) for 30-day AMI were 100% (95% CI 89.3%-100%) and 100% (95% CI 97.8-100%), respectively. The sensitivity and NPV of a troponin below limit of detection (<5ng/L) for 30-day AMI were 93.8% (95% CI 80.0-98.3%) and 99.5% (95% CI 98.1-99.9%) respectively. Sensitivity for 30-day MACE at both cutoffs was lower: 96.1% (95% CI 92.5-98.0%) for <3ng/L, and 88.4% (95% CI 83.3-92.1%) for < 5ng/L, respectively.

Conclusion: A high sensitivity troponin T result below the limit of blank is highly sensitive at excluding AMI and identifies patients at reasonably low risk of 30-day MACE. A result below the limit of detection will identify a larger population of patients as low risk but has a greater risk of missed AMI and MACE.

Jennie Ding- Medical Student

Jennie Ding, Dongmei Wang, Eddy Lang, Simon Colgan, Jessica Simon

What are the palliative care needs of homeless patients with chronic diseases who frequent emergency departments in Calgary?

Introduction: Complex chronic diseases in the homeless population occur earlier and with worse prognosis than in the general population; often resulting in unmanaged suffering and premature death. We identified the prevalence and mortality from chronic diseases amongst homeless individuals in Calgary that result in emergency department (ED) admissions, as an initial step in determining the need for focused palliative interventions.

Methods: A retrospective cohort study of homeless individuals who visited 4 EDs in the Calgary Zone from July 1, 2013 - June 30, 2016 was conducted using de-identified patient data. We included individuals who experienced either chronic or episodic homelessness by “no fixed address” labels or the address of shelters or supportive housing. The data review focused on the following primary ED diagnoses of homeless patients by using the corresponding ICD-10 codes: respiratory cerebrovascular, cardiovascular, and liver diseases, HIV, and renal failure.

Results: 256 homeless individuals visited EDs with cerebrovascular diseases, heart diseases, HIV, liver diseases, renal failure, or respiratory diseases resulting in a total of 434 ED visits in the studied time period. COPD accounted for 47% of the 434 visits followed by asthma and liver diseases which consisted of 13% and 12% of the total ED visits, respectively. COPD and liver diseases were linked with the highest rate of mortality. The combined in-hospital and post-discharge mortality rates for homeless individuals with a primary diagnosis of COPD was 13 per 100 and 7 per 100 for liver diseases.

Conclusions: Effective palliative care interventions for end-stage COPD and liver diseases would impact the greatest number of homeless individuals who visit EDs for treatment of chronic conditions. Such interventions could not only reduce the mortality rate for these conditions but also improve quality of life.

Katie Lin – Emergency Medicine Resident

Katie Lin, Kathy Yiu, Eddy Lang, Tom Rich, Shawn Dowling

Filling in the Blanks: Assessing the Impact of Mandatory Clinical Context Fields on Quality of Emergency Department Diagnostic Imaging Orders

BACKGROUND: Computerized Provider Order Entry (CPOE) prepackaged order sets allow healthcare providers to streamline the order entry process by utilizing checklist-style data entry forms, often with preset and automatically filled order requisitions to improve efficiency. Within the Calgary Emergency Department (ED) environment, diagnostic imaging (DI) orders embedded in the ED Acute Stroke order set were previously designed with automatically applied "acute stroke" text entered into the clinical context field of the form, with the expectation that physicians would voluntarily add additional notes to aid radiologist interpretations. However, physicians were not consistently supplementing the order form with additional clinical information, resulting in callbacks from the radiology department for further information and delays to neuroradiology interpretation in time-sensitive cases. To address this issue, a force function was added to the ED Acute Stroke order set, requiring physicians to include mandatory clinical context notes on DI requisitions before orders could be submitted.

OBJECTIVE: To determine the impact of a CPOE mandatory text entry force function on the adequacy of clinical context notes provided by ED physicians utilizing an ED Acute Stroke order set in suspected acute stroke presentations.

METHODS: This retrospective pre-post cross-sectional comparison study will evaluate patients aged 18 years or older presenting to any Calgary ED for whom a computed tomography (CT) and/or CT with angiography (CTA) head or neck order was placed through the ED Acute Stroke order set. Patients will be excluded if a CT/CTA was ordered but subsequently canceled, changed, not completed, or reordered by the DI department. A clinical context adequacy scoring tool was developed in collaboration with the departments of Emergency Medicine, Diagnostic Imaging, and Stroke Neurology to rank clinical context entries as adequate, indeterminate, or inadequate/absent. The primary outcome of this study will be to evaluate the proportion of adequate, indeterminate, and inadequate/absent clinical context entries pre- and post- implementation of an ED Acute Stroke order set change involving a mandatory force function for clinical context note entry before DI orders can be submitted. Orders within the preselected time periods will be evaluated by two independent reviewers with any discrepancies adjudicated by a third reviewer who will be either a neuroradiology staff or fellow. In addition to the primary outcome measures, kappa values will also be reported for inter-rater agreement using the clinical context adequacy scoring tool.

TIMELINE: Ethics approval for the study was secured on Jan 30, 2017 through IRISS/CHREB. The clinical context adequacy scoring tool has already been developed and is undergoing review by neuroradiology and stroke neurology teams. Pending finalization of the scoring tool, data capture is slated to begin in early February with data analysis beginning in late March. Preliminary results are to be produced in early May with a CAEP abstract presentation planned for June.

Kenneth Chan- Emergency Medicine Resident

Kenneth Chan, Daniel Joo, Andrew McRae, Yemisi Takwoingi, Zahra Prejmi, Eddy Lang, Abel Wakai

Chest Ultrasonography by Emergency Physicians versus Supine Chest Radiography for Detection of Pneumothorax in Trauma Patients in the Emergency Department

1) **BACKGROUND:** Traumatic injuries to the chest cavity can cause significant morbidity and mortality. Traumatic pneumothorax (PTX) is one of the most common thoracic injuries. The early detection of PTX is important to determine the management and disposition in trauma patients. Supine chest radiography (CXR) is a common screening test completed in the initial trauma assessment, but previous literature have shown that it is not a sensitive test for detecting PTX. Computed tomography (CT) is still considered the gold standard for detection of thoracic injuries. However, the clinical status of the trauma patient may preclude physicians from transitioning them from the resuscitation bay to the diagnostic imaging department for the CT.

