Abstracts for the 2019 NAEMSP Scientific Assembly

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1. IN OUT-OF-HOSPITAL CARDIAC ARREST, LONGER ON SCENE TIMES ARE ASSOCIATED WITH HIGHER SURVIVAL RATES: “SCOOP AND RUN” MAY BE DEADLY

Christopher Berry, Douglas Kupas, Mark Olaf, Anne Knorr, Andrea Berger, Division of EMS, Geisinger Health System CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: The approach to managing out-of-hospital cardiac arrest (OOHCA) has generally involved either minimal on-scene resuscitation to reduce time to arrival at hospital or extended care at the scene to increase the chance of return of spontaneous circulation (ROSC) before transport. This study compared patient outcomes across EMS agencies with respect to the duration of on-scene time. We hypothesized that EMS agencies with greater average time on-scene would have more favorable outcomes. Methods: The Cardiac Arrest Registry to Enhance Survival (CARES) was used to identify OOHCA cases, including characteristics and outcomes. EMS agencies were included if they submitted at least 80 OOHCA cases from 2013 to 2017. To study outcomes based upon culture of OOHCA management, outcomes were studied by EMS agency rather than by individual patient cases. Agencies in the top and bottom quartiles of on-scene time duration were categorized as high (HOSTAs) and low on-scene time agencies (LOSTAs), respectively. Generalized estimating equation models compared HOSTAs and LOSTAs. Results: We classified 89 agencies as HOSTAs (24,114 patients, average ≥25 minutes on scene) and 89 agencies as LOSTAs (37,297 patients, average <18.9 minutes on-scene). Among patients transported, HOSTAs were more likely to have a shockable rhythm (28.4% vs 22.2%, OR=1.4, 95%CI 1.2 to 1.5), a witnessed arrest (65.1% vs 53.6%, OR=1.7, 95% CI 1.5 to 1.9), and receive bystander CPR (41.9% vs 37.0%, OR =1.3, 95% CI 1.1 to 1.5) than LOSTAs, all p<.001. When controlling for these and other patient characteristics, including mechanical CPR device use, HOSTAs had a higher proportion of ROSC on emergency department arrival (66.7% vs 31.1%, OR=4.6, 95%CI 3.5 to 6.0, p<.001), survival to discharge for transported patients (22.3% vs 11.2%, OR=2.6, 95%CI 2.0 to 3.4, p<.001), and good
neurologic outcome among survivors (84.9% vs 78.6%, OR=1.3, 95%CI=1.0 to 1.7, p=0.04) than LOSTAs.

Conclusions: This study suggests that HOSTAs have more favorable patient outcomes compared to LOSTAs. RESULTS indicate that spending more time on-scene performing resuscitation is associated with higher rates of ROSC, survival and survival with good neurologic function.

2. UTILITY OF A PREHOSPITAL "CRASHING PATIENT" CARE BUNDLE IN REDUCING THE INCIDENCE OF POST EMS CONTACT CARDIAC ARREST OF CRITICALLY ILL MEDICAL PATIENTS

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CATEGORY OF SUBMISSION: PROFESSIONAL

Background: 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 utility of a prehospital "Crashing Patient" Critical Care Bundle in reducing the incidence of post EMS contact cardiac arrest for critically ill medical patients. Methods: A critically ill medical patient "Crashing Patient" Care Bundle was developed and implemented in an urban EMS system in 2014. The key elements of this care bundle were: 1. No move of the patient until care objectives have been completed; 2. Apply physiological monitoring. 3. Aggressive management of the airway via basic and advanced methods. 4. Aggressive management of respiratory distress/failure via CPAP/positive pressure ventilation via BVM; 5. Early IV/IO access, aggressive management of hypotension via fluids and vasopressors; 6. Maximal medication therapy based on the patient's underlying pathology. Yearly case incidence was measured as percentage of system medical cardiac arrests that were post EMS contact so as to compare to the incidence reported in the Cardiac Arrest Registry to Enhance Survival (CARES®) database. Yearly analysis of the subset of patients experiencing EMS witnessed cardiac arrest ≥ 5 minutes after contact (allowing time for bundle implementation) was also conducted. Results: The system incidence of post EMS contact cardiac arrest decreased from 12.1% in 2015 (37 cases/299 arrests) to 5.8% through July 2018 (10
cases/171 arrests) (p=0.0251). The incidence of "911 Responder Witnessed" cardiac arrest reported in the CARES® Registry increased from 12.1% to 12.5% from 2015-2017. The system incidence for post EMS contact cardiac arrest ≥ 5 minutes after contact decreased from 9.7% in 2015 (30 cases/299 arrests) to 4.7% through July 2018 (8 cases/171 arrests) (NS: p=0.0519). **Conclusions:** The implementation of a prehospital "Crashing Patient" Care Bundle significantly reduced the incidence of post EMS contact cardiac arrest in the field. The there was a trend for reduced incidence of EMS witnessed cardiac arrest ≥ 5 minutes after contact that was not quite significant. The "Crashing Patient" Care Bundle appears to have utility to improve care for critically ill patients in the prehospital setting.

3. PREHOSPITAL KETAMINE ADMINISTRATION FOR EXCITED DELIRIUM: DEMOGRAPHICS, SIDE EFFECTS, AND SYSTEM IMPLICATIONS FOR AN URBAN HOSPITAL-BASED AMBULANCE SYSTEM

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**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** Patients with excited delirium (ExDS) and extreme agitation pose a safety hazard for themselves and for Emergency Medical Services (EMS) providers. A number of sedative agents can be used in this patient population. Increasingly, ketamine, a dissociative anesthetic, has been used in the prehospital environment for rapid sedation. There is still limited data supporting its safety and efficacy when used in this manner. Additionally, the system wide implications of its use have not been fully analyzed. The purpose of this study was to describe characteristics and complications of prehospital ketamine administrations in an urban hospital-based EMS system. **Methods:** We performed a retrospective cohort study of adult patients who received ketamine (5 mg/kg IM) for ExDS from June 2013 through December 2016. The Denver Paramedic Division is the principal advanced life support EMS agency for Denver County, and receives approximately 120,000 911 calls annually and transports 70% to
area hospitals. Using standard chart abstraction METHODS, we collected demographics, trip details, intubation, disposition, length of ED stay, admission, ingestions, and diagnoses using prehospital trip sheets, and ED and hospital records. Descriptive and bivariate statistics were performed. **Results:** During the study period, ketamine was administered to 228 patients. The median age was 30 (IQR: 24-37), 86% were male, and 61% were transported emergently to the hospital. Median prehospital heart rate and systolic blood pressure were 140 (IQR: 130-156) and 160 (IQR: 146-182), respectively. Additionally, 30% (95% CI: 24%-37%) required intubation, of which 56% were for airway protection and 31% for respiratory failure; 59% (95% CI: 52%-65%) were ultimately discharged home, although the median ED length of stay was 7.9 (IQR: 2.6-12.2) hours; moreover, 11% (95% CI: 7%-16%) were noted to have a minor complication (e.g., laryngospasm, respiratory depression); and 0% (95% CI: 0%-2%) died. Patients who were transported emergently were more likely to require intubation (p=0.02) but not more likely to be admitted to the hospital (p=0.08). **Conclusions:** Prehospital ketamine appears to be a rapid and effective means of chemical sedation in patients with ExDS, however, intubation, hospitalization, and overall resource use remains high after its use.

4. SURVIVAL AFTER INTRAVENOUS VS. INTRAOSSEOUS AMIODARONE, LIDOCAINE OR PLACEBO IN OUT-OF-HOSPITAL VENTRICULAR FIBRILLATION CARDIAC ARREST

Mohamud Daya, Brian Leroux, Thomas Rea, Paul Dorian, Joshua Lupton, Tom Aufderheide, David Barbic, James Christenson, Caroline Herdeman, James Menegazzi, Laurie Morrison, Craig Newgard, Gary Vlike, Peter Kudenchuk, *Department of Emergency Medicine, Oregon Health & Science University*

