UNIVERSITY OF CALGARY
CUMMING SCHOOL OF MEDICINE

Alberta Health Services

EMERGENCY MEDICINE RESEARCH DAY 2018

2018 Emergency Medicine Research Day

Submitted Abstracts

2018 Award Recipients

Best Student Project: Christina Schweitzer

Best Resident Project: Nick Packer

Ian Blanchard

IE Blanchard, D Lane, TS Williamson, G. Vogelaar, BE Hagel, G Lazarenko, S Dean, D Niven, ES Lang, CJ Doig

The Epidemiology of Mortality in Patients Transported by Emergency Medical Services (EMS)

INTRODUCTION: Outside of key conditions such as cardiac arrest and trauma, little is known about the epidemiology of mortality of all transported EMS patients. The purpose of this study is to describe characteristics of EMS patients who after transport, die in a health care facility. METHODS: EMS transport events over one year (April, 2015-16) from a BLS/ALS system serving an urban/rural population of approximately 2 million were linked with in-hospital datasets to determine overall, emergency department (ED), and in-patient mortality. Medical Priority Dispatch System (MPDS) determinant, age in years (>=18 years - adult, <=17 years - pediatric), gender, day of week, season, time (categorized in six hour periods), and the highest risk of mortality MPDS cards, paramedic clinical impressions, and ED diagnoses (International Classification of Disease v.10 - Canadian) are presented. Analyses included two-sided t-test or chi-square with alpha<0.05.

RESULTS: A total of 239,534 EMS events resulted in 159,507 patient transports; 141,114 were included for analysis after duplicate removal(89.1% linkage), of which 127,867 had final outcome. Of 127,867 patients, 4,269 died(3.0%; 95%CI 2.9%, 3.1%). There were 724/4,269 deaths in the ED(17.0%) and 3,545/4,269 died as in-patients(83.0%). The risk of overall mortality by MPDS determinant was Echo(24.6%), Delta(3.9%), Charlie(3.4%), Bravo(1.1%), Alpha(2.1%), and Omega(1.1%). For adults the mean age of survivors was less than non-survivors(59.2 vs. 75.8; p<0.001), but pediatric survivors were older than non-survivors(8.8 vs. 2.8; p<0.001). Males had increased mortality(3.3%) compared to females(2.8%)(p<0.001). Mortality did not change by day of week(p=0.573), but did by season with increased ED mortality in the winter(p=0.004). The highest overall mortality occurred with patients presenting between 0600-1200 hours(3.9%), and the lowest between 0000-0600 hours(2.3%)(p<0.001). The MPDS cards with the highest overall risk of mortality were 9-cardiac/respiratory arrest(34.4%), 33-interfacility transfers(7.1%), 6-breathing problems(5.8%), and 28-stroke/transient ischemic attack(4.3%). The highest overall mortality for paramedic clinical impressions were cardiac arrest(76.4%), respiratory arrest(18.0%), hypovolemia/shock(11.4%), and stroke/CVA(10.9%). The ED diagnoses with the highest overall mortality were related to neoplasms(19.8%), circulatory system(12.4%), respiratory system(7.4%), and infections(6.0%).

CONCLUSIONS: Significant in-hospital mortality differences were found between event, patient, and clinical characteristics. These data provide important foundational and hypothesis generating knowledge regarding mortality in transported EMS patients that can be used to guide research and training.

Ian Blanchard

IE Blanchard; Ryan Kozicky; Dana Dalgarno; Stacy Goulder; Tyler Williamson; Susan Biesbrook; Lenore Page; Karen Leaman; Suzanne Snozyk; Lyle Redman; Keith Spackman; Christopher Doig; Eddy Lang; and Gerald Lazarenko

Community Paramedic Point of Care Blood Analysis: Validity and Usability Testing of Two Commercially Available Devices.

INTRODUCTION: Community Paramedics (CPs) require access to timely blood analysis in the field to guide treatment. Point of care testing (POCT), as opposed to traditional laboratory analysis, may offer a solution, but limited research exists on CP POCT. The purpose of this study is to assess the validity of two devices (Abbott i-STAT and Alere epoc) and contrast their usability in the CP setting.

METHODS: In a CP programme responding to 6,000 annual patient care events, a split sample validation of POCT against traditional laboratory analysis for seven analytes (sodium, potassium, chloride, creatinine, hemoglobin, hematocrit, and glucose) was conducted on a consecutive sample of patients requiring blood analysis. The difference of proportion of discrepant results between POCT and laboratory was compared using a two sample proportion test. Usability was analysed by survey of CP experience, linear mixed effects model of Systems Usability Scale (SUS) adjusted for experience, expert heuristic evaluation of devices, device-logged errors, and coded observations of quality control testing.

RESULTS: Of 1,649 study period patient care events, 174 had a blood draw, with 108 events (62.1%) enrolled from 73 participants. Participants had a mean age of 58.7 years (SD16.3); 49% were female. In 4 of 646 (0.6%) individual comparisons, POCT reported a critical value but the laboratory did not; occurring more often in i-STAT (0.9%;95%CI:0.0%,1.9%) compared to epoc (0.3%;95%CI:0.0%,0.9%)(p=0.323). There were no instances of the laboratory reporting a critical value when POCT did not. In 88 of 1,046 (8.4%) individual comparisons the a priori defined acceptable difference between POCT and the laboratory was exceeded; occurring more often in epoc (10.7%;95%CI:8.1%,13.3%) compared to i-STAT (6.1%;95%CI:4.1%,8.2%)(p=0.007). Eighteen of 19 CP surveys were returned, with 11/18 (61.1%) preferring i-STAT over epoc. The i-STAT had a higher mean SUS score compared to the epoc (84.0/100 vs. 59.6/100; p<0.011). Fewer field blood analysis device-logged errors occurred in i-STAT (7.8%;95%CI:2.9%,12.7%) compared to epoc (15.5%;95%CI:9.3%,21.7%)(p=0.063). A possible explanation may relate to usability issues with the epoc cartridge and test menus.

CONCLUSIONS: CP programs can expect valid results from POCT in most instances, however an important discrepancy between traditional laboratory did occur. Usability assessment suggests a preference for i-STAT.

James Andruchow

Andruchow JE, Vatanpour S, Boyne T, Wang D, McRae AD.

Very low concentrations of hs-cTnT at presentation can rapidly exclude acute myocardial infarction

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. While testing strategies using conventional troponin assays require repeat testing over many hours to avoid missed diagnoses, high-sensitivity troponin (hs-cTnt) assays may be able to exclude AMI in a large proportion of patients with a single result at presentation. This objective of this study is to validate the ability of very low concentrations of hs-cTnt at presentation to exclude AMI in ED chest pain patients.

Methods: This prospective cohort study was conducted at a single urban tertiary center 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 Emergency physician. Patients were excluded if they had clear acute ischemic ECG changes, new arrhythmia or renal failure requiring hemodialysis. A high-sensitivity troponin result (Roche Elecsys hs-cTnT) was obtained in all patients at presentation. The primary outcome was AMI on the index visit. Secondary outcomes included 30-day AMI and major adverse cardiac events (MACE - including AMI, revascularization or cardiac death). Electronic medical records were reviewed and telephone follow-up was obtained for all patients at 30-days to ensure relevant events were captured. Two physician adjudication (board-certified emergency physician and cardiologist) was obtained for all outcomes. This study was REB approved.

Results: A total of 1,167 patients were enrolled from August 2014 – September 2016, of which 191 (16.3%) patients had an initial troponin below the limit of blank (LoB, <3ng/L) and 416 (32.8%) were below the limit of detection (LoD, <5ng/L). The sensitivity of a single troponin below the LoB (<3ng/L) for index AMI was 100% (95% CI 96.2%-100%) and for 30-day AMI was 100% (95% CI 96.4-100%). The sensitivity of a troponin below the LoD (<5ng/L) for index AMI was 97.9% (95% CI 92.7%-99.8%) and for 30-day AMI was 98.0% (95% CI 93.0-99.8%). Sensitivity for 30-day MACE at both cutoffs was lower: 98.4% (95% CI 94.3-99.8%) for <3ng/L, and 94.4% (95% CI 88.8-97.7%) for < 5ng/L, respectively; however, negative predictive values remained high at both cutoffs: <3ng/L, 99.0% (95% CI 96.3-99.9%) and <5ng/L, 98.3% (95% CI 96.6-99.3%).

Conclusion: A high sensitivity troponin T result below the LoB (<3ng/L) is highly sensitive for excluding AMI and identifies patients at low risk of 30-day MACE. A result below the LoB (<5ng/L) will identify a larger population of patients as low risk but has a greater risk of missed AMI and MACE.

James Andruchow

Andruchow JE, Vatanpour S, Boyne T, Wang D, McRae AD.