Chest ultrasonography (CUS) may be an accurate and effective modality for the diagnosis of PTX in trauma patients. There have been studies done to show the high sensitivity and specificity of CUS in the detection of PTX outside of traumatic clinical contexts. CUS can be completed in conjunction with the Focused Assessment with Sonography for Trauma (FAST) scan at the bedside without moving the patient out of the resuscitation bay and can be an effective diagnostic tool in detecting thoracic injuries. The rapid detection of PTX with CUS will lead to more efficient management with tube thoracostomy, reducing the incidence of PTX-related complications and improve outcomes in trauma patients.

2) **OBJECTIVE:** Our objective is to assess the diagnostic accuracy of CUS by emergency physicians (EPs) versus CXR in the diagnosis of PTX in trauma patients. We will also determine the sensitivity and specificity of various CUS finding (comet-tail artefact, lung sliding, lung point, seashore sign).

3) **METHODS:** We will perform a systematic review and meta-analysis of prospective, comparative diagnostic accuracy studies assessing patients for PTX that undergo both CUS performed by EPs and CXR as index tests, as well as CT of the chest as the reference standard. Two authors will select studies based on our determined inclusion criteria and extract data for diagnostic accuracy statistics. We will perform a quality assessment on included studies using the QUADAS-2 tool. We will utilize a summary receiver operator characteristics (ROC) space to visually assess for heterogeneity. We will calculate a pooled sensitivity and specificity to compare diagnostic accuracy of CUS versus CXR.

4) **TIMELINE:** We have successfully registered the systematic review title within the Cochrane Library in January 2017. We are currently developing the protocol and aim to have it completed by July 2017. We hope to complete the review by December 2018.

Marcie Veitch – Emergency Medicine Resident

Marcie Veitch, Adam Oster

Year-In-Review: Patient Complaints Regarding Calgary's Emergency Medicine Physicians

Introduction: Patient complaints are stressful and anxiety provoking for any physician involved. Rather than having patient complaints remain in solitude, patient complaint reviews can be a useful way to identify common themes or inadequate policies and procedures and are often included in department quality improvement/quality assurance (QI/QA) projects. The goal of this QI/QA project was to review, summarize and categorize patient complaints to identify and analyze common themes and circulate information to staff and trainees.

Methods: A retrospective analysis was completed of all patient complaints regarding emergency medicine physicians from 5 Calgary hospitals for a 1 year period. Before this project began, the project's goal/purpose passed the ARECCI (a pRoject Ethics Community Consensus Initiative) Guidelines for Quality Improvement and Evaluation Projects. A literature review was also completed in order to set appropriate categories to analyze complaints.

Results: In total, 161 complaints were submitted during the 1 year analysis period. Highest complaint rates were from females (93 total, 68%). Approximately half were submitted by the patient themselves (49%), 25% were initiated by a parent and 12.5% were initiated by a spouse. Fifty-five complaints (40%) were filed due to concern about the assessment/diagnosis, 44 total (32%) were about treatment provided, while 36 total (26%) showed concerns for the physician's attitude. Practice standards (32 total, 24%) and concerns regarding discharge (25 total, 18%) completed the top 5 complaint categories. When grouping all communication categories (physician attitude, communication and information sharing) together, communication is the largest complaint category (46.3%). Patient factors, which includes patient expectations, were involved in 25% of all filed complaints. Highest risk patient encounter categories were related to psychiatric-based visits (15 total complaints) and chronic pain (9 total complaints), which when combined includes 17.5% of all filed complaints. Seventy-seven percent of patient complaints were resolved satisfactorily.

Conclusions: Concerns regarding assessment/diagnosis, treatment provided and physician attitude are significant factors that lead to patient complaints. Communication between the physician and both the patient and their support system during the emergency department encounter is an additional factor that leads to complaints being initiated.

Meaghan MacKenzie – Medical Student

Meaghan MacKenzie, Rashi Hiranandani, Dongmei Wang, Tak Fung, Eddy Lang

CT Head Ordering Practices of Emergency Physicians for Low Risk Atraumatic Headache

- 1) Introduction. Many specialty societies have found that neuroimaging in headache is a low-value intervention for benign presentations. This study describes factors that influence ER physicians' adherence to Choosing Wisely recommendations for low risk headache patients presenting to Calgary's Emergency Departments. EM has yet to address imaging in headache as a CW topic; however, this study may inform that decision.
- 2) Methods. Data was retrospectively collected for all patients presenting to Calgary EDs with headaches from April 1/14-March 31/16. Patients were deemed low-risk by virtue of discharge home from the ED, age <50; and no LP, trauma, neurology or neurosurgery consult, or red flags on history (headaches associated with a "bursting sensation", those triggered by exercise, or associated with loss of physical control). The primary outcome was CT ordering rates with an eye to MD practice variation. Patient, physician and environmental factors were used for a Chi-squared analysis comparing patients who did and did not receive CT.
- 3) Results. 2734 headache patients and 117 Calgary ER physicians met eligibility criteria. CTs were ordered more often in males than females (39.9%; 34.1%; $p=0.002$), and in patients presenting during the day and evening (38.1%; 39.0%) than at night (29.7%; $p<0.001$). Patients were divided into quartiles by age, with the oldest group (41.6-50 y.o.) receiving significantly more CT heads (45.1%) than the younger quartiles (34.9%; 34.9%; 27.5%; $p<0.001$). The physician mean ordering rate was 38.0% with a range of 0% to 95% (M=39.0%, IQR=21.0%). Longer triage-to-discharge times were associated with an increase in CT ordering rates (12% for <2.95 hours; 35% for >4 hour wait; $p<0.001$). Lastly, patients who did not have a CT were more likely to revisit the ED within 7 days compared to those who did (6.9% vs 4.0%; $p=0.003$), but their 7-day admission rate was unaffected. Time to assessment, day of week, physician gender, age, years of experience and training program did not influence CT ordering practices.
- 4) Conclusion. To our knowledge, this is the first study to assess how patient, physician and environmental factors relate to the use of CT scans in low-risk headaches presenting to the ED. These findings may be able to inform future Choosing Wisely guidelines.

Melissa Bouwsema – Medical Student

Melissa Bouwsema, Seth Turner, Dana Saleh, Peter Rogers, Jantzen Franke, Joshua Nicholas, Zoe Polsky, Matthew Pfaff, Irina Charania, Marcia Clark

Student Run Simulation Team: A near-peer approach to simulation education

BACKGROUND: Student Run Simulation Team (SRST) is an extracurricular medical student group that provides peers with opportunities to learn and teach principles of acute care medicine in a simulated environment. Early exposure to simulation has been identified as a way for medical students to engage in self-directed education. SRST operates through a peer-led model. Senior medical students design and deliver didactic sessions, simulation scenarios, and debrief the scenarios to target SRST specific objectives.