**CATEGORY OF SUBMISSION: CARDIAC**

**Background:** Antiarrhythmic drugs have not demonstrated improvement in survival from out-of-hospital cardiac arrest (OHCA) due to shock-refractory ventricular fibrillation or pulseless ventricular tachycardia (VF/VT). Whether this apparent inefficacy might be influenced by the route of drug administration -
intravenous (IV) versus intraosseous (IO) is not known. **Methods:** In this pre-specified analysis of a randomized, placebo-controlled trial, we compared survival to hospital discharge in adults with non-traumatic, shock-refractory VF/VT OHCA who were randomized to antiarrhythmic drugs versus placebo in the Resuscitation Outcomes Consortium Amiodarone, Lidocaine or Placebo Study (ALPS) stratified by the route of vascular access (IO or IV) for drug administration. **Results:** Of 3,026 randomized patients, 3,019 had a known vascular access site, 2,358 of whom received ALPS drugs IV and 661 by an IO route. The IO and IV groups were similar in age, location of arrest, whether bystander or EMS-witnessed, receipt of bystander CPR or shock, compression rate, peri-shock pauses, advanced airway placement, time interval from emergency call to vascular access and study drug administration, and receipt of other resuscitation drugs. Overall survival was 23%. Unadjusted and adjusted analyses yielded similar findings among active drug vs placebo recipients in IV and IO treatment groups: For the 2,860 patients (95%) with complete covariate data, adjusted absolute survival did not differ between recipients of IO lidocaine vs placebo (adjusted absolute survival difference (95% confidence interval) -1.1% (-8.8, 6.5)), nor between IO amiodarone vs placebo (-2.6 (-10.0, 4.7)) but was significantly higher in recipients of IV lidocaine vs placebo (4.6% (0.5, 8.6)) and IV amiodarone vs placebo (5.6% (1.6, 9.6)); p for interaction ≤0.15. **Conclusions:** Amiodarone and lidocaine compared to placebo were associated with a significant increase in survival to hospital discharge when administered IV but not IO. Though suggestive, the study was underpowered to assess statistical interactions between IV and IO administered drugs. Whether the route of drug administration itself plays a determining role in antiarrhythmic drug effectiveness in OHCA merits prospective investigation.
5. SHARED DECISION-MAKING TO REDUCE EMS TRANSPORT AMONG ASSISTED LIVING FACILITY RESIDENTS WITH SIMPLE FALLS: EVALUATION OF LONG-TERM OUTCOMES

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CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

Background: We previously showed shared decision-making between advanced practice paramedics (APP) and primary care physicians (PCP) could reduce EMS transports for assisted living facility (ALF) residents who experienced simple falls, without missing time-sensitive conditions evident within 72 hours. This study evaluated longer-term outcomes in this population. We hypothesized there would be no difference in the 1-year risk of a second fall or death, and no difference in fall-free survival time and overall survival time, between transported and non-transported patients. Methods: This secondary analysis used data from our prospective cohort study of ALF patients with simple falls served by a single urban EMS system. APPs utilized history and exam criteria and consultation with an on-call PCP as necessary to decide transport vs. non-transport with close PCP follow-up. Evaluated outcomes in this secondary analysis were: 1-year (second) fall risk, 1-year mortality risk, fall-free survival time, and overall survival time. The 1-year risk of a second fall or death was measured as events per person-year of follow-up and compared using incident risk ratio (IRR) with 95% confidence intervals (CI). 1-year fall-free and overall survival time were measured in months and compared using Cox regression, with hazard ratios (HR) and CI reported. Results: Of 953 subjects enrolled in the primary study, 359 had a (first) fall: 130 (36%) were transported and 229 (64%) were not. Fifty-two transported subjects experienced a second fall within 1 year (1.0 falls/person-year) compared with 116 non-transported subjects (1.1 falls/person-year) (IRR 1.15, CI: 0.83-1.63). Thirty-six transported subjects died within 1 year (0.5 deaths/person-year) compared with 41 non-transported subjects (0.3 deaths/person-year) (IRR 0.58, CI: 0.36-0.93). There was no difference in fall-free survival time (HR 0.84, CI: 0.53-1.35) or overall...
survival time (HR 0.77, CI: 0.40-1.52). This analysis is limited to 1-year follow-up and does not include other potentially important outcomes such as resource utilization, hospitalizations, and/or costs.

Conclusions: An EMS protocol allowing APP/PCP shared decision-making regarding transport for ALF residents with simple falls does not result in increased risk of a second fall or increased death rate, or shortened time to a second fall or death, over the ensuing 1-year period.

6. IDENTIFYING BARRIERS TO PREHOSPITAL ADVERSE EVENT REPORTING

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Background: Despite attention focused on adverse events in medical practice, there remains a paucity of research into the nature and abatement of errors in EMS. While adverse events have been found across the spectrum of EMS systems, they are infrequently reported in a systematic manner to assist in developing local mitigation strategies. However, integral to the development of such systems is an understanding of the perspective of providers on barriers to reporting adverse events. Objective: To determine the perceived barriers to EMS providers reporting adverse events. Methods: A voluntary, anonymous survey was sent to 879 providers across five different EMS agencies in southeastern Wisconsin. These organizations ranged from urban and rural ground services to air medical programs. The survey was conducted using online software and was shared with all providers through electronic communication with a one-week follow-up reminder. The survey was developed using barriers that were previously identified by locally conducted focus groups. Data were analyzed using descriptive statistics. Results: The survey had an 63% response rate, with 550 surveys completed across the five agencies. Of those who responded, 49.6% felt there were barriers to reporting adverse events. The most cited barriers were fear of blame or punishment from EMS agency (47.1%; 95% CI 41.2-53.0%), concern for more bureaucracy/paperwork requirements (32%; 95% CI 26.1-37.2%), confusion on how to report
errors (29%; 95% CI 23.8-34.6%), reporting not anonymous (28%; 95% CI 22.6-33.3%), and fear of blame or punishment from medical director (17%; 95% CI 12.2-21.0%). When results were separated by EMS agency type, we found that the primary concern was fear of blame or punishment from EMS agency for ground agencies and concern for more bureaucracy/paperwork for flight agencies. Conclusions: EMS providers universally identified several primary barriers to adverse event reporting. These barriers should be addressed when attempting to implement processes and programs to enhance adverse event reporting as well as serve as a model for determining and addressing agency-specific issues.

7. EFFECTIVENESS OF PREHOSPITAL DUAL SEQUENTIAL DEFIBRILLATION FOR REFRACTORY VENTRICULAR FIBRILLATION AND VENTRICULAR TACHYCARDIA CARDIAC ARREST

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CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Dual sequential defibrillation (DSD) – successive defibrillation with two separate defibrillators – offers a novel approach to treating refractory ventricular fibrillation and tachycardia (VF/VT). The effectiveness of DSD is unknown. We evaluated the association of DSD with outcomes in refractory VF/VT out-of-hospital cardiac arrest (OHCA). Methods: We used data from Houston Fire Department, a large metropolitan fire-based EMS service. We included all adult OHCA during 2013-2016 with refractory VF/VT after ≥3 standard 360J defibrillations. Online physicians authorized subsequent DSD use, consisting of rapid successive 360J rescue shocks delivered by two separate defibrillators (PhysioControl LIFEPAK® 12/15) with pads placed in anterior-lateral and anterior-posterior configurations. Evaluated outcomes included return of spontaneous circulation (ROSC), survival to hospital admission, survival to 72 hours, and survival to hospital discharge. Using multivariable logistic regression, we evaluated the associations between defibrillation type (DSD vs convention) and OHCA
outcomes, adjusting for age, sex, witnessed arrest, bystander CPR and initial ECG. **Results:** We included 310 patients in the analysis, including 71 patients receiving subsequent DSD, and 239 receiving conventional defibrillation. Patient demographics and event characteristics were similar between DSD and conventional defibrillation. ROSC was lower for DSD than standard defibrillation: 39.4% vs 60.3%, adjusted OR 0.46 (95% CI: 0.25-0.87). There were no differences in survival to hospital admission (35.2% vs 49.2%, adjusted OR 0.57 [95% CI: 0.30-1.08]), survival to 72 hours (21.4% vs 32.3%, adjusted OR 0.52 [95% CI: 0.26-1.10]), or survival to hospital discharge (14.3% vs 20.9%, adjusted OR 0.63 [95% CI: 0.27-1.45]). **Conclusions:** Compared with conventional defibrillation, DSD was associated with lower odds of ROSC. Defibrillation type was not associated with other OHCA endpoints. DSD may not be beneficial in refractory VF/VT OHCA.

