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Abstracts for the 2018 NAEMSP Scientific Assembly

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2018 NAEMSP Abstracts

Abstracts for the 2018 NAEMSP Scientific Assembly

Oral Presentation Abstracts (1–30)

1. Timing of Advanced Airway Placement after Out-Of-Hospital Cardiac Arrest: Earlier Is Better

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Category of Submission: Cardiac

Background: Advanced airways (e.g., endotracheal tubes, supraglottic airways) are frequently placed by Emergency Medical Services (EMS) in patients with out-of-hospital cardiac arrest (OHCA). However, the optimal timing of advanced airway placement during the sequence of resuscitation events is unknown. We hypothesized that earlier advanced airway placement would be associated with increased probability of return of spontaneous circulation (ROSC). **Methods**: This secondary analysis of ROC PRIMED study data included adult, non-traumatic, OHCA patients with advanced airway placement by EMS prior to ROSC. Patients were excluded if EMS witnessed the arrest or arrest time was unknown. The primary exposure variable was time from EMS arrival to advanced airway placement. The outcome variable was ROSC. A Cox proportional hazards model was constructed to estimate the probability of ROSC as a function of the time to advanced airway placement using non-linear penalized splines. The Cox model was stratified by initial cardiac rhythm, accounted for resuscitation duration, and adjusted for Utstein variables including age, sex, bystander interventions, and EMS response time. Patients were right censored at time of hospital arrival or EMS termination of resuscitation. **Results**: A total of 7,547 OHCA patients were evaluated. Mean age was 67 years (standard deviation 15), 69% were male, 38% had an initial shockable rhythm, and 49% received bystander CPR. Median EMS response time was 6 minutes (interquartile range 4–7). Time from EMS arrival to advanced airway placement was 0–5 minutes (12%), 5–10 (36%), 10–15 (29%), 15–20 (14%), 20–25 (5%), 25–30 (2%), and >30 (2%). Median time from EMS arrival to ROSC was 19 minutes (interquartile range 14–25). Time to advanced airway placement was significantly associated with ROSC based on the Cox model. For initial shockable rhythms, the probability of ROSC was 59%, 55%, 51%, 45%, 39%, and 33% with airway placement at 5, 10, 15, 20, 25, and 30 minutes, respectively. For non-shockable rhythms, the probability of ROSC was 43%, 40%, 35%, 30%, 25%, and 20% at the same airway intervals. **Conclusions**: EMS advanced airway placement for OHCA has a time-dependent association with ROSC. Early advanced airway placement is associated with increased ROSC, regardless of initial cardiac rhythm.

2. EMS Agencies with High Rates of Field Termination of Cardiac Arrest Care Also Have High Rates of Survival

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Category of Submission: Cardiac

Background: The relationship between field termination of resuscitation (FTOR) and survival from cardiac arrest is unknown. We hypothesized that EMS agencies with more frequent FTOR would be more likely to optimize resuscitative efforts on scene and would also have better patient outcomes. **Methods**: The Cardiac Arrest Registry to Enhance Survival (CARES) identified out-of-hospital cardiac arrests (OOHCAs) occurring from 2013 to 2016. A priori, EMS agencies were included if they submitted at least 80 cases during this period. Subsequently, agencies were divided into quartiles based upon FTOR frequency. The top and bottom quartiles were identified as high (HFTAs) and low field termination agencies (LFTAs). Generalized estimating equation models were used to compare HFTAs and LFTAs. **Results**: Seventy agencies were classified as HFTAs (treating 31,486 OOHCA patients) and 70 agencies were classified as LFTAs (treating 27,314 OOHCA patients). FTOR was performed on 51.6% HFTA patients and on 7.1% of LFTA patients. The mean patient age was 62.1 years and 61.2% were male. HFTAs were more likely to have patients with a shockable rhythm (OR = 1.16, 95%CI 1.1–1.3, p = .003) and who received bystander CPR (OR = 1.52, 95%CI 1.3–1.7, p < .001) than LFTAs. HFTAs had higher proportions of ROSC (35.4% vs. 26.4%, OR = 1.38, 95%CI 1.2–1.6), survival to discharge (12.5% vs. 8.5% OR = 1.46, 95%CI 1.3–1.7), and favorable neurologic outcome in survivors (86.7% vs. 77.9%, OR = 1.84, 95%CI 1.4–2.4) than LFTAs, all p < .001; These results remained significant after controlling for patient characteristics like age, shockable rhythm, and bystander CPR. When compared to LFTAs, HFTAs spent greater time at the scene before patient transport (25 min vs. 16 min, 95%CI 6.3–9.0, p <.001) and were more likely to administer drugs to patients (92.0% vs. 86.7%, 95%CI 1.0–2.1, p = .04). **Conclusions**: EMS agencies with the highest rates of FTOR also have higher rates of ROSC, survival, and good neurologic outcome. HFTAs spend more time on scene before patient transport, suggesting they may not have a culture of "scoop and swoop" for OOHCA care. Additional studies are needed to identify any subgroup of OOHCA that may benefit by transport for care at a hospital.

3. Prehospital Delivery of Death Notifications Associated with Higher Rates of Occupational Burnout Among EMS Professionals

Remle Crowe, Rebecca Cash, Madison Rivard, Abraham Campos, Brian Clemency, Robert Swor, Eric Ernest, Ashish Panchal, *The National Registry of Emergency Medical Technicians*
Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: EMS professionals often undertake the difficult task of notifying families when a death occurs in the prehospital setting. However, many do not receive related training, which may exacerbate the associated stress. The emotional strain that accompanies death notifications has been linked to burnout in other healthcare settings, yet this has not been examined in EMS. Our objective was to assess the relationship between death notification, training and work-related burnout among EMS professionals. We hypothesized that after controlling for training, delivering death notifications would be associated with higher odds of burnout. **Methods**: We analyzed data from a cross-sectional electronic survey administered in April 2017. A sample size calculation approximated that 1,300 responses were needed to make estimates with 95% confidence. Assuming an 11% response rate from previous work, we randomly selected 19,330 nationally-certified EMS professionals. Inclusion criteria consisted of EMTs or higher, practicing in non-military settings. We assessed burnout using the validated Copenhagen Burnout Inventory and providers self-reported training and the number of adult death notifications delivered in the past 12 months. We conducted multivariable logistic regression modelling using confounders selected a priori from previous research: certification level, experience, agency type, and call volume. We used the Hosmer-Lemeshow goodness-of-fit test to assess model calibration. **Results**: We received 2,333/19,330 responses (response rate:12.1%) and 1,514 (65%) met inclusion criteria. Over half (53%, n = 780) delivered at least one death notification in the past 12 months, while one-third (32%, n = 468) exhibited burnout. A step-wise increase in burnout prevalence was noted as number of death notifications increased. The prevalence of burnout was 23%, 36%, and 51% for those who delivered 0, 1–5, and 6 or more death notifications, respectively. After adjustment, delivering one or more death notifications was associated with 47% greater odds of burnout (OR:1.47, 95%CI:1.12–1.94). Meanwhile, training was associated with reduced odds of burnout (OR:0.60, 95%CI 0.47–0.77). **Conclusions**: After adjustment for

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provider characteristics including experience, delivering death notifications was associated with higher odds of burnout, while training was protective. Important limitations include response bias, recall bias and the cross-sectional nature of this evaluation. Prospective work is needed to explore the underlying causes of this relationship.

4. Incivility among Nationally Certified Ems Professionals Is Linked to Workforce-Reducing Factors

Rebecca Cash, Remle Crowe, Kim White-Mills, Madison Rivard, Ashish Panchal, *The National Registry of Emergency Medical Technicians* Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: Incivility is defined as negative interpersonal acts that violate norms for social interaction, ranging from breaches of etiquette to outright harassment. In other healthcare settings, incivility has been linked to negative individual and organizational effects, although scant literature exists concerning incivility in the unique, high-stress EMS setting. Our objective was to describe the association between incivility and stress, career satisfaction, turnover intentions, and workplace absence among EMS professionals. We hypothesized that exposure to incivility would be linked to poorer personal and occupational well-being. **Methods**: Based on a sample size calculation, 38,000 nationally-certified EMS professionals received an electronic questionnaire. Incivility was measured using an EMS-adapted Workplace Incivility Scale (WIS). Stress was measured using the depression anxiety and stress scale (DASS). Satisfaction was measured using a 4-point Likert scale and high self-reported workplace absence was classified as missing 10 or more days of work in the previous 12 months. Non-military, practicing EMTs or higher were included in the analysis. Multivariable logistic regression was conducted using a priori selected covariates based on directed acyclic graphs to obtain adjusted odds ratios and 95% confidence intervals (OR, 95% CI) to examine the association between experiencing incivility and the outcomes of interest. **Results**: A total of 3,741 EMS professionals responded (response rate = 10.3%), with 2,815 (75%) meeting inclusion criteria. Most were male (70%) and white, non-Hispanic (87%) with 54% certified at the EMT level. Incivility was experienced at least once per week by 47% of respondents. Exposure to incivility was associated with greater odds of dissatisfaction with EMS (4.70, 3.48–6.35), dissatisfaction with a main EMS job (6.68, 4.99–8.93), dissatisfaction with immediate supervisors (11.04, 8.21–14.85), increased stress (5.31, 4.04–6.98), intent to leave one's job or the EMS profession in the next 12 months (3.99, 3.17–5.02 and 3.55, 2.48–5.09, respectively), and workplace absence (1.38, 1.06–1.81). **Conclusions**: About half of nationally-certified EMS professionals were exposed to regular incivility. Exposure to incivility was associated with workforce reducing factors such as career dissatisfaction, stress, turnover intentions, and workplace absence. Further research is needed to understand how organizational climate and interpersonal behaviors in the workplace affect individual employees and EMS workforce stability.

5. Statewide Trends in Out-of-Hospital Cardiac Arrest Related to Drug Overdose

Samuel Beger, Gabriella Smith, Vatsal Chikani, Daniel Spaite, Samuel Keim, Terry Mullins, Taylor George, Bentley Bobrow, *University of Arizona College of Medicine – Phoenix* Category of Submission: Student, Resident, Fellow

Background: Along with out-of-hospital cardiac arrest (OHCA), opioid abuse and overdose (OD) have become major public health problems in the US. While opioid-related deaths have increased in the US, recent temporal and regional trends in the proportion of OHCAs related to overdose (OD-OHCA) are largely unknown and may impact treatment strategies and outcomes. **Objective**: To assess trends in incidence, process of care, and outcomes of OD-OHCAs compared to presumed cardiac etiology arrests (C-OHCA). **Methods**: Statewide observational study utilizing an Utstein-style database, along with detailed review of EMS first care reports linked with hospital records and vital statistics data between 2010 and 2015. The proportion and 95% Confidence Intervals were calculated to compare the rate of arrests between OD-OHCAs vs. C-OHCAs. Multivariate logistic regression was carried out to compare survival between the two groups. **Results**: There were a total of 21,658 confirmed OHCAs during the study period. After excluding non-C-OHCAs/non-OD-OHCAs, 18,988 cases remained. Overall, 18,001 (94.8%) of arrests were C-OHCA and 987 (5.2%) were OD-OHCA. There was a significant increase in the proportion of OD-OHCAs between 2010, 4.6% (95% CI = 3.8–5.4) and 2015, 6.4% (95% CI = 5.7–7.3). Mean age for OD-OHCA was 38.8 yrs compared to 64.2 yrs for C-OHCA ($p < 0.0001$) and location of OD-OHCA arrests was more likely residential 66.6% vs. 54.0% ($p < 0.0001$). Shockable rhythm was present in 7.0% of OD-OHCAs vs. 22.6% of C-OHCAs ($p < 0.0001$). Bystander CPR was performed in 49.4% of OD-OHCAs vs. 48.3% of C-OHCAs ($p < 0.5231$). Overall survival to discharge in the OD-OHCA group was 18.6% vs. 11.9% in the C-OHCA group ($p < 0.0001$). After risk adjustment, there was an aOR of 2.0 (1.6–2.5) for survival to hospital discharge in the OD-OHCA group compared to the C-OHCA group. **Conclusions**: This statewide study found a significant upward trend in the proportion of OD-OHCAs as well as differences in population demographics and epidemiology. Given the varying etiology, location, and age, it is surprising that the bystander CPR rates were nearly identical. It is likely that regional variations in OD-OHCAs exist and emergency medical systems should track data to optimize their prevention and resuscitation efforts.

6. Death by Suicide: The EMS Profession Compared to the General Public

Bentley Bobrow, Micah Panczyk, Robyn Blust, Paula Brazil, Taylor George, Vatsal Chikani, Chengcheng Hu, Daniel Spaite, *Arizona Department of Health Services* Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: EMS professionals face high levels of chronic physical/emotional stress and Post Traumatic Stress Disorder related to prehospital care. Suicide has been linked to other first responder professions, such as law enforcement, presumably related to multiple chronic stressors. While high-profile anecdotal EMT suicide cases and national survey data on suicidal ideation/attempts have received much attention, there is a paucity of data on EMT suicide completions. We sought to determine the statewide proportionate mortality ratios of suicide completions among EMTs compared to the general public (GP) in Arizona. **Methods**: Observational study of adults (≥18 yrs; 1/2009–12/2015. The Arizona Vital Statistics Information Management System-Electronic Death Registry was queried with manual review of decedent occupation free-text fields. These data were compared to the non-EMT cohort aggregate of all other occupations combined. Suicide was defined based on ICD-10 E-Codes. The proportionate mortality ratios (PMRs) for suicide were compared between the groups, after adjusting for age, sex, race, and ethnicity. **Results**: There were a total of 349,793 GP deaths (all causes) of which 7,775 (2.2%) were by suicide. EMT death total was 1,205 EMT–63 (5.2%) by suicide. Demographics of suicide: Mean age: GP–48.7 yrs; EMT - 43.4 yrs ($p = 0.023$); Male: GP–77.3%; EMT–88.8% ($p = 0.029$); White non-Hispanic: GP–80.0%; EMT–73.0% ($p = 0.166$). The crude odds ratio (OR) for EMT suicide was 2.43 (95%CI = 1.88–3.13) compared to the GP. The adjusted OR (aOR) for EMT suicide was 1.39 (95%CI = 1.06–1.82) compared to the GP. The top three mechanisms of suicide among EMTs and the GP in Arizona, respectively, were firearm (67% vs. 57%), suffocation (24% vs. 21%), and poisoning (9.5% vs. 17%). **Conclusions**: In this statewide analysis, EMTs in Arizona had a significantly higher proportional mortality ratio of deaths due to suicide compared to the general population, even after controlling for age, sex, race, and ethnicity. This is the first study that we are aware of to compare EMT suicide completions with the general public. Hopefully this information will increase awareness and spur studies to elucidate underlying causes and evaluate the effectiveness of interventions.

7. Assessment of the Rapid Arterial Occlusion Evaluation (Race) Scale in Real-World Practice for Prediction of Large Vessel Occlusion and Reducing Time to Thrombectomy

Peter Antevy, Brijesh Mehta, Ashutosh Jadhav, Joy Sessa, Randy Katz, Hoang Duong, Andrey Lima, Gina Dimartini, Lakota Woodall, Ryan McTaggart, Ronil Chandra, Thabele Leslie-Mazwi, Joshua Hirsch, Albert Yoo, Tudor Jovin, Raul Nogueira, *Memorial Healthcare System* Category of Submission: Medical

Background: Prehospital identification of potential large vessel occlusion (LVO) stroke patients may lead to faster triage and treatment. We examined whether the Rapid Arterial Occlusion Evaluation (RACE) scale can be reliably implemented in a real-world setting with multiple EMS agencies and lead to rapid treatment. **Methods**: A prospective study was performed at a high volume comprehensive stroke center. In the first phase, eight EMS agencies were educated on use of the RACE scale using an online training video. All EMS stroke alerts were recorded. When EMS RACE score was 5 or higher, the neurocath lab team was alerted prior to EMS arrival as part of a parallel workflow. Upon emergency department arrival, the following characteristics were tracked: NIHSS score, RACE score, CT findings, presence of LVO and workflow time metrics. **Results**: During the study period (January 2016 to June 2017), RACE score was provided for 797 of 1498 EMS stroke alerts (53%). Higher prehospital RACE scores correlated with NIHSS scores. LVO was found in 13% of patients with an available RACE score. A RACE score of 5 or higher was able to identify 64% of all LVO patients (sensitivity: 64%; specificity: 72%; PPV: 30%; NPV: 93%; accuracy: 71%; Youden's index). However, of the 260 patients with RACE score 5 or higher, only 68 patients (26%) were found to have LVO while 29 patients (11%) had ICH; among 499 patients with RACE score less than 5, LVO was present in 38 patients (8%). When an EMS stroke alert with high RACE score triggered early alert of the neurocath lab team, median door to groin puncture time for thrombectomy was 68 minutes compared to 91 minutes for cases with sequential workflow. **Conclusions**: The RACE scale can be

successfully implemented across EMS agencies and results in faster door to groin puncture times. While a RACE score of 5 or higher is associated with greater likelihood of LVO, there are a significant number of false positives. Further refinement of prehospital stroke severity scales is warranted to improve the accuracy of this approach.

8. Effecting Neurologically-Intact Survival for Children with Out-of-Hospital Cardiac Arrest

Paul Pepe, Paul Banerjee, Amninder Singh, Latha Ganti, *University of Texas Southwestern Medical Center* Category of Submission: Pediatric

Background: EMS crews commonly limit on-scene care for pediatric out-of-hospital cardiac arrest (POHCA) patients, typically attempting to provide treatment while transporting. Hypothesis: Neurologically-intact survival for children can be improved by deferring transport and prioritizing on-site care using strategies that expedite on-scene drug delivery and intubation with tightly-controlled ventilation. **Methods**: Data for all consecutive POHCA cases between January 1, 2012 and April 30, 2017 were collected prospectively (comprehensive Utstein-style registry). In 2014, new training prioritized on-scene resuscitation strategies (Phase I) that expedited drug delivery and intubation with controlled ventilation (e.g., rates ~6/min). In 2016, techniques to dose/prepare drugs while responding were introduced (Phase II). Neuro-intact survival in 2012–13 (Phase 0, pre-changes) were then compared to Phase I and II outcomes. Throughout the study, protocols followed the 2010 American Heart Association guidelines. No other relevant modifications were made system-wise. The modified training included psychological and skills-enhancing tools to provide greater confidence in providing on-scene care. **Results**: EMS crews managed 143 consecutive POHCA cases over the 5.33-year study period throughout which the majority of children continued to present in asystole, including those resuscitated. In resuscitated patients, the interval from vehicle arrival on-scene to the first epinephrine administration fell from 16.5 minutes (2012–2013) to 7.3 minutes (Phase I) and 5.0 minutes (Phase II). Children received intubation and intraosseous insertion in much greater frequency on-scene in Phase I and II with no other significant differences in terms of age, sex, etiology, response intervals, or sequence of drug infusions. Rates of survival to hospital discharge with intact neurological status did improve immediately: 23.2% (13/56) in Phase I and 34.7% (17/49) in Phase II versus 0 of 38 for the pre-change calendar years of 2012–2013 ($p < 0.0001$; 2-tailed Fisher's exact test). By 2017, the mean time to epinephrine administration had fallen to 2 minutes for resuscitated patients and 3.33 minutes for all patients. **Conclusions**: Although a historically-controlled study, the sudden appearance of neuro-intact survivors following the renewed focus upon on-scene care was profound, immediate and sustained. Beyond skills-enhancing strategies, physiologically-driven techniques and supportive encouragement from leadership, pre-arrival psychological and clinical tools were also likely contributors to the observed outcomes.

9. Motivations for Exiting the EMS Profession Differ between EMTS and Paramedics

Madison Rivard, Remle Crowe, Rebecca Cash, Jeremy Miller, Ashish Panchal, *The National Registry of Emergency Medical Technicians* Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: Understanding motivations for exiting the workforce is important to improve recruitment and retention of EMS professionals. Factors influencing the choice to leave EMS have not been explored by provider level. Our objective was to describe and compare the most important factors in the decision to leave EMS among EMTs and paramedics. As education requirements and practice settings vary between EMTs and paramedics, we hypothesized that reasons for leaving EMS differed by certification level. **Methods**: This was a cross-sectional analysis of an electronic questionnaire deployed in June 2017 to all nationally-certified EMTs and paramedics who did not renew National EMS Certification during the 2016–2017 recertification period ending on March 31, 2017. Since National EMS Certification is not required to renew a license in all states, participants were asked if they were currently practicing in EMS. Inclusion criteria consisted of those who reported not working in EMS. Z-tests of proportion with a Bonferroni adjustment for multiple comparisons were used to evaluate differences in reasons for leaving EMS between EMTs and paramedics. **Results**: We received 4,793/51,344 responses (response rate = 10%) and 2,703 met inclusion criteria. Most were EMTs (85%, n = 2,291) and 15% were paramedics (n = 412). For EMTs, the most commonly selected reason for leaving EMS was the pursuit of further education (22%), while paramedics most commonly cited a desire for better pay and benefits (20%). There was more than a two-fold increase in the proportion of paramedics that selected illness/injury/disability compared to EMTs (13% vs. 6%, $p < 0.001$). Three times as many paramedics selected stress/burnout compared to EMTs (9% vs. 3%, $p < 0.001$). Only 5% of EMTs listed retirement as the most important factor for leaving EMS compared to 14% of paramedics ($p < 0.001$). Excluding those who left for retirement, 68% of EMTs stated they intended to return to EMS, compared to 32% of paramedics ($p < 0.001$). **Conclusions**: Important factors related to leaving EMS differed by provider level. Of concern, a larger proportion of paramedics reported illness/injury/disability or stress/burnout as their primary reason for leaving the profession compared to EMTs. Additionally, fewer paramedics reported an intention to return to EMS. Limitations include potential response bias and confounding.

10. Do Age Appropriate Vital Sign Cut Points Improve the Predictive Ability of the Physiologic Criteria of the Field Triage Decision Scheme for Identifying Children Who Need the Resources of a Trauma Center

E. Brooke Lerner, Jeremy Cushman, Mohamed Badawy, Amy Drendel, Courtney Jones, Manish Shah, David Gourlay, *Medical College of Wisconsin* Category of Submission: Trauma

Background: Prior research found the Field Triage Decision Scheme's (FTDS) physiologic step is a moderate predictor of pediatric trauma center (TC) need. Predictive ability could be hindered by the current use of adult values when defining abnormal vital signs. Our objective was to determine the accuracy of the FTDS physiologic step when traditional cut points are compared to age-specific cut points for identifying children needing TC resources. **Methods**: A prospective study of all injured children ≤15 years, regardless of severity, transported by EMS to pediatric TC was conducted in three mid-sized cities. EMS providers were interviewed to obtain patient demographics and presence or absence of each FTDS criteria. Children were considered to need a TC if they met a published consensus definition. Outcome data was obtained through structured hospital record review. The over- and under-triage rates and positive likelihood ratios (+LR) were calculated using traditional and age-specific cut points for the physiologic step, as well as for systolic blood pressure (SBP), and respiratory rate (RR). **Results**: EMS and outcome data were available for 9,484 children. 2% of all patients needed the resources of a TC. 11% of patients met the physiologic step when traditional cut points were used and 23% when age-specific cut points were used. Using the traditional physiologic criteria, 46% of children needing a TC would have been under-triaged and 10% over-triaged (+LR 5.44, 95%CI 4.75–6.24). Using the age-specific physiologic criteria, 40% would have been under-triaged and 22% would have been over-triaged (+LR 2.69, 95%CI 2.40–3.01). The traditional RR cut point had a +LR of 3.12 (95%CI 2.39–4.07). The age-specific RR cut point had a +LR of 1.86 (95%CI 1.56–2.22). The traditional SBP had a +LR of 5.28 (95%CI 3.35–8.34). The age-specific SBP had a +LR of 6.10 (95%CI 3.54–10.00). EMS did not obtain RR in 16% and SBP in 28% of cases. **Conclusions**: The accuracy of the physiologic step of the FTDS is not improved by using age-specific criteria. The rate of under-triage is decreased while the rate of over-triage is increased.

11. Comparative Effectiveness of Antiarrhythmics for Out-of-Hospital Cardiac Arrest: A Systematic Review and Network Meta-Analysis

Shelley McLeod, Romina Brignardello-Petersen, Andrew Worster, John You, Alla Iansavichene, Gordon Guyatt, Sheldon Cheskes, *Schwartz/Reisman Emergency Medicine Institute, University of Toronto* Category of Submission: Cardiac

Background: The objective of this systematic review, direct pairwise meta-analysis and network meta-analysis (NMA) was to assess the use of antiarrhythmic drugs for patients experiencing out-of-hospital cardiac arrest (OHCA). **Methods**: Electronic searches of Medline, EMBASE, and Cochrane Central Register of Controlled Trials were conducted and reference lists were hand-searched. Randomized controlled trials (RCTs) investigating the use of antiarrhythmic agents administered during resuscitation for adult (≥ 18 years) patients suffering non-traumatic OHCA were included. Two reviewers independently screened abstracts, assessed risk of bias of the included studies, and extracted data for the following outcomes: return of spontaneous circulation (ROSC), survival to hospital admission, survival to hospital discharge and survival to hospital discharge with good neurologic status. Direct and indirect evidence were combined in a NMA using a frequentist approach with fixed-effects models and reported as relative risks (RR) with 95% confidence intervals (CIs). For each pairwise comparison, the certainty of direct, indirect, and network evidence was assessed using the GRADE approach. **Results**: 8 RCTs involving 4,464 patients were combined to compare the effectiveness of five antiarrhythmic agents (amiodarone, bretylium, lidocaine, magnesium, and sotalol) and placebo administered during resuscitation following OHCA. Lidocaine was associated with a statistically significant increase in ROSC compared to placebo (1.15; 95% CI: 1.03–1.28) and was also superior to bretylium (1.61; 95% CI: 1.00–2.60) for ROSC.

When compared to placebo, both amiodarone (1.18; 95% CI: 1.08–1.30) and lidocaine (1.18; 95% CI: 1.07–1.30) were associated with a statistically significant increase in survival to hospital admission (certainty of the evidence was high). However, no antiarrhythmic was statistically more effective than placebo for survival to hospital discharge or neurologically intact survival, and no antiarrhythmic was convincingly superior to any other for any outcome (certainty of the evidence was low or very low). **Conclusions**: Amiodarone and lidocaine were the only agents associated with improved survival to hospital admission in the NMA. For the outcomes most important to patients, survival to hospital discharge and neurologically intact survival, no antiarrhythmic was convincingly superior to any other or to placebo.

12. EMERGENCY MEDICAL SERVICES PROVIDER PERSPECTIVES ON PEDIATRIC CALLS: A QUALITATIVE STUDY

Jessica Jeruzal, Lori Boland, Monica Frazer, Jonathan Kamrud, Russell Myers, Charles Lick, Andrew Stevens, *Allina Health Emergency Medical Services* CATEGORY OF SUBMISSION: CARDIAC

Background: Previous survey results in our ambulance service indicate that 9-1-1 response to incidents involving children are particularly distressing for emergency medical services (EMS) clinicians. This qualitative study was conducted to increase understanding about the difficulties of responding to pediatric calls and obtain information about how organizations can better support EMS providers in managing potentially difficult calls. **Methods**: Paramedics and emergency medical technicians from a single U.S. ambulance service were invited to participate in focus groups about responding to 9-1-1 calls involving pediatric patients. A total of 17 providers from both rural and metro service regions participated in six focus groups held in community meeting spaces. A semistructured focus group guide was used to explore: (1) elements that make pediatric calls difficult, (2) pre-arrival preparation practices, (3) experiences with coping after difficult pediatric calls, and (4) perspectives about follow-up resources and support. Focus groups were audio recorded and transcripts were analyzed using standard coding, memoing and content analysis methods in qualitative analysis software (NVivo). **Results**: Responses about elements that make pediatric calls difficult were organized into the following themes: (1) the social value of children, (2) clinical difficulty of pediatric calls, (3) type or nature of the call, (4) interactions with parents, and (5) location/scene challenges. With regard to pre-arrival preparation, participants often cited mentally reviewing protocols, equipment location and dosages, and discussing assignment of on-scene tasks with their partner. The use of retrospective call reviews among peers was highlighted across the topic areas as a high-value, commonly used method for coping with difficult pediatric calls that also serves as a learning or preparation tool. Suggestions for additional supportive resources included: increasing opportunities for external feedback (e.g., from hospital-based staff); additional, more frequent pediatric clinical training; institutionalization of structured recovery time after difficult calls; and improved storage and labeling of pediatric equipment. **Conclusions**: This study provides qualitative data about the difficulties of responding to pediatric calls and resources needed to support clinicians. Findings from this study will be used to guide EMS leadership in designing and implementing institutional initiatives to enhance wellbeing among EMS clinicians.

13. EFFECTIVENESS OF PREHOSPITAL HYPERTONIC SALINE FOR HYPOTENSIVE PATIENTS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Background: The optimal prehospital fluid for the treatment of hypotension is unknown. Hypertonic fluids, meaning that the composition of solutes is higher to that of the human body, may increase circulatory volume and mute the pro-inflammatory response of the body to injury and illness. The purpose of this study was to determine whether in patients presenting with hypotension in the prehospital setting (population), the administration of hypertonic saline (intervention), compared to an isotonic fluid (control), improves survival to hospital discharge (outcome). **Methods**: In this PROSPERO registered review, searches were conducted in Medline, Embase, CINAHL, and CENTRAL from the date of database inception to November, 2016, and included all languages. Two reviewers independently selected randomized control trials of hypotensive human participants administered hypertonic saline in the prehospital setting. The comparison was isotonic fluid, which included normal saline, and near isotonic fluids such as Ringer's Lactate. Assessment of study quality was done using the Cochrane Collaborations' risk of bias tool and a fixed effect meta-analysis was conducted to determine the pooled relative risk of survival to hospital discharge. Secondary outcomes were reported for fluid requirements, multi-organ failure, adverse events, length of hospital stay, long term survival and disability. **Results**: Of the 1,160 non-duplicate citations screened, 38 articles underwent full-text review, and five trials were included in the systematic review. All studies administered a fixed 250 mL dose of 7.5% hypertonic saline, 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 fluids and colloids. Five studies were included in the meta-analysis ($n = 1{,}162$ injured patients) with minimal statistical heterogeneity ($I2 = 0\%$). The pooled relative risk of survival to hospital discharge with hypertonic saline was 1.02 times that of patients who received isotonic fluids (95% CI: 0.95,1.10). There were no consistent statistically significant differences in secondary outcomes. **Conclusions**: There was no significant difference in important clinical outcomes for hypotensive injured patients administered hypertonic saline compared to isotonic fluid in the prehospital setting. Hypertonic saline cannot be recommended for use in prehospital clinical practice for the management of hypotensive injured patients based on the available data.

14. ARE EMS PROVIDER CHARACTERISTICS ASSOCIATED WITH APPROPRIATE RESPONSES DURING VIOLENT ENCOUNTERS?

Donald Garner, Mallory DeLuca, Remle Crowe, Rebecca Cash, Madison Rivard, Jefferson Williams, Ashish Panchal, Jose Cabanas, *Wake County EMS* CATEGORY OF SUBMISSION: PROFESSIONAL

Background: Violence against Emergency Medical Services (EMS) providers is increasing. Little is known regarding providers' response during threatening encounters. Recognition and management of threatening situations is key to provider and patient safety. Our objective was to evaluate the association between provider characteristics and response to escalating threats of violence during EMS calls. We hypothesized that providers with greater EMS experience and training would be more likely to escape threatening situations. **Methods**: EMS providers of a large county-based system participated in specially-developed patient care simulations. Each scenario escalated threats of violence so that providers should escape the scene for safety. Trained evaluators recorded performance per provider on 51 standardized data elements including time, de-escalation attempts, and escape. Our primary outcome was whether the provider escaped before the scenario ended. Our secondary outcome was whether a provider made an adequate de-escalation attempt. Descriptive statistics and univariable odds ratios (OR, 95%CI, p-value) were calculated. **Results**: We evaluated 272 EMS providers as individual members of two-person crews, with <3% missing data. Overall, 55% ($n = 145/263$) made an adequate de-escalation attempt and 55% ($n = 147/268$) escaped the unsafe scene. Of those who did not escape, nearly half (44%, $n = 53/120$) also did not make an adequate de-escalation attempt. EMS experience ($p = 0.31$) and military background ($p = 0.39$) were not associated with odds of de-escalation. A two-fold increase in odds of adequately attempting de-escalation was observed for providers with Crisis Intervention Training (CIT) (2.13, 1.15–3.93, $p = 0.02$). As experience increased, a stepwise decrease in the proportion of providers that escaped was noted (p-trend = 0.01). Providers with 20-plus years of EMS experience had 64% lower odds of escaping (0.36, 0.17–0.76, $p < 0.01$; referent:<5 years experience). Providers with military experience (0.38, 0.18–0.84, $p = 0.02$) or CIT (0.37, 0.20–0.67, $p < 0.01$) also had reduced odds of escaping. **Conclusions**: Nearly half of EMS providers failed to escape a simulated scene with threat of physical violence. Experienced providers and those with military or CIT training had lower odds of escaping. Limitations include that these results were obtained in a training environment. Future research should focus on developing training to improve recognition of failed de-escalation and the need to escape an unsafe scene.

15. PERFORMANCE CHARACTERISTICS OF THE MODIFIED RAPID ARTERIAL OCCLUSION EVALUATION SCALE (MRACE) TO PREDICT LARGE VESSEL OCCLUSION

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Background: Stroke is a leading cause of disability in the United States. The most debilitating strokes are caused by large vessel occlusion (LVO), and patient outcomes are improved through delivery of time-sensitive endovascular therapies at comprehensive stroke centers (CSC). The Rapid Arterial Occlusion Evaluation (RACE) scale can identify patients with LVO and facilitate triage to CSCs, with published sensitivity of 68% and specificity of 85% at score of ≥5. We aimed to demonstrate the implementation feasibility and performance of prehospital mRACE scale, which does not assume the laterality of aphasia and agnosia symptoms, to identify LVO. **Methods**: The mRACE scale was implemented in 12 EMS agencies, scoring both aphasia and agnosia regardless of laterality of symptoms to improve the ease of training and capture of atypical symptoms. Training consisted of a didactic presentation with both video and hands-on demonstrations of patient scenarios. A step-by-step scoring guided paramedics through the exam. mRACE data were collected prospectively and documented

upon completion of the prehospital electronic health record. A project coordinator obtained in-hospital data elements for those individuals transported to UPMC facilities. Analysis included descriptive statistics and performance characteristics (sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). **Results**: From December 2015 to July 2017, a prehospital mRACE scale was completed for 780 patients with suspected stroke. Complete in-hospital data were available for 517 (66%). Of these, 186 had a mRACE scale of ≥5. There were 188 (36%, CI 32–40%) cases with final diagnosis of ischemic stroke of which 65 (12.6% CI 10–16%) had LVO. This yielded 75.3% (CI 72–79%) sensitivity, 68.6% (CI 65–73%) specificity, 56.3% (CI 45–67%) PPV, and 83.8% (CI 75–90%) NPV with a ROC AUC of 0.76 in the identification of LVO. **Conclusions**: Implementing the prehospital mRACE scale to identify patients with LVO is feasible and performs similarly to the RACE scale without need to discriminate laterality of symptoms. Further research is necessary to determine if implementation of the mRACE scale leads to increased interventions for patients with LVO and subsequent decreased morbidity.

16. Effects of Failed Defibrillation Attempts on Waveform Characteristics of the Ventricular Fibrillation Electrocardiogram

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Category of Submission: Student, Resident, Fellow

Background: The morphology of the electrocardiogram (ECG) of the ventricular fibrillation (VF) waveform during cardiac arrest can be quantified using signal analysis (QECG). Studies have shown that QECG measures may be predictive of defibrillation success. We sought to quantify the effect of failed rescue shocks on the QECG values for patients with VF in out-of-hospital cardiac arrest (OHCA). We considered a failed shock to be one in which the ECG rhythm was VF prior to and after the shock. We hypothesized that failed rescue shocks would lead to worsened QECG measures. **Methods**: Electronic defibrillator data were taken from non-traumatic, EMS-treated OHCA cases from the Resuscitation Outcomes Consortium (ROC) Continuous Chest Compression trial. For each shock, QECG values amplitude spectrum area (AMSA), median slope (MS), centroid frequency (CF), and detrended fluctuation analysis (DFA) were calculated for the closest artifact-free 3 second gap in chest compressions prior to and after the shock. We used custom-built MATLAB programs to perform QECG calculations. QECG values were compared using a paired t-test for the pre- and post-shock values. Correlation coefficients were also calculated between the time from shock to post-shock window and the change in QECG values. **Results**: Out of 5,195 total shocks, 1,399 shocks were analyzable. 520 were the first shock. For all shocks, AMSA increased from 4.83 to 5.60 (p-value < 0.01). MS increased from 2.36 to 2.44 (p-value $= 0.01$). CF increased from 7.05 to 7.16 (p-value < 0.01). DFA did not show any change: 1.28 to 1.27. For only first shocks, similar results were observed. No correlation appeared between time to post QECG measurement and the change in QECG values. **Conclusions**: For all the QECG measures except for DFA, a slight improvement in value was observed. While statistically significant, these changes may not be physiologically or clinically meaningful. Possible explanations include: (1) These may be a result of the CPR delivered in between the shock and the post-shock QECG; (2) The pre-shock values started very low which may make decreases difficult to detect from a floor effect; and (3) Modern bi-phasic waveforms may be less harmful than those previously studied.

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

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Category of Submission: Professional

Background: 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 was to describe characteristics of EMS patients who after transport, die in a health care facility. **Methods**: EMS transport events over one year (April, 2015–2016) 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 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 141,114 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 proportion 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 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.

18. Epidemiology of Infections And Sepsis in a Large, Canadian Emergency Medical Services (EMS) System

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Category of Submission: Student, Resident, Fellow

Background: Sepsis is a life-threatening syndrome caused by a dysregulated immune response to infection. Early recognition and intervention are critical to improve patient outcomes. In modern healthcare systems paramedics often encounter patients with sepsis before other clinicians, offering an important opportunity for earlier sepsis care. The purpose of this study was to estimate the incidence and examine characteristics of patients with infections, and sepsis transported by paramedics. **Methods**: A one-year cohort of all adults(> = 18 years) transported by a BLS/ALS EMS system servicing a rural/urban population of approximately 2 million was linked to in-hospital administrative databases(emergency department[ED] and inpatient). Infection, and sepsis cases were classified based on ED infectious disease diagnosis code, and an existing sepsis algorithm based on ED diagnosis codes and EMS clinical information. Clinical characteristics including age (years), Glasgow Coma Score (GCS)<15, tachypnea (>22/minute), and fever (> = 37.8 Celsius), and operational factors such as prehospital time (minutes), transport distance from municipality to hospital, and high-priority Medical Priority Dispatch System (MPDS) determinant (Echo/Delta) were evaluated in adults (> = 18 years) and compared to patients not meeting sepsis criteria. Two sided t-test or difference of proportion were used with statistical significance <0.05. **Results**: 131,174 unique adult encounters were successfully linked to in-hospital databases (89% linkage rate). The one-year incidence of infections, and sepsis were 11% and 2.1%, respectively. A minority of all patients with infections presented with fever (18%), abnormal GCS (22%) or tachypnea (32%). Compared to other patients, adults with sepsis were more likely to have an abnormal GCS (60% vs. 16%, $p < 0.001$), tachypnea (48% vs. 20%, $p < 0.001$), or fever (25%vs.4%, $p < 0.001$). They were generally older(mean 75 vs. 60 years, $p < 0.001$), and more likely to have a high priority MPDS determinant (38% vs.31%, $p < 0.001$). Sepsis patients had longer prehospital intervals (mean 44 vs.39 minutes, $p < 0.001$) despite shorter transport distances(15/9.3 vs.16/9.9 km/miles, $p = 0.004$). The in-hospital mortality rate for patients with infection was 6.8% (95%CI, 6.4–7.2), and 19% for sepsis (95%CI, 18–21). **Conclusions**: Infections and sepsis are common among paramedic-transported patients, and paramedics spend a considerable time with these patients prior to arriving in the ED. These patients frequently have altered vital signs, suggesting earlier recognition may be feasible. The in-hospital mortality of these patients is significant, supporting the need for further research into opportunities for prehospital identification and intervention.

19. Combined Prehospital Hypoxia-Hypotension "Depth-Duration Dose" and Mortality in Major Traumatic Brain Injury

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Category of Submission: Trauma

Background: Our previous work has shown that the depth-duration doses of prehospital hypoxia (SpO2 < 90%) and hypotension [SBP < 90 mmHg], separately, are strongly associated with mortality in Traumatic Brain Injury (TBI). However, hypoxia and hypotension are

obviously not mutually exclusive. Hence, the next logical step in evaluating the influence of the "dose" of these physiological anomalies in TBI is to identify the combined risk. **Methods**: We evaluated major TBI cases (moderate/severe) enrolled in the EPIC Study (NIH-1R01NS071049) before TBI guideline implementation (N = 16,711; 1/07–9/14). Definitions: hypoxia dose-SpO2 depth < 90% integrated over time (min); hypotension dose-SBP < 90 mmHg integrated over time. Both dose variables were then transformed to achieve approximate normality. Logistic regression was used to determine the association between odds of death and nonparametric functions of the (transformed) hypoxia and hypotension doses. The combined fitted effects of both hypoxia and hypotension then yielded the dose score. **Results**: After exclusions [age <10 (6.8%), transfers (28.4%), SBP >200 (2.1%), missing SBP/SpO2/time (12.8%), only one recorded SBP or SpO2 (8.3%),] 6682 cases remained (median age = 40; male = 70%). Mortality increases consistently across the quartiles (Q) of unadjusted dose score (No hypoxia or hypotension-5.6%; Q1–16.5%; Q2–20.8%; Q3–35.8%; Q4–43.2%). In the adjusted model, the mortality increase is remarkably monotonic (indeed, nearly linear) with increasing dose score. Across the entire range of dose, an increase of one standard deviation of adjusted dose score is associated with a 63% increased odds of death (aOR = 1.63) among patients with either hypoxia or hypotension or both. This result is strongly supported by the highly significant, monotonically-increasing relationship between the separate hypoxia and hypotension doses and their adjusted death rates. **Conclusions**: Both hypoxia and hypotension depth/duration appear to have a profound and additive influence on TBI mortality. The influence of hypoxia and hypotension on outcome (both separately and combined) appears to be far more complex than the current literature reflects (only being assessed dichotomously as present or not). Future TBI studies should account for both the depth and duration of prehospital hypoxia and hypotension.

20. Association Between Induction and Sedation Agents and Post Intubation Hypotension in Trauma Patients

Frederick Brown, Francis Guyette, Christian Martin-Gill, Jonathan Elmer, *Department of Emergency Medicine, University of Pittsburgh School of Medicine* Category of Submission: Trauma

Background: Medications used for rapid sequence intubation and post-induction sedation may cause hypotension, resulting in secondary injury and worse outcomes after trauma. We identified patient and treatment characteristics associated with post-intubation hypotension. **Methods**: We retrospectively reviewed charts from consecutive patients undergoing transport between January 2001 and June 2016 by STAT MedEvac, a multistate critical care transport service with >10,000 missions per year. We identified adult trauma patients intubated by a flight crew member. The primary outcome was early post-intubation hypotension, defined as a systolic blood pressure (SBP) <90 mmHg within 15 minutes of intubation. We used logistic regression to identify predictors of post-intubation hypotension. **Results**: During the study period, 4701 adult trauma patients were intubated and transported. Mean age was 44 years, 26% were female, mean pre-induction heart rate was 99 bpm (SD 25), SBP was 137 mmHG (SD 32), SpO2 was 96% (IQR 95, 100), and respiratory rate was 18 (SD 7). A total of 14% of patients experienced post-intubation hypotension. Patient factors independently associated with hypotension were age (adjusted odds ratio (aOR) 1.03, 95%CI 1.02–1.04), female gender (aOR 1.40, 95%CI 1.06–1.85), lower SBP (aOR 0.96, 95%CI 0.96–0.97), higher heart rate (aOR 1.01, 95%CI 1.00–1.01) and lower SpO2 (OR 0.97, 95%CI 0.95–0.98). Paralysis with rocuronium (aOR 1.83, 95%CI 1.26–2.67) compared to succinylcholine was associated with increased odds of post-intubation hypotension while pre-intubation treatment with lidocaine (aOR 0.70, 95%CI 0.52–0.94), post-intubation treatment with fentanyl (aOR 0.23, 95%CI 0.18–0.30) and post intubation administration of normal saline (aOR 0.30, 95%CI 0.10–0.88) were associated with a decreased occurrence of post-intubation hypotension. **Conclusions**: In trauma patients undergoing critical care transport, multiple patient factors and modifiable treatments including administration of rocuronium for intubation were independently associated with hypotension. Additional investigation is needed to confirm this effect and identify other patient and treatment factors associated with post-intubation hypotension. In the interim, current protocols and clinical practice should be reviewed.

21. Prehospital Lactate: A Severity Indicator in Early Sepsis Management

Kurt Isenberger, Aaron Burnett, Jeffrey Anderson, Adam Mayer, Sandi Wewerka, Joseph Pasquarella, Ralph Frascone, *Regions Hospital* Category of Submission: Medical

Background: Serum lactate levels can rapidly dictate clinical awareness of shock and prompt intervention in sepsis. Collecting serum lactate levels is restricted to the hospital setting. The objective of this study was to investigate whether a prehospital lactate value (PL) improves time to intervention upon ED arrival. We hypothesized that EMS communication of a PL value to the ED physician would result in improved time to antibiotics and an in-hospital lactate (IL) order. **Methods**: This prospective, observational study included patients with a prehospital impression of infection based on SIRS criteria. A POCT PL was collected by paramedics prior to ED arrival, and reported during presentation. ED metrics were collected and compared to a previously collected control group (CG) of patients presenting without a PL but who met early sepsis criteria. Cox regression models were used to estimate hazard ratios (HRs) with 95% confidence intervals (CIs) for time to physician order for an antibiotic or in-hospital lactate test. **Results**: Study patients (age 60–96) included 170 with PL measures and 269 controls. The PL group was older on average (mean age, 69 vs. 54; $p < 0.001$), and was more likely to have expired in the hospital (10% vs 5%; $p = 0.027$). An antibiotic was ordered for 104 prehospital lactate patients (61%) and 216 controls (80%). In a Cox model adjusted for age and gender, the CG had a nearly two-fold faster rate of time to antibiotic order (HR = 1.93; 95% CI: 1.50, 2.48), relative to prehospital lactate patients. Among the PL patients, time to antibiotic order did not differ by PL (>2 vs. ≤2 mmol/L, $p = 0.545$). Time to IL order did not significantly differ between CG and patients with PL >2 mmol/L ($p = 0.811$), but time to IL order was twice as slow for patients with PL ≤2 mmol/L (vs. CG, HR = 0.47; 95% CI: 0.33, 0.68). **Conclusions**: In this small study, the availability of PL value did not improve time to antibiotics. Patients with a normal PL had a prolonged time to antibiotics compared to the CG, and a higher death rate. A larger study is required to validate these results.

22. Prevalence of Mortality Due to Rebound Toxicity after "Treat and Release" Practices in Prehospital Opiate Overdose Care: A Systematic Review and Meta-Analysis

Jennifer Greene, Brent Deveau, Justine Dol, Micheal Butler, *Dalhousie University* Category of Submission: Medical

Background: Death from fentanyl overdose was declared a public health crisis in Canada in 2015. Traditionally, patients who have overdosed on opiates that are managed by emergency medical services (EMS) are treated with the opiate antagonist naloxone, provided ventilatory support and subsequently transported to hospital. However, certain EMS agencies have allowed paramedics who have reversed an opiate overdose to refuse transport, if the patient has the capacity to do so. The safety of this practice has not been examined by a systematic review. Therefore, our intent is to examine the available literature to determine the prevalence of mortality and serious adverse events within 48 hours of EMS treat and release due to suspected rebound opiate toxicity after naloxone administration. **Methods**: A systematic search was preformed on May 11, 2017 in PubMed, Cochrane Central, Embase, and CIHAL using search strategies developed with the aide of a health sciences librarian. No search limits were applied. Included studies were hand searched. Two authors conducted the screening, selection and data extraction process. Discrepancies were resolved via discussion. A modified QUIPs tool was used to evaluate risk of bias. Analysis for prevalence of outcomes were preformed. **Results**: A total of 1,401 records were screened after duplicate removal. Eighteen full text studies were reviewed with eight selected for inclusion. Included studies had a low risk of bias. The prevalence of mortality within 48 hours was so infrequent that it could not be quantitatively meta-analyzed. There were 4/4912 (0.00081%) total reported deaths of suspected rebound etiology from included patients across all studies. Only one study reported on adverse events of patients released on scene. This study found no incidence of adverse events from their sample of 71 released patients. **Conclusions**: Mortality or serious adverse events in the included studies due to suspected rebound toxicity in patients released on scene post EMS treatment with naloxone was rare. Despite limited studies, the prevalence rate was so low that we concluded that this practice may be safe in terms of mortality and may be considered an alternative of traditional transport. Additional prospective studies need to be preformed to strengthen knowledge around adverse events.

23. Prehospital qSOFA Score as Predictor of Sepsis and Mortality

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Background: The quick Sequential [Sepsis-related] Organ Failure Assessment (qSOFA) score was proposed in 2016 as a rapid way to identify adult patients with suspected infections who are likely to have poor outcomes. A 2017 study showed that qSOFA was correlated with hospital admission, ICU admission, hospital length of stay, and inpatient mortality. However, to our knowledge, the ability of the qSOFA score to predict patient outcomes has not been evaluated in the prehospital setting. We hypothesize that prehospital qSOFA scores are correlated with up-triage (change to a higher acuity triage zone in the emergency department), presence of sepsis, ICU admission, and in-hospital mortality. **Methods**: We conducted a

retrospective observational study using prehospital ambulance vital signs to calculate qSOFA scores for all adult medical patients that presented in September 2016 to a large academic emergency department in Fresno, CA. Information from the electronic health record (EHR) was used to determine up-triage, presence of sepsis, hospital admission, ICU admission, and in-hospital mortality. **Results**: A total of 1,903 adult medical patients were transported by ambulance to the emergency department during the study period. Of these, 151 patients (7.93%) were prehospital qSOFA positive. A positive prehospital qSOFA score was correlated with emergency department diagnosis of infection (29.1% vs. 15.2%; $p < 0.001$), hospital admission (55.0% vs. 33.4%; $p < 0.001$), ICU admission (9.93% vs. 2.22%; $p < 0.001$), admission diagnosis of sepsis (19.2% vs. 3.08%; $p < 0.001$), and in-hospital mortality (6.62% vs. 0.74%; $p < 0.001$). A positive prehospital qSOFA score was not associated with up-triage (7.95% vs. 5.82%; $p = 0.291$); however, it was correlated with final triage to a high acuity zone in the emergency department (35.8% vs. 8.96% $p < 0.001$). **Conclusions**: Prehospital qSOFA is correlated with the diagnosis of infection and sepsis. Furthermore, it is correlated with poorer patient outcomes including need for hospital admission, ICU admission, and in-hospital mortality. However, a positive prehospital qSOFA score in isolation does not appear to be more useful than the current triage process in the emergency department to identify patients who should be triaged to a high acuity zone in the absence of other patient factors.

24. Prehospital Provider Attitudes and Beliefs Regarding Pediatric Seizure Management: A Multicenter, Qualitative Study

John Carey, Jonathan Studnek, Lorin Browne, Malcolm Leirmoe, Daniel Ostermayer, Tyler Miller, Diaa Alqusairi, Thomas Grawey, Stephanie Schroter, E. Brooke Lerner, Manish Shah, *Baylor College of Medicine, Pediatrics, Section of Emergency Medicine* Category of Submission: Pediatric

Background: Seizures have the potential to cause significant morbidity and mortality, and are a common reason EMS are requested for a child. A pediatric prehospital seizure evidence-based guideline (EBG) was published and has been implemented as protocol in multiple EMS systems. Knowledge translation and protocol adherence in medicine can be incomplete. In EMS, systems-based factors and providers' attitudes and beliefs may contribute to incomplete knowledge translation. The purpose of this study was to identify EMS provider-reported attitudes, beliefs, barriers, and enablers to adhering to EBG-derived seizure protocols in multiple EMS systems. **Methods**: This was a qualitative study utilizing 30-minute semi-structured interviews of paramedics who recently transported actively seizing 0–17 year olds in two different urban EMS systems. Interviewers explored the providers' decision-making during their recent case and regarding seizures in general. Two investigators used NVivo software, the grounded theory approach, and constant comparison to independently analyze transcribed interview recordings until thematic saturation was reached. **Results**: Several overarching themes emerged from the 32 paramedics that were interviewed. Enablers included dosing/protocol references, training, provider knowledge about preferred routes, predefined provider roles, options to use different routes, online medical control, multiple crews on scene, and physical accessibility of medication on scene. Systems barriers included equipment availability, controlled substance management, infrequent training, few pediatric calls, unclear definition of a treatable seizure, and incongruent protocol and reference tool dosing. Personal barriers included fear of respiratory depression, confusion about dosing, and misconceptions about preferred routes, febrile seizure management, and accurate methods of weight estimation. Paramedics shared other opinions about management: preference for intranasal vs. intramuscular medication, how transport distance affects management, use of online medical control, and the need to manage bystanders. Providers suggested system improvements to address equipment, medication, protocol, and training limitations. **Conclusions**: Paramedics identified many standardized strategies EMS systems used that enabled pediatric seizure protocol adherence, as well as numerous systems-based and personal barriers to adherence. Providers identified solutions to address the barriers. Conducting research on EMS protocol changes, policy modifications, and training that address the barriers identified in this study may enhance understanding of how to optimize pediatric prehospital seizure outcomes.

25. Analysis of Dosing Errors Made by Paramedics During Simulated Pediatric Patient Scenarios after Implementation of State-Wide Pediatric Drug Dosing Reference

John Hoyle, Glenn Ekblad, Tracy Hover, Bill Fales, Richard Lammers, Dena Smith, *Western Michigan University, Homer Stryker, MD School of Medicine* Category of Submission: Pediatric

Background: Medication errors occur at a high rate for prehospital pediatric patients. Epinephrine dose errors have been 60%. To reduce errors, Michigan implemented a pediatric dosing reference (PDR), with doses listed in milliliters, the requirement that doses be drawn into a smaller syringe from a pre-loaded syringe using a stop cock and dilution of drugs to standard concentrations. The purpose of this study was to evaluate the prevalence of medication errors by paramedics treating pediatric patients after the implementation of a state-wide PDR. **Methods**: 8 EMS agencies completed 2 validated, pediatric scenarios: infant seizing and infant cardiac arrest. Agencies were private, public, not for profit, for profit, urban, rural, fire-based, and third service. Simulations took place in a simulation center or mobile simulation unit. EMS crews used their regular equipment with sham drugs and were required to carry out all the steps to administer a drug dose. Two evaluators scored crew performance via direct observation and video review. A dose error was defined as $> = 20\%$ difference compared to the weight-appropriate dose. Descriptive statistics were utilized. **Results**: 80 simulations have been completed and initial analysis has been conducted using descriptive statistics. The majority of crews were EMTP/EMTP. In cardiac arrest scenarios, 8/20 (40%; 95% CI 18.5%, 61.5%) epinephrine doses were incorrect. In 0/20 doses, there was no cross check of the drug volume prior to administration. There were 6, ten-fold overdoses and one, ten-fold underdose. In seizure scenarios, 5/11(45%; 95% CI 16%, 74.9%) benzodiazepine doses were incorrect (2 underdoses, 3 overdoses); 2/9 (22%; 95% CI 0%, 49.4%) drug dilutions were incorrect resulting in large dosing errors. In 1/10 cases (10%; 95% CI 0%, 28.6%) the crew was unable to dilute D50 to D25. Unrecognized air bubbles were frequently entrained in the administration syringe resulting in underdoses. In 11/20 (55%) of cases there was an error using the length-based tape for weight determination. **Conclusions**: Epinephrine dose errors have decreased since implementation of PDR, but frequent ten-fold errors still occur. Cross checks of drug doses do not occur. Errors occur with dilution and length-based tape use. Error reduction strategies are needed for pediatric prehospital drug administration.