OBJECTIVE: Informal interviews conducted by the SRST as part of a needs analysis identified barriers to an effective transition from pre-clerkship to clerkship. Specifically, students identified a lack of confidence in principles of team dynamics, including effective communication and role clarification in emergency situations. The curriculum focuses on leadership and an effective team approach to common acute presentations.

METHODS: SRST members acquired simulation skills under the guidance of a simulation team at the University of Calgary. In the inaugural year, 8 second year students developed and delivered the SRST curriculum to 16 first year students. Quality improvement surveys and participant feedback contribute to ongoing program review and refinement. Didactic lectures and task-trainer based skills sessions were created to assist the medical students in developing a foundational approach to a patient presenting to the emergency department. Three distinct simulations of increasing complexity were designed for students to build on their skills. SRST members worked with simulation consultants during 4 custom designed training sessions to develop simulation skills (design and debriefing). The distinguishing aspect of SRST is an emphasis on the non-technical skills of teamwork, leadership, and communication, rather than knowledge acquisition alone. The structure also includes a succession plan for continued peer-led education where the student participants will form the next year's team and will receive similar simulation education.

TIMELINE: Between February 2016 and August 2016, the SRST senior members developed the curriculum and project plan, and worked with the Advanced Technical Skills Simulation Laboratory (ATSSL) to refine the group's model. The inaugural year of SRST from first year member selection to final simulation is currently in progress (September 2016-February 2017). Current senior SRST members have been working longitudinally with the simulation consultants on the aforementioned simulation skills. The senior members for the following year will be selected in February 2017. The new senior members will be trained and oriented to their new roles between February 2017-August 2017. As SRST is an ongoing initiative, the next cycle of curriculum delivery will commence in September 2017.

Michelle Leong / Catherine Patocka – Medical Student / Emergency Physician

Michelle Leong, Eddy Lang, Shelagh Coutts, Jillian Stang, Dongmei Wang, Catherine Patocka

Regional variation in Transient Ischemic Attack (TIA)/minor stroke care in Alberta emergency departments (EDs)

INTRODUCTION: The risk of recurrent stroke following a transient ischemic attack (TIA) has been estimated to be as much as 5 percent in the first 48 hours and ten percent in the first week following initial TIA symptoms, but can be modified as a result of intensive risk factor management. Care pathways for these patients vary between different regions within Alberta with Edmonton admitting more TIA patients and Calgary using computed tomography angiography (CTA) based triage. To examine regional differences in the quality of care, the rate of admission for stroke within 90 days of an index ED visit for TIA/minor stroke was investigated.

METHODS: Data analysts from the Data Integration, Measurement and Reporting (DIMR) branch of Alberta Health Services (AHS) used the National Ambulatory Care Reporting System (NACRS) to identify patients in Alberta who were admitted for stroke within 90-days of an index ED visit for TIA/minor stroke from April 2010 to March 2016. Information extracted included patient demographics, region of residence (Edmonton, Calgary or non-major urban [NMU]) return diagnosis and timing of return ED visit. Analysis included descriptive summaries and proportions were compared using a χ^2 test.

RESULTS: During the study period, there were 26,232 index visits to Alberta EDs for TIA/minor stroke . 5426 (26.1%) of patients were admitted on their index visit. Calgary (22.5%) had lower rates of admission on index visit followed by Edmonton (31.4%) and the NMU (46%). 20,806 (79.3%) were discharged home following their index visit. Of the patients discharged on their index visit 729 (3.5%) had an admission for stroke within 90-days of their index ED visit with rates in Edmonton (3.8%) and the NMU regions (3.8%) being significantly higher than Calgary (2.8%, $p < 0.01$).

CONCLUSIONS: Our study demonstrates significantly lower rates of admission for stroke within 90-days of ED visit for minor stroke/TIA in Calgary compared to Edmonton and the NMU. Further work should focus on validating this result and consideration of standardized care pathways that promote effective resource utilization and quality of care.

Mohammad Alnajjar – Pediatric Resident

Mohammad Alnajjar, Chandan Bal, Jennifer Thull-Freedman, Antonia Stang

Patients' reported experience at the emergency department

- 1. Introduction:** Previous studies have shown and validated the importance of patient reported experience in shaping, and improving the delivery and quality of healthcare provided. In pediatrics one has to capture the reported experience of both the patient and the parent/caregiver in order to get an accurate representation of the true 'reported experience.' There is minimal existing literature on patient reported experience in pediatric emergency departments (PEDs). The aim of our project was to use a validated tool to assess patient reported experience at our PED, and to compare children and parents reported experience.
- 2. Methods:** A validated survey measure developed specifically for pediatric patients at PEDs was used (Picker Institute and Royal College of Paediatrics and Child Health (RCPCH) Urgent and Emergency Care Patient Reported Experience Measure). Patients ≥ 8 years of age and the parents of children 0-17 who visited the Alberta Children's Hospital PED were approached during their visit, and invited to complete the survey. Children ≥ 8 years of age were asked to fill out a separate survey independent of their parent. Project assistants approached patients and parents over 21 randomly selected days, evenings and nights (7 each). The survey consisted of 26 items asking about patient experience during the ED visit. Problem scores, which are percentages calculated for each question to help identify aspects of patient care that respondents thought could have been improved, were calculated for each element of the survey. We selected four items a-priori (wait times, explanations of what nurses/doctors were doing in a way that was understandable, explanations of what was wrong with the patient in a way that was understandable, and pain management) on which to compare problem scores between parents and children. Demographic information was described using medians with interquartile ranges and problem scores as proportions with 95% Confidence Intervals (CI).
- 3. Results:** 367 families were approached and 202 (55%) surveys were completed. The median age of patients was 7 years old (interquartile range [IQR]= 2) and the median CTAS score assigned to the patients was 3 (IQR=3). The median number of patients in the waiting room of the ED when the surveys were distributed was 39 (IQR=30). For wait time, the parent problem score was 34% ((59/173); 95% CI = 27% to 42%) compared to 42% ((30/72); 95% CI = 30% to 54%) for children. The problem score for explanations on what doctors and nurses were doing was 21% ((41/196); 95% CI= 16% to 27%) for parents and 39% (30/77); 95% CI= 28% to 51%) for children. For explanation of what was wrong with the patient the parental problem score was 25% ((48/196); 95% CI=19% to 31%) and the children's score was 42% (32/76); 95% CI=31% to 54%). The parental score for pain management was 20% ((40/195) 95% CI=15% to 27%) compared to 27% ((21/77) 95% CI=18% to 39%) for children.
- 4. Conclusions:** In a pediatric setting, capturing children's opinions about their experience is as important as that of their parents, and may help us improve the delivery and quality of health services in PEDs. Our work has shown that children report a worse experience in PEDs when compared to parents. More work is needed to delineate and further identify the particular aspects of healthcare that cause children and parents experiences to vary, and to design interventions to improve the experience.