8. **DOUBLE SEQUENTIAL EXTERNAL DEFIBRILLATION IMPROVES TERMINATION OF VENTRICULAR FIBRILLATION AND RETURN OF SPONTANEOUS CIRCULATION IN SHOCK-REFRACTORY OUT-OF-HOSPITAL CARDIAC ARREST**

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**Background:** Despite significant advances in resuscitation efforts, there are some patients who remain in ventricular fibrillation (VF) after multiple shocks during out-of-hospital cardiac arrest (OHCA). Double sequential external defibrillation (DSED) has been proposed as a treatment option for patients in shock refractory VF. Objective: To compare DSED to standard therapy with regards to VF termination and return of spontaneous circulation (ROSC) for patients presenting in shock refractory VF. **Methods:** We performed a retrospective review of all treated adult OHCA who presented in VF and received a minimum of four successive shocks over a one year period beginning on Jan 1, 2015 in six Canadian EMS
agencies. Using ambulance call reports and defibrillator files, we compared VF termination (defined as
the absence of VF at the rhythm check following defibrillation and 2 minutes of CPR) and VF termination
into a perfusing rhythm with ROSC between patients who received standard therapy (CPR, defibrillation,
epinephrine and antiarrhythmics) and those who received DSED (after on-line medical consultation) for
shock refractory VF (patients who presented in VF and did not terminate VF after four successive
shocks). Cases of public access defibrillation, EMS witnessed arrest and those who presented in VF but
terminated VF prior to 4 shocks were excluded. Results: Among 197 patients who met the study criteria
for shock refractory VF, 161 (81.7%) patients received standard therapy and 36 (18.3%) received DSED.
For the primary outcome, VF termination was significantly higher compared to standard therapy (63.9%
vs 18.0%; Δ45.9%; 95% CI: 28.3 to 60.5). For the secondary outcome of VF termination into ROSC, DSED
was associated with significantly higher ROSC compared to standard care (33.3% vs 13%; Δ20.3%; 95%
CI:13.0 to 33.3). The median (IQR) number of failed standard shocks prior to DSED was 8 (6, 10). When
DSED terminated VF, it did so with a single DSED shock in 69.6% of cases. Conclusions: Our
observational findings suggest improved VF termination and ROSC are associated with DSED compared
to standard therapy for shock refractory VF. An appropriately powered randomized controlled trial is
required to assess the impact of DSED on patient-important outcomes.

9. DISPARITIES IN RECEIPT AND UTILIZATION OF TELECOMMUNICATOR CPR INSTRUCTION

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Background: Telecommunicator Assisted cardiopulmonary resuscitation (T-CPR) has been shown to be
independently associated with improved survival and improved functional outcome after Out of Hospital
Cardiac Arrest (OHCA). The objective of this study is to evaluate whether there are racial and
socioeconomic disparities in the receipt of T-CPR instructions and subsequent CPR performance.

**Methods:** This study is a retrospective review of a convenience sample of EMS agencies nationally that utilized the Cardiac Arrest Registry to Enhance Survival (CARES) dispatch registry during the period 1/2014-12/2017. Data was collected from a dispatch agency review of 911 OHCA audio recordings. Elements related to dispatcher CPR instruction, barriers to bystander CPR performance, patient race (Caucasian, African American, Hispanic-Latino, or other) and Utstein data were captured from the CARES database. This data was merged with census tract information from incident locations. The effects of race and income on outcome were analyzed using multilevel logistic regression. **Results:** 3,552 cases were identified from 37 dispatch agencies in 6 states. The population was predominantly Caucasian (60.0%), male (64.9%), with an average age of 60.4 +/- 19.8. In the adjusted analysis, for every $1,000 increase in Census Tract Income, the odds of receiving T-CPR instructions increased by 1% (OR: 1.01; P=0.0011). African American patients had a 35% lower odds of receiving T-CPR as compared to Caucasian patients (OR: 0.65; 95% CI (0.46 -0.91)). Subsequent utilization of T-CPR instruction for bystander CPR was also less likely for patients that had a lower income or who were African American. For every $1,000 increase in Census Tract Income, the odds of receiving bystander CPR increased by 1% (OR: 1.01; P=0.0105). African American patients had a 37% lower odd of T-CPR utilization as compared to Caucasian patients (OR: 0.63; 95% CI (0.41 -0.99)). **Conclusions:** Although this study is limited by incomplete demographic and dispatch data, we identified income and racial disparities in provision of T-CPR instructions and subsequent CPR performance in OHCA.
10. COMPARISON PEDIATRIC AND ADULT SIZED BAG-VALVE-MASK VENTILATION TO ACHIEVE APPROPRIATE TIDAL VOLUME IN SIMULATED ADULT OUT OF HOSPITAL CARDIAC ARREST IN MOVING AMBULANCE

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CATEGORY OF SUBMISSION: CARDIAC

Background: An appropriate ventilation is a key to success in resuscitation of out of hospital cardiac arrest (OHCA) patients. Previous study proposed that ventilation with pediatric sized bag-valve-mask (BVM) provided more appropriate tidal volume (Vt) for adult patients than adult sized BVM. However, the study was conducted in static simulated environment. We hypothesized that the result might be different from the previous study when we ventilated in moving ambulance. Therefore, the study compared pediatric and adult sized BVM ventilation in achieving appropriate Vt in simulated adult OHCA in moving ambulance. Methods: This was a randomized crossover trial. All participants performed both pediatric (500 cc) and adult (1600 cc) sized BVM ventilation during 30: 2 chest compression and ventilation ratio in simulated OHCA on moving ambulance. Both scenarios utilized mechanical chest compression for controlling rate and duration of chest compression. The participants were asked to ventilate the adult sized manikin for 10 minutes during each scenario. The study measured appropriate Vt which defined as percentage of the ventilation volume ranged in basic life support (BLS) recommendation (400-600 mL) and ventilation rate between each scenarios. We also compared percentage of hypo and hyperventilation between each groups. Results: Fifty-two volunteers were included, 57.69 % was registered nurses, 42.31 % basic emergency medical technicians (EMT-B). Of all the volunteers, 84.62 % were low experience in prehospital ventilation (<5 years). The mean Vt of pediatrics size was 239.04 mL, whereas the Vt of adult size was 444.54 mL (P <0.001). The average ventilation of pediatric size was 29.15 ± 12.35 ventilations, whereas adult size was 43.84 ± 9.25 ventilations (P <0.001). The pediatric sized BVM was 100% hypoventilation, however the adult sized was
52.13 ± 25.63% appropriate ventilation, 11.35 ± 18.59 % hyperventilation, and 36.54 ± 29.11 % hypoventilation (P <0.001). **Conclusions:** A comparison of pediatric and adult sized BVM ventilation in simulated adult OHCA patients in moving ambulance demonstrated a superiority of adult sized BVM over the pediatric sized BVM in appropriate both Vt and ventilation as BLS recommendation guideline.

11. VENTILATION VARIABILITY IN SIMULATED OUT-OF-HOSPITAL CARDIAC ARREST RESUSCITATION

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**Background:** While airway management and chest compressions have been widely studied, ventilation characteristics during out-of-hospital cardiac arrest (OHCA) resuscitations have been poorly described and routinely limited to respiratory rate (RR). Total published experience with tidal volume (TV) is a series of 12 subjects, and minute ventilation (MV) has never been reported. We hypothesize that RR, TV, and MV vary during simulated OHCA resuscitations. **Methods:** On-duty fire department teams of four EMS providers (mixed EMTs and paramedics) participating in a standardized simulation of EMS-witnessed adult OHCA were unaware that the study was taking place. The study team prospectively observed a consecutive series of resuscitations from a control room. Proctors provided no feedback on ventilations to maintain blinding. Laerdal SimMan 3G and DebriefViewer software recorded ventilation characteristics. Goal RR was defined as 8-10/min reflecting current guidelines. DebriefViewer designates ideal TV as 400-700mL. We report summary statistics with standard deviations (SD) and 95% confidence intervals (CI). Pearson’s correlation coefficient was used to determine the correlation between variables.

**Results:** We observed 22 simulations totaling 158 minutes with a mean of 7.2 (SD: 2.7) min/simulation. The mean RR was 5.6 respirations/min (95% CI: 4.5-6.7). Only 4 (18%) simulations were within the target ventilation range (8-10/min), with 17 (77%) simulations below and 1 (5%) above. The mean TV per simulation was 649 mL (95% CI: 589-710), with 2 (9%) simulations <400 mL and 8 (36%) ≥700 mL. Of the
922 total ventilations across all simulations, 13% were below the target volume (400-700 mL) and 46% were above. Three simulations (14%) had both a mean TV and RR within goal. Minute ventilation ranged from 0.7 to 8.8 L/min with an overall mean of 3.7 (95% CI: 2.8-4.6). The Pearson's correlation coefficient between TV and RR was 0.32. **Conclusions:** In this small series of simulated OHCA resuscitations, ventilation variability was common and rarely within target range. Respiratory rate was frequently below target, and tidal volume was frequently above target. Respiratory rate and tidal volume are poorly correlated and, if confirmed with additional studies, should be considered independent variables when describing ventilation characteristics.