External validation of a 2-hour rapid diagnostic algorithm for ruling out AMI

Introduction: Ruling out acute myocardial infarction (AMI) using serial troponin testing is central to the care of many emergency department (ED) patients with chest pain. While diagnostic strategies using conventional troponin assays require repeat sampling over many hours to avoid missed diagnoses, serial high-sensitivity troponin (hs-cTn) assays may be able to exclude AMI in most patients within 1 or 2 hours. However, many of the initial studies deriving and validating these rapid diagnostic algorithms had all hs-cTn samples analyzed in a central core lab likely representing op)mal assay performance. This objective of this study is to validate a 2-hour rapid diagnostic algorithm to exclude AMI in ED chest pain patients using an hs-cTn assay in real world practice.

Methods: This prospective cohort study was conducted at a single urban tertiary center 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 emergency physician. Patients were excluded if they had clear acute ischemic ECG changes, new arrhythmia or renal failure requiring hemodialysis. A high-sensitivity troponin result (Roche Elecsys hs-cTnt was obtained in all patients at ED presentation and 2-hours later. The primary outcome was AMI on the index visit. Secondary outcomes included 30-day AMI and 30-day major adverse cardiac events (MACE - including AMI, revascularization or cardiac death). Electronic medical records were reviewed and telephone follow-up was obtained for all patients at 30-days to ensure relevant events were captured. Two physician adjudication (board-certified emergency physician and cardiologist) was obtained for all outcomes. Funding was provided by an investigator-initiated unrestricted research grant from Roche Diagnostics, the maker of the assay being tested. This study was REB approved.

Results: A total of 549 patients were enrolled from August 2014 – September 2016 with 2-hour serial hs-cTnT results, of which 349(63.6%) met the 2-hour rapid diagnostic algorithm low risk criteria ()me 0h/2h hs-cTnT <14ng/L and delta 2h <4ng/L). The sensitivity of the 2-hour low risk criteria for index AMI was 98.4% (95% CI 91.3%-100%) and for 30-day AMI was 98.4% (95% CI 91.6-100%). The sensitivity for 30day MACE was lower 84.4% (95% CI 74.4-91.7%) but maintained a high negative predictive value, 96.6% (95% CI94.1-98.2%).

Conclusion: A 2-hour rapid diagnostic algorithm using an hs-cTnT assay was highly sensitive for AMI on the index visit and successfully identified patients at low risk of 30-day AMI. Sensitivity for MACE was lower, reminding us that while biomarker-only rapid diagnostic algorithms excel at ruling out AMI, careful clinical risk stratification is needed to avoid missed MACE events

James Andruchow

Andruchow JE, Vatanpour S, Boyne T, Wang D, McRae AD.

External validation of a 1-hour rapid diagnostic algorithm for ruling out AMI

Introduction: Ruling out acute myocardial infarction (AMI) using serial troponin testing is central to the care of many emergency

department (ED) patients with chest pain. While diagnostic strategies using conventional troponin assays require repeat sampling over many hours to avoid missed diagnoses, serial high-sensitivity troponin (hs-cTn) assays may be able to exclude AMI in most patients within 1 or 2 hours. However, many of the initial studies deriving and validating these rapid diagnostic algorithms had all hs-cTn samples analyzed in a central core lab likely representing optimal assay performance. This objective of this study is to validate a 1-hour rapid diagnostic algorithm to exclude AMI in ED chest pain patients using an hs-cTn assay in real world practice.

Methods: This prospective cohort study was conducted at a single urban tertiary center 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 emergency physician. Patients were excluded if they had clear acute ischemic ECG changes, new arrhythmia or renal failure requiring hemodialysis. A high-sensitivity troponin result (Roche Elecsys hs-cTnT) was obtained in all patients at ED presentation and 1-hour later. The primary outcome was AMI on the index visit. Secondary outcomes included 30-day AMI and 30-day major adverse cardiac events (MACE - including AMI, revascularization or cardiac death). Electronic medical records were reviewed and telephone follow-up was obtained for all patients at 30-days to ensure relevant events were captured. Two physician adjudication (board-certified emergency physician and cardiologists was obtained for all outcomes. The study was REB approved.

Results: A total of 350 patients were enrolled from August 2014 – September 2016 with 1-hour serial hs-cTnT results, of which 219 (62.6%) met the 1-hour rapid diagnostic algorithm low risk criteria ()me 0h hs-cTnT <12ng/L and delta 1h <3ng/L). The sensitivity of the 1-hour low risk criteria for index AMI was 97.2% (95% CI 85.5%-99.9%) and for 30-day AMI was 97.3% (95% CI 85.8-99.9%). The sensitivity of the low risk criteria for 30-day MACE was lower 80.9% (95% CI 66.7-90.9%ti but maintained a high negative predictive value, 95.9% (95% CI 92.3-98.1%).

Conclusion: A 1-hour rapid diagnostic algorithm using an hs-cTnT assay was highly sensitive for AMI on the index visit and successfully identified patients at low risk of 30-day AMI; however, sensitivity for 30-day MACE was much lower. Of note, the 1-hour algorithm appears to be less sensitive for both AMI and 30-day MACE than a 2-hour algorithm validated in the same population.

James Andruchow

Andruchow JE, Grigat D, Abedin T, McRae AD, Innes G, Lang E.

An RCT of electronic CDS to reduce unnecessary head CT for patients with MTBI

Introduction:

Utilization of CT imaging has risen dramatically with increases in availability, but without corresponding improvements in patient outcomes for many clinical scenarios. Previous attempts to improve imaging appropriateness have met with limited success, with commonly cited barriers including a lack of confidence in patient outcomes, medicolegal risk, and patient expectations. The objective of this study was to assess the impact of an electronic clinical decision support (CDS) intervention to reduce CT utilization for emergency department (ED) patients with mild traumatic brain injury (MTBI).

Methods:

This was a cluster-randomized, controlled trial with physicians as the unit of randomization. All emergency physicians (EPs) at 4 urban adult EDs and 1 urgent care center were randomly assigned to receive evidence-based imaging CDS (intervention) or no CDS (control) for patients with MTBI over a 1-year study period. CDS was launched in an external web browser whenever an intervention EP ordered a non-enhanced head CT from the computerized physician order entry (CPOE) system for ED patients CTAS 2-5 with a CEDIS chief complaint of “head injury”; however, interaction with CDS was voluntary. The CDS tool provided detailed information to physicians about the Canadian CT Head Rule, including patient eligibility, exclusion criteria, risk factors and probability of serious injury, as well as an imaging recommendation (yes/no). CDS recommendations could be printed for the medical record as could educational patient handouts to support physician decision making. The primary outcome was CT utilization for patients with MTBI on the index visit. Secondary outcomes included ED length of stay (LOS), and return visits, CT use, hospital admission and trauma)c head injury diagnoses over the next 30-days. This study was REB approved.

Results: Physician demographics and baseline CT utilization for MTBI patients were similar among intervention and control EPs during a 2-year pre-intervention period. In the first 8-months following CDS implementation, 102 intervention EPs saw 2,189 eligible patients while 100 control EPs saw 1,707 patients. Intervention EPs voluntarily interacted with CDS on 36.2% of eligible encounters. Head CT utilization was lower among intervention EPs than controls (38.5% vs 45.1%, $p<0.0001$) as was ED LOS (201 vs 218.5 minutes, $p<0.001$). There was no difference in 30-day ED return visits, head CT utilization, hospital admission or traumatic head injury diagnoses.

Conclusions: In one of the largest RCTs of CDS to date, exposure to CDS was associated with decreased head CT utilization and shorter LOS on the index visit, and no difference in 30-day head CT use, return ED visits or hospital admission. These results suggest that a comprehensive CDS implementation may be able to overcome several barriers to use of decision rules and may contribute to improved clinical decision making and decreased CT utilization.

James Andruchow

Andruchow JE, Grigat D, Abedin T, McRae AD, Innes G, Lang E.

An RCT of electronic CDS to reduce unnecessary CTPA for patients with suspected PE

Introduction: Utilization of CT pulmonary angiography (CTPA) to rule out pulmonary embolism (PE) has risen dramatically but diagnostic yield has fallen over the past several decades, suggesting that lower risk patients are being tested. Given little evidence to suggest improved patient outcomes with higher CTPA utilization, and increasing evidence of harm, evidence-based guidelines have been developed to reduce unnecessary CTPA use. The objective of this study was to assess the impact of an electronic clinical decision support (CDS) intervention to reduce unnecessary CTPA utilization for emergency department (ED) patients with suspected PE.

Methods: This was a cluster-randomized, controlled trial with physicians as the unit of randomization. All emergency physicians (Eps) at 4 urban adult EDs and 1 urgent care center were randomly assigned to receive either evidence-based imaging CDS for patients with suspected PE (interventions or no CDS (control over a 1-year study period. CDS was launched in an external web browser whenever an intervention EP ordered a CTPA from the computerized physician order entry software for ED patients CTAS 2-5; however, physician interaction with CDS was voluntary. The CDS tool enabled calculation of patient-specific information, including the patient's Wells score, PERC score, and age-adjusted D-dimer, as well as prediction of each patient's pre-test risk of PE along with an imaging/no imaging recommendation. CDS recommendations could be printed for the medical record as could educational patient handouts to support physician decision-making. The primary outcome was CTPA utilization of patients with CEDIS chief complaints of "shortness of breath" or "chest pain" on the index visit. Secondary outcomes included index visit length of stay (LOS), and CTPA use or VTE diagnosis within 90- days. This study was REB approved.