Omar Damji – Medical Student

O Damji, A Froliis, S Moore, N Kamal, M Betzner, E Lang, MD Hill

THRIFT – Transportation via Helicopter to Regional Institutions for Fast Thromboectomy

Introduction: Fast transport to hospital is a critical component of the treatment of acute stroke. The Shock Trauma Air Rescue Service (STARS) is an ambulatory helicopter service that provides fast transport from the site of the emergency to tertiary care centres across Alberta, Saskatchewan and Manitoba. Endovascular therapy (EVT) has revolutionized acute stroke treatment by allowing (within 12 hours of event onset) physical retrieval of the thrombus causing the acute ischemic event. The aim of our study was to describe characteristics of individuals who used air ambulance for atraumatic acute neurological emergencies.

Methods: The STARS database for southern Alberta was searched from 2010-2015 to identify adult cases of atraumatic acute neurological emergencies (REB15-2910). Individuals transported via STARS were cross-matched with emergency department visits and an EVT database to attain a temporal account of time from first contact with STARS, total time from pick up to tertiary stroke center, those who received EVT, and until hospital discharge/death. Transport times reflect scene to tertiary stroke center as well as primary care center to tertiary stroke center. Demographic information including vital signs at the time of pick-up were extracted. Data were described as medians and frequency estimates.

Results: From 2010-2015, 172 individuals utilized STARS transport for acute neurological emergencies. The most common reasons for transport were acute stroke (n=85, 49.4%), altered level of consciousness (n=27, 15.7%), intracranial hemorrhage (n=19, 11.1%) and weakness (15, 8.7%). A total of 14 individuals (8.1%) underwent EVT. 13 of the 85 (15.9%) individuals presented with acute stroke, and one of the 19 people (5.3%) developed ICH secondary to ischemic stroke post-EVT. There was no significant difference in travel time between ischemic stroke patients who received EVT [median 89 minutes (Q1: 80, G3: 111)], and those who did not [median 94 minutes {Q1: 69, Q3: 122}]. There was no significant difference in vital signs between those who required endovascular treatment and those who did not.

Peter Rogers – Medical Student

Peter Rogers, Adam Oster, Dongmei Wang

Fast Track in Calgary Hospitals: Measures for Quality Improvement

INTRODUCTION: One strategy to address emergency department (ED) overcrowding was the establishment of dedicated spaces to manage non-acute care patients. This became known as Fast Track (FT) zones or Minor Treatment areas. Since its implementation in many EDs, the literature has shown that FT has decreased patient wait times, length of stay (LOS), left without being seen rates, and has increased patient satisfaction. The objective of this study was to analyze the demographics and presenting complaints of patients presenting to FT in Calgary EDs using local administrative databases to understand the current selection of FT patients, as well as to uncover potential throughput efficiencies through LOS and time to decision analysis.

METHODS: Sunrise Clinical Manager (SCM) is an administrative database used in the Calgary Zone EDs tracking patient demographics, presenting complaints, and bed hours. To our knowledge, this electronic database has not been used to analyze patient demographics in FT. SCM data was pulled from the Foothills Medical Center (FMC), Peter Lougheed Center (PLC), and Rockyview General Hospital (RGH) EDs between October 2015 and September 2016. Based on consensus achieved by the Calgary FT-Minor Treatment Sub-committee, data was descriptively analyzed based on the following criteria: (1) triage profiles of the Calgary ED sites; (2) site admission rates by complaint, Canadian Triage and Acuity Scale (CTAS), vitals, and age; (3) time to decision for orthopedic patients admitted from FT/Minor; and, (4) LOS in FT for non-admitted back pain patients.

RESULTS: Over the 12 month period, a total of 53,911 patients were triaged to FT, with 16,224 patients triaged to FMC, 18,299 to PLC, and 19,388 to RGH. 6.9% of FT patients were admitted to hospital at FMC, 4.8% at PLC and 4.8% at RGH. 14.4% of patients at FMC, 18.3% at PLC and 17.6% at RGH were CTAS 2; 40.9% of patients at FMC, 46.2% at PLC and 37.9% at RGH were CTAS 3; 34.0% of patients at FMC, 27.8% at PLC and 33.3% at RGH were CTAS 4; 10.7% of patients at FMC, 7.7% from PLC and 11.2% for RGH were CTAS 5. In total, 29.5% of admitted patients were between the ages of 20-40, 34% between the ages of 40-60, and 23.9% between 60-80 years of age. Between ages 40-60, 6.4% of FMC FT patients were admitted, 5.6% at PLC and 5.8% at RGH. For FT patients 80 years or older, 10.4% were admitted at FMC, 13.1% at PLC and 9.4% at RGH. The top five FT presenting complaints at FMC, PLC and RGH were lower extremity injury (6,860 patients), upper extremity injury (6,723 patients), laceration/puncture (5,670 patients), lower extremity pain (4,058 patients) and localized swelling/redness (3,402 patients). The annual bed hours used for patients admitted to orthopedic surgery (consultation request to time of orthopedic admission) was 802.3 hours at FMC, 441.1 at PLC and 705.1 from RGH. The annual FT bed hours for patients with non-admitted back pain (FT bed to time of discharge) was 2,144.3 hours from FMC, 3,367.9 from PLC and 1,134.9 from RGH.

CONCLUSIONS: The efficiency of FT is based on streamlining low acuity patients with an expected rapid discharge from hospital. This data identifies patient profiles and admission rates, as well as aggregated FT bed hours for a select subgroup of patients. The results of this will be presented to the FT-Minor Treatment Sub-committee with the hopes of potentially improving patient throughput.

Tahireh Shams – Medical Student

Tahireh Shams, Sophie Gosselin, Ryan Chuang

Unintentional Ingestion of Black Henbane: Two Case Reports

Introduction: Black henbane (*Hyoscyamus niger*) is a member of the nightshade family and is an invasive species that grows world-wide. Black henbane contains tropane alkaloids, the most notable of which are hyoscyamine, scopolamine (hyoscine), and atropine. The entire plant is toxic. The alkaloids in black henbane have significant central and peripheral ant muscarinic effects; peripheral signs appear first with mild to moderate ingested amounts and central signs are seen with larger ingestions. We present two cases of acute poisoning from unintentional black henbane ingestions.

Methods: Telephone interview at the home of the couple involved two months' post-ingestion. One patient gave the information for both family members. The authors reviewed the relevant medical records after patients' consent was obtained. A literature search was conducted via PubMed for relevant publications.