12. **AUTOMATED MACHINE LEARNING CLASSIFICATION OF ELIGIBILITY STATUS USING EMS CLINICAL NOTES TO IDENTIFY PATIENTS FOR MULTI-SITE PREHOSPITAL TRIALS**

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**Background:** Improved methods for identifying eligible patients for prehospital emergency trials are needed. Currently, manual review is considered the gold standard of validation and requires a lengthy review of patient records, a cumbersome process that creates a significant financial burden for an institution. Our objectives were to develop and evaluate automated classification methods for eligibility screening in prehospital trials utilizing prehospital EHR clinical notes and discrete data to facilitate feedback for multi-site prehospital trials. This study leveraged natural language processing (NLP), information extraction (IE), and machine learning (ML) techniques on real-world EMS data. **Methods:** We annotated 1211 electronic health records (EHRs) from an EMS EHR system based on discrete data fields to create a rule-based sample population using eligibility criteria for patients exhibiting non-traumatic chest pain or anginal equivalent symptoms. Leveraging NLP, IE, and ML technologies, the automated algorithms classified the patients into four categories: eligible with ST-elevated Myocardial
Infarction (STEMI), eligible with non-STEMI chest pain, indeterminate, and ineligible. We used Python open source packages Scikit-Learn for the classifiers and Natural Language Toolkit (NLTK) for the bag of words model to assist in feature extraction. The performance was validated on gold-standard manual review by experts, mean average precision, recall, and F1-score were assessed. **Results:** Compared with the case without automation, the workload with automated eligibility screening was reduced by 99% on the gold standard set. We identified 9113 features within the clinical notes that were used to train the models that were compared using mean average precision, recall, and F1-score. We compared four machine learning algorithms of Naïve Bayes, Support Vector Machine (SVM), logistic regression, and random forest decision tree. Empirical findings indicated that the SVM and Random Forest approaches outperformed all other classifiers achieving precision scores of 0.88 and 0.89, recall scores of 0.91 and 0.92, and F1-scores of 0.88 and 0.90, respectively. **Conclusions:** We show that it is feasible to develop a high-performing, automated classification system using EMS clinical notes to streamline the identification of patients for prehospital trials. We intend to use this approach in conjunction with a feedback loop to enhance enrollment for multi-site prehospital trials.

13. THE ASSOCIATION BETWEEN OCCUPATIONAL BURNOUT AND TURNOVER, SICKNESS ABSENCE, AND INJURY AMONG EMS PROFESSIONALS

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**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** Cross-sectional studies have linked burnout to forms of job withdrawal including absenteeism and turnover in EMS; however, not all people experiencing burnout leave the job. Those who remain at work may engage in shortcuts to reduce job demands, which could lead to occupational
injury. Our objective was to prospectively assess the relationship between turnover, sickness absence, injury, and occupational burnout among EMS professionals. We hypothesized burnout is linked to increased turnover, absenteeism, and injury. **Methods:** We conducted a prospective cohort study of EMS professionals working for a large municipal EMS agency. Participants were followed for a six-month period (12/1/2017-6/17/2017). Work-related burnout was assessed at baseline using the Copenhagen Burnout Inventory. Turnover, sickness absences, and occupational injuries were obtained from agency records. Five or more sickness absences in the six-month period was classified as high absenteeism based on estimates from the Bureau of Labor Statistics. Generalized linear models with robust standard error estimates were used to calculate risk ratios (RR, 95% CI) comparing providers experiencing burnout to those who were not. **Results:** A total of 238/425 (56%) EMS professionals responded to the baseline questionnaire. Nearly half (48%, n=112) of participants were experiencing at least one type of burnout at baseline. At six months, 7% (n=16) of all participants had left the agency, 47% (n=110) took five or more sick days, and 11% (n=26) incurred at least one occupational injury. The risk of leaving the agency was nearly three-fold higher among those experiencing work-related burnout (2.93, 1.07-8.07). EMS professionals experiencing work-related burnout also demonstrated 75% greater risk of incurring five or more days of sickness absence (1.75, 1.28-2.39). We found no difference in risk of occupational injury by burnout status (1.02, 0.41-2.53). **Conclusions:** Burnout was prospectively associated with turnover and increased absenteeism, but was not associated with higher risk of occupational injury in this study. Limitations include the use of a single agency, small sample size, and potential response bias. Future larger-scale prospective work is needed to examine the potential association between burnout and injuries.
14. HELPING THOSE WHO HELP US: PERSONALITY, STRESS, COPING AND SOCIAL SUPPORT IN CANADIAN PARAMEDICS

Joanna Lockhart, Stephen Perrott, Emergency Health Services Nova Scotia, Mount Saint Vincent University CATEGORY OF SUBMISSION: PROFESSIONAL

Background: Support services and psychological interventions available to paramedics are largely adopted from those employed by other occupational groups, notably combat military personnel, police and firefighters. In doing so, these interventions assume equivalent work experiences and shared psychological states on stress-relevant constructs. Considering the abundance of mental health problems experienced by paramedics, research focused exclusively on the potentially unique personality characteristics, coping styles, and perceptions of social support of paramedics is needed to provide a foundation for developing the most efficacious support services to ameliorate stress reactions.

PURPOSE: The primary objective was to collect descriptive data related to these psychological constructs and to examine the utilization of, and satisfaction with, currently available support services intended to manage psychological distress. A secondary goal was to investigate which of the assessed variables predict perceived stress in this sample. Methods: An internet-based survey was distributed to 1,348 paramedics in the province of Nova Scotia, and responses from 344 paramedics were analyzed. The survey included a Big-Five measure of personality and indices of social support, coping and perceived stress. Results: When compared to a normative sample, paramedics were higher in Conscientiousness, Extraversion and Agreeableness and lower in Open-Mindedness and Negative Emotionality (all ps <.001). Greater levels of perceived stress (p <.001) and utilization of both healthy (p <.001) and less-than-optimal (p <.001) coping strategies were reported. Strikingly low perceptions of social support were observed (p <.001). Negative Emotionality was the strongest personality predictor of perceived stress (R2=.438) and Less-Useful Coping and perceptions of social support (R2=.383) were the top non-personality predictors. Conclusions: Results suggest that respondent paramedics experience
inordinately high levels of stress with a predisposed state of considerable psychological resiliency. Given that this seemingly psychologically healthy group reports such high levels of perceived stress likely belies even greater levels workplace stress than reported scores suggest. The relationship between social support and perceived stress, against the backdrop of lower than normative perceptions of support overall, are the findings of greatest concern. However, deficiencies in perceived social support are amenable to remediation by positive policy changes.

15. DEPENDENCE ON OVERTIME OR MULTIPLE JOBS IS ASSOCIATED WITH WORKFORCE-REDUCING FACTORS AMONG EMS PROFESSIONALS

Madison Rivard, Rebecca Cash, Ashish Panchal, National Registry of Emergency Medical Technicians

CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

Background: EMS professionals frequently work more than a standard 40-hour workweek. For some EMS professionals, working overtime or multiple jobs may be necessary to make ends meet. It is unclear the impact on EMS professionals' job satisfaction and intent to leave a job if they depend on overtime pay or multiple jobs. Our objective was to evaluate the association between job satisfaction, intention to leave EMS, and dependence on overtime or working multiple jobs. We hypothesized that dependence on overtime or multiple jobs is associated with low job satisfaction and an intention to leave EMS.

Methods: This study was a cross-sectional survey of nationally-certified EMS professionals. After recertifying their National EMS Certification, EMS professionals were invited to complete a survey with questions regarding their dependence on overtime or multiple jobs, job satisfaction, and intention to leave EMS assessed on 4-point Likert scales dichotomized to agree/disagree. We included currently working patient care providers, ages 18 to 85, who were certified at the emergency medical technician (EMT) level or higher. Logistic regression models (OR, 95%CI) were used to describe the association between job satisfaction, intent to leave their EMS job within 12 months or 5 years, and dependence on
overtime and multiple jobs, controlling for certification level. **Results:** A total of 18,646 individuals met inclusion criteria (response rate=21%). Of these respondents, 71% stated they depended on overtime or multiple jobs to make ends meet. This differed by certification level with 65% of EMTs dependent on overtime or multiple jobs compared to 75% of paramedics (p<0.001). Respondents who depended on overtime or multiple jobs had over a 2-fold increase in odds of being dissatisfied with their job (2.18, 1.88-2.53). Similarly, those who depended on overtime or multiple jobs had increased odds of intending to leave EMS within the next 12 months (1.43, 1.23-1.65) or 5 years (1.24, 1.15-1.34). **Conclusions:** In this sample, many EMS professionals depended on additional work hours or multiple jobs. This economic dependence was associated with job dissatisfaction and intention to leave EMS. Future work should focus on improving pay and benefits for EMS professionals to improve retention.