26. Training in Prehospital Death Notifications Linked to Improved Provider Comfort and Preparation

Abraham Campos, Rebecca Cash, Remle Crowe, Madison Rivard, Brian Clemency, Robert Swor, Ashish Panchal, Eric Ernest, *Department of Emergency Medicine, University of Nebraska Medical Center* Category of Submission: Student, Resident, Fellow

Background: Death notifications in the prehospital setting are difficult situations that require training. However, this training is not uniformly included in initial EMS education, and the proportion of providers prepared for this task is unknown. Our objective was to describe the prevalence of death notification training by provider level and its association with preparation and comfort in performing this task. We hypothesized that fewer EMTs received training and that training was associated with greater preparation and comfort. **Methods**: An electronic questionnaire was sent to a random sample of 20,000 nationally-certified EMS professionals in April 2017. Participants reported death notification training received during initial or continuing education and adult death notifications performed in the past 12 months. Level of comfort and preparation in delivering adult death notifications was rated using a 4-point scale. Inclusion criteria were practicing, non-military EMTs or higher. Certification level was grouped into advanced life support (ALS:paramedic/intermediate/AEMT) or basic life support (BLS:EMT). Odds ratios (OR, 95%CI, p-value) were calculated to estimate the association between training and provider comfort and preparation. **Results**: There were 2,333 responses (12% response rate), and 1,514(65%) met inclusion criteria. Most respondents had performed at least one adult death notification in the past year (ALS: 87%, BLS: 78%, $p < 0.001$). Equal proportions of ALS and BLS (51% versus 52%, $p = 0.58$) respondents received death notification training during an initial course, however fewer BLS respondents received additional training (BLS: 30% versus ALS: 44%, $p < 0.001$). A larger proportion of BLS respondents did not receive any death notification training (BLS: 40%, ALS: 32%, $p = 0.005$). Over one-third (34%) of those without training had performed an adult death notification in the past year. After controlling for certification level, training was associated with increased odds of reporting greater comfort (2.20, 1.77–2.75, $p < 0.001$) and preparation (6.05, 4.73–7.74, $p < 0.001$) in performing death notifications. **Conclusions**: Most respondents delivered a death notification in the past year; however, one-third of these EMS providers had not received training. Training was associated with greater comfort and preparation in delivering death notifications. Limitations include recall bias attributed to self-report. Future work should focus on barriers to receiving death notification training.

27. Reduction in Cervical Spine Immobilization Is Not Associated with Missed Injuries

Jennifer Gibson Chambers, Michael O'Brien, Brian Clemency, *University at Buffalo* Category of Submission: Student, Resident, Fellow

Background: Previous studies have demonstrated EMS providers can correctly determine which patients have a cervical spine injuries and patients arriving at the emergency

department via EMS without a cervical collar rarely have serious cervical spine injuries. In a recent study, we demonstrated that implementation of a spinal motion restriction (SMR) protocol was associated with decreased cervical collar use. We sought to determine if this decrease was associated with an increase in serious cervical injuries among patients transported without cervical collars. **Methods**: This was a secondary analysis of a retrospective chart review of patients transported by a single large, commercial EMS agency with a dispatch for motor vehicle collision to one of three hospitals. EMS and hospital data were reviewed for all calls during a 6-month period before (January–June 2015) and a 6-month period after (January–June 2016) the protocol change. Fisher exact test was used for statistical comparisons between time periods. Cervical spine injuries identified on CT were considered serious if the patient required operative intervention, discharge in an immobilization collar or cervical spine injuries present in patients who died as a result of traumatic injuries. **Results**: There were 1,614 patient records identified, 819 under the immobilization protocol and 796 under the SMR protocol. Cervical collar use decreased from 66.8% to 59.3% ($p = 0.002$). There was no significant difference between time periods in proportion of male patients, average age, or subtype of motor vehicle accident. No significant change was observed in the rate of CT cervical spine imaging (51.0% before and 52.5% after, $p = 0.55$). Serious cervical spine injuries were identified in 2.2% before and 2.4% of imaged patients after SMR ($p = 0.99$). All patients with serious cervical spine injury were placed in cervical collars by EMS providers, a sensitivity of 100%. The specificity was 14.0% before and 18.7% after SMR ($p = 0.10$). **Conclusions**: Despite decreased use of cervical collars under the SMR protocol, there were no motor vehicle accident patients with serious cervical fractures transported without a cervical collar in either period. These findings may not generalize to other mechanisms of injury.

28. PSYCHOMETRIC PROPERTIES OF A SURVEY ON PATIENT SAFETY CULTURE (SOPS)-BASED TOOL FOR EMS

Remle Crowe, Rebecca Cash, Madison Rivard, William Gilmore, Alex Christgen, Tina Hilmas, Lee Varner, Amy Vogelsmeier, Ashish Panchal, *The National Registry of Emergency Medical Technicians* CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY, SYSTEMS, DISASTER

Background: Measuring and improving organizational safety culture has been linked to positive safety outcomes in EMS, yet few evaluation tools exist for this unique setting. The Agency for Healthcare Research and Quality's (AHRQ) Surveys on Patient Safety Culture (SOPS) are widely used to assess safety culture in various healthcare settings and results are included in a national comparative database to allow for benchmarking; however, there is no SOPS instrument specific for EMS. Our objective was to evaluate the psychometric properties of an EMS-adapted tool based on existing SOPS domains. We hypothesized that the reliability and validity of the EMS tool would be similar to existing SOPS instruments. **Methods**: We developed and cognitively tested a 37-item instrument adapting 10 domains from the SOPS instruments and one new domain capturing the unique EMS aspect of communication while enroute to a call. We administered an electronic survey to all 332,584 nationally-certified EMS professionals. Analysis inclusion criteria consisted of EMTs or higher practicing in non-military settings. We evaluated domain structure using confirmatory factor analysis (CFA) using a polychoric correlation matrix for ordinal data. We used prior SOPS thresholds to assess fit (0.90), factor-loadings (0.4), and factor variances (0.5). We assessed domain reliability and validity using Cronbach's alpha (cutoff:0.6) and Pearson's correlation coefficients (r; cutoff:0.3). **Results**: We randomly split 23,765 responses into equally-sized calibration and validation datasets. The CFA supported the 11-domain model with a comparative fit index = 0.94, exceeding the 0.90 threshold. Item factor-loadings all exceeded 0.4 (range: 0.51–0.98). Three domains exhibited factor variances below the 0.5 threshold: staffing, communication about incidents, and handoffs. Cronbach's alpha was above 0.6 for all domains (range:0.65–0.88). Predictive validity was supported as all domain composite scores were correlated with the outcome variables of overall safety rating ($r = 0.44$–0.72) and frequency of event reporting ($r = 0.31$–0.48). Results from the validation dataset confirmed the presented calibration results. **Conclusions**: Overall, the EMS-adapted tool demonstrated adequate psychometric properties, and the reliability and validity of the tool were consistent with existing SOPS instruments. Important limitations include potential response bias and the inability to aggregate data at the agency level. Future work should focus on agency-level data testing.

29. EXPLAINING DISPARITIES IN FIELD TRIAGE OF OLDER ADULTS: FACTORS THAT INFLUENCE EMS DESTINATION DECISIONS AND REASONS FOR OVER- AND UNDER-TRIAGE

Courtney Jones, Jeremy Cushman, Julius Cheng, Martina Anto-Ocrah, Nancy Wood, Heather Lenhardt, Molly McCann, Suzanne Gillespie, Ann Dozier, Jeffrey Bazarian, Manish Shah, *University of Rochester, School of Medicine and Dentistry* CATEGORY OF SUBMISSION: TRAUMA

Background: The Field Triage Decision Scheme (FTDS) is designed to identify severely injured patients and guide EMS providers' selection of a destination hospital, but a minimal amount is known regarding the real-world application of these criteria. We aimed to identify the factors that influence EMS destination decisions, the extent to which EMS decisions align with the FTDS, and explore EMS provider-identified reasons for over- and under-triage of older adults. **Methods**: We conducted a prospective multi-center study, encompassing all four hospitals within a county, one of which was a verified Level I trauma center which serves a nine county region of over one million people. We enrolled all older adults aged 55 or older who sustained an injury of any severity and were transported by EMS. Research staff administered a standardized interview-based survey with the patient's EMS provider. FTDS criteria was used as the gold standard to assess patterns of destination decisions and adherence to protocol. We used descriptive statistics to characterize the study sample and used chi-square tests to assess factors that influenced destination decisions and agreement between EMS decisions and the FTDS. Proportions were used to quantify reasons for under- and over-triage. **Results**: Data from 4,295 patients were analyzed. The median age was 75 years and 59% were female. Using the FDTS as a gold standard for destination decisions, 1,584 patients (43.8%) were over-triaged and 285 (42.0%) were under-triaged. There were only 2 patients (2%) who met the mechanism of injury criteria who were under-triaged, compared to 154 (41.1%) and 141 (47.2%) who met the physiologic and anatomic criteria who were under-triaged, respectively. Of those who were over-triaged to the trauma center, the most frequently cited reason by EMS was patient request (60.5%). Of those who were under-triaged to the non-trauma centers the most frequently cited reasons by EMS was patient request (61.4%) and proximity of the non-trauma center (13.7%). **Conclusions**: EMS provider destination decisions are influenced by mechanism of injury, but a substantial proportion of patients who meet the physiologic and anatomic criteria of FTDS were under-triaged. Both under- and over-triage appear to be heavily influenced by patient preference.

30. DOES MECHANISM OF INJURY PREDICT TRAUMA CENTER NEED FOR CHILDREN?

E. Brooke Lerner, Mohamed Badawy, Jeremy Cushman, Amy Drendel, Courtney Jones, Manish Shah, David Gourlay, *Medical College of Wisconsin* CATEGORY OF SUBMISSION: PEDIATRIC

Background: To determine if the Mechanism of Injury step of the Field Triage Decision Scheme (FTDS) is accurate for identifying children who need the resources of a trauma center (TC). **Methods**: EMS providers transporting any injured child ≤15 years, regardless of severity, to a pediatric TC in three midsized communities over 3 years were interviewed. Collected data included EMS observed physiologic condition, suspected anatomic injuries, and mechanism. Patients were considered to need a TC if they met a consensus-based definition. Data were analyzed with descriptive statistics including positive likelihood ratios (+LR) and 95% confidence intervals (95%CI). **Results**: A total of 9,484 provider interviews were conducted and linked to hospital data to obtain patient outcome. Of those, 215 (2.3%) needed a TC. A total of 1,485 enrolled patients were excluded from further analysis because they met the physiologic or anatomic steps of the FTDS. Of the remaining 7,999 cases, 61 needed a TC. The mechanisms sustained by the remaining cases were 35.5% fall (15 needed TC), 28.5% motor vehicle crash (MVC) (26 needed TC), 7.1% struck by a vehicle (8 needed TC), 0.2% motorcycle crash (MCC) (none needed TC), and 28.8% had a mechanism not on the FTDS (12 needed TC). Among those who fell greater than 10 feet, 2 needed a TC (+LR 2.67; 95%CI: 0.73–9.79). Among those in a MVC, 42 were reported to have been ejected and none needed a TC. While 63 had reported intrusion >12 inches and 1 needed a TC (+LR 1.40; 95%CI: 0.20–9.69). There were 34 reported as having a death in the same vehicle, and 2 needed a TC (+LR 5.41; 95%CI: 1.37–21.00). **Conclusions**: Over a quarter of the children who need the resources of a TC are not identified in the physiologic or anatomic steps of FTDS. The mechanism of injury step of the FTDS does not include over a quarter of the mechanisms experienced by children transported by EMS for injury. Use of the mechanism step does not appear to greatly enhance identification of children who need a TC. More work is needed to improve the identification of children who a need the resources of a TC.

Poster Presentation Abstracts (31–206)

31. APPROPRIATE NEEDLE LENGTH FOR EMERGENT PEDIATRIC NEEDLE THORACOSTOMY UTILIZING COMPUTED TOMOGRAPHY

Maria Mandt, Kathleen Adelgais, Kari Hayes, Fred Severyn, *Children's Hospital Colorado* CATEGORY OF SUBMISSION: PEDIATRIC

Background: Needle thoracostomy is a life-saving procedure. Advanced Trauma Life Support guidelines recommend insertion of a 5 cm, 14-gauge needle for pneumothorax

decompression. High-risk complications can arise if utilizing an inappropriate needle size. No study exists evaluating appropriate needle length in pediatric patients. Utilizing computed tomography (CT), we determined the needle length required to access the pleural cavity in children matched to Broselow™ Pediatric Emergency Tape color. **Methods**: Three investigators reviewed chest CTs of children < 13 years of age obtained between 2010–2015. Patient exclusions included those with a chest wall mass, muscle disease, pectus deformity, anasarca, prior open thoracotomy, inadequate imaging, or missing height documentation. We established four groups based upon Broselow™ color as determined by recorded height. Investigators, trained by a pediatric board-certified radiologist, obtained standardized CT measurements of chest wall thickness at four points: right/left second intercostal space at the midclavicular line (ICS-MCL) and right/left fourth intercostal space in the anterior axillary line (ICS-AAL). Our outcome was the median chest wall thickness and interquartile ranges (IQR) for each Broselow grouping and anatomic site. **Results**: To date, 225 chest CTs have been reviewed. Median patient age was 5 years and 52.4% were male. Children measuring Broselow Gray/Pink (<68 cm), had a median chest wall thickness at the right ICS-MCL of 1.5 cm (IQR 1.3 cm, 1.9 cm), left ICS-MCL 1.6 cm (IQR 1.5 cm, 2 cm), right ICS-AAL 1.7 cm (IQR 1.5 cm, 1.9 cm), left ICS-AAL 1.6 cm (IQR 1.4 cm, 2.2 cm). Children measuring Broselow Red/Purple (68.1–90 cm): right ICS-MCL 1.8 cm (IQR 1.5 cm, 1.9 cm), left ICS-MCL 2 cm (IQR 1.7 cm, 2.1 cm), right ICS-AAL 1.8 cm (IQR 1.6 cm, 2.2 cm), left ICS-AAL 1.6 cm (IQR 1.3 cm, 2 cm). Children measuring Broselow Yellow/White (90.1–115 cm): right ICS-MCL 2.1 cm (IQR 1.5 cm, 2.3 cm), left ICS-MCL 1.9 cm (IQR 1.6 cm, 2.3 cm), right ICS-AAL 1.8 cm (IQR 1.7 cm, 2.1 cm), left ICS-AAL 1.7 cm (IQR 1.5 cm, 2.1 cm). Children measuring Broselow Blue/Orange/Green (>115.1 cm): right ICS-MCL 2.4 cm (IQR 2.1 cm, 2.9 cm), left ICS-MCL 2.4 cm (IQR 2.1 cm, 2.9 cm), right ICS-AAL 2.1 cm (IQR 1.7 cm, 2.9 cm), left ICS-AAL 2.1 cm (IQR 1.6 cm, 2.9 cm). **Conclusions**: Median chest wall thickness varies little by height or location in children < 13 years of age. The standard 5-cm needle is twice the chest wall thickness of most children.

32. Descriptive Analysis of Defibrillation Vector Change for Prehospital Refractory Ventricular Fibrillation

Matthew Davis, Andrew Schappert, Jay Loosley, Kristine VanAarsen, Shelley McLeod, Sheldon Cheskes, *Department of Medicine, Division of Emergency Medicine, Western University*
Category of Submission: Cardiac

Background: Patients in ventricular fibrillation (VF) who do not respond to standard Advanced Cardiac Life Support treatments are deemed to be in refractory VF (rVF). The ideal prehospital treatment for patients with rVF remains unknown. Double sequential external defibrillation (DSED) has been proposed as a viable option for patients in rVF. Although the mechanism by which DSED terminates rVF remains unknown, one theory is that the change in defibrillation vector that occurs may contribute. Our objective was to describe clinical outcomes for patients presenting in rVF during out-of-hospital cardiac arrest (OOHCA) for those who underwent vector change defibrillation, compared to those who received standard treatment. **Methods**: This was a retrospective chart review of adult (≥18 years) patients presenting in rVF during OOHCA over 15 months beginning in March 2016. Patients who underwent vector change defibrillation had a change in pad position (anterior-anterior to anterior-posterior) after 3 or more consecutive shocks. Termination of rVF was defined as the absence of VF after a vector change or standard defibrillation during the next rhythm analysis. **Results**: There were 372 OOHCA, with 25 (6.7%) patients meeting our definition of rVF. Of these, 16 (64.0%) patients (median age 62 years, 81.3% male) had vector change after a median (IQR) of 3 (3.0–4.0) paramedic defibrillation attempts. Median (IQR) time to vector change defibrillation was 8.8 (7.1–11.1) minutes. Eight (50%) patients had termination of rVF after the first vector change shock, 6 (37.5%) had prehospital return of spontaneous circulation (ROSC) and 5 (31.3%) patients survived to hospital discharge. Of the 9 rVF patients who did not have vector change, median age was 63 years and 88.9% were male. The median (IQR) number of defibrillations within this group was 5 (4.5–7.0). All patients remained in VF after the fourth defibrillation. Prehospital ROSC was achieved in 3 (33.3%) patients. Three patients (33.3%) survived to hospital discharge. **Conclusions**: This is preliminary evidence that vector change defibrillation in patients with rVF may result in VF termination. A randomized controlled trial is warranted to test whether or not vector change has a role in the termination of rVF.

33. Benchmarking EMS Compass Stroke Performance Measures Using a Large National Dataset

Jeffrey Jarvis, Dustin Barton, Lauren Sager, Nick Nudell, *Williamson County EMS*
Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: Prehospital stroke alerts have been promoted as a means of facilitating rapid ED treatment of acute strokes. These alerts are dependent upon the performance of validated stroke screening tools and assessment of blood glucose to eliminate a common stroke mimic. EMS Compass has identified several performance measures on this topic. No work has been done to calculate a national performance benchmark for these measures. These benchmarks would be useful in system improvement efforts. We sought to describe national performance on these measures for the first time. **Methods**: Using anonymous data from 9-4-1 consenting agencies in a large commercial EMS electronic health record (ESO Solutions), we identified records of patients felt to have acute strokes who were transported from the scene of a 9-1-1 call. From these records, we calculated the proportion of all patients who had a stroke screen and blood glucose documented. For each of these measures, we also calculated the 95% confidence interval. **Results**: Over a 6 1/2-year periods, we identified 168,854 patients with 9-1-1 calls who had an impression of acute stroke. Of these, 88,751 patients or 52.6% (52.3–52.8%) had a stroke scale documented. Additionally, 140,294 patients, or 83.1% (82.9–83.3%) had a blood glucose documented. **Conclusions**: In this study, we calculate the first national benchmarks of two important clinical performance measures on stroke care described by EMS Compass. Importantly, there was poor performance of stroke screens with only 52.6% of all 9-1-1 calls for stroke having them documented. At 83.1%, agencies performed better with blood glucose documentation. These results provide initial benchmarks and provide a starting point for improvement of both the measures, documentation systems, and clinical performance.

34. Effect of Instructor's Real-Time Feedback During Layperson Cardiopulmonary Resuscitation Training on Quality of Cpr Performances: A Prospective Cluster Randomized Trial

So Yeon Kong, Sang Do Shin, Kyoung Jun Song, Tae Han Kim, Gwan Jin Park, *Department of Emergency Medicine, Seoul National University Hospital*
Category of Submission: Cardiac

Background: It was reported most bystander CPR does not meet high quality CPR criteria, strongly implying an urgent need for new strategies to assist in the delivery of quality bystander CPR. The aim of this randomized trial was to assess the effectiveness of instructor's real-time, objective feedback during CPR training compared to a conventional feedback in terms of trainee's CPR quality. **Methods**: We performed a cluster randomized trial of community CPR training at Nowon District Health Center in Seoul. CPR training classes were randomized into either intervention (instructor's objective real-time feedback based on Laerdal QCPR Classroom) or control (conventional feedback) group. Laerdal QCPR Classroom software is a real-time feedback device, which monitors quality of real-time CPR performances of multiple trainees simultaneously. During each training session, trainees performed a total of five CPR. The primary outcome was the total score, which is an overall measure of chest compression quality. Generalized linear mixed models were used to analyze the outcome data from baseline to fifth CPR session, accounting for both cluster- and individual-level covariates. **Results**: A total of 77 training sessions (1,894 trainees) were randomized into 37 intervention (996 trainees) and 40 control (898 trainees) groups. At baseline, both groups had equal overall CPR quality scores (78 in both groups). During the course of the training, QCPR feedback significantly increased trainees' overall quality of CPR performance compared with conventional feedback ($p < 0.01$). In terms of changes from baseline to last session, trainees in the intervention group demonstrated significant improvements on overall quality of CPR compared with those in the control group (QCPR feedback $\Delta = 11.64$ (95% CI 9.75–13.53) ; Conventional feedback $\Delta = 6.96$ (5.16–8.76); $p < 0.001$). A statistically significant difference between the two groups was observed for change in compression depth from baseline to fifth CPR session with a mean change of 4.51 mm in the intervention group and 2.72 mm in the control group ($p < 0.001$). **Conclusions**: Considering the rate of chest compression, we did not observe a statistically significant different between two groups ($p = 0.06$). In this prospective randomize trial, instructor's objective real-time feedback resulted in improved overall CPR quality.

35. Confirming the Safety and Feasibility of a Bundled Resuscitation Technique Involving a Head-Up/Torso-Up Mechanical Chest Compression Technique for Cardiopulmonary Resuscitation

Paul Pepe, Kenneth Scheppke, Peter Antevy, Daniel Millstone, Charles Coyle, Craig Prusansky, Sebastian Garay, Johanna Moore, *University of Texas Southwestern Medical Center*
Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: Strategies to lower intracranial pressure (ICP) and improve cerebral/systemic perfusion during CPR have become a recent focus for resuscitation researchers. One experimental method to lower ICP has been to elevate the head/chest during CPR combined with the use of devices to enhance venous return to the thorax. The purpose of this study was to evaluate both the safety and clinical feasibility of such a bundled technique that includes mechanical CPR devices used at an angle. **Methods**: The EMS system catchment (pop. 1.4 million) is geographically expansive with broad ethnic

diversity, extremes of age and socioeconomics and low frequency of bystander CPR. Through an established Utstein-style registry, all out-of-hospital cardiac arrest (OOHCA) cases (all rhythms) were followed over 3.5 years (January 1, 2014 through June 30, 2017; n =2,285). EMS crews were previously using the Lucas© device and impedance threshold device (ITD), but, after April 1, 2015, they also: (1) applied O2 while deferring positive-pressure ventilation and ITD application several minutes; (2) raised the backboard ~20° (head/torso-up) following ITD application; and (3) solidified a pit-crew approach for device application. With neuro-intact discharge data not available until 2015, "short-term" survival (sustained resuscitation by EMS to hospital admission) was used for consistent comparisons. Quarterly reports were run to identify any periodic variations or incremental effects during protocol transition (in Quarter 2, 2015). **Results**: There were no complications/difficulties in using the head/torso-up position (n = 1,319). Of 806 consecutive OOHCA cases attended between January 1, 2014 and March 31, 2015, quarterly (all-rhythm) survival rates remained constant (mean 17.87%, range 15–20%) but rose steadily during the transition period with an ensuing sustained doubling (35.18%; range 30–40%) for the next two years (July 1, 2015 through June 30, 2017). Outcomes improved across subgroups while response intervals, indications for initiating CPR and bystander CPR rates were unchanged. EMS resuscitation rates in 2016 and 2017 were found to be proportional to neuro-intact discharge. **Conclusions**: The head-up/torso-up CPR bundle was not only feasible, but was associated with an immediate, steady rise in EMS resuscitation rates during the transition phase with a subsequent sustained doubling of survival chances, making a compelling case that this bundled technique may improve OOHCA outcomes in future clinical trials.

36. Intraosseous Access Use in Chemical, Biological, Radiation, and Nuclear Personal Protective Equipment

Tim Collins, *Clinical & Medical Affairs, Teleflex Medical* Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: To determine comparisons of success rates and ease-of-use ratings in achieving intraosseous access in both wearing and non-wearing of Chemical, Biological, Radiation and Nuclear (CBRN) personal protective equipment (PPE) in a cadaver model. **Methods**: Using a cross over design, eight experienced paramedics inserted an intraosseous (IO) device (Arrow EZ-IO©) into a cadaver specimen wearing their standard prehospital clothing. The sample then crossed over and applied CBRN PPE and repeated IO insertions. IO insertion times were recorded and assessed for clinical accuracy both before and after cross over with wearing CBRN PPE. Data collection involved the sample completing a confidential questionnaire assessing self-perceived ease-of-use scores for IO access measured in Likert scales (0–10). Qualitative data was captured following structured focus group interviews. **Results**: The results found no statistical difference between ease-of-use scores for IO access between wearing or non-wearing CBRN PPE. No difference in determining land marking for IO insertion (M 9 vs. 8.75 $p = 0.726$), humeral site insertion (M 9.13 vs. 8.75 $p = 0.593$), administration of IO saline flush (M 9.25 vs. 8.75 $p = 0.405$), holding and manipulating driver (9.13 vs. 8.75 $p = 0.593$), and trocar removal (9.25 vs. 8.75 $p = 0.405$). The mean ease-of-use scores were found to be lower in CBRN group but not significant, focus group discussions stated that PPE had some restrictions but effective EZ-IO insertion could still be achieved. Insertion times (25 secs SD 3.46 vs. 34.38 secs SD 4.17 $p = 0.0002$) were statistically longer with wearing CBRN PPE. However, focus group discussion stated that it would take significantly longer to achieve intravenous (IV) access and that IO was an effective and faster option compared to IV during a CBRN incident. **Conclusions**: Intraosseous access can be effectively and promptly achieved while wearing CBRN PPE. IO access took an additional 9.4 seconds while wearing CBRN PPE which can provide fast and efficient vascular access during a CBRN incident.

37. Reprioritization of 9-1-1 Emergency Medical Calls Using Historical Clinical Data

Veer Vithalani, Sabrina Vlk, Steven Davis, Neal Richmond, *Office of the Medical Director; MedStar Mobile Healthcare* Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: Emergency Medical Services (EMS) systems often utilize a structured approach to 9-1-1 call-taking and emergency medical dispatch (EMD). One such system, Medical Priority Dispatch System (MPDS), categorizes 9-1-1 calls into EMD codes based on problem and severity, with response priorities and resources determined at the local level through a predetermined response matrix. In this study, we propose a methodology for utilizing historical clinical data to increase the accuracy of 9-1-1 call prioritization of patients with time-sensitive critical illness. The primary objective is to increase the number of patients with time-sensitive critical illness who receive the highest-priority response ("Priority 1"). The secondary objective is to decrease the number of Priority 1 responses to patients who do not have time-sensitive critical illness. **Methods**: All 9-1-1 calls-for-service in a large EMS system, between December 1, 2015 and November 30, 2016, were included. Electronic patient care reports (ePCRs) were analyzed for time-sensitive critical illness, including any patients in cardiac or respiratory arrest or who required airway management or electrical therapy (pacing, cardioversion, or defibrillation). The percentage of calls with time-sensitive critical illness was calculated for each of the 382 EMD codes in the MPDS. In our proposed response matrix, any codes which had at least 1% of patients with time-sensitive critical illness were assigned a theoretical Priority 1 response. **Results**: Out of a total of 119,287 actual calls-for-service, 30,123 (25.2%) were assigned a Priority 1 response through the current response matrix; 1,205 (4%) of these patients had time-sensitive critical illness. Utilizing our proposed methodology, these same calls-for-service would have resulted in 25,441 (21.3%) Priority 1 responses, including 1,333 (5.2%) patients with time-sensitive critical illness. The net result would have been an overall 15.5% decrease in Priority 1 responses, and a 10.6% increase in Priority 1 responses to patients with time-sensitive critical illness. **Conclusions**: Historical clinical data may be used to increase the accuracy of call prioritization of patients with time-sensitive critical illness, while simultaneously increasing operational efficiency and 9-1-1 resource utilization.

38. Kink in the Stroke Chain of Survival: Is EMS Appropriately Prenotifying the ED of Suspected Strokes?

Jeffrey Nusbaum, Nachiketa Gupta, Alec Glucksman, Michael Redlener, Kevin Munjal, *Mount Sinai Hospital* Category of Submission: Student, Resident, Fellow

Background: The purpose of this study was to determine rates of prenotification in a large urban setting among patients suspected by EMS of having had an acute stroke and to determine factors associated with appropriate prenotification. **Methods**: This was a retrospective cohort study of all patients with a discharge diagnosis of CVA, TIA or intracranial hemorrhage who arrived by EMS between January 1 and December 31, 2015 at three urban hospitals. Patients transferred from another acute care facility were excluded. "Get with the Guidelines" data was matched to data from the prehospital care reports. Appropriate prehospital notification was defined by any reference in the EMS narrative or hospital record to advanced notification of the patient's arrival. Logistic regressions were used to determine factors that may have been important for EMS prenotification and whether prenotification was associated with higher rates of tPA administration. Analysis was done using the R-statistical computing software. **Results**: During the study period, 379 patients presented via EMS; 126 arrived within 3.5 hours of their last known normal (LKN). EMS suspected a CVA in 107 (85%). Prenotification was given in 52 of 107 instances (49%). Shorter EMS LKN times were associated with increased rates of prenotification ($p < 0.01$). Prenotification was more likely in patients with higher NIHSS ($p = 0.01$). For the elements of the Cincinnati Prehospital Stroke Scale (CPSS), prenotification was 24% higher in patients with slurred speech ($p = 0.01$), 24% higher with arm drift ($p = 0.01$), and 20% higher with facial droop ($p = 0.04$). In a multivariate logistic regression including the three components of the CPSS, slurred speech was the most influential factor for prenotification ($p = 0.09$), followed by arm drift ($p = 0.14$), and facial droop ($p = 0.56$). With appropriate prenotification, there was a 17% increase in likelihood of receiving tPA ($p = 0.06$). **Conclusions**: Prehospital providers are not consistently providing prenotification. In our cohort, EMS prenotified the ED in patients with more severe and recent onset symptoms. Similar to other studies showing improved time interval metrics with prenotification, our study suggests that prenotification was associated with higher rates of tPA administration. There may be a benefit to dedicating resources toward EMS education on the role of prenotification in the stroke chain of survival.

39. Interaction Effects of Communities and Advanced Airway Management on Survival after Out-of-Hospital Cardiac Arrest; Multi-Level Analysis

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Background: Chest compression and adequate ventilation are essential for oxygen delivery in out-of-hospital cardiac arrest (OHCA) patients. The association between prehospital advanced airway management (AAM) and survival outcomes was inconsistent. We hypothesized that differences in the application of prehospital AAM between regions due to medical resource would have an effect on the effectiveness of the AAM. The aim of this study was to investigate whether the effect of prehospital AAM on outcomes between regional EMS systems of four Asian cities. **Methods**: We used a PAROS (Pan-asia resuscitation outcome study) registry. We identified patients with OHCA of presumed cardiac etiology who were resuscitated by emergency medical services in four Asian cities between 2012 and 2014. OHCA patients were witnessed by EMS personnel and age

under 18 years were excluded. The main exposure variables were AAM. The primary endpoint was survival discharge and neurologic recovery. We compared outcomes between the AAM and non-AAM groups using multivariable logistic regression with an interaction term between AAM and four Asian cities (Osaka, Seoul, Singapore, and Taipei), after adjusting for potential confounders. **Results**: Among 27,375 patients, 16,510 patients were included in the final analyses. Survival discharge and neurologic recovery was better in the non-AAM group (8.7% vs. 5.1%, 4.9% vs. 2.0%) than in the AAM group (adjusted odds ratio [aOR] 0.58 [95% confidence interval (CI)0.59–0.68]). In the interaction model for the survival discharge, the aORs for AAM of Osaka and Singapore was 0.43 (95% CI 0.35–0.52) and 0.31 (0.17–0.58), respectively. In the interaction model of Seoul and Taipei, the association between AAM and survival to discharge were statistically insignificant (aOR 0.99 ; 95% CI 0.75–1.30) and aOR 1.04; 95% CI 0.69,1.55, respectively) . The similar results showed for neurologic recovery. **Conclusions**: Regional EMS system modified the effect of AAM on outcomes for patients with OHCA.

40. Rapid Cycle Deliberate Practice and Coaching of Specific Interventions Improves Cardiopulmonary Resuscitation Quality Measures in Teams of EMS Providers

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Background: High-quality cardiopulmonary resuscitation (CPR) skills are paramount for good survival from cardiac arrest, but previous studies have suggested that CPR quality is often poor. The purpose of this study was to evaluate changes in the quality of EMS provider CPR skills using rapid cycle deliberate practice (RCDP) of specific teaching interventions with real-time feedback. **Methods**: A recording mannequin, with feedback blinded from participants, was used to evaluate CPR quality metrics on 3- or 4-person teams of EMS providers. All participants were certified EMS providers who also had previous CPR education and certification. CPR quality metrics were assessed, before and after educational interventions, using a 5-minute resuscitation case simulating adult cardiac arrest with ventricular fibrillation. The intervention included using coaching and RCDP to teach techniques of palm lift, two-person two-thumbs-up bag-mask ventilation, upstroke ventilation during continuous compressions, and chest compressions during defibrillator charging. CPR metrics included: compression fraction, compression rate, percentage of compressions with full depth and full recoil, percentage of compressions between 100–120 per minute, ventilation rate, percentage of ventilation of adequate volume, and length of longest pause. Outcomes were compared through Paired Samples t-tests using bias-corrected bootstrapping, resampling 1000 times with 95% confidence intervals. **Results**: The sample consisted of 67 providers divided into 18 teams. There were significant improvements for the following metrics of CPR quality when comparing the pre- and post- intervention measures: percentage of compressions between 100–120 per minute (39.5% vs. 78.5%; $p = .001$, $\eta 2 = 0.60$), compression fraction (78.8 vs. 92.3; $p = .006$, $\eta 2 = 0.52$), percentage with full recoil (52.7% vs. 85.6%; $p = .001$, $\eta 2 = 0.60$), percentage with adequate ventilation volume (38.5% vs. 57.4%; $p = .002$, $\eta 2 = 0.55$), and longest pause in compressions (16.6 sec vs. 6.2 sec; $p = .004$, $\eta 2 = 0.48$). **Conclusions**: The use of RCDP and coaching with real-time mannequin feedback led to significant improvements in measures of CPR quality in teams of EMS providers.

41. Influence of Patient Race on Administration of Analgesia by Student Paramedics

Bill Lord, Sahaj Khalsa, *University of the Sunshine Coast* Category of Submission: Professional

Background: Disparities in healthcare are associated with factors that include social status, age and race or ethnicity, with evidence showing African American individuals receive fewer procedures and poorer-quality medical care than white individuals. Disparities in the management of pain have been shown to be associated with race. However, there is limited data regarding the influence of race on analgesia provided by paramedics. As such, this study aims to investigate associations between patient race and student paramedic management of pain, using a null hypothesis of no difference. **Methods**: This retrospective cohort study used a contiguous dataset of all student paramedic records entered in the FISDAP Skill Tracker database between January 1, 2014 to December 31, 2015. Cases were extracted if aged 16 to 100 years, the patient was alert and the primary or secondary impression was trauma (abdominal, chest, extremity, neck-back, multi) or burns. Head injury was excluded as this is a contraindication to analgesia in some settings. The primary outcome of interest was the interaction between patient race and student paramedic administration of any analgesia for cases meeting inclusion criteria. Secondary outcomes of interest were associations between age and gender and analgesia administration. The adjusted logged odds of patients receiving any analgesic was tested with binomial logistic regression using a stepped modelling approach. **Results**: A total of 59,962 cases were available for analysis; median age was 50 years (IQR 39 years), 50.2% were female ($n = 30,077$). The most common cause of trauma was fall, representing 50% ($n = 26,053$) of cases. 14.1% of patients received any analgesia ($n = 8,425$). Caucasian patients have significantly higher logged odds of receiving analgesia than non-Caucasian patients ($p < 0.001$). When analgesic administration is adjusted for age category and gender, African Americans have the lowest logged odds of receiving any analgesia when compared to Caucasian patients (OR 0.65, $p < 0.001$). **Conclusions**: The results indicate inequality in the provision of analgesia by student paramedics based on patient race. This suggests a need for education that addresses cognitive and affective biases that can affect clinical judgements, and EMS audit of cases to identify disparities in care based on race.

42. Paramedics Providing Palliative Care at Home: Patient and Family Satisfaction

Alix Carter, Judah Goldstein, Marianne Arab, Michelle Harrison, Barbara Stewart, Mireille Lecours, Carolyn Villard, James Sullivan, *Dalhousie University* Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: Paramedic crisis and symptom management for patients receiving palliative care with the goal to treat in place represents a novel approach to care. A new clinical practice guideline, additional medications, and a training program Learning Essentials Approach to Palliative Care (LEAP) Mini for Paramedics were implemented in two provincial EMS systems. Our objective was to determine the impact of this new model of care on patient/family satisfaction and to describe their experience with paramedic palliative support at home. **Methods**: The perspective of families/patients registered in a provincial palliative care registry in Nova Scotia and PEI was gathered in a mixed methods approach from June 1, 2016 to August 31, 2016. Upon enrollment in the program, a survey was mailed. Six months after an episode of care (allowing for grieving time) a semi-structured telephone interview using a validated guide was conducted. Overall satisfaction was measured using a 5-point Likert scale. Respondent characteristics are reported descriptively. Open ended-questions were analyzed by thematic content analysis. **Results**: A total of 225 registration surveys were distributed, 67 (30%) were returned. Of those, 49 (73%) were completed by the family. For the interviews, families were contact sequentially (8 declined, 22 disconnected telephones, 32 unanswered calls with two call attempts). Eighteen families completed the interview. Three themes emerged from the pre-encounter survey: registering meant fulfilling loved one's care wishes, providing peace of mind, and feeling prepared for emergencies. Post-encounter, 14/18 families rated the care received as "excellent," and all indicated that symptoms were helped. Seven families indicated that without the program, they would have had to be in hospital. Five themes emerged: 24/7 availability, professionalism of paramedics, compassion of paramedics, relief of symptoms, and a plea for program continuation. Thematic saturation was reached with minimal divergence of comments. **Conclusions**: The model of paramedics providing palliative support in the home resulted in high patient/family satisfaction; registering in the program, prior to any call for assistance, provides peace of mind and a feeling of being prepared. Families particularly note the value of 24/7 availability, success in relief of symptoms, and the degree of compassion and professionalism of paramedics.

43. Amplitude Spectrum Area Changes during Cardiopulmonary Resuscitation after Different Durations of Untreated Cardiac Arrest in a Porcine Model of Ventricular Fibrillation with a Concurrent Acute Myocardial Infarction

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Background: Amplitude spectrum area (AMSA) is a predictor of successful defibrillation (DF). In this study, we investigated the effect of high quality cardiopulmonary resuscitation (CPR) on AMSA in relationship with the duration of untreated ventricular fibrillation (VF) in a preclinical porcine model with a concurrent acute myocardial infarction. **Methods**: An established model of myocardial infarction followed by VF and CPR was used. Forty-four pigs were subjected to different VF durations: 8–10 minutes (short), $n = 14$; 12 minutes (intermediate), $n = 21$; and 13–15 minutes (long), $n = 9$. Continuous mechanical CPR (Lucas, PhysioControl) with ventilation with oxygen and epinephrine administration (1 mg at 2 minutes of CPR) was performed for 5 minutes prior to a 150 J DF attempt. AMSA and changes in AMSA during CPR (dAMSA), in relationship with the duration of untreated VF, coronary perfusion pressure (CPP), and epinephrine administration were evaluated. **Results**: Overall AMSA decreased from 13.7 $\pm$ 0.8 mVHz to 6.5 $\pm$ 1.7 mVHz during the 15 minutes VF (dAMSA -7.2 ± 2.5 mVHz, $p <$ 0.01), while it increased to 17 $\pm$ 1.2 mVHz after 5 minutes of CPR (dAMSA 10.5 $\pm$ 3.5 mVHz,

$p < 0.01$) independently of the duration of untreated VF (dAMSA: 10.7 ± 1.7, 11.3 ± 1.5, and 14.7 ± 1.5 mVHz, for short, intermediate, and long VF duration, respectively, p = NS). AMSA during CPR was significantly correlated with CPP ($r = 0.46$, $p < 0.01$). AMSA increased significantly during the first 2 minutes of CPR, as compared to the subsequent 2 minutes after epinephrine (dAMSA 6.2 ± 0.8 vs. 3.6 ± 0.6 mVHz, $p < 0.01$). Interestingly, dAMSA improved similarly in the 3 VF duration groups during the first 2 minutes of CPR, but after epinephrine the magnitude of dAMSA continued to increase only when the duration of untreated VF was ≥ 13 minutes, while it decreased for shorter durations. **Conclusions**: High quality CPR allowed for AMSA increases independently of the duration of untreated VF. However, epinephrine administration further improved dAMSA only in the instance of longer durations of VF, while it seemed to have a detrimental effect for a shorter duration.

44. Prehospital Evidence-Based Gudieline Implementation Methodology: A Systematic Literature Review

Jennifer Fishe, Remle Crowe, Rebecca Cash, Nikiah Nudell, Christian Martin-Gill, Christopher Richards, *University of Florida COM Jacksonville, Department of Emergency Medicine* Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: As prehospital research advances, evidence-based guidelines (EBGs) are increasingly implemented into EMS practice. However, incomplete EBG implementation may hinder improvement in prehospital patient outcomes. To inform future EBG efforts, this study reviews and summarizes existing evidence pertaining to prehospital EBG implementation methodologies. **Methods**: This study is a systematic literature review followed by the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) methodology. PubMed®, EMBASE®, Scopus®, and Google Advanced SearchTM were searched without language or publication date filters for articles addressing prehospital EBG implementation. Conference proceedings, textbooks, non-English articles, and articles that did not address prehospital EBG implementation were excluded. GRADE was applied to remaining articles independently by three of five members of the Prehospital Guidelines Consortium Research Committee. Variations in ratings were resolved by consensus. Study characteristics and salient findings are reported. **Results**: The systematic literature review produced 1,375 articles, with 41 meeting inclusion criteria. Most articles described EBG implementation (N = 24, 59%), or implementation barriers ($N = 13$, 32%). Common study designs were statement documents ($N = 12$, 29%), retrospective cohort studies ($N = 12$, 29%), and cross-sectional studies ($N = 9$, 22%). Using GRADE, evidence quality was rated low ($N = 18$, 44%), or very low ($N = 23$, 56%). Salient findings included: (1) EBG adherence and patient outcomes depend upon successful implementation, (2) published studies generally lack detailed implementation methods, (3) implementation takes longer than planned (mostly for EMS education), (4) EMS systems' heterogeneity affects implementation, and (5) multiple barriers limit successful EBG implementation (e.g., financial constraints, equipment purchasing, coordination with hospitals and regulatory agencies). The study found no direct evidence for best prehospital EBG implementation practices, including comparisons of implementation methods, or of methods in different contexts (e.g., urban versus rural, ALS versus BLS). **Conclusions**: While numerous implementation barriers are well described, there is a paucity of evidence for optimal prehospital EBG implementation methods. For scientific advances to reach prehospital patients, future prospective studies should compare implementation methodologies in different prehospital contexts. EBG projects should publish reproducible implementation methods, with "lessons learned" compiled in an easily accessible repository. Funding priorities should include implementation research to ensure the efforts of EBG development translate into practice.

45. Are There Disparities in Dispatch CPR Instruction Receipt and CPR Performance?

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Background: Dispatch-assisted cardiopulmonary resuscitation (DA-CPR) has been shown to improve rates of bystander CPR (BCPR), which enhances survival in Out of Hospital Cardiac Arrest (OHCA). Our objectives are to evaluate whether there are racial and socioeconomic disparities in the receipt of DA-CPR instructions and subsequent CPR performance. **Methods**: We performed a retrospective review of the Cardiac Arrest Registry to Enhance Survival (CARES) dispatch registry from January 2014 to December 2016. Data was collected from a convenience sample of dispatch agency supervisor audits of 9-1-1 OHCA audio recordings in one state. Elements related to dispatcher CPR instruction, and barriers to bystander CPR performance were recorded. Demographics including patient race (white, black or other) and Utstein data were captured from the parent CARES database. These data were merged with census tract data regarding socioeconomic status (SES) of each incident location. The effects of race and SES were analyzed to determine their association with two outcome variables: caller receipt of DA-CPR instructions and subsequent performance of CPR. Multivariate logistic regression analysis was performed. **Results**: We identified 1,872 cases from 23 dispatch agencies that had dispatch, Utstein, and census tract data. The population was predominantly white (70.0%), male (66.0%), with an average age of 63.5 +/−18.7. DA-CPR instructions were more commonly associated with an incident that occurred in a private residence (ORadj 3.8, 95% CI (2.5–5.8)) or in highest income quartile census tracts [ORadj: 1.65; 95% CI (1.01–2.72)]. Older patient age [ORadj: 0.99; 95% CI (0.98–0.99)] and black race [ORadj: 0.61; 95% CI (0.39–0.98)] were negatively associated with receipt of DA-CPR instructions. Subsequent performance of CPR after DA-CPR instruction was more common in witnessed arrests [OR 2.0, (95% CI 1.3–3.0)] and negatively associated with black race [ORadj: 0.31; 95% CI (0.16–0.58)] but not significantly different by socioeconomic or demographic characteristics. **Conclusions**: Although this preliminary study is limited by incomplete demographic and dispatch data, we identified racial disparities in provision of DA-CPR instructions and subsequent CPR performance. These findings varied minimally by SES or other demographic characteristics.

46. Utilization of Emergency Medical Resources at Mass Gathering Events at an Urban University with a Collegiate-Based Emergency Medical Services Agency

Emma Ordway, Neil Sarna, Lindsey DeGeorge, Jose Nable, *Georgetown University* Category of Submission: Student, Resident, Fellow

Background: Mass gathering events (MGEs) challenge medical directors and emergency medical services (EMS) agencies with providing appropriate and sufficient medical resources. This study aimed to examine EMS resource utilization during MGEs at a medium-sized urban university with a collegiate-based basic life support (BLS) agency, and how such utilization may be associated with specific attributes of these events. **Methods**: All emergency medical dispatches for the studied on-campus EMS agency during MGEs were included for analysis in this retrospective study, covering MGEs from January 1, 2012 through September 1, 2016. This collegiate-based agency is the sole provider of medical standby details at its university. Environmental factors such as temperature, location (indoor vs outdoor), estimated event size, and event type were analyzed for each MGE based on data from standby duty logs and the National Weather Service. Linear regression, logistic regression and bivariate correlations were used to determine correlational relationships between environmental factors and patients-per-event presentation rates (PPR) to EMS during these events. **Results**: No calls for service occurred for any events with less than 500 attendees, while at least 1 call for service occurred at 6.1% of events with 500–1000 attendees and at 24.5% of events with over 1000 in attendance. Neither heat nor humidity was found to be significant predictors of PPR, with p-values of 0.72 and 0.65, respectively. However, in the subset of events that attracted more than 1,000 people and were outdoor non-sporting events, the linear regression of PPR and temperature had a Pearson's Correlation Coefficient of 0.983 and a p-value of 0.017. Outdoor non-sporting events, as compared to indoor non-sporting events, had an increased likelihood of calls for service (OR 4.4, p = 0.18). Outdoor sporting events, as compared to indoor sporting events, were also more likely to have requests for EMS (OR 6.1, p = 0.005). **Conclusions**: This study highlights that environmental features such as estimated crowd size, location, event type, and outdoor temperature can possibly be used to predict EMS resource utilization at MGEs. University administrators, event organizers, and EMS agencies can potentially prepare medical plans for such mass gatherings by pre-assessing these event attributes.

47. Simple Feedback Form Improves Quality of Out-of-Hospital CPR

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Background: Despite medical advances and health awareness campaigns, the incidence of prehospital cardiac arrest remains high while survival rates remain low. Excellent prehospital care is tantamount to survival and high quality CPR is a vital contributor to positive outcomes. A quality improvement program was recently implemented to provide simple, goal based feedback to prehospital providers after each cardiac arrest resuscitation. Expanding upon an earlier preliminary study, we aim to assess whether the provision to prehospital providers of a simple CPR feedback form led to improved quality metrics in out of hospital cardiac arrest resuscitations. **Methods**: This before and after retrospective review evaluated data from a quality improvement program in a midsized urban community with BLS and ALS providers. Two 9-month periods, one before and one after

the implementation of the form were evaluated. Metrics measured included the means and rates of goal achievement for compression depth, rate, and fraction as well as preshock pause time. **Results**: A total of 439 before encounters and 621 after encounters were evaluated including those of BLS and ALS providers. Overall, significant differences were found in the mean compression depth (5.0 cm vs. 5.5 cm; $p < 0.001$), compression fraction (79.2% vs. 86.4%; $p < 0.001$), compression rate (109.6/min vs. 114.8/min; $p < 0.001$) and preshock pause time (18.8 sec vs. 11.8 sec; $p < 0.001$). Additionally, improvements were noted in goal achievement for compression depth (48.5% vs. 66.6%; $p < 0.001$), compression fraction (68.1% vs. 91.0%; $p < 0.001$), and preshock pause time (24.1% vs. 59.5%; $p < 0.001$). No significant difference was found in goal achievement of compression rate. **Conclusions**: We found that the introduction of a simple CPR feedback form to prehospital providers was associated with improvement in prehospital CPR quality.

48. Cumulative Success of Prehospital Advanced Airway Management in a National Cohort

Jeffrey Jarvis, Dustin Barton, Henry Wang, *Williamson County EMS* Category of Submission: Medical

Background: Repeated attempts at Advanced Airway Management (AAM) are associated with increased risk of adverse events. There are few current descriptions of the number of attempts needed for success. We sought to characterize cumulative AAM success rates in a national cohort of Emergency Medical Services (EMS) agencies. **Methods**: We used 9 years of data from ESO Solutions, a national EMS electronic health record system. We included all encounters with attempted AAM. We examined the following subsets: (1) cardiac arrest intubation (CA-ETI), (2) medical non-arrest intubation (NA-ETI), (3) rapid-sequence intubation (RSI), (4) sedation-assisted ETI (SAI), and (5) some type of supraglottic airway (SGA). Using binomial proportions with exact confidence intervals, we determined the cumulative success rates for each attempt. We also identified rates of first-pass success (FPS) and overall success (OS), and the number of attempts needed to reach OS. **Results**: A total of 61,793 patients from 552 EMS agencies underwent AAM efforts, including 38,063 CA-ETI, 19,138 NA-ETI, 7,229 RSI, 3,095 SAI, and 9,993 SGA. The number of AAM attempts per patient varied (median 1, range 1–10). CA-ETI performance was: FPS 71.4% (95% CI: 70.8–71.9%), 4 attempts to reach the OS threshold of 91.7% (91.4–92.1). NA-ETI performance was: FPS 66.3% (95% CI: 65.4–67.2%), 3 attempts to reach the OS threshold of 80.4% (79.6–81.1%). RSI performance was: FPS 75.9% (95% CI: 74.9–76.9%), 5 attempts to reach the OS threshold of 96.3% (95.8–96.7). SAI performance was: FPS 66.9% (95% CI: 65.2–68.6%), 4 attempts to reach OS threshold of 86.9% (85.6–88.1%). SGA performance was: FPS 88.8% (95% CI: 88.1–89.4%), 5 attempts to reach OS threshold of 93.2% (92.6–93.6%). **Conclusions**: In this national series, first pass prehospital AAM success rates have improved from prior studies but are still low. Multiple attempts are common and often unsuccessful. These results may guide protocols limiting AAM attempts.

49. Benchmarking EMS Compass Performance Measures Using a Large National Dataset: Pediatric Care

Jeffrey Jarvis, Dustin Barton, Lauren Sager, NIck Nudell, *Williamson County EMS* Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: Children make up ~10% of all EMS transports, often require weight-based dosing, and are commonly affected by respiratory issues. A subset of the EMS Compass performance measures addresses pediatric care, including documentation of weights, vital signs, and treatments for dyspnea. No benchmarks of these measures have been done on a national scale. We aim to describe these measures using a large national cohort. **Methods**: Using a 6 ½ year sample of 9-4-1 EMS agencies using the ESO electronic health record (EHR), we calculated compliance rates among transported 9-1-1 patients under 15 for the following measures: (1) documented weight, (2) at least one SpO2 and RR documented for those with any respiratory illness, (3) at least one dose of a beta-agonist given to those with asthma, and (4) at least one dose of beta-agonist given to those with asthma and an SpO2 <90%. For measures requiring administration of a medication, only ALS providers were included. For each measure, a rate and 95% Confidence Interval were calculated. **Results**: There were 524,856 patients analyzed. Of these, 287,719 [54.8% (54.7–55.0%)] had a documented weight. There were 43,067 children with a respiratory impression, 37,689 of these [87.5%, (87.2–87.8%)] had at least one SpO2 and Respiratory Rate documented. 6,202 children had an impression of asthma and 4,336 of these [69.9% (68.8–71.1%)] received a beta-agonist. Of those children with an impression of asthma, 755 were hypoxic and 635 [84.1% (81.5–86.7%)] of them received a beta-agonist. **Conclusions**: These are the first benchmark data drawn from a large, national dataset against the EMS Compass measures. These results provide a starting point for quality improvement efforts and suggest areas for improvement in pediatric care. Only 55% of children had documented weights which are needed for correct medication dosing and only 83% of hypoxic asthmatics received a beta-agonists. This highlights opportunities for improvement.

50. AEDS on Wheels: A Pilot Programme to Equip Taxis with AEDS

Alexander White, Desmond Mao, Vernon Kang, Marcus Ong, *Singapore General Hospital* Category of Submission: Cardiac

Background: We aimed to determine the feasibility of improving AED utilization rates and time-to-first-shock times by equipping taxis with AEDs. **Methods**: This is a prospective observational feasibility study conducted in Singapore, a densely populated Southeast Asian nation with 5.54 million people on a land area of 719 square kilometres. There are 3,300 licensed SMRT taxis in Singapore. 155 drivers of the SMRT taxi company were recruited, trained and certified in CPR+AED skills. They were then assigned to 100 taxis equipped with AEDs and displaying AED decals on taxis' windows and interior. A phone app alerted drivers to cardiac arrests within 1.5 km. Drivers receiving the alert would choose to accept or decline to respond. Upon arrival, the drivers either provided AED to lay bystanders on scene or applied it themselves. If paramedics arrived at the scene first, taxis would be notified to stand down. Post-incident, drivers were required to document incident and submit AED for check-up and maintenance. **Results**: From November 2015 to July 2017, more than 2,400 activations were sent to a total of 71 drivers. A total of 24 taxi drivers accepted 192 alerts to mobilize. Of these mobilizations, 22 taxi drivers arrived at scene of 105 potential out-of-hospital cardiac arrest cases prior to ambulance arrival. The mean time of activation-to-acceptance of the case was 1.17 minutes (95%CI 0.90–1.43). The average time of activation-to-arrival at scene was 6.01 minutes (95%CI 5.24–6.78). Where the taxi arrived at scene, the average distance from case location to the initial location of the taxi was 763 meters (95%CI 654–871). Taxis that were closer to the incident had a higher likelihood of arriving before the ambulance (763 meters vs. 955 meters, P-value = 0.041). A total of 10 drivers were "Super Responders" as they had arrived at the scene three times or more. **Conclusions**: A voluntary "AEDs on Wheels" program can be an exciting feature of a public AED program (PAD). This mode of mobilizing AEDs has a high likelihood of utilization, increases the reach of AEDs, and improves time-to-first shock, all of which are important components of successful PAD.