Results: A 65 year old woman and her 71 year old husband were brought into hospital by their friend because they were feeling unwell within ten minutes of eating what they thought was an oddly shaped parsnip from their garden. Both patients presented to the emergency department (ED) with confusion, delirium, hallucinations, memory difficulty, agitation, mydriasis, urinary retention, as well as warm and dry skin. The woman was seen in the emergency department approximately 1 hour post-ingestion; the man was assessed 4 hours post-ingestion. The woman also presented with one episode of nausea, vomiting, and a "stiff tongue", dizziness upon ambulation, a GCS of 15, and vitals as follows: Temperature (T) 36.9 degrees Celsius, heart rate (HR) 104 beats/min, blood pressure (BP) 125/79 mmHg, respiratory rate (RR) 20 breaths/min, and oxygen saturation (O2 Sat) of 100%. Her pupils were 5mm bilaterally and sluggishly reactive. Her initial electrocardiogram (ECG) showed tachycardia, bigeminy, and non-specific ST/T changes. She developed a widened QRS complex and a new left bundle branch block (LBBB) approximately 28.5 hours post-ingestion. Notably, the patient had three normal sinus rhythm ECG's with sinus tachycardia during her course in hospital (after her initial ECG) prior to developing the LBBB. The man presented with profound agitation, insensible speech, a GCS of 9 (2E 5M 2V), unsteady gait, tremulousness, a 1 cm head laceration from several falls prior to arriving in the ED, and vitals as follows: T 37.4 degrees Celsius, HR 131 beats/min, BP 157/80 mmHg, RR 24 breaths/min, and O2 Sat of 95%. His initial ECG showed sinus tachycardia. Labs sent on both patients included complete blood counts, electrolyte panels, venous blood gases, liver function tests, and toxicology screening – specifically ethanol, acetaminophen, and salicylates. The man also received a CT head given his multiple falls prior to ED presentation. The woman also had troponin levels done. All the investigations were normal, apart from the man's venous blood gas that showed a metabolic alkalosis on presentation that resolved 12 hours later. The patients' daughter, a provincial parks worker, identified the leaf samples as black henbane. The consulting toxicology team felt the electrocardiogram changes were unusual for black henbane and referred to cardiology to rule out other causes. They found no signs of ischemia and opted to follow the patient as outpatient. She remained asymptomatic, though her QRS did not narrow over the course of her admission. Both patients' toxidrome symptoms resolved after 36 and 48 hours, respectively for the man and woman, though they both required lorazepam for agitation over the course of their admissions. Their only other treatment was IV fluids. The woman received one dose of lorazepam sublingually, whereas the man received a total of eight doses of lorazepam intravenously over the course of his admission due to his profound agitation. The woman was also given D5W and sodium bicarbonate with potassium chloride coverage for 24 hours after she developed the left bundle branch block, however this did not change the QRS width. During the phone call interview, the woman reported that both patients' retained a continued feeling of fatigue and 'fuzziness' for approximately three weeks post-ingestion; this had resolved by the time of the phone interview. Upon outpatient cardiology follow up for the woman, she remained asymptomatic of her left bundle branch block and had a normal echocardiogram and myocardial perfusion imaging with no signs of ischemia or reduced ejection fraction.

Conclusions: These case reports illustrate the rapid onset of ant muscarinic effects associated with black henbane poisoning consistent with previous descriptions in the literature. However, the left bundle branch block seems to be a new occurrence and no other causes for it could be identified. This is the first report describing a new left bundle branch block in the context of black henbane poisoning, however the authors have been unable to find any reported sodium channel activity with any of the constituents of black henbane at this point. Therefore, the connection, if any, is unclear. Increased public information is needed to warn individuals about the dangers of noxious invasive weed ingestion, and educate them on the recognition of these mimic plants given their ubiquity in nature, even in private gardens.

Rajan Minhas – Medical Student

Rajan Minhas, Marshall Ross, Ian Wishart, Graham Thompson

Utility of Serum Electrolytes in Pediatrics Presenting With Suspected Appendicitis

Introduction: Appendicitis is the most common surgical cause of abdominal pain in children. At the Alberta Children's Hospital (ACH) between Jan 1 2007 to Dec 31 2008, 484 children had pathology confirmed appendicitis (Ross 2014). In Dec 2007 a CHR Regional Appendicitis Safety Committee was established to make recommendations to improve the safety of all patients with suspected appendicitis. Subsequently, Appendicitis Care Pathways were established and implemented on April 27th 2009. This protocol involves the routine evaluation of serum electrolytes in all children with suspected acute appendicitis. Previous studies have evaluated the utility of cell counts as well as CRP in the diagnosis of appendicitis. Although the individual test characteristics for these tests are poor, the combination of all three has had conflicting results. It is unclear in the literature if electrolyte disturbances are common in appendicitis, and if present require or change treatment.

Methods: This study was a secondary analysis of a database from a previous study of disposition of children with suspected appendicitis. The original data was collected from 1321 health records from Jan 1 2007 to December 31 2008. Data was reported on pathology confirmation of cases of appendicitis and included children aged 2-17 years admitted to the Pediatric Emergency Department at the Alberta Children's Hospital with abdominal pain who were managed according to the pediatric appendicitis pathway. Children in whom electrolytes were not obtained were excluded. Reference ranges for normal electrolyte values were set using CLS cutoffs, and data was collected for serum sodium (<133, >145, critical <120 or >155), potassium (<3.3, > 5.1, Critical <2.5 or >6.0), chloride (<98, >111), bicarbonate (<21, >27), and creatinine (<40, >85).

Results: Of 1321 records the results and test characteristics are reported below: Of the abnormal potassium values, eight were critical (0.8%) and all were above 6.0. Six of the eight critical values had confirmed appendicitis (data was incomplete on the other two). There were no critical sodium abnormalities. Of the creatinine values, six (0.6%) were above 85 and three (0.3%) were above 100.

Conclusion: This study evaluated the utility of measuring routine serum electrolytes in the workup of suspected pediatric appendicitis. The test characteristics of sodium, potassium, chloride, bicarbonate, and creatinine were calculated. Unsurprisingly the positive and negative likelihood ratios of an abnormal result for all values approached 1. Interestingly the exception was a positive likelihood ratio of an abnormal serum chloride which approached 3, however the clinical utility of this finding is doubtful. Although the incidence of abnormal results of significance were low, no data was obtained on whether abnormal results prompted intervention by treating physicians. Further data are required prior to making a recommendation regarding the routine measurement of electrolytes in the workup of suspected pediatric appendicitis.