16. **EXPLORATORY STUDY OF THE ROAD TO MENTAL READINESS PROGRAM WITHIN EMERGENCY MEDICAL SERVICES PERSONNEL IN ALBERTA HEALTH SERVICES**

**Jabin Binnendyk, Jamie Prowse-Turner, Ian Blanchard, Chris McIntosh, Scott Oddie, University of Calgary**
**CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW**

**Background:** Occupational Stress Injuries (OSIs), like post-traumatic stress disorder, among Emergency Medical Services (EMS) personnel produce a public-safety concern and negatively impact resiliency and workplace mental health. In response, the Mental Health Commission of Canada modified and deployed a program created by the Canadian military called Road to Mental Readiness (R2MR), which has seen widespread implementation among some EMS services. The R2MR program aims to enhance resilience and help-seeking behaviours while reducing stigma, although sparse empirical evidence currently confirms its effectiveness. **Purpose:** To determine if R2MR retention produced differences in resilience, help-seeking behaviours, and stigma. **Methods:** An on-line survey was made available to all operational and management personnel in a provincial EMS system servicing approximately four million people.
Retention of R2MR was defined as the ability to recall R2MR components and assessed using knowledge-based questions while resilience, help-seeking behaviours, and stigma utilized pre-existing validated measurements (Brief Resilience Scale, Mental Health Service Use Questionnaire, and Mental Health Knowledge Schedule respectively). A correlational design using analyses of variance, and t-tests were used with statistical tests considered significant at an alpha of 0.05. **Results:** Three hundred and ninety (390) participants fully completed the survey with another 265 partial respondents. The vast majority of participants were Caucasian (93.5%); however, gender (49.6% male, 48.4% female), level of certification (50.7% Advance Care Paramedic, 30.8% Primary Care Paramedic, 14.2% Emergency Call Officer), and geographical location (52% metropolitan, 30.2% rural, 16.2% suburban) were heterogeneous. The high R2MR retention group reported increased resiliency ($p=0.042; 95\%CI 0.06, 2.91$) and help-seeking behaviours ($p=0.047; 95\%CI 0.02, 3.84$) along with reduced stigma ($p<0.001; 95\%CI -2.95, -0.51$) in comparison to the moderate retention group. No significant differences between low and moderate retention groups were found and R2MR retention and recency of receiving the training was nonsignificant. **Conclusions:** High retention of the R2MR program was correlated with preventative (increased resilience and reduced stigma) and reactive (increased help-seeking behaviours) protections helping combat OSIs. Although causality should be further explored, this study enhances EMS leadership’s ability to understand the scope of impact produced by R2MR on mental health in EMS personnel.

17. PREHOSPITAL EMERGENCY ASSESSMENT OF KIDS (PEAK) PERFORMANCE

Kathryn Rappaport, Chelsea Zuger, Neil Desai, Michelle Alletag, Ashley Balakas, Sean Caffrey, Jan Leonard, Kelley Roswell, Patrick Mahar, Kathleen Adelgais, University of Colorado School of Medicine

CATEGORY OF SUBMISSION: PEDIATRIC
**Background:** Prehospital providers (PHPs) infrequently transport children leading to difficulty recognizing pediatric critical illness, maintaining management competency and high rates of medication error. Simulation provides a venue to assess the management of pediatric critical illness, however the impact of serial simulations on improving management is unknown. The objective of this study is to examine performance changes in PHP critical illness management during serial simulations of pediatric emergencies. **Methods:** Teams of 4-6 PHPs from one urban fire agency participated in two high-fidelity simulations 3 months apart. The initial case (Time0) simulated a 15 month-old seizure and the second case (Time1) simulated a 1 month-old with hypoglycemia. Both cases required management of respiratory failure, decompensated shock, and medication administration. Two investigators scored simulations via video review using a validated scoring tool assessing team-based care (total possible score: 42). Inter-rater reliability was assessed on 30% of videos using Kappa analysis. Volumes of administered intravenous fluid (IVF) and medications were measured; an accurate dose defined as +/- 20% per the agency field guide. PHPs completed self-efficacy surveys at Time0 and Time1 for pediatric resuscitation tasks using a Likert Scale. The simulation score, management, and self-efficacy were univariately compared between Time0 and Time1. **Results:** A total of 292 PHPs participated in 49 simulations at Time0 with 179 PHPs participating in 40 simulations at Time1 (65% ALS, 35% BLS). Interrater reliability for video review was good (k =0.7). Median simulation score improved from Time0 to Time1 (24 vs 27, p=0.04) with greatest improvements in recognition and management of respiratory decompensation (4 vs 6, p=0.003; total possible: 8) and timeliness of vascular access (p=0.03). At Time1, there was no change in administration of correct volume of IVF (29% vs 50%, p=0.17) but administration method (pull-push 44% vs 75%, p=0.03) and administration of correct dose of medications (75% vs 100%, p=0.02) improved. Self-efficacy scores across all resuscitation tasks increased from Time0 to Time1 (p<0.001). **Conclusions:** Serial simulations improved PHP pediatric critical illness management.
with decreased medication errors and improved method of fluid administration. Additionally, PHP self-efficacy increased. Further studies are needed to determine if improvement is sustained over time.

18. EDUCATING COMMUNITY PARAMEDICS: A GROUNDED THEORY ANALYSIS

Kevin William Lobay, Jack Zhang, Joshua Bezanson, Steven Amrhein, University of Alberta CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

Background: Community Paramedicine (CP) is a new care-delivery model being trialed by EMS agencies internationally to reduce pressures upon hospital Emergency Departments and save healthcare dollars. Ensuring quality training for CPs is important to patients, EMS agencies, paramedic schools and regulators, but scarce published literature exists to guide us. This study aims to provide an informed perspective on CP education needs through Grounded Theory Analysis. Methods: We employ Gioia Methodology, an established standard for inductive qualitative research that assumes an informant-centered perspective; listening to what interviewees say, identifying patterns in the data and analyzing for emergent concepts and relationships. 20 knowledgeable agents were recruited from various urban and rural CP sites primarily in western Canada. Interviewees include paramedics who work in the community, medical and executive leaders, educators and regulators. Semi-structured 1-hour interviews were conducted by our research team. Interviewer notes were compiled and analyzed to identify "first-order concepts." These concepts were then synthesized by members of our research team into "second-order themes" and "aggregate dimensions." Results: Our data suggests that CP practice and educational needs can be organized into 18 first-order concepts. CPs require enhanced medical knowledge, strong clinical decision-making skills, enhanced assessment and diagnostic skills, and they offer specific therapies. CPs must be skilled at relationship-building, multidisciplinary collaboration and health system navigation. CPs should offer preventive healthcare, facilitate access to care, and ensure quality care. CP training should have a formal component, incorporate information management training, involve
trainers from multiple healthcare disciplines, and facilitate continuing education opportunities. CPs also require accreditation consistent with their unique scope of practice and patient population. Second order themes fall surprisingly in parallel with the educational needs of medical resident trainees as identified in the CanMEDS Competency Framework: medical expert, communicator, collaborator, leader, health advocate, scholar and professional. Conclusions: Community Paramedics must have a very broad skillset if they are to meet the range of healthcare needs that exist among patients in the community. We suggest that CPs must work with regulators and educators toward further defining core CP practice and become highly skilled at interfacing with other members of the healthcare team.

19. USING PREHOSPITAL SCREENING TOOLS TO IDENTIFY LARGE-VESSLE OCCLUSION

Peder Humlen-Ahearn, Larry Hadland, Lawrence Brown, Remle Crowe, Ada County Paramedics

CATEGORY OF SUBMISSION: MEDICAL

Background: Stroke screening tools used by U.S. EMS systems vary widely, but common tools include FAST, CPSE, LAPSS, PASS, RACE, LAMS, and VAN. The recent advent of cerebral endovascular mechanical thrombectomy as a treatment option for large vessel occlusions (LVO) has highlighted the need for prehospital stroke screening tools that reliably identify LVO. The purpose of this analysis was to determine the test characteristics for commonly used prehospital stroke scales for detecting LVO.

Methods: This retrospective analysis included all patients with both a stroke screening and health data exchange (HDE) hospital outcome data included in a nationwide calendar year 2017 database maintained by a single, large commercial ePCR provider. LVO was identified using ICD-10 diagnosis and procedure codes (I63.239; I63.411; I63.22; O3CG3ZZ). We evaluated sensitivity, specificity and positive/negative predictive values (PPV/NPV) for RACE or LAMS score ≥ 4 (the only two scales with established cut points for LVO); we also evaluated the test characteristics of the presence of any two of the three scale components common among most prehospital stroke scales (facial droop, arm drift,
speech impediment). **Results:** There were 1,712 patients with both stroke screening and HDE outcome data; 48 (3%) had documented LVO. Only 242 (14%) of the patients (7 with LVO) were assessed using RACE/LAMS. The sensitivity of RACE/LAMS was 100% (CI: 60%-100%) and the NPV was 100% (CI: 97%-100%), but the specificity (53%, CI: 46%-59%) and PPV (6%, CI: 2%-12%) were poor. Facial droop, arm drift and speech impediment were fully documented for 1,598 (93%) of the patients (45 with LVO); any two being present had a sensitivity of 80% (CI: 65%-90%) and an NPV of 99% (CI: 98%-100%), but again specificity (48%, CI: 45%-50%) and PPV (4%, CI: 3% - 6%) were low. **Conclusions:** Use of the LAMS/RACE>/>/4 stroke-screening tools or two or more screening characteristics by EMS is a poor predictor of large vessel cerebral occlusions. Further efforts are needed to expand and further evaluate the prehospital use of RACE/LAMS for identifying LVO, and to establish the LVO-identifying aspects of other common prehospital stroke scales.