Results: Demographics were similar among intervention and control EPs; however, during a 2-year pre-intervention period control Eps had a higher baseline CTPA rate (8.5% vs 7.7%, $p<0.001$). In the first 8-months following CDS implementation, 94 intervention EPs saw 9,609 patients and voluntarily interacted with the CDS tool on 43.2% of eligible encounters while 91 control EPs saw 9,498 patients. CTPA utilization was higher among intervention EPs than control (9.6% vs 8.3%, $p<0.001$) as was ED LOS (302 vs 287 minutes, $p<0.001$). There was no difference in 90-day CTPA use or VTE diagnoses.

Conclusions: In one of the largest RCTs of CDS to date, exposure to CDS was associated with higher rates of CTPA utilization and longer ED LOS on the index visit, and no difference in 90-day CT use or VTE diagnoses. These results differ from a concurrent study of CDS for patients with mild traumatic brain injury in the same physician population and may relate to the implementation of the CDS intervention and/or complexity of the underlying evidence-based algorithms.

Kate Eppler

Kate Eppler, Dongmei Wang, Timothy Pollak, Eddy Lang

Prevalence, demographics, and severity of hypertension presenting to Calgary area Emergency Departments- an opportunity for improved diagnosis and treatment?

1) Introduction: Hypertension is common and a major cause of morbidity and mortality. Because it is asymptomatic, its diagnosis is often delayed. For many Canadians, especially those lacking family physicians, the Emergency Department (ED) is the only point of entry to the health care system, and therefore the recognition of undiagnosed and untreated hypertension in the ED is increasingly important. This study sought to evaluate the prevalence and severity of hypertension in patients presenting to Calgary area EDs, as well as to determine whether medical therapy was initiated and if patients had primary care providers for follow-up.

2) Methods: The Calgary area multi-centre electronic medical record (EMR) was reviewed for all adult patients presenting to EDs over a one-year period from January 1st, 2016 to December 31st, 2016. Hypertension was coded electronically by triage nurses and defined as systolic blood pressure SBP ≥ 140 mmHg and/or diastolic blood pressure DBP ≥ 90 mmHg. Hypertensive urgency was defined as SBP ≥ 180 mmHg and/or DBP ≥ 120 mmHg. Descriptive data was used to show patient demographics and hypertension prevalence. Primary care provider status, previous diagnosis of hypertension, chief complaint, and ED diagnoses were extracted and the EMRs were manually searched to determine whether treatment was initiated in the ED.

3) Results: Of 304392 patients presenting to all Calgary sites, 43055 (14%) were found to have hypertension; mean age 52 (range 18 to 104), female 42%. Of these, 32986 (77%) had no known previous hypertension and 31% lacked a primary care provider. 0.2% had documentation of treatment initiated in the ED. 16% met criteria for hypertensive urgency.

4) Conclusions: Many patients presenting to the ED have hypertension, often previously undiagnosed and at times severe. Many lack access to primary care. EDs may play an important role in the early recognition of hypertension. Dedicated management and follow-up pathways are indicated for this high-risk population.

Kathryn Crowder

Kathryn Crowder, Elizabeth Domm, Jason Fedwick, Cameron McGillivray, Arthur Tse, Bryan Weber, Christopher Rebus

Can one emergency physician improve department flow? A proof-of-concept trial of a physician float role

INTRODUCTION: Emergency departments (EDs) are overcrowded and patient acuity and volumes are ever-increasing. While changes to the flow of ED patient input and output are outside the control of frontline ED teams, the efficiency of ED throughput can be optimized. One widely studied intervention is the implementation of a physician liaison role to assist in managing overall ED flow.

The Physician Float (PF) acts as a triage liaison, second physician for resuscitations, ED procedural sedation physician, and fields ED referral calls. This is a first-iteration proof-of-concept trial to evaluate if the PF role would decrease ED length of stay (LOS) by a goal of thirty minutes, over a four-week period, without adverse changes to left without being seen (LWBS) and bounce-back rates.

METHODS: The PF role was implemented as a scheduled emergency physician shift in the fall of 2017. The primary outcome measure was ED LOS; secondary outcomes included time-to-physician initial assessment (PIA), EMS offload rates, LWBS and bounce-back rates. Qualitative data including patient concerns and physician feedback were also collected. Data were collected after the trial from a centralized, de-identified ED information system database with time-stamp quantifiers and compared to the following four-week time period where the shift is a regular ED physician shift at the same time. The ED physician and nursing team planned and implemented the PF role, then results were evaluated and shared with the wider ED staff in departmental grand rounds and quality council presentation formats, and recommendations were gathered from to adjust and strengthen future iterations of PF role implementation as part of an ongoing quality improvement initiative within the primary site of implementation.

RESULTS: Descriptive statistics were calculated and continuous variables were evaluated with Mann-Whitney and Median tests. On average there were 185 daily ED visits in the trial and comparison periods. Median ED LOS decreased by 12 minutes in the PF trial period ($p<0.05$). Furthermore, there was a 12 minute decreased LOS for all discharged patients ($p<0.05$). PIA time decreased by 13 minutes for patients that were admitted. The average percentage of EMS offloads within 60 min was improved from 75% to 80.7% for admitted patients. LWBS rates and 72-hour bounce-back rates were unchanged. No additional patient concerns arose related to or during the trial. Physician feedback on the PF role was mainly positive.

CONCLUSIONS: The defined role of a PF in an ED can decrease ED LOS, albeit not achieving the goal 30 minute reduction in this first proof-of-concept trial, this trial supported proof-of-concept for implementation of a PF role in a tertiary care center ED. Further trials are needed to evaluate the scalability and sustainability of this role.

Katrina Koger

Katrina Koger, James E. Andruchow, Andrew McRae, Dongmei Wang, Grant Innes, Eddy Lang

ICD-10 coding of free text diagnoses is not reliable for the diagnosis of PE in Calgary zone emergency department patients

Introduction:

Administrative data are attractive for research, policy and quality improvement initiatives as large amounts of data can often be obtained quickly and at low cost. Unfortunately, administrative data often have significant limitations owing to how they were collected and coded. In many cases, free text, often hand written, diagnoses provided by physicians are converted into ICD-10 (International Statistical Classification of Diseases and Related Health Problems, 10th Revision) codes by trained nosologists for administrative purposes. However, because of the large data sets often obtained from administrative sources, it is difficult to verify the accuracy of the data, which may lead researchers to misleading or false conclusions. The objective of this study was to evaluate the accuracy of ICD-10 codes for the diagnosis of pulmonary embolism (PE) in emergency department (ED) patients.

Methods:

As part of a larger study examining the effectiveness of a clinical decision support intervention on CT utilization and diagnostic yield for ED patients with suspected PE, all patients with an ICD-10 code corresponding to PE (126.0 and 126.9) on ED discharge were obtained from four adult urban EDs and one urgent care center from August 2016 to March 2017. PE diagnosis was confirmed by reviewing electronic medical records and imaging reports for all patients. Discrepancies between coded ICD-10 diagnoses and actual imaging findings were quantified. This study was REB approved.

Results:

Of 584 ED patients with ICD-10 codes identifying PE as a discharge diagnosis, 535 had imaging that could be reviewed. Of these, 225 (42.1%) did not have clinical diagnoses of PE, and thus were incorrectly coded, resulting in false positive ICD-10 codes. Common coding errors included physician free text diagnoses of “rule out PE” or “query PE” being coded as positive for PE.

Conclusions:

Administrative data are subject to errors in coding. In this study ICD-10 codes were not reliable for the diagnosis of PE, with 42.1% of PE diagnoses being false positives. Similar coding errors are likely for other diagnoses that require waits for confirmatory imaging (e.g. appendicitis). Nosologist coding of physician free text diagnoses is challenging and prone to errors. Consequently, validation of ICD-10 coding prior to analysis of administrative datasets is crucial for meaningful results.

Braden Teitge

Braden Teitge, Grace G Perez, Marissa Tsoi, and Paul Parks

Frequent users of the emergency department have an increased burden of disease and higher two-year mortality

Introduction

Frequent users of the emergency department (ED) are a diverse group of patients that are incompletely understood. The purpose of this study is to compare the frequent user population (top 1% users, 4+ visits/year) to non-frequent user controls (<4 visits/year), performing a chart review to quantify the burden of medical disease, psychiatric disease, substance use, and mortality.

Methods

We retrospectively reviewed the database triage records for individuals presenting during a one year period 2014-15. We reviewed 38,355 unique patient visits and conducted a chart review and two-year follow-up on 200 frequent users and 200 non-frequent user controls. ANOVA, chi-square and Mann-Whitney U tests were performed to compare differences between the two groups. The associated mortality risk of frequent ED use and other risk factors were evaluated using multiple logistic regression analyses.