Renee Vilneff – RN

A Demchuk, B Mann, M Hill, M Rashead, J Snider, RL Vilneff

EVT Pre-hospital Communication Strategy

Introduction: Endovascular therapy (EVT) is a treatment that removes large stroke-causing clots from the brain and substantially improves the functional independence of eligible patients. In Alberta, EVT is only available in Calgary at the Foothills Medical Centre and Edmonton at the University of Alberta Hospital. It is important for Alberta's health care system to adapt and ensure the timeliness and accessibility of this procedure for all Albertans. The Cardiovascular Health and Stroke Strategic Clinical Network™ (CvHS SCN™) undertook a provincial quality improvement project, called Endovascular Reperfusion Alberta (ERA), to increase access to EVT for eligible patients. In partnership with key stakeholders from across the province, ERA worked to change the early system of stroke care to ensure that EVT is accessible to those who would benefit.

Methods: ERA engaged key stakeholders in the province, including EMS, STARS, Emergency Medicine, Zone Stroke Programs, Stroke Neurology, the Emergency Strategic Clinical Network™, the QuICR initiative, Primary Stroke Centres, and RAAPID. These stakeholders participated in a series of monthly meetings, one table top exercise, and multiple virtual communication simulations. This stakeholder engagement led to a redesign of the prehospital triage, communication, and transport pathways. The stakeholder meetings involved the conceptualization of triggers in the pre-hospital environment that would help identify potential EVT eligible patients. This early identification of patients in the field would subsequently trigger a multi-way communication that involved the EMS practitioners, stroke experts, and transport medical experts. The purpose of this multi-way communication is to identify the most efficient and fastest mode of transportation to the most appropriate stroke centre for optimum patient care. The table top exercise was an in-person meeting that involved members from all stakeholder groups. In the table top exercise, a series of predetermined scenarios completed that allowed all of the stakeholder groups to test the conceptualized redesign of the EMS triage, communication, and transport pathways. These scenarios were varied with many common scenarios that occur in the province. The multiple provincial virtual communication simulations evaluated the feasibility and latent safety threats of the revisions to EMS triage, communication and transport pathways. These simulations allowed the stakeholders to experience 'real-time strokes' and allowed for the identification of EVT eligible patients and subsequent treatment decisions through the multi-way communication and transportation pathways.

Results: Through participation in the ERA project, provincial stakeholder successfully redesigned the EMS triage, communication, and transport pathways. This redesign, called the EVT Pre-hospital Communication Strategy, introduced a validated tool for EMS to identify EVT eligible patients as well as a communication and transport pathway to ensure that stroke and transport medical experts consulted with those on the scene to ensure appropriate transport and care for the patient.

Conclusions: To successfully redesign a provincial system of care, it is critical to have key stakeholders from various levels of the provincial healthcare system involved. These stakeholders are key to inform the project of the most appropriate changes that need to occur. Engaging these stakeholders through a series of opportunities to simulate the conceptualized pathway redesigns is critical to ensure 'real-time' success.

Sean Crooks – Medical Student

Sean Crooks, Gordon Jewett, Theo Mobach, Shelagh Coutts, Eric Smith

Aphasia or confusion? Challenges in the acute setting

Introduction: Aphasia is an acquired language disturbance, commonly caused by a focal brain lesion such as stroke. Confusion is poorly defined but typically refers to loss of normal coherence, thought process and speech. On the other hand, delirium is a common cause of confused state and is well defined as a short term, fluctuating state of altered cognition and disturbance in consciousness. Causes of confusion can range from focal lesions to systemic abnormalities. Clinically differentiating aphasia from confusion is difficult, and mistakes can lead to devastating consequences. We review literature and incorporate clinical nuance of practicing neurologists to highlight challenges and suggest an approach to distinguishing acute aphasia from confusion in the emergency department.

Methods: We conducted a search of Medline and PubMed up to January 27, 2017. Abstracts were screened and relevant articles reviewed. Articles were selected if reporting on techniques to differentiate aphasia and confusion. Clinical examination nuances used by experienced neurologists were incorporated with results.

Results: No single diagnostic approach is well recognized or validated for differentiating aphasia and confusion. Key differentiating features are level of consciousness (LOC), attention, repetition, and presence of other neurological abnormalities. LOC is often altered in confusion and an alert patient with language abnormalities should raise suspicion for aphasia. Attention is commonly assessed with bedside tests such as serial reversal (i.e. “world” backwards) or continuous performance (i.e. tap on “A”, not on other letters). These tests have poor accuracy and are easily confounded by language deficits and patient factors. It has been suggested that less structured observation of attention through conversation is as effective. Language assessment should include evaluation of spontaneous speech, comprehension, naming and repetition. The confused patient will most often have impaired comprehension with intact fluency and repetition. Intact repetition helps differentiate confusion from Wernicke’s aphasia, which is fluent and is the most common aphasia in acute stroke. Fluent aphasic speech often includes neologisms (i.e. invented words) that are less common in confusion. Tests of reading and writing should also be considered. Acutely confused patients may show reluctance to write, in contrast to aphasic patients that may have agraphia with empty content or paragraphic errors. Because aphasia is often a symptom of focal lesion, such as stroke, the presence of other focal neurological abnormalities aids in localization. Conversely, non-focal symptoms such as asterixes, postural tremor, multifocal myoclonus, or perceptual disturbances suggest a more diffuse process involving the cortex in acute confusion.

Conclusion: Rapid and accurate distinction of aphasia from confusion can be challenging in a busy emergency department. Even experienced clinicians and specialists can mistake them. Recognizing that aphasia and confusion may be difficult to differentiate aids the clinician in avoiding misdiagnosis. Particular care should be taken when patient and clinician do not share a common language. There is no single well-defined approach and accuracy of commonly used tests is not well defined. There may be a role for development of a systematic approach or clinical scoring tool to aid acute care physicians in differentiating aphasia from confusion.

Sean Fair – Emergency Medicine Resident

Sean Fair, Shawn Dowling, Christopher Naugler

Correlation of Hemoglobin Levels Between Concurrent Venous Blood Gases and Serum Hemoglobin Samples

1.) BACKGROUND - Patients presenting to the emergency department frequently receive simultaneous laboratory and point of care testing (POCT), most often in the form of a point-of-care venous blood gas (VBG) and serum hemoglobin (Hgb) and electrolytes. Accuracy of the POCT is critical, as hemoglobin and hematocrit are frequently used to make clinical decisions such as transfusion before serum values have been processed. Inaccurate results can have a significant influence on investigations, interventions and outcomes.

2.) OBJECTIVE - In emergency department patients who had concurrent (<15 minutes separation) VBG and Hgb performed, how does the hemoglobin value on the VBG correlate with the serum Hgb when examined in a retrospective cohort? How well can the VBG predict the transfusion threshold (Hgb <70)?