20. **IS USE OF WARNING LIGHT AND SIRENS ASSOCIATED WITH INCREASED RISK OF AMBULANCE CRASHES? A NATIONAL ANALYSIS.**

Gregory Patterson, Brooke Watanabe, Orlando Magallanes, James Kempema, Lawrence Brown, Dell Medical School at the University of Texas at Austin CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** No previous studies have explored the crash risk associated with ambulance use of lights and sirens (L&S) on a broad, national scale. The purpose of this study was to compare reported crash rates for U.S. ambulances responding to, or transporting patients from, a 9-1-1 emergency scene with or without L&S. Our null hypothesis was that there would be no difference in the rate of ambulance crashes when using or not using L&S. **Methods:** We used the National EMS Information System (NEMSIS) Dataset for 2016 to identify 9-1-1 scene responses and subsequent patient transports by transport-capable EMS units (excluding air-medical services). We used the NEMSIS 'Response Mode to
Scene’ and ‘Transport Mode from Scene’ fields to determine L&S use. We used the ‘Type of Response Delay’ and ‘Type of Transport Delay’ fields to identify responses and transports that were delayed due to a crash involving the ambulance. We calculated the rate of crash-related delays per 100,000 responses or transports. We used multivariable analyses with agencies treated as clusters to adjust for EMS system characteristics and covariance of within-agency effects. We use adjusted odds ratios (AOR) with 95% confidence intervals (CI) to compare the rate of crash-related delays among responses and transports with and without L&S. We also conducted sensitivity analyses excluding responses and transports for which L&S were used for part, but not all, of the response or transport. Results: Among 19 million 9-1-1 scene responses by transport-capable EMS units, the response phase crash rate was 4.6/100,000 without L&S and 5.4/100,000 with L&S (AOR=1.31, CI: 1.03-1.67). For the transport phase, the crash rate was 7.0/100,000 without L&S and 17.1/100,000 with L&S (AOR=3.17, CI: 2.53-3.96). Excluding responses and transports with partial L&S use did not meaningfully alter the RESULTS (response: AOR=1.37, CI: 1.07-1.75; transport: OR=3.14, CI: 2.49-3.97). Conclusions: Ambulance use of L&S siren is associated with increased ambulance-involved traffic crashes. The association is strongest during transport. EMS providers should weigh these risks against any potential time savings associated with L&S use when transporting patients.

21. ACCURACY OF A WEIGHT-BASED DOSING PROTOCOL IN THE PREHOSPITAL ENVIRONMENT

Nick Simpson, Sarah Scharber, Jon Cole, Gregg Jones, Aaron Robinson, Jeff Ho, Paul Nystrom, Hennepin EMS, Hennepin Healthcare CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

Background: Emergency medical services (EMS) personnel often encounter patients who are unable to provide information regarding their health, including weight. There are many weight-based medications used in the prehospital environment. This requires EMS personnel to estimate the patient’s weight and
calculate the dosing. The purpose of this study was to evaluate the ability of EMS providers to conduct weight-based dosing on a population of patients unable to provide their weight. HYPOTHESIS: EMS personnel will use weight-based dosing accurately despite using visual weight estimates. Methods: This was a sub-analysis of a Waiver of Consent study (45 CFR 46.116) of all patients in our EMS system receiving ketamine sedation for agitation from August 2017-January 2018 transported to our ED. A tiered, weight-based dosing system was utilized and the target dose for patients with severe agitation was 3 mg/kg IM with a maximum dose of 250mg. The target dose for profoundly agitated patients was 5 mg/kg IM with a maximum dose of 500 mg. EMS personnel were asked to record estimated weight and doses that were given. Results: A total of 202 patients were enrolled in the study and of these 190 had measured weights in the ED. For the severely agitated patients with a target dose of 3 mg/kg IM, the median dose administered was 2.95 mg/kg (mean dose 3.02 mg/kg; IQR 2.63-3.40 mg/kg; range 0.54-6.85 mg/kg). For the profoundly agitated patients with a target dose of 5 mg/kg IM, the median dose administered was 5.09 mg/kg (mean dose 4.91 mg/kg; IQR 3.74-5.99 mg/kg; range 2.20-7.87 mg/kg). 181 patients had both recorded ED and EMS estimated weights. Median difference in estimated and actual weight was 1.6 kg with an IQR of -4.9 to 10.1 kg. Conclusions: EMS personnel are adept at weight estimations. Weight-based dosing protocols in the field can be accurate even in a population of patients that are unable to provide weight information.

22. EXPLORING PARAMEDIC-PHYSICIAN HANDBOFFS DURING THE CARE OF THE CRITICALLY-ILL: A MIXED METHODS STUDY

Emily Hillman, Charlie Inboriboon, Bryon Vogt, Jennifer Quaintance, University of Missouri-Kansas City

CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

Background: Patient handoffs are an important aspect of patient care prone to medical errors. Patient handoffs have been studied in many settings but there is a paucity of information about the handoff off
of critically-ill patients from paramedics to emergency medicine (EM) physicians. The purpose of this study is to explore paramedic-physician handoffs to identify key characteristics and factors that influence the quality of handoffs of critically-ill patients. **Methods:** A sequential explanatory mixed methods design was employed. First, survey participants were recruited in a single-stage convenience sampling and stratified according to EM physician and paramedic subgroups. Survey results shaped the development of the focus group interview guide. Seven, one-hour focus groups were conducted over a 9-month period. Physician focus groups represented academic and community practice. Paramedic focus groups represented 3 diverse EMS agencies that cover a combination of urban, suburban, and rural catchment areas across four counties. Transcripts were manually coded using conventional content analysis through an extensive reiterative process. **Results:** There were 125 respondents to the survey. The majority of respondents feel that handoff communication needs improvement (106, 85%). Approximately half of those that responded received formal training on handoffs (60, 48%). Most of respondents do not currently use a standardized handoff (103, 82.4%). Qualitative analysis revealed the perspectives of paramedics and EM physicians were overwhelmingly similar. Five encompassing themes emerged as having the largest impact on handoff: Communication, Teamwork, Competence, Handoff Encounter, and Systems. Under the umbrella of each theme, numerous factors and subfactors influence patient handoff; many behaviors, if done well, promote effective handoffs, whereas when done poorly, are a barrier to the patient handoff. Communication factors included verbal and nonverbal face-to-face communication, written documentation, and radio report timing and characteristics. Teamwork factors included trust and respect, rapport, receptiveness to EMS, empathy, and handling mistakes. **Conclusions:** The patient handoff is affected by a variety of factors. This framework adds to the existing literature, highlighting that interdisciplinary training and intersystem collaboration are needed. It can be used to guide multidisciplinary training, modify or enhance handoff tools, and direct system-based solutions. A multipronged approach is required to improve handoff processes in clinical practice.
IMPLEMENTATION OF AN EVIDENCE-BASED ASSESSMENT TOOL BY COMMUNITY PARAMEDICS TO REDUCE EMERGENCY RESOURCE USE IN PATIENTS WITH COMPLEX NEEDS

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Background: Patients with complex medical and social needs are at risk for increased ambulance and emergency department (ED) usage. Community paramedics in our service have successfully reduced 911 calls and ED visits among these clients. We introduced an evidence-based, validated community assessment tool on a trial basis. This pilot study evaluates the effect of this process change on emergency-resource recidivism in a group of patients with active and predicted frequent usage.