Results

This study identified 1130 frequent ED users, 4.3% of patients accounting for 16.2% of total visits. Psychiatric disease, chronic pain, and substance use were common issues. Serious and acute psychiatric and medical illnesses were common. Frequent users were found to have advanced age, significantly more medical comorbidities, psychiatric comorbidities, substance use, and an increased two-year mortality (OR=4.0 p=0.003). Gender and absence of a family physician were not significant factors associated with frequent ED use.

Conclusions

The frequent ED user in this study population has significantly more medical comorbidities, psychiatric comorbidities, substance use, and had a higher two-year mortality. Frequent ED use, cardiovascular disease, cancer, and psychiatric disease were significantly associated with mortality. This study reaffirms frequent ED users as a high-risk population, as they had a 16% two-year mortality.

Alyssa Ness

Alyssa Ness, Nicola Symonds, Michael Siarkowski, Michael Broadfoot, Kerry McBrien, Eddy Lang, Jayna Holroyd-Leduc, Paul Ronksley

Effectiveness of hospital avoidance interventions among elderly patients: a systematic review

Introduction

Overuse of acute care services, particularly emergency department (ED) use, is an important topic for healthcare providers and policy makers within Canada and abroad. Prior work has shown that frail elderly patients with complex medical needs and limited personal and social resources are heavy users of ED services and are often admitted when they present to the ED. Updated information on the most effective strategies to avert ED presentation and hospital admission focused specifically on elderly patients is needed.

Methods

This systematic review addressed the question: what interventions have demonstrated effectiveness in decreasing ED use and hospital admissions in elderly patients? Comprehensive literature searches were conducted in databases including Ovid Medline, EMBASE, CINAHL, and the Cochrane Central Register of Controlled Trials with no language or date restrictions. Citations were limited to interventional studies. Grey literature and reference list searches, as well as communication with experts in the field were performed. Consensus or a third reviewer resolved any disagreements. Original research regarding interventions conducted in populations 65 years or older with acute illness, either living in community or facility-living were included. Primary outcomes were ED visits and hospital admissions. Secondary outcomes included: mortality, cost, and patient-reported outcomes such as health-related quality of life and functional status.

Results

Forty-three relevant studies were identified including 22 randomized controlled trials (RCT), 2 cluster-RCT, 2 trials with non-random allocation, 4 before-after studies, 6 quasi-experimental studies, and 7 cohort studies. Intervention settings included: home visits (22), long-term care (7), outpatient or primary care clinics (8), and ED (3) or inpatient (3). Data characterization revealed that home-based, outpatient and/or primary care-based strategies reduced ED visits and hospitalizations, particularly those which included comprehensive geriatric assessments, home visits or regular face-to-face contact and interdisciplinary teams. Hospital-based models generally showed no difference in ED or inpatient service utilization. There was, however, considerable variability across individual studies with respect to reporting of outcomes, statistical analyses performed, and overall risk of bias.

Conclusion

Various interventional strategies have been studied to avert ED presentation and hospital admission for frail elderly patients. More rigorous methodology and standardization of outcome measures is needed to quantitatively assess the effects of these programs.

Shannon Moore

Shannon Moore, Dennis Nesdoly

Providing "Proof" That Our Organization is Safe

1) Background: What we currently measure in healthcare is not how safe our system is, but how harmful it's been in the past. Other high-risk industries have been characterized by the shift they were able to make from responding to specific incidents of harm to assessing the presence of conditions that create safety. We recognized that the way we view safety from a clinical lens is different from aviation safety, which is in turn different from occupational safety - we needed to develop a common approach.

In 2017, STARS (Shock Trauma Air Rescue Service) participated in the "Measuring and Monitoring of Safety Framework in Canada - Demonstration Project," in collaboration with the Canadian Patient Safety Institute, as well as six other Canadian healthcare organizations. Through this work, we examined the use of the framework by front line teams and leaders, and the ways in which this framework is integrated into ongoing work, including the way we speak of safety, reflect on appropriate measurement, and plan for potential risk. The framework focuses on a fundamental shift in thinking – away from the "absence of harm" to the "presence of safety."

As an organization, we have learned to move away from an assurance model of thinking (what is the one measure that PROVES we're safe) and towards an inquiry model (what can we LEARN about safety today). The framework allows us to answer the question of "How safe is our care?" through five areas of measurement: 1. Measures of past harm (Has patient care been safe in the past?) 2. Reliability (Are our clinical systems and processes reliable?) 3. Sensitivity to operations (Is care safe today?) 4. Anticipation and preparedness (Will care be safe in the future?), and, 5. Integration and learning (Are we responding and improving?).

At STARS, we can't just focus on patient safety or clinical safety. We have to also integrate aviation safety, as well as occupational health and safety. We have had some unique experiences in doing this and have learned that introducing clinical ideas within a federally regulated aviation industry has its challenges. We have been intentional in taking a holistic organizational approach: this framework has applicability across all disciplines.

We will share our learning and challenges in trying to shift the safety thinking, including shift work, integrating clinical and aviation safety, and operating across three different provinces. At the conclusion of the session, participants will be familiar with the Framework for Measuring and Monitoring Safety, and will have examples of how they could take it back to their own organization. Participants will also see examples of how it can, and should, be altered to make it organization – specific. We will share risks and challenges to avoid, and some insight into how to make the concepts "stick."

2) Objective: A) To explain the shift in thinking between, "Are we safe?" to "What can we learn about safety today?" through the lens of the Framework for Measuring and Monitoring Safety. B) To identify learnings and challenges with implementing a change in safety thinking in a unique clinical setting.

3) Methods: We have mapped our STARS organizational activities and quality metrics to all dimensions of the Framework. Each dimension is associated with questions to ask to delve deeply into it. The safety maturity matrix identifies where an individual feels their practice/unit/organization fits currently with each dimension based on a 5-point scale, and results can easily be stratified with an online tool.

4) Timeline: STARS began this journey in May 2017 and are already starting to see the conversation shift at all levels. We will have the organization complete the safety maturity matrix again in one year. We will incorporate the ideas from the Framework into our safety reporting system, and keep the language prominent through all levels of committee meetings.

Matthew Yeung

Matthew Yeung, Christina Schweitzer, Dongmei Wang, Eddy S. Lang

Who is falling? Population level predictors of epidemic orthopedic trauma in Calgary

1) BACKGROUND:

On March 16th, 2017, unique meteorological conditions led to an Emergency Medical Services (EMS) "code red" (acute ambulance insufficiency) in Calgary as a result of an unprecedented spike in the number of individuals injured as a result of falls, fractures, or a combination of the two. Emergency departments (ED) and EMS were overwhelmed by a more than 200% increase in call volumes. There was a corresponding spike in visits to Calgary-area EDs.

2) OBJECTIVE: While a separate project has analyzed what specific meteorological conditions are predictive factors of surges in fall-related orthopaedic presentations to Calgary EDs, this ongoing project aims to identify population groups (e.g. elderly, high-comorbidity, etc.) who are disproportionately affected by these weather conditions in terms of EMS call-outs and ED presentations related to falls. The results of this research can be used by EDs, EMS and hospital services (e.g. orthopaedics, geriatrics) and improve efficiency and EMS turnaround times, reducing the risk of a "code red".

3) METHODS:

Anonymized data will be collected from an Alberta Health Services (AHS) ED patient database by an AHS analyst. Bivariate correlation, multivariate, and linear regressions will be performed to determine which variables are significant predictors of one another, as well as which variables are the most important predictors of the population presenting to Calgary area EDs during these unique weather events. Variables include gender, age, location, the nature of the injury, the mechanism of the injury, potential comorbidities, fracture history and hospital admission history. These variables can be correlated with the likelihood of emergency fracture intervention in the ED, admission status, wait times, operating theatres utilized, the number of electives cancelled for that particular day and any other ED or orthopaedic "stress indices".

Variables can also be combined to identify other data, such as who is more likely to have a prolonged stay in hospital/hospital admission, as well as where EMS can expect to attend the highest volume of calls.

4) TIMELINE:

As the data has already been collected, scheduled completion for analysis is during March, 2018, and a concluding statement of the analysis will be completed by Early April, 2018.

Christina Schweitzer

Christina Schweitzer, Colin Weaver, Dongmei Wang, Eddy S. Lang

Orthogeddon: Meteorological predictors of epidemic orthopedic trauma in Calgary

1) INTRODUCTION:

On March 16 2017, Calgary emergency departments and urgent care centres (EDs) saw 3 times the number of fall related ED visits, and 8 times the number of ED orthopedic consultations and admissions than the daily average for March 2014-2016. Fall related injuries have significant associated morbidity and burden of disease, as well as cost to the health care system, caregivers and society. Unexpected surges in fall related ED presentations can also strain Emergency Medical Services (EMS), ED, consulting service, operating room, and hospital ward capacity and resources, and result in delays to treatment. The purpose of this study was to use regression analysis to generate best fit models and identify weather and temporal variables which predict the frequency of fall related ED visits, orthopedic consultations and admissions in winter (November to March) in Calgary.