51. Medical Command Training for Emergency Medicine Residents: An Overview of Medical Command Education, Oversight, and Evaluation

Abagayle Renko, Nicholas Julius, Chadd Nesbit, *Penn State Milton S. Hershey Medical Center* Category of Submission: Student, Resident, Fellow

Background: Training Emergency Medicine (EM) residents provide medical oversight as a requirement for EM residency accreditation through the ACGME; yet, no standard curriculum from which to train residents to develop this essential skill exists and literature describing the current state of resident medical command training is limited. We sought to assess the state of medical command training in EM residency programs. **Methods**: A thirty question survey was created and distributed electronically through email via the Research Electronic Data Capture (REDCap) program. The survey contained questions regarding demographics, general facility and program descriptors, medical command training procedures, personnel providing command, resident oversight, and feedback. Descriptive statistics were collected and analyzed using chi-squared tests for categorical variables. **Results**: A total of 109 surveys were completed (54.5% response rate), and 96 of those programs (88.1%) reported that their residents do receive formal medical command training. A majority of those programs begin medical command training during their residents' first (42 programs, 43.8%) or second (40 programs, 41.7%) year of residency. Most programs do not have required formal classroom-based (56 programs, 57.7%) or online-based (75 programs, 77.3%) training. EM physicians are the primary individuals providing training (91 programs, 93.8%). Most programs allow their residents to begin giving medical command in their second year of residency (52 programs, 54.7%). A majority of programs do not have a system in place to track how many medical command calls their residents take (63 programs, 66.3%), nor do they assign dedicated medical command shifts to their residents (85 programs, 89.5%). Most programs allow their residents to issue medical command orders without the presence of an attending physician (62 programs, 65.3%). A majority of programs indicated that their residents are provided feedback on their performance for their command call management (83 programs, 85.6%) and most programs indicated that medical command calls by residents are not routinely audited (51 programs, 53.4%). **Conclusions**: Most EM residencies train their residents in providing medical command, yet there is wide variation in how this is accomplished. Further research and analysis are required to make recommendations for a more uniform system of resident command training.

52. Near Misses in a Two-Tiered Suburban EMS System: A Descriptive Study on Down-Triaged Patients Who Are Taken

EMERGENTLY TO THE OPERATING ROOM OR ADMITTED TO INTENSIVE CARE UNITS

Joslyn Joseph, Joshua Bucher, David Feldman, Albert Ritter, Frederick Fiesseler, *Morristown Medical Center* CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY, SYSTEMS, DISASTER

Background: A two-tiered EMS system has the advantage of incorporating volunteer, public, and private BLS ambulances into the system to decrease response times and spread resources further. An ALS unit who responds to a scene may down-triage or "release" to BLS if no ALS interventions are warranted outside of BLS scope of practice to allow their unit to stay in service. To date, no studies have evaluated the characteristics of high-risk patients "released" to BLS and then taken to the Operating Room (OR) or admitted to the Intensive Care Unit (ICU). In order to make safer triage decisions, we sought to describe this "near-miss" mistriaged population of patients who were ultimately deemed to be critically ill by Emergency Departments and had the potential to decompensate quickly. **Methods**: Setting: A suburban two-tiered EMS system in which ALS units evaluate approximately 14,000 patients per year. Patients: All patients from 2007–2015 "released" to BLS, transported to an Emergency Department, and subsequently admitted to an ICU, Cardiac Catheterization Lab, or OR. Protocol: Demographics, history of present illness, vital signs, GCS, disposition, final diagnosis, and interventions done prior to EMS arrival and by EMS personnel were extracted via chart review and 95% Confidence Intervals (CIs) calculated when appropriate. **Results**: Out of 17,639 patients from 2007–2015 who were evaluated by ALS and triaged to BLS, 372 patients (2%) were mistriaged to BLS. The average age of patients was 66.4 years CI (61.0–71.7) and 52% were female. The most common mistriaged final diagnosis category was Neurological, 24% CI (23.3–24.7), followed by GI/Abdominal Emergencies 15%(14.3–15.7%). Sepsis was mistriaged 10.2% CI (9.5–10.9) of the time, and 9 patients, 2.4% CI (2.3–2.6) were taken emergently to the Cardiac Catheterization Lab. **Conclusions**: This is the first step to investigate this phenomenon unique to two-tiered EMS systems. From our study, we can conclude that more education is needed to recognize prehospital Neurological and Abdominal/GI Emergencies to avoid near misses in the future. More research is also needed to determine which patients, if any, had poor outcomes as a result of being mistriaged to make triage protocols safer for our patients.

53. ASTOUNDING RATES OF SUICIDALITY IN EMS PROVIDERS: A HIDDEN EPIDEMIC

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Background: EMS providers experience severe workplace stress, which increases their risk of suicidality. Past suicidal thoughts and attempts have been established as placing individuals at high risk for future suicidal behavior. We sought to assess the severity of the problem of suicidality in EMS providers and to identify potential factors that place individuals at higher risk. **Methods**: We administered a 19 item online survey to a convenience sample of 16 EMS agencies and 1,688 EMS providers. In order to assess for suicidality, the Suicide Behaviors Questionnaire Revised (SBQ-R) was utilized. SBQ-R assesses 4 dimensions of suicidality using a Likert scale. These 4 dimensions are (1) lifetime suicidal ideation and/or suicide attempt, (2) frequency of suicidal ideation over past 12 months, (3) threat of suicide attempt, and (4) likelihood of future suicidal behavior. In prior studies, a SBQ-R score of 7 or greater has been validated as an effective predictor of suicidal behavior. The SBQ-R score has previously demonstrated ability to identify individuals at risk for suicide with 93% specificity and 95% sensitivity. We used Pearson's chi-square to determine the relationship between suicidality and gender, age, shift-length, hours worked per week, years in EMS, race, practice setting, service type, family history of suicide, and knowing an EMS provider who committed suicide. **Results**: We received 289 completed surveys analyzed less than 2 weeks after survey distribution. 30.8% (89) [95% confidence interval (CI): 25.5–36.1%] of individuals had SBQ-R scores greater than or equal to 7, reflecting suicidality. The strongest predictors of suicidality were family history of depression or suicide [OR = 3.0 (1.8–5.1)], and working in a hospital-based service [OR = 2.0 (1.0–4.0)]. Gender, age, race, practice setting, shift length, hours worked per week, years in EMS, and knowing an EMS provider who committed suicide were not found to be statistically significant predictors of suicidality. **Conclusions**: High rates of suicidality exist within the EMS community; however, further research on risk factors and potential solutions needs to be conducted.

54. IDENTIFICATION OF SEPSIS IN THE PREHOSPITAL SETTING: AN OBSERVATIONAL STUDY OF PARAMEDIC SEPSIS SCREENING STRATEGIES

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Background: Sepsis is a life-threatening syndrome where earlier recognition and prompt intervention is critical to improving patient outcomes. In modern healthcare systems, paramedics encounter many sepsis patients first, offering an opportunity for earlier detection. The purpose of this study was to provide the incidence of paramedic reported suspicion of infection, and to compare the accuracy of published paramedic screening strategies for sepsis within a cohort of Emergency Medical Services (EMS) patients. **Methods**: A previously published systematic review that identified strategies for paramedic identification of sepsis was updated and used as the source for paramedic screening strategies. A one-year cohort of EMS data linked to in-hospital administrative databases (n = 131,745;89% linkage rate) was used for the cohort of EMS patients. Sepsis was identified by Emergency Department (ED) International Classification of Diseases v.10 Canadian (ICD-10CA) diagnosis codes, and EMS clinical information. The incidence of paramedic documented suspicion of infection in patients diagnosed with sepsis in the ED, and the sensitivity, specificity, positive, and negative likelihood ratios (LR) for each of the screening strategies, using the recommended score threshold as originally published where applicable are reported. **Results**: Paramedics documented suspicion of infection in 350 of 2,713 [13%(95% Confidence Interval) 2–14%] sepsis patients. Twelve paramedic sepsis screening strategies were identified in the literature. The PRESS, HEWS (score of > = 2), and Robson scores had the highest sensitivities [0.98(0.98–0.99), 0.87(0.86–0.88), 0.74(0.72–0.76) respectively], and lowest negative LR [0.08(0.04–0.08), 0.27(0.24–0.30), and 0.39(0.37–0.42), respectively] for ruling out sepsis. The PSP score (high risk) and Sepsis Alert strategies had high specificity [0.98(0.98–0.98] and 0.99(0.99–1.0)], and positive LR [19(17–22) and 13.6(11.6–16.0)] for ruling in sepsis, but lower sensitivity [0.34(0.33–0.36) and 0.07(0.06–0.08)]. Comparing the qSOFA score recommended in the Sepsis-3 definition to the previously recommended SIRS score, qSOFA was better for ruling in sepsis [positive LR 9.1(8.5–9.7) vs. 2.7(2.6–2.8)], while SIRS was better for ruling out sepsis [negative LR 0.67(0.65–0.70) vs. 0.74(0.72–0.75)]. **Conclusions**: Paramedics had low rates of documented suspicion of infection in sepsis patients. Paramedic screening strategies may help to identify sepsis, but the choice of strategy will depend on whether the goal is to correctly rule out versus rule in these diagnoses.

55. PRELIMINARY IMPACT OF ADDING FOLLOW-UP HOME VISITS ON CALL VOLUMES GENERATED BY EMS "SUPER-USERS" ENROLLED IN A NEW MOBILE INTEGRATED HEALTH PROTOCOL

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Background: Rising EMS call volumes tax EMS resources in many jurisdictions. A significant contributor to volumes includes the frequent 9-1-1 callers, some of whom may return home from hospitals with limited resources. After a new partnership in 2015 between EMS and our County's HHS agency helped facilitate services for 9-1-1 "Super-users", our previous study found a preliminary association with reduced call volumes. Our agency has now partnered with discharging hospitals to start a new home visit program under Maryland's new Mobile Integrated Health (MIH) Protocol beginning March 2017. We wished to establish if this additional intervention was associated with a reduction of EMS call volumes from enrollees in the protocol. Hypothesis: Initiation of follow-up home visits by our paramedics and hospital outreach nurses has an impact on EMS utilization by a selected group of enrolled 9-1-1 super-users. **Methods**: After our EMS-HHS partnership identified 9-1-1 super-users, we recruited a voluntary cohort to enroll in the MIH program. We retrospectively measured using CAD and EMS records cumulative call volumes for the group of new enrollees, 90, 60 and 30 days before and after the home visits program started. **Results**: A cohort of Patients (N = 10) was enrolled in the MIH protocol and scheduled for home visits beginning March 1, 2017. Cumulatively, those patients generated 63, 53, and 30 calls during the periods 90, 60, and 30 days, respectively, prior to the home visits. Thereafter, those calls decreased to 7, 8, and 18 calls for the periods of 30, 60, and 90 days, respectively, after visits began. The change yields 9-1-1 call reductions of 77%, 85%, and 71% during the post intervention three months. **Conclusions**: We believe super users in our large system benefit from a coordinated program of EMS partnerships with public health agencies and hospitals. A new partnership with Hospital Outreach and the initiation of follow-up home visits had preliminary impacts on call volumes generated by the enrollees over a 30–90 day period. More studies are needed to prospectively prove value, sustainability and best practices of these programs, and which interventions during home visits make the most difference.

56. MULTI-DISCIPLINARY COMMUNITY HEALTH CARE INTERVENTIONS REDUCE EMS UTILIZATION BY ELDERS

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Category of Submission: Professional

Background: Previous studies in a small, suburban town showed that more than half of elders who fall and require lift assists will activate the 9-1-1 system again within 30 days. Community-based interventions involving paramedics, visiting nurses, and primary care providers substantially reduced the frequency of repeat EMS and lift assist calls. This study was designed to evaluate these findings across larger and more diverse populations of elders at risk for falls. **Methods**: For this non-randomized, prospective study, informed consent to follow subsequent health care utilization was obtained from 2,265 participants residing in AMR's regional response areas. Participants chose to have no intervention, or the interventions that included sequential home visits by a research paramedic evaluating disability and home safety, a visiting nurse assessing for home health care requirements and eligibility, plus an offer of free transportation for a primary care provider visit. Participants were enrolled during (1) an EMS call for lift assist, (2) an ED visit, or by (3) self-referral. Subsequent EMS calls were captured by matching identifiers in our study database with those in AMR's call records. Outcomes compared the proportion of participants that had at least one EMS call during the 30 or 90 days following enrollment (nonintervention group), or completion of the intervention, using a generalized estimating equation approach, in SAS. **Results**: As of May 31, 2017, 980 non-intervention group participants completed >30 days of follow up, and 652 completed >90 days, vs. 1,285 intervention group participants completing > 30 days, and 980 completing >90 days. At 30 days, the intervention group showed a 51% reduction, and at 90 days, a 38% reduction in the proportion of participants with at least one EMS response (both $p < 0.001$), compared with nonintervention. ED enrollees benefitted most, with a 45% reduction in EMS utilization at 30 days ($p < 0.001$), and a 25% reduction at 90 days ($p = 0.009$). **Conclusions**: This study demonstrates short-term effectiveness of our multidisciplinary community health care interventions at reducing EMS utilization by the elderly. ED enrollees, by our metrics the group that was most disabled at baseline, appeared to benefit the most from the interventions.

57. Effect of Sodium Bicarbonate Administration During Out-of-Hospital Cardiac Arrests on End-Tidal CO2 Readings in Considering Termination of Resuscitation

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Category of Submission: Cardiac

Background: The administration of sodium bicarbonate (NaHCO3) during out-of-hospital cardiac arrests (OHCA) has been shown to produce increased end-tidal capnography (EtCO2) during resuscitations. Traditionally, EMS systems may authorize termination of resuscitation (TOR) efforts after prolonged periods where the EtCO2 remains <10 mmHg. However, if NaHCO3 has been administered, the EtCO2 may be elevated, possibly resulting in prolonged resuscitation efforts. The purpose of this study was to determine the effects of the administration of NaHCO3 during OHCA on EtCO2. We hypothesized that there would be no observable difference in EtCO2 readings between OHCA TOR patients who received NaHCO3 and those who did not. **Methods**: A retrospective analysis was performed on all OHCA TOR patients in a large, urban EMS system between January 2013 and December 2016. The off-line and on-line medical control databases were queried to identify all patients for whom the Provider Impression was "Cardiac Arrest." The records were individually examined to determine the EtCO2 readings and whether these patients received NaHCO3. **Results**: A total of 182 OHCA cases were selected which had a documented EtCO2, with 93 receiving NaHCO3 and 89 not receiving NaHCO3. The results were analyzed using a Welch's t-test. A significant difference was found in EtCO2 readings between the two groups, with a mean EtCO2 of 26 mmHg in the NaHCO3 group and a mean of 19.7 mmHg in the non-NaHCO3 group, with a p-value of 0.026. A subgroup analysis showed that when comparing the 50 highest EtCO2 readings, the significance was even greater, with a mean of 39.9 mmHg in the NaHCO3 group and 27.7 mmHg in the non-NaHCO3 group, with a p-value of 0.0018. When the EtCO2 readings were below 20 mmHg, there was no significant difference. **Conclusions**: There are no widely accepted guidelines for the technique of TOR in OHCA patients. The value of employing EtCO2 readings in TOR decisions is unclear. This study indicates that administering NaHCO3 during OHCA will significantly elevate the EtCO2, and NaHCO3 administration complicates the utility of EtCO2 when levels are above 20 mmHg. Further study of the use of EtCO2 in TOR decisions is necessary.

58. Feasibility of Recording Out-of-Hospital Cardiac Arrest Treatment Via Use of a Mobile Smartphone Application

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Category of Submission: Student, Resident, Fellow

Background: Given the demanding nature of out-of-hospital cardiac arrest (OHCA) resuscitations, recordings of the times of interventions in EMS patient care reports (PCRs) are often inaccurate. The American Heart Association developed Full Code Pro (FCP), a smartphone application designed to assist providers in recording the timing of interventions performed. Through OHCA simulations, this study assessed the group size necessary to use the FCP recording functions accurately and safely without compromising patient care. Program evaluation was based on participant feedback surveys, data accuracy, delays between recording and performing interventions, and delays in care attributed to using the application, stratified by group size. **Methods**: Simulations of a standard OHCA scenario using the Gaumard TraumaHal mannequin and a dedicated iPhone 5 pre-loaded with FCP version 3.4 were run with group sizes of 2–6 participants, with group sizes determined by participant availability. Participants included Connecticut certified paramedics and paramedic students who had completed the respective coursework. A seven-item feedback survey using a Likert scale established participant feedback on the application. Videos of the simulations were analyzed to assess for delays. One-way ANOVA with trend analysis was used to test if outcomes differed by group size and if differences tended in one direction in parallel with group size. **Results**: There were 37 simulations including 142 participants. The feedback survey questions achieved a Cronbach's alpha of 0.91 signifying high reliability, and demonstrated a linear trend supporting greater satisfaction with FCP as group size increases ($p < 0.001$). Similarly, increasing group size displayed linear trends with greater numbers of interventions recorded ($p = 0.009$) and fewer missed and false recordings ($p = 0.002$). Delays revealed significant linear trends ($p = 0.018$ for delays in recording and $p < 0.001$ for delays in care), as increasing group size corresponded with lesser delays. Greatest improvement was noted to be between groups of 3 and 4 participants. **Conclusions**: OHCA simulations using FCP demonstrate increased provider comfort, increased recording accuracy, and decreased delays as the group size increased. While the application may improve recordings for PCRs and future research, the data suggest a sufficient number of providers (>3) should be present to achieve reliable data without compromising patient care.

59. Influence of Neighborhood Socioeconomic Status on Disparities in Emergency Medical Services Use and Quality of Prehospital Care for Ischemic Stroke

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Category of Submission: Student, Resident, Fellow

Background: A minimal amount is known regarding the effect of neighborhood socioeconomic status (nSES) on emergency medical services (EMS) use and quality of prehospital stroke care. We assessed the association between nSES and EMS use, decision delay time, and quality of prehospital care among stroke patients. **Methods**: A retrospective cohort study was performed using the Get With The Guidelines-Stroke registry at two hospitals to identify patients with a hospital diagnosis of ischemic stroke between 2012 and 2016. Registry data were merged with data from EMS medical records and the United States Census Bureau. Patient addresses were geocoded and a one-kilometer buffer was created around each patient's address to represent their neighborhood. Census data from each buffer were used to create a composite nSES score, which was categorized into quartiles. Multivariable log-binomial regression models assessed the associations between nSES and 1) EMS use, and 2) decision delay time to calling 9-1-1. Among EMS patients, we also assessed associations between nSES and (1) dispatched EMS level of care, (2) EMS response time, (3) EMS on-scene time, (4) Cincinnati Prehospital Stroke Scale (CPSS) assessment, and (5) hospital prenotification by EMS. **Results**: Of 1,472 patients, 48% were aged 50–74 years, 50% were female, 73% were white, and 59% used EMS. Compared with patients in the highest nSES quartile, patients in the lowest nSES quartile were 20% less likely to use EMS (risk ratio (RR): 0.80; 95% confidence interval (CI): 0.67, 0.95). EMS providers performed the CPSS on 65% of patients. Patients of lower nSES were less likely to have a CPSS performed: risk ratios, compared with the highest nSES quartile, were 1.72 (95% CI: 1.14, 2.60), 2.91 (95% CI: 2.00, 4.21), and 3.39 (95% CI: 2.30, 4.99) for nSES quartiles 2, 3, and 4 (lowest nSES), respectively. nSES was not significantly associated with other outcomes. **Conclusions**: Among a sample of ischemic stroke patients, 41% did not use EMS and those of lower nSES used EMS more frequently. EMS providers performed the CPSS assessment less frequently on patients of lower nSES. Understanding reasons for these observations is vital to improving the quality of prehospital stroke care.

60. Paramedic Recognition of Paroxysmal Supraventricular Tachycardia

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Ontario CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Paroxysmal supraventricular tachycardia (PSVT) is a common group of arrhythmias that Advanced Care Paramedics (ACPs) can often manage with vagal maneuvers, adenosine, and/or cardioversion, provided that they correctly identify the rhythm. The purpose of this study is to determine the accuracy of ACP identification of PSVT. **Methods**: Following ethics approval, all calls with patients ≥18 years with a 12-lead ECG available, who were assessed by ACPs within a region of western Ontario between July 2015 and December 2015 and had a documented heart rate>150 bpm, were included. Paramedic call reports were retrospectively reviewed for study data, including documentation of ACP identified PSVT. The reference standard was consensus between a fellow and prehospital physician who adjudicated each ECG for the presence of PSVT in a blinded, independent fashion. In the event of a disagreement, a third, blinded prehospital physician was used for consensus. **Results**: Of the 442 patients included, 197 (45%) were male and the median age [Interquartile range(IQR)] was 70.0 years (58.0–82.8). ACPs identified 74 (16.7%) patients as having PSVT. Of these, 48.5% had a history of previous arrhythmia, compared to 31.9% of patients with no ACP identified PSVT ($p = 0.026$). They were also significantly younger [median(IQR) = 63.0 (47.0–72.0)] compared to those without ACP identified PSVT [median(IQR) = 72.0 (61.0–85.0)] ($P < 0.0001$). Sensitivity of ACP identified PSVT was 97.3% (95%CI:85.8–99.9%) and specificity was 90.6% (95%CI:87.3–93.3%). The positive predictive value (PV) of ACP identified PSVT was 48.6% (95%CI:41.1–56.3%), the negative PV was 99.7% (95%CI:98.1–99.9%), the positive likelihood ratio (LR) was 10.4 and the negative LR was 0.03. Moderate inter-rater agreement was seen between initial ECG interpretations [387 (87.6%)] (kappa = 0.42, 95%CI:0.29–0.54) by the fellow and prehospital physician, while agreement was higher (good) between the two prehospital physicians [49/55 (89.1%) (kappa = 0.70, 95%CI:0.48–0.92)]. **Conclusions**: These results indicate that ACPs are adept at identifying PSVT, but are prone to false positives. Given the relatively good sensitivity and specificity seen in this investigation, future studies should investigate ACP recognition of specific rare arrhythmias (antidromic accelerated atrial fibrillation) that may require different management including avoidance of adenosine.

61. POLICE DEPARTMENT TACTICAL MEDICINE (TACMED) PROGRAM IMPACT ON TRAUMA PATIENT MORTALITY: REVIEW OF A LARGE URBAN EMS AND TACMED SYSTEM

Elliot Ross, David Wampler, Avery Kester, Xandria Gutierrez, Crystal Perez, Lauren Reeves, Alejandra Mora, Joseph Maddry, Craig Manifold, *San Antonio Uniformed Services Health Education Consortium* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Tactical Emergency Medical Services (TEMS) is a growing subspecialty of prehospital care. Tactical providers are ideally suited to provide care at the point of injury in areas traditional EMS cannot enter. A minimal amount is currently known regarding the clinical impact of these programs. This study examines patient outcomes of those treated by a Police based TEMS system vs. traditional EMS. **Methods**: Study inclusion criteria consisted of trauma patients where police were dispatched and EMS was staged and were then transferred to a Level I trauma hospital. All patients that died at the scene or enroute were excluded. The computer automated dispatch (CAD) system was used to identify all cases from 2011–2015. The TEMS and EMS records for cases meeting inclusion criteria were extracted. Demographics, injury description, prehospital index (PHI) scores, disposition, and interventions were collected. Hospital disposition and outcome data were linked using the regional trauma registry. Using gender, injury year/type, age, and ISS a case-match controlled comparison between EMS and TEMS records (2:1) was conducted. Chi-square (or Fisher's Exact) test for categorical and t-test (or Wilcoxon) for continuous variables. **Results**: Of the 122,707 CAD events, only 2243 met inclusion criteria. Seventy TEMS records and 140 EMS case matched controls were included. Majority were male (90%) civilians (99%) with a median age of 31. Sixty percent of patients were injured secondary to a shooting, 30% stabbing, and 10% assault. Moderate to severe bleeding was encountered in 75% of patients, and 46% sustained major trauma (PHI ≥ 4). TEMS providers had a shorter response time compared to EMS providers; 6 vs. 13 minutes, $p < 0.0001$. Cohorts had similar PHI scores and intervention performance rates. Final hospital disposition and hospital resource utilization were comparable. Both had similar number of ventilator, ICU, and hospital days. There was no difference in mortality rates. **Conclusions**: In this study, TEMS providers exhibited shorter response times and performed medical interventions at similar rates to traditional EMS. Although no differences in patient outcomes were noted, all patients who died prior to hospital arrival were excluded. Future studies are needed to determine how response time impacts the rate of preventable death.

62. OPTIMIZING DEPLOYMENT OF MECHANICAL CPR DOES NOT IMPROVE OHCA OUTCOMES WHEN COMPARED WITH MANUAL CPR

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Background: Deploying mechanical CPR in out-of-hospital cardiac arrest (OHCA) is logistically challenging. Inefficient deployment might explain reports of unfavorable OHCA outcomes associated with mechanical CPR. We hypothesized that in an EMS system with optimized deployment, sustained ROSC and survival to hospital discharge will not differ for OHCA patients managed with and without mechanical CPR. **Methods**: In 2015, we initiated a quality improvement process to choreograph and optimize deployment of mechanical CPR. All primary first response agency (attending ±75% of OHCAs) field personnel attended in-person training and practical exercises emphasizing high quality traditional CPR, timely defibrillation, airway management / ventilatory support and first-round medication administration before initiating mechanical CPR. We then analyzed all adult, non-traumatic OHCA attended by the first response agency during 2016. During the study period, mechanical CPR devices were deployed on some—but not all—first response units; use of mechanical CPR was based primarily on availability and/or whether patients achieved ROSC after initial resuscitation attempts. We therefore used propensity score matching to select cases with and without mechanical CPR that had similar patient demographics and arrest characteristics. We excluded OHCAs with sustained ROSC following only CPR or defibrillation without medication administration, terminations of resuscitation without meaningful resuscitation attempts (including DNRs), and EMS-witnessed arrests. All prehospital data were obtained from the EMS electronic health record; hospital outcomes were obtained from receiving hospitals. **Results**: Of 444 eligible OHCAs, 227 received mechanical and 217 received traditional CPR. Crude ROSC (29.1% vs. 39.2%) and survival to discharge (5.7% vs. 13.8%) were lower with mechanical CPR, but mechanical CPR cases were also less likely to be witnessed arrests and less likely to present with a shockable rhythm. In the propensity score analysis of 187 patients with mechanical CPR well-matched to 187 patients with traditional CPR, both ROSC (29.2% vs. 39.5%; difference: −10.3%; CI: −0.7% to −19.9%) and survival to discharge (7.0% vs. 14.1%; difference: −7.1%; CI: −0.9% to −13.1%) remained significantly lower for patients receiving mechanical CPR. **Conclusions**: In an EMS system with optimized deployment, mechanical CPR was associated with decreased ROSC and decreased survival to discharge.

63. GENDER DISPARITIES IN THE PREHOSPITAL SETTING AMONG KNOWN ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION PATIENTS

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Background: Identification of a ST elevation myocardial infarction (STEMI) in the prehospital setting has been shown to decrease door-to-balloon time and mortality. Up to 20% of STEMI patients do not present with typical symptoms and gender disparities exist in the prehospital setting in the assessment of patients ultimately found to have ACS. Our hypothesis is women are more likely to have delayed STEMI care than men. **Methods**: This is a retrospective cohort study of 9-1-1 patients who were transported by a single large urban EMS provider to STEMI-Receiving Centers (SRC) from January 2011 to December 2015 and were diagnosed with a STEMI, had emergent PCI, and were found to have a culprit coronary artery obstruction. Our primary outcome was EKG-to-balloon time (E2B). Our exclusion criteria were: interfacility transfer, age under 18, inability to calculate E2B, and missing gender data. Our secondary outcomes were: time intervals from 9-1-1-call through device time. **Results**: Of the 2,778 patients eligible for analysis, 2,148 patients were included in final analysis after application of the exclusion criteria. Women had longer on-scene times, longer times from 9-1-1-call to arrival at the SRC, time from first medical contact (FMC) to balloon, and time from 9-1-1 call to EKG ($P < 0.001$). Time from first medical contact to cath lab arrival was longer in women, but did not reach statistical significance ($P < 0.002$) using a very conservative Bonferroni-corrected p-value. There were no statistically significant differences in whether or not a prehospital EKG was performed or transmitted, whether a prehospital EKG indicating STEMI was noted, whether or not aspirin was given, transport time, time from EKG to cath lab arrival, EKG-to-balloon or door-to-balloon ($p > .001$). **Conclusions**: Our study demonstrates women are more likely to have delayed times from 9-1-1-call to hospital arrival, FMC to balloon, and time from 9-1-1 call to EKG, but do not have a delayed E2B or door-to-balloon time. Limitations include short transport times, a single urban EMS service, and the retrospective nature of the study.

64. STATEWIDE RETROSPECTIVE ANALYSIS ON THE CHARACTERISTICS OF EMS REFUSALS OF CARE

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Medical School Category of Submission: Student, Resident, Fellow

Background: Improving EMS systems of care requires a better understanding of out-of-hospital refusals of care. There is a paucity of data on EMS refusals of care. Studies over the past three decades have shown widely varying results on the characteristics, demographics, and rates of EMS refusals of care. The purpose of this study is to analyze, at the state level, the characteristics, demographics, and rates of EMS refusals of care to provide a platform for identifying targets to help improve EMS systems of care. **Methods**: Delaware statewide EMS data for all refusals and transports were queried for the calendar year of 2016. Age, gender, dispatch reason, time of year, and location were aggregated and retrospectively analyzed through descriptive statistics and multi-variate logistic regression. **Results**: Of the 155,303 EMS incidents, 12,244 (7.9%) resulted in refusals of care. Patients 65 years and older had a smaller percentage of refusals than adults 18–64 years old and children <18 years old (6.4% vs. 8.8% vs. 10%, $p < 0.001$). Men had a greater refusal rate than women (8.5% vs. 7.3%, $p < 0.001$). Diabetes-related problems (36.2%) and motor vehicle accidents (28.5%) resulted in the highest rates of refusal of care ($p < 0.001$). The highest percentage of overall refusals occurred during mid-summer (8.8%, $p < 0.001$). Locations of care which include places of recreation and bodies of water had the highest refusal rates (45.6% $p < 0.001$). **Conclusions**: In this population, geriatric patients had lower refusal proportions; whereas, prior studies suggested that geriatric refusal numbers are greater than other age groups. The greater refusal rate among men is consistent with previous literature. Prior studies have shown the highest rates of refusals for motor vehicle accidents and other trauma, however, diabetes-related problems comprised the highest percentage of refusals in this population. Mid-summer time of year and places of recreation also comprised high percentages of refusals and further investigation is necessary to identify root causes of these patterns.

65. Feasibility of Point-of-Care Ultrasound (Pocus) in Out-of-Hospital Cardiac Arrest (OHCA) by Novice Ultrasonographers

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Background: Point-of-care ultrasound (POCUS) may be a useful tool to predict survival and guide interventions in out-of-hospital cardiac arrest (OHCA), yet a paucity of data exists on its prehospital use by users with limited ultrasound experience. We aimed to determine the feasibility of using POCUS during OHCA by resident and fellow physicians staffing a 24/7 prehospital response vehicle and identify barriers to its use. **Methods**: We deployed a portable ultrasound device (iViz, by Sonosite) for use by prehospital physicians for OHCA in an urban EMS system. All physicians received POCUS education as part of graduate training, and were provided an instructional video on use of the iViz device. POCUS use was limited to identifying cardiac motion during pulse checks, without interrupting resuscitation, and the results could be used to guide management at the physicians' discretion. Data were recorded prospectively by saving video and still images on the device and through a custom electronic form within the patient care report (emsCharts). The primary measure was the frequency of use of POCUS during OHCA. Secondarily, we characterized image quality by expert (ultrasound fellowship trained) faculty review (using kappa statistic for agreement), and identified barriers to the use of prehospital POCUS. **Results**: From November, 2016 to March, 2017, 348 physician field responses were reviewed, including 127 cases of OHCA, and 56 (44%) cases with POCUS performed. Still or video images were recorded in 48 (86%) cases and video in 34 (61%) cases. From video images, agreement in identifying cardiac motion between prehospital physician and expert reviewer occurred in 91% of cases (K=0.82). Reasons cited for not using POCUS included return of circulation soon or before arrival, prioritizing interventions, provider preference, not having the ultrasound device, mechanical failure, and cessation of resuscitation per advanced directives. **Conclusions**: Use of POCUS by novice prehospital physician ultrasonophraphers to detect wall motion in OHCA is feasible and correlates with expert interpretation. Several avoidable barriers to the use of prehospital POCUS may be addressed through additional educational interventions and increased familiarity with the device.

66. Air Versus Ground Transfer to Comprehensive Stroke Center in Patients with Large Vessel Occlusion Stroke

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Background: Optimal treatment ischemic stroke caused by a large vessel occlusion (LVO) involves timely transfer from a primary stroke center to a comprehensive stroke center (CSC) that can offer mechanical endovascular therapy. Transfers are either done via air or ground, however data have not shown a clear benefit of one method of transfer over the other. The objective of this study was to compare air vs ground transfer times from decision to transfer to definitive care in patients with LVO strokes transferred to a single CSC. **Methods**: This is a cohort study of patients transferred to a single suburban CSC (January 2015–December 2016) from seven primary stroke centers within a 15-mile radius with the diagnosis of LVO stroke. Key time intervals including transport time, time from decision to transfer (access to sending hospital EMR allowed characterization of this time point), and time intervals from arrival to first ED to interventional skin puncture (access) and reperfusion at the CSC were recorded. Non-parametric statistics were used for comparisons. Median and range are reported. **Results**: There were 30 inter-hospital transfers from within a 15-mile radius. Of these 16 were by air and 14 were ground transfers. Air transport times were significantly shorter (16.5 vs. 30.0 minutes, $p = 0.013$). There was no difference between transfer decision-CSC ED arrival between air and ground (65.5 vs. 67.5 minutes, $p = 0.967$, respectively). In hospital processes for air and ground transfer patients at the CSC were shorter but not significantly so, CSC door-table (2.5 minutes vs. 16.5, $p = 0.44$) and CSC door to access (28.0 vs. 40.5, $p = .44$). Time interval for air and ground transfer were not different for arrival to 1st ED to access (155.5 vs.172, $p = 0.118$ or arrival - reperfusion (208.5 vs. 211, $p = 0.495$). **Conclusions**: In our small pilot study, despite shorter transport times, there was no significant difference between air and ground transfer from decision to transfer to CSC arrival, or time from first hospital to access or reperfusion. Assessment of unmeasured intervals are needed to assess the optimal method for inter hospital transfer of critical patients.

67. Patient Preferences toward Emergency Medical System Provider Attire

Jesse Olsen, Jeffrey Lubin, Khaled Iskandarani, *Penn State College of Medicine* Category of Submission: Operations, Quality, Safety, Systems, Disaster

Background: In a health-care landscape driven by patient satisfaction and quality assurance, preferences towards provider attire has become a topic of interest. Uniforms afford essential visual clues for personnel identification; recent research demonstrates attire impacts patient preferences for both nurses and physicians in emergency settings. In emergency medical systems, teams rely on trust for effective and successful responses. In the context of EMS personnel, no studies have addressed patient perception of attire. This prospective study addresses how EMS attire influences patient perception of care through five different variables: likeability, trust, confidence, willingness to confide, and intelligence. **Methods**: Over six weeks in the Emergency Room at Penn State Hershey, 165 surveys were completed evaluating a team of two EMS providers. Participants surveyed viewed one of three two-minute videos of an EMS team responding to a patient with chest pain. In each video EMS personnel wore a distinct outfit: a blue tee shirt, a white button-up shirt or turnout gear. Participants subsequently completed a six question survey addressing providers on a 5-point Likert scale. Attires were compared using a two tailed Kruskal-Wallis test, a non-parametric equivalent of an ANOVA. **Results**: Of 165 surveys completed, 87.5% of responders rated EMS attire as important. No differences in responses were found related to patient age, gender or ethnicity. Analysis of the likert data, showed no significant differences with respect to perceived provider trust, smartness, likeability or confidence. However, participants answered significantly lower on the Likert scale for willingness to discuss confidential information with the providers in the turnout gear compared to the other two attires at an alpha of .0057. **Conclusions**: Based on our results, EMS provider attire does not impact patient perceived quality of care. Lower responses were found for turnout attire, possibly from a lack of association of EMS providers with fire gear. Studies drawing a larger sample, and those that analyze more outfits or aspects of provider appearance would lend support to this conclusion. Our study was small, limited by length of the videos, and number of outfits tested but our results conclude attire as a minor factor in EMS responses.

68. Multivariable Analysis of Factors Associated with EMS Non-transports

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Background: Emergency response without transport confers a risk of negative patient outcomes, increased liability, and non-payment. Yet, few rigorous studies have identified risk factors for non-transports. We aimed to identify demographic and clinical characteristics predictive of non-transports using a large database of out-of-hospital EMS responses. **Methods**: We retrospectively reviewed consecutive patient care records from 21 urban, suburban, and rural EMS agencies in Western Pennsylvania from April 2013 to December 2016. We identified age, gender, race, ethnicity, level of transport,

last vital signs (BP, RR, HR, SPO2, and GCS), loss of consciousness (LOC), abnormal mental status (AMS), medical category, and time of day. We excluded cases of cardiac arrest, interfacility/scheduled transports, EMS assist, no patient encountered, and patients aged <18 years or unknown age. For non-transports, we described the incidence of protocol-defined abnormal vital signs (HR <50, >100; SBP <100, >200; DBP <50, >100; RR <12, >24; SpO2 <95; GCS <15), LOC, and AMS. We used unadjusted and adjusted logistic regression to identify independent predictors of non-transport. **Results**: We identified 385,908 cases meeting study criteria, with 35,266 (9.1%) non-transports. Patient characteristics were: median age 59 years (IQR 41–77), 55.6% female, 16.8% Black, 0.7% Hispanic, and 96.3% advanced life support (ALS). Incidence of abnormal vitals were HR (N = 4435, 12.6%), SBP (N = 539, 1.5%), DBP (N = 1324, 3.8%), RR (N = 159, 0.5%), SpO2 (N = 1543, 4.4%), and GCS (N = 834, 2.4%). There were 785 (2.2%) with LOC and 2031 (5.8%) with AMS. In adjusted multivariable analysis, we identified associations (OR, 95%CI) with non-transports and male gender (1.08, 1.00–1.16); ALS (1.60, 1.04–2.47); and morning [6:00–11:59] hours (0.79, 0.70–0.88) and evening [18:00–23:59] hours (1.07, 1.03–1.11), compared to overnight [0:00–5:59] hours. Medical categories most associated with non-transports were trauma (2.37, 1.79–3.14), dizziness/syncope (1.80, CI 1.47–2.20), and allergic reaction (OR 1.54, CI 1.33–1.79). Race, ethnicity, LOC, and AMS were not associated with the incidence of non-transports. **Conclusions**: Patients not transported by EMS often have abnormal heart rate and are associated with complaints of trauma, dizziness/syncope, or allergic reaction. This information can guide patient refusal protocols and future research on outcomes of these at-risk patients.

69. Among Stemi Patients, Is Inferior ST Elevation Associated with a Higher Frequency of Hypotension after Field Nitroglycerin?

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Category of Submission: Cardiac

Background: Patients with inferior STEMI involving the right ventricle are believed to be at higher risk for hypotension after nitroglycerin (NTG). The objective of this study was to determine if inferior STEMI is associated with increased risk of hypotension upon ED arrival in patients treated with NTG by EMS. **Methods**: Consecutive adult patients with suspected STEMI transported by EMS to one of three participating PCI-capable hospitals were prospectively identified and maintained in a log during an 18-month period. Investigators reviewed records for initial field and ED vital signs, field NTG treatment, and hospital outcomes. Inter-rater reliability was assessed on a random 10% sample of records using the kappa statistic. Patients with a hospital diagnosis of STEMI treated with NTG were included. Patients with hypotension on EMS arrival were excluded. Inferior STEMI was defined as ST-elevations in the inferior leads on the prehospital ECG. The frequency of ED hypotension, defined as a triage SBP less than 100 mmHg, in patients with inferior STEMI was compared to patients with other STEMI. Patients were further stratified by lesion location. The frequency of hypotension was compared with Fisher's exact test and change in SBP with Hodges-Lehmann's median difference. **Results**: Of 239 patients with STEMI, 46 were excluded for initial hypotension and 38 did not receive NTG; thus, 155 comprised the study cohort. Median age was 61 years; 71% male. Hypotension occurred in 10 (14%) with inferior STEMI and 3 (4%) with other STEMI, RR 1.13 (95%CI 1.00, 1.23) p = 0.04. Hypotension was mild; one patient with inferior STEMI arrived with SBP <90 mmHg due to cardiac arrest. Inter-rater reliability was excellent, kappa 0.93 (95% CI 0.80, 1.0). Mean decrease in SBP was -15 ± 23 mmHg and -10 ± 22 mmHg in inferior and other STEMI, respectively, median difference in the decrease in SBP −4.5 mmHg (95% CI −12.0, 3.0). Compared to patients treated with PCI in any other location, hypotension after NTG among patients with proximal or mid RCA lesions was similar, RR 1.0 (95%CI 0.9, 1.1) p = 0.6. **Conclusions**: When compared with other STEMI patients, those with inferior STEMI had a slightly higher risk of mild hypotension after field NTG; RCA lesion location was not associated with an increased risk.

70. Characteristics of Emergency Medical Technician Graduates Unsuccessful on the National Certification Cognitive Examination

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Category of Submission: Operations, Quality, Safety Systems, Disaster, Disaster

Background: Research on EMT student performance has focused on pass rates and characteristics related to success. Conversely, a minimal amount is known regarding EMT graduates who were unsuccessful at passing the examination. The objective of this study was to describe demographics and test-related performance of graduates unsuccessful on the computer adaptive National EMT Certification examination. We hypothesized that the majority of candidates who are unsuccessful on the examination are close to the passing standard (maximum length testers) and would be likely to retest. **Methods**: National EMT Certification cognitive examination results for graduates of non-military EMT education programs from the class of 2013 were analyzed as a cross-sectional evaluation. The computer adaptive test terminates when the 95% confidence interval surrounding the estimate of the candidate's ability is entirely above or below the passing standard. Test length ranged from 70 to 120 questions. Unsuccessful testers were defined as candidates who had a grade of fail or incomplete (did not finish the examination) on their first examination attempt. Chi-square tests were used to compare demographics of candidates and to assess for differences in retesting between minimum and maximum length testers. **Results**: A total of 59,560 EMT graduates from the class of 2013 attempted the National EMT Certification cognitive examination and 33% (n = 19,899) were unsuccessful the first attempt. The proportion of males and females who were unsuccessful did not differ (males: 34%, n = 12,642; females: 33%, n = 6,187, p = 0.05). More than one-third of unsuccessful candidates received the maximum number of questions (36%, n = 7,128) while 40% (n = 7,985) received the minimum number of questions. Of those unsuccessful on the first attempt, 66% (n = 13,111) attempted a second examination. More maximum length testers attempted a second examination compared to minimum length testers (72%, n = 5,156 vs. 60%, n = 4,763, p < 0.001). **Conclusions**: Two-thirds of first-time candidates unsuccessful on the National EMT Certification cognitive examination attempted a second examination. A greater proportion of those close to the passing standard (maximum length testers) retested. Future work is needed to better understand the reasons behind candidate retesting including personal and educational experiences.

71. Interfacility Transport of the Pregnant Patient: A 5-Year Retrospective Review of a Single Academic Center Based Critical Care Transport Program

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Category of Submission: Student, Resident, Fellow

Background: Interfacility transport of pregnant patients involves unique challenges and considerations. Data from the National Emergency Medical Services Information System (NEMSIS) dataset indicate that 0.6% of all EMS transports and 0.6% of interfacility transports involve pregnant patients. Limited information exists surrounding the safety and adverse events of this patient population in the out-of-hospital setting. This study aimed to examine clinically significant adverse events that occur during the interfacility transport of pregnant patients. **Methods**: A retrospective review of quality assurance data was performed. The study population consisted of pregnant patients transported to the labor and delivery units of two hospitals within an academic quaternary-care hospital system between January 2012 and December 2016. Primary outcomes (adverse events) were defined as: hypotension, respiratory distress, exacerbation of hypertensive disease of pregnancy (preeclampsia, eclampsia), need for vasoactive medications, dysrhythmia, intubation or unintended extubation, change in mental status, need for restraints, cardiac arrest or death, and delivery during transport. Use of online medical direction and reason for consultation were secondary outcomes of interest. **Results**: Our critical care transport system performed 30,181 total interfacility transports within the five year study period. 709 patients (2.4%) met inclusion criteria. Clinically significant adverse events occurred during 32/709 patient transports (4.5%). The most frequent events were: exacerbation of hypertensive disease requiring intervention (25), hypotension (4), and altered mental status (2). There were zero instances of cardiac arrest, death, or delivery. **Conclusions**: Interfacility transport of pregnant patients is a common occurrence that involves unique challenges and risks. Within the experience of this critical care transport program, significant adverse events were identified in 4.5% of transported patients over a 5-year period. This data will help guide the training of prehospital providers and the formation of protocols to mitigate and respond to these events. Notable limitations include the use of data from a single system, absence of scene transports, and use of paramedic/nurse crew configuration.

72. Advanced Provider Response Unit (APRU), an Answer to Low-Acuity 9-1-1 Calls?

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Category of Submission: Student, Resident, Fellow

Background: The Los Angeles Fire Department (LAFD) has experienced an unsustainable increase in 9-1-1 calls. Over the past 2 years, call volume rose by 14%; vastly higher than the historical rate of increase of 1–2%. To address the increasing call volume, while still providing care for the citizens of Los Angeles, the LAFD launched the Advanced Provider Response Unit (APRU), a specialized ambulance staffed by a licensed advanced practice

provider (APP) and a firefighter/paramedic with the mission of treating and releasing patients on scene and providing linkage to further care. This is a description of the first 19 months of service. Methods: This was a retrospective review of LAFD electronic health records from January 2016 to August 2017 in the Los Angeles area. The APRU was active 4 days a week for approximately 82 weeks. Enrolled patients were either low-acuity 9-1-1 callers, identified through monitoring 9-1-1 radio traffic or housed (i.e., non-homeless) 9-1-1 frequent users identified from prior LAFD health records. Summary descriptive statistics were collected. **Results**: The APRU was linked to 1,079 incidents over approximately 328 days of service (mean 3.3 incidents/day). Of these incidents, there were 127 cancellations, 88 found no patient, 13 refused care, and another 12 were ineligible for APRU care. The remaining 839 were treated (77.8%). Of those treated, 379 (45.2%) were treated and care was transferred to another transporting unit, 360 (42.9%) were treated and released on scene, and 100 (11.9%) were treated and transported. Of the 100 transported by the APRU, 58 were transported to a non-emergency room with 55 transported directly to mental health clinics and 3 to a sobering center. Of the 360 treated and released on scene, the APRU spent an average of 23 minutes on scene (minimum 1 minute, maximum 1 hour 15 minutes, median 20 minutes). **Conclusions**: The LAFD APRU has shown promise in decreasing costly EMS transports and ED care. Furthermore, by leveraging the diagnostics skills of the APP, patients can be treated and released on scene or medically cleared for alternate destinations. Further research is needed to study this novel type of EMS care.

73. Predictive Value of Each Component Field Triage Guidelines on Hospital Outcome in EMS-Treated TBI

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Background: Unbiased estimates for field triage guideline performance are important in optimizing trauma systems and improving outcomes among seriously injured patients. The accuracy of each triage component has not been evaluated in traumatic brain injury (TBI) patients. Based on evaluation as a diagnostic test, we considered the standard to be mortality and disability, which is the final hospital outcome. The aim of this study is to predict the performance of each component of field triage guidelines on hospital outcomes in TBI patients. **Methods**: This was a cross-sectional observational study using a nationwide, prospective registry of severe trauma patients treated by emergency medical services (EMS) providers in 10 provinces in Korea. The study population was adult TBI patients between January 2013 and December 2013. The main exposure was each component of field triage set by the American College of Surgeons Committee on Trauma and Centers for Disease Control and Prevention as determined by EMS provider. The primary outcome was hospital mortality and secondary outcome was disability at discharge. Disability is defined as new disability or worsened Glosgow Outcome Scale (GOS) including death than pre-event GOS. Sensitivity, specificity and area under the curve (AUC) were calculated. **Results**: Total 5,133 patients met the field triage guidelines. 21.5% died, and 51.4% of patients had disability. The sensitivity and specificity for mortality of the physiologic, anatomic and mechanical criteria were 91.4% and 47.3%, 20.0% and 93.15%, 57.8% and 89.3%, respectively. Among each component of criteria, altered mentality showed highest sensitivity and AUC for mortality, which was 89.2% (95% CI 87.4 to 91.0) and 0.699 (95%CI 0.687 to 0.711). Amputation and chest wall instability in anatomic criteria showed highest specificity for mortality, 99.8% (95%CI 99.6% to 99.9%). Altered mentality showed highest sensitivity and AUC for disability, which was 75.9% (95% CI 74.3% to 77.5%) and 0.671 (95%CI 0.658 to 0.684), respectively. **Conclusions**: The physiologic criteria of field triage guidelines showed high sensitive for mortality. Anatomic and mechanical criteria showed low sensitivity and high specificity. The trend was similar for disability. Altered mentality of physiologic criteria showed highest sensitivity and AUC among each component of field triage scheme.

74. Effect of Chest Compression Parameter Variation on Waveform Characteristics of the Ventricular Fibrillation Electrocardiogram

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Background: The ventricular fibrillation (VF) electrocardiogram (ECG) waveform is known to deteriorate over time if untreated, recover with CPR, and to predict defibrillation success. VF ECG measures could inform CPR quality feedback algorithms based on patient physiologic response. Objectives: Investigate the effects of chest compression rate, depth and duty cycle (DC) on VF ECG waveform characteristics in a swine cardiac arrest model. **Methods**: Twelve mixed-breed domestic swine were sedated (ketamine & xylazine), anesthetized (fentanyl) and paralyzed (vecuronium), followed by endotracheal intubation and mechanical ventilation. Animals were instrumented with a battery of physiological sensors, including multi-lead ECG (BioAmp, ADInstruments, Inc), recorded continuously with a high-fidelity data acquisition unit (PowerLab, ADInstruments, Inc) at 1000 Hz. Ventricular fibrillation was induced with a 3-second 100 mA transthoracic shock. After 7 minutes, animals were randomized to receive continuous CPR with a custom robotic device using 1 of 6 pre-programmed, 2-phase CPR schemes that varied 1 parameter in 5 x 1-minute intervals per phase while holding the other 2 parameters fixed. Frequency (AMSA) and slope-based (MS) quantitative ECG characteristics of artifact-filtered ECG were calculated from 3-second segments at the end of each 1-minute interval and compared between rate, depth and DC schemes, as well as experimental phases. Correlations between CPR parameter settings and ECG characteristics were calculated. **Results**: Compression rate showed a low-to-moderate correlation (0.454) with change in MS in Phase I, however neither DC nor depth showed a correlation with either AMSA or MS. In ANOVA models, MS differed between CPR groups at the end of Phase I ($p = 0.046$) but not AMSA, suggesting limited response of quantitative ECG measures after extended time intervals. **Conclusions**: In this study only chest compression rate in early phase CPR appeared to be related to quantitative characteristics of the VF ECG.

75. Variation in the Characteristics of Patients with Acute Stroke Arriving by EMS Versus Those Arriving by Private Vehicle

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Background: We conducted this study to identify differences between patients arriving by EMS versus those arriving by private vehicle with acute ischemic and hemorrhagic stroke. Determination of these differences may allow for refinement of public education on the timely treatment of acute stroke. **Methods**: This study was conducted at an academic medical center that is an accredited comprehensive stroke center. Consecutive patients with acute stroke were enrolled between January 2015 and May 2017, and were categorized by mode of arrival (EMS vs. private vehicle). The type of stroke (hemorrhagic vs. ischemic) was identified and the NIHSS measured in the ED for all stroke patients, with the ICH Score and Hunt & Hess Score determined for ICH and SAH respectively. Age, gender, PMH of stroke, and "time last known well" were identified. Statistical analysis was performed using the Yates corrected Chi-Square, Mann-Whitney, and Kruskal-Wallis tests. **Results**: A total of 935 patients were enrolled with 716 (77%) arriving by EMS and 219 (23%) arriving by private vehicle. Of these, 636 (68%) had ischemic strokes, 190 (21%) had ICH, 92 (10%) had SAH, and 17 (2%) were not classified. Ac greater proportion of ICH (93%) and SAH (93%) patients than ischemic stroke patients (69%) arrived by EMS ($p < 0.001$). Patients arriving by EMS had significantly higher NIHSS (9.2 vs. 2.7, $p < 0.001$), ICH scores (1.7 vs. 0.3; $p < 0.001$), and Hunt & Hess scores (2.8 vs. 2.0) than those arrive by car. The "last known normal" time was significantly lower for the EMS arrival group (mean = 547 minutes; median = 211 minutes) than the private vehicle group (mean = 1,407 minutes; median = 715 minutes; $p < 0.001$). Demographic data and prior history of stroke were similar based on mode of arrival. **Conclusions**: Stroke patients arriving by EMS have significantly higher NIHSS, ICH score, and Hunt & Hess score and significantly shorter time from "last known well" than those arriving by car. Because a significant proportion of ischemic stroke patients arrive by car, targeted public education efforts should focus on identification of stroke patients with longer symptom duration and those with lower NIHSS.

76. Carotid Blood Flow Is Dependent on Rate And Duty Cycle during CPR Cardiac.

Joshua Lampe, Karen Moodie, Jeffrey Gould, Christopher Kaufman, Norman Paradis, *Feinstein Institute for Medical Research* Category of Submission: Cardiac

Background: We have previously presented data that blood flow generated by piston-type mechanical chest compressions (CC) is sensitive to changes in the inter-compression pause time, which changes both chest compression rate and duty cycle. We sought to clarify the dependence of CC generated blood flow on changes in CC rate and duty cycle during piston type CPR. **Hypothesis**: We hypothesized that the observed dependence of CC generated blood flow on changes in intra-compression pause time is due to the change in CC duty cycle. **Methods**: CPR was performed on five domestic swine (~30 kg) using standard physiological monitoring. Blood flow was measured by Doppler in the right common carotid artery. Ventricular fibrillation (VF) was electrically induced. CC were started after 5 minutes of untreated VF. CC were delivered at a rate of 125 or 50 compressions per minute (cpm) with a duty cycle of 45% or 27% for each rate, and at a depth of 2" for a total of 6 minutes after 2 minutes of "break-in" CPR (increased depth from 1 inch to 2 inches). CC rate or duty cycle were

changed every 1.5 minutes. **Results**: At a rate of 125 CPM, CC delivered at a duty cycle of 45% generated roughly twice the carotid blood flow in L/min of CC delivered at a duty cycle of 27% (0.157 ± 0.086 L/min vs. 0.075 ± 0.04 L/min, respectively). However at a rate of 50 CPM, blood flow was not dependent on duty cycle (45%: 0.045 ± 0.015, 27%: 0.037 ± 0.015). This relationship appeared to be conserved when blood flow was compared at the level of L per compression. **Conclusions**: The results of these experiments suggest that carotid blood flow is dependent on both rate and duty cycle. These data suggest that the dependence of CC generated blood flow on intra-compression pause time cannot be assigned to either the change in rate or duty cycle, but is a combination of both effects. These data highlight possible mechanistic differences between piston and vest CPR.