3.) METHODS - A retrospective, observational cohort study of patients who presented to Calgary zone adult Emergency Departments and received concurrently drawn VBG and serum Hgb (separated by <15 minutes) in 2015. Only the first set of paired values were used from each patient. Hemoglobin values were statistically compared using Bland and Altman plots and Pearson correlation. The reliability of transfusion was assessed using a three-zone error grid.

A total of 7350 patients were included. Mean serum Hgb levels were 132 ± 0.52 , and VBG Hgb 134 ± 0.56 g/L. There was significant correlation between measurements ($r^2 = 0.924$, $p < 0.001$). The Bland-Altman analysis revealed a mean difference of -2 g/L read by the VBG, with standard deviation of +11.4 and -15.3 g/L, where a difference of ± 10 is generally considered acceptable. The three-zone error grid demonstrates 98.9% of measurements falling in Zone A (accurately predicting need for transfusion), while 0.91% fall in Zone B and only 0.16% fall in Zone C (3 samples failing to predict transfusion need and 9 samples potentially resulting in unnecessary transfusion).

The absolute accuracy of the tested POCT device was statistically beyond the level of difference that is considered clinically acceptable (± 10 g/L). However, accuracy in that regard is not useful clinically. The three-zone error grid more accurately informs medical decision making as it occurs at the bedside, especially with respect to prediction of transfusion. In this study, the largest data set in the literature, we can see that a POCT VBG sample will safely and correctly inform nearly 99% of decisions.

4.) TIMELINE - We are completing statistical analysis and rounding out a discussion section, with a timeline for completion of a manuscript at the end of February 2017. Work is being done in conjunction with the lab to identify possible reasons for discrepant values, especially those in Zone C.

Seth Turner – Medical Student

Seth Turner, Eddy Lang, Kathleen Brown, Christopher Leyton, Eileen Bulger, Michael Sayre, Diana Kraus, Helen Robertson

Is Prehospital Care Supported by Evidence-Based Guidelines? An Environmental Scan and Quality Appraisal using AGREE II

Introduction: The Institute of Medicine (IOM) has recommended that high-quality, evidence-based guidelines be developed for emergency medical services (EMS). The National Association of EMS Physicians (NAEMSP) has outlined a strategy that will see this task fulfilled, consisting of multiple working groups focused on all aspects of guideline development and implementation. A first step, and our objective, was a cataloguing and appraisal of the current guidelines targeting EMS providers.

Methods: A systematic search of the literature was conducted in MEDLINE (1175), EMBASE (519), PubMed (14), Trip (416), and guidelines.gov (64) through May 1, 2016. Two independent reviewers screened titles for relevance to pre-hospital care, and then abstracts for essential guideline features, including a systematic review, a grading system, and an association between level of evidence and strength of recommendation. All disagreements were moderated by a third party. Citations meeting inclusion criteria were appraised with the AGREE II tool, which looks at six different domains of guideline quality, containing a total of 23 items rated from 1 to 7. Each guideline was appraised by three separate reviewers, and composite scores were calculated by averaging the scaled domain totals.

Results: After primary (kappa 97%) and secondary (kappa 93%) screening, 49 guidelines were retained for full review. Only three guidelines obtained a composite score of > 90%, the topics of which included aeromedical transport, analgesia in trauma, and resuscitation of avalanche victims. Only two guidelines scored between 80% and 90%, the topics of which included stroke and pediatric seizure management. One guideline, splinting in an austere environment, scored between 70% and 80%. Nine guidelines scored between 60% and 70%, the topics of which included ischemic stroke, cardiovascular life support, hemorrhage control, intubation, triage, hypothermia, and fibrinolytic use. Of the remaining guidelines, 14 scored between 50% and 60%, and 20 obtained a composite score of <50%.

Conclusion: There are few high-quality based guidelines in EMS. Of those that are published, the majority fail to meet established quality measures. Although a lack of randomized control trials conducted in the pre-hospital field continues to limit guideline development, suboptimal methodology is also commonplace within the existing literature.

Stephen Freedman – Pediatric Emergency Physician

Stephen Freedman, Jianling Xie, Alberto Nettel-Aguirre, Bonita Lee, Linda Chiu, Xiao-Li Pang, Ran Zhou, Brendon Parsons, James Dickinson, Otto Vanderkooi, Samina Ali, Lara Osterreicher, Karen Lowerison, Phillip Tarr

Enteropathogen Detection in Children with Acute Gastroenteritis: A Comparison of Rectal Flocked Swabs and Stool Specimens

1) **INTRODUCTION:** Microbiologic diagnoses in the context of acute gastroenteritis (AGE) provide clarity to clinical situations, guide appropriate treatment and prompt public health investigations. Pathogen specific burden of disease estimates, which require accurate population-based diagnoses, direct food and environmental safety measures and public health intervention prioritizations (e.g. vaccines). To obtain population-based estimates, knowledge of etiology is required in individuals with diarrhea and/or vomiting and in those seeking medical care and those managed at home. For decades, enteropathogen testing has relied on diarrheal stool specimen (SS) analysis. Some laboratories will not test SSs if the consistency is incompatible with diarrheal illness. This approach prohibits enteropathogen identification in patients with isolated vomiting and those from whom a diarrheal specimen is not obtained at the point of clinical evaluation. Additionally, stool collection and transportation is burdensome, presents biosafety concerns, and contributes to diagnostic delays which can adversely affect outcomes. Point-of-care rectal swabs (RS) are an attractive alternative to stool specimens. RSs permit testing in individuals with isolated vomiting and they expedite diagnoses while reducing cumbersome SS collection and transportation. Stool versus swab comparative analyses are limited to date. Most notable are a small adult emergency department (ED) study that employed traditional laboratory diagnostic approaches, and a study of hospitalized children in Botswana which analyzed matched stool and rectal flocked swabs. We are entering an era of sensitive, rapid, nucleic acid based, syndromic molecular diagnostic panels, with time-to-results depending more on time to specimen collection and transportation than laboratory turnaround. While RSs represent a means of reducing the former time required for collection and transportation there are limited data regarding diagnostic yield of RSs relative to SSs. Therefore, we conducted a comparison of stool and RSs in children with AGE. The study objective is to determine whether rectal swab is a suitable alternative diagnostic specimen.