2) METHODS:

Daily number of ED visits, orthopedic consults, and orthopedic admissions for presenting complaint of 'Lower Extremity Injury', 'Upper Extremity Injury', or with an ED diagnosis of 'Fracture' or 'Fall', were obtained for winter months from November 1 2013 to March 31 2017 from the Alberta Health Services ED database. Weather data was obtained from Environment Canada. Linear and multiple regression were performed to evaluate the predictive value of individual weather and temporal parameters, and derive the best-fitting model to predict the number of ED visits, orthopedic consultations, and orthopedic admissions.

3) RESULTS:

Individual predictive factors ($p<0.05$) were month, temperature, overnight temperature drop from >0˚C to <0˚C, day of the week, amount of snow on the ground at 05:00 am, post chinook day (chinooks are a warm winter wind in Calgary that can cause large temperature swings), maximum wind gust speed, and presence of precipitation.

The best fit multivariable models predicting fall related ED visits (F stat=15.36, $R^2=0.171$), orthopedic consults (F stat=6.369, $R^2=0.048$), and orthopedic admissions (F stat=8.658, $R^2=0.126$) were statistically significant (probability of F statistics all <0.0001).

4) CONCLUSIONS

This study is, to the best of our knowledge, the first to use multiple regression to compute models using weather and temporal variables that can predict fall related ED visits, orthopedic consults and admissions. This information could be used to alert the population regarding an increased fall and fracture risk ahead of the weather occurrence, as well as municipal snow and ice clearing services, who may be able to mitigate that risk. The ability to predict the frequency of fall related injuries could enable EDs, EMS, orthopedic services, and hospitals to adjust resource and staffing allocation in anticipation of increases in fall related injuries. Ongoing work is being performed to assess whether the representation of specific population groups (e.g. elderly, high comorbidity index etc.) among fall related ED presentations is disproportionately affected by meteorological variables.

Kara Halvorsen

Kara Halvorsen, Sandra Reilly

Continuity of Care: From Admission to Recovery at Home

1) Background: The input-throughput-output approach to emergency department (ED) crowding examines factors that individually and/or collectively interfere with the delivery of quality care (Korn & Mansfield, 2008; Solberg, Asplin, Weinick, & Magid, 2003) and incidentally the transfer of patients to selected care units. As a result, hospitals now regard crowding as a major component that affects the manner and quality of patient care not just in EDs, but associated specialty units (Flabouris, Jeyadoss, Field, & Soulsby, 2013; Hoot & Aronsky, 2008; Sun et al., 2013). Therefore, any reduction in crowding should improve care beyond the walls of the ED. This project aims to analyze the problem by understanding the successes and failures of existing practice in the transfer of patients at the Foothills Medical Centre between the ED and one patient care unit (PCU), unit 41B. This information can provide insight how to ensure efficient, effective, and streamlined transitions to ensure continuity of care and address selected issues associated with crowding.

2) Objective: This project will examine the patient journey for a sub-group of patients (n=10) transferred from an ED to a selected PCU for unplanned abdominal surgeries. The project team will observe the transfer of patients from the ED to PCU 41B at the Foothills Medical Centre (FMC) and upon completion of treatment, their discharge and recovery at home. In so doing, the team will examine the continuity of care, and then make recommendations to enhance existing processes and delivery of care. The project team will observe existing processes and construct a process map utilizing the quality improvement (QI) principles of Alberta Health Services Improvement Way (AIW). To this end, the project team will advise on the better uses of available resources and recommend improvements for patient care.

The team believes that patients and their families represent important stakeholders when improving all aspects of the hospital experience. A questionnaire and three open ended question should help the project team understand the patient experience and ideas on how to improve the process.

3) Methods: Analysis of the observations includes a process map that utilizes QI principles of AIW. The process map includes observations about the activities and roles of the different stakeholders that contribute to the hospital experience. The process map describes the continuity of care as a function of time. The map largely relies on simple descriptive statistics to describe the mean, medium, and mode, according to different observations.

The Patient Continuity of Care Questionnaire or PCCQ (Hadjistavropoulos et al., 2008) collects data regarding the patient experience. This includes analyzing the mean and standard deviation for each item—items with an average score lower than 4.0 suggest areas for improvement. Due to the fact this project includes a small non-representative sample, simple descriptive data analysis suffices.

To explore the complexities of the patient experiences, three open ended questions will provide data for thematic analysis. Analysis of the data should improve our understanding of how effective and efficient transitions in the hospital and to the community improve the experiences and continuity of care for those requiring nursing support.

4) Timeline: Data collection began in late January and will take approximately two weeks to four weeks. The data analysis will begin alongside the data collection and will occur in two steps. The first includes the construction and confirmation of the process map. The second includes the analysis of the questionnaire and open ended questions. Final results and report will become available around March.

Brett Shaw

BH Shaw, I Blanchard, G Lazarenko, R Lee, T Campbell, RS Sheldon, M Runte, SR Raj

Keeping fainters safely at home: An EMS treat and refer protocol for low risk syncope

1) BACKGROUND. There were 3558 patients seen in the Emergency Department (ED) for syncope in Calgary over a 12 month period. Over 50% of these patients (n=1883) arrived via Emergency Medical Services (EMS). Ambulances in Calgary are staffed by an Emergency Medical Technician – Paramedic, who are able to perform assessments in the field, including a history, focused physical examination, as well as performance and assessment of a 12-lead electrocardiogram. Current protocols dictate that even patients who are at low risk of adverse outcomes from their syncopal episode require transport to the ED. Both the paramedics and the patients often have to wait several hours to be seen by an ED physician prior to probable discharge home. Given that only a small fraction of patients with a syncopal episode require hospital admission, it raises the possibility that alternative transport and follow-up options may be beneficial for low-risk patients. Here, we seek to develop and test the feasibility of an EMS treat and refer protocol for low-risk syncope. The potential benefits of such a protocol include decreased operational burden on EDs, a reduction in healthcare costs due to syncope-related visits, and increased patient satisfaction with their healthcare experience.

2) OBJECTIVE. To conduct a pilot study to test the acceptability and effectiveness of an EMS treat and release protocol diverting low-risk syncope patients away from EDs to other locales for follow-up.

3) METHODS. An EMS treat and release protocol has been developed in consultation with syncope experts, emergency medicine physicians, EMS researchers and administrators, and patient advocates. This protocol will be implemented for all paramedics within the Calgary Zone. Patients will be assessed upon EMS arrival. A history, focused physical exam, and 12-lead electrocardiogram will be performed. Paramedics will follow the treat and refer protocol to assess if any high risk exclusion criteria exist for the patient. Patients with any one of these high risk criteria will be transported to the ED for further assessment. Patients who are assessed as being low-risk and do not require transport will be provided with an alternative treatment pathway. This pathway includes: patient-education materials, links to the STARS-Can website, information for the patient's family physician, and an outpatient phone follow-up within 72 hours. Data will be collected for one year post implementation of the treat and release protocol. The primary outcome of this study will be to identify the proportion of patients that can be diverted. Secondary outcomes include: Patient re-presentation rates (at 7 and 30 days), adverse events/safety profile, parmedic protocol adherence, health economic analyses, and patient experience/satisfaction. Data will be compared to historical data one year prior to implementation in Calgary, as well as data collected during the same year by EMS in the Edmonton Zone.

4) TIMELINE. Development of the treat and release protocol has been ongoing since Fall of 2017. Implementation of the protocol, including training of Calgary paramedics has been taking place over Winter 2018. The protocol will go "live" in April 2018. Data collection will continue through March 2019. Data analysis and dissemination of the study results will occur through the Spring-Summer of 2019.

Nicholas Packer

Nicholas Packer, MD, MSc (Emergency Medicine Resident, University of Calgary) Andrew McRae, MD, PhD (Assistant Professor, University of Calgary) Dongmei Wang, MSc (Data Specialist, Alberta Health Services)

Cannabis hyperemesis syndrome within emergency department users in the Calgary health region: a retrospective analysis

Introduction

Cannabis hyperemesis syndrome (CHS) is associated with long-term, regular use of marijuana. CHS patients typically present to emergency departments (ED) during a hyper-emetic phase of paroxysmal nausea and vomiting. Despite extensive investigations as well as frequent ED presentations, CHS patients have a delayed time to diagnosis, and many are often missed. To date, there is a paucity of research examining CHS in emergency departments. Our objective was to identify CHS cases presenting to ED's within the Calgary health region, and to quantify the number of patients and frequency of ED visits for CHS.