77. REARREST INCIDENCE AND POST-ROSC RHYTHMS AFTER PREHOSPITAL RETURN OF SPONTANEOUS CIRCULATION IN OUT-OF-HOSPITAL CARDIAC ARREST

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CATEGORY OF SUBMISSION: CARDIAC

Background: Limited out-of-hospital cardiac arrest (OHCA) studies have found that rearrest after return of spontaneous circulation (ROSC) is both common and independently associated with lower survival. To better understand prehospital rearrest after ROSC, we sought to describe rearrest cardiac rhythms for adults with OHCA of presumed cardiac etiology in an expanded and more recent sample of OHCAs. **Methods**: Cases were identified from September 2008 to December 2015 from three EMS systems in Arizona. Minute-by-minute post-ROSC and rearrest rhythms were grouped into Utstein categories by two emergency medicine trained physicians after analysis of continuous defibrillator ECG data (E Series, ZOLL Medical). Rearrest was defined as 1 minute of lethal arrhythmia or crew restarting CPR for any length of time, indicating loss of pulses. Descriptive statistics were used to describe the distribution of post-ROSC and rearrest rhythms. **Results**: Of 1,603 adult OHCA patients, there were 409 cases of ROSC (25.5%) and 350 were included in this analysis. Cases were excluded if age <18 (2), non-cardiac etiology (34), ROSC was not achieved prior to ED arrival (1,194) or adequate electrocardiograph (ECG) rhythm recordings were not available (23). There was a total of 4,009 minutes of ROSC (not including rearrest) with 7 distinct post-ROSC rhythms. Sinus rhythms predominated after achieving ROSC, with sinus tachycardia representing the greatest percentage (52.15%) of all rhythms. A smaller percentage of minutes were seen of sinus rhythm (21.14%), sinus bradycardia (5.00%), V-tach (4.41%), idioventricular (8.91%), atrial fibrillation/flutter (1.88%), and junctional rhythms (1.31%). Almost half of ROSC patients in this sample (45%) sustained at least one episode of rearrest and 22 patients (7%) sustained multiple rearrests. The most common rearrest rhythms in this sample were pulseless electrical activity (62.3%) and VT/VF (32.6%). **Conclusions**: This study demonstrates that rearrest is common after ROSC in cases of prehospital OHCA. In this analysis, a wide variety of both post-ROSC and rearrest rhythms were observed. This information helps prepare EMS rescuers for rearrest and provides the potential for targeted interventions to prevent OHCA rearrest.

78. EFFECT OF EARLY DETECTION BY DISPATCHER ON SURVIVAL OUTCOMES AFTER OUT-OF-HOSPITAL CARDIAC ARREST

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CATEGORY OF SUBMISSION: CARDIAC

Background: Dispatcher-assisted cardiopulmonary resuscitation(DA-CPR) is an important intervention to improve outcomes of out-of-hospital cardiac arrest. We studied the association between the time to detect cardiac arrest by dispatcher and outcomes in out-of-hospital cardiac arrest (OHCA). **Methods**: We conducted a cross-sectional study. All adult OHCAs of presumed cardiac etiology and bystander witnessed between 2013 and 2015 were analyzed. The main exposure of interest was time from EMS call to detection of cardiac arrest by dispatcher. Patients with unknown time to detection by dispatcher or extremely longer detection time (>20 minutes), and unknown outcomes were excluded. Time to detection of cardiac arrest by dispatcher was classified into the early (0–90 seconds), middle (91–180 seconds), and late (181–1,200 seconds) groups. The primary outcome was survival to discharge and secondary outcome was good neurological recovery. Multivariable logistic regression analysis was performed, adjusting for patient, arrest, environmental, and dispatcher factors. **Results**: Of 83,083 OHCAs, 6,539 (7.9%) patients were instructed DA-CPR between 2013 and 2015. A Total of 6,383 (7.7%) patients were enrolled, excluding cases who did not receive bystander CPR. The rates of DA-CPR performed were 28.7%, 43.0%, and 28.3% in early, middle, and late detection groups, respectively. Overall, survival to discharge occurred in 635 (9.9%) OHCAs and good neurological outcome was observed in 441 (6.9%) patients. After adjusting for potential confounders, longer time to recognize cardiac arrest was associated with decreased odds of survival to discharge for both middle (AOR 0.74, 95%CI 0.59–0.91) and late groups (AOR 0.75, 95%CI 0.59–0.94) compared with early group. There was no significant association between recognition time and good neurological outcome [Middle vs Early AOR(95% CI): 0.81 (0.63–1.04), Late vs Early AOR (95%): 0.79 (0.60–.03), Late vs Middle AOR (95% Cl): 0.98 (0.76–1.26)]. Metropolitan status was significant effect modifier ($p < 0.001$). In non-metropolitan areas, compared to the early group, AORs (95% Cl) for survival to discharge were 0.65 (0.49–0.85) in the middle group, 0.68 (0.51–0.90) in the late group. In metropolitan areas, there was no significant association between recognition time and survival to discharge [Middle vs Early AOR (95%CI): 0.91(0.64–1.30), Late vs Early AOR(95%Cl): 0.88(0.60–1.29)]. **Conclusions**: The shorter duration from the EMS call to recognition of cardiac arrest by dispatcher was associated with favorable outcomes after OHCA.

79. IMPACT OF REAL TIME CHEST COMPRESSION FEEDBACK INCREASES WITH APPLICATION OF THE 2015 GUIDELINES

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CATEGORY OF SUBMISSION: CARDIAC

Background: Cardiac arrest survival is dependent upon chest compression quality. Target parameters for compression depth and rate became more specific from the 2010 Guidelines [≥2 inches, 80–120/min] to the 2015 Guidelines [2.0–2.5 inches, 100–120/min]. Real-time audiovisual feedback (RTAVF) may improve compression guideline adherence, but the impact of RTAVF with application of more specific targets is unknown. Hypothesis: Dependence on RTAVF to achieve compression guideline adherence will increase with application of the more specific 2015 Guidelines. **Methods**: Data were collected as part of a benchmarking program conducted at multiple U.S. hospitals. Compression rate and depth were recorded using standard compression mannequins and RTAVF defibrillators (R Series, ZOLL Medical). The program included subjects enrolled before ($n = 756$) and after ($n = 995$) introduction of the 2015 Guidelines, with target compression parameters modified accordingly. At baseline subjects performed 2 min of continuous compressions with RTAVF feedback disabled. After a brief RTAVF orientation, subjects repeated 2 min of continuous compressions with feedback enabled. The 2010 Guidelines cohort and 2015 Guidelines cohort were compared with regard to the percentage of compressions meeting appropriate rate/depth targets with and without use of RTAVF. **Results**: An increase in compression guideline adherence was observed with use of RTAVF for both the 2010 Guidelines cohort [60.3% to 96.0%, OR 15.9 (10.8–23.6), $p < 0.01$] and the 2015 Guidelines cohort [16.7% to 95.0%, OR 94.4 (67.9–131.2), $p < 0.01$]. The proportion of subjects requiring RTAVF to achieve adherence increased from the 2010 Guidelines cohort to the 2015 Guidelines cohort [36.1% vs. 79.3%, OR 6.8 (5.5–8.4, $p < 0.01$), $p < 0.01$]. There were no statistically significant differences between the 2010 Guidelines cohort and the 2015 Guidelines cohort with regard to the proportion of subjects that could not be corrected [3.6% vs. 4.0%, OR 1.1 (0.7–1.9), $p = 0.63$] or became nonadherent [0.4% vs. 1.0%, OR 2.6 (0.7–9.3), $p = 0.16$] with RTAVF. **Conclusions**: The use of RTAVF increases adherence to chest compression guidelines, particularly with application of the narrower 2015 Guidelines targets for compression depth and rate.

80. DIRECT TRANSPORT TO COMPREHENSIVE STROKE CENTER MAY NOT EXPEDITE REPERFUSION OF LARGE VESSEL OCCLUSION STROKE

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CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: A body of knowledge has evolved that has demonstrated improved survival and functional outcome from LVO strokes with timely mechanical endovascular therapy. To decrease time to care, EMS policy makers have begun to develop methods to identify and triage EMS LVO stroke patients directly to comprehensive stroke centers (CSC). Our objective was to assess whether time to definitive care for LVO stroke patients is decreased in patients who present directly to a CSC compared to patients who are transferred from a primary stroke center. **Methods**: We performed a cohort study of patients admitted to a single suburban CSC (July 2015 –December 2016) with a diagnosis of LVO stroke. Patients presented directly to the CSC, or were transferred by air or ground from a primary stroke center. Time intervals from arrival at either first hospital or CSC to interventional skin puncture (access) and reperfusion at the CSC were recorded. Transfer distance was calculated using Google Maps. Because we sought to assess impact of triage within a regional EMS system, we included patients transferred within a 15-mile radius. Non parametric statistics were used for comparisons. Median and range are reported. **Results**: We had a total of 62 cases admitted to our CSC, with 54 transported within 15 miles. Of these, 25 patients were direct transports (15 via EMS and 10 via private car) and 29 were transferred from 7 hospitals. As expected, transferred patients had shorter times from CSC arrival to access and reperfusion [median, 30.5 (6–216) vs. 156 (30–248), $p < 0.001$, and 69 (25–

288) vs. 209 (99–315), $p < 0.001$], respectively. When comparing first hospital arrival to outcomes, direct transport patients had a small decrease in time to access [156 (30–248) vs. 171 (115–384), $p = 0.03$] and no difference to reperfusion [208.5 (25–288) vs. 209 (142–412), $p = 1.0$]. **Conclusions**: Using this small pilot data set, direct transport of LVO patients to a CSC had a minimally shorter time to access and no difference in time to reperfusion compared to those transferred. EMS systems need to critically assess the benefit of direct transport vs early transfer as a component of strategies to optimize care for LVO stroke patients.

81. Benchmarking EMS Compass Cardiac Performance Measures Using a Large National Dataset

Jeffrey Jarvis, Dustin Barton, Lauren Sager, Nick Nuddel, *Williamson County EMS* Category of Submission: Operations, Quality, Safety Systems, Disaster, Disaster

Background: Early defibrillation of shockable cardiac arrests, aspirin and 12 lead ECG, and a combination of nitroglycerin and non-invasive pressure ventilation (NIPPV) in acute decompensate heart failure has been shown to provide meaningful clinical benefit. There has not yet been work done to provide benchmarks on these measures based on large national datasets. We aim to describe national performance on these measures. **Methods**: Using a 6 1/2-year convenience sample of records from 9-4-1 consenting EMS agencies using ESO Solutions electronic health record (EHR), we calculated compliance with the following performance measures: the average time from dispatch to first defibrillation in shockable rhythms, the proportion of these provided within 5 minutes, the proportion of patients over 35 with non-traumatic chest pain who received both aspirin and a 12 lead ECG, and the proportion of patients with acute decompensated heart failure (ADHF) as defined by SBP > 200 and either a RR > 30 or an SpO2 < 90 who received both NTG and NIPPV. For times, we provide the average, median and interquartile rank. For proportions, we also calculated the 95% confidence interval. **Results**: Of 11,144 cardiac arrests with an initial shockable rhythm, 1,630 or 14.6% (14.0–15.3%) were defibrillated within 5 minutes. The average time to first shock was 13.65 min, IQR 9.0(6.4, 13.2). There were 533,127 patients over 35 with non-traumatic chest pain. Of these, 199,123 or 37.4% (37.2–37.5%) received both aspirin and a 12 lead ECG. There were 2,612 patients with ADHF and 2,100 or 80.4% (78.9–81.9%) of these received both NTG and NIPPV. **Conclusions**: There was a low rate of rapid defibrillation pointing out the difficulties with achievement of this metric without non-EMS (public) support. There was also poor compliance with a chest pain bundle of aspirin and 12 lead ECG use. On the other hand, there was much better use of NTG and NIPPV in ADHF. These data provide baseline performance benchmarks for use in system improvement.

82. Characteristics Associated with Success on the National AEMT Certification Examination

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Background: Advanced emergency medical technician (AEMT) certification, the provider level between emergency medical technician (EMT) and paramedic, was first issued on a national level in 2011. While characteristics of examination success at other provider levels have been explored, little is known regarding the AEMT level. Our objective was to examine the association between AEMT graduate characteristics and success on the National AEMT Cognitive Examination. We hypothesized that prior EMT experience, program entrance exams, course-ending final exams, and exam fee payor would be associated with success. **Methods**: We performed a cross-sectional evaluation of all first-attempt National AEMT Certification cognitive examination results from October 2016 to April 2017. Upon completion of the examination, a brief, voluntary questionnaire was administered assessing graduates' characteristics and experiences. Descriptive statistics were calculated, and the association between characteristics reported by graduates and success on the exam was assessed using univariable logistic regression models (OR, 95%CI). **Results**: In the study period, 3,835 AEMT graduates attempted the cognitive examination and 2,372 completed the post-test questionnaire (response rate = 62%). Among those who completed the questionnaire, 56% ($n = 1323$) were successful on the first attempt. Compared to those with no EMT experience prior to enrollment in an AEMT program, those with one to five years of experience had greater odds of passing (1.37, 1.10–1.71), while more than five years of EMT experience was not significantly associated with examination success (1.09, 0.84–1.42). Attending an AEMT program that required an entrance exam was not associated with odds of success (0.85, 0.69–1.05). However, respondents who were required by their program to complete a final course-ending cognitive examination exhibited higher odds of success compared to those who did not (2.18, 1.78–2.65). Compared to those who paid for their own exam, there was no difference in odds of passing for those whose employers (1.21, 0.99–1.49) or programs (1.16, 0.85–1.58) paid some/all of the exam fees. **Conclusions**: Prior EMT experience and program course-ending cognitive examinations were significantly associated with increased odds of success on the National AEMT Examination. Future work should examine the impact of program entry requirements and program curriculum composition on graduate performance.

83. Change in Quantitative Ventricular Fibrillation Over Bouts of Chest Compressions in CPR

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Background: Chest compressions (CC) given during cardiac arrest generate blood flow to the brain and other vital organs, but the effect of CC is dependent on their performance characteristics. Quantitative ECG (QECG) features of the ventricular fibrillation (VF) waveform correlate with myocardial perfusion levels during cardiac arrest and therefore may be a good quality metric. We hypothesized that there would be an association between change in QECG measures and CC characteristics. **Methods**: CC process and associated continuous prehospital ECG data were retrospectively extracted from defibrillator downloads obtained from the continuous chest compression (CCC) trial of the Resuscitation Outcomes Consortium (ROC). Cases were included if they had at least one defibrillator file with a bout of CC bounded by analyzable ECG signal segments, and amounted to 25,210 bout-gap intervals spanning 1,099 unique cases. For each bout, the QECG measures AMSA, MS, LAC, and DFA were calculated for the starting and ending ECG segments around the bout, and CPR performance metrics were calculated for the intervening bout of CC. CC process metrics included rate, depth, duty cycle, fraction, bout duration, dosed rate, dosed depth, and dosed duty cycle. We then analyzed the relationship between CC metrics and QECG by regressing the change in QECG measures from the start each bout to the end of each bout against the CC process parameters for that bout in multivariable models including bout duration and patient characteristics. **Results**: CC rate was associated with change in QECG value and was significant for change in MS ($t = 2.13$, coefficient 8.92, $p = .0330$). All other associations between chest compression parameters and dQECG were not significant. **Conclusions**: These results suggest a limited relationship between CC process metrics and QECG measures during resuscitation of out-of-hospital cardiac arrest.

84. The Utilization of a Province Wide EMS System by Children and Youth with Mental Health Complaints

Aaron DeRosa, Michael Zhang, Judah Goldstein, Carl Jarvis, Md Shamsuzzaman, *University of Prince Edward Island, Atlantic Regional Training Centre* Category of Submission: Student, Resident, Fellow

Background: Children and youth Emergency Department (ED) and hospital based mental health(MH) service use is increasing in Canada and the United States. This may extend to the EMS setting. Our objective was to describe trends and characteristics of EMS utilization by children and youth with MH complaints. **Methods**: We conducted a retrospective population based quantitative descriptive study, using secondary data from the provincial EMS database. Patients 5 to 18 who utilized EMS for MH related complaints between 2010 and 2015, inclusive, were used in the analysis. We described prevalence, demographics, and operational characteristics. MH calls were based on chief complaint or clinical impression relating to MH and resemble the Canadian ED short list of Diagnosis under Mental and Behavioural Disorders. Continuous and discrete variables reported as n, mean, SD; Categorical as *n*, %. **Results**: Our electronic query retrieved 16,169 EMS responses for children and youth; of which 2108(16%) were related to MH. The mean age was 16.26(SD1.699) and most MH calls were female ($n = 1238$, 59%). There was a 27% increase in total MH calls over the 6 year study period compared to a 9% increase in all EMS calls in the same age group. Females had the largest increase (47%) in MH related complaints over the study period. The majority of patients were single users ($n = 1436$, 68%), whereas, 180 repeat users accounted for 503(24%) responses, ranging from 2–13 incidents over the study period. Most patients were transported ($n = 1920$; 91%). The two most common conditions addressed by paramedics were overdose/poisoning ($n = 1747$; 83%), and depressed/suicide ($n = 250$; 12%). Anxiety ($n = 257$; 35%) was the most prevalent charted comorbidity, followed by Attention-Deficit Disorder/ Hyperactivity Disorder ($n = 207$,28%). When categorizing patients over a calendar year 1635 patients were low users (1 call per year), 108 patients were medium users (2–4 calls per year), 8 patients were high users (5–14 calls per year). **Conclusions**: We observed an increasing trend in MH related EMS service use by children and youth. The majority of patients are transported by paramedics to the ED. This trend should be considered when developing EMS policies, programs, and training for paramedics.

85. PUSH DOSE EPINEPHRINE USE IN CRITICAL CARE TRANSPORT

Francis Guyette, Gabriela Galli, Neal McQuaid, Jonathan Elmer, Christian Martin-Gill, *Department of Emergency Medicine, University of Pittsburgh School of Medicine* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: The use of push dose epinephrine (PDE) is becoming increasingly common in the treatment of profound hypotension in the prehospital setting. However, no quantitative research has been done to analyze the patient populations receiving this treatment. We aim to describe the population of patients treated with PDE as compared to hypotensive patients not treated with PDE. **Methods**: We performed a retrospective cohort study to describe the use of PDE in a critical care transport system. We evaluate the use of PDE for management of prehospital hypotension from January 2015 to April 2017. We reviewed prehospital and in-hospital medical records for patients treated and transported by a multi-state air medical service that incorporated PDE into its protocols (epinephrine 100 mcg IV/IO every 2 minutes for SBP < 70 mmHg or peri-arrest state). Patients were selected if they were hypotensive and met inclusion criteria for PDE use in the current protocol. We compared pretreatment characteristics and vital signs for patients following an index event (SBP < 70). We utilized non parametric (rank sum tests) and chi-square to identify differences between the cohorts. **Results**: 1862 eligible (SBP < 70) cases were identified, PDE was administered to 23%. Cases vs. controls differed by age, PDE median age 65 (IQR 55–76) No PDE 61 (IQR 50–72), but not gender or race. Patients receiving PDE were most commonly treated for post arrest, cardiogenic shock, trauma and sepsis. Patients receiving PDE were also more likely to be intubated (PDE 32.4%, No PDE 14.3% Pr0.00) and vasopressor dependent (PDE 32.8%, No PDE 15.5% Pr0.00) prior to flight crew arrival. Patients also differed with respect to Lactate level (PDE 8.2 (IQR 4.5,9) vs. No PDE 3.7 (IQR2.3,7) and pretreatment crystalloid (PDE 1000 IQR 500,2600) vs. No PDE (PDE 1000 IQR 200,2000). Other pretreatment variables (HR, SpO2, RR) did not differ. **Conclusions**: Prehospital administration of PDE in our system is administered in only a fraction of patients meeting protocol criteria. PDE administration is associated with intubation, vasopressor use, increased lactate, and crystalloid compared to patients not receiving PDE possibly indicating a selection or indication bias.

86. ADHERENCE TO RECOMMENDATIONS FOR PREHOSPITAL CARDIAC ARREST CARE ACROSS AN EMS SYSTEM OF CARE: HOW WELL ARE WE IMPLEMENTING GUIDELINES?

Jonathan Kamrud, Lori Boland, Andrew Stevens, Jessica Jeruzal, Charles Lick, *Allina Health Emergency Medical Services* CATEGORY OF SUBMISSION: CARDIAC

Background: To evaluate adherence to American Heart Association (AHA) recommendations for optimal care for out-of-hospital cardiac arrest (OHCA) across the spectrum of prehospital care by analyzing care rendered by bystanders, dispatchers, first responders (FR), and emergency medical services (EMS) providers within a system of care. **Methods**: A total of 294 OHCA events treated by a single ambulance service in Minnesota in 2014–2015 occurred before ambulance arrival in adult patients who sustained non-traumatic arrest, and had complete data available for bystander, dispatch, first responder, and EMS care elements. An adherence index (AI; range = 0 to 6) was calculated based on successful delivery of six care elements aligned with AHA recommendations: dispatcher provided instructions for CPR when possible, bystander or FR initiated chest compressions (pre-ambulance CPR), bystander or FR placed an AED (pre-ambulance AED), compression fraction during EMS CPR > 0.8, compression rate during EMS CPR of 100–120/minute, and number of pauses >10 sec in duration during EMS CPR was < 3. Only the first 10 minutes of compressions were considered for EMS CPR criteria. Data sources included audio recordings of dispatch calls, the Cardiac Arrest Registry to Enhance Survival (CARES) registry data, and transthoracic impedance data tracings. **Results**: Adherence to individual guidelines was generally high: dispatcher instructions for CPR = 100%, pre-ambulance CPR = 93%, pre-ambulance AED = 72%, compression fraction = 84%, compression rate = 91%, and number of pauses >10 sec < 3 = 81%. Care was delivered in accordance with all six criteria (AI = 6) in 52% of events ($n = 153$) and the AI was ≥ 5 in 78% of events ($n = 228$). The number of events with AI ≥ 5 increased from 70% among 2014 cases to 83% among 2015 cases (p = 0.009). **Conclusions**: Adherence to the guidelines for optimal prehospital OHCA management that were studied is very high in this system of care and appears to be increasing. Identified opportunities for improvement include increasing pre-ambulance AED use and reducing pauses during EMS CPR.

87. RECOGNITION OF OUT-OF-HOSPITAL CARDIAC ARREST DURING EMERGENCY CALLS BY COMMUNITY LEVEL PUBLIC AWARENESS OF CARDIOPULMONARY RESUSCITATION: A MULTI-LEVEL ANALYSIS

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Background: In dispatcher-assisted cardiopulmonary resuscitation (CPR) program, dispatchers' recognition of out-of-hospital cardiac arrest (OHCA) is the first step to initiate bystander CPR. This study aimed to investigate whether the community CPR awareness is associated with recognition of arrest, provision of CPR instruction, and bystander CPR. **Methods**: A nationwide population-based observational study was conducted with adult OHCA patients with cardiac etiology between 2013 and 2015. Exposure was community level awareness of CPR using the national Korean Community Health Survey database categorized into quartile (the lowest, lower, higher, and the highest) groups. Endpoints were recognition of arrest, provision of CPR instruction, and bystander CPR. Multi-level logistic regression analysis was performed for study outcomes. Adjusted odds ratios (AORs) per 10% increment in community CPR awareness were calculated adjusting for potential confounders. **Results**: A total of 43,875 OHCAs were included in the final analysis. Of those cases, 20,182 cases (46.0%) were recognized during the emergency calls and CPR instructions were given in 17,804 (40.6%) cases. Compared with the lowest CPR awareness communities, AORs (95% CIs) for arrest recognition were 1.06 (0.96 to 1.17) in lower, 1.12 (1.02 to 1.23) in higher, and 1.19 (0.99 to 1.22) in the highest CPR awareness communities. For CPR instruction, AORs (95% CIs) were 1.13 (1.00 to 1.27) in lower, 1.25 (1.08 to 1.44) in higher, and 1.25 (1.09 to 1.44) in the highest CPR awareness communities. Bystander CPR was done in 21,973 cases (50.1%) and the communities with the highest CPR awareness showed higher bystander CPR rate (51.4%) than other communities (higher 50.9%, lower 48.3%, and the lowest 46.4%) (p < 0.01). AORs (95% CIs) per 10% increment in CPR awareness were 1.05 (1.00 to 1.11) for arrest recognition, 1.11 (1.06 to 1.17) for CPR instruction, and 1.07 (1.03 to 1.11) for bystander CPR. **Conclusions**: Although the dispatcher's recognition rate of OHCA was not different according to the community CPR awareness level, dispatchers provided more CPR instruction in communities with higher CPR awareness level. Finally, more bystander CPR was provided to the patients in higher CPR awareness communities.

88. EFFECT OF TEXT MESSAGE ALERT SYSTEM FOR TRAINED CITIZENS ON BYSTANDER CARDIOPULMONARY RESUSCITATION AND SURVIVAL TO DISCHARGE IN A METROPOLITAN CITY: A BEFORE-AFTER POPULATION-BASED STUDY

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Background: Bystander cardiopulmonary resuscitation (CPR) is a key factor to improve survival outcomes in out-of-hospital cardiac arrest (OHCA) patients. A text message (TM) alert system for trained citizens was implemented to increase bystander CPR in the community. This study aimed to determine the effects of a TM alert system on bystander CPR rate and survival outcomes after OHCA. **Methods**: A before-after population based study was conducted with resuscitation attempted OHCAs between 2014 and 2015 in the study districts of Seoul, South Korea. Seoul implemented a TM-alert system as a community intervention in May, 2015. The intervention group was defined as OHCA cases that occurred from May to December in 2015, and the historical control group was defined from the same period (May to December) in 2014. Endpoints were bystander CPR rate and survival to discharge. Multivariable logistic regression analysis was used to evaluate the effect of TM alert intervention compared with historical control group. **Results**: A total of 1,124 OHCAs were analyzed, with 560 OHCA cases in the intervention group and 564 OHCA cases in the historical control group. Bystander CPR was performed in 141 patients (25.1%) in 2014 and 119 patients (21.3%) in 2015 (p-value = 0.14). Survival to discharge was observed in 31 patients (5.5%) in 2014 and 56 patients (10.0%) in 2015 (p-value = 0.57). The adjusted odds ratios (95% CI) of bystander CPR and survival to discharge for intervention group compared to control group were 0.80 (0.60 to 1.06) and 0.94 (0.57 to 1.54), respectively. **Conclusions**: The text message alert system for CPR trained citizens was not associated with a significant increase in bystander CPR and survival to discharge rates.

89. COMPARISON OF MANUAL VS. MECHANICAL CHEST COMPRESSION QUALITY DURING PREHOSPITAL CARDIAC RESUSCITATION

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Background: Cardiopulmonary resuscitation (CPR) quality is strongly linked to outcomes following out-of-hospital cardiac arrest (OHCA). Manual CPR quality varies and has risk to providers. We hypothesized that use of a mechanical CPR device might provide higher quality CPR than manual CPR during technically challenging periods of OHCA resuscitation, including the packaging, loading, and transporting of patients. **Methods**: Cases of

OHCA at a single site from 10/2008–10/2016 were identified. Two CPR quality metrics, chest compression fraction (CCfr) and CC rate (CCra), were measured using accelerometer-based technology (E & X-Series), and compared between 3 groups: packaging (terminal 5 minutes on scene), loading (terminal 3 minutes on scene), and transport. Mechanical CPR was performed using AutoPulse® (ZOLL Medical), while most cases of manual CPR were performed with real-time audiovisual feedback (Real CPR Help®). Manual CPR [metronome rate of 100 beats per minutes (bmp)] and mechanical CPR (set CCra of 80 bpm) were compared by the median proportion of time in which CCra was within +/−5 bmp of the target range (pCCra) and the mean CCfr is reported using the Wilcoxon rank-sum test. **Results**: 357 cases were reviewed and 239 excluded: no age or age <18 years (6), medical or unknown location (31), non-cardiac etiology (87), data unavailable (115), leaving 118 included. No significant difference in CCfr was noted between the two groups during transport ($p = 0.47$). In cases with mechanical CPR, CCfr was higher during packaging 85.0 vs. 74.5 ($p = 0.0043$) and loading 86.0 vs. 72.2 ($p = 0.001$) than in cases with manual CPR. With mechanical CPR, CCra was more frequently within the target range during all study periods 0.4 versus 0.8 ($p = 0.001$), 0.3 vs. 1 ($p = 0.0021$), and 0.5 vs. 0.8 ($p = 0.0002$). **Conclusions**: In adults with OHCA, use of a mechanical CPR device was associated with higher CCfr during patient packaging and loading and a higher proportion of time within the target CCra rate during all time periods. Use of mechanical CPR may improve CPR quality without exposing providers to the risks of performing manual CPR during the packaging, loading, and transport of OHCA patients.

90. Is Prehospital Epinephrine Used Appropriately in Pediatric Anaphylaxis?

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Background: Anaphylaxis is an acute, life-threatening condition that requires immediate recognition and treatment. The goal of therapy should be early recognition and treatment with epinephrine to prevent progression to life-threatening respiratory compromise or cardiovascular collapse. More prehospital providers, parents, and school nurses, are being instructed in using epinephrine. We sought to determine how often epinephrine is used in children and, more importantly, how often it is administered correctly for anaphylaxis. **Methods**: Setting: A suburban two-tiered EMS system in which ALS units evaluate approximately 600 patients under age 13 per year. Patients: Children less than 13 years old over a 5-year period for whom ALS was dispatched for "Allergy/Anaphylaxis". Protocol: Demographics, history of present illness, vital signs, and interventions performed prior to EMS arrival and by EMS personnel were extracted using chart review. The percentage of patients with 95% confidence intervals ("CI") who were given epinephrine prior to EMS arrival, by EMS, and overall were calculated. Anaphylaxis was defined as acute cutaneous and/or mucosal involvement after antigen exposure plus one of the following: respiratory compromise, cardiovascular compromise, or persistent GI symptoms. Appropriate treatment was defined as epinephrine being administered when the patient's clinical syndrome met the definition of anaphylaxis, or being withheld when the clinical syndrome did not meet the definition. The percentage of patients who were treated appropriately was then calculated with CI. **Results**: Out of 2,750 ALS calls for patients under 13 years old, 287 (10.4%) were for "Allergy/Anaphylaxis." The average age of patients was 6.5 years and 63% were male. 59% (CI: 54–65) of these patients received epinephrine - 49% (CI: 44–55) prior to EMS arrival, and 10% (CI: 6–13) by ALS personnel. The percent of patients who received appropriate treatment was 62% (CI: 56–66%). Of the inappropriate treatments, epinephrine was given inappropriately 30% (CI: 24–35%) of the time, and was withheld inappropriately 9% (CI: 5–12%) of the time. **Conclusions**: Despite increasing incidence and public awareness of life-threatening allergic reactions, both laypeople and prehospital providers struggle to diagnose and treat anaphylaxis in pediatric patients. More education is needed to recognize this disease process and treat it appropriately.

91. Pediatric Out-of-Hospital Cardiac Arrest Outcomes before and after Implementation of a Standardized Resuscitation Tool

Scott Alter, Lisa Clayton, Richard Paley, Richard Shih, *Florida Atlantic University* Category of Submission: Pediatric

Background: Pediatric out-of-hospital cardiac arrest (POHCA) occurs infrequently, yet requires the same urgency as for adults. Therefore, it is imperative that prehospital providers are prepared to rapidly treat POHCA. To meet this need, pediatric-specific tools have been developed. This study compares POHCA outcomes before and after implementation of an age-based resuscitation tool. **Methods**: Design: retrospective chart review. Setting: county-based ALS service with 87,000 calls per year, covering a population of 635,000 over 2,000 square miles. Subjects: patients <18 years old who sustained POHCA with resuscitation attempt without return of spontaneous circulation (ROSC) before EMS arrival between January 1, 2012 and December 31, 2016. On January 1, 2014, a commercial tool for POHCA, consisting of age-based medication dosing protocols, was implemented. Rates of ROSC, survival to hospital admission, and survival to hospital discharge were calculated and compared between the pre-implementation and post-implementation groups. **Results**: A total of 132 POHCA patients were identified, of whom 24 were excluded for having ROSC before EMS arrival. The remaining 108 patients had average age of 1.61 years, with similar baseline characteristics between groups. In the two years preceding the tool implementation (control group), there were 37 cardiac arrests. Of these, two had ROSC after EMS arrival and none survived to hospital admission. In the three years after implementation (experimental group), there were 71 cardiac arrests. Of these, 13 had ROSC after EMS arrival. All patients with ROSC survived to hospital admission and 3 survived to hospital discharge. Between the control and experimental groups, there was a 13% difference in ROSC after EMS arrival (5% vs. 18%; 95% CI: −0.01–0.24), 18% difference in hospital admission (0% vs. 18%; 95% CI: 0.06–0.29), and 4% difference in overall survival to discharge (0% vs. 4%; 95% CI: −0.06–0.12). **Conclusions**: After implementation of an age-based resuscitation tool, there was a statistically significant increase in POHCA survival to hospital admission. ROSC rate obtained after EMS arrival and survival to hospital discharge also increased, though failed statistical significance. Based on these results, EMS agencies may consider implementing an age-based resuscitation tool as part of a strategy to improve POHCA treatment.

92. Comparison of Commercial Tourniquets in a Pediatric Trauma Patient Model

James Vretis, *Center for Tactical Medicine* Category of Submission: Pediatric

Background: Young children and adolescents are frequently injured in peacetime and wartime. Reviews of trauma registries at U.S. military medical facilities during the Iraq and Afghanistan conflicts show as the age of a child a child decreases the injury severity and mortality increases. Tourniquet use for control of extremity hemorrhage in adult trauma patients is associated with increased survival with only minimal tourniquet associated morbidity. Use of commercial tourniquets on pediatric patients treated at US military facilities shows survival benefits similar to those seen in the adult population. Hypothesis: We hypothesized that there wound be differences in the efficacy of commercial tourniquets designed for adults when applied to pediatric patients of different ages. **Methods**: The institutional Ethics Review Board approved the study. The study was a prospective and non-blinded test of nine commercial tourniquets on a pediatric arm hemorrhage test model using six sized mannequins to simulate pediatric arms. The Stretch Wrap And Tuck (SWAT), TacMed K9 (TMK9), and Rapid Application Tourniquet System (RATS) tourniquets apply compressive forces by the elastic recoil action of the tourniquet strap. The Combat Application Tourniquet (CAT), Sam XT (SAMXT), Tactical Mechanical Tourniquet (TMT), and the SOF Tactical Tourniquet – Wide (SOFTTW) use a windlass to increase circumferential compression by decreasing strap length. The Child Ratcheting Medical Tourniquet (CRMT) uses a ratchet and ladder mechanism for circumferential compression. The Mechanical Advantage Tourniquet (MAT) has a turnkey apparatus mounted on a fixed length C-shaped housing that pulls a portion of the retaining strap into the housing as a mechanism to increase circumferential pressure. **Results**: The SWAT, TMK9 and RATS were successful stopping the flow of water on all sized mannequins. The CRMT was the only mechanical advantage tourniquet that was successful in stopping fluid flow on all mannequin sizes. The TMT and SOFTTW started failing on mannequins with 6.35 cm diameters. The CAT, SAMXT, TMT, and SOFTTW all failed on the 5.08 cm diameter mannequin. The MAT failed on the 7.62 and smaller diameter mannequin. **Conclusions**: We have shown that many commercially available tourniquets do not stop fluid flow in our pediatric arm hemorrhage test model.

93. Prehospital Blood Pressure Measurement in Major Traumatic Brain Injury: Concordance between EMS Provider Documentation and Non-invasive Monitor Data Tracking

Octavio Perez, Octavio Perez, Eric Helfenbein, Bruce Barnhart, Saeed Babaeizadeh, Dawn Jorgenson, Chengcheng Hu, Vatsal Chikani, Joshua Gaither, Samuel Keim, Duane Sherrill, Daniel Spaite, *University of Arizona* Category of Submission: Operations, Quality, Safety Systems, Disaster, Disaster

Background: Recent studies have shown that the lowest prehospital systolic blood pressure (SBP) is strongly associated with mortality across a remarkably wide range (far above 90 mmHg) in traumatic brain injury (TBI). Furthermore, in TBI research, case ascertainment and risk-adjustment are highly dependent upon documentation of prehospital BP. Objective: To identify the concordance between the lowest SBP documented by EMS personnel in patient care records (PCR) and the recorded non-invasive monitor data in TBI. **Methods**: A subset of major TBI cases (moderate/severe; CDC Barell Matrix 1) in the EPIC EMS TBI Study (NIH 1R01NS071049) were

evaluated (3/13–3/17). Cases from 6 EMS agencies that report continuous monitor data (Philips MRx™) as part of EPIC were included. All monitor data available for this post-hoc review were displayed and accessible to the providers during EMS care. We compared the lowest PCR-documented SBP to the monitor-recorded value in each patient. **Results**: 132 cases were included (median age: 52, 65% male). In 96 cases (72.7%), the lowest PCR-documented SBP was exactly concordant with the lowest monitor value. When concordance was defined by the difference being ≤5 mmHg, 113 (85.6%) were concordant. Among the 16 patients with guideline-defined hypotension identified by the monitor (<90 mmHg), only 11 (68.8%) were documented in the PCR. **Conclusions**: Significant disparities were identified between the lowest monitor-recorded SBP and the PCR-documented value. Furthermore, PCRs failed to identify one third of monitor-documented hypotension. This may be explained, in part, by ongoing care responsibilities and scene distractions that may cause providers to miss BP readings. Our findings identify a potential hidden contributor to poor outcomes if hypotension goes unrecognized, and untreated, rather than simply not being documented. Furthermore, case ascertainment, confounding, and risk-adjustment in TBI studies may be substantially impacted. Whenever possible, quality improvement and research projects should utilize monitor data to identify and evaluate hypotensive TBI patients. Future development of monitor-based real-time audiovisual feedback technology might improve provider identification of hypotension.

94. Evaluating the Gender Gap in EMTS and Paramedics Obtaining National EMS Certification from 2007 to 2016

William Krebs, Remle Crowe, Rebecca Cash, Madison Rivard, Ashley Larrimore, Christine Hamilton, Ashish Panchal, *Department of EM, The Ohio State University Wexner Medical Center* Category of Submission: Operations, Quality, Safety Systems, Disaster, Disaster

Background: With roots in battlefield medicine and the fire service, the EMS workforce has traditionally been comprised of mostly male providers. As the EMS profession has evolved in both prominence and function, it is unknown how the gender composition of the workforce has changed on a national level. The objective of our study was to describe the proportion of females who earned initial National EMS Certification at the EMT and paramedic levels over a 10-year period (2007–2016). We hypothesized that the proportion of female EMTs and paramedics earning certification increased during this time. **Methods**: This was a longitudinal assessment of all EMTs and paramedics earning initial National EMS Certification from 2007 through 2016. There is no national database of all licensed EMS professionals, however National EMS Certification is required to earn initial licensure at one or more provider levels in the majority of states. We assessed all EMS professionals who earned initial EMT or paramedic certification between January 1, 2007 and December 31, 2016. Descriptive statistics were calculated. A non-parametric test of trend was used to assess for increasing or decreasing trends in the proportion of females earning certification during the study period. **Results**: In 2007, a total of 28.7% of EMTs earning initial certification were female compared to 34.8% in 2016, representing a percent change of 21.3% (p-trend<0.001). An increase was noted in 7 of 9 year-to-year comparisons. However, the proportion of females earning initial paramedic certification was stagnant during the 10-year period. While statistically significant (p-trend = 0.03), the overall increase was less than one percentage point (21.4% in 2007 to 22.1% in 2016). A change of less than 2% was noted in 8 of 9 year-to-year comparisons. **Conclusions**: While the proportions of females earning initial National EMS Certification increased for EMTs, the population earning paramedic certification remained relatively stable over the ten-year period. Despite other health care fields closing the gender gap, paramedic certification has not followed this trend. Future research is needed to identify the underlying reasons and barriers for the lack of change in the paramedic gender composition of those earning National EMS Certification.

95. Impact of Community Paramedic Home Visits on CHF Patients: A Pre-Post Assessment of Heart Failure on Quality of Life

Sandi Wewerka, Joseph Pasquarella, Ann Majerus, Aaron Burnett, Matthew Simpson, Paula Miller, *Regions Hospital* Category of Submission: Operations, Quality, Safety Systems, Disaster, Disaster

Background: Effective management of congestive heart failure (CHF) often requires patients to make significant lifestyle changes, which may be best managed in partnership in the patient's home. The objective of this study was to evaluate the effectiveness of a fire-based community paramedic (CP) program on CHF management in patients recently discharged from the hospital using the Minnesota Living with Heart Failure® Questionnaire (MLHF). We hypothesize that CP visits will contribute to improvement in the patient's quality of life as assessed by the MLHF. **Methods**: Patients with a CHF-related hospitalization who provided consent to participate in the CP program completed the MLHF prior to discharge. The CP program entailed weekly home visits from a CP. The MLHF is a validated questionnaire that uses a Likert scale to measure the effects of CHF symptoms, functional limitations and psychological distress. Each symptom is rated on a 0–5 scale, with a score of 5 corresponding to the greatest detriment to quality of life (QOL). Total MLHF scores range from 0–105. 4–6 weeks after discharge, patients repeated the MLHF. Pre/post survey scores were analyzed descriptively using means and standard deviations. Scores were assessed with Wilcoxon signed-rank tests in three dimensions: total score, emotional symptoms, and physical symptoms. **Results**: Twenty-three patients completed the pre- and post-tests from March 2015 to May 2017. The mean total scores on the pre-assessment (score = 57.83, SD = 28.09) and post-assessment (score = 45.30, SD = 30.77) were significantly different (p = 0.022). Mean pre-score for physical assessment questions was 25.78 (SD = 12.06) while on the post assessment it was 21.22 (SD = 11.66). Mean of the emotional score on the pre-assessment was 12.17 (SD = 8.55) while on the post assessment it was 9.96 (SD = 8.84). Total scores were significantly different between the pre and post assessments (p = 0.0216). Scores for the physical questions of the assessment were significantly different between the pre and post assessments (p = 0.0218). The pre–post difference in emotional score was not different (p = 0.21). **Conclusions**: Using the MLHF, we found significant improvement in QOL of CHF patients who completed the CP program. This study is limited by the small sample size but demonstrates encouraging improvements to this patient population.

96. Seatbelt Use by Ambulance Personnel in the Patient Compartment Is Low Regardless of Patient Presence, Seating Position, or Patient Acuity

Rebecca Cash, Evan Crowe, Remle Crowe, Madison Rivard, Anne Knorr, Ashish Panchal, Douglas Kupas, *National Registry of Emergency Medical Technicians* Category of Submission: Operations, Quality, Safety Systems, Disaster, Disaster

Background: Recent crash testing shows EMS professionals are at high risk of injury or death while riding unrestrained in an ambulance, yet seatbelt use is reportedly low. Variation in seatbelt use based on seating location and patient acuity is unknown. Our objectives were to describe the prevalence of seatbelt use by seating location and identify factors associated with seatbelt practices. We hypothesized that seatbelt use would be low in the patient compartment regardless of presence of a patient, seating position, or patient acuity. **Methods**: We analyzed a cross-sectional electronic questionnaire administered to a random sample of nationally-certified EMS professionals. Respondents reported frequency of seatbelt usage in the prior 12 months. Inclusion criteria consisted of practicing EMTs or higher in non-military settings who work in ambulances. We defined consistent seatbelt use as reporting frequency of use >50% of the time in a seating location. Denominators reflect respondents reporting sitting in the specific seat. Multivariable logistic regression (OR, 95%CI) using an investigator-controlled backwards selection process was used to assess characteristics associated with wearing a seatbelt on the crew bench while transporting patients. **Results**: A total of 1,431 responses met inclusion criteria (response rate = 11.4%). Most respondents wore a seatbelt while driving the ambulance (97%, n = 1,181/1,221). In the patient compartment without a patient being transported, consistent seatbelt use was poor regardless of seat position (forward-facing seat: 60% [n = 49/82], rear-facing airway/jump seat: 59% [n = 670/1,136], crew bench: 36% [n = 362/997]). During patient transport, consistent seatbelt use on the crew bench was reported at 23% with stable patients and 11% with critical patients. Factors associated with increased odds of seatbelt use on the crew bench when transporting a critical patient (lowest seatbelt use) included having a company policy for seatbelt use (6.25,4.06–9.60) and EMT provider level (2.39,1.52–3.78 [referent: AEMT/Paramedic]), controlling for years of experience. **Conclusions**: Seatbelt use by EMS personnel in the patient compartment was low and varied by seat and patient acuity, with use highest in forward-facing seats. Seatbelt use was lowest in the patient compartment during the potentially more hazardous transport of critical patients. Future work should examine ways to increase seatbelt use in the patient compartment.

97. Feasibility of Manual Active Compression Decompression CPR in a Thirty-Degree Head Up Position

Heather Ellis, David Chase, *Ventura City Fire Department* Category of Submission: Cardiac

Background: Manual active compression decompression CPR (ACD CPR) with ITD (impedance threshold device) in supine position has shown improved outcome in out-of-hospital cardiac arrest. Automated ACD CPR with ITD in a thirty-degree head up position (HUP) has shown improved cerebral perfusion in porcine and human cadaver models. There is controversy regarding the ability to perform high quality manual ACD CPR in HUP. Hypothesis: High quality manual ACD CPR in HUP to specific standards is feasible. **Methods**: A recording simulation mannequin was placed in HUP. After brief instruction and practice using the Zoll ResQCPRTM

system continuous ACD CPR was started by a three-member first response team. The compressor straddled the mannequin. After each 200 compressions there was a break to switch compressors. The CPR feedback from the mannequin and the ResQCPRTM system was recorded and analyzed looking at depth, rate, and decompression negative pressure (>10 kg). 80% beat-to-beat compliance for depth and decompression and an average rate between 75 and 85/minute was considered high quality CPR. Zoll recommends a rate of 80/minute for this system. After completion of 15–20 minutes of simulated manual ACD HUP CPR the team members were asked to complete a survey to assess the degree of fatigue and muscle strain they experienced in comparison to standard CPR. **Results**: 5984 separate compressions were recorded. Mean (SD; CI95) rate was 78.1 (6.9; 75.6–80.6)/minute and mean depth was 2.16 (0.07; 2.14–2.19) inches. 30 separate 200 compression efforts were analyzed for beat-to-beat compliance for depth and decompression. Mean depth compliance was 78.6% (6.08%; 75.8–81.3%). Mean decompression compliance was 91.4% (1.1%; 88.0–94.8%). 10 of 10 survey respondents described manual ACD CPR HUP as more fatiguing than standard CPR and 9 of 10 described muscle strain. Discussion: Beat-to-beat % depth compliance fell just short of the benchmark set. All other defined benchmarks were met. The authors anticipate that with more instruction and practice the beat-to-beat depth compliance of 80% would be achieved. **Conclusions**: High quality manual ACD HUP CPR can be done; however, it is more fatiguing and causes more muscle strain than standard CPR.

98. Television and Film Depict Unrealistic Rates of Cardiac Arrest Survival

Johanna Innes, Brian Clemency, Maxwell Diddams, Peter Natalzia, Deborah Waldrop, *University at Buffalo* Category of Submission: Cardiac

Background: The media's portrayal of cardiac arrest management and outcomes may shape public perception of a cardiac arrest victim's chance of survival. We sought to determine the rates of cardiac arrest survival depicted in television and film. We hypothesize that the survival rates portrayed on television and in movies were significantly higher than actual cardiac arrest survival rates. **Methods**: We conducted a meta-analysis of existing studies of cardiac arrest resuscitations depicted on television and film. A PubMed search was conducted using the following search terms: "cardiopulmonary resuscitation and television," or "resuscitation and television," or "heart arrest and television." Two reviewers independently reviewed all studies. Studies that included survival data from in hospital and out of hospital cardiac arrest patients depicted on television or in movies were included in the analysis. Subject demographics, rates of return of spontaneous circulation (ROSC), and survival to discharge were reviewed and compared to published data from the Cardiac Arrest Registry to Enhance Survival (CARES) registry. **Results**: The initial PubMed search yielded 260 unique references. There were 412 resuscitation attempts among 532 cardiac arrests, from 8 studies which met the inclusion criteria. The most common cause of cardiac arrest was trauma (46.2%). All studies had data on ROSC, which occurred in 203 cases. The average rate of ROSC among the studies was 49% (range 19% - 79%). Three studies had no information on survival to discharge. Five studies had survival to discharge statistics; 73 (25.2%) subjects were lost to follow up. Survival to discharge information was available for 217 subjects of which 63 (29.0%) survived to discharge. This was substantially higher than the out of hospital cardiac arrest survival rate reported by the CARES registry ($p < 0.001$). **Conclusions**: The media's depiction of cardiac arrest survival often does not include survival to discharge information. When television and film survival to discharge rates are known, they are significantly greater than actual cardiac arrest survival rates. This may lead to unrealistic expectations regarding out of hospital cardiac arrest victims' chances of survival in the general public.

99. Benchmarking the Use of Red Lights and Sirens in 9-1-1 Systems: A Review of a Large, National Dataset

Jeffrey Jarvis, Dustin Barton, Lauren Sager, Nick Nudell, *Williamson County EMS* Category of Submission: Operations, Quality, Safety Systems, Disaster, Disaster

Background: The use of Red Lights & Sirens (RLS) in responses to and from the scene of a 9-1-1 call has long been tradition in EMS, although with limited evidence of clinical efficacy. There is a growing body of evidence of the dangers of RLS response and the effectiveness of priority dispatch triage for better triage of RLS responses. Little data has been published which defines the prevalence of RLS use to and from 9-1-1 scenes. We sought to describe the proportion of RLS responses using a large national dataset. **Methods**: Using an electronic review of 6 1/2 years of data from 9-4-1 consenting agencies using ESO's Electronic Health Record (EHR) system, we identified the transport mode of all responses to and from the scene of a 9-1-1 call that resulted in transport to a hospital. The proportion of calls to and from the scene using RLS was determined, along with 95% confidence intervals. **Results**: There were 7,709,012 9-1-1 calls that resulted in a patient transport. Of these, 5,846,038 (75.8%, 75.8–75.9%) involved RLS response to the scene and 1,494,378 (19.4%, 19.4–19.4%) resulted in RLS response from the scene to the hospital. **Conclusions**: Using a large national dataset, we provided baseline information on the prevalence of the use of RLS to and from 9-1-1 calls. While we are unable to assess the necessity of such response, given the known prevalence of high-acuity 9-1-1 calls, it is possible that the 76% of RLS responses to 9-1-1 scenes could safely be decreased with appropriate priority dispatch processes and ongoing quality improvement. Further efforts using patient outcome should assess the necessity of RLS response from the scene.

100. Usefulness of Epinehprine in Cardiac Arrest

James Hehl, Matthew Wells, Beth Langley, JE Winslow, *Cape Fear Valley Mobile Integrated Healthcare Cumberland County EMS* Category of Submission: Cardiac

Background: The landscape for treatment of cardiac arrest is evolving. The importance of prompt, high quality cardiopulmonary resuscitation and early defibrillation is receiving more emphasis. For decades, intravenous (IV) administration of epinephrine every 3–5 minutes has been a component of the standardized protocol for treatment of cardiac arrest, yet recent studies suggest that frequency of administration could impede neurological recovery. Therefore, our EMS agency developed a "one dose epinephrine" prehospital protocol for medical cardiac arrest as a quality improvement project. **Hypothesis**: Utilizing a "one dose epinephrine" protocol will improve neurological recovery in survivors of cardiac arrest. **Methods**: The protocol was revised and implemented in February of 2017 to include one IV dose of epinephrine. All other components of the cardiac arrest protocol where unchanged and followed the ACLS algorithm. Each patient was closely followed through a Quality Assurance and Quality Improvement process. Data was compared from February through July 2016, with epinephrine administered every 3–5 minutes; to February through July 2017, with epinephrine administered once. Evidence of neurological status was obtained from the physician discharge summary in the patient's medical record. **Results**: In the 2016 period, 134 cardiac arrest calls were identified from a total of 27,282 EMS calls. Thirty-three patients achieved return of spontaneous circulation (ROSC) with 10 surviving to discharge. Three of the 33 patients survived to be discharged home with no documented neurological deficit. In the 2017 period, 134 cardiac arrest calls were identified from a total of 27,572 total EMS calls. Thirty-nine patients achieved ROSC with 8 surviving to discharge. Seven of the 39 patients survived to be discharged with no documented neurological deficits. **Outcomes**: The number of patients who received the "one-dose epinephrine" protocol and achieved ROSC increased by 18%. Patient survival to discharge home with no documented with neurological deficits increased from 30% in 2016 to 87.5% in 2017. **Conclusions**: Utilization of the "one-dose epinephrine" protocol demonstrated significant improvement in the percentage of victims who survived a medical cardiac arrest with no documented neurological deficits.

101. Association between Initial Blood Glucose in Out-of-Hospital Cardiac Arrest and Return of Spontaneous Circulation

Caitlin Howard, Hattie McAviney, David Wampler, Jeremy Allen, Justin Smith, David Miramontes, Joan Polk, *United States Army, UTHSCSA* Category of Submission: Student, Resident, Fellow

Background: Elevated blood glucose is associated with poor outcomes in patients resuscitated from out-of-hospital cardiac arrest (OHCA). In this study, we evaluate whether initial blood glucose level in OHCA patients is associated with return of spontaneous circulation (ROSC). **Methods**: This was a retrospective review of a registry containing details of each resuscitation attempt by a large, urban fire-based EMS system where the prevalence of diabetes is much higher than the national average (14.2% vs. 9.3%). Data from January 1, 2016 through August 15, 2016 was analyzed. Patients were included in the study if the following variables were available: age, gender, initial blood glucose, and outcome (no ROSC vs. ROSC). Patients were excluded if age < 17, no age, gender, or initial blood glucose recorded, multiple blood glucoses crossing 200 mg/dl, or no outcome recorded. Only the initial blood glucose obtained at the onset of resuscitation was considered. Patients were divided into two groups: blood glucose < 200 mg/dl and blood glucose > 200 mg/dl. A t-test was used to analyze continuous variables and a $\chi 2$ test was used to analyze categorical variables. **Results**: 620 patients were included in this study. Mean age was 64.23 + 17.20 years with 385 males (62.10%). 453 patients (73.06%) had an initial blood glucose level < 200 and 167 patients (26.94%) had a glucose level > 200. Of the patients with glucose < 200, 171 (37.75%) obtained ROSC. Of those with glucose > 200, 63 (37.72%) obtained ROSC. There was no association between blood glucose levels and achievement of ROSC ($P = 0.10$). **Conclusions**: We found no significant association between initial blood glucose levels in OHCA patients and likelihood of achieving ROSC. The main

limitation to this study was that the patient population was restricted to San Antonio, Texas. Additionally, we only considered the initial blood glucose obtained during the resuscitation.