Methods: This was a retrospective before-and-after study assessing the implementation of the interRAI Community Health Assessment (CHA) by community paramedics. Primary outcome measures were 911 calls and ED visits, assessed six months pre and post intervention. Secondary outcomes included the number, type, and time to implementation of supplementary community services. Historic medical data and baseline demographics were also collected. Paired differences were analyzed using the Wilcoxon signed rank test. Descriptive statistics were used to describe outcomes in frequent users versus those at risk for frequent use Results: 20 clients were assessed in the study period (12 female). The mean age was 67.0 (SD 10.7, median 65.7). Median decreases of 3.5 911 calls (p=0.004) and 2.5 ED visits (p=0.0055) six months before and after assessment were observed. Post intervention, 13 of 20 clients received supplementary community services, with an average time from referral to service implementation of 11 business days (SD 12). This group showed median decreases of 8.0 911 calls (p=0.0039) and 5.0 ED visits (p=0.0044) six months before and after service implementation. When clients were grouped by their prior history of resource use, active frequent users showed greater
median decreases than those at risk of frequent use in all categories post intervention: 911 calls (8.0 vs 1.0) and ED visits (6.0 vs 0); and 911 calls (8.5 vs 3.0) and ED visits (7.0 vs 4.0). **Conclusions:** This study demonstrates a significant reduction in 911 calls and ED visits among clients with complex needs after implementing the interRAI CHA. Future studies will further investigate the increased impact of the intervention in highly frequent users versus those at risk for frequent use.

24. **DETERMINING AMBULANCE DESTINATIONS IN THE PRESENCE OF OFFLOAD DELAY USING A MARKOV DECISION PROCESS**

**Mengyu Li, Peter Vanberkel, Dalhousie University**

**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** When emergency departments (EDs) are crowded and cannot accept incoming ambulance patients immediately, paramedics will commonly continue to provide patient care until an ED bed becomes available. This delay in transferring a patient to the ED is referred to as ambulance offload delay (AOD). AOD is a pressing problem for Emergency Medical Services (EMS) systems as it negatively affects ambulance availability and patient safety. The objective of this study is to develop a method to determine which hospital (including out-of-region hospitals) to send patients to in the presence of AOD. It aims to provide trip destination guidelines to EMS to minimize the effects of AOD. **Methods:** A retrospective analysis of all emergency responses in a mixed urban/rural setting (where AOD is commonly experienced) between 01/2016-12/2016 was performed. Operational (ambulance location, times) and patient (acuity) data were obtained from Computer aided dispatch (CAD) and electronic patient care reporting (ePCR) records. Inclusion criteria were any emergency response that led to transport to an ED. A discrete time, infinite-horizon, discounted Markov Decision Process (MDP) model was formulated to determine when it is advantageous to send appropriate patients to out-of-region EDs, which have longer transport times but shorter offload times. **Results:** The study includes 22,243
calls that result in patient transportation to an ED. When minimizing the ambulance out-of-service time due to patient transportation, the model suggests sending 11.9% patients (7.2 patients/day) to an out-of-region ED, which reduces the ambulance turnaround time from 75.81 to 70.87 minutes, but increases the ambulances travel distance from an average 5.28 to 10.78 km. When minimizing the time-to-ED bed for patients, the model suggests sending 26.1% patients (15.1 patients/day) to an out-of-region ED, with an average turnaround time of 59.35 minutes, and an average ambulances travel distance of 18.48 km.

Conclusions: This study provides a method to determine allocation policies to guide EMS services on transporting ambulance patients to the appropriate ED with consideration of AOD, patient acuity level, and travel distance. This model can be generalized and used as a decision support tool for EMS systems to mitigate the impact of AOD on their operations.

25. DISPARITIES IN PREHOSPITAL ANALGESIA FOR TRAUMA PATIENTS IN THE UNITED STATES

Brooke Burton, Lee Van Vleet, Remle Crowe, David Page, Dustin Barton, Henry Wang, Gold Cross Ambulance

Background: Management of pain is an important treatment goal for severe injuries. Only limited data describe disparities in Emergency Medical Services (EMS) management of pain. Objective: We sought to characterize differences by age, sex, race, and region in EMS analgesia administration to injured patients. Methods: We conducted a retrospective analysis using 2017 data from the ESO research database containing electronic patient care records from over 900 EMS agencies. We included 911 responses with a clinical impression of trauma and a documented injury that had at least one reported pain score ≥7 (on a 1-10 scale). The primary outcome was administration of ≥1 analgesic medication. Using multivariable logistic regression, we determined the independent associations between analgesia and age category, sex, race, and census region. Results: Of 118,203 injured patients with pain score ≥7, 10,377 (9%) received analgesia. The mean age among this injured patient population was 50 years and
43% were male. The average highest documented pain score was 8.84. Compared with young adults (age 18-29 years), children were less likely to receive analgesia (OR: 0.57, 95% CI: 0.45-0.70). Older patients (≥70 years) were more likely to receive analgesia (OR: 1.18, 95% CI: 1.10-1.26). Males were more likely to receive analgesia (OR: 1.23, 95% CI: 1.19-1.29) Patients identified as Black or African American were less likely than White, non-Hispanic patients to receive analgesia (OR: 0.60, 95% CI: 0.56-0.63). Compared with the West census region, injured patients in the Northeast were less likely to receive analgesia (OR: 0.53, 95% CI: 0.44-0.63), while those in the South were more likely to receive analgesia (OR: 1.18, 95% CI: 1.10-1.27). **Conclusions:** EMS analgesia administration differs by age, sex, race and region. Furthermore, EMS management of pain secondary to traumatic injury using analgesic medications was below 10% overall. These results highlight opportunities for improving EMS analgesia administration practices.

26. EVALUATING THE APPLICATION OF THE PREHOSPITAL CANADIAN C-SPINE RULE BY PARAMEDICS IN SPORT-RELATED INJURIES

Harrison Carmichael, Christian Vaillancourt, Ian Shrier, Manya Charette, Elizabeth Hobden, Ian Stiell, University of Ottawa, Department of Emergency Medicine CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

**Background:** The Canadian C-Spine rule (CCR) was validated for use by paramedics to selectively immobilize stable trauma patients. However, the CCR "Dangerous Mechanism" is highly prevalent in sports. Our objective was to compare the CCR performance in sport-related vs. non-sport-related injuries and describe sport-related mechanisms of injury. **Methods:** We reviewed data from the prospective paramedic CCR validation and implementation studies in 7 Canadian cities, which already included identification of sport-related injuries. A single trained reviewer further categorized mechanisms of injury using a pilot-tested standardized form, with the aid of a sport medicine physician.
in 15 ambiguous cases. We compared the CCR's recommendation to immobilize sport-injured versus non-sport-injured patients using chi-square and relative risk statistics with 95% confidence intervals.

**Results:** There were 201 amateur sport-injuries among the 5,978 patients. Sport-injured patients were younger (mean age 36.2 vs. 42.4) and more predominantly male (60.5% vs 46.8%) than non-sport-injured patients. Paramedics did not miss any c-spine injuries when using the CCR. Although cervical spine injury rates were similar between sport (2/201; 1.0%) and non-sport injured patients (47/5,777; 0.8%), the absolute number of sport-related injuries was very small. Although CCR recommended immobilization equally between the two groups (46.4% vs 42.5% p=0.29; RR 1.17 95%CI 0.87-1.57 ), the reason for immobilization was more likely to be a dangerous mechanism in sport injuries (68.6% vs 54.5%, p=0.012). Although we observed a wide range of mechanisms, the most common dangerous mechanism responsible for immobilization in sport was axial load. **Conclusions:** The CCR identified all significant c-spine injuries in a cohort of patients assessed and transported by paramedics. Although an equal proportion of sport and non-sports related injuries were immobilized, a dangerous mechanism was most often responsible for immobilization in sport-related cases. These findings do not address the potential impact of using the CCR to evaluate all sport-related injuries in collegiate or pro athletes evaluated by sport medicine therapists and physicians, as these patients are rarely assessed by paramedics or transported to a hospital. It does support the safety and benefit of using the CCR in sport-injured patients for which paramedics are called.

27. **END-TIDAL CO2 MONITORING IN NON-INTUBATED TRAUMATIC BRAIN INJURY: PATIENTS RECEIVING O2 VIA NASAL CANNULA VERSUS NON-REBREATHER MASK**

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**Background:** The advent of highly sensitive End-Tidal CO2 (ETCO2) sensors allows effective monitoring of intubated patients in many emergency care settings, including EMS. Previous work has explored the use of ETCO2 monitoring in non-intubated patients with sensors placed in the nares. However, nothing is known about the effect of passive oxygen delivery [nasal cannula (NC) or non-rebreather mask (NRB)] on ETCO2 measurement. Objective: To compare ETCO2 measurements in non-intubated Traumatic Brain Injury (TBI) patients receiving O2 via NC vs NRB in the prehospital setting. **Methods:** A subset of major TBI cases (CDC Barell Matrix Type 1) in the Excellence in Prehospital Injury Care (EPIC) TBI Study (NIH/NINDS-1R01NS071049; ClinicalTrials.gov-NCT01339702) were evaluated 4/13-3/17). Non-intubated cases from six Arizona EMS agencies providing monitor data (Philips MRx) were included when continuous ETCO2 data were available. Beginning and ending ETCO2 readings were excluded from analysis to remove artifact from initiation ("ramp-up") or termination of monitoring. **STATISTICS:** Two-tailed t test, α=0.05. **Results:** The 104 included cases had a median age of 50.5 (range: 9-91; male: 67%). Of those, 39 (37.5%) received O2 via NC and 65 (62.5%) via NRB. Mean ETCO2 varied little between the two groups: NC cases=27.7 mmHg (95% CI: 25.7, 29.8); NRB=30.0 (28.1, 31.8; p=0.132). There were also no significant differences among the mean lowest recorded values (p=0.449) or the mean highest values (p=0.275). **Conclusions:** We believe this is the first report comparing ETCO2 values based upon the method of passive O2 delivery in non-intubated patients. The minor differences between NC vs NRB-oxygenated patients was neither statistically nor clinically significant. This is surprising since: 1) the O2 flow rates and 2) the open-air (NC) vs mask (NRB) delivery methods are so dramatically different. Future study is needed to identify the clinical implications of using noninvasive ETCO2 measurement as a tool for monitoring ventilatory status and changes in non-intubated TBI (and other) patients.