Methods

A retrospective chart review was performed on all patients who presented to any Calgary ED or urgent care center between January 1, 2015 and December 31, 2016 (ages 18 - 55 years) who had an ED discharge diagnosis of either nausea or vomiting alone, nausea with vomiting, or poisoning by cannabis, as identified in administrative data. Data abstraction from medical records was performed by trained personnel using standardized forms with comprehensive inclusion criteria for CHS.

Results

The search strategy yielded a total of 320 ED visits from 156 individual patients. 55% of visits were by males, and 45% by females. The average age was 29.5 years. Of the 156 patients, 53% had cannabis use documented in the chart, with 51% reporting daily and/or regular cannabis use. Relief of symptoms from use of hot showers (a pathognomonic finding) was found in 17% of patients. 18% of patients (n = 28) met criteria for CHS, and 28% (n = 44) met partial criteria for CHS (having documented regular cannabis use, cyclic vomiting and abdominal pain) but no record of symptom resolution with cessation of cannabis use or from the use of hot showers. Patients meeting CHS criteria had an average of five repeat ED visits during the study period with 16% (n = 12) of ED visits resulting in hospital admission.

Conclusions

We identified a large cohort of patients with confirmed or suspected CHS. Given that nearly one third of the sample met partial criteria for CHS highlights the need for improved patient screening, as it is possible that this cohort may include missed cases. Further, many CHS patients are not responsive to first-line anti-emetics and accurate diagnosis is crucial for managing these patients effectively in the ED. This is of particular importance given the admission rate for CHS and resulting burden on the health system.

Brooke Button

Brooke K Button, George M Layton, Shawn M Varney

Challenges to SPI-led Research

Authors: Brooke K Button (Poison and Drug Information Service, Calgary, Alberta), George M Layton, Shawn M Varney

Introduction: Specialists in Poison Information (SPIs) have expressed interest in research but have often encountered obstacles. The American Association of Poison Control Centers (AAPCC) SPI Committee developed a research subcommittee to study these barriers. Our objective was to determine interest, gauge perception, identify obstacles, and determine best ways to promote SPI-led research.

Methods: The subcommittee designed a survey consisting of 12 multiple-choice questions on SPI background and education; previous research achievements; identification of needs and perceived obstacles; and self-assessment of desire to participate in research in the coming year. Questions were piloted on 7 SPIs and then revised for clarity. A SurveyMonkey® link was sent to US and Canadian SPIs from 60 poison centers on the AAPCC listserv. Participation was voluntary and remained open for 60 days. De-identified data were collected and analyzed using descriptive statistics.

Results: Of 1017 SPIs, 321 responded (31.5%). Respondents were 64% Registered Nurses, 30% Pharmacists, 3% Medical Doctors, 1% PhD, and 2% other (Nurse Practitioner or Paramedics), in which 84% were certified SPIs, 11% non-certified, 4% diplomates, and one board-certified toxicologist. Only 20% were American Academy of Clinical Toxicology members. Regarding years in practice, 33% had less than 5 years, and 20% more than 20 years experience. Sixty-nine percent had never published research, 25% had published 1-5 articles, 3.5% 6-10 articles, and 2% more than 10 articles. Twenty-seven percent had published as 1st or 2nd author in toxicology research. Of all respondents, 37% had presented a poster at a North American Congress of Clinical Toxicology meeting, and 22% of these had more than 5 posters accepted. Seventy-one percent reported they were interested in pursuing a research topic in the next year. Respondents identified the following barriers to doing research (in order of interest): (47 %) designing a study; (45 %) navigating publication; (38%) collecting data; (38 %) searching literature; (30%) forming a hypothesis; (30%) drafting a manuscript; (30%) working with specific programs; and (28%) finding a co-author.

Conclusions: SPIs have demonstrated interest in toxicology research but commonly faced difficulties in starting the process. Common barriers were designing a study, navigating the publication process, collecting data, and searching the literature. In a budget-limited environment, the SPI Research subcommittee can help SPIs engage in research by closely aligning support and implementing measures to address these challenges to SPI-led research.

Kerry McBrien

Kerry McBrien, Eddy Lang, Van Nguyen, Jacob Bailey, Alicia Polachek, Ginetta Salvalaggio, Cheryl Barnabe, Patrick McLane, Paul Ronksley, Tyler Williamson, Karen Tang, William Ghali, Gabriel Fabreau

Coordinated care for vulnerable populations with complex needs and high acute care utilization: evaluation of a novel care delivery model

Background: Socially vulnerable individuals, including those experiencing homelessness, have higher acute care utilization than the general population. Despite available primary care and social services, many of these individuals face challenges accessing needed services in the community. Connect to Care (C2C) is an innovative community outreach program that combines case management and health navigation to bridge acute care, community care, and social services. We aim to evaluate C2C's effectiveness in reducing acute care utilization and its associated costs and improving intermediate outcomes for socially vulnerable clients.

Objective: The primary objective is to determine if C2C effectively reduces acute care utilization (emergency department visits and hospitalizations). Secondary objectives include estimating the cost impact of C2C and determining if C2C improves intermediate outcomes (housing stability, primary care attachment, substance use).

Methods: Since November 2015, C2C has accepted referrals for homeless or unstably housed adults with at least 3 ED or urgent care visits or at least 2 hospitalizations in the previous year. We will access multiple data sources including administrative health records from Alberta Health Services and client surveys completed at program intake, 6, and 12 months after intake. We will use a within-subject controlled analysis to assess changes in ED visits, hospitalizations, length of hospital stay, 30-day readmissions, and estimated acute care costs in the 12 months before and after enrolling in the C2C program. We will also assess changes housing stability, primary care attachment and self-reported substance use at 6 and 12-month post-enrolment compared with baseline.

Timeline: Given that secured program funding ends by September 30, 2019, enrolment for study purposes will end on March 31, 2019 to allow for a full 6 months of intervention services for all patients. If an extension in program funding is realized, we may elect to continue enrolling study participants beyond this date. We will acquire utilization data at three time points: February 1, 2018; February 1, 2019; and February 1, 2020. At each juncture we will examine the individual patient outcomes listed above. Our first set of analyses based on data to February 2018 will be completed by April 2018. We will provide written and oral reports to our partners throughout the project and will complete a final report and prepare manuscripts for publication in the second quarter of 2021.

Sara Nosworthy

Sara Nosworthy, Sandra Hirst, Cynthia Mannion, Gudrun Reay

Improving Triage to Electrocardiogram Time in the Emergency Department

Introduction:

The ST-segment elevation myocardial infarction (STEMI) team of a large Canadian urban tertiary care hospital identified that best practice recommendations were not being met for walk-in patients presenting with suspected ischemic chest pain (SICP) to the Emergency Department (ED). The recommended target for triage to first-device time is 90 minutes. However, this target was only achieved 6% of the time for walk-in patients diagnosed with STEMI.

It is recommended that the initial electrocardiogram (ECG) be completed within 10 minutes for patients presenting with SICP to the ED. Data analysis identified that a significant delay for walk-in patients diagnosed with STEMI was the time to the initial ECG. This delay places patients at risk for adverse outcomes, such as cardiac arrest. It was therefore necessary to implement a streamlined process to improve triage to ECG times.

Methods:

A quasi-experimental study was conducted at a large Canadian urban tertiary care hospital. A new streamlined process at triage for walk-in patients presenting with SICP was evaluated. The primary outcome measured was triage to ECG time.

Results:

The was a statistically significant difference between May 2016 and May 2017 ($U = 28425$, $Z=-5.01$, $p <.001$). Following the streamlined process there was a significant decrease of 16-minutes in the median triage to ECG time for walk-in patients presenting with SICP compared to those prior to the streamlined process.

Conclusion:

The target time of triage to ECG within 10-minutes was not achieved for all patients presenting with SICP but the time improvement was significant. Future interventions directed at decreasing triage to ECG time should focus on early identification of patients with chest pain, examining the streamlined process for further improvements, ensuring staffing levels that enables access to early ECGs, and ongoing evaluation of triage to ECG data.

Katie Anker

Katie Anker, Julia Hews-Girard, Marilyn Goodyear and Tom Rich

FACTOR FIRST, THINK SECOND: Exploring if Electronic Care Plans improve time to factor administration in adult patients with Hemophilia presenting to the ED with bleeding

BACKGROUND: Adequate hemostasis occurs through complex interactions between platelets, the coagulation cascade, and the vascular endothelium. In the absence of a clotting factor, as is the case with Hemophilia A (deficiency of factor VIII) and Hemophilia B (deficiency of Factor IV), the ability to create a strong fibrin clot is lost and hemostasis is jeopardized. These diseases are the most common coagulation disorders worldwide, and afflict 1 in every 10,000 people. The cornerstone of Hemophilia treatment is replacing the deficient clotting factor, sometimes prophylactically and in acute bleeding. When these patients present to the ED with acute bleeding concerns, National evidence-based guidelines dictate that this replacement should occur within two hours of bleed onset, before investigations or diagnostic imaging. A delay to factor replacement increases mortality and disability. To emphasize these guidelines, the Southern Alberta Rare Blood and Bleeding Disorders Comprehensive Care Program Clinic developed individualized treatment plans for their patients. Until 2015, these treatment plans were kept in cumbersome binders at triage, which were challenging to access, frustrating to update and relied on patients self-identifying as Hemophiliacs with a care plan. In 2015, these care plans were incorporated into regional electronic medical records, in the hopes that factor replacement administration would occur faster.