102. IMPLEMENTING A PREHOSPITAL PROTOCOL TO TREAT BEHAVIORAL EMERGENCIES WITH MIDAZOLAM LEADS TO EFFECTIVE CONTROL OF AGITATED PATIENTS

Christopher Richards, Ryan Huebinger, Katie Tataris, Joseph Weber, Kenneth Pearlman, Eddie Markul, Matthew Strzalka, Mark Kiely, Leslee Stein-Spencer, Leslie Zun, *Northwestern Feinberg SOM Department of Emergency Medicine and Center for Healthcare Studies, Chicago EMS System* CATEGORY OF SUBMISSION: MEDICAL

Background: Combative patients are commonly encountered by EMS providers and pose challenges for both patient care and provider safety. Chemical sedation with midazolam is commonly used in the emergency department setting to treat agitation from psychiatric disturbances and intoxication. However, limited data exist regarding midazolam use in the prehospital setting to treat agitation. We sought to describe our experience after implementing a protocol for treating patients with behavioral emergencies using midazolam in a large urban EMS system. Hypothesis: We hypothesize that implementation of a prehospital protocol using midazolam to treat patients having a behavioral emergency leads to improved clinical conditions without causing significant clinical deterioration. **Methods**: We performed a retrospective review of EMS records following the implementation of a behavioral emergencies protocol in a large urban EMS system from February 2014 through April 2016. Paramedics were instructed to administer midazolam 1 mg intravenous (IV) or intraosseous (IO) or 5 mg intramuscular (IM) or intranasal (IN), repeating once as needed, and to record the response to treatment. Patients receiving midazolam for the indication of "behavioral emergency" were included, and any patient receiving midazolam for "seizure" were excluded. Descriptive statistics were used to report results, and Spearman's rho was calculated to determine correlation of dose and route. **Results**: In total, midazolam was administered in 435 instances to 390 patients. Median age was 33 (IQR 24–50) years; 69.0% were male, and 53.1% were African American. Doses administered were 1 mg (11.8%), 5 mg (72.3%), and 10 mg (15.1%) via IM (42.2%), IN (41.1%), IV (16.5%), and IO (0.2%) routes. In 37 patients, a second dose was required, and the same dose (rho = 0.84, $p < 0.0001$) and route (rho = 0.68, $p < 0.0001$) as the first administration was common. Paramedics reported slight or substantial improvement in clinical condition in 75.3% of patients, and 24.7% had no clinical change. No paramedic reported clinical deterioration in a patient's condition following midazolam administration. **Conclusions**: A protocol using midazolam in behavioral emergencies can be successfully implemented in a large urban EMS system. Midazolam successfully treated agitation, and paramedics did not feel that patients' clinical conditions worsened after midazolam administration.

103. TERMINATION OF RESUSCITATION CHECKLIST: DURATION AND OUTCOMES OF RESUSCITATION

Katherine Kuefler, Aurora Lybeck, Thomas Grawey, M. Riccardo Colella, *Medical College of Wisconsin* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Checklists are often used in medical and non-medical fields to aid in error prevention, management of complex processes, and to help produce reliable outcomes. On April 1, 2016 a termination of resuscitation (TOR) checklist was implemented for use during out-of-hospital cardiac arrests (OHCA) by Milwaukee County Emergency Medical Services (EMS) online medical control (OLMC) physicians concurrently staffing an emergency department. Objective: To evaluate if the use of a TOR checklist by OLMC impacted return of spontaneous circulation (ROSC) for medical or traumatic OHCA. To compare if checklist use changed the duration of resuscitations performed by EMS providers and the duration of the OLMC call. **Methods**: Medical and traumatic OHCA data were extracted from the Milwaukee County EMS database from April 1, 2015 to September 30, 2015 (452 medical, 44 trauma) and April 1, 2016 to September 30, 2016 (482 medical, 71 trauma). Patient outcomes were measured by occurrence of ROSC during resuscitation and by presence of ROSC at hospital arrival. Analysis of the data was done using t-tests. **Results**: In medical OHCA, incidence of ROSC during resuscitation increased from 41% (185/452) to 46% (220/482) with implementation of the TOR checklist and ROSC at hospital arrival increased from 35% (160/452) to 40% (191/482). There was also a significant ($p < 0.001$) increase in mean duration of resuscitations (26 to 30 minutes) and duration of OLMC (13 to 15 minutes) after the checklist was implemented in cases of medical OHCA. **Conclusions**: In medical OHCA the use of a TOR checklist by OLMC significantly increased the duration of both resuscitations and OLMC time. The rates of ROSC during resuscitation and at hospital arrival increased after the checklist was implemented for medical OHCA. These results show a potential clinical benefit for OLMC use of a TOR checklist for medical OHCA, and also inform resource utilization in an academic Emergency Department. In traumatic OHCA there were no significant changes in duration of resuscitation or OLMC and there was a decrease in ROSC; further study with a larger sample size may be needed. Neurological outcomes are unknown and further research may provide a better understanding of the impact of these findings.

104. QUALITATIVE EVALUATION OF COMMUNITY PARAMEDIC CARE TRANSITIONS INTERVENTION COACH TRAINING

Hunter Lau, Matthew Hollander, Jeremy Cushman, Amy Kind, Courtney Jones, Michael Lohmeier, Manish Shah, *University of Wisconsin School of Medicine and Public Health* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: The Care Transitions Intervention (CTI) has potential to improve the emergency department (ED)-to-home transition for older adults. Community paramedics may function as the CTI coaches instead of nurses who traditionally serve in that role. To do so requires that the community paramedics possess the appropriate knowledge, skills, and attitudes, which are not inherently part of traditional EMS education. The aim of this study is to evaluate an expert-panel developed training program for community paramedics serving as CTI coaches who support the ED-to-home transition. **Methods**: This study is a component of an ongoing two-center randomized controlled trial evaluating a community paramedic-implemented CTI to enhance the ED-to-home transition. Community paramedic training covered multiple domains including the CTI program, geriatrics, motivational interviewing, ED discharge, and community paramedicine. One year after starting the study, we conducted audio-recorded semi-structured interviews with community paramedics in both cities (June–July 2017). After transcribing the interviews verbatim, team members independently performed preliminary coding. Ensuing group data analysis sessions led to the development of final codes and thematic generalizations recurrent in the interviews. **Results**: All eight participating community paramedics were interviewed. Of the paramedics, five were women and all were non-Hispanic whites. The mean age was 43. Participants typically had extensive backgrounds in healthcare, primarily as EMS providers, but minimal experience with community paramedicine. All reported some prior geriatrics training. Four themes emerged from the interviews: (1) certain characteristics make coaches more likely succeed in this program; (2) active rather than passive learning may achieve the best results for community paramedic CTI training; (3) training program components require minor refinements; and (4) continuing education should more effectively address the paramedic coaches' evolving needs. **Conclusions**: Paramedics represent a crucial and largely untapped resource for supporting ED-to-home care transitions, such as through the CTI. Training that leads to the appropriate knowledge, skills, and attitudes is critical for effective implementation, including choosing the optimal candidate coaches, delivering training in the most effective manner for the students, and delivering content targeted to student needs.

105. EMERGENCY MEDICAL SERVICES RESPONSE TO MASS SHOOTING AND ACTIVE SHOOTER INCIDENTS, UNITED STATES, 2014–2015

Matthew Sztajnkrycer, Aaron Klassen, Morgan Marshall, Mengtao Dia, N Clay Mann, *Mayo Clinic Department of Emergency Medicine* CATEGORY OF SUBMISSION: TRAUMA

Background: According to Federal Bureau of Investigation statistics, the number of active shooter incidents has increased over the past decade. The purpose of the current study was to describe the EMS response and interventions to mass shooting and active shooter incidents. **Methods**: Retrospective analysis of 2014 and 2015 National Emergency Medical Services Information System (NEMSIS) data sets. Date, time, and location for mass shooting incidents were obtained from the open source Gun Violence Archive and then correlated with NEMSIS data set records. Active shooter incidents were identified through FBI data. A de-identified database was generated for final analysis. **Results**: A total of 608 mass shooting were identified, of which 19 were classified as active shooter incidents. Mean number of injured victims was 4.6 ± 2.5, while mean number of fatalities was 1.2 ± 2.2. NEMSIS data identified 652 EMS activations to 226 unique incidents; 5 were active shooter incidents. 76% of victims were male. 80% of victims were African American. The mean age was 27.7 ± 11.1 years. Dispatch complaint was reported as not known or unknown problem/man down in 14.6% of records. The predominant response configuration was ALS (78.8%). Volunteer services responded to 7% of events. The most commonly reported incident locations were Street/Highway (38.2%), Home/Residence (32.4%), and Trade/Service (11.5%). Location of wounds included extremities (38%), chest (9%), and head (9%). Tourniquet use was documented in 6 victims. Gunshot wound was self-inflicted in 2.3% of victims. When present, cardiac arrest occurred after EMS arrival in 37.5% of cases. 35.9% of victims were transported to the closest facility. **Conclusions**: Mass shooting and active shooter incidents are prevalent in the United States, with an average of 5.8 victims per incident.

Despite the fact that extremity wounds were the most common injury noted, suggesting a role for public access bleeding control, documented EMS tourniquet use was uncommon. While mass shooting events pose high risk for responders, dispatch information was lacking in nearly 15% of records. Responding EMS agencies were diverse and included BLS providers and volunteers, emphasizing the need to ensure all EMS providers are prepared to respond to mass shootings.

106. When Dogs Fly: Use of Air Medical Services to Transport Operational K9s Injured in the Line of Duty

Chelsea Hogan, Chadd Nesbit, Department of Emergency Medicine, *Penn State Milton S. Hershey Medical Center* Category of Submission: Student, Resident, Fellow

Background: Instances of operational K9 air medical transports have been documented in the popular press. There have been no studies to look at the prevalence of such transports or to determine what policies flight programs have in place to address this challenging transport issue. We sought to assess the prevalence of operational K9 transports as well as existence and content of protocols to conduct such a transport should one be deemed necessary. **Methods**: We distributed a survey to air medical programs in the United States via the Research Electronic Data Capture (REDCap) program. Programs were identified using the Atlas and Database of Air Medical Services (ADAMS). Programs that could not be reached via email were excluded. A survey containing up to 23 questions inquiring about K9 transports, policies and procedures was emailed to 295 identified programs. **Results**: We received 147 total survey responses (49.8% response). Twenty-two programs (15%) reported receiving a request to transport a K9 and of those, 15 reported flying the K9. Forty-one K9 transports were reported. Smaller numbers of programs reported having any additional training related to care or transport of operational K9s or a pre-designated emergency veterinarian. Six programs reported carrying some type of equipment for use on K9s and 7 programs reported having some type of protocol in place for these types of flights. Ninety-five of the programs reported that they would be able to fly the K9 and handler as well as the normal flight crew. **Conclusions**: The goal of this survey was to quantify the number of transports for injured operational K9s and to identify any policies or procedures that programs have in place to carry out a transport if one is requested. Although supposedly a rare occurrence, 15% of our respondents have reported such a request. Of those requests the majority of transports were completed. While some programs may decide that they will not transport an injured operational K9, those programs that will should establish policies and procedures for this type of mission.

107. Community Paramedic Partnership: Shifting Healthcare Utilization through Partnership between Municipal Fire/EMS and the Local Level I Trauma Center

Tia Radant, Joseph Pasquarella, Ann Majerus, Matthew Simpson, Paula Miller, Sandi Wewerka, Aaron Burnett, *Regions Hospital EMS* Category of Submission: Operations, Quality, Safety Systems, Disaster, Disaster

Background: A partnership between a Level I Trauma Center and an urban, municipal Fire/EMS Department for patients with congestive heart failure (CHF) was launched in 2014. The program aimed to improve healthcare utilization and reduce readmissions through a unique Community Paramedic (CP) partnership. Hypothesis: Patients with congestive heart failure who receive CP visits for 30 days post-discharge have a reduced rate of readmission and an increased use of clinic visits. **Methods**: Inpatients with CHF were offered visits by a CP for up to 30 days post discharge. Inclusion criteria included, local residentTia, no homecare services upon discharge, diagnosis of CHF, English speaking, and consent to home visits by a CP. The CP visited the patient in the home 1–2 times per week for 4 weeks following discharge. At each visit the CP conducted medication reconciliation, a physical exam, home safety evaluation, coordination of follow-up care and referral to community or healthcare resources as needed. Pre/post comparisons were analyzed descriptively using means and standard deviations. Scores were assessed with Wilcoxon signed-rank tests. **Results**: A total of 64 patients were enrolled between February 2015 and July 2017; 32 patients completed the program with complete data. A comparison of 90-day healthcare utilization pre- and post-admission showed that patients who were provided CP services had a significant decrease in hospital admissions (68%, $p < 0.0001$) and ED visits (62%, $p < 0.0001$), and had a 14% increase in clinic visits (ns, $p = 0.45$). A group of patients that met inclusion criteria but declined consent to participate was compared to the patient group that participated in the CP program. Patients who completed the program had a significantly higher decrease in admissions ($p = 0.0145$) and ED visits ($p = 0.0009$) pre- to post-hospitalization than those who did not enroll ($n = 20$). There was no significant difference in change in clinic utilization. **Conclusions**: Partnership between fire-based EMS and hospitals for Community Paramedic programs can be successful. CP's providing post-discharge care results in a shift of healthcare utilization toward reduced admissions/ED visits and increased clinic visits. Further research with a larger cohort is needed to determine if utilization patterns would be sustained past 90 days.

108. "PDTREE": Development of a New Pediatric Prehospital Transport Destination EBG

Jennifer Fishe, Kye Fratta, Jennifer Anders, *University of Florida COM - Jacksonville, Department of Emergency Medicine* Category of Submission: Pediatric

Background: Prehospital triage should match patient needs with hospital service availability. EBGs guide EMS' destination choice for adult patients suffering from trauma, MI, and stroke. However, analogous guidelines do not exist for any pediatric condition save trauma. This study's objective was to create a non-trauma pediatric prehospital transport destination EBG. **Methods**: A systematic literature search identified articles pertinent to non-trauma pediatric prehospital destination choice. Resulting articles were reviewed using GRADE and compiled into an evidence profile. An expert panel (including stakeholders from pediatric EM, EM, EMS medical directors, EMS providers, and patient/family advocates) reviewed the evidence profile and data from the statewide EMS system where the EBG would undergo pilot testing. Using a modified-Delphi process with three voting rounds and 75% agreement threshold, the panel selected items for inclusion, refined terminology, and reached consensus on a pediatric prehospital transport destination EBG. **Results**: The literature search produced 60 articles. After GRADE review, 47 articles were included in the evidence profile. Articles identified specific pediatric populations (ALTE, seizures, special health care needs) at risk for secondary transport or interfacility transport (IFT). IFT decisions are made quickly, but patients risk suboptimal pre-transfer care, and suffer delays in definitive care and increased morbidity. Quantitative physiologic data (vital signs, capillary refill time, hospital-based scoring systems) in isolation do not accurately or reliably predict the need for pediatric specialty/critical care. Combining quantitative and qualitative prehospital assessments promises more accurate, reliable prediction of specialty/critical care needs. After reviewing the evidence, the expert panel's modified-Delphi process produced a pediatric prehospital destination EBG ("PDTree"). The PDTree is formatted as an algorithm, matching 14 non-trauma conditions/risk factors (including ALTE, seizure requiring EMS-administered benzodiazepine, sepsis, and emergencies related to conditions treated at a medical home) to three different levels of pediatric care (specialty, comprehensive, regional). **Conclusions**: Existing medical literature identifies the need for prehospital transport destination guidance for non-trauma pediatric patients. That evidence supported the modified-Delphi process that produced the "PDTree," a new non-trauma pediatric prehospital destination EBG. "PDTree" will be pilot tested by computerized resource modeling, prehospital provider simulation, and implementation in three diverse EMS agencies.

109. Duplicate Procedures and Charges Associated with Pediatric Inter-Facility Transfer from Emergency Departments

Ali Aledhaim, Jon Mark Hirshon, Jennifer Fishe, Jennifer Anders, *University of Maryland Department of Emergency Medicine* Category of Submission: Pediatric

Background: Interfacility Transfer (IFT) of patients with emergency conditions from an Emergency Department (ED) delays definitive care and burdens the patient with potentially harmful duplicate procedures and extra charges. This physical and economic hardship may be preventable if patients are taken to a definitive care facility for their initial destination. **Objective**: To determine duplicate procedures and charges sustained by pediatric patients undergoing IFT for inpatient admission after an ED visit to a different facility. **Methods**: This study utilized three years (2010–2012) of Maryland HCUP ED and inpatient visit data. A modified probabilistic linkage was performed to identify ED patients who were dispositioned to IFT and admitted to a distant facility. Included patients were 0–17 years of age with any of the 20 most common Diagnosis Categories (DxC) and whose conditions were classified "emergent" or "urgent". After linkage, duplicate procedures were identified and classified as administrative or clinical. Multiple regression analysis was used to compare the average total charges of IFT patients, including duplicate charges, to non-IFT admitted patients presenting with the same top 20 DxC. **Results**: Of the 9,447 IFT inpatients identified, 2,254 patients were successfully linked, of which 1713 (76%) had one of the top 20 DxC. The most frequent administrative duplicate procedure was ER EMTALA emergency medical screening (1,407). Notable duplicate clinical procedures involving repeat radiation were chest X-ray (239) and CT scan of head (97) or body (32). IFT patients incurred an average total charge of $11,786.61 including an average duplicate charge of $1,627.84. In comparison, the average charge incurred by a non-IFT was $8,209.72. Adjusting for the effect of age, gender, and race, a weighted regression model estimated an average 34% (30.1–37.6%, $p < 0.001$) increase in total charges for an IFT patient

compared to a non-IFT patient. **Conclusions**: Both safety harms (radiation exposure) and significant economic burden are seen in the subset of patients undergoing IFT from an ED for inpatient admission to a distant facility. EMS systems can minimize this inefficiency and burden by transporting patients to definitive care facilities whenever feasible.

110. CLINICAL EVENTS IN PREHOSPITAL PATIENTS WITH ST-ELEVATION MYOCARDIAL INFARCTION TRANSPORTED TO A PCI CENTER BY BASIC LIFE SUPPORT PARAMEDICS IN A RURAL REGION

Pierre-Alexandre LeBlanc, Sylvain Bussières, François Bégin, Alain Tanguay, Jean-Michel Paradis, Denise Hébert, Richard Fleet, *Département de Médecine d'Urgence – Université Laval* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Rural areas have limited hospital staff and often rely on basic life support (BLS) paramedics for inter-facility transport. No previous study has established whether ST-segment elevation myocardial infarction (STEMI) patients transported in ambulance over long distances are at risk of suffering from clinical events such as bradycardia or hypotension. The objective of this study was to establish clinical events, and to determine if the complications occurring in the presence of BLS paramedics are influenced by the transportation time. **Methods**: In a retrospective cohort study, we reviewed 896 consecutive STEMI patients diverted and transported to the nearest PCI-capable center according to an emergency physician interpretation of a 12-lead ECG transmitted by paramedics. Patients had continuous electrocardiogram (ECG) and vital signs monitoring during transport. A focus group composed of the authors established clinically important and minor events based on literature search. A multivariate ordinal logistic regression model was used to study the association between transportation time (0–14, 15–29 and >30 min) and the occurrence of clinical events. **Results**: Clinically important and minor events were experienced by 18.6 and 12.16% of STEMI patients, respectively. Transportation time was not associated with higher risk of suffering from clinical events ($p = 0.182$). The most frequent events were bradycardia (8.87%), followed by hypotension (6.1%), and ventricular tachycardia / ventricular fibrillation (VT/VF) (5.13%). All patients suffering from VT/VF were successfully resuscitated with defibrillation. No death on arrival at PCI center was recorded. **Conclusions**: Prehospital STEMI diagnosis by transmission of a 12-lead ECG interpreted by emergency physicians and triage for primary PCI by paramedics without advanced care training is a safe option that could use less advanced staff in rural areas with limited resources.

111. DESCRIPTION OF DRUG-ASSISTED INTUBATION IN STATEWIDE TREATMENT PROTOCOLS

Steven Sommerville, Daniel Wilner, David Schoenfeld, *Beth Israel Deaconess Medical Center* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Endotracheal intubation in prehospital airway management has been a focus of research and debate for decades. Endotracheal intubation is performed using drug-assisted intubation (DAI) or without medication. DAI is divided into rapid sequence intubation (RSI) where a sedative as well as neuromuscular blockade is used or sedative-only intubation. The extent to which DAI is incorporated in statewide treatment protocols (STP) has not been described. The majority of states have STPs that are either mandatory or serve as a guide for medical directors. The purpose of this investigation is to describe the extent to which STPs include DAI and the variability in pharmacopeia utilized. **Methods**: Cross sectional study of STP utilizing a standardized review of DAI protocols and medications. Protocol revision date was also captured. **Results**: Thirty one out of fifty states (64%) issue STPs, seven (22%) of which serve as guidelines. RSI is included in the STP of 17 states (55%). Sedative-only intubation is included in the STP of 5 states (16%). The most commonly included induction agents are etomidate and midazolam (19 STPs each, 61%); other induction agents include ketamine (11 STPs, 35%), fentanyl (2 STPs), and propofol (1 STP). Succinylcholine is the most commonly included paralytic (17 STPs, 55%); rocuronium (11 STPs, 35%) and vecuronium (7 STPs, 23%) are other approved paralytic agents. 16 states (52%) permit intubation of both adult and pediatric patients while 6 states (19%) only allow DAI of adult patients. All protocols have been revised within the past 5 years and 75% of protocols were revised since 2015. **Conclusions**: The NAEMSP position statement on drug-assisted intubation recommends the use of a paralytic during DAI, as it increases the likelihood of first pass success. Just over half of all STPs allow for DAI, and 16% allow for sedative-only intubation despite the NAEMSP position statement on DAI. There is significant variation in both the induction agent as well as the paralytic utilized for intubation across STPs. There is also variation in the number of states that allow for both adult and pediatric intubation. Additional research is needed to determine optimal agents and protocols for prehospital intubation.

112. ASSESSMENT OF INTRAOSSEOUS NEEDLE PLACEMENT BY EMS PROVIDERS

Alexandra Petrie, Jeffrey Lubin, *Penn State College of Medicine* CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS, DISASTER, DISASTER

Background: Intraosseous (IO) needle placement can be used to provide quick delivery of various fluids to the patient, particularly in cases in which venous access is compromised; however, if done incorrectly, it can lead to unwanted complications such as extravasion of fluid, poor flow, and catheter dislodgement (Paxton 2009; Dev 2014; Gluckman 2014). The purpose of this study is to see if EMS providers can adequately locate the correct locations for the placement of IO needles in live models. **Methods**: We assessed the accuracy of intraosseous placement by asking EMS providers from a statewide conference to simulate where they would use an intraosseous needle on standardized patients. Each participant also filled out a demographic survey that included their experience with intraosseous needles and a knowledge of acceptable EZIO intraosseous needle landmarks from a list of options. Measurements were established on live human models using transfer paper with stickers placed in tibial and humeral IO spots, marked so that they easily lined up with the model via landmarks. The participant was asked to place a sticker directly on the model where they would insert the EZIO at both locations. Afterward, a transfer sheet with the sticker placed at a location correlating with standard placement was compared against the participant-placed sticker. Differences in placement were measured with a ruler to the nearest half centimeter. Direction was qualitatively noted. Numbers were assigned to each participant so that the demographic survey, location survey, and sticker location could be linked to each individual subject ($N = 30$). **Results**: Results were analyzed via several 2 sample t tests using 0 as the standard landmark. The average distance from the landmark on the humerus was 5.06 cm (95% CI: 4.06–6.06). The average from the tibia was 4.13 cm (95% CI: 3.16–5.10). Both were statistically significant with a p value of <0.0001. **Conclusions**: These results show a low accuracy among EMS providers in identifying correct landmarks for intraosseous needle placement. This suggests additional training and skills review may be needed across the state in order to safely perform this procedure.

113. PARAMEDIC RECOGNITION AND MANAGEMENT OF ANAPHYLAXIS IN THE PREHOSPITAL SETTING

Rakesh Gupta, Krystyna Samoraj, Simerpreet Sandhanwalia, Matt Kerslake, Luke Ryan, Colleen Shortt, Michelle Welsford, *McMaster University* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Anaphylaxis is a life-threatening condition that paramedics are equipped to treat effectively in the field. Current literature suggests improvements in paramedic recognition and treatment of anaphylaxis could be made. The aim of this study was to compare the proportion of cases of anaphylaxis appropriately treated with epinephrine by paramedics before and after a targeted educational intervention. **Methods**: This was a retrospective medical records review of patients with anaphylaxis managed by primary or advanced care paramedics in five Emergency Medical Service areas in Ontario, before and after an educational module was introduced. This module included education on anaphylaxis diagnosis, recognition, treatment priorities, and feedback on the recognition and management from the before period. All paramedic call records (PCRs) coded as "local allergic reaction" or "anaphylaxis" during 12-month periods before and after the intervention were reviewed by trained data abstractors to determine if patients met an international definition of anaphylaxis. The details of interventions performed by the paramedics were used to determine primary and secondary outcomes. **Results**: Of the 600 PCRs reviewed, 99/120 PCRs in the before and 300/480 in the after period were included. Of the charts included, 63/99 (63.6%) in the before and 136/300 (45.3%) in the after period met criteria for anaphylaxis ($p = 0.002$). Of the cases meeting anaphylaxis criteria, 41/63 (65.1%) in the before and 88/136 (64.7%) in the after period were correctly identified as anaphylaxis ($p = 0.96$). Epinephrine was administered in 37/63 (58.7%) of anaphylaxis cases in the before period and 76/136 (55.9%) in the after period ($p = 0.70$). Anaphylactic patients with only two-system involvement received epinephrine in 20/40 (50.0%) cases in the before period and 45/93 (48.4%) in the after period ($p = 0.86$). **Conclusions**: There are gaps in paramedic recognition and management of anaphylaxis, particularly in cases of two-system involvement. These gaps persisted after the implementation of an educational intervention. Other quality interventions and periodic refreshers may be necessary to improve prehospital treatment of anaphylaxis. Limitations include an increase in overall cases and decrease in rate of true anaphylaxis in the after period, which may relate to better case identification after electronic PCR implementation and changes in paramedic recognition.

114. NATIONAL DESCRIPTION OF PATIENT REFUSALS FOLLOWING PREHOSPITAL ADMINISTRATION OF NALOXONE

Mirinda Gormley, Juan Lu, *Virginia Commonwealth University* CATEGORY OF SUBMISSION: MEDICAL

Background: Emergency medical services (EMS) personnel deliver Naloxone to reverse deadly opioid overdoses. However, EMS personnel may experience challenges with patient care, including being unable to convince a patient to be transported to the hospital. Without accessing appropriate follow-up care, these patients could overdose again. **Objective**: Identify characteristics associated with patients who received Naloxone from EMS but refused to be transported to hospital. **Methods**: Data came from the 2015 National Emergency Medical Services Information System. The incident/patient disposition was used to create a binary outcome ("transported" or "refused"), where "treated, transferred care," "treated, transported by EMS," and "treated, transported by Law Enforcement" made up "transported," and "no treatment required," "patient refused care," "treated and released," and "treated, transported by private vehicle" comprised "refused." Characteristics included age, gender, race, prior aid, location, U.S. census region, and urbanicity. Descriptive and multivariable logistic regression were utilized. **Results**: In 2015, EMS agencies reported 585,108 Naloxone administrations by personnel of a transport unit during a 9-1-1 response. After treatment, 1.6% of patients refused transport. These patients were primarily male (65.0%), white (76.8%), and had a median age of 48 (IQR = 32–61). Compared to transported patients, those who refused were more likely to be found in a residence (75.6% vs. 68.0%), or receive aid prior to EMS arrival (60.3% vs. 23.9%). Larger proportions of patients went to the hospital if found in a public location (19.7% vs. 13.5%), or a rural/wilderness area (10.4% vs. 6.6%). Patients had nearly double the odds of being transported from a public location rather than a residence (OR = 1.704, 95% CI = 1.58–1.84), and patients in rural/wilderness locations were 1.5 times more likely to be transported than urban patients (OR = 1.58, 95% CI = 1.44–1.73). Patients who did not receive aid prior to EMS arrival were nearly twice as likely to go to the hospital (OR = 1.71, 95% CI = 1.61—1.81). **Conclusions**: While effective at reversing fatal overdoses, prehospital administration of Naloxone is not sufficient to address addiction, whereas those transported to hospital could access treatment. EMS agencies should work together with public safety partners to plan how to work with patients most at risk of refusing transport following initial treatment.

115. EMS Compass Benchmarks Using a National EMS Dataset: Status Epilepticus and Hypoglycemia Performance Measures

Jeffrey Jarvis, Dustin Barton, Lauren Sager, Nick Nudell, *Williamson County EMS* Category of Submission: Medical

Background: Status epilepticus and hypoglycemia are emergent conditions, both of which can be effectively treated by EMS. It is unclear how often these assessments and treatments are given. EMS Compass is a national organization that has developed several clinical measures. No work has been done to benchmark these measures against large, national datasets. This is necessary for quality improvement efforts and refinement of the measures themselves. We aimed to describe compliance with these measures using a large, national cohort. **Methods**: Using a 6 ½-year sample of 9-4-1 consenting EMS agencies using the ESO electronic health record (EHR), we calculated compliance rates among transported 9-1-1 patients for the following measures: (1) some type of glucose given to those with blood glucose under 60, (2) a blood glucose documented for those felt to be in status epilepticus, and (3) a benzodiazepine given for those in felt to be in status epilepticus. For measures requiring administration of a medication, only ALS providers were included. For each measure, a rate and 95% Confidence Interval were calculated. **Results**: A total of 147,238 patients had a documented blood glucose <60. Of these, 117,358 (79.7%, 95% CI 79.5–79.9%) received some type of glucose. Of 11,148 patients with a status epilepticus, 8,072 (72.4%, 71.6–73.2%) had a blood glucose documented and 6,250 (56.1%, 55.1–56.0%) had some type of benzodiazepine given by ALS agencies. **Conclusions**: We describe the compliance rates on several EMS Compass measures using a national cohort. We found a low rate of benzodiazepine use for status epilepticus. It is possible that this is a function of poor, non-standard documentation, imprecise measure definitions, or poor clinical performances. In any case, these results identify opportunities for important system improvement.

116. Analysis of Medication Storage Temperatures in a Modern EMS Fleet: Preliminary Results from the Analysis of Medication Storage Temperatures Trial (AFIRE)

Timothy Burns, Alan Butsch, Cristopher Touzeau, Roger Stone, Barry Reid, *Montgomery County (MD) Fire And Rescue Service* Category of Submission: Professional

Background: EMS operational programs deploy medications using a variety of means under all kinds of conditions. Because of this deployment versatility, medications that were once limited to somewhat controlled clinical settings are now deployed on vehicles whose climate control is more difficult. Purpose: To explore whether or not EMS medications deployed in modern fire and EMS vehicles experience temperatures that are outside storage temperature ranges from the US Pharmacopeia. **Hypothesis**: Medications will be exposed to temperatures outside the guidelines in all types of our apparatus. **Methods**: We recorded ambient temperatures on two of our paramedic engines and in two of our transport units during two summer months in 2017 using temperature data loggers. Once downloaded into a database, these measurements created a continuous stream of temperature data for the entire study period. **Results**: Data from the paramedic engine location reveals that the ambient temperature was above the definition of "extreme heat" from the USP (104°F) for 1,350 minutes (1.4%) of the 94620-minute study period, in the range "warm" (86–104°F) for 60168 minutes (64%) of the study period, and out of the "controlled room temperature" range 89229 minutes (94%.) Neither position in the transport unit was subjected to "extreme heat," but they were in the "warm" range for 5759 minutes (6%) and 12092 minutes (13%) respectively, during the study period. Transport unit temperatures were outside of the "controlled room temperature" range for 51138 minutes (54%) and 67131 minutes (71%). **Conclusions**: Temperature is much more controlled in the transport units than in the Paramedic Engines. Medications deployed on our paramedic engines experience a significant "extreme heat" exposure. During the summer months of the study period, all environments tested temperatures in the "warm" range and all were out of "controlled room temperature" range a majority of the time. Limitations: These observations only define the temperatures to which the medications were exposed. Further study would need to be conducted on the effects of this exposure.

117. Epidemiology And Outcomes Of Anaphylaxis-Associated Out-Of-Hospital Cardiac Arrest

Seung Chul Lee, Sun Young Lee, Sang Do Shin, Jeong Ho Park, *Dongguk University Ilsan Hospital* Category of Submission: Cardiac

Background: Understanding the epidemiologic characteristics of anaphylaxis-associated out-of-hospital cardiac arrests (OHCAs) is the first step for developing preventative strategies and optimizing care systems. We aimed to describe and compare the epidemiologic features and outcomes among patients with anaphylaxis-associated OHCAs according to causative agents group. **Methods**: We identified emergency medical service (EMS)-treated anaphylaxis-associated OHCA patients from a nationwide OHCA registry between 2008 and 2015. We compared epidemiologic characteristics and outcomes according to the causal agents and evaluated temporal variability in anaphylaxis-associated OHCA incidence. The rate of survival to discharge was compared among causative agents groups using multivariate logistic regression analysis. **Results**: During the study period (8 years), a total of 224 anaphylaxis-associated OHCAs were included in the analysis. Natural agents group including insect sting and foods were 192 (85.6%) and iatrogenic agents group were 32 (14.3%). There was significant variability in the frequency of anaphylaxis-associated OHCA by hour of the day (p value < 0.01) and season of the year (p value < 0.01), with the highest incidence occurring during the daytime (7:01 am to 3 pm; 64.6%) and in summer (June to August, 48.7%). Compared with natural agents, the adjusted odds ratios (AORs) for survival to discharge in iatrogenic agents were statistically insignificant (AORs 3.61, 95% CIs 0.86 to 15.06). **Conclusions**: There was significant temporal variability in the incidence of anaphylaxis-associated OHCA, with its peak during the summer. Anaphylaxis-associated OHCA by natural agents accounted for the greater proportion of anaphylaxis than iatrogenic agents but there was no difference in survival to discharge between the two groups.

118. Relationship between Adult Body Mass Index and Anticipated Failure Rate of Needle Decompression Using a 5cm Needle for Tension Pneumothorax

John Lyng, Kristin Pokorney-Colling, Michaela West, Gregory Beilman, *North Memorial Health Ambulance and Air Care* Category of Submission: Trauma

Background: Tension pneumothorax is traumatic injury that can lead to rapid circulatory collapse and death. Emergent needle thoracostomy can quickly treat tension pneumothorax, but the best anatomic location and catheter length necessary to perform the intervention has been questioned in the recent years given the increasing rates of obesity in our population. **Methods**: We conducted a retrospective review of a convenience sample of all trauma patients admitted to our level 1 trauma center in Minneapolis, MN that underwent chest computed tomography (CT) during their admission between 2011 and 2012. Using these CT radiographs, chest wall thickness was measured bilaterally at the 2nd intercostal space (ICS) at the midclavicular line, and at the 4th and 5th intercostal spaces at the anterior axillary line. Baseline demographic data including age, sex, BMI, ISS and associated chest wall trauma were collected from medical chart review. Needle thoracostomy failure was defined as chest wall thickness (CWT) of > 5cm, based on the length of commonly used needle decompression needles. **Results**: A total of 141 patients that met all inclusion criteria were identified. There were no significant differences in mean CWT at any of the anatomic sites. CWT was similar between males and females. BMI > 30 was

associated with an adjusted odds ratio of 13.8 (Confidence interval 4.8–39.8) for failure with a standard 5cm catheter needle decompression. **Conclusions**: In the increasingly obese general population, needle thoracostomy with a standard 5cm needle may be more prone to failure. Adult BMI > 30 is a significant risk factor for anticipated failure of needle tube decompression. Alternative anatomic sites for needle decompression did not appear increase the anticipated success of the intervention.

119. Evaluating the Incorporation of a Journal Club Series into Paramedic Initial Education

Lauren Maloney, Paul Werfel, Robert Marshall, Scott Johnson, *Stony Brook University Dept of Emergency Medicine* Category of Submission: Student, Resident, Fellow

Background: Given Paramedic National Standard Curriculum cognitive objectives, we developed an 8-hour curriculum that guides educators and paramedic students (PS) through the scientific process and offers a simple way to find and evaluate research articles. We then evaluated its effect on PS perception of finding and evaluating research articles, and their interest in participating in future prehospital research studies. **Methods**: PS participated in four 2-hour long journal club sessions. First, the educator provided PS with four types of articles and highlighted differences between formats. Next, PS used search engines to fact check references of a free open access article. Third, PS sent articles on a topic selected by the class to the educator, who facilitated a discussion of several articles after a short statistics lecture. Finally, PS found an article on a topic of their choice and verbally presented as it as if telling their partner about it between calls. Before and after the module, PS completed a survey with demographic questions and a series of affective domain questions, with surveys linked using unique identifiers. PS will receive a follow-up survey in one year. **Results**: A total of 21 PS participated. 81% were male, with an average age of 24. 43% were college graduates. Before the module, 76% of PS could identify a research article, 29% had a journal subscription, and many read articles several times a month (38%) or year (33%). Affective survey questions had five-point Likert scale responses that were converted to numeric responses (strongly disagree = 1, strongly agree = 5) and analyzed using a paired t-test, with $p < .05$ for significance. After the module, PS had significantly more agreement that they could find research articles ($p < .001$) and are interested in attending a journal club for their continuing education ($p = .02$). PS significantly disagreed more that patient care decisions should be based on personal experience instead of research based evidence ($p = .01$). All PS agreed the module was a productive use and time and would recommend it to others. **Conclusions**: This cohort of PS demonstrated their ability to find, interpret, and communicate important findings in research articles, and had overall positive trends in opinions about evidence-based medicine.

120. Double-Sequential Defibrillation: Efficacy and Risk of Defibrillator Damage Are Highly Dependent on the Choice of Shock Timing and Shock Vectors

Tyson Taylor, Sharon Melnick, Fred Chapman, Gregory Walcott, *Physio-Control, Inc.* Category of Submission: Cardiac

Background: Double-sequential defibrillation (DSD) is the use of two defibrillators for delivery of two near-simultaneous shocks in an attempt to terminate refractory VF. We hypothesized that the efficacy of DSD compared to control shocks (one vector, one device, shock size the same as each of the two DSD shocks) would depend on the time between the two shocks. Furthermore, we hypothesized that the potential for damaging a defibrillator during DSD would depend on the choice of shock vectors. **Methods**: To assess shock efficacy, defibrillation pads were applied in lateral-lateral (LL) and anterior-posterior positions in 10 anesthetized pigs. Episodes of electrically-induced VF were treated with a shock of a block-randomized therapy. Shock energy was chosen to yield approximately 25% success for a single LL shock. We compared LL stacked shocks (i.e., a failed LL shock was repeated) and seven DSD shock intervals (Overlapping; 10, 50, 100, 200, 500, 1000 ms apart), with $n = 81$ VF episodes per therapy. To assess the potential for damaging a defibrillator, two sets of pads were applied in six different configurations (either approximately parallel or approximately orthogonal defibrillation vectors). Ten 360 J shocks were delivered from one set of pads while the voltage across the second set of pads was measured. We compared the voltage coupling ratio (VCR): ratio of the measured voltage to the delivered voltage. **Results**: Compared to stacked LL shocks, DSD shocks that were Overlapping, 10, and 100 ms apart significantly increased efficacy ($p < 0.05$), DSD shocks that were 50 ms apart significantly decreased efficacy ($p < 0.05$), and DSD shocks 200, 500, and 1000ms apart were not different. During DSD potential damage assessment, voltage of delivered shocks was 1833±5 V and voltage across the second set of pads ranged from 1.2 to 503 V; parallel vectors resulted in significantly higher VCR compared to orthogonal vectors (15.2 ± 0.6% vs. 1.6±0.2%, $p < 0.0001$). **Conclusions**: The efficacy of orthogonal-vector DSD is highly dependent on time between shocks and can increase, decrease, or not change compared to stacked shocks on a single vector. Potential for defibrillator damage during DSD can likely be minimized by choosing near-orthogonal defibrillation vectors.

121. Biometric Analysis of Thoracolumbar Movement during Ambulance Transport

David Wampler, Ronald Stewart, Rena Summers, Lawrence Roakes, Mike Shown, Craig Cooley, Chetan Kharod, Tasia Long, Brian Eastridge, *The University of Texas Health Science Center at San Antonio* Category of Submission: Trauma

Background: Within the community of trauma surgeons, emergency medicine physicians and emergency medical services (EMS) providers responsible for the care of injured patients, there is mounting concern that the long spine board (LSB) does little to reduce spinal motion, and that risk outweighs benefit. The purpose of this study was to evaluate the movement of the thorocolumbar spine during ambulance transport, comparing different patient positions with and without LSB. We hypothesized that transport on a mattress with the head of the bed elevated would limit thoracolumbar movement more effectively than a LSB. **Methods**: This was a randomized 10-treatment adult healthy volunteer crossover trial. Real-time 3D motion analysis of the thoracolumbar region was measured using a wireless motion tracking system. Positions analyzed included: on LSB at zero and ten degree incline, and on EMS stretcher with head elevated to 10, 30, 45, and 60 degrees. All subjects were fitted with a rigid cervical collar (c-collar) and headblocks when on LSB. Subjects on stretcher without LSB were fitted with a c-collar and were transported with and without foam headblocks. Each subject underwent simulated ambulance transport over a city street course at, or below, posted speed limits. The driver was blinded to the subject position. Composite volume of motion was measured at the T12-L1 body area. Statistical significance was determined using t-test. **Results**: Nine healthy subjects participated, 66% were male. Comparing movement between LSB and no LSB respectively, there was no statistical difference in three-dimensional volumetric movement of the thorocolumbar spine (2 ± 0.6 mm3 LSB vs. 4.7 ± 5 mm3 no LSB). The two positions that allowed the lowest mean volume of spinal movement were: head of the bed elevated to 10 degrees and 30 degrees with headblocks adhered to the stretcher mattress (1.2 ± 1.5 mm3 and 0.9 ± 0.5 mm3, respectively). **Conclusions**: In healthy volunteers thorocolumbar spinal motion was limited in all groups and not contingent upon use of LSB. These data support the assertion that the long spine board is not superior for immobilization, and that more investigation should be performed to evaluate optimal thoracolumbar immobilization.

122. Supraglottic Airway Utilization vs Endotracheal Intubation Pre/Post Deployment of the I-Gel LMA in a Large Ground and Air-Based EMS Service

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Background: Identify changes in invasive airway management using supraglottic airways (SGA) and endotracheal intubation (ETI) as primary and secondary interventions following transition from the King LTS-D to the i-gel LMA in an EMS setting. **Methods**: This is a retrospective observational study performed in a US-based ground/air EMS performing 86,000 transports annually. Charts documenting an attempt at invasive airway placement over a 12 month period were abstracted for age, gender, airway indication, type(s) of invasive airway device(s) attempted, number of placement attempts, and placement success. Two cohorts were defined: cohort "K" representing King LTD and cohort "I" representing i-gel LMA. ETI was continuously available. Primary endpoint was number of airways successfully managed using an SGA. Secondary endpoints included rate of use of invasive devices based on clinical indication and use of devices as primary or secondary interventions. Descriptive statistics were utilized. **Results**: A total of 660 charts were abstracted, 259 cohort K and 401 cohort I. Age (57.5 +/− 21.9y), and gender (63.5% male) were consistent across cohorts ($p = 0.07$ and 0.81, respectively). Acuity was similar across cohorts. SGAs were the primary device in 1.9% of cohort K and 37.9% of cohort I, and the secondary device in 10.4% of cohort K and 10.2% of cohort I. Success for first device was ETI 84.0% and SGA 40% in cohort K, and ETI 80.1% and SGA 92.7% in cohort I. Final successful device in cohort K was ETI 87.3%, SGA 11.1%, and in cohort I was ETI 54.6% and SGA 44.7%. Successful airway management was achieved using any invasive device at 94.2% in cohort K and at 98% in cohort I ($p = 0.015$). **Conclusions**: Deployment of the i-gel LMA improved invasive airway management in this EMS service, achieving a 4% increase in success, and a final 98% overall success rate. Introduction of the i-gel resulted in an increase in use of SGAs as a primary device, and neutral effect on use of SGAs as a secondary device. Despite that successful invasive airway management by any device improved following i-gel deployment, erosion of ETI skills is identified as a potential collateral effect that requires surveillance.

123. I Love My Community Paramedic: Patients Report Overwhelming Satisfaction with Community Paramedic Program

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Background: Patient satisfaction is a key indicator of healthcare quality. Community Paramedic (CP) is an emerging profession and as such is there is limited data on patient satisfaction with CP programs. Hypothesis: Patients enrolled in a 30-day post-discharge community paramedic program report high satisfaction with both the program and the care provided by the CP. **Methods**: Inpatients with a diagnosis of CHF were offered post-discharge home visits by a CP for up to 30 days after discharge. Inclusion criteria required that the patient was a local resident, not eligible for home-health services upon discharge, diagnosis of CHF, English speaking, and written, informed consent to home visits by a CP. The CP visited the patient in the home 1–2 times per week for 4 weeks following discharge. At the final visit the patient was surveyed to assess their satisfaction with the program. Scores ranged 1–4, 1 being "very dissatisfied" and 4 being "very satisfied." Mean scores from the Likert scale were analyzed and are reported descriptively. **Results**: A total of 59 patients completed surveys regarding their satisfaction with the program. Mean scores for each question were as follows: willingness to listen carefully to the patient (4.0), time taken to answer patient questions (4.0), amount of time spent with the patient (4.0), explaining things in a way the patient could understand (3.95), instructions regarding medication and follow-up care (3.97), thoroughness of the examination (4.0), advice given on ways to stay healthy (3.94), and overall satisfaction level (4.0). 100% of patients responded they would recommend the community paramedic service to others. **Conclusions**: Patients provided overwhelmingly positive feedback on the CP program. Patient's open responses included: "I was glad that they were here the first day that I got out of the hospital." "When I got out of the hospital I was just so messed up, I had all these drugs and stuff, and she went through them and got everything worked out. It made a big difference; I was so overwhelmed at that time." This study is limited by the small sample size. We hope to maintain these results as the program continues.

124. Evaluation of Educational Methods for Prehospital Medical Command (PMC) Training for Emergency Medicine Residents (EMRS)

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Background: PMC is a crucial part of EMR training. This skill can be difficult to teach in predominantly off-line prehospital systems, and training for PMC may not be standardized across programs. The purpose of this study was to evaluate a phased comprehensive PMC curriculum for EMRs. **Methods**: Setting: Tertiary academic medical center. Participants: EMRs. Design: Subjects were taught PMC in phases consisting of (1) lecture; (2) review of PMC calls; and (3) simulated PMC calls. A survey was given pre-training and after each phase using a Likert Scale to assess comfort with medical command (MC), refusal of medical assistance (RMA), and field termination (FT) along with familiarity of protocols (FP) and phase usefulness (PU). Mean and median Likert scores for these categories were compared among phases using the t-test and Mann-Whitney test, respectively, with statistical significance set a priori at < 0.05. Participants indicated the most useful and instructional phase. Pre- and post-tests were given to evaluate changes in knowledge. Mean and median test scores were similarly compared. The IRB deemed this study exempt. **Results**: Statistically significant differences were found in all comparisons, except for FT, FP, and PU from phase 1 to 2 and from phase 2 to 3, and for MC and RMA from phase 2 to 3. For the former group, statistically significant differences were found from phase 1 to 3. A statistically significant increase was found in test scores (mean 50% to 65%, median 40% to 67%). Participants found phase 2 the most useful and simulated calls the best way to learn PMC. **Conclusions**: A statistically significant increase in Likert scores was found in all categories from pre-training to completion of all phases. The study found a possible cumulative effect of phases 2 and 3 for FT and FP, suggesting a benefit from the addition of simulated calls to review of PMC calls alone. The statistically significant increase in test scores demonstrated an increase in PMC knowledge from the training. One limitation was the lack of a consistent population due to EMR schedules. Further research should provide the training over one day to ensure consistency.

125. Effect of Transport Time Interval on Neurological Recovery after Out-of-Hospital Cardiac Arrest in Patients without a Prehospital Return of Spontaneous Circulation

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Background: Longer transport can adversely affect the outcomes of out-of-hospital cardiac arrest (OHCA) patients without return of spontaneous circulation (ROSC), and those effects can be aggravated when resuscitation efforts at the scene are insufficient. The aim of this study was to determine the association between the transport time interval (TTI) and neurologic outcomes in OHCA patients without ROSC. **Methods**: We analyzed 57,902 adult OHCA patients with presumed cardiac etiology and without prehospital ROSC. The primary exposure was TTI, which was categorized as short (1–5 min), intermediate (6–10 min), and long (≥11 min). The primary outcome was good neurological recovery at discharge (cerebral performance category 1 or 2). Multiple logistic regression analysis was used, and the final model included an interaction term between TTI and scene time interval (STI). **Results**: Among the patients, 40%, 36%, and 24% were classified as short, intermediate, and long TTI, respectively. Good neurological recovery occurred in 1.0%, 0.6%, and 0.3% of the short, intermediate, and long TTI groups, respectively. Referencing the short TTI group, the adjusted odds ratios (aORs) [95% confidence interval (CI)] of TTI for good neurological recovery was 0.58 (0.47–0.73) for intermediate TTIs and 0.30 (0.21–0.41) for long TTIs. In the interaction model, the aOR of TTI for good neurological recovery was smaller in the 1- to 5-min STI group than in the ≥6-min STI group. **Conclusions**: A longer TTI adversely affected the likelihood of good neurologic recovery among OHCA patients without prehospital ROSC. This negative effect was intensified when the STI was short.

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

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Background: 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. Purpose: In the CP setting, to assess the validity of two devices (Abbott i-STAT and Alere epoc) and contrast their usability. **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.

127. Characteristics of Paramedic Graduates Who Retest after an Unsuccessful Attempt on a National Cognitive Examination

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Background: Paramedic program graduates invest significant time and effort in completing their training. However, some graduates are

unsuccessful on the national paramedic certification examination on their first attempt. The proportion of paramedic graduates who do not retest, despite available attempts, is unknown. The objective was to describe paramedic graduates who do not retest and their associated characteristics. We hypothesized that few graduates chose not to retest and retesting was not associated with specific candidate characteristics. **Methods**: We conducted a cross-sectional evaluation of the national paramedic certification cognitive examination results for the class of 2013. This computer adaptive test terminates when the 95% confidence interval surrounding the estimate of the candidate's ability is entirely above or below the passing standard. Test length ranged from a minimum of 80 to a maximum of 150 questions. Unsuccessful testers were defined as candidates who had a grade of fail or incomplete (did not finish the examination) on their first examination attempt. Graduates of military only training programs were excluded. Chi-square tests, Wilcoxon Rank Sum test, and two tailed independent t-test were used to compare demographics and individual performance on the examination between successful and unsuccessful testers. **Results**: In 2013, 11,090 paramedic graduates attempted the national paramedic cognitive examination for the first time with an overall pass rate of 73%. Paramedic graduates who failed were more likely to be maximum length testers (38%, $N = 1{,}148$) than minimum length testers (29%, $N = 892$). Most graduates who were unsuccessful chose to retest (89%, $N = 2{,}697$). There was no clinically significant difference in the median age (28 vs. 29 years, $p = 0.0156$) or race/ethnicity (white, non-Hispanic 88% vs. minority 89%; $p = 0.706$) of students who chose to retest. Female students (86%, $N = 734$) were less likely to retest than male students (90%, $N = 1{,}911$, $p = 0.001$). **Conclusions**: The majority of graduates who were unsuccessful on their first attempt retested on the national paramedic cognitive examination with female graduates having lower retest rates. This study was limited by the lack of graduate specific information concerning their reasons for retesting. Future studies will need to focus on the individual characteristics which affect whether graduates chose not to retest.

128. Interaction Effect between Bystander Cardiopulmonary Resuscitation and Community Urbanization Level on Outcomes after Out-of-Hospital Cardiac Arrest

Jeong Ho Park, Young Sun Ro, Sang Do Shin, Kyung Jun Song, Ki Jeong Hong, So Yeon Kong, Dong Sun Choi, Gwan Jin Park, *Department of Emergency Medicine, Seoul National University Hospital* Category of Submission: Cardiac

Background: Positive association between bystander cardiopulmonary resuscitation and outcomes of out-of-hospital cardiac arrest (OHCA) are reported. There are various differences of sociodemographic and EMS factors between rural areas and urban areas. The aim of this study was to investigate whether the effect of bystander CPR on outcomes after OHCA differed by urbanization level of community. **Methods**: This study was a cross-sectional study using a nationwide EMS-based OHCA registry in Korea. We included adult witnessed OHCA patients with presumed cardiac etiology from 2013 to 2015. The primary exposure was bystander CPR categorized into 3 groups: bystander CPR with dispatcher assistance, bystander CPR without dispatcher assistance, and no bystander CPR. The endpoint was good neurologic recovery at discharge. We compared outcomes between bystander CPR group using multivariable logistic regression with an interaction term between bystander CPR and community urbanization level (Rural vs Urban). **Results**: Among 108,253 patients, 53,528 patients were included. 49.1% received bystander CPR (12.8% without dispatcher assistance and 36.3% with dispatcher assistance), and 50.9% received no bystander CPR. Good neurological recovery rate was 5.0% in bystander CPR with dispatcher assistance, 5.5% in bystander CPR without dispatcher assistance, and 2.2% in no bystander CPR group. In the interaction model, the adjusted OR of bystander CPR for good neurological recovery was different in urban areas [AOR (95% CI): 1.38 (1.17–1.63) without dispatcher assistance and 1.64 (1.44–1.86) with dispatcher assistance] and rural areas [AOR (95% CI): 2.80 (1.33–5.92) without dispatcher assistance and 4.46 (2.28–8.74) with dispatcher assistance]. **Conclusions**: The effect of Bystander CPR and DA-CPR was more prominent in rural areas than urban areas.

129. A National Description of the Use of Continuous Positive Airway Pressure in the Prehospital Setting

Rebecca Cash, Remle Crowe, Jeremiah Kinsman, Madison Rivard, Dave Bryson, Gamunu Wijetunge, Ashish Panchal, *National Registry of Emergency Medical Technicians* Category of Submission: Medical

Background: The use of continuous and bilevel positive airway pressure (CPAP/BiPAP) is limited to paramedics under the 2007 National EMS Scope of Practice Model. However, state and local practices may vary and current national trends of CPAP/BiPAP use by other EMS licensure levels is unknown. Our objective was to describe use and outcomes of CPAP/BiPAP by EMS licensure level nationally. We hypothesized that basic life support (BLS) only agencies use CPAP/BiPAP with similar patient outcomes compared to agencies with advanced life support (ALS) capability. **Methods**: Using the 2012–2015 National Emergency Medical Services Information Systems (NEMSIS) datasets, we evaluated all records with CPAP/BiPAP use documented by EMS professionals in agencies with BLS-only response versus a response with a combination of BLS and ALS (ALS-BLS). Only 911 responses were included. Variables assessed included patient and response characteristics, additional procedures performed, and cardiac arrest occurrences. Chi-square tests were used to evaluate differences between BLS-only and ALS-BLS responders. **Results**: There were 259,099 cases of CPAP/BiPAP use documented during the study period. Of these, 253,728 (98%) were performed by services with ALS-BLS responders. Most patients were 70 years or older (78%) and 49% were male. The most common incident locations were residences (65%) and health care facilities (20%). The proportion of patients treated by BLS-only responders who suffered cardiac arrest after EMS arrival was significantly greater (4% vs. 0.5% for ALS-BLS responders, $p < 0.001$) with a concomitant increase in the provision of chest compressions (BLS-only: 4%, ALS-BLS: 1%, $p < 0.001$). BLS-only response agencies more frequently upgraded to lights and sirens during transport (7%) than ALS-BLS responders (2%, $p < 0.001$). **Conclusions**: Use of CPAP/BiPAP by EMS agencies with BLS-only response occurred in 2% of cases. BLS-only responders documented more cardiac arrest events after EMS arrival than ALS-BLS responders, although the reasons for this finding require further evaluation beyond the scope of this dataset including geographical location and patient population served. This evaluation likely underestimates the use of CPAP/BiPAP by BLS practitioners since the dataset is unable to separate combined BLS-only and ALS-BLS response agencies. Further work is needed to understand the trends of CPAP/BiPAP use by BLS EMS professionals.