2) **METHODS:** Children with gastroenteritis were prospectively recruited from two pediatric emergency departments, a provincial telephone advice line and public health clinic in Alberta. Eligible participants were aged <18 years, with ≥ 3 episodes of vomiting or diarrhea in 24 hours and <7 days of symptoms. Exclusion criteria were participants enrolled within prior 14-days, unable to complete follow-up, psychiatric illness, neutropenia, emergent care required. Rectal swabs were performed and subjects provided a stool specimen. A courier retrieved specimens collected at home. Testing included the Luminex xTAG Gastrointestinal Pathogen Panel, an in-house 5 virus panel and culture. The primary outcomes were comparative (paired specimens) and overall (including unpaired specimens with unsubmitted considered as negative) yields (i.e. ≥ 1 pathogen identified). To account for the non-independent nature of data, generalized estimating equations were performed with adjustment for the presence of diarrhea, location, and their interactions with specimen.

3) **RESULTS:** Between December 2014 and August 2016, 2802 eligible participants were consecutively approached; 1519 consented. Submission rate was 75.5% (1147/1519) for stool and 99.7% (1514/1519) for swabs. Positive pathogen yield was 75.9% (871/1147) for stool and 67.6% (1024/1514) for swabs (OR=1.41; 95% CI: 1.29, 1.53). Comparative yield adjusted OR in stool relative to swabs were 1.24 (95% CI: 1.11, 1.38) and 1.76 (95% CI: 1.47, 2.11) in children with and without diarrhea at presentation, respectively. When the entire cohort was considered, the positive pathogen rates were 57.3% and 67.4% for stool specimens and rectal swabs. The overall yield unadjusted OR was 0.65 (95% CI: 0.59, 0.72). Performance varied based on presence of diarrhea and location of specimen collection.

4) **CONCLUSIONS:** Compared to paired stool specimens, rectal swabs have a lower diagnostic yield. However, when the effect of higher rectal swab submission rates is considered, the yield is greater for rectal swabs. When enteropathogen identification is required and stool is unavailable or unlikely to be submitted, rectal swabs should be performed.

Steven Liu – Emergency Medicine Resident

Steven Liu, Katie Lin, Shalyn Beatty, Joanne Masur, Ryan Chuang, David Johnson, Scott Lucyk, Marco Sivilotto, Mark Yarema

A case series to evaluate the treatment and outcomes for patients with recurrent methanol poisoning in Calgary

1) Background: Methanol poisoning can lead to serious consequences such as blindness and death. The treatment is through alcohol dehydrogenase inhibition (ADHi) or hemodialysis (HD) which can be costly. In Calgary, a small group of patients present recurrently to the Emergency Departments (ED) for methanol poisoning from substance abuse contributing significantly to health care expenditure. Occasionally, some of these patients present with a methanol level mildly above recommended treatment threshold and are otherwise well. This creates a treatment dilemma as it has been suspected in prior literature that the current guideline recommended treatment threshold is overly cautious. It is unclear whether it is safe to observe these patients without initiating expensive treatment.

2) Objective: The primary objective of the study aims to identify a case series of patients who present with recurrent methanol poisoning with methanol level mildly above current treatment threshold who were not treated with ADHi or HD and to examine the prevalence of serious adverse outcomes. The secondary objectives aim to evaluate the health care resource utilization by these patients and to provide quality improvement data such as the adherence of local practice to current guideline recommendations, proportions of visits with visual acuity documentation, and proportions of visits with ophthalmology follow up.

3) Methods: We are conducting a retrospective case series through chart review of all methanol poisoning related visits by patients with recurrent methanol poisoning (defined by 3 or more methanol poisoning related visits during the study period) in 4 Calgary EDs from year 2002 to 2015, inclusively. The patients are identified using International Classification of Diseases (ICD-9 and ICD-10) codes for methanol poisoning through Data Integration, Measurement&Reporting (DIMR) Service. The inclusion criteria include any methanol poisoning related visits as specified by discharge diagnosis and ICD codes. The exclusion criteria include ED visits unrelated to methanol poisoning and patients with less than 3 visits related to methanol poisoning. Three independent chart reviewers will be collecting data using standardized forms and inter-observer reliability will be reported. Primary and secondary outcomes will be reported as outlined above in the objective section.

4) Timeline: Study has been approved by CHREB ethics board. Data collection is very close to completion. Data analysis and final result of the study will be available by Research Day on April 13, 2017.

Jan 2017 - Data collection completion

Feb 2017 - Data analysis completion

Zoe Polsky – Medical Student

Zoe Polsky, Eddy Lang, Aynharan Sinnarajah, Tak Fung, Bejoy Thomas

Does Palliative Care Consultation Influence Emergency Department Utilization?

INTRODUCTION: For cancer patients undergoing active treatment, emergency department (ED) visits may be an indicator of a breakdown in continuity and quality of care. Palliative care may be an important resource for patients in need of symptom management even during treatment with curative intent. This study aims to describe ED utilization by cancer patients, and determine if palliative care consults are associated with reduced ED use.

METHODS: Patient data from the Tom Baker Cancer Center (TBCC) was linked to palliative care and ED data as a retrospective cohort study. ED data was obtained from two administrative databases and palliative care data was obtained from four administrative databases and restricted to the first four hundred days following diagnosis. Univariate and Multivariate analyses were used.

RESULTS: Three actively treated cancer patient cohorts were identified: 1) Used the emergency department first after presenting to the TBCC (n=1637), 2) Used palliative care first after presenting to the TBCC (n=539) and 3) Only used services at the TBCC (n=2153). Using Multivariate analysis, patients living alone or who had a diagnosis of prostate or breast cancer were more likely to access the emergency department first after presenting to the TBCC or to only use services at the TBCC rather than access palliative care. Patients who were divorced, on income support, or diagnosed with a lung or gastrointestinal cancer, were more likely to access palliative care first after presenting to the TBCC rather than access the emergency department or only use services at the TBCC. A subgroup analysis was performed on those who accessed the ED at some point during their care following intake at the TBCC, consisting of three groups:

1) Emergency department only users (n=1091), 2) Emergency department first users, who also accessed palliative care (n=546), and 3) Palliative care first users, who also accessed the emergency department. There was a significant difference in rates of ED visits between the three groups: Emergency department only users went to the ED at a rate of 3.8 per 1000 patient days; emergency department first users, who also accessed palliative care, went to the ED at a rate of 7.7 per 1000 patient days; and palliative care first users, who also accessed the emergency department went to the ED at a rate of 9.2 per 1000 patient days ($p < 0.001$).

CONCLUSIONS: Following intake in a tertiary cancer center, patients who were divorced, on income support, or diagnosed with lung or gastrointestinal cancer were more likely to access palliative care first rather than the ED. Amongst those patients who accessed the ED, those who accessed palliative care first had higher rates of ED use. Further explorations of presenting complaints, utilization patterns, and symptom burdens will be analyzed to determine if early palliative consults can influence ED utilization during disease course.