OBJECTIVE: No Canadian study has examined how long patients with Hemophilia wait in the ED before replacement. Additionally, the impact electronic care plans have on this metric has not been analyzed, nor has the effect of Calgary's electronic care plans been reported. Our objective was to determine how often hemophiliac patients access the ED, and whether personalized electronic care plans linked to our EMR improve time to product ordering. We hypothesize that these plans will reduce time to product order by 25% in Hemophilia patients with acute bleeding episodes. We hope that this data will facilitate the improvement of care for future patients with Hemophilia with acute bleeding.

METHODS: We performed an electronic health record (EHR)-based retrospective before-and-after clinical study in the Calgary Health zone, including the four adult EDs and two urgent care centres. All adult patients with Hemophilia A or B followed by the Southern Alberta Rare Blood and Bleeding Disorders Comprehensive Care Program Clinic as of September 1, 2017 who presented to a Calgary zone ED or UCC with bleeding were enrolled. All patients followed by SARBBDCCP annually consent to their health information being used for research and quality control initiatives. Two separate time periods were analyzed: the control period, August 1, 2013-August 1, 2015, and the intervention period, September 1, 2016- September 1, 2017. These correspond to ED visits before and after the care plans were implemented, respectively. Our primary outcome was time from triage to factor replacement order. Secondary outcomes included time from factor replacement to administration, consult utilization and timing, and ED or hospital LOS.

TIMELINE: Data has been extracted from SCM in January 2018. ARECCI screening will be done by the end of February 2018. Data will be statistically analyzed by April 2018 and ready to present.

Omar Damji

Damji O., Lee-Nobbee P., Borkenhagen D1., Cheng A

Eye-Tracking in Pediatric Trauma Simulation: An Alberta Children's Hospital KIDSIM Initiative.

Introduction:

Visual eye-tracking devices are able to capture eye movements, which are further characterized by fixations, gaze-stabilizing movements, and gaze-shifting movements. Utility of eye-tracking is supported in the literature; however, application to a trauma setting have been simple and few. Visual fixation can be utilized as a surrogate measure of attention during the management of a trauma patient. The aim of this study was to determine feasibility of utilizing eye tracking and characterize eye tracking behaviors of EM (emergency medicine) physicians during management of a pediatric trauma patient.

Methods:

Nine pediatric EM physicians participated in this observational, non-blinded simulation-based study. Each participant was equipped with a head-mounted eye-tracking device during a standardized pediatric trauma scenario. Each session was video recorded via the eye tracking unit. Fixations were defined as a moment (longer than 0.2s) when the team leader's eyes were stable on a fixed object. Fixations were characterized by start time, duration, and area of interest. Noldus Observer XT software was used for video analysis. Data was characterized in a descriptive fashion.

Results:

A total of 9 video sessions were recorded, 7 analyzed, and 2 excluded due to calibration difficulties mid-simulation. The first 5 minutes of each video was used to record eye fixations on pre-defined areas of interest (AOI). AOI included the patient, bedside doctor, paramedic, monitor, recording nurse, medication nurse, procedure nurse, fluids, oxygen and respiratory therapist. 35% of eye fixations were directed towards the mannequin, 16% towards the monitor, and 13% towards the bedside doctor.

Conclusions:

Visual eye tracking in a trauma simulation is feasible. Frequency of fixations tends to be highest towards the patient. Eye tracking methods within trauma simulation may provide new insights into quality improvement and inform therapeutic interventional advancements in pediatric trauma.

Kelsey Ragan

Kelsey Ragan, Anjli Pandya, Neil Collins, Mark Swain & Tristan Holotnak

Rapid hepatitis C virus screening and diagnostic testing for high-risk patients in an urban emergency department: A pilot project

BACKGROUND: Hepatitis C virus (HCV) infection represents a significant public health problem in Canada and it is estima ted that nearly half of individuals with chronic hepatitis C infection are unaware of their disease status. Previous studies of urban emergency department (ED) based screening programs have shown a prevalence ranging from 7.3 to 26% in hig h risk patients presenting to the ED . The Canadian Task Force on Preventive Health Care and Centers for Disease Control and Prevention suggests screening individuals who are at increased risk for HCV infection including those from endemic countries, IV drug users, individuals with a history of incarceration and those born between 1945 and 1965 (baby boom ers). The advent of new treatment regimens with high rates of virologic cure strengthens the case for identifying the opti mal setting for screening and testing individuals who may benefit from treatment.

OBJECTIVE: This pilot project of ED based screening for hepatitis C virus will aim to determine the prevalence of undiagn osed HCV infection and to link patients with chronic HCV infection to appropriate specialized followup care. To our know ledge, no emergency department in Canada has undertaken protocoled HCV screening using rapid antibody testing in th e ED. Based on published results from other centres, we estimate that a significant proportion of screened patients will t est positive for chronic HCV infection (> 10%). Results will inform the future development of integrated ED based screen ing programs in novel settings more likely to be accessed by the at risk population. Linking patients with chronic HCV inf ection to appropriate care will decrease the number of individuals developing HCV related cirrhosis and hepatocellular c arcinoma, thereby improving patient outcomes and reducing the future impact on our health care system.

METHODS: We will be conducting a prospective cohort study of patients presenting to an urban ED in Calgary, Alberta. P atients will be screened using high risk criteria for HCV infection as per national guidelines through completion of a self a dministered survey. Eligible patients will be offered and consented for a rapid point of care antibody test (Oraquick, sens itivity and specificity 100%). Individuals with a positive antibody screen will undergo confirmatory HCV RNA testing and will be referred to the Calgary Liver Unit (Hepatology) central access and triage to complete linkage to care. The primary outcome will be the prevalence of hepatitis C virus infection among tested high risk patients. Secondary outcomes will in clude (i) the proportion of high risk patients without a primary care physician or access to alternate care settings where s creening may occur and (ii) the proportion of HCV positive patients who are successfully linked to specialized care. Descr iptive analyses will be performed for all variables using proportions with 95% confidence intervals.

TIMELINE: Participant recruitment is planned to being in March 2018 and the study will run over a 3 month period. Data analysis and result dissemination is expected to be complete by July 2018.

Grant Innes

G. Innes, A. McRae, H. Boyda, T. Holotnak, J. Andruchow

ED Initiated Drug Therapy and Patient Compliance in Acute Renal Colic

Introduction: NSAIDS offer more effective analgesia than opioids, require less rescue medication, and decrease the incidence of nausea and vomiting in renal colic patients. Alpha-blockers and NSAIDs are also prescribed frequently, but doses used and treatment durations are not well described. Our objective was to investigate ED prescribing decisions and medication use (compliance) by patients with acute renal colic.

Methods: In this prospective two-city cohort study, we invited patients with a first ED visit for image-confirmed 2-10 mm ureteric stones to consent to a telephone survey 10 days after their ED visit. During follow-up interviews, patients were asked what drugs they were prescribed and how many doses they required. This study was REB approved.

Results: A convenience sample of 224 patients, including 152 males (67.9%) and 72 females (median age= 52.4 years) completed 10-day surveys. NSAIDS were prescribed for 48.7%, tamsulosin for 65.2% and opioids for 81.7%. One-third received a tamsulosin-NSAID combination, 40% an opioid-NSAID combination and 28% a tamsulosin/ NSAID/ opioid combination. Of 109 patients prescribed an NSAID, only 70 (64.2%) took ≥ 1 dose/day; however an additional 28 who were not prescribed NSAIDs took ≥ 1 NSAID dose/day. Mean (sd) NSAID intake in the overall study group was 1.1 (1.5) doses/day from day 1-5 and 0.6 (1.1) doses/day on days 6-10, with 90%ile values of 3.0 and 2.0 doses/day during these periods. NSAID compliance was more common in patients who stated they received high quality discharge instructions (63.8% vs. 32.6%; RR=1.95; 95% CI 1.47-2.60). Mean opioid intake in the overall study group was 1.2 (1.7) doses/day from day 1-5 and 0.5 (1.3) doses/day on days 6-10, with 90%ile values of 4.0 and 2.0 doses/day. Among patients prescribed tamsulosin, the average was 4.0 days of compliance (sd=4.3), with a 90%ile value of 10 days.

Conclusions: This study provides estimates for the amount of drug actually used by renal colic patients during the 10-days after their ED visit. Patients used fewer opioid doses than expected, and NSAID and tamsulosin compliance appears relatively poor. NSAID compliance was better in patients who perceived high quality discharge instructions. This study suggests there is room for improvement in medication prescribing and counseling for ED patients with an acute episode of ureteral colic.