130. Association Between BMI and Return of Spontaneous Circulation in Out-of-Hospital Cardiac Arrest

Caitlin Howard, Jeremy Allen, David Wampler, Hattie McAviney, Justin Smith, David Miramontes, Joan Polk, *United States Army and UTHSCSA* Category of Submission: Student, Resident, Fellow

Background: Sudden cardiac arrest (SCA) continues to be the leading cause of death in the U.S. Current studies suggest that there is no strong correlation between BMI and resuscitation rates. The objective of this study was to evaluate what effect BMI has on the rate of return of spontaneous circulation (ROSC). **Methods**: This was a retrospective review of an in-house cardiac arrest registry containing details of each resuscitation attempted by a large, urban fire-based EMS system. Data was analyzed from January 1, 2016 through August 15, 2016. The BMI recorded was a subjective measurement obtained from the paramedic at the time of data collection. Patients were included in the study if the following variables were available: age, gender, BMI, and outcome (no ROSC vs. ROSC). Patients were excluded if age < 17, no age or gender recorded, no BMI data available, or no outcome available. Patients were divided into four groups based on the recorded BMI (under, normal, over, morbid). An ANOVA test was utilized to analyze continuous variables and a $\chi 2$ test was used to analyze categorical variables. **Results**: There were a total of 771 possible patients. 516 patients were included in the analysis. The mean age of the subjects was 63.08 + 17.96 years with 319 males (61.82%). 64 (12.40%) patients were underweight, 224 (43.41%) patients were normal weight, 168 (32.56%) patients were overweight, and 60 (11.63%) patients were morbidly obese. There was no statistically significant difference in outcome (no ROSC vs ROSC) between the BMI categories ($P = 0.37$). **Conclusions**: BMI did not have an association with rates of ROSC in this study. Our study did have limitations. First, the BMI was a subjective measurement and not calculated. Second, the data is from a single system cardiac arrest registry and may not be extrapolated to other systems.

131. Paramedics Providing Palliative Care at Home: Management of Pain and Breathlessness

Brianne Robinson, Alix Carter, Judah Goldstein, Michelle Harrison, Marianne Arab, *Dalhousie University* Category of Submission: Student, Resident, Fellow

Background: Palliative care is aimed at alleviating pain and distressing symptoms while offering support. Paramedics routinely respond to palliative patients and can assist with symptom relief. In Nova Scotia, a novel clinical practice guideline was implemented enabling paramedics to assist families with home medications, collaborate with on-scene home care teams, or to administer opiates through an expanded EMS formulary with the goal to treat at home if the patient desired. Paramedics comfort with the dose and range of opiates for palliative care is increasing. Our objective was to describe paramedic medication administration practices for the management of pain and breathlessness. **Methods**: We conducted a retrospective review of 100 consecutive palliative care responses from February 1, 2016 to June 30, 2016. An electronic query would fail to cap-

ture assistance with home medications; a manual chart review including standard medication administration fields and the free-text narrative was conducted to fully capture the care provided. Descriptive analysis was conducted and results were reported with n and % or mean and standard deviation. **Results**: Study population included 94 unique patients; 6 patients had 2–4 calls and the remaining had one. Paramedics administered medication to 58 (58%) patients, and of those 42 (72.4%) remained at home compared to 17/42 (40.5%) with no medication. Most common CC was pain; despite this, only 36 (80%) pain patients received treatment and 6 (13.3%) had both pre- and post-treatment pain scores. Only 12 (44.4%) breathlessness patients received medication. Paramedics assisted with home medication 10 (17.2%), administered from drug kit 45 (77.6%) and both 3 (5.2%). Mean oral morphine equivalent was 13 ± 7.5 mg. Contact with an OnLine Medical Physician (OLMP) occurred during 57 encounters, and was increased when medication was administered 46 (79.3%) compared to no medication 11 (26.2%). **Conclusions**: Medication administration would be underestimated in an electronic query alone. Even with inclusion of assistance with home medications, management of pain and breathlessness may not be optimized. Pre- and particularly post-medication pain scores would confirm symptom control. Contact with OLMP when paramedics were not going to administer medication should increase administration and non-transport through increased comfort and confidence.

132. Ketamine Indications in Statewide Treatment Protocols

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Background: Ketamine was discovered in the 1960s, and since that time has been used for multiple indications including pain control, procedural sedation, induction, depression, and excited delirium/behavioral disturbances. Ketamine has a more favorable hemodynamic profile than many of its alternatives for the same indications. It can be administered through the intravenous, intraosseous or intramuscular routes. The purpose of this investigation is to describe the overall prevalence of ketamine in STPs and the indications for which it can be utilized. **Methods**: Cross sectional study of STPs for inclusion of ketamine in any protocols. Protocol revision date was also captured. **Results**: Thirty-one out of fifty (62%) states issue ALS STPs, seven of which serve as guidelines. 48% of STPs include ketamine as an approved medication in their pharmacopeia. Ten states (32%) include ketamine for induction during rapid sequence intubation, and five states (16%) allow ketamine for procedural sedation. Six states (19%) include ketamine in their pain control protocols. Eight states (26%) have excited delirium protocols which include the use of ketamine. One state also includes ketamine as an agent for shivering. 60% of states which include ketamine in their protocols only allow its use for one indication. 75% of protocols have been revised since 2015 and all have been revised within the past 5 years. **Conclusions**: Ketamine is a versatile medication with a variety of applications in prehospital care. Despite this, less than half of STPs include ketamine in their pharmacopoeia, and the majority of those that include it have limited indications. Ketamine is a hemodynamically stable option for pain control or induction for RSI, but a minority of states with STPs include ketamine for these indications. Ketamine has had a recent resurgence in emergency medicine, although as most protocols have been revised in the last 3 years, it is unlikely that protocol revision timing has been a barrier to ketamine adoption into STPs. Further study is needed to examine the barriers to introduction and indication expansion of ketamine in STPs.

133. Manual Syringe Aspiration and Administration of Epinephrine by Emergency Medical Technicians for Prehospital Treatment of Anaphylaxis

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Background: In recent years, the costs of epinephrine autoinjectors (EAIs) in the United States have risen substantially. In 2014, emergency medical services within a large urban/suburban county in the United States implemented the "Check and Inject" program to replace EAIs by teaching emergency medical technicians (EMTs) to manually aspirate epinephrine from a single-use 1 mg/mL epinephrine vial using a needle and syringe followed by prehospital intramuscular administration of the correct adult or pediatric dose of epinephrine for anaphylaxis or serious allergic reaction. Treatment was guided by an EMT protocol that required a trigger and symptoms. We sought to determine if the "Check and Inject" program was safely implemented by EMTs treating presumed prehospital anaphylaxis or serious allergic reaction. **Methods**: We conducted a prospective investigation of all cases treated as part of the "Check and Inject" program from July 2014 through December 2016 in the suburban aspects of the County and January 2016 through December 2016 within the major American city located within the county. All cases were prospectively collected using a custom quality improvement data form completed by the first responding EMTs. Two physicians completed a structured review of each EMS medical record to determine if the EMTs followed the "Check and Inject" protocol and determine if epinephrine was clinically-indicated based on physician review. **Results**: Of the 411 cases eligible for analysis, EMTs followed the protocol appropriately in 367 (89.3%) cases. In the remaining 44 (10.7%) cases, the EMS incident report form failed to document either a clear inciting allergic trigger or an appropriate symptom from the protocol list. Physician review determined that epinephrine was clinically indicated in 36 of the 44 cases. Among the remaining 8 cases (1.9%) that did not meet protocol criteria and were not clinically-indicated based on physician review, none had a documented adverse reaction to the epinephrine. **Conclusions**: We observed that EMTs successfully implemented the manual "Check and Inject" program for severe allergic reactions and anaphylaxis in a manner that typically agreed with physician review and without any overt identified safety issues.

134. Timely Treatment of Tiny Tummies: The Use of Oral Ondansetron in the Prehospital Environment

Kelly Meehan-Coussee, Abhijit Srungavarapu, John Martel, Michael Bohanske, J. Matthew Sholl, Tania Strout, *Maine Medical Center Emergency Medicine Division of EMS, Tufts University* Category of Submission: Student, Resident, Fellow

Background: Nausea and vomiting are common emergency department (ED) complaints. While oral rehydration therapy is the preferred treatment modality for dehydration, emesis is a therapeutic barrier. In 2013, Maine's statewide Emergency Medical Services (EMS) protocols added oral ondansetron for paramedic administration to children with nausea and vomiting, as unnecessary prehospital intravenous (IV) catheter placement is associated with discomfort, prolonged scene time and increased cost. Prehospital oral ondansetron administration has not previously been evaluated for clinical endpoints. Our objective was to evaluate the impact of prehospital oral ondansetron administration to pediatric patients on frequency of use, additional interventions, ED length of stay, rate of hospital admission and ED recidivism. **Methods**: We conducted a simple interrupted time-series analysis to assess the effect of oral ondansetron availability on study endpoints. Pediatric patients transported via EMS to our tertiary care pediatric referral center ED who received either oral or IV ondansetron in the prehospital setting for nausea or vomiting from 2011–2015 were included. Pre- and post-oral ondansetron protocol implementation groups were compared using chi-square, Fisher's exact or t-test as appropriate. **Results**: A total of 48 patients met inclusion criteria with a greater number treated in the post-protocol implementation period (34 vs. 14). A statistically significant increase in the proportion of patients receiving oral ondansetron in the prehospital setting was noted following protocol implementation (0% vs. 47%, $p = 0.002$). This was associated with a significant decline in the proportion receiving prehospital IVs (100% vs. 65%, $p = 0.010$) and prehospital IV ondansetron (100% vs. 53%, $p = 0.002$). Significant changes in other prehospital ($p = 0.521$) or ED interventions ($p = 0.741$), length of stay ($p = 0.253$), hospital admission rates ($p = 0.161$), or 48-hour ED return visits ($p = 0.254$) were not observed. **Conclusions**: The results of this study suggest that the availability of prehospital oral ondansetron increases the frequency of antiemetic use, decreasing the need for vascular access and improving patient comfort. An increase in other interventions, hospital admissions, or return ED visits was not observed. Despite concern that ondansetron may mask a medical or surgical emergency, this study suggests that pediatric patients treated with oral ondansetron prehospitally are not at increased risk of symptom-masking and subsequent return ED visits.

135. Use of a Community Paramedicine Program to Address High Utilizers of the 9-1-1 System

Thomas Grawey, Mario Colella, Steven Riegg, Michael Wright, *Medical College of Wisconsin* Category of Submission: Student, Resident, Fellow

Background: The role of community paramedics (CP) has been expanding over recent years. Many programs exist across the country, attempting to meet the unique needs of the local community. The Milwaukee Fire Department (MFD) has created a CP program which addresses high utilizers of the 9-1-1 system, attempting to decrease unnecessary use of resources and improve patient quality of life. **Objective**: To determine if enrolling high utilizers of the 9-1-1 system in a one month community paramedicine program decreased system usage. **Methods**: This is a retrospective chart review. Data from MFD's program in 2016 was reviewed. 9 out of 12 months had patients enrolled in the program, varying from 2–8 patients per month. Data was available and analyzed based on month of enrollment in the program. The number of 9-1-1 calls from the patients enrolled were reviewed with the 6 months prior to participation compared to

6 months after the program was completed. Total hours of community paramedic contact time was also monitored; 30 patients were excluded because they dropped out of the program prior to completion. **Results**: In all 9 months of implementation there was a drop in number of 9-1-1 use during the 6 months after completion of the program. August participants saw the least change, where 5 patients who required a total of 54.1 CP work hours saw a decrease from 18 to 13 runs over a 6 month period (−28%). In July there was the largest drop in 9-1-1 usage of 77% (48 to 11), during which time 4 patients were enrolled and 43.8 contact hours were performed. In 2016 there were a total of 47 patients enrolled in the program accounting for 337 calls pre-intervention and 149 calls (−56%) after 419.8 total hours of CP care were performed. For every 27 minutes of care provided, one less 9-1-1 call occurred. **Conclusions**: Participation in a community paramedicine program established to decrease 9-1-1 utilization cut use by 56%. Limitations include lack of information about nature of 9-1-1 calls including which calls required hospital transport. A future study could look at cost savings provided by the program.

136. UNDERSTANDING HOW TRANSACTIONAL STRESS RELATES TO STRESS REACTIONS AND SAFETY OUTCOMES

Elizabeth Donnelly, Paul Bradford, Cathie Hedges, Matthew Davis, Doug Socha, Peter Morassutti, *University of Windsor* CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS, DISASTER

Background: Increasing attention is being paid to the impact of stress and fatigue on safety in paramedicine. Specifically, empirical linkages have been established between fatigue, chronic work stress, critical incident stress, and safety outcomes. However, the relationship between transactional stresses, stress reactions like posttraumatic stress, fatigue, and safety outcomes (safety compromising behaviors, medication errors and adverse events, and injuries or exposures) have not been assessed. There are two types of transactional stress. Internal transactional stresses are associated with the day to day provision of service (e.g., offload delays, being placed on standby, dealing with dispatch, inappropriate use of EMS, mandatory overtime, and dealing with frequent service users). External transactional stress involves interacting with allied professions (e.g., law enforcement, Base Hospital, ER Charge nurses, ER Physicians, ER primary nurses, and fire fighters). The purpose of this study was to see if there was significant variation in levels of transactional stress in paramedics that endorsed high levels of posttraumatic stress, fatigue, or reported negative safety outcomes. **Methods**: An online survey was conducted with ten Canadian paramedic services with a 40.5% response rate ($n = 717$). T-tests were used to assess for significant differences. **Results**: Analyses revealed high levels of internal and external transactional stress in those paramedics with high levels of posttraumatic stress ($p < .001$), those who reported being fatigued ($p < .001$), those who reported injuries or exposures at work [internal ambulance stress ($p < .05$), external ambulance stress ($p < .001$), safety compromising behaviors ($p < .001$), and medication errors ($p < .05$)]. **Conclusions**: These results indicate that there are higher levels of transactional stresses between paramedics that report pathological levels of posttraumatic stress, significant fatigue, and negative safety outcomes. These exploratory analyses indicate that transactional stresses may influence the wellbeing of paramedics. The ability to further break down and focus on the specific factors may offer opportunities addressing posttraumatic stress and negative safety outcomes.

137. PREHOSPITAL AVAILABILITY AND USE OF MEDICATIONS FOR MANAGING HAZMAT EMERGENCIES

Kubwimana Mhayamaguru, Amber Bellafiore, Eric Lederer, Carl Youngs, Robert French, Joshua Gaither, Kristina Waters, Frank Walter, *The University of Arizona* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: A minimal amount is known about prehospital availability and use of medications to treat hazardous materials (hazmat) emergencies. The purpose of this study was to identify the availability and use of hazmat medications among paramedics with advanced hazmat training, practicing in prehospital settings in the United States (U.S.). **Methods**: An email Qualtrics® survey was sent to U.S. paramedics who completed the Advanced Hazmat Life Support (AHLS®) Provider Course from 1999–2017. The survey asked what specific hazmat medications were available to each respondent, how they were carried, and how frequently they had been used. For analysis, responses were grouped into those medications with hazmat indications only and those with multiple uses. Availability and use of each hazmat medication is reported using simple descriptive statistics, including number (n) and percent (%). Hazmat medications were considered to have been used if the surveyed paramedic gave them anytime in the last five years. **Results**: Of the 4,360 surveys sent, 784 (18.0%) were completed. Of the completed surveys, 279 (35.6%) paramedics had dedicated hazmat medication kits and 505 (64.4%) had hazmat medications carried with other medications. For those hazmat medications with hazmat uses only, availability/use was: cyanide antidotes 463 (59.1%) / 36 (4.6%), atropine + pralidoxime auto-injectors 376 (48.0%) / 5 (0.6%), pralidoxime multi-dose vials 122 / (15.6%) / 3 (0.4%), and methylene blue 103 (13.1%) / 5 (0.6%). The availability/use of hazmat medications with other uses was: atropine 513 (65.4%) / 63 (8.0%), calcium chloride 540 (68.9%) / 83 (10.6%), calcium gluconate 247 (31.5%) / 26 (3.3%), diazepam 498 (63.5%) / 49 (6.3%), lorazepam 262 (33.4%) / 18 (2.3%), midazolam 619 (79.0%) / 29 (3.7%), ophthalmic topical anesthetics 254 (32.4%) / 50 (6.4%), and topical lubricating jelly 462 (58.9%) / 28 (3.6%). **Conclusions**: Among paramedics with AHLS® Provider training there is limited availability and use of hazmat medications. Although local scope of practice, financial, and other geographical considerations likely contribute to these results, further work is needed to identify which medications should be available to paramedics to optimize the cost benefit ratio of stocking and using hazmat medications.

138. VALIDATION OF A PREHOSPITAL FALLS RISK ASSESSMENT TOOL

Allison Infinger, Meghan Wally, Rachel Seymour, Jonathan Studnek, *Mecklenburg EMS Agency* CATEGORY OF SUBMISSION: TRAUMA

Background: Every 15 seconds an older adult will present to the emergency room with a fall related injury. Prevention programs have demonstrated efficacy; however, health care providers must be able to identify at risk patients. This study aimed to develop a content valid and reliable assessment of environmental fall risk performed in the prehospital setting. **Methods**: First, we identified validated items for screening extrinsic factors from the literature. Then, a multidisciplinary expert panel completed two rounds of assessment using content validity index (CVI) scores to eliminate items. The remaining items were revised for prehospital use and rated by EMS professionals for clarity, relevance, and feasibility. The draft assessment tool was deployed for field testing with two paramedics to determine the feasibility and frequency of item identification. Following descriptive analysis and structured interviews, a second field test was conducted with a revised tool. Paired crews completed the assessment independently on low acuity patients whose home they entered. Pair agreement on the final tool was measured using Cohen's kappa. **Results**: A total of 87 items measuring extrinsic factors were identified. Round one of content validity testing eliminated 33 items (CVI ≤ 0.76); 22 items were condensed or removed due to redundancy. Round two eliminated another 6 items (CVI ≤ 0.70). Twenty-eight items were included in the initial EMS assessment and items with CVI scores ≤ 0.70 ($n = 4$) were eliminated. Twenty-two items were deployed for field testing. Round one of field testing ($n = 12$) revealed paramedics infrequently accessing the kitchen (41.6%), bathroom (0.0%), or bedroom (25%) and excluded room-specific items. Five crews completed 57 paired assessments in round two using a nine-item tool. One item ($\kappa = 0.8721$) returned a high level of agreement, whereas the remaining items showed low to moderate agreement ($\kappa = 0.3322$–0.5369). **Conclusions**: A nine-item, content-valid, prehospital falls risk assessment tool was created using a standardized process. After two rounds of field testing, the tool is not yet highly reliable. It is hypothesized that the low agreement is due to the variation in priorities of providers on scene. Future efforts should test the accuracy of extrinsic factor identification among secondary care providers only.

139. DEVELOPMENT OF A HYPOXIC ASPHYXIAL MODEL OF PSEUDO-PULSELESS ELECTRICAL ACTIVITY IN SWINE

Norman Paradis, Sarah Crockett, Jeffrey Gould, Christopher Kaufman, Karen Moodie, *Dartmouth-Hitchcock Medical Center* CATEGORY OF SUBMISSION: CARDIAC

Background: Pulseless electrical activity (PEA) is an increasingly prevalent initial rhythm in cardiac arrest, particularly with in-hospital respiratory arrests. Pseudo-PEA (p-PEA), which often precedes true PEA, is characterized by a low-flow state in which cardiac contraction produces a non-palpable blood pressure, and is difficult to treat. We set out to develop a reproducible, stable, and clinically relevant animal model of p-PEA for testing novel treatments. Hypothesis: Rapid induction of a hypoxic asphyxial state will result in a reproducible p-PEA state sufficient for study of pathophysiology and therapy. **Methods**: A state of p-PEA was induced via progressive hypoxia in twelve domestic swine ~32 kg with standard physiological monitoring. Blood flow was measured in the common carotid artery and jugular vein. FiO2 was reduced to 6% by increasing the fraction of nitrogen in inspired gas. A target systolic blood pressure (SBP) of 40 mmHg was used to mimic p-PEA. After resuscitation, the animal was stabilized. This cycle of hypoxic p-PEA and resuscitation was repeated until return of spontaneous circulation could not be achieved. **Results**: p-PEA could be reliably created by hypoxic asphyxiation. In this model, p-PEA was characterized by a mean heart rate of 77 ± 16 bpm, mean aortic blood pressure of 23 ± 6 mmHg, mean right atrial pressure of 14 ± 2 mmHg, mean carotid flow of 48 ± 16 mL/min, mean jugular flow of 10±5 mL/min, and mean intracranial pressure of 24 ± 3 mmHg. Time to achieve target systolic blood pressure was significantly less in the second round, however

the physiological responses were similar for both rounds. **Conclusions**: A reproducible, stable and clinically relevant porcine model of p-PEA via hypoxic asphyxiation was developed. Time to induction was reduced after multiple insults. This model offers an improved method for testing innovative therapies for p-PEA.

140. Characteristics of Acute Myocardial Infarction Cases Coded as Low-Acuity at Dispatch

Marie Gardett, Greg Scott, Chris Olola, Meghan Broadbent, *International Academies of Emergency Dispatch* Category of Submission: Cardiac

Background: Identification of acute myocardial infarction (AMI) can be complicated by the wide variety of symptomologies or presentations. While the most common symptom of AMI is chest pain, so-called "atypical" presentations are in fact quite common and extremely variable, and AMI sometimes presents with very mild-seeming symptoms such as flu-like chills and nausea, abdominal pain, or lightheadedness. Correctly identifying mild-seeming presentations that actually turn out to be AMIs can help ensure appropriate response and treatment. This study identified hospital-confirmed AMI cases coded as low-acuity at dispatch to determine whether any common characteristics could help identify these cases in the future. **Methods**: This was a retrospective study utilizing emergency medical dispatch (EMD), emergency medical services (EMS), and hospital discharge datasets. The study sample included all cases that arrived to the hospital via EMS. Primary outcome measures were the numbers of hospital-diagnosed AMIs categorized by patient age and gender, Chief Complaint Protocol, and dispatch determinant code; secondary measures were comparisons between EMD- and EMS-recorded symptoms. Descriptive statistics were used to characterize the distributions of all ALPHA-level cases and of ALPHA-level AMIs, categorization by hospital discharge destinations, and Chief Complaint. **Results**: A total of 8,007 ALPHA priority-level cases with corresponding hospital records were identified. Of these, 40 (0.50%) were identified as AMIs. These ALPHA-level AMI cases fell into only five Chief Complaint Protocols (Sick Person, Falls, Unconscious/Fainting, Abdominal Pain/Problems, and Hemorrhage/Lacerations). Older age and discharge to medical facility (rather than to home or self-care) were identified with AMI cases. The most commonly reported symptom was a fall, especially ground-level fall in an older-age patient. Certain "sick person" characteristics were also somewhat associated with AMI diagnosis. **Conclusions**: Overall, the number of AMI cases assigned to the ALPHA priority level is very low and is confined to very few Chief Complaint Protocols. In general, the ALPHA-coded AMIs in this study showed characteristics consistent with missed or silent AMIs widely described in other healthcare settings.

141. Heat Index Is the Main Factor Influencing Rates of Patient Presentation at East Carolina University Football Games

An Truong, Stephen Taylor, Roberto Portela, Kori Brewer, *Brody School of Medicine at East Carolina University* Category of Submission: Student, Resident, Fellow

Background: Mass gathering events are large gatherings of greater than 1000 people where access to patients is difficult and response by emergency medical services (EMS) may be delayed. Current literature suggests that multiple factors can influence patient presentation rates during these events. Local emergency physicians and EMS provide medical care at East Carolina University (ECU) football games with a stadium capacity of 51,082. ECU football games are typically staffed by six EMS units placed around the field's perimeter, one field-dedicated EMS unit, and 2 Medical Treatment Areas staffed with four physicians. Cooling tents are used as needed based on weather forecasts for the game. **Objective**: This study aimed to quantify patient presentation rates and factors influencing patient presentation during ECU football games between 2008 and 2016. **Methods**: A retrospective review of EMS field records and 9-1-1 incident numbers originating from the stadium on the dates and times of home football games from 2008–2016 was conducted. JMP Version 13 (Cary, NC) was used to conduct a bivariate correlation analysis on the cumulative data set to determine relationships between external factors and patient presentation as well as emergency department (ED) transport rates per 10,000 attendees. Heat index, attendance, and kickoff times were the main factors evaluated. RESULTS: Data from 47 home football games with attendance ranging from 33,048 to 51,082 were included. The heat index during the games ranged from 37.8 to 89.6 °F. Kickoff times ranged from 1200 to 2000 hours. Bivariate correlation analysis of heat index and patient presentation was calculated as 0.432 ($p < .05$). This result suggests a positive correlation between heat index and patient presentation rates. The correlation between heat index and rates of ED transport was moderately positive at 0.316 ($p < .05$). The bivariate analysis of attendance and kickoff times with patient presentation and ED transport rates showed little to no correlation with no statistical significance. **Conclusions**: Heat index values were shown to have a moderately strong correlation with rates of patient presentation at ECU football games. There was no correlation between attendance at the football games, kickoff times, and patient presentation rates.

142. Reducing 9-1-1 Over-Utilization through a Targeted Community Paramedic Hospice Referral Program

Peter Antevy, Kenneth Scheppke, Juan Cardona, Susan Toolan, Sharon Maraj, Frank Babinec, Julie Corona, Paul Pepe, *Memorial Healthcare System* Category of Submission: Medical

Background: Over-utilization of 9-1-1 systems is a nationwide problem that overburdens EMS agencies and often results in hospital transports better suited for other dispositions. For example, EMS professionals often are called to attend and transport patients who likely require out-of-hospital end-of-life care, yet still have unmet healthcare needs. The purpose of this study was to evaluate if a community paramedic (CP) could successfully refer appropriate patients to local hospice partners and thereby diminish EMS responses for those patients. **Methods**: Between April 1, 2015 and December 31, 2016, front-line EMS crews, guided by established criteria, referred potential hospice candidates to a single designated CP who visited those patients at their residence then referred those meeting specified hospice criteria to a hospice partner (VITAS Healthcare) for enrollment. Demographics, diagnoses, length of stay (LOS), and outcomes were collected for patients enrolled. The associated 9-1-1 utilization, before and after enrollment, was tracked and measured. **Results**: The CP attended 320 potential hospice patients over the 21-month period. Of the 136 patients seen in 2015, 42 (30.9%) were enrolled in hospice and, similarly, 64 of 184 (34.8%) seen in 2016 were also enrolled. Of those 106 total patients enrolled, 58 were men and 48 were women. While ranging in age from 3 to 86 years, 95.2% ($n = 101$) were over 68 and the main diagnoses involved included COPD, CHF, dementia and cancer. The average combined LOS with hospice services was 71 days and 23.5% ($n = 25$) of the 106 patients used their full 6-month hospice benefit. Another 11.3% ($n = 12$) are still enrolled. The total number of 9-1-1 responses for this cohort (prior to hospice enrollment) had been 439. This fell to 17 after enrollment (a 96.1% reduction in related EMS utilization). **Conclusions**: Based on this experience, it is concluded that community paramedic programs can play a very important role in facilitating the care of hospice-eligible patients and thus help to avoid unneeded EMS system utilization for such patients. Appropriate education of front-line EMS professionals, working in synchrony with a designated CP, can reduce unneeded 9-1-1 utilization, but, more importantly, facilitate the most appropriate and expert care through hospice-partner resources.

143. Prehospital Provider Year of Hire Correlates to Time Spent On-Scene in Emergent Trauma

Clark Smith, Steven Hulac, Spencer Knierim, Zachary McDade, David Edwards, *Denver Health and Hospital Authority* Category of Submission: Trauma

Background: The definitive prehospital management of critically-injured blunt or penetrating trauma patients is rapid transport to a trauma center. Retrospective studies of trauma registry data have indicated that prolonged on-scene times may worsen mortality in the most critically-injured patients. The preponderance of available research suggests that optimal management of these patients is the provision of basic stabilization measures while minimizing time spent on-scene. The objective of our study was to investigate if prehospital provider date of hire was associated with time spent on-scene in patients transported emergently with traumatic injuries. **Methods**: We conducted a data analysis of emergent transports of trauma patients by paramedics hired by our EMS agency during the years 2006 through 2015. We examined the on-scene times for these calls as recorded through the agency's computer-aided dispatch system, from January 2011 to June 2017. We compared the mean on-scene times for paramedics over this period, aggregated by year of hire. We excluded calls in which the provider indicated a specific delay or barrier to care in the electronic patient care report. **Results**: During the study period, paramedics from the included years of hire transported a total of 2,910 emergent trauma patients. The number of emergent trauma transports for paramedics from each year of hire range from 179 to 380. Paramedics with earlier years of hire have lower average on-scene times than those hired later. Paramedics hired in 2006 average 7.16 minutes on scene, while paramedics hired in 2015 average 9.14 minutes on scene. Linear regression of this data yielded an R-squared value of 0.82. Utilizing a one-way between subjects ANOVA, there was a significant effect of year of hire on average on-scene time at the $p < 0.05$ level [$F(2,2900) = 4.713$, $p < 0.001$]. **Conclusions**: There was a distinct association between paramedic year of hire and on-scene times in emergent transports of trauma patients. This is the first study comparing providers' years in service to their on-scene times with critically injured patients. Further research is needed to determine if this trend is seen in other similar agencies and to investigate its impact on patient outcomes.

144. BENCHMARKING EMS COMPASS TRAUMA SCENE TIMES AND TRAUMATIC PAIN MANAGEMENT PERFORMANCE MEASURES USING A NATIONAL DATASET

Jeffrey Jarvis, Dustin Barton, Lauren Sager, Nick Nudell, *Williamson County EMS* CATEGORY OF SUBMISSION: TRAUMA

Background: Minimizing scene times for patients with critical trauma has long been recommended. Additionally, pain from traumatic injuries is very common. Assessment and management of this pain has been identified as a key clinical performance measure by the EMS Compass initiative. There has been little work done using national data to benchmark these measures. We sought to describe the performance on these measures using a large commercial dataset. **Methods**: Using anonymous data from 9-4-1 consenting agencies, we analyzed 6 ½-years of data from ESO Solution's electronic health record (HER) to calculate benchmarks for: (1) the percentage of patients with trauma alert criteria as defined by the CDC trauma triage criteria for transport to a trauma center who have a scene time under 10 minutes, and (2) of patients with any traumatic injury, the proportion with at least one pain scale documented. For those with an initial pain score >5, the proportion with a second score reassessing pain. Of patients from ALS agencies who had an initial score >5, the proportion with decreased pain from the first to last pain score. We calculated both the proportion and 95% Confidence Interval as well as average, median and interquartile range (IQR) for time-based measures. **Results**: Of the 66,414 critical trauma patients, 16,162 (24.3%, 24.0–24.7%) had a scene time less than 10 minutes. The average scene time was 16.4 min, IQR 14.7(10.2, 20.2). Of 2,166,680 trauma patients, 1,053,747 (48.6%, 48.6–48.7%) had a pain score documented. Of 503,656 patients with initial scores of >5, 305,493 (60.7%, 60.5–60.8%) had a reassessment. Of the 310,737 patients of ALS agencies with a score >5, 64,076 (20.6%, 20.5–20.8%) had an improvement in pain scores. **Conclusions**: We provide the first benchmarks on critical trauma scene times and pain management using a large national dataset. The results indicate additional efforts are needed, both for assessing/documenting traumatic pain and in addressing it. Additionally, scene times on critical patients are rarely under the "platinum" 10 minutes, indicating either need for improvement or a more realistic goal.

145. STOP THE BLEED: THE EFFECT OF HEMORRHAGE CONTROL EDUCATION ON LAYPERSONS' WILLINGNESS TO RESPOND DURING A TRAUMATIC MEDICAL EMERGENCY

Derek Brown, Elliot Ross, Theodore Redman, Julian Mapp, Kaori Tanaka, Chetan Kharod, Craig Cooley, David Wampler, *SAUSHEC Military EMS & Disaster Medicine Fellowship* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: The "Stop the Bleed" campaign advocates for non-medical personnel to be trained in basic hemorrhage control. However, it is not clear what type of education or the duration of instruction that is required to meet that condition. The objective of this study was to determine the impact of a brief hemorrhage control educational curriculum on the willingness of laypersons to respond during a traumatic emergency. **Methods**: This education initiative was conducted between SEP 2016 and MAR 2017, and subjects were recruited from multiple community groups in a large metropolitan area. Individuals with formal medical certification were excluded. Participants completed a pre- and post-education questionnaire assessing personal comfort levels and their knowledge and attitudes about tourniquets and responding to traumatic emergencies. Each training course included 20 minutes of didactic instruction on hemorrhage control techniques, encompassing indications for tourniquets, and hands-on instruction with tourniquet application on both adult and pediatric mannequins. The primary outcome was willingness to use a tourniquet in response to a traumatic medical emergency. **Results**: Of 236 participants, 218 met eligibility criteria. When initially asked if they would use a tourniquet in real life 64% (140/218) responded "Yes". Following training, 96% (194/203) of participants responded that they would use a tourniquet in real life. Of participants who initially responded "No" (2%, 6/218), all responded "Yes" following training. Before training, men were statistically more likely to respond "Yes" to using tourniquets than women (80.9% vs. 57.1%, $p = 0.003$), but that difference resolved following training. When participants were asked about their comfort level with using a tourniquet in real life, there was a statistically significant improvement between their initial and post-training response (2.5 vs. 4.0, based on 5-point Likert scale, $p < 0.001$). **Conclusions**: In this hemorrhage control education study we found that a short educational intervention can improve layperson's self-efficacy and reported willingness to use a tourniquet in an emergency. Significant gender differences exist in the stated willingness to respond in emergencies. Identified barriers to act should be addressed when designing future hemorrhage control public health education campaigns. Community education should continue to be a priority of the "Stop the Bleed" campaign.

146. CAN PREHOSPITAL PROVIDERS CORRECTLY TRIAGE PATIENTS TO FREESTANDING EMERGENCY DEPARTMENTS?

Charles Hwang, Desmond Fitzpatrick, Jason Jones, *University of Florida Department of Emergency Medicine* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Freestanding emergency departments (FSEDs) are equipped to care for most emergencies but do not have all the resources that hospital-based emergency departments (EDs) offer. Emergency medical services (EMS) must routinely determine whether a FSED is an appropriate destination. Inappropriate triage may increase morbidity and mortality due to delay in definitive care. We sought to evaluate paramedics' ability in determining whether a FSED is the most appropriate destination. **Methods**: We conducted a retrospective study of two county EMS agencies and two FSEDs over more than 2 years. Both EMS agencies allow paramedic discretion in determining transport destination; both protocols read, "Any patient potentially requiring admission in the paramedic's best judgment (Ex. elderly, weakness, dizziness, dialysis, etc.) will be EXCLUDED and not considered eligible for transport to a FSED." The primary outcome was whether paramedics can correctly identify patients that can be cared fully at a FSED without additional resources. We sought to identify the percentage of patients brought by EMS to FSEDs that were discharged without additional hospital-based services. **Results**: Between January 1, 2015 and February 6, 2017, 1,247 EMS patients had a selected destination of FSED. We excluded patients that did not arrive at their selected FSED destination, left before FSED disposition, or were transferred from the FSED to unaffiliated hospitals. A total of 1,184 patients were included for analysis, and 885 (74.7%) did not require additional hospital resources. Comparing the two EMS agencies yielded similar results. Of note, multiple EMS narratives revealed that paramedics transported patients to a hospital-based ED instead of a FSED because the main hospital had more resources. **Conclusions**: The primary goal of triage is "determining how best to get the right person to the right place at the right time using the right amount of resources". The burgeoning of FSEDs highlights the significance of this critical concept. As FSEDs become more popular, a burden is frequently placed on paramedics to determine which patients are appropriate for specific emergency departments. Our study demonstrated that paramedics have a reasonable ability to appropriately triage patients to FSEDs and to predict the need for hospital resources.

147. OUTCOME IMPACTS OF COMMUNITY BYSTANDER DEFIBRILLATION VERSUS DISPATCHER-ASSISTED CPR (DA-CPR) IN OUT-OF-HOSPITAL CARDIAC ARREST AT PUBLIC LOCATIONS

Patrick Chow-In Ko, Shih-Chieh Huang, Yu-Wen Chen, Hong-Yi Hsiao, Matthew Huei-Ming Ma, Chung-Liang Shih, *National Taiwan University, College of Medicine, Department of Emergency Medicine* CATEGORY OF SUBMISSION: CARDIAC

Background: We compared the outcomes between a community-wide bystander defibrillation program and a DA-CPR program in patients after out-of-hospital cardiac arrest at public sites. **Methods**: A prospective 2-year community-wide observational database collected from a metropolitan OHCA e-Registry was studied, after a citywide bystander defibrillation rescue program had been launched that strategically provided publicly accessed AEDs (automated external defibrillators) in designated locations that were also e-registered; and a DA-CPR program had been run. The survival outcomes of OHCA at pubic locations between the two program interventions were compared. Outcomes included 2-hour sustained ROSC (return of spontaneous circulation) at hospital, survival to hospital discharge, and good CPC (Cerebral Performance Category Scale 1 or 2). All patient prehospital characteristics and outcome relations were evaluated and adjusted by regression analysis. **Results**: The density of public AEDs distribution increased from 3.96 to 6.24 per square kilometers in the studied 2 years. Among a total of 6,356 OHCA, 627 patients occurred at public locations, including 28 patients (male for 82%, witnessed arrest for 79%) received bystander aid by public AEDs plus CPR rescue and 243 patients (male for 64%, witnessed arrest for 61%) received dispatcher-assisted CPR. For these 28 patients, 53.6% (15/28) achieved prehospital ROSC at scene or during transport, 71.4% (20/28) achieved sustained ROSC after resuscitation at hospital, 57.1% (16/28) achieved survival-to-discharge and noticeably all those 16 (100%, 16/16) survival-to-discharge patients achieved excellent neurological outcome of CPC 1 (CPC Scale 1). Their outcomes were significantly better [71.4 vs. 43.6%, OR: 3.2 (95%CI: 1.4–7.6) for sustained ROSC; 57.1 vs. 25.9%, OR: 3.8 (95%CI: 1.7–8.5) for survival of discharge; 57.1 vs 16.9%, OR: 6.6 (95%CI: 2.9–14.9) for good CPC; and 100 vs. 65.1% for good CPC among survival-to-discharge] compared with those 243 patients by dispatcher-assisted CPR rescue. In 28 patients by bystander defibrillation rescue only one man without prehospital ROSC still achieved survival-to-discharge and good CPC. **Conclusions**: For OHCA patients at public locations, we found that a community-wide bystander defibrillation program were associated with excellent neurological outcome of CPC 1 and survival to hospital discharge that

were significantly higher than those associated with dispatcher-assisted CPR program.

148. Randomized Trial of a Shear Reduction Surface in Ambulance Transport

Kathleen Berns, Ann Tescher, Lucas Myers, Patrick Koehler, Kip Salzwedel, Heather McCormack, Marianne Russon, Josh Burton, Christine Lohse, Jay Mandrekar, Evan Call, Scott Zietlow, *Mayo Clinic* Category of Submissions: Operations, Quality, Safety Systems

Background: Shear is a known risk factor in pressure injury development such as decubitus ulcers. The purpose of this study is to examine the effectiveness of an anti-shear mattress overlay (ASMO) in reducing shear/pressure and increasing comfort on an ambulance stretcher. **Methods**: This was a randomized, cross-over design. Thirty adult volunteers in 3 BMI categories served as their own controls. PRE-DIA shear/pressure sensors were applied to the sacrum, ischial tuberosity (IT), and heel. The stretcher was placed in sequential 0°, 15°, and 30° elevations, with and without ASMO. The ambulance travelled over a closed course achieving 30 mph, with 5 complete stops at each head of bed elevation for a total of 900 trials. Subjects rated discomfort on a 0–10 scale after each series of 5 runs. **Results**: Peak shear difference between surfaces was −0.89, indicating that after adjusting for elevation, sensor location, BMI, starting pause peak shear levels were 0.89 Newtons (N) lower for ASMO compared with standard surface ($p = 0.057$). Compared with 0°, elevations of 15° and 30° increased these levels by 2.41N ($p < 0.001$) and 3.44N ($p < 0.001$), respectively. Using the sacrum as the reference, IT and heel had increased shear levels of 2.54N ($p < 0.001$) and 1.01N ($p = 0.079$), respectively. Peak pressure difference between surfaces was −1.69, indicating pre-run peak pressure levels were 1.69 mmHg lower for ASMO compared with standard surface ($p = 0.070$). Discomfort was lower on ASMO than standard surface at 0° and 30° ($p = 0.004$, $p = 0.014$). Both surfaces had increased discomfort moving from 0° to 30° ($p = 0.005$ and 0.039, respectively). **Conclusions**: ASMO reduced levels of shear, pressure and discomfort. During transport, attention should particularly be given to the heels and head of bed elevation.

149. Sleep Disorders Are Common Risk Factors for Occupational Injury

Matthew Weaver, Jason Sullivan, Conor O'Brien, Salim Qadri, Charles Czeisler, Laura Barger, *Brigham and Women's Hospital and Harvard Medical School* Category of Submission: Operations, Quality, Safety Systems, Disaster

Background: The rate of occupational injury in EMS is high and crashes are common. Fatigue has been identified as an important risk factor. Sleep disorders are common, often overlooked contributors to fatigue. We sought to examine the prevalence of common sleep disorders and their impact on occupational safety. **Methods**: A nationwide cross-sectional study collected data from 66 fire departments across the US who participated in a workplace-based sleep disorders screening and education program. Participants were screened for common sleep disorders using reliable and valid screening questionnaires and asked a series of questions about adverse safety outcomes which occurred in the past month. The cooperation rate was 58.6%. For this secondary analysis, the dataset was limited to participants who reported their primary responsibility as medical care and listed an EMT-Basic or higher certification. The prevalence of common sleep disorders is reported using descriptive statistics. The association between sleep disorder screening result and safety outcomes was tested using multi-level mixed effects logistic regression models which accounted for clustered responses. Models controlled for individual and agency-level risk factors, including age, gender, body mass index, exercise frequency, years of experience, shift schedule, work at multiple jobs, and annual call volume. **Results**: Responses were obtained from 2,992 fire-based EMS providers employed at 65 departments. Most were male (93%), full-time employees (99%), who worked 24 hour shifts (77.2%). One in three was obese (33.2%). Nearly half (45.1%), screened positive for at least one sleep disorder. Over 1/3 (33.9%) screened positive for obstructive sleep apnea, 7.5% screened positive for insomnia, and 10.1% screened positive for shift work disorder. More than 2/3 (71.6%) reported sleeping less than 7 hours per night on average and 33.8% had excessive daytime sleepiness. After controlling for potentially confounding variables, positive sleep disorder screening was independently associated with more than twice the odds of an occupational injury (OR 2.04; 95% CI 1.48–2.81), motor vehicle crash (OR 2.10; 95% CI 1.12–3.93), and near-crash (OR 2.27; 95% CI 1.94–2.66). **Conclusions**: Sleep disorders are highly prevalent among EMS providers. Sleep disorder screening may help to identify providers who are vulnerable to adverse safety outcomes.

150. Effectiveness of Manual Ventilation in Intubated Helicopter EMS Transported Trauma Patients

Timothy Lenz, Brett McLachlan, Craig Bilbrey, Keith Mausner, *Medical College of Wisconsin* Category of Submission: Trauma

Background: Helicopter EMS agencies are frequently called to prehospital settings to transport intubated patients to definitive care at a trauma center. There is no current evidence to inform the decision of ventilation in this population. Current practice varies by group from hand-operated bag-valve-mask (BVM) to mechanical ventilation. Our goal was to evaluate the effectiveness of manual BVM ventilatory support in our population of severely injured trauma patients. We hypothesized that manual control of ventilation will provide adequate support to maintain a physiologic end-tidal carbon dioxide (ETCO2). **Methods**: This research represents a prospective, observational, proof of concept study. Over a seven month period of data collection (June 2015 to December 2015) and across the three distinct bases of our flight program, twenty patients were enrolled. Inclusion criteria for the study was limited to traumatic mechanisms and patients endotracheally intubated on scene and transported by helicopter. Excluded were any interfacility transports, non-scene calls, and any patient intubated with a supraglottic device. ETCO2 monitoring was accomplished with a ZOLL ProPac programmed to collect data at 30 second intervals for the duration of the flight. Additional information on demographics and mechanism was also collected. As a descriptive pilot study, there were no considerations of power; we enrolled all patients during the study period who met the inclusion criteria. **Results**: The subject group of 20 trauma patients was used to collect data for over 500 cumulative minutes of manual ventilation. The percentage of cumulative time spent with adequate oxygen saturations (≥90% Sp02) was 83.6%. The percentage of cumulative total time spent with adequate ETCO2 (35–45 mmHg) was 48.7%, with 34.6% of time spent under this range and 16.7% above this range. **Conclusions**: Manual control of ventilation via BVM was able to maintain a physiologic ETCO2 only 48.7% of the time. There was significant variability, which resulted in intermittent hypoxia, as well as significant hyperventilation. Prior research has linked these events to increased morbidity and mortality. Further studies to compare similar data against mechanically ventilated patients is warranted before changes to practice can be made.

151. Development and Validation of Reality-Based Training Scenarios Simulating Violent EMS Encounters

Mallory DeLuca, Donald Garner, Jr., Remle Crowe, Rebecca Cash, Madison Rivard, Jefferson Williams, Ashish Panchal, Jose Cabanas, *Wake County EMS* Category of Submission: Professional

Background: Emergency Medical Services (EMS) providers are often exposed to violence during patient encounters. Traditional EMS training may not adequately address appropriate responses to potentially threatening situations. Our objective was to develop and validate scenarios to evaluate EMS providers' response to threatening situations. We hypothesized that provider recognition and perception of threatening situations would not differ given different patient presentations or aggressors. **Methods**: Using an iterative process, EMS physicians, EMS educators and law enforcement training staff developed four simulation scenarios to assess provider responses to threatening situations. Each scenario involved patient presentations and distractors that simulated common high-stress EMS encounters. The scenarios were standardized for timing (8 minutes) and distinct phases of escalation (e.g., entrance of distractor, physical contact with patient, physical contact with crew), with the same 51 data elements collected. The scenarios used actors in an immersive, realistic, video-recorded environment. Role players and evaluators attended a week-long course to standardize simulation performance and assessment. Providers were told that they were participating in a "patient care scenario" but otherwise blinded to the purpose of the simulation. Each provider participated in a single scenario as a member of a two-person team. The evaluator to participant ratio was 1:1. Characteristics were compared using chi-square tests. **Results**: A total of 272 EMS providers were evaluated across the four scenarios: domestic abuse ($n = 94$, 35%), possible overdose ($n = 44$, 16%), deceased mother ($n = 68$, 25%), and intoxicated homeless person ($n = 66$, 24%), with <3% missing data across elements. There were no differences in participant characteristics by scenario: certification levels ($p = 0.96$), sex ($p = 0.28$), and years of EMS experience ($p = 0.86$). Most providers felt their scenario was realistic ($n = 219/265$, 83%) and this rating did not differ across scenarios ($p = 0.08$). Overall, 63% ($n = 170/269$) of providers stated that if this scenario had occurred in real life, they would have felt threatened, with no difference across scenarios ($p = 0.31$). **Conclusions**: We created and validated four realistic scenarios for prehospital providers that simulated threatening patient encounters with standardized phases of escalation and data collection points. Future research should focus on evaluating the characteristics of threatening encounter phases that alert providers to the potential for violence.

152. Paramedics Providing Palliative Care at Home: An Evaluation of Paramedic Comfort and Confidence in Providing Palliative Support

Alix Carter, Judah Goldstein, Marianne Arab, Michelle Harrison, Wilma Crowell, Katherine

Houde, Jan Jensen, Mireille Lecours, James Sullivan, Carolyn Villard, Kathryn Downer, *Dalhousie University* CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS, DISASTER

Background: Paramedics are called for crisis and symptom management for patients receiving palliative care. To address the mismatch between EMS current care and the patient's goals of care, a new program was implemented in two provincial EMS systems. Prior to program launch, all paramedics were trained in the Learning Essentials Approach to Palliative Care (LEAP) Mini for Paramedics. We evaluated paramedic comfort and confidence to deliver palliative or end of life care. **Methods**: A prospective, cross-sectional electronic survey was delivered before and 18 months after training and program launch. A total of 1,255 paramedics received an email invitation. Participants scored questions on comfort and confidence on a 4-point Likert scale, and attitudes on a 7-point Likert scale. Scores are reported as Median (IQR). Wilcoxon ranked sum tested before and after differences. Open-ended questions were thematically analyzed by one author. **Results**: Pre-launch, 235 (18.9%) responded;105 were primary care paramedics (PCP) (44.7%). Post-launch, 267 responded (21.3%), 118 by (44.2%) PCPs. Paramedic comfort to provide palliative care scores improved: pre = 3 (IQR 1) to post = 3 (IQR 1) (p = 0.00009), where 4 = very comfortable. Comfort to provide palliative care without transport increased: pre = 3 (IQR 1) vs. post = 3 (IQR 1), p =< 0.000001). Confidence in having the right interventions tools to deliver palliative care increased from: pre = 2 (IQR 1) to post = 3 (IQR 0) (p =<0.000001); for care without transport to hospital: pre = 2 (IQR 1) to post = 3 (IQR 1), p =<0.000001). Respondents strongly agreed that all paramedics should be able to provide good basic palliative care: 7 [IQR 6, 7]) and that a patient with an incurable illness should receive palliative care: 6 [IQR 4, 7]). Thematic analysis revealed paramedics feel delivering palliative care is rewarding, although additional experiential training, continued expansion of the role of PCPs and additional medications were recommended. **Conclusions**: The palliative care training and additional resources resulted in improved comfort and confidence. Paramedics strongly agree with paramedic administration of palliative care, cite palliative care as an important and rewarding part of their job, and identified recommendations for further training and scope.

153. COMPLICATIONS WITH USE OF A TRANSPORT VENTILATOR WITH A KING-LTD BASED ON PEAK AIRWAY PRESSURE

Leonard Weiss, Gabriel Diamond, Thomas Segerson, Justin Talarico, Francis Guyette, Christian Martin-Gill, *Department of Emergency Medicine, University of Pittsburgh School of Medicine* CATEGORY OF SUBMISSION: MEDICAL

Background: Our prior pilot data demonstrated that mechanical ventilation during critical care transport using the King Laryngeal Tube Disposable airway (King-LTD) was associated with peak inspiratory pressures (PIP) above the manufacturer recommended 30 cmH2O in almost half of cases. In the current study, we aimed to determine prehospital and in-hospital complications associated with use of King-LTD when PIP with mechanical ventilation is above or below 30 cmH2O. **Methods**: We retrospectively reviewed all King-LTD uses with mechanical ventilation in a large multistate critical care transport service from December, 2006 through November, 2015. Cases of discontinuation of ventilatory efforts with King-LTD or missing PIP data were excluded. Primary outcomes were the incidence of prehospital complications (cardiac arrest, oxygenation or ventilation failure, emesis, and documented air leaks) and where hospital outcome data were available, the incidence of aspiration on radiologic studies (compared with chi square tests). We secondarily compared prehospital oxygenation and ventilation parameters, in-hospital ventilator days, ICU days, hospital days, and in-hospital death, using descriptive statistics. **Results**: Of 137 cases meeting inclusion, $N = 93$ (68%) were male, and average age was 50 years (+/−18). Median initial PIP was 30 cmH2O (IQR 24–40). In patients with PIP ≥ 30 cmH2O at any time ($N = 74$, 54%) vs. PIP <30 cmH2O ($N = 63$, 46%), final prehospital vital parameters were SpO2 99.5 (IQR 96–100) vs. 98.5 (IQR 95–100) and ETCO2 35 (IQR 32–41) vs. 33.5 (IQR 29–38). Prehospital complications occurred in 11 (8%) vs. 10 (7%) (p = 0.68). Of 87 patients with in-hospital data with PIP ≥ 30 cmH2O ($N = 46$) or <30 cmH2O ($N = 41$), incidence of aspiration was $N = 11$ (23.9%) vs. $N = 5$ (12.2%) (p = 0.16). Median ventilator days were 4 (IQR 1–10) vs. 3 (IQR 1–11.5), ICU days were 5.5 (IQR 2–16) vs. 3 (IQR 2–19), and hospital days were 8 (IQR 3–22) vs. 7.5 (IQR 2–27). $N = 19$ (40.4%) vs. $N = 13$ (31.7%) died. **Conclusions**: Although confounders such as aspiration prior to airway placement may exist, these data suggest that patients receiving mechanical ventilation via the King-LTD with PIP ≥ 30 cmH2O have similar incidence of prehospital and in-hospital complications.

154. THE EFFECT OF IV VS. IO ACCESS IN PREHOSPITAL CARDIAC ARREST ROSC RATES

Colby Redfield, Stephen Suarez, Jessica Daniels, Cristina Sanchez, Heidi Siples, Kim Landry, *Leon County EMS* CATEGORY OF SUBMISSION: CARDIAC

Background: The prevailing standard of care in prehospital emergency medical services is that either intravenous (IV) or intraosseous (IO) are acceptable routes for obtaining vascular access and delivery of resuscitation medications and volume expanders in cardiac arrest patients. Our local EMS agency's current cardiac arrest protocol allows for either IV or IO access to be placed without preference. Objective: To evaluate the effectiveness of IV access versus IO access, in terms of Return of Spontaneous Circulation (ROSC), for patients suffering from cardiac arrest. **Methods**: Quality Improvement retrospective review project examining cardiac arrest data with a single ACLS EMS agency with average call volume of 37,000 calls annually. We examined a four year period from 2013 to 2016. Cardiac Arrest patients were identified from a Quality Assurance Database. Exclusion criteria included trauma arrest, pediatrics, pregnancy, and obvious signs of death. Method of vascular access was determined by reviewing the report and placed into an excel spreadsheet along with ROSC determination. **Results**: A total of 1,028 patient care reports were examined from January 1, 2013 to December 31, 2016. There were 230 patients where resuscitation was not initiated due to obvious signs of death. A total of 46 patients were excluded as trauma related cardiac arrests and 31 patients excluded due to age less than 18 years. A total of 721 patients remained after applying the exclusion criteria. A total of 361 cardiac arrest patients had an IV placed with a ROSC in 148 (41.1%). A total of 360 cardiac arrest patients had an IO placed with a ROSC in 80 (22.2%). IV use during cardiac arrest had improved ROSC when compared to IO use (p < 0.001). **Conclusions**: In this small retrospective review, there is a correlation between higher ROSC rates and IV access versus IO access. Limitations include small sample size, single EMS agency and retrospective nature of study. Future studies should further evaluate the effectiveness of IO vs IV access in cardiac arrest and other low perfusion states such as shock in a prospective manner.

155. TYPE OF AIRWAY DEVICE DOES NOT AFFECT PHYSIOLOGIC MARKERS IN PATIENTS UNDERGOING MECHANICAL CPR: THE PREHOSPITAL AIRWAY AND MECHANICAL CPR EVALUATION STUDY

Torben Becker, Arjun Prabhu, Aric Berning, Clifton Callaway, Francis Guyette, Christian Martin-Gill, Torben Becker, *University of Florida* CATEGORY OF SUBMISSION: CARDIAC

Background: Mechanical chest compression (MCPR) devices and manual chest compressions achieve similar survival for patients with out-of-hospital cardiac arrest (OHCA). However, recent data suggest supraglottic airway devices (SGA) during MCPR may impair ventilation compared with an endotracheal tube (ETT). In this study, we tested whether markers of oxygenation, ventilation, and perfusion differed between OHCA patients receiving MCPR with SGA and OHCA patients receiving MCPR with ETT. **Methods**: We retrospectively reviewed prehospital and in-hospital electronic health records from three Emergency Medical Services (EMS) agencies from January 1, 2014 to December 21, 2016. We included all patients with OHCA who underwent MCPR and who had their airway managed with an ETT or SGA. The primary outcome was intra-arrest end-tidal carbon dioxide (etCO2) measurements. We also examined ventilation rates, vital signs upon return of spontaneous circulation (ROSC), as well as vital signs, lactic acid values, and venous or arterial blood gas results in the emergency department (ED). We also recorded rates of ROSC and survival at 24 hours, 30 days, and 90 days. **Results**: Of 140 patients who received MCPR, valid data were available for 126 patients. Of included patients, 84 (66.7%) had an ETT placed, and 42 (33.3%) had a SGA placed. Twenty-eight (22.6%) achieved ROSC. In-hospital data were available for 13 (10.3%) patients. There were no group differences in etCO2 values during arrest, vital signs upon ROSC or ED arrival, or arterial or venous partial pressure of oxygen, partial pressure of carbon dioxide, pH and lactic acid levels in the ED. There were no group differences in ROSC or survival at 24 hours, 30 days, or 90 days. **Conclusions**: We detected no difference in markers of oxygenation, ventilation or perfusion and no differences in survival for OHCA patient managed with either an ETT or SGA in combination with MCPR.

156. THE USE OF AIRWAY SIMULATION SCENARIOS TO AUGMENT SYSTEMIC QUALITY IMPROVEMENT INITIATIVES IN A FIRE-BASED EMS AGENCY

Eric Cortez, Tyler Smith, Andrew Little, Rich Latham, William Krebs, James Davis, David Keseg, *Ohio Health Doctors Hospital* CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS, DISASTER

Background: Airway simulation for prehospital providers has several benefits, including provider exposure to low-frequency procedures and identification of systemic quality improvement concerns. The objective of this study was to analyze two airway simulation scenarios during a two-hour paramedic airway course. We hypothesized that the simulation scenarios would identify areas of focus for future quality improvement initiatives. **Methods**: This was a prospective evaluation of paramedics in an all advanced life support (ALS) fire-based emergency medical services (EMS) system during two simulated airway scenarios in a hospital-based simulation center. During each session,

teams of paramedics (4–6 individuals) managed one trauma patient and one acute decompensated heart failure patient. Trained EMS agency instructors and simulation center personnel using a standard scoring sheet with predefined data points evaluated teams. The primary outcome was successful endotracheal intubation. Secondary outcomes included several pre-intubation and post-intubation assessment and management steps. Descriptive statistics were reported as medians with interquartile ranges (IQR) and proportions. **Results**: A total of 375 paramedics participated in 61 trauma scenarios and 74 heart failure scenarios. The median number of self-reported successful intubations in the previous six months was 1 (IQR 0–2). Successful intubation was achieved in 59 (97%) of the trauma scenarios and 73 (99%) of the heart failure scenarios. End-tidal capnography confirmation was performed in 60 (98%) of the trauma scenarios and 73 (99%) of the heart failure scenarios. Preoxygenation was performed in 60 (98%) of the trauma scenarios and 72 (97%) of the heart failure scenarios. Basic airway maneuvers (repositioning, suctioning) were performed in 13 (21%) of trauma scenarios and 31 (42%) of heart failure scenarios. In the heart failure scenario, allergies were reviewed in 10 (13.5%) encounters, and endotracheal tube dislodgement was recognized in 57 (77%) encounters. **Conclusions**: This study found high intubation success rates during the simulated scenarios, while other tasks, such as basic airway maneuvers and reviewing allergies, were performed at lower than expected rates. Developing quality improvement initiatives is challenging for low-frequency procedures. This study exemplifies the utility of airway simulation in helping to help guide quality improvement initiatives for large EMS agencies.

157. Incidences of Adverse Reactions Secondary to the Administration of Hydroxocobalamin for Suspected Cyanide Poisoning in the Prehospital Setting

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Background: The objective of this study was to assess the incidences of adverse reactions secondary to the prehospital administration of hydroxocobalamin to patients with suspected cyanide poisoning after exposure to smoke inhalation. Exposure to fires involves a high morbidity and mortality, in part by the cellular asphyxiant cyanide - a byproduct of the combustion of synthetic materials. Hydroxocobalamin, one of the most common antidotes, combines with cyanide to form a nontoxic metabolite. Since 2009, our department has administered hydroxocobalamin in 239 cases, creating one of the largest prehospital case series for a single agency. **Methods**: This is a retrospective analysis of adverse reactions in patients who were administered hydroxocobalamin in the setting of suspected cyanide poisoning by review of patient care reports as well as hydroxocobalamin-specific questionnaires. Patients were separated into two study populations: those in cardiac arrest, and those that were experiencing respiratory failure, altered mental status, seizures, coma, or hypotension of unknown etiology. Patients received 1.25–5 grams of hydroxocobalamin intravascularly. Adverse reactions recorded included erythema, nausea, seizures, headaches, allergic reactions, or increased blood pressures. **Results**: A total of 239 patients, with ages ranging from 1–99 years and a median age of 52 years, of whom 58% were male, were administered hydroxocobalamin. Patients in cardiac arrest comprised 36.8% of the patients studied and were excluded from subjective adverse reactions. For the remaining patients, one was observed to have nausea and another with post-administration seizure. An increase in blood pressure was noted in 42.4% of the patients, with a change in systolic measurements between 1–106 mmHg with a mean change of 13.9 mmHg (median 7 mmHg, SD = 17.6 mmHg) and change in diastolic measurements between 1–77 mmHg with a mean change of 19 mmHg (median 10 mmHg, SD = 24.8 mmHg). Of these patients, 7.9% experienced a clinically significant increase in blood pressure that resulted with a value greater than 180/110 mmHg. **Conclusions**: The administration of hydroxocobalamin was associated with a low incidence of previously reported adverse reactions when given in the prehospital setting for the treatment of suspected cyanide toxicity. Limitations for this study include its retrospective nature and its lack of hospital patient outcomes.

158. BIS: Bispectral Index Monitoring for Patients During Out-of-Hospital Cardiac Arrest

Ralph Frascone, Jeffrey Anderson, Joseph Pasquarella, Nicholas Loken, Sandi Wewerka, *Regions Hospital EMS* Category of Submission: Cardiac

Background: Progress in the treatment of OHCA has resulted in a need to rapidly determine the likelihood of neurological viability in patients during CPR. End tidal (Et) CO2 levels have been used as a measure of circulation during CPR, however, EtCO2 is not predictive of neurological recovery. Based upon studies in our animal laboratory, we hypothesize that measuring processed electroencephalography (EEG) during CPR can be used together with EtCO2 to determine if there are signs of brain electrical activity that may predict neurologically intact recovery from a cardiac arrest. The primary research question was to determine if EEG activity alone or in combination with another non-invasive measurement, EtCO2, could be used to predict the return of spontaneous circulation (ROSC). **Methods**: This is a multi-agency, prospective, proof-of-concept, prehospital, cohort study to determine the relationship between EtCO2 and BIS. Paramedics from three agencies were trained in the application of BIS. Sensors were applied as early as possible during resuscitation. BIS was recorded until the patient achieved ROSC or was pronounced dead. The BIS monitor transforms the EEG waveform into a dimensionless percent ranging from 0 (complete cerebral suppression) to 100 (fully awake and alert). Data was analyzed using descriptive statistics and unadjusted logistic regression. **Results**: Forty-two patients with BIS measures were enrolled. (ROSC) was achieved in 13 patients (31%). Neither BIS at initiation of CPR ($p = 0.513$) or BIS nadir (0.975) was significantly associated with ROSC. 29/40 (73%) died prior to or during transfer to the ED. BIS measures at initiation of CPR ($p = 0.973$) or at nadir (0.285) were not significantly associated with mortality. 2/11 patients who survived the ED transfer had BIS measures that fell below 5%. Similarly, among 40 patients with available data, ETCO2 at initiation of CPR or at nadir did not significantly predict ROSC outcomes ($p0 = 0.995$; $pnadir = 0.416$) or mortality ($p0=0.772$; $pnadir = 0.532$). Using ETCO2 <5% as a stopping rule only would have achieved 91% sensitivity for survival, as one patient who survived ED transfer had ETCO2 readings <5 during monitoring. **Conclusions**: In this small study, neither BIS nor ETCO2 monitoring are predictive of ROSC or survival through ED transfer.

159. Descriptive Analysis of Patients Administered Naloxone by Prehospital Providers

Eric Cortez, Kaitlin Bowers, Judd Shelton, Andrew Little, Robert Lowe, Sam Kotran, *Ohio Health Doctors Hospital* Category of Submission: Medical

Background: Emergency medical services (EMS) providers are administrating naloxone more frequently and at higher doses. The objective of this study was to analyze patients that received naloxone by EMS providers. We hypothesized that a proportion of prehospital patients were administered naloxone in the absence of apnea. **Methods**: This was a retrospective study of patients that received prehospital naloxone between October 1, 2015 and March 31, 2016. All patients administered naloxone and transported to emergency departments (EDs) within the study's healthcare system were included. Patients were excluded if they were transported to EDs outside of the healthcare system. The primary outcome was the presence of prehospital apnea before naloxone administration. Secondary outcomes included the proportion of patients diagnosed with opioid overdose in the ED, and the presence of prehospital unresponsiveness, miosis and hypoxia (< 94% pulse oximetry). Data points were defined a priori and a standardized data sheet was utilized. Data were reported as percentages, and medians with interquartile ranges (IQR). **Results**: A total of 350 patients were included. The median age was 45 years (IQR 31–56), and 61% were males. The most common naloxone doses were 2 mg (54%), 4 mg (26%), and 6 mg (7.2%). Of 347 patients with available prehospital physical exam findings, apnea was present in 27%, unresponsiveness in 56%, miosis in 51%, and hypoxia in 17%. Final ED diagnosis was available for 284 patients, and 128 (45%) were diagnosed with opioid overdose. **Conclusions**: In this study, a proportion of EMS patients received naloxone in the absence of apnea and other signs of opioid toxicity. Furthermore, over half of the patients were not diagnosed with opioid overdose in the ED. This data highlights several important considerations for EMS naloxone administration: indications (obvious opioid toxicity vs. undifferentiated overdose), endpoints of therapy (reversal of apnea vs. confusion), need for re-dosing (potent opioid toxicity vs. non-opioid overdose with partial response), and effects of naloxone administration in the setting of medical or traumatic emergencies. Limitations include a high number of missing ED diagnoses, and exclusion of patients transported to other hospitals.

160. Can Grip Technique and Bag Size Improve Volume Delivered with a Bag-Valve-Mask by EMS Providers?

Melissa Kroll, Jyotirmoy Das, Jeffrey Sielger, *Washington University/ Barnes-Jewish Hospital* Category of Submission: Medical

Background: Emergency Medical Services (EMS) professionals rely on the bag-valve-mask (BVM) to provide life-saving positive pressure ventilation in the prehospital setting. Multiple emergency medicine and critical care studies have shown that lung-protective ventilation protocols reduce morbidity and mortality. A recent study has shown that the volumes typically delivered by EMS professionals with the adult BVM are often higher than recommended by lung-protective ventilation protocols. Our primary objective was to determine if a group of EMS professionals could reduce the volume delivered by adjusting the way the BVM was held. Secondary objectives included (1) if the

adjusted grip allowed for volumes more consistent with lung-protection ventilation strategies and (2) comparing volumes to similar grip strategies used with a smaller BVM. **Methods**: A patient simulator of a head and thorax was used to record respiratory rate, tidal volume, peak pressure, and minute volume delivered by participants for 1 minute each across six different scenarios: three different grips (using the thumb and either three fingers, two fingers, or one finger) with two different sized BVMs (adult and pediatric). Trials were randomized by blindly selecting a paper with the scenario listed. A convenience sample of EMS providers was used based on EMS provider and research staff availability. **Results**: We enrolled 50 providers from a large, busy, urban hospital-based EMS agency a mean 8.60 (SD = 9.76) years of experience. Median volumes for each scenario were 836.0mL, 834.5mL, 794mL for the adult BMV ($p = 0.003$) and 576.0mL, 571.5mL, 547.0mL for the pediatric BVM ($p < 0.001$). Across all three grips, the pediatric BVM provided more breaths within the recommended volume range for a 70kg patient (46.4% vs 0.4%; $p < 0.001$) with only a 1.1% of breaths below the recommended tidal volume. **Conclusions**: The study suggests that it is possible to alter the volume provided by the BVM by altering the grip on the BVM. The tidal volumes recorded with the pediatric BVM were more consistent with lung-protective ventilation volumes.

161. Retrospective Refinement and Validation of a Hypoglycemia Decision Tool for Paramedics

Julie Sinclair, Michael Austin, Shannon Leduc, Zachary Cantor, Richard Dionne, Penny Price, Justin Maloney, Andrew Reed, Andrew Willmore, Valerie Charbonneau, Christian Vaillancourt, *Regional Paramedic Program for Eastern Ontario* Category of Submission: Medical

Background: Hypoglycemia symptoms are often treated by paramedics in the prehospital environment. Some evidence suggests that not all patients require transport to hospital following successful reversal of symptoms. We sought to refine and validate a decision tool derived to identify patients that could safely be assessed, treated, and not transported to hospital following paramedic care for hypoglycemia. **Methods**: We conducted a health record review of paramedic call reports and emergency department (ED) health records over a 6-month period (July 1, 2015–December 31, 2015). Prehospital records were queried to identify all adult patients with a prehospital reading of <72 mg/dl (4.0 mmol/L) excluding cardiac arrests and terminally ill patients. We used standardized case report forms to collect data. We defined short-term adverse events as admission to hospital, repeat access to paramedics/ED care, or death, occurring within 72 hrs of the initial prehospital hypoglycemic event. The hypoglycemia decision tool incorporates the following variables: on insulin, not on corticosteroid/oral diabetic agent, no seizure disorder or cardiovascular disease, and given CHO/protein. We performed descriptive, logistic regression analysis and test characteristics of the decision tool. **Results**: There were 392 included patients with the following characteristics: mean age 57.5 [range 18–97], male 55.9%, diabetic 72.5%, on insulin 60.2%, oral diabetic agents 10.7%, >1 paramedic encounter 18.6%; 247 (63.0%) were transported to hospital and 57 (14.5%) were admitted; 34 (8.7%) had repeat access to paramedic/ED care. A significant association was found between these patient characteristics and short-term events: renal disease, liver disease, homelessness and on chemotherapy agent; 60 (15.3%) patients met the revised hypoglycemia decision tool for non-transport. Of these, 8.3% were transported to hospital and all were discharged from ED with no additional management for hypoglycemia; 6.7% had repeat access to paramedics/ED care for hypoglycemia and none were admitted. The sensitivity of the hypoglycemia decision tool was 93.3%, specificity 17.8%, PPV 25.0%, NPV 90.0%. **Conclusions**: Demonstrating high sensitivity and NPV, this tool is potentially safe to rule out transport to hospital following paramedic care for prehospital hypoglycemia. Further research is needed to prospectively validate the tool and evaluate its impact on prehospital and healthcare systems.

162. Fall Risk Inventory by Paramedics Predicts Future Hospitalization and ED Utilization by Elders

Ryan Carter, Joanne McGovern, James Dziura, Fangyong Li, Geliang Gan, David Cone, Sandy Bogucki, *Yale University* Category of Submission: Medical

Background: One-third of community-dwelling elders fall each year. Previous work showed that more than half of elders who fall and activate EMS for "lift assists" without transport will activate EMS again within 30 days. Objective. To evaluate whether several parameters assessed by a research paramedic at a scheduled home visit predict ED visits and hospitalizations within 90 days in elders at risk for falls. **Methods**: For this prospective study, informed consent to track future healthcare utilization was obtained, and participants were enrolled via three pathways: 9-1-1 activation for lift assist, ED visit, or self-referral. Participants had scheduled home visits by research paramedics, who assessed home safety and fall risk (a 15-item survey of yes/no questions adapted for field use from a previously validated instrument), balance, and medical disability, and by a visiting nurse, who evaluated home health needs. Subsequent healthcare utilization within 90 days after the visiting nurse evaluation was identified by querying electronic hospital records. A multivariate analysis was performed, including several of the research paramedics' assessments plus race, sex, medication count, history of prior healthcare utilization, and enrollment pathway with the dependent variable being ED or hospital admission within 90 days. **Results**: Of 2,265 participants, 1,512 completed their research paramedic and visiting nurse appointments, with at least 90 days of subsequent observation. The median age was 77, with 69% female, 19% black, and 11% Hispanic. 390 (25.8%) had an ED or hospital admission within the 90-day time period. In the multivariate analysis, significant independent predictors of 90-day healthcare encounters included history of prior encounter (adjusted OR 2.94, p-value <0.0001), medication count (1.06, 0.0001), and fall risk (0.91, 0.0002). In an analysis using the same variables with the single outcome of 90-day hospitalization, these factors remained significant independent predictors, with similar adjusted odds ratios. **Conclusions**: This study demonstrates that the fall risk inventory, along with medication count and history of previous encounter, is an independent predictor of future healthcare utilization and hospitalization within 90 days. The field-adapted fall risk inventory is a simple tool for paramedics to enhance the EMS assessment of patients at risk of falls.

163. Factors Associated with a Good Outcome Following Pediatric Out-of-Hospital Cardiac Arrest in the Years Following the 2010 Resuscitation Guidelines

Paul Banerjee, Paul Pepe, Amninder Singh, Latha Ganti, *Polk County Fire Rescue* Category of Submission: Pediatric

Background: To determine which factors had the strongest association with good outcomes after pediatric out-of-hospital cardiac arrest (POHCA) since 2010 when clinical practice guidelines became more aligned with those used for adults. **Methods**: Conducted in a large EMS urban/surburban jurisdiction that uses a comprehensive Utstein-style database, all POHCA cases encountered over 5 calendar years (January 1, 2012 through December 31, 2016) were analyzed for associated outcome correlations following full implementation of the latest (2010) international guidelines for childhood basic and advanced life support. The analysis was used to identify current predictors for return of spontaneous circulation (ROSC), hospital admission (HA) and survival to successful hospital discharge (SURV). Logistic regression models of traditional predictors were performed using JMP 12.0 for Mac. **Results**: Of 133 consecutive POCHA cases studied, the interquartile range (IQR) for response intervals was 16 to 47 minutes (range: 0–490) and the majority presented with asystole. As traditionally predicted, shorter times from arrest to EMS arrival were associated (significantly) with ROSC, HA and SURV (all $p < 0.0001$) whereas bystander-witnessed arrest cases (only 13%) were not (p = NS). Still, in 95% of cases, the arrest was identified by a bystander prior to EMS arrival and, contrary to previous studies (with lower reported frequencies of bystander CPR), chest compressions were performed by bystanders in 59% of cases. The earlier CPR was provided by EMS personnel was itself (significantly) associated with ROSC, HA and SURV (all $P < 0.0001$), but some form of treatment before EMS arrival was provided in 54% of cases and such actions were strongly associated with ROSC, HA and SURV ($p < 0.0001$ for all 3 outcomes) whereas AED placement (50% of cases) was not. **Conclusions**: Although "witnessed arrest" cases and AED placement were not identified as contributing factors in this subpopulation of cardiac arrests (likely reflecting infrequent ventricular dysrhythmia etiologies), as expected, shorter elapsed intervals from the moment of arrest to EMS arrival; performance of CPR prior to EMS arrival; and, most importantly, any treatment provided before EMS arrival, all resulted in significantly higher rates of ROSC, hospital admission and survival beyond hospital discharge.

164. Adherence to Quality CPR Principles During the EMS to ED Handoff in Simulated Pediatric Cardiac Arrest

Ariel Cohen, Jen Anders, Jordan Duval-Arnould, *UCSD* Category of Submission: Pediatric

Background: The aim of this study is to quantitatively evaluate adherence to 2015 AHA guidelines for quality CPR during the transition of patient care from EMS to ED. We hypothesized that quality would be compromised during this complicated period; as measured by pauses in chest compressions. **Methods**: We simulated the handoff and resuscitation of a pediatric patient in a tertiary pediatric ED using EMS and hospital volunteers. This was a pilot study conducted over two, four hour sessions, where as many simulations as possible were run. Simulation began with entry of the prehospital gurney in the ER hallway and continued through first 10 seconds of dedicated compressions from ER staff on emergency department bed. CPR recording defibrillators collected CPR data (chest compression pauses (sec), rate (cc/min), depth (in) and CC fraction (CCF, %) throughout the scenario.

Qualitative assessment was performed using video recording and post-simulation participant surveys. The primary outcome was number of pauses in chest compression longer than 10 seconds. Secondary outcomes include analysis of depth and rate of compressions and qualitative feedback from participants about potential for errors. **Results**: A total of 16 simulated resuscitations were analyzed, with a total of 16 minutes of CPR. Only two simulations, each had a total of one pause longer than 10 seconds. Average depth of compressions ranged from 0.5–1.2 in. Average rate ranged from 107–146 cc/min, with the majority of compressions being above 120cc/min. **Conclusions**: Simulated CPR during EMS to ED handoff did not have an issue with prolonged pauses. However, the majority of the resuscitation did not meet quality goals/2015 Pediatric BLS Guidelines for depth and rate of compressions. Limitations include that this was a simulated resuscitation scenario and only one size mannequin was used. Future studies observing real-time resuscitation should evaluate the validity of this pilot study findings to possibly guide efforts to improve resuscitation quality.

165. Factors Associated with Pediatric Interfacility Transfer from Emergency Departments

Ali Aledhaim, Jon Mark Hirshon, Jennifer Fishe, Jennifer Anders, *University of Maryland Department of Emergency Medicine* Category of Submission: Pediatric

Background: In regionalized health systems, pediatric patients often require interfacility transfer (IFT) from an initial emergency care to a second acute care facility to reach definitive care. IFT is associated with patient safety risks, delays in definitive care, and increased cost. EMS triage tools to guide pediatric destination choice should be developed to reduce the need for IFT. Objective: To determine factors associated with the likelihood of pediatric ED patients undergoing Interfacility Transfer (IFT). **Methods**: This study encompassed 3 years (2010–2012) of Maryland HCUP ED visit data. We included patients 0–17 years of age with a discharge or transfer disposition. The analysis was limited to visits classified as "emergent" and the 20 most common Diagnosis Categories (DxC) associated with IFT. Factors assessed included DxC, age, gender, race, and insurance type. The likelihood of IFT from the ED was evaluated by weighted multivariate logistic regression modeling design. **Results**: For the three-year period, 146,995 pediatric ED patients were diagnosed with one of the top 20 DxC emergent conditions; 10,143 underwent IFT. All factors assessed were statistically significant with varying effect sizes. The largest difference was seen between the top 20 DxC medical (11.5% IFT) vs. trauma conditions (3.2% IFT, $p < 0.001$). Age was associated with incremental increases in transfer rate. Compared to 0–4 yo, the ORs of IFT were 1.35, 2.48, and 3.54 for 5–9 yo, 10–14 yo, and 15–17 yo, respectively ($p < 0.001$). In the adjusted logistic model, pediatric patients with medical conditions were 4.6 (4.41–4.85) times more likely to be transferred than patients with trauma conditions ($p < 0.001$). African-Americans were 22% less likely to undergo IFT than Caucasians. Private insurance and self-pay had a higher OR of transfer than Medicaid, 1.08 ($p = 0.002$), and 1.51 ($p < 0.001$), respectively. **Conclusions**: For pediatric medical patients, IFT from ED to another acute facility for admission is more common than for trauma. EMS triage tools to guide destination choice for pediatric medical patients may help reduce this discrepancy. Additionally, racial and insurance disparities exist for pediatric IFT from EDs.

166. Paramedics' Perceptions of Focused Point of Care Cardiac Ultrasound

John Reynolds, Juan March, Roberto Portela, Steven Taylor, Bryan Kitch, *Department of Emergency Medicine, Division of EMS, Brody School of Medicine, East Carolina University* Category of Submission: Student, Resident, Fellow

Background: Focused point of care cardiac ultrasound (FOCUS) has been used successfully in screening for many life threatening emergencies such as cardiac standstill, pericardial effusion, and others. There has been limited research on paramedics' ability to perform FOCUS, but none looking at their perceptions. The goal of this study was to evaluate paramedics' perceptions of FOCUS before and after an educational intervention. **Methods**: A prospective study was performed in a suburban/urban setting with a population of 180,000 and 26,000 EMS calls annually. Over a six month period a convenience sample of fire-based paramedics were recruited. The paramedics attended a 60 minute ultrasound lecture and practicum. An emergency medicine trained physician educated in basic ultrasound skills delivered the educational intervention to the paramedics. The paramedics completed a 5 question survey both before and after the education, regarding their perceptions of prehospital ultrasound. A Chi-square test or Fischer Exact test was used to determine statistical significance. **Results**: All 27 (100%) paramedics completed the pre-survey, education intervention, and the post-survey. Pre-survey only 2 of 27 paramedics felt they had a significant knowledge regarding FOCUS, while in the post-survey that number increased to 13 of 27, $p < 0.001$. Pre-survey 4 of 27 paramedics felt comfortable performing and reading a FOCUS during a cardiac arrest compared to 23 of 27 post-survey, $p < 0.001$. Pre-survey 8 of 27 paramedics agreed that the cost of FOCUS justifies the benefits as compared to 21 of 27 post-survey, OR = 8.3, 95% CI: 2.4–28.4. Almost half (13 of 27) of the paramedics thought that FOCUS performed by paramedics during cardiac arrest would be easy to perform based on the pre-survey, compared to 24 of 27 on the post-survey, OR= 8.6, 95% CI: 2.1–35.6. Pre-survey the majority of paramedics (19 of 27) already believed that they should have access to prehospital ultrasound, and in the post-survey that number increased to 25 of 27, $p < 0.08$. **Conclusions**: This study suggests that without previous education paramedics were not comfortable using ultrasound and believed FOCUS was not cost effective. Yet, after a brief educational intervention, paramedics' perceptions significantly changed.

167. Paramedics Can Successfully Perform Cardiac Ultrasonography Utilizing the Parasternal Long Axis Approach

John Reynolds, Juan March, Roberto Portela, Steven Taylor, Bryan Kitch, *Department of Emergency Medicine, Division of EMS, Brody School of Medicine, East Carolina University* Category of Submission: Student, Resident, Fellow

Background: Focused point of care cardiac ultrasound (FOCUS) has been used successfully in screening for many life-threatening emergencies such as cardiac standstill, pericardial effusion, and others. There has been limited research on paramedics' ability to perform FOCUS, but none specifically comparing paramedics' ability to utilize different cardiac views. This study aimed to determine if paramedics can perform FOCUS utilizing two different views. **Methods**: A prospective study was performed in a suburban/urban setting with a population of 180,000 and 26,000 EMS calls annually. Twenty-seven fire-based paramedics were recruited for this study. The paramedics completed a 60-minute educational intervention on FOCUS which included a lecture followed by a hands-on practicum concentrated on using the parasternal long axis and subxiphoid views only. An emergency medicine trained physician educated in basic ultrasound skills delivered the educational intervention to the paramedics. The paramedics were given a brief overview and training of ultrasound knobology, and then asked to perform FOCUS using only the parasternal long axis and subxiphoid views. Participants were then graded using the Cardiac Ultrasound Structural Assessment Scale (CUSAS). CUSAS is a 6-point graded scale that evaluates visualization of the cardiac structure. A CUSAS score of 6 is given when multiple chambers are visualized. A CUSAS score of 3 is given when there is only partial visualization of the ventricle. A CUSAS score of 1 is given when no chambers are visualized. **Results**: All 27 paramedics were able to view the heart during the practicum. When performing the parasternal long axis view 27 of 27 paramedics (100%) received a CUSAS score of 6 (multiple chambers visualized). In contrast, when performing the subxiphoid view 0 of 27 (0%) received a CUSAS score of 5 or 6, $p < 0.001$, 5 of 27 (19%) paramedics received a CUSAS score of 4 (multiple partial chambers including one ventricle) and 22 of 27 (81%) paramedics received a CUSAS score of 3. **Conclusions**: Our pilot study suggests paramedics with only limited education can be taught to successfully perform a FOCUS using the parasternal long axis view, but have difficulty using the subxiphoid view.

168. Increasing Cardiac Arrest Survival through a Novel Dispatcher CPR Instruction Program

Brittany Farrell, E. Brooke Lerner, M. Riccardo Colella, Kenneth Sternig, Lesley Simley, Christine Westrich, Charles Cady, *Medical College of Wisconsin* Category of Submission: Cardiac

Background: Out-of-hospital cardiac arrest (OHCA) survival rates remain low as do bystander CPR rates. When a dispatcher provides CPR instructions to a bystander who performs compressions the odds of survival increase. However, many communities do not provide this lifesaving intervention, often citing the barriers of limited personnel and funding. **Objective**: To describe the implementation of a novel centralized dispatcher CPR instruction program that serves seven PSAPs in a single county and compare bystander CPR rates before and after implementation. **Methods**: As of April 22, 2016, seven municipal public safety answering points (PSAPs) that did not previously provide dispatcher instructions implemented this novel program. Using a simple 30-minute self-directed video, 84 PSAP dispatchers were trained to utilize a two-question protocol to identify and transfer suspected OHCA cases to a central communication center. At this center, a trained communicator delivered CPR instructions to the caller. Training of the 26 central communicators was accomplished with a 2-hour in-person didactic session followed by a 2-hour practice session. We compared pre and post countywide EMS medical record data through December 2016 using descriptive statistics. We also collected and analyzed data from recordings of communicator-to-caller interactions. **Results**: 169 calls were transferred to the central dispatch center. Of those, 106 needed CPR instructions. Of those, 56 callers performed compressions before EMS arrival (52%). The 63 non-OHCA calls were for a variety of ailments ranging from severe to mild and the number

of non-OHCA calls decreased over time (May 44%; Dec 29%). 11 victims survived to hospital discharge, for a 19% survival rate; previously, the countywide survival rate was 10%. The countywide bystander CPR rate increased from 19% to 24%. Approximately 109 OHCA calls were not transferred for instructions, work continues to increase the rate of OHCA calls transferred. **Conclusions**: Implementing a novel centralized dispatcher CPR program increased the rate of bystander CPR. Using a central communication center for instructions allowed us to train and maintain a smaller group of communicators, leading to less cost and more experience for those communicators, while limiting the burden on the PSAP dispatchers.

169. Qualitative Study of Emergency Medical Technician and Patient Perspectives on the Transport Plus Program

Hayley Neher, Ksenia Gorbenko, Nadir Tan, Diana Grigoriou, Hugh Chapin, Lynne Richardson, Ula Hwang, Kevin Munjal, *Icahn School of Medicine at Mount Sinai* Category of Submission: Student, Resident, Fellow

Background: "Transport PLUS" is an educational intervention in which Emergency Medical Technicians (EMTs) are trained to use a checklist to perform discharge instruction comprehension assessments and home fall safety assessments for older adult patients transported home following hospitalizations. Previously reported preliminary findings demonstrated high rates of patient acceptance and removing fall hazards following the intervention. In this qualitative study, we endeavored to identify potential barriers to success and refine the existing checklist and other modifiable aspects of the program in order to maximize its effectiveness. **Methods**: This qualitative study consisted of two homogenous focus groups led by an experienced facilitator with Transport PLUS trained EMTs and potential older adult patients to assess barriers and opportunities for improving the program. Three independent analysts coded anonymous transcripts for themes, compared for consistency, and resolved disagreements through discussion. **Results**: Trained EMTs and potential patients found the program valuable but uncovered a number of potential barriers to success and suggested improvements. Themes identified by both groups included concerns for patient privacy and the importance of obtaining buy-in from both patients and providers. Trained EMTs also suggested improving phrasing of items on the checklist and optimizing delivery of educational information. Patient focus group suggested ways to enhance comprehension. Suggested improvements included emphasis on situational awareness during EMT training, building rapport, question order, normalizing safety measures, and explaining the reasoning behind including and excluding specific items on the checklist. **Conclusions**: The Transport PLUS program was well received by both EMTs and patients. We found a high degree of agreement between the two groups in identified barriers to success. Adjustments in EMT training and supportive materials, including checklists and handouts, were made based on suggestions obtained during the focus group interviews. Training was specifically enhanced to emphasize quality, consistency, communication skills and technique. Documents were enhanced to be more visually appealing, easier to understand, and promote better flow throughout the encounter. A randomized controlled trial to assess effectiveness of the program is already underway. If successful, our program will reduce the burden of preventable injuries and readmissions on frontline providers and health care systems.

170. Am I awake? Lack of Sedation Protocols for Intubated Patients during Transport in Statewide Treatment Protocols

Christina Loporcaro, David Schoenfeld, *Beth Israel Deaconess Medical Center/Harvard Medical School* Category of Submission: Student, Resident, Fellow

Background: In our constantly evolving healthcare system the transfer of intubated patients between facilities is an ever more common occurrence. While there is a paucity of literature regarding the impact of adequate sedation in the out of hospital environment, intensive care unit (ICU) studies have shown significant outcome measures such as ICU length of stay is associated with inadequate patient sedation. The purpose of this study was to describe current protocols for sedation of intubated patients during interfacility transfer (IFT), as well as the use of standardized sedation assessment scoring to guide sedative medication administration. **Methods**: Cross sectional study of STPs utilizing a standardized review to evaluate sedation protocols for intubated patients and the use of standardized sedation assessment scores. Protocol revision date was also captured. **Results**: Thirty-one out of fifty states (62%) issue ALS STPs. Of those thirty-one states, only one (3%) has a protocol for sedation of intubated patients. No STP incorporates or references any sedation scoring tool to help guide sedative administration or aid in patient assessment. 75% of protocols have been revised since 2015 and all have been revised within the past 5 years. **Conclusions**: Although there is little in the prehospital literature regarding patient outcomes with respect to inadequately sedated patients, self-extubation, excessive agitation on hospital arrival and vital sign abnormalities are complications well known to providers. This study demonstrates that current STPs do not provide paramedics with the tools to optimally assess and sedate intubated patients in the out of hospital environment. While sedation plans may be developed with medical control prior to transfer, a protocolized approach to sedation scoring and medication administration may be beneficial. This represents a serious deficiency in our ability to provide high quality care to intubated patients in the out of hospital environment. In the future, we hope to develop and validate a prehospital sedation scoring model and associated protocol for the management of intubated patients in the out of hospital environment.

171. Prevalence of Recurring Patient Encounters that Require Administration of Prehospital Naloxone: A Retrospective Chart Review

Thomas Dykstra, Jen Knapp, Patrick Dugan, Rhees Nickel, *City of Fort Wayne, EMS Foundation Chair* Category of Submission: Student, Resident, Fellow

Background: A significant proportion of patients responded to by EMS personnel for opioid overdose will continue to abuse opioids after treatment and resuscitation, leading to subsequent overdoses in the future that require additional treatment. The aim of this study is to identify the prevalence of recurrent encounters that require the administration of Naloxone to reverse opioid overdose. The trend of opioid abuse within the United States has continued to increase despite efforts to decrease their accessibility. To deter this issue, stricter guidelines regarding the prescription of medicinal opioids has led many individuals with addiction to seek illicit substances. The major health concern of opioid abuse, respiratory depression, is treated mainly with Naloxone, which counteracts opioids at the receptor level. It is thought by many EMS personnel that people experiencing resuscitation with Naloxone will continue to abuse opioids. **Methods**: This retrospective chart review examined electronic patient care reports provided by the Three Rivers Ambulance Authority (TRAA). All encounters in which Naloxone was administered between November 1, 2010 and October 31, 2016 by TRAA or other bystanders were examined. The number of encounters each patient had during this date range was used to analyze a general recurrence rate of opioid use. **Results**: The increase in number of individuals experiencing more than one Naloxone related event annually did not differ significantly from what was expected over the 6-year range, $\chi 2 = 9.81$, $p = 0.08$. However, the number of patients falling into this category increased more than triple throughout the study. **Conclusions**: The results of this study suggest that the number of recurrent patient encounters involving the administration of Naloxone has increased. While the extent of the increase of recurrence is much less than initially believed by EMS personnel, additional future studies to correctly identify the impact of recurrent patient encounters may show significant results to assist combating addiction.

172. Pharmacologic Opioid Alternatives for Pain Control in Statewide Treatment Protocols

Christie Fritz, Christina Loporcaro, David Schoenfeld, *Beth Israel Deaconess Medical Center/Harvard Medical School* Category of Submission: Student, Resident, Fellow

Background: There has been an increasing focus on reducing opioid use across healthcare in light of the opioid epidemic. There are multiple pharmacologic options for treating pain in the prehospital setting including ketamine, nitrous oxide, acetaminophen, ibuprofen, ketorolac and aspirin. The majority of states issue statewide treatment protocols (STPs) that are either mandatory, or serve as a guide for medical directors. The purpose of this investigation is to describe the extent to which STPs include alternatives to opioids for pain control. **Methods**: Cross sectional study of STPs, utilizing a standardized review of pharmacopeia in pain control protocols. Protocol revision date was also captured. **Results**: Thirty-two of fifty states (64%) issue STPs; 78% are mandatory; 38% of STPs limit pain management to opioid medications only; and 62% of STPs provide for pharmacologic alternatives to opioids for pain management. Pharmacologic alternatives for pain control are variable across STPs and include Nitrous oxide (50%), ketamine (19%), Tylenol (25%), ketorolac (25%), Ibuprofen (16%), and aspirin (6%). A total of 75% of protocols have been revised since 2015 and all have been revised within the past five years. All ALS statewide treatment protocols have explicit orders for opiates in their pain control protocols. **Conclusions**: The opiate epidemic in the U.S. has led to an increased focus on the use of alternatives to narcotic medications in healthcare. Pain management is an important part of prehospital care, however many states do not provide pharmacologic alternatives to narcotic medications. While no studies have identified prehospital narcotic administration as a cause of or contributor to the opiate epidemic, we should strive to reduce the use of narcotics when appropriate alternatives exist. Despite the majority of STPs undergoing protocol revisions within the last two years which is during the ongoing opiate

epidemic, STPs have not fully incorporated alternatives to opiates for pain control. This represents a significant opportunity to improve our STPs to include alternatives to narcotic medication for the management of pain, and do our small part to help combat the opiate epidemic. Further study is needed to better understand the barriers to adoption of non-opiate pharmacologic treatment or adjuncts for pain treatment.

173. The Heavy Lift: Impact of a Regional Bariatric Transport Program

Gerald Wydro, Larry Loose, Alvin Wang, *Department of Emergency Medicine, Aria Jefferson Health* Category of Submission: Operations, Quality, Safety Systems, Disaster

Background: Obesity is an epidemic in this nation and provides serious challenges to EMS for care and transport. Many systems have identified the problem, but few provide a solution to their providers. Alternatively, EMS systems should create a solution that is deployable, cost effective, and provides safe dignified transport. We describe the characteristics of a regional Bariatric Support Unit (BSU) transport system dispatched via the 9-1-1 system for bariatric patients. **Methods**: Descriptive analysis of a regional BSU transport system in our suburban EMS system served by 17 agencies covering an area of 622 sq. miles with a population of over 620,000. Requests for EMS service exceed 53,000 annually and are handled via a single 9-1-1 center. The BSU transport system utilizes three specially equipped ambulances (bariatric stretchers, lifts, ramps, and winches) strategically located throughout the county. The BSU ambulances rendezvous with the on scene EMS unit and assist with transport of the patient and crew to the hospital. **Results**: There were 121 requests for BSU transport during the 12 month period of review with 108 (89%) ending in transport to the hospital. The average weight of transported patients was 419 lbs. Of BSU requests, 66 (55%) were dispatched ALS, with less than half receiving an ALS intervention. The most common complaint type was Acute Extremity Pain (19%). Twenty Four patients (20%) used the system more than once. Average on-scene time increased by 150% for patients transported via BSU (30 minutes) compared to our system average on-scene time (12 minutes). Patient and EMS crew satisfaction was high with the BSU system and there were no reported injuries to patients or EMS providers during the review period. **Conclusions**: A regional BSU transport system provides a cost effective, safe and dignified means of transport of bariatric patients during EMS response. While more than half of cases were dispatched ALS, the most common complaint was Extremity Pain. No practitioners used unconventional modes of transportation for transporting a patient to the hospital during this period; 20% of patients utilized the system more than once. On-scene times were significantly increased however no adverse events were reported.

174. Nationwide Quality E-Registry for Dispatcher-Assisted Cardiopulmonary Resuscitation (DACPR) of Out-of-Hospital Cardiac Arrest (OHCA) – The Design for Structured Measurement

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Background: Following the guidelines of dispatch-assisted CPR (DACPR) may enhance bystander CPR rate after OHCA. Registry of quality measurement for DACPR has never been explored. We designed a nationwide quality registry for DACPR performance and innovated a structured format of measurement. **Methods**: A nationwide Google Forms based online e-registry system covering over twenty administrative regions and more than twenty millions of population was designed and launched for DACPR performance and quality measurement at individual case level for non-traumatic OHCA patient. Audio records of individual EMS call were reviewed for performance rating. System data inputted could be immediately retrieved as feedback to each corresponding administrative region. Recognition of cardiac arrest by call communication, CPR Instructions upon the recognized OHCA, and chest compression upon the recognized OHCA were the three major categorical performance indicators, and each operational time interval of call-to-recognition, call-to-instruction, and call-to-compression were evaluated. Each categorical performance indicator (Y-axis) was paired with its operational time interval (X-axis) as a set of quality index for diagrammatic comparison in our design. We used regression analysis for statistical analysis. **Results**: A total of 6,078 audio records for OHCA EMS calls across 18 regions were centralized into the nationwide DACPR Quality Registry in 6 months (minimal 40 to maximal 1,625 cases/region according to its population). Regional recognition rate significantly varied from 10.0% to 88.1% ($p < 0.01$; averaged 60.4%, SD 21.2%). Instruction rate varied from 41.3% to 93.1%% ($p < 0.01$; averaged 77.4%, SD 14.9%). Compression rate varied from 45.2% to 88.4% ($p < 0.01$; averaged 75.3%, SD 12.8%). Averaged regional call-to-recognition time, call-to-instruction time, and call-to-compression time were 58 (SD 21), 92 (SD 48), and 174 (SD 71) seconds. The designated diagrammatic comparisons may indicate the administrative regions of better performance located at the upward and leftward dimension, and the ones of unsatisfied performance located at the downward and rightward dimension (diagrams will be illustrated). **Conclusions**: We successfully innovated and launched a nationwide DACPR quality e-registry showing a wide variety of regional performance needing improvement. The designated diagram may easily indicate and compare the individual performance across the joint regions.

175. Pilot Randomized Control Trial of Pelvic Binder Compared to Standard Care in Prehospital Patients with a Suspected Pelvic Fracture

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Background: Pelvic ring fractures are associated with high morbidity and mortality, however, pelvic stabilization and hemorrhage control has not been rigorously tested. The primary objective of this study was to determine the feasibility of conducting a randomized controlled trial comparing a commercially available pelvic binder to standard care in prehospital patients with a suspected pelvic fracture. **Methods**: This prospective study collected data from an EMS agency - which serves a population of nearly 1 million and transports approximately 114,000 patients per year - and a level 1 trauma center. Eligible patients were those ≥18 years with a high-energy mechanism of injury and prehospital suspicion of pelvic fracture. Exclusion criteria were low-energy mechanism of injury, penetrating pelvic injuries, pregnancy, and inability to secure binder due to patient size. Community consultation to meet the requirements of Exception from Informed Consent was conducted prior to study implementation. EMS crews were randomly assigned a sealed kit at the start of each shift containing either a commercial binder (intervention) or towels (comparison), indicating standard of care. Prehospital providers were blinded to the contents until it was opened after identifying a patient meeting inclusion criteria. Outcomes included skin complications, hospital and ICU admissions, angioembolization, surgical control of bleeding, transfusions, and 30-day readmission and mortality. **Results**: A total of 30 patients with suspected pelvic fractures were enrolled from June 2016 to April 2017. Fourteen (46.7%) patients were randomized to the binder group; six (42.9%) had pelvic fracture diagnoses compared to four (25.0%) in the comparison group. The patient population was majority male (n=19, 63.3%) and averaged 31.5 years. Of the twenty-three patients (74.2%) admitted to the hospital, 11 (47.8%) were admitted to the ICU. Only 3 (9.6%) patients required angioembolization, 2 (6.5%) surgical control of bleeding, and 3 (9.6%) a transfusion. One (3.2%) patient required readmission and died within 30 days. There were no serious adverse events. **Conclusions**: This pilot test demonstrates that prehospital providers are able to implement a randomized trial, including identification of eligible patients, maintaining the randomization scheme and assignment to treatment, and handoff to the clinical and research teams at the receiving hospital.

176. Descriptive Analysis of Patients Transported via Ground and Air Critical Care Teams on Extracorporeal Membrane Oxygenation (ECMO)

Matthew Sztajnkrycer, Ryan Sherden, Meghan Lamp, Kathleen Berns, David Claypool, *Mayo Clinic* Category of Submission: Medical

Background: Despite improved portability and ease of cannulation, few U.S.-based medical transport services currently transfer patients on ECMO. The purpose of the current study was to perform a descriptive analysis of a cohort of patients transported via air or ground while on ECMO. **Methods**: Retrospective case series of patients transported by a single critical care transport provider to a single tertiary care facility between January 1, 2014 and May 31, 2017. Patients were included if transported while on ECMO. T-test and Fisher's Exact Test were performed for statistical analyses. **Results**: Twenty-five patients met inclusion criteria, of which 16 (64%) were male. Mean age was 43.4 ± 17.6 years (range 1–68 years). Sixteen patients were transported on VA-ECMO, while 9 were transported on VV-ECMO. Three patients were transported by ground critical care team, while 9 were transported by rotor wing and 13 were transported by fixed wing. Mean transport time was 60.8 ± 28.4 minutes. The most common indications for ECMO were respiratory failure/acute lung injury (48%) and cardiogenic shock (28%). Four patients received ECMO as extracorporeal life support (ECLS) for refractory cardiac arrest. No patient died during ECMO initiation or transport. Two patients required fluid boluses for low blood flow, while 5 received blood transfusion for cannulation-related blood loss. The most common interventions in transit were sedation, muscle relaxation, and heparinization. Survival to hospital discharge was 48%, with improved survival amongst younger patients ($p = 0.52$). Mortality for patients on VA-ECMO was 62.5%, compared

with 33.3% for those on VV-ECMO ($p = 0.35$). In patients receiving ECLS, 50% survived to discharge; both had refractory VF/VT arrests. No difference in survival was noted based upon early (40%) versus late (50%, $p = 0.70$) ECMO initiation. **Conclusions**: In our patient cohort, transport on ECMO was not associated with significant adverse event or mortality. VA ECMO for cardiopulmonary support was associated with worse final outcome. ECLS secondary to VF/VT arrest was associated with better survival to discharge compared with other dysrhythmias. The current data suggest that transportation of ECMO patients is safe, and initiation of ECMO need not be delayed pending transfer.

177. Does Prehospital Mode of Arrival Influence Women's Decisions to Participate in Research?

Madeline Karafanda, Martina Anto-Ocrah, Vivian Lewis, Todd Jusko, Jeff Bazarian, Edwin van Wijngaarden, Courtney Jones, *Department of Environmental Health, University of Rochester Medical Center* Category of Submission: Medical

Background: Advances in medicine require voluntary participation in research. This requirement however, may compromise study generalizability, as it is often unclear how refusals and participants differ. Further complicating the matter is the National Institutes of Health (NIH) requirement, that proposed research studies address any possible disparities in gender. Investigators have explored the barriers and facilitators for research participation. Few, however, have focused on how prehospital factors, specifically mode of Emergency Department (ED) arrival, may influence the recruitment of female subjects in research studies. We explored how prehospital mode of arrival (ambulance vs non-ambulance) affects research participation, sampling female subjects only. We hypothesize that women arriving via ambulance will be less willing to participate in research, compared to those arriving as walk-in/ambulatory patients. **Methods**: From January 9 to July 8 2017, we collected data on 373 women presenting for care in the ED of a Level 1 Trauma Center. All subjects were required to have GCS ≥13 and/or deemed capable of providing informed consent (following standard protocol and/or provider approval). Refusals were compared to participants based on variables abstracted from the medical record. Comparisons were made between groups using 2-tailed independent t tests or $\chi 2$ tests, as appropriate. **Results**: Ambulance users comprised a third of the sample (33.5%, $n = 125$) and non-users represented 66.5% ($n = 248$). The mean age was 28.5(+/−7.9), with no statistical differences between ambulance users and non-users ($p = 0.4$). Compared to non-users, a significant proportion of ambulance users (41.6% vs. 14.1%, $p < 0.001$), were involved in motor vehicle crashes, and sought care within 24 hours of their injury. Over a quarter of ambulance users (versus non-users) refused to participate in research (28.8% vs.19.4%, $p = 0.039$). Ambulance use was associated with a 69% increased odds of refusal to participate in research (95% CI: 1.02, 2.78). Reasons for refusing included "disinterest in research", time constraints" and "discomfort with consent process/nature of study". **Conclusions**: As hypothesized, ambulance transport to the ED is associated with increased odds of research refusal. Future studies should explore if this finding is unique to females only, and tailor ED-based research recruitment efforts, with ambulance mode of arrival as a consideration.

178. Pediatric Bypass: Characteristics and Effects on EMS Resources

Jennifer Fishe, Kevin Psoter, Kyle Fratta, Carla Tilchin, Jennifer Anders, *University of Florida College of Medicine - Jacksonville* Category of Submission: Pediatric

Background: Regionalization of pediatric care decreases pediatric service availability at community hospitals. However, pediatric regionalization's effects on EMS operations are unknown. This study describes pediatric transport characteristics, focusing on bypass patients. **Methods**: This retrospective study examined all transports ages 0–17 years from three geographically diverse EMS agencies (urban, suburban, and rural) over a 12-month period. Those agencies only pediatric destination protocol is the CDC Trauma Triage Tree. Scene response, destination facility, and surrounding facility locations were geocoded, and each facility assigned a category denoting pediatric service availability. Bypass was defined as transport to any facility other than the nearest. **Results**: The three agencies transported 12,223 pediatric patients during the study period, and 8,039 (66%) bypassed the nearest facility (80% to a higher level of pediatric care, and 20% to an equivalent or lower care level). Over half of urban (71%), suburban (60%), and rural (59%) agency pediatric transports were bypasses. The majority of children bypassed to a higher level of care were transported to pediatric trauma/specialty facilities (55%), followed by regional pediatric facilities (24%), and comprehensive pediatric facilities (21%). The top five EMS clinical impressions were pain, other, seizure, traumatic injury, and no apparent illness/injury. Patients bypassed to the same or lower care level were transported to community (51%), trauma/specialty (30%), comprehensive (12%), and regional facilities (7%). The top five impressions were pain, other, no apparent illness/injury, traumatic injury, and asthma. For bypass patients, median EMS transport distance was 6.2 km (25–75th percentiles: 3.2–10.8) and median driving time was 15.8 minutes (25–75th percentiles: 10.8–21.9), representing an additional median 2.9 km (25–75th percentiles: 1–6.4) and 6.8 minutes (25–75th percentiles: 3.1–12.6) from the closest facility. Median transport distance was 2.8 km (25–75th percentiles: 1.6–4.6) and median driving time was 8.6 (25–75th percentiles: 6.2–11.9) for patients transported to the closest facility. **Conclusions**: This study demonstrates high pediatric bypass rates, which coupled with increased transport distances and times, affect EMS resource allocation by occupying vehicles and crews for longer runs. Future work will determine each bypass' appropriateness to inform both EMS operations and pediatric destination decisions.

179. Removal of Left Bundle Branch Block from Prehospital ST-Elevation Criteria Decreases Number of Unnecessary Cath Lab Activations

Rachel Semmons, Elizabeth Mannion, Andrew Thomas, Quinn Frier, Jason Wilson, Cory Thomas, *Tampa Fire Rescue, University of South Florida* Category of Submission: Cardiac

Background: Prehospital identification of STEMI allows decreased time to PCI. False positive prehospital STEMI Alerts may waste resources through unnecessary cath lab activation as well as pose risks to patients. Our current prehospital STEMI Alert Criteria includes ST-segment elevation >1mm in two or more contiguous leads and/or presumed new left bundle branch block (LBBB) in the presence of anginal symptoms. LBBB was removed from STEMI criteria in the most recent AHA/ACC STEMI guidelines as a result of low specificity. We hypothesize that LBBB has led to a high number of false positive activations in our system and can safely be removed from our STEMI criteria. **Methods**: We conducted a one-year retrospective analysis of prehospital STEMI alerts. Hospital records were reviewed for ED physician interpretation of EKG findings of ST-elevation, LBBB, or neither of these criteria (nondiagnostic). Primary outcomes were cath lab activation and intervention. Secondary outcomes analyzed were presence of initial elevated troponin. We excluded patients with missing records. **Results**: A total of 107 STEMI Alerts were transported over the study period, with records available for 102 patients. Of patients identified as EMS STEMI Alerts, 45.1% went to cath, and 36.3% received coronary intervention. Rates of cath lab activation and coronary intervention were significantly higher in patients with an ED physician interpretation of ST-elevation compared to those with LBBB (71% vs. 9%, OR 22.03, CI 9.77–49.68, $p < 0.0001$). One patient with LBBB received emergent cath with stenting after testing revealed elevated troponin. Secondary analysis of this patient's EKG showed that he did not have Sgarbossa criteria. **Conclusions**: The majority of EMS STEMI alerts did not require emergent cardiac catheterization. More false positive alerts were due to nondiagnostic EKGs rather than LBBB. It appears that removal of LBBB as criteria for STEMI activation can safely lower STEMI alert numbers. Future protocols will direct EMS to transport patients with LBBB and anginal symptoms to a PCI-capable center without designating the patient as a STEMI alert. Further efforts will be aimed at decreasing the number of false positive alerts through EMS education.