Shawn Dowling

Shawn Dowling, Heather Hair, Denise Boudreau, Christopher Rice, Daniel Grigat, Stephanie VandenBerg

A Patient Focused Information Design Intervention to Support the mTBI Choosing Wisely Recommendation

Introduction: Within Alberta, 30% of patients presenting to emergency with minor traumatic brain injury (mTBI) will receive a CT scan before being sent home. Choosing Wisely (CW) Canada recommends using validated clinical decision support to determine whether a CT scan is necessary for patients presenting with a mTBI. In order to provide patients with information on the risks and benefits of CT scans in mTBI and to encourage discussions between patients and their doctor, the Emergency Strategic Clinical Network (ESCN) designed a patient infographic on CT scans for head injuries.

Methods: The ESCN, Physician Learning Program and CW Alberta partnered with the Mount Royal University Department of Information Design to develop an interactive patient infographic storyboard. Students spent a semester developing infographics on Choosing Wisely recommendations which were then presented to stakeholders. From this work a student was selected to develop a final design.

The refinement of the storyboard took place in consultation with clinical experts, and was tested in two patient focus groups. The final design was evaluated against the International Patient Decision Aid Standards checklist. The infographic was posted in 2 locals emergency department waiting rooms. A survey was administered to any patients in the waiting room when volunteers were available. The survey was designed to evaluate whether the storyboard influenced patient beliefs about the risks and benefits of CT scans, and their willingness to engage in a discussion with their doctor.

Results: In a 56 day period, 89 patients consented and completed the survey. Before reading the survey, 33% of patients thought a CT after a head injury was always a good idea and 63% thought it was sometimes a good idea. 82% and 91% of patients stated the poster helped them understand the indications and risks of CT imaging for mTBI. After viewing the poster, only 15% of patients felt that a CT was always a good idea after a mTBI.

Conclusions: The mTBI storyboard significantly changed patient perceptions regarding the need for CT scans, as well and increased awareness indications, alternatives and risks of CT scans in the setting of mTBI. This study demonstrates that targeted patient education materials can help support CW recommendations.

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The accuracy and prognostic value of point-of-care ultrasound (POCUS) for nephrolithiasis: A systematic review and meta-analysis

Introduction:

Point-of-care ultrasound (POCUS) has been suggested as an initial investigation in the management of renal colic. Our objectives were: 1) to determine the accuracy of POCUS for the diagnosis of nephrolithiasis, and 2) to assess its prognostic value in the management of renal colic.

Methods:

The review protocol was registered to the PROSPERO database (CRD42016035331). An electronic database search of MEDLINE, EMBASE, and PubMed was conducted utilizing subject headings, keywords, and synonyms that address our research question. Bibliographies of included studies and narrative reviews were manually examined. Studies of adult emergency department patients with renal colic symptoms were included. Any degree of hydronephrosis was considered a positive POCUS finding. Accepted criterion standards were CT evidence of renal stone or hydronephrosis, direct stone visualization, or surgical findings. Screening of abstracts, quality assessment with the QUADAS-2 instrument, and data extraction were performed by two reviewers, with discrepancies resolved by consensus with a third reviewer.

Test performance was assessed by pooled sensitivity and specificity, calculated likelihood ratios, and a summary receiver operator curve (SROC). The secondary objective of prognostic value was reported as a narrative summary.

Results:

The electronic search yielded 627 unique titles. After relevance screening, 26 papers underwent full-text review, and 9 articles met all inclusion criteria. Of these, 5 high-quality studies (N = 1773) were included in the meta-analysis for diagnostic accuracy, and the remaining yielded data on prognostic value. The pooled results for sensitivity and specificity were 70.2% (95% CI = 67.1% to 73.2%) and 75.4% (95% CI = 72.5% to 78.2%), respectively. The calculated positive and negative likelihood ratios were 2.85 and 0.39. The SROC generated did not show evidence of a threshold effect. Two of the studies in the meta-analysis found that the finding of moderate or greater hydronephrosis yielded a specificity of 94.4% (95% CI = 92.7% to 95.8%).

Four studies examining prognostic value noted a higher likelihood of a large stone when positive POCUS findings were present. The largest randomized trial showed lower cumulative radiation exposure and no increase in adverse events in those who received POCUS investigation as the initial renal colic investigation.

Conclusion:

Point-of-care ultrasound has modest diagnostic accuracy for diagnosing nephrolithiasis. The finding of moderate or severe hydronephrosis is highly specific for the presence of any stone, and the presence of any hydronephrosis is suggestive of a larger (>5mm) stone in those presenting with renal colic.

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Bronchiolitis Management in Calgary Emergency Departments

Bronchiolitis is a viral respiratory infection and the most common reason for hospitalization of infants. Despite evidence that few interventions are beneficial in patients with bronchiolitis, other studies would have shown that a significant proportion of patients undergo various forms of low value care. This objective of this project was to 1. establish baseline management of bronchiolitis in the Calgary Zone, and 2. deliver audit and feedback (A&F) reports to pediatric emergency physicians (PEP) to identify opportunities and strategies for practice improvement.

Methods: This retrospective cohort study included all patients ≤12 months old that presented to a Calgary emergency department or urgent care center with a diagnosis of bronchiolitis from April 1, 2013 to March 31, 2017. Using data from various electronic health data sources, we captured age, vital signs, CTAS, common therapeutic interventions (bronchodilators, steroids, antibiotics) and investigations (chest x-ray (CXR), viral studies, antibiotics). Results were stratified by site and by admission status. Descriptive statistics were used to report baseline characteristics and interventions. Interhospital ranges (IHR) were provided to compare different hospitals in the zone. For the A&F component of the project, consenting PEP received a report of both their individual and peer comparator data and an in-person multi-disciplinary facilitated feedback session.

Results: We included 4023 patients from all 6 sites (range from 28 to 3316 patients). Admission rates were 21.7% (IHR 0-29%). Mean age was 5.4 months old. Bronchodilator use was 27.0% (IHR 21-41%). 22.0% of patients received a CXR (IHR 0-57%) and 30.3% had viral studies done (IHR range 0.8-33%). PEP had higher usage of viral studies (30% vs 5.7%), whereas non-PEP had higher CXR usage (46.2% vs 23.4%). 41 of 66 PEP consented to receive their individual A&F reports (62%). In the facilitated feedback session PEP 1. identified two areas (bronchodilators and viral studies) where improvements could be made and 2. discussed specific strategies to decrease practice variation and minimize low value care including development of a multi-disciplinary care pathway, alignment with in-patient management, education and repeated A&F reports.

Conclusion: Significant variability exists in management of patients with bronchiolitis across different hospitals in our zone. A facilitated feedback session identified areas for improvement and multi-disciplinary strategies to reduced low value care for patients with bronchiolitis. Future phases of this project include repeated data in 6 months and implementation of a provincial care pathway for the management of bronchiolitis.

Huma Ali

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Emergency Department Patients' Perception of Pain during Formal Abdominal Sonography

Background: Pain is a component of up to 80% of all emergency department (ED) visits, and is a common experience during ED procedures, investigations and treatments. Oligoanalgesia, the under-treatment of pain, is a recognized problem in the ED and can have numerous detrimental effects. Abdominal ultrasonography can be a key part of assessment for the etiology of abdominal pain in ED patients. While essential to the management of many patients, ultrasonography can be painful. It involves placement of the ultrasound probe on potentially the area of maximal abdominal tenderness, which can worsen the pain already experienced by the disease process. To date, there have been no studies published that describe patients' perception of pain associated with abdominal sonography.

Objective: For patients presenting to the ED with abdominal pain necessitating abdominal sonography, we aimed to a)

quantify the pain experienced on presentation to the ED, during abdominal sonography, and immediately after abdominal sonography, (b) describe the timing and variety of pain medications patients received in the ED, relative to the ultrasound procedure and c) describe patients' suggestions on ways to ameliorate their experience of pain.

Methods: This study is a descriptive cross sectional survey of adult patients (>17 years old) presenting to the ED at South

Health Campus in Calgary, Alberta with abdominal pain concerning for cholecystitis or appendicitis necessitating a radiology department ultrasound to make the diagnosis. With expert panel input, and following published methodology guidelines, we created a novel survey tool. The expert panel included practicing emergency physicians, pain experts, a radiologist, and an ultrasound technician. The survey tool was assessed for face and content validity, and sensibility, and then pilot testing was conducted. The research assistant (RA) will be present in the ED during the summer to identify and recruit patients for the study in addition to doing a brief medical record review. Once consent is obtained, online surveys will be completed on a tablet by the patients in the ED shortly after the ultrasound is completed. All data will be gathered in a confidential manner by the RA, and kept in the ED at all times. The sample size is 100.

Timeline: We have recruited seventeen patients from July to August 2017. We plan to recruit the remaining patients from May to August 2018. We expect that our study will be ready for publication by the winter of 2018. We plan to submit our research for presentation at the Canadian Association of Emergency Physicians (CAEP) 2019 Conference, as well.