180. Is Door-to-needle Time Reduced for EMS Transported Stroke Patients Routed Directly to the CT Scanner on ED Arrival?

Bryan Sloane, Nichole Bosson, Jeffrey Saver, Nerses Sanossian, Marianne Gausche-Hill, *Harbor-UCLA Medical Center* Category of Submission: Medical

Background: To evaluate if a protocol to route EMS-transported stroke patients directly to the CT scanner on ED arrival reduces door-to-needle time (DTN). We hypothesized a reduced DTN compared to initial routing to an ED bed. **Methods**: This is a retrospective analysis from a large regionalized stroke system. EMS utilize the modified Los Angeles Prehospital Stroke Screen (mLAPSS) and transport all suspected acute stroke patients to one of 46 Approved Stroke Centers (ASC). Some ASC route EMS directly to CT. ASC report patient treatment and outcomes to a registry, from which data were abstracted from May 2015 through April 2016. Adult patients transported by EMS and treated with intravenous thrombolytic therapy (IV tPA) were included. The primary outcome was median DTN at hospitals with CT routing protocols compared to hospitals with ED routing. Secondary outcomes were door-to-imaging time, hospital length of stay, and modified Rankin Scale at discharge. A subgroup analysis of patients with positive mLAPSS was planned a priori. Outcomes were compared with Hodges-Lehmann's median difference. **Results**: EMS transported 6315 patients for suspected stroke and 797 (13%) were treated with IV tPA, 143 at hospitals with CT routing and 654 at hospitals with ED routing. Patient characteristics were similar between groups; overall 420 (53%) were male, 500 (62%) White race, and 189 (24%) Hispanic ethnicity. Median NIHSS was 12 (IQR 8–19) in the CT routing group and 11 (IQR 5–19) in the ED routing group. Positive mLAPSS and EMS notifi-

cation occurred respectively in 63% and 96% in the CT routing group and 66% and 86% in the ED routing group. DTN was not different between groups, median DTN 59 minutes (IQR 45–78) for CT routing and 54 (IQR 40–73) for ED routing, median difference 4.5 (IQR 0–9). There were no differences between the groups in terms of secondary outcomes or within the mLAPSS-positive subgroup. **Conclusions**: In this regional stroke system, hospitals with protocols for routing EMS-transported stroke patients directly to CT did not have reduced DTN compared to hospitals without such protocols. These results are limited by the fact that the actual routing of each patient is not known.

181. Withdrawn

182. Association between BMI and Prehospital Selection of Advanced Airway in Out-of-Hospital Cardiac Arrest

Caitlin Howard, David Wampler, Jeremy Allen, Hattie McAviney, Justin Smith, David Miramontes, Joan Polk, *United States Army and UTHSCSA* Category of Submission: Student, Resident, Fellow

Background: Obesity is associated with difficult prehospital endotracheal intubation. The objective of this study was to examine the association between patient BMI and the selection of advanced airway by prehospital providers during out-of-hospital cardiac arrest (OHCA). **Methods**: This was a retrospective review of an in-house cardiac arrest registry containing details of each resuscitation attempted by a large, urban fire-based EMS system. Advanced airway selection was at the discretion of the resuscitation team. The BMI recorded was a subjective measurement obtained from the paramedic at the time of data collection. Data was analyzed from January 1, 2016 through August 15, 2016. Patients were included in the study if the following variables were available: age, gender, BMI, and initial airway attempted (supraglottic vs ETT). Patients were excluded if age < 17, no age, gender, or BMI recorded, or an airway other than supraglottic or ETT was used. Patients were divided into 4 groups based on the BMI (under, normal, over, morbid). A subcategory analysis of endotracheal intubation method (direct laryngoscopy (DL) vs video laryngoscopy (VL)) was also examined. ANOVA was utilized to analyze continuous variables and a $\chi 2$ test was used to analyze categorical variables. **Results**: A total of 474 patients were included. Mean age for the population was 63.56 + 17.65 years with 293 males (61.81%). Most patients were classified as normal BMI (209 patients, 44.09%) or over BMI (156 patients, 32.91%). The ETT was more frequently utilized as the initial airway of choice in under BMI vs morbid BMI ($P = 0.03$). Compared to normal BMI, more over BMI and more morbid BMI had a supraglottic airway selected as the initial airway ($P = 0.03$ and $P = 0.009$, respectively). Subgroup analysis of laryngoscopy method used for endotracheal intubation was not significant between the BMI groups ($P = 0.80$). **Conclusions**: We found that paramedics tended to favor endotracheal intubation with lower BMI patients. There was no difference noted between BMI and DL vs VL. Limitations included that the BMI was not calculated and we only looked at the initial airway attempt, which may not have been the conclusive airway.

183. Development of Modified Trauma and Injury Severity Score Model to Predict Disability for Acute Trauma Patients

Ki Jeong Hong, Sang Do Shin, Kyoung Jun Song, Young Sun Ro, So Yeon Kong, Tae Han Kim, Jeong Ho Park, *Department of Emergency Medicine, Seoul National University Boramae Medical Center* Category of Submission: Trauma

Background: Trauma and Injury Severity Score (TRISS) has been used to predict mortality of trauma patients and to perform quality improvement of trauma care system. In advanced countries, functional outcome including disability is recently emphasized as a quality indicator for trauma care system. The goal of this investigation is to develop modified model of Trauma Related Injury Severity Score to predict Disability (TRISS-D) for acute trauma patients. **Methods**: We used emergency medical services based severe trauma database of the Korea Centers for Disease Control. We enrolled severe trauma cases transported by fire department from January to December 2013 in 10 provinces across Korea. We calculated revised trauma score (RTS) and injury severity score (ISS) for enrolled cases. We developed modified TRISS model predicting severe disability and worsening disability using age index (0–14, 15–54, 55– years), RTS and ISS. TRISS-D model 1 added injury mechanism category divided by blunt or penetrating injury. TRISS-D model 2 added presence of severe head injury when abbreviated injury scale (AIS) of head is from 3 to 6. We developed coefficients of each TRISS-D model for severe disability and worsening disability. Severe disability was defined when Glasgow outcome scale (GOS) at hospital discharge was 1,2,3. If the difference of GOS at hospital discharge and GOS before trauma incident is 1 point or more, we defined the case as worsening disability. We assessed discriminative power of each model by Area Under the ROC Curve (AUC) value. **Results**: A total of 14,791 patients were enrolled. 3,757 cases were severe disability and 6,018 cases were worsening disability. AUC value of TRISS-D model 1 and model 2 for severe disability was 0.948(95% Confidence Interval (CI): 0.944–0.952) and 0.950(95% CI: 0.946–0.954), respectively. AUC value of TRISS-D model 1 and model 2 for worsening disability was 0.810(95% Confidence Interval (CI): 0.803–0.817) and 0.816(95% CI: 0.809–0.823) respectively. **Conclusions**: We developed modified TRISS model for functional outcome like severe disability and worsening disability of acute trauma patients. TRISS-D model for severe disability showed excellent discriminative power with AUC value higher than 0.9. AUC value of TRISS-D model for worsening disability was higher than 0.8.

184. Most Civilian Prehospital Care Providers Require Additional Wound Packing Training and Protocols

Mark Liao, Daniel O'Donnell, Thomas Lardaro, *Indiana University* Category of Submission: Student, Resident, Fellow

Background: Civilian EMS agencies are increasingly interested in adopting hemostatic dressings and wound packing for treating difficult-to-control or junctional hemorrhage. However, baseline civilian provider training of hemostatic dressings and wound packing is variable. We conducted a survey of prehospital care providers in a large metropolitan EMS agency that did not equip hemostatic dressings or provide wound packing training to evaluate baseline provider knowledge and comfort level of these techniques. **Methods**: A total of 178 prehospital providers (68% of whom were paramedics) completed an online survey. This survey queried their prior training, understanding of local EMS protocol, knowledge of hemostatic dressing efficacy vs. regular gauze for wound packing and comfort level performing wound packing. **Results**: Only 27 civilian prehospital providers (15%) identified themselves as having prior military/Tactical Combat Casualty Care/law enforcement training that had familiarized them with wound packing and hemostatic dressings. 81.5% of all respondents ($n = 145$) did not believe that wound packing was authorized to perform as part of local or State EMS protocols, when in fact the procedure was not mentioned in any such regulations. 64% ($n = 114$) providers believed that hemostatic dressings would be more effective than a regular gauze roll when used for wound packing; those with prior familiarization were more likely to think this was true. (92.5% for those with prior familiarization vs. 58.9% without. $\chi 2$ statistic = 11.69, $p = 0.002$). On a ranked scale of 0 to 100 indicating comfort level using hemostatic dressings/wound packing, individuals with prior familiarization were more likely to rate a higher comfort level (mean score of 89 for those with prior military/LEO/TCCC training vs. 64 without, t-value 5.9, $p < 0.00001$). **Conclusions**: Current civilian EMTs and Paramedics are interested and motivated to utilize hemostatic dressings and wound packing techniques, but most require additional training to increase comfort with these interventions. Prior military, tactical combat casualty care or law enforcement training appears effective in increasing confidence. Civilian EMS protocols may need to explicitly reference wound packing to ensure providers are aware that they can utilize this skill.

185. Transport Determinates for Continuing Care Residents Assessed by an EMS Urgent Response Team: A Retrospective Observational Study

Kevin Lobay, Robyn Palmer, Lorissa Mews, Robert Sharman, Brian Boswell, Priya Jaggi, *University of Alberta Department of Emergency Medicine* Category of Submission: Operations, Quality, Safety Systems, Disaster

Background: Alberta Health Services (AHS) Emergency Medical Services (EMS) in the City of Edmonton recently introduced an "EMS Continuing Care Urgent Response Team" (ECCURT) to support continuing care residents by providing urgent care on-site, thereby reducing unnecessary patient transfers to emergency departments. ECCURT is comprised of Advanced Care Paramedics and Nurse Practitioners, and is dispatched via a dedicated consult line and/or 9-1-1. Various patient characteristics are tracked within our internal database including age, diagnosis, Goals of Care Designation (GCD), and Canadian Triage Acuity Scale (CTAS) score. **Objectives**: This study will provide an analysis of various ECCURT patient characteristics, and determine whether age, GCD and CTAS score are correlated with frequency of transport to hospital. **Methods**: This is a six-month retrospective, observational study of patient data. All new patients assessed between January 1, 2016 and June 30, 2016 were included. Multiple regression analysis was performed to determine whether a statistically significant correlation exists comparing age, GCD and CTAS score with transport frequency. **Results**: A total of 471 (83%) of 567 new patients assessed by ECCURT during the study period had established GCDs in place; 521 (92%) of our patients had a CTAS score assigned; 131 (23%) of our patients were transported to hospital. All patients with a GCD of C2 (specifically requesting no transfer to hospital) were managed by our team on-site. Multiple regression analysis reveals a statistically significant correlation of age, GCD, and CTAS score with transport frequency (F statistic = 3.26 E-11). P-values for each variable are: age = 0.92; GCD = 0.05; CTAS = 5.08 E-12. **Conclusions**: Although patient age appears not to be strongly

correlated with transport frequency independently, GCD and CTAS score may be quite useful predictors for Community Care EMS Teams when selecting patients who can be managed on-site without transport to hospital.

186. EARLY DOUBLE SEQUENCE DEFIBRILLATION IMPROVES OUTCOMES IN REFRACTORY VENTRICULAR FIBRILLATION

Matthew Harris, Ronald Klebacher, Joshua Schwarzbaum, Andrew Parrish, Michael Carr, Andrew Torres, Navin Ariyaprakai, Amundep Tagore, Eric Wasserman, Bauter Robert, Mark Merlin, *Newark Beth Israel Medical Center* CATEGORY OF SUBMISSION: CARDIAC

Background: Refractory ventricular fibrillation (RVF) has been defined as VF that persists after 5 standard attempts at defibrillation (SD), though no uniform definition exists. Its incidence has been estimated at 0.5–0.6 per 100,000 population. Double sequence defibrillation (DSD) has emerged as a possible treatment for RVF to improve rates of ROSC. **Methods**: A retrospective chart review of patients greater than 17 years with RVF, defined as VF persistent after 3 standard defibrillations (SD), after the implementation of a quality project allowing paramedics to perform DSD in patients with RVF. After 3 SDs, 2 sets of defibrillation pads were placed on the patients with RVF. Two rapid sequence defibrillations at 360 Joules were delivered. No limit was placed on the number of DSD shocks provided. We compared patients who received DSD to those who received SD. Our primary outcome was ROSC. We performed descriptive statistics, and association and correlation between variables with ANOVA and Chai-squared. **Results**: We identified 280 patients with RVF, 229 (82%) received SD only and 51 (18%) received DSD. Comparing the SD group vs. DSD group: Mean Age 67.7 years vs. 66.8 years ($p < 0.001$), Male gender 76.2 % vs. 72.5% ($p < 0.001$), and mean weight (kg) 89.3 vs. 90.1 ($p < 0.001$). There were fewer witnessed arrests in the control group (61.6% vs. 80.4%). Time to 1st shock was the identical (14.7min $\pm$ 9.5 vs 14.7min $\pm$ 10.1), and in those who received DSD, mean time to first DSD was 33.6 minutes. The rate of ROSC was higher in the control arm compared to therapy arm, though this was not statistically significant (31.4% vs. 23.5%) (p value = 0.26). Of the 32/51 patients with ROSC in DSD arm, average time to 1st DSD was lower (32.7 min vs. 35.01). These patients had similar numbers of primary shocks (4.42 vs. 4.78) but required fewer DSD (2.8 vs. 3.47). **Conclusions**: The management of RVF remains challenging. While the achievement of ROSC was higher in the non-DSD group, the difference did not meet statistical significance. Those who received DSD earlier had higher rates of ROSC than those with more delay, and required fewer DSD attempts.

187. PREHOSPITAL ONLINE MEDICAL OVERSIGHT (PROMO) AN ANALYSIS OF THE INTERACTION BETWEEN EMERGENCY ROOM PHYSICIANS AND PARAMEDICS

Jason Prpic, Alicia Violin, Sylvie Michaud, Nicole Sykes, Paul Myre, *Health Sciences North Centre for Prehospital Care* CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS, DISASTER

Background: In Ontario, paramedics operate mainly under off-line medical direction, they use online medical control when it is mandatory according to provincial medical directives or if a patient presents with a condition that does not fit into their protocols. Literature that encompasses the interaction that occurs between oversight physicians and paramedics is limited even though this interaction is critical to ensure patients receive appropriate prehospital care. **Objective**: The objective was to describe the quality of online medical control in a Canadian EMS system and use the study findings to develop a quality improvement program which will enhance the outcome of online medical control. **Methods**: A retrospective review of written and audio records of online medical control interactions from April 1, 2016 to March 31, 2017. Audio recordings were assessed by a single reviewer to evaluate predetermined criteria which gauged the efficiency of communication that occurred during each interaction. **Results**: There were 454 online interactions in the fiscal year, 14 cases were excluded as audio was unavailable and 27 could not be retrieved due to technology failure at the dispatch level. Therefore 413 cases were assessed. Three hundred thirty-eight patches (81.8%) were mandatory provincial patch points with 289 (85.5%) regarding patients in cardiac arrest. Analgesia administration made up 30.7% of the non-mandatory calls, and all resulted in medication orders. In 100% of patches additional information was requested by the oversight physician and in 131 (31.7%) patches no request was made by the paramedic. The average length of patch was 0:02:03 (SD = 0:01:07) and the paramedic had to wait on average 0:01:11 (SD = 0:00:44) before talking to an oversight physician. **Conclusions**: Implementing standardization of information handover will allow for patch calls to be more efficient and ensure all pivotal information is communicated. This will allow oversight physicians to make informed clinical decisions optimizing the care provided to patients. To further enhance the medical control provided by oversight physicians it would be beneficial to determine the most effective way to provide EMS training to these physicians. Also, as all requests for analgesia were granted, implementing a medical directive with increased paramedic autonomy for pain control would be warranted.

188. QUANTIFYING EMS RESOURCE ALLOCATION FOR PEDIATRIC TRANSPORTS

Jennifer Anders, Jennifer Fishe, Kevin Psoter, Carla Tilchin, Kyle Fratta, *Johns Hopkins University School of Medicine* CATEGORY OF SUBMISSION: PEDIATRIC

Background: Regionalization of pediatric care decreases available pediatric services at community hospitals. Therefore, some children should bypass closer hospitals for direct transport to pediatric specialty facilities. Future tools assisting EMS with transport destination choices must balance EMS resource allocation with direct transport's benefits. To do so, the current burden of pediatric transport on EMS agencies must be quantified to provide a benchmark for future systems changes. **Objective**: The objective of this study was to describe the baseline EMS services utilization for pediatric transport in three geographically diverse jurisdictions (urban, suburban, and rural). **Methods**: This study examined a 12-month retrospective cohort of pediatric (0–17 years) EMS transports from three Maryland counties. All agencies use the same patient care protocols, EMR, and Helicopter EMS (HEMS) system. Each patient transport location, actual transport times, demographics, and clinical variables were abstracted from the EMR. The response scene and destination hospital locations were geocoded to calculate road driving distance. Each agency's baseline EMS utilization for pediatric transport was then estimated using transport miles and minutes. **Results**: The three counties transported a total of 12,223 pediatric patients during the 12-month period (urban $n = 6{,}033$, suburban $n = 5{,}987$, and rural $n = 243$). Total EMS utilization for pediatric transport was 63,631 minutes and 27,613 miles in the urban jurisdiction; 91,002 minutes and 77,831 miles in the suburban jurisdiction; and 5,248 minutes and 7,605 miles in the rural jurisdiction. HEMS use for pediatric transport was zero in the urban county, 0.1% in the suburban county and 4.8% in the rural county ($p < 0.001$). The mean transport time per patient varied significantly at 10.6, 15.2, and 21.6 minutes, respectively ($p < 0.001$). Mean road transport miles per patient was 4.6, 13.0, and 31.3 miles, respectively ($p < 0.001$). On a population basis, EMS utilization for pediatric transport was 0.493, 0.494, and 0.445 minutes per pediatric citizen and 0.214, 0.716, and 0.381 road miles per pediatric citizen per year, respectively ($p < 0.001$). **Conclusions**: EMS resource use for pediatric transports is noteworthy and varies significantly between urban, suburban, and rural jurisdictions. This study provides essential benchmarks for future development of pediatric direct transport protocols.

189. ASSESSMENT OF EMERGENCY MEDICAL SERVICES PROVIDER RESEARCH LITERACY AND INVOLVEMENT

Lauren Maloney, Robert Marshall, Henry Thode Jr, Adam Singer, Scot Johnson, *Stony Brook University Department of Emergency Medicine* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: For a needs assessment for future continuing medical education classes and rollout of prehospital clinical research, a survey was developed to gather data on provider attitudes towards evidence-based medicine (EBM), participating in clinical research, and informed consent. **Methods**: A 35 question survey was distributed to 71 employees of a university-based EMS system. Surveys included demographic and experience items. Responses to various statements were graded on a 5-point Likert scale from "strongly disagree" to "strongly agree" and analyzed with Chi square tests. **Results**: Of 54 analyzable surveys, 81.5% respondents were paramedics and 18.5% were EMT-Bs. 78% of respondents were male. Mean age was 39 with an average 18 years of EMS experience. 61% held college degrees, 48% subscribed to medical journals, and read articles a couple times a week (20%), month (32%), or year (35%). At least 95% of providers agreed about the importance of prehospital EBM and their responsibility to stay current with medical advances. Paramedics were more likely than EMT-Bs to disagree that EMS protocols are updated promptly. 37% agree that patient care decisions should be based on research evidence and not personal experience, (45% males vs. 8% females). 65% of those surveyed disagreed with limiting the rights of an individual to better the care of a large group, and disagreement was higher in females than males (92% vs. 57%), respectively. A total of 96% agreed with an option to read research articles for CME; those without a college degree were more likely to disagree. No significant relationship between age, education, provider level, or experience existed with frequency of reading research articles. A total of 65% disagreed that spending an additional 5 minutes after a call to complete clinical trial paperwork would be a burden; those who read articles a couple times a year or never were more likely to agree. A total of 44% disagreed with enrolling a critical patient in a trial if delayed consent is obtained, with a significant relationship to age; younger respondents were less likely to disagree than other age groups. **Conclusions**: In this cohort of prehospital personnel, evaluating medical research and involvement in future prehospital clinical trials was overall well received.

190. Can Heart Rate Variability Risk Stratify Patients with Undifferentiated Non-Traumatic Chest Pain?

Juan March, Carmon Russoniello, Nicholas Murray, Walter Robey, *East Carolina University Department of Emergency Medicine Division of EMS* Category of Submission: Cardiac

Background: Previous research suggests that heart rate variability (HRV), also known as R to R variability, can be used to risk stratify patients with known acute coronary syndromes. The HRV spectrum contains two major components. One component of HRV is the high frequency (0.18–0.4 Hz) component, which is synchronous with respiration and is identical to respiratory sinus arrhythmia. The second is a low frequency (0.04–0.15 Hz) component that appears to be mediated by both the vagus and cardiac sympathetic nerves. This study examined whether heart rate variability can be used to risk stratify patients presenting with undifferentiated non traumatic chest pain. **Methods**: This exploratory study was performed at a percutaneous coronary intervention capable tertiary teaching hospital with 900 beds and an Emergency Department (ED) with an annual census of 120,000. A convenience sample of adult patients presenting to the Emergency Department with a chief complaint of non-traumatic chest pain were enrolled. HRV was captured using a physiological status monitor (PSM) affixed to the chest for a 5–10 minute period during the patient's ED stay. High risk patients were identified by either a positive troponin, positive stress test, positive cardiac catheterization, ST elevation on EKG, or death within 30 days. A low frequency/high frequency ratio of less than 1.0 was used as the cutoff. Data analysis was performed with a Fischer Exact test. **Results**: A total of 26 patients were enrolled. All six patients identified as high risk had a LF/HF ratio of less than 1.0; sensitivity = 100%. Furthermore, all 20 patients who were determined to be low risk had an HF/LF ratio > 1.0; specificity = 100%, $p < 0.0001$. **Conclusions**: This pilot study suggests that heart rate variability with a LF/HF ratio < 1.0 may be used to rapidly risk stratify patients with undifferentiated non traumatic chest pain. Further studies in the prehospital environment with a larger sample size are needed to determine if HRV can be used by EMS to rapidly risk stratify patients with undifferentiated non traumatic chest pain.

191. Correlation of EEG-Based Brain Resuscitation Index and End Tidal Co2 in Porcine Cardiac Arrest Model

Dongsun Choi, Hee Jin Kim, Taehan Kim, Ki Jeong Hong, Young Sun Ro, Kyoung Jun Song, Hee Chan Kim, Shin Sang Do, *Seoul National University Hospital, Department of Emergency Medicine* Category of Submission: Cardiac

Background: Evaluation and monitoring of brain viability is important during resuscitation of cardiac arrest. We developed non-invasive EEG-based brain resuscitation index (EBRI) and evaluated correlation EBRI and end-tidal CO2(ETCO2). **Methods**: A crossover animal experimental study using porcine cardiac arrest model was designed. After 1 minute of untreated ventricular fibrillation, alternation of high quality CPR (compression depth 5 cm and compression rate 100/min) and low quality CPR (compression depth 3 cm and compression rate 60/min) was performed for every 50 seconds in 10 phases. EBRI was calculated from selected single EEG channel which have the lowest noise. Mixed model analysis was conducted to compare the differences of hemodynamic parameters, ETCO2 and EBRI between high quality CPR period and low quality CPR period. Pearson's correlation coefficient was calculated to assess correlation between EBRI and ETCO2. **Results**: Experiment was performed in five female porcine (44.6 ± 2.8kg). EBRI and EtCO2 was obtained according to quality of CPR received. Delta EBRI obtained during high quality CPR was significantly higher than delta EBRI of lower quality CPR (HQ: Median 0.17, (0.04–0.30), LQ: Median −0.18 (−0.05−−0.32), $p =< 0.01$). EBRI had statistically moderate positive correlation with ETCO2 ($r = 0.56$). **Conclusions**: In porcine cardiac arrest model, EEG-based Brain Resuscitation Index was successfully obtained during resuscitation and had statistically moderate correlation with ETCO2.

192. Social Connectedness and Coping Styles in EMS Workers and Their Association with Burnout and Perceived Stress

Lori Boland, Pamela Mink, Jonathan Kamrud, Jessica Jeruzal, Russell Myers, Charles Lick, Andrew Stevens, *Allina Health Emergency Medical Services* Category of Submission: Professional

Background: To assess social connectedness and coping styles among emergency medical services (EMS) providers and explore their association with occupational burnout and perceived stress. **Methods**: A 167-item electronic survey was distributed to employees of a large ambulance service that provides 9-1-1 response in Minnesota. The survey included the Maslach Burnout Inventory (MBI), Cohen's 4-item Perceived Stress Scale (PSS), the Brief COPE Inventory, and the Berkman-Syme Social Network Index (SNI). Burnout was defined as a high score on the emotional exhaustion (≥27) or depersonalization (≥13) subscales of the MBI. The COPE inventory assesses an individual's tendency to use 14 coping styles in response to stressful situations, with scores ranging from 2 (low use) to 8 (high use). **Results**: Responses were received from 217 providers (54% response); the mean age was 40, 60% were male, and 55% had an EMS tenure of 10+ years. The prevalence of burnout was 18% and the mean PSS score was 4.8 (SD=3.2). The SNI characterized respondents as socially isolated (15%), moderately isolated (33%), moderately integrated (29%), and socially integrated (24%), and the prevalence of burnout in each group was 38%, 19%, 16%, and 7%, respectively. After adjustment for age, gender, EMS tenure and marital status, providers characterized as socially isolated were more likely to experience burnout than those who were socially integrated (OR = 6.4; 95%CI = 1.3–32.2). Decreased social connectedness was associated with increased mean PSS score: socially integrated = 3.8, moderately integrated= 5.0, moderately isolated = 4.8, and socially isolated = 6.0 (p for trend = 0.03). Commonly used coping strategies included planning, positive reframing, and active coping, while substance abuse, behavioral disengagement, and denial were infrequently used. Higher use (scores = 6,7,8) of religion, use of emotional support, and use of instrumental support to cope were associated with a lower prevalence of burnout. Conversely, higher scores on the coping subscales of self-blame, food, and substance abuse were associated with increased burnout and were correlated positively with PSS scores (all $p <$ 0.002). **Conclusions**: EMS providers who are socially isolated or who frequently use the coping strategies of self-blame, food, or substance abuse may be at increased risk of burnout and stress, however the temporality of these characteristics remains unclear.

193. Impact of the Implementation of a Critically Ill Patient Bundle of Care on the Performance of Key Medical Interventions for Respiratory Distress Patients by Paramedics in the Field

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Background: Medical intervention patient care bundles have been advocated as a process based system to improve patient care and outcomes using evidence based guidelines. We sought to evaluate the effect of the implementation of a Prehospital "Crashing Patient" Critical Care Bundle on the performance of key prehospital intervention for patients presenting with respiratory distress. **Methods**: A "Crashing Patient" bundle of care addressing key interventions for critically ill patients was implemented in an urban Advanced Life Support (ALS) EMS system from 2012–2014. After full implementation of the care bundle, retrospective Patient Care Report (PCR) review was conducted of PCRs with a chief complaint of "Respiratory Distress" for the first calendar quarter after implementation (July–September 2014) and compared to PCRs for the most recent quarter (April–June 2017). Rates of EKG & end tidal carbon dioxide (EtCO2), vascular access and CPAP application were compared for all respiratory distress cases. For the subset of patients who received Albuterol for bronchospasm, the rates of administration of Methylprednisolone, Magnesium Sulfate and 1:1000 Epinephrine were compared between the two time intervals. **Results**: There were 905 respiratory distress PCRs in the 2014 interval and 885 in 2017. In 2017 there were improvements in EKG monitoring from 32.6% to 45.9% ($p < 0.0001$) of cases, EtCO2 monitoring from 7.1% to 17.3% ($p < 0.0001$), vascular access from 37.2 to 45% ($p = 0.0009$) & CPAP use from 6.5% to 10.8% ($p = 0.0013$). 408 of the patients received Albuterol for bronchospasm in 2014 compared to 306 in 2017. In this subset there were improvements in the administration of Methylprednisolone from 24.4% in 2014 to 52% ($p < 0.0001$), Magnesium Sulfate from 12.5% to 19.9% ($p = 0.0091$) & 1:1000 Epinephrine from 3.2% to 6.8% ($p = 0.0318$). These care improvements were associated with a decrease of the rate of cardiac arrest after EMS contact for medical patients in the system from 12% to 9.1% (NS). **Conclusions**: The implementation of a prehospital critical ("crashing") patient bundle of care resulted in a significant performance improvements in accomplishing key interventions for respiratory distress patients. Patient care bundles may have significant utility to improve patient care and safety in the prehospital setting.

194. Tracking Violations of Newly Implemented Behavioral Emergency Treatment Protocol

Timothy Lynch, Christie Fritz, David Schoenfeld, *Beth Israel Deaconess Medical Center/Harvard Medical School* Category of Submission: Student, Resident, Fellow

Background: In September 2014, Massachusetts statewide EMS protocols authorized the use of haloperidol and/or a benzodiazepine for management of behavioral emergencies. The newly adopted protocol allows for medication administration with contraindications of age <18, history of seizures, or prolonged QT interval. Geriatric dosing was reduced by 50%. The new protocol was implemented following a standard training module. The purpose of this investigation is to describe the frequency and type of protocol violations observed during the implementation of a new protocol, with the goal of help-

ing to better understand the types of errors, so as to improve implementation of future treatment protocols. This will help to determine what further training if any is needed and plan for future protocol roll out difficulties. **Methods**: Retrospective chart review of calls occurring between October 1, 2014 and June 30, 2015, in which the new behavioral emergencies protocol was utilized. Cases were reviewed for protocol violations and the type of violation was recorded. **Results**: There were a total of 56 calls during the study period that utilized the new behavioral emergencies protocol including the administration of haloperidol. Protocol deviations were identified in 29% (95%CI 18–42%) of cases. The most common error was protocol violations at 17%(95%CI 9–26%), with 13% (95%CI 6–24%) having a seizure history of or reported seizure and 4%(95%CI 1–13%) pediatric administrations. 9%(95%CI 4–20%) of haloperidol administrations were not reduced for geriatric use. While not required by the protocol, OLMC was contacted in 14% (95%CI 7–27%). **Conclusions**: Standard Treatment Protocols allow for rapid implementation of care by prehospital providers, without the need to contact OLMC. Little is known about the type and frequency of errors observed when adopting a new protocol and this analysis can provide useful insight to help better tailor training for new protocol implementation. Additionally, unnecessary calls to OLMC were observed, suggesting a lack of familiarity or confidence with the new protocol. This investigation demonstrates potential risks in new protocol implementation and we recommend further study to develop best practices for training and implementation of new clinical protocols.

195. EMERGENCY PHYSICAIN TELEHEALTH DISPOSITIONS OF LOW-ACUITY 9-1-1 PATIENTS

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Background: Every day within the United States low-acuity patients are transported to emergency departments (ED) for primary care. American College of Emergency Physicians and National Association of EMS Physicians believe not all patients require ALS care and in these circumstances, alternate transport and destination may be appropriate. EMS patient dispositions are traditionally determined by the medic assessment along with off-line medical direction. At present, literature regarding prehospital physician telehealth patient dispositions are limited. The aim of this study was to measure and report prehospital Emergency Telehealth and Navigation (ETHAN) mobile-integrated patient dispositions for alternate transportation and/or destination. **Methods**: This retrospective study was conducted on consecutive EMS patients triaged by telehealth emergency physicians in a major metropolitan urban fire-based EMS system from December 2014 through May 2017. Once on scene, EMS completes a patient assessment together with ETHAN inclusion/exclusion criteria. If eligible, the medic transfers the ePCR and contacts the Physician, who interviews the patient via real-time video/voice conferencing and determines the appropriate disposition. Those cases where the ETHAN protocol was employed were abstracted from the ePCR system. Descriptive statistics describe study characteristics and a 95% confidence interval was calculated for telehealth dispositions. **Results**: During the study period 10,042 patients met the ETHAN criteria. Among this group of telehealth dispositions; alternate transport and/or destination 77% (95% CI 76–78%) (5942/Referred to ED by ETHAN MD-Cab or Self Transport, 639/Referred to ETHAN Clinic-Cab or Self Transport, 839/Patient Declined Clinic Referred wants ED Visit-Cab or Self Transport, 340/Referred to Patient Care Physician/Alternate Clinic-Cab or Self Transport), traditional transport 15% (1497/Referred for EMS Transport to ED-Ambulance) and miscellaneous 8% (274/Patient Declined to speak with ETHAN MD, 130/Unable to Complete Due to Technical Issues, 230/Referred for Home Care Instructions Only, 31/Patient Refused EMS Transportation, 120/Other). The mean study age was 44 years (range 1–99 years), 54% were female and no patient adverse events were reported. **Conclusions**: In this system's population, telehealth alternate transport and/or destination dispositions significantly reduced low-acuity ambulance transports and ED visits. Further studies are warranted to develop guidelines for uniform reporting of prehospital care depositions based on the Physician telehealth model.

196. NOVEL MEASURE TO CAPTURE TRANSACTIONAL STRESS IN PARAMEDIC SERVICES

Elizabeth Donnelly, Paul Bradford, Cathie Hedges, Matthew Davis, Doug Socha, Peter Morassutti, *University of Windsor* CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS, DISASTER

Background: In the past few years, there has been an increase in awareness of the challenge of managing work related stress in EMS. Extant research has liked different types of chronic and critical incident stress to stress reactions like posttraumatic stress. However, there is no tool to capture the transactional stresses that are associated with the day to day provision of service (e.g., dealing with offload delays or mandatory overtime) and interacting with allied professions (e.g., emergency department staff) or allied agencies (e.g., law enforcement). The purpose of this study was to develop and validate a measure which captured transactional stresses in paramedics. **Methods**: An online survey was conducted with ten Canadian Paramedic Services with a 40.5% response rate ($n = 717$). Factor analysis was used to identify variation in responses related to the latent factor of transactional stress. The scale was validated using both exploratory and confirmatory factor analyses. **Results**: The sample of transactional stress questions was split to allow for multiple analyses (EFA $n = 360$/ CFA $n = 357$). In the exploratory factor analysis, principal axis factoring with an oblique rotation revealed a two-factor, twelve item solution, (KMO = .832, x2 = 1440.19, df = 66, $p < .001$). Confirmatory factor analysis also endorsed a two factor, 12 item solution, ($x2 = 130.39$, df = 51, $p < .001$, CFI = .95, TLI = .93, RMSEA = .07, SRMR = .06). Results supported two groups of six-item factors that captured transactional stress in the provision of service. The factors, clearly aligned with transactional stress issues internal to the ambulance and transactional stress relationships external to the ambulance. Both subscales demonstrated good internal reliability ($\alpha = .843/\alpha = .768$) and were correlated ($p \leq .01$) with a convergent validity measure. **Conclusions**: This study successfully validated a two-factor scale which captures stress associated with the day to day provision of EMS and the interaction with allied professions. The development of this measure of transactional stresses further expands the potential that paramedics, Paramedic Services, employers, and prehospital physicians may understand the dynamics that influence provider health and safety. As a result, there may be greater opportunities to intervene holistically to improve paramedic health and well-being.

197. REVIEW OF EMERGENCY MEDICAL SERVICES (EMS) TRANSPORTS TO A FREESTANDING EMERGENCY DEPARTMENT (FSED)

Matthew Chinn, Brittany Farrell, M. Riccardo Colella, *Medical College of Wisconsin* CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS, DISASTER

Background: Freestanding emergency departments (FSED) are an area of expansion in healthcare. Despite rapid growth, there is a minimal amount of literature regarding the appropriate triage of patients to these facilities by emergency medical services (EMS) providers. Purpose: The study seeks to review and develop a list of objective markers for improving EMS field triage to a FSED through evidence-based recommendations. **Methods**: Patient data was retrospectively reviewed from the EPIC electronic medical record system of all patients brought in to a single FSED by ambulance during a six month convenience period. A report was generated to abstract patient demographics, medical information, and disposition. Missing data fields were then manually entered. Ambulance services were all previously given a list of FSED capabilities and guidance on bypass for major trauma, STEMI, and stroke care, amongst others, in accordance with best practice guidelines upon facility opening. Data was analyzed using an unpaired t-test. **Results**: There were 138 patients brought to the FSED for the six month period of September 2016–February 2017 by 12 ambulance services. A total of 105 patients were discharged home directly from the FSED and 20 were transferred to a full-service hospital for admission or specialty care; 7 were admitted to a psychiatric facility; 6 were admitted to a skilled nursing facility. There was a statistically significant difference in age between patients discharged home and those transferred to a full-service hospital (52.69 years vs. 71.75 years; $p = 0.0011$). There was no statistically significant difference between these two groups in initial FSED pulse rate, respiratory rate, systolic blood pressure, or temperature. There was a trend towards a longer length of stay in the FSED for patients transferred to a full-service hospital (183.51 min vs. 236.25min; $p = 0.0865$). **Conclusions**: The data reflects that older patients are more likely to require transfer and possibly admission after initial treatment at a FSED. The FSED initial vitals were not good predictors of the need for transfer; the use of initial vitals as a surrogate for prehospital vitals is a limitation. Further research is needed to evaluate other possible indicators that may be used to triage patients to the most appropriate emergency department.

198. VARIABILITY OF CALIFORNIA LOCAL EMS AGENCIES' PEDIATRIC RESPIRATORY DISTRESS PROTOCOLS AND THEIR CORRESPONDING LEVEL OF EVIDENCE

Jennifer Farah, J. Joelle Donofrio, Nicholas Aldridge, *University of California, San Diego* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: We sought to compare California local EMS agencies' (LEMSA) protocols and review evidence-based guidelines on the treatment of three main pediatric respiratory complaints by presentation: asthma (wheezing), bronchiolitis (wheezing <24 months), and croup (stridor). **Methods**: In 2016, publicly available protocols from 33 California LEMSAs were itemized and reviewed in the following categories: wheezing, wheezing <24 months, and stridor. Descriptive statistics were used to compare these protocols. Literature reviews, including the American Academy of Pediatrics' (AAP) current treatment guidelines, were used to create level of evidence (LOE)

tables for asthma, bronchiolitis, and croup. Of note, steroids were included only in the literature review, as California LEMSAs do not currently use steroids prehospital. The evidence-based tables were compared to California local EMS agency protocols. **Results**: Among the 33 LEMSAs, wheezing protocols had the least amount of variability with only two of the six treatments, ipratropium (15/33) and nebulized epinephrine (3/33), having >2 LEMSAs with variability. The most common wheezing treatments included albuterol (33/33) and IV/IM epinephrine (33/33). The least common treatments included nebulized epinephrine and magnesium (2/33). Current evidence strongly supports the use of albuterol, ipratropium, epinephrine, magnesium, steroids, and noninvasive positive pressure ventilation (NIPPV) in the asthmatic child. Only three agencies differentiated wheezing in children <1 year of age, referencing this as possible bronchiolitis. All three included albuterol and NIPPV as their recommended treatments but did not include nebulized hypertonic saline, nebulized epinephrine, steroids or suctioning. For children <24 months, albuterol and steroids are no longer strongly recommended based on new AAP guidelines. Stridor had the highest protocol variability, with no treatment having uniform use among agencies. The most common treatments included IV/IM epinephrine (24/33), NIPPV (29/33), and humidified mist (18/33). The least common treatments were nebulized epinephrine (12/33) and suctioning (4/33). For stridor, evidence supports the efficacy of all formulations of epinephrine. **Conclusions**: There is wide variation among California LEMSAs in their management of pediatric respiratory distress. Recent changes to treatment guidelines have likely created the discordance between current treatment practices and LOE tables. Timely evidence-based updates will likely benefit prehospital agencies' treatment protocols.

199. Early Impact of an Emerging Mih Program for 9-1-1 High Utilizers

Jon Ehrenfeld, Ashley Clayton, Catherine Counts, Michael Sayre, *Seattle Fire Department* Category of Submission: Operations, Quality, Safety Systems, Disaster

Background: Vulnerable, medically complex patients comprise a disproportionate share of responses in an urban, fire-based EMS system. A social worker-based Mobile Integrated Healthcare (MIH) program was designed to intervene using either direct engagement (DE) or indirect care coordination (CC). We hypothesized that sustained outreach would reduce 9-1-1 activations and engage more appropriate services. **Methods**: We used computer-aided dispatch and electronic health records to identify housed individuals with ≥3 EMS responses in the previous quarter. The social worker then assigned enrollees to the DE or CC cohort based on previous call volume, current services, vulnerability, and case management history. We recorded medical and social services in place, existing case managers or providers, services and referrals initiated, ongoing 9-1-1 utilization, and reason for disenrollment when applicable. Groups were compared by chi-squared and t-tests. **Results**: During the baseline quarter, EMS responded 389 times to 45 patients. Twenty-eight were female, the median age was 64 (IQR 56–71), 29 were Caucasian, and 12 were African American. All were medically and socially complex, with a mean of >4 medical or social comorbidities per patient. Nineteen were assigned to DE and 26 to CC. In the baseline quarter the cohorts had a similar number of responses (DE 9.5 ± 7.2, CC8.4 ± 4.7, $p = 0.54$). More patients in the DE cohort received multidisciplinary care conferences (37% vs. 8%, $p = 0.02$) and primary care linkage (53% vs. 15%, $p = 0.008$), while case management staffing alone was more prevalent in the CC cohort (77% vs.. 47%, $p = 0.041$). Quarterly EMS responses declined to 6 ± 5.7 after 3 months, 6.4 ± 6.6 after 6 months, and 3.9 ± 4.5 after 9 months of enrollment. Clients in the third quarter averaged a six call decrease compared to baseline (1.8–10.2, $p = 0.011$). Nine were disenrolled due to death, relocation, or reduction in EMS calls. **Conclusions**: These preliminary findings indicate that MIH direct engagement and care coordination yield a reduction in 9-1-1 utilization. This study was limited by a small sample size and lack of randomization, but strongly indicates that additional investigation is warranted.

200. Urban Law Enforcement Naloxone Deployment for Treatment of Suspected Out-of-Hospital Opioid Overdoses: A Pilot Program

Eric Cortez, David Keseg, James Davis, Kenneth Kuebler, Ashish Panchal, *Ohio Health Doctors Hospital* Category of Submission: Operations, Quality, Safety Systems, Disaster

Background: Law enforcement (LE) naloxone programs aimed at early recognition and treatment of opioid overdoses have increased. Implementation is often challenged by emergency medical services (EMS) engagement, which may impact adoption and overall success. The objective of this study was to analyze the implementation of a naloxone pilot program at a large urban LE agency supported by local EMS providers. We hypothesized that with direct training and interaction with EMS providers, LE adoption would be high. **Methods**: This prospective pilot program was conducted between May 2016 and December 2016. LE officers, investigative personnel, and support personnel underwent training by the city's fire-based EMS providers. LE training included identifying the symptoms of opiate overdose, and administration of naloxone if opioid overdose was suspected and respiratory depression was present. LE personnel were deployed with 2 mg naloxone doses administered intranasally with a mucosal atomizer device. At the end of the study period, LE personnel completed a survey concerning their training and experience with naloxone administration. LE clinical performance was monitored for each naloxone administration. Outcomes included patient survival at the time of EMS arrival, and the results of the post program survey. **Results**: A total of 124 LE officers underwent naloxone training with 31 (25%) LE officers administering naloxone to 58 suspected overdose patients. Thirteen (42%) administered naloxone to more than one patient. Fifty-six (97%) of the patients received a single 2 mg dose of naloxone, and 2 (3%) of the patients received two 2 mg doses of naloxone. Of the treated patients, 98% (57/58) patients survived to EMS arrival. The post program survey demonstrated that 82% of LE officers felt they received adequate naloxone training, 90% felt that the program promoted timely and safe use of naloxone, and 90% felt prepared to handle issues on scene. **Conclusions**: This study suggests that urban LE agencies partnered with EMS may successfully implement naloxone administration programs for suspected opioid overdoses. Limitations to this study include the lack of patient-centered outcomes, and the significant number of LE officers that did not administer naloxone.

201. Association of Case Volume Per Ambulance Station with Outcome of Out-of-Hospital Cardiac Arrest (OHCA)

Tae Han Kim, Sang Do Shin, Kyoung Jun Song, Ki Jeong Hong, Young Sun Ro, So Yeon Kong, *Seoul National University Hospital, Department of Emergency Medicine* Category of Submission: Operations, Quality, Safety Systems, Disaster

Background: Sufficient case volume for emergency medical service may be important for retention of resuscitation skills and procedures during prehospital management of Out-of-Hospital Cardiac Arrest (OHCA). We evaluated association of case volume per ambulance station with outcome of OHCA. **Methods**: Nationwide data of all adult OHCA during 2013 to 2014 was retrospectively analyzed. All ambulance station was stratified in to 4 groups according to annual average number of OHCA treated by EMS teams dispatched from each ambulance station. Multivariable logistic regression model was conducted to evaluate effect of increased case volume per an ambulance station on survival outcome of OHCA. **Results**: From 2013 to 2014, total of 47,637 OHCAs were treated and transported by EMS teams from 1,205 ambulance stations nationwide. Mean annual number of OHCA dispatched from each ambulance station was 19.8 cases. Overall survival to discharge rate was 5.5% with 2.9% of discharge with favorable neurological outcome. Survival was highest in groups with largest case volume (7.2% in group 4(largest case volume) vs. 3.3% in group 1(smallest case volume)). Adjusted odds ratio of largest case volume per ambulance station for predicting survival was 1.46(95% CI 1.26 – 1.70). **Conclusions**: Case volume of OHCA per ambulance station might be associated to survival outcome of EMS treated OHCA. Appropriate prehospital EMS dispatching strategy according to case volume should be further studied.

202. Resource Utilization and Clinical Outcomes of Older Adult EMS Patients with Traumatic Brain Injury Who Were Transferred to a Level I Trauma Center

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Background: Traumatic brain injury (TBI) is a substantial source of death, disability, and healthcare utilization among older adults. Older patients are frequently under-triaged by EMS to community hospitals and require subsequent transfer to a trauma center for further care. However, a minimal amount is known regarding the provision of care and patient outcomes at the final receiving hospital. We aimed to describe trauma center care among geriatric transfer patients with TBI. **Methods**: We conducted a secondary analysis on a sub-cohort from a prospective multi-center study focusing on ambulance and emergency department (ED) care of injured older adults transported via ambulance. The current analysis focused on patients transferred to the region's Level I trauma center from another hospital. The trauma center for the present study serves a nine county catchment area of over one million people. Transfer paperwork from the originating hospital was reviewed and a detailed medical record abstraction was conducted, including

computed tomography (CT) findings, procedures, length of stay (LOS), and ED disposition. We used descriptive statistics to characterize the study sample including proportions and confidence intervals. **Results**: There were 205 patients transported by EMS to a community hospital who were subsequently transferred to the Level I trauma center. Thirty had confirmed abnormalities on head CT (14.6%). The mean age was 78 years (range: 55–91), 57% female, and the most frequent mechanism of injury was falls (93%). Median length of stay at the trauma center was 13.5 days (range: 0–230), with 8 patients staying one day or less. CT findings included subdural hematoma (60%), subarachnoid hemorrhage (50%), and intraparenchymal hemorrhage (36.7%). Five patients required neurosurgical intervention (17%), eight required ICU admission (27%), two were discharged from the ED (7%), and two transitioned to inpatient hospice (7%). **Conclusions**: In our sample, geriatric patients with TBI who were subsequently transferred to a trauma center were overwhelmingly injured via falls and had variable resource utilization and clinical outcomes. Additional ways for responding EMS providers to identify geriatric fall patients who are at high risk for TBI are warranted.

203. Relationships between Right Atrial and Aortic Pressures and Jugular and Carotid Flows Respectively in a Swine Model of Asphyxial Pseudo-Pulseless Electrical Activity

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Background: The initial cardiac rhythms found during in-hospital respiratory arrests are typically either pulseless electrical activity (PEA) or asystole. Pseudo-PEA (p-PEA) often precedes true PEA and is characterized by a low-flow state in which cardiac contraction produces a non-palpable blood pressure. The purpose of the study was to characterize the relationships between venous and arterial pressures and the flows that drive brain perfusion in a hypoxic asphyxial model of p-PEA. Hypothesis: We hypothesized that during CPR right atrial pressure (RAP) would be related to jugular venous flow (JVF), and that aortic pressure (AOP) would be related to carotid flow, and that these relationships might change with time during p-PEA. **Methods**: Pseudo-PEA was induced via hypoxic asphyxiation in 12 domestic swine (~32 kg) with standard physiological monitoring. AOP and RAP were measured with solid state transducers placed in the thoracic aorta and right atrium. Blood flow was measured in the common carotid artery and jugular vein with ultrasonic flow probes. FiO2 was reduced to 6% by increasing the fraction of nitrogen. A target systolic blood pressure (SBP) of 40 mmHg was used to define p-PEA. The relationship between pressures and flows was determined with a Pearson correlation coefficient. **Results**: Overall, RAP was significantly negatively correlated with JVF ($r = -0.51$, $p < 0.05$), however, the relationship varied over time during p-PEA (Figure). AOP was significantly positively correlated with carotid flow ($r = 0.85$, $p < 0.05$), but did not show the same time dependence as seen with RAP and JVF. **Conclusions**: In an asphyxial model of p-PEA, venous blood pressures and flows were negatively associated and the relationship varied as a function of time. Arterial pressures and flow were positively associated and the relationship varied less over time. These findings have implications for how and when chest compressions or other interventions should be applied when treating p-PEA.

204. Change in the Utilization of Emergency Care after Establishment of Emergency Centre in Yaoundé, Cameroon: A Before and After Cross-Sectional Analysis

So Yeon Kong, Sang Do Shin, Young Sun Ro, Yun Jeong Kim, Joong Sik Jeong, Dae Han Wi, *Seoul National University Hospital* Category of Submission: Medical

Background: In effort to address the shortage of emergency medical care in Cameroon, Yaoundé Medico-Surgical Emergency Center (CURY) was established in June, 2015 in Yaoundé, Cameroon. To evaluate its impact on the communities of Yaoundé, we assessed the changes in utilizations of emergency medical care since the establishment of CURY. **Methods**: In 2014 the first survey was conducted on randomly selected 619 households (3,358 individuals) living in six health districts of Yaoundé. In 2017 the second quantitative survey was conducted on 634 households (3,466 individuals) using the same survey methods as the first survey. In both surveys, data on demographic information, socioeconomic status, and utilization of healthcare, including emergency care in the past year were collected on every member of the households via face-to-face interview. Data on two surveys were compared and emergency unit utilization by the distance from CURY was examined. **Results**: Participants in the both surveys had similar age and gender distribution with mean age of 24 and 54% being male. In 2014 survey, healthcare utilization rates for outpatient, emergency unit, and hospitalization were 37.2%, 4.5%, and 9.6%, respectively. In 2017 survey, corresponding rates were 32.4%, 5.7%, and 8.7%, respectively. The increase in the utilization of emergency unit between two surveys were statistically significantly (p=0.01). When the emergency unit utilization rates were examined by 3 km radius from CURY, there was decrease in the utilization of emergency care among residents living near CURY (27.3% in 2014 to 22.8% in 2017). **Conclusions**: After the establishment of emergency medical center (CURY) in Yaoundé, Cameroon, the utilization of emergency care was significantly increased. This increase was regardless of the distance from the patients' residential places to the emergency medical center, suggesting that the establishment of an emergency medical center may have impacted the utilization of emergency care throughout the entire communities of Yaoundé.

205. Prehospital Push Dose Epinephrine in Hypotension

Mark Merlin, Navin Ariyaprakai, Ammundeep Tagore, Matthew Harris, Andrew Parrish, Josh Schwarzbaum, Alex Torres, Michael Carr, Susmith Koneru, *Newark Beth Israel Medical Center/RWJBarnabas-MONOC* Category of Submission: Medical

Background: Hypotension is commonly encountered in the prehospital arena and occurs in the setting of illness, trauma or may be iatrogenic during rapid sequence intubation (RSI). The mainstay of prehospital treatment has been intravenous (IV) fluids; however, this method is not always effective. Push doses of epinephrine or phenylephrine, so called "push-dose pressors," have long been used by anesthesiologists for acute hypotension in the operating room. Push dose epinephrine (PDE) offers another tool to advanced life support (ALS) providers to combat hypotension. **Methods**: A retrospective review of data collected for the administration of PDE for the management of acute hypotension in the prehospital setting. We included patients >17 years old with systolic blood pressures <90 mmHg during the peri intubation period. Primary outcome was cardiac arrest. Secondary outcomes included changes in vital signs and shock index (SI). We performed descriptive statistics on demographics, biometrics and derived the mean, median and standard deviations for continuous variables of both the interventional and control group. RESULTS: PDE was administered 75 times in the two-year study period. 22 of those were peri-intubation (treatment group). Mean age in PDE was 69 years vs. 72.4 years in control group ($P = 0.23$). When comparing pre- and post-intubation vital signs of patients receiving PDE, we found significant increases in mean HR, SBP, DBP, MAP, and SI ($P < 0.001$). In the control group SBP, DBP, MAP, SI, and RR all achieved a statistical significant decrease of the mean ($P < 0.001$). The mean dose of epinephrine was 10 micrograms (range 10–80mcg); 19.7% of peri-intubation patients in the control group went into cardiac arrest. Only 4.5% of patients in the treatment group went into cardiac arrest. This did not reach statistical significance. **Conclusions**: PDE used in the management of peri-intubation hypotension in the prehospital setting resulted in statistically significant improvements in SBP, DBP, MAP and SI. The control group showed statistically significant worsening of vital signs after intubation. Overall, fewer patients went into peri-intubation cardiac arrest after receiving PDE. Readily available, easily composed and rapidly effective, PDE is a useful tool to combat acute hypotension in the prehospital arena.

206. Accuracy of Stroke Dispatch by a Large Urban EMS Dispatch System

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Background: Stroke is a time sensitive emergency that requires appropriate triage in EMS transport planning. The existence of hospitals with varying stroke-care capabilities and more recently mobile stroke units (MSUs) necessitates early recognition of stroke symptoms and accurate triage of patients to appropriate resources. This study investigates the accuracy of the EMS dispatch system in a major U.S. metropolitan area in predicting whether or not a patient is having a stroke. **Objective**: The objective of this study was to evaluate the accuracy of stroke recognition by a large urban EMS dispatch system in the United States. **Methods**: We performed a retrospective cohort study looking at the initial dispatch for stroke within a large urban-area EMS system. We then compared these patients to a stroke registry from a large urban tertiary hospital in the same city over a two-year period (2015–2016). **Results**: Over the study period, a total of 33,910 patients were transported to the tertiary care hospital for any complaint, including 778 patients with an initial dispatch code for stroke. Of the patients with initial dispatch coded as stroke, 133 were then confirmed as truly having a stroke based on stroke registry data. Dispatch for stroke had a sensitivity of 43.2% (95% CI 37.6–48.9), specificity of 98.1% (95% CI 97.9–98.2), positive predictive value of 17.1% (95%CI 15.1–19.3), and negative predictive value of 99.5% (95% CI 99.4–99.5). **Conclusions**: These findings imply EMS dispatch alone is not sufficient to rule-in stroke. In the case of MSUs, dispatch alone may lead to patients being inappropriately triaged to this resource due to the 82.9% false positive rate. The authors conclude that (1) triage tools beyond dispatch are required to ensure appropriate triage of potential stroke patients for intercept by a MSU or transport to a stroke center and (2) EMS systems need triage tools to prevent inappropriate triage of non-stroke patients to such resources such as MSUs to ensure patient safety and to prevent delays in definitive care.