28. TOURNIQUET APPLICATION BY LAYPEOPLE: MEASURING THE EFFECT OF AUDIO INSTRUCTIONS ON THE TIME AND EFFECTIVENESS OF TOURNIQUET APPLICATION ON A SIMULATED BLEEDING ARM
Background: "Stop the Bleed" is a campaign aimed at educating laypeople about bleeding control techniques and making bleeding control kits available in public locations. Unfortunately, previous research has indicated that up to half of all laypeople cannot effectively apply a tourniquet. The purpose of this study was to determine if just in time instructions for application of tourniquets, using combined written-audio instructions could help laypeople apply tourniquets more effectively versus written instructions alone. **Methods:** We conducted a study comparing application of a tourniquet using a task trainer of a simulated bleeding arm. Participants were laypeople 18 years and older. Those with previous tourniquet experience or training were excluded. Time to application of the tourniquet and effectiveness of tourniquet application were recorded. Statistical analysis was performed by t-test and AVOVA to identify differences in effectiveness and time to tourniquet application. **Results:** Eighty-two (82) participants were included in the study, with forty (49%) participants in the written-audio instructions group. The participants were 58.5% male with 49% of the participants between the ages of 18 and 24, 23% between 25 and 34, 10% between 35 and 50, and 18% over 50. Time to effective application of the tourniquet was inversely associated with age of participant, regardless of instructions used (p=0.029). Our research failed to show a significant difference in application time between written only instructions (mean time=106.05 seconds) versus combined written-audio instructions (mean time=100.43 seconds), p=0.576. The written only group indicated more effective tourniquet application (M=2.73, SD=0.599) compared to audio and written instructions (M=2.38, SD=0.854) with a mean difference of 0.344. The results suggested a significant difference between the two groups t(80)=2.103, p=0.039. **Conclusions:** This study suggests that providing combined audio-written instructions does not improve effectiveness or time to tourniquet application compared to written only. It also suggests that just in time training does improve effectiveness of tourniquet application compared to previous
historical data. Further studies may be needed to assess the effectiveness of audio alone. Limitations to the study are the geographic sample and size of the sample.

29. ACCURACY OF CARBOXYHEMOGLOBINEMIA SPOT-CHECK WITH A NEW PULSE OXIMETER IN THE PRESENCE OF HYPOXEMIA

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Background: Unintentional, non-fire-related carbon monoxide (CO) exposure is responsible for approximately 15,000 emergency department visits and nearly 500 deaths annually in the United States. CO binds to hemoglobin forming carboxyhemoglobin (COHb) and displaces oxygen thereby producing hypoxemia. Early COHb identification is critical for rapid patient triage and treatment. Typical pulse oximeter technology cannot measure COHb and invasive, more time-consuming arterial blood gas (ABG) measurements are required to confirm COHb. Recent advances in pulse oximeter technology have created systems capable of noninvasive COHb monitoring. However, these systems’ accuracy during spot-checking, as used in the prehospital setting, have not been assessed in a controlled prospective study. The objective of this study is to evaluate the spot-check accuracy of a new noninvasive system for measuring COHb. Methods: Following IRB approval, consent and screening, healthy volunteers were recruited for a prospective, non-blinded, randomized study. Each subject received incremental doses of CO (COHb range of 0–15%) with concurrent desaturations (SaO2 range of 80-100%) controlled by inhalation gas mixtures. Stable gas plateaus were held for ABG sample collection and evaluation (ABL90, Radiometer). During the plateaus, multiple COHb noninvasive sensors (SenSmart® Multi-Sensing Oximetry System, Nonin Medical) were exchanged at 60 second intervals on the non-arterial hand to replicate a spot-check use case. Spot-check performance was measured using the accuracy root mean square difference (ARMS [95% confidence interval]), sensitivity and specificity comparing arterial and
noninvasive COHb estimates. **Results:** 10 subjects (7M, Aged: 21-50, BMI: 20.9-29.2 Kg/m2) completed the study with a total of 169 blood samples drawn. The ARMS of COHb spot-checking, during CO exposure and normoxia, was 2.2% [1.94%, 2.45%]. Concurrent hypoxia did not significantly degrade the COHb measurement, producing an ARMS of 2.5% [2.28%, 2.75%]. CO exposure in excess of a 10% clinical threshold was detected with a sensitivity of 89% and specificity of 93%. **Conclusions:** This study demonstrated a satisfactory accuracy, sensitivity and specificity for the noninvasive system studied, when used in a COHb spot-check application. The ability to accurately measure COHb during spot-checks, especially in the presence of hypoxemia, represents a significant technical improvement for prehospital personnel to assist with the triage of patients.

30. REVISITING THE “SCANTY SCIENCE” OF PREHOSPITAL EMERGENCY CARE

James Menegazzi, Benjamin Glennon, University of Pittsburgh CATEGORY OF SUBMISSION: PROFESSIONAL

**Background:** It has now been 20 years since the scathing editorial by Dr. Michael Callaham in which he labeled prehospital emergency care as a “scanty science”. This commentary made note of the fact that between 1985 and 1997, only 54 randomized controlled trials (RCTs) had been conducted in the prehospital setting. We sought to quantify the number of RCTs conducted in the prehospital environment in the 20 years following the Callaham publication. **Methods:** We searched PubMed replicating the Callaham study by using the exact search terms he employed: emergency medicine technician (xs); prehospital emergency care (xs); emergency medical services (xs); plus the keywords “paramedic”, “prehospital” and “out-of-hospital”. We searched the time-period from December 1997 through December 2017 and did not use a language restriction. We included only RCTs. We excluded: preliminary/feasibility/pilot studies; letters/editorials/commentaries; simulation/animal/cadaveric studies; secondary analyses; studies done in the emergency department; and studies that were not
controlled or randomized. Titles and abstracts were first reviewed and publications that overtly met exclusion criteria were removed. Full manuscripts for all other studies were retrieved. Studies that were unclear were adjudicated by mutual agreement of the two investigators after close inspection. **Results:** Our original search produced 311 studies. There were 85 RCTs during the study period. These enrolled 105,084 patients; 46,719 in intervention groups and 53,625 controls. The three most active countries producing prehospital RCTs were the United States (15), France (9), and Austria (9). Two RCTs of continuous chest compression CPR, one done by the Resuscitation Outcomes Consortium (N=26,148) and one done in Japan (N=19,669), enrolled almost half of the total number of patients. During the past 20 years the average number of RCTs per year worldwide was 4.25 (while it was 4.5 during the 12 years of the Callaham study). **Conclusions:** RCTs done in the prehospital setting are difficult to conduct and are less common than those done in-hospital. The rate of RCTs done per year is not increasing. Whether prehospital emergency care remains a “scanty science” is difficult to determine.

31. PREDICTIVE VALUE OF EACH COMPONENT FIELD TRIAGE GUIDELINES ON HOSPITAL OUTCOME IN EMERGENCY MEDICAL SERVICES-TREATED TRAUMATIC BRAIN INJURY

**Sola KIM, Ki Jung Hong, Sang Do Shin, Kyoung Jun Song, Young Sun Ro, So Yeon Joyce Kong, Jeong Ho Park, Yu Jin Kim, Joo Jung, Tae Han Kim, Seoul National University Bundang Hospital**

**CATEGORY OF SUBMISSION:** TRAUMA

**Background:** Unbiased estimates for field triage scheme (FTS) guideline performance are important in optimizing trauma care systems and improving outcomes for seriously injured patients. Traumatic brain injury (TBI) is the crucial injury for mortality and disability and suspected TBIs by the FTS are required for immediate transportation with optimal prehospital care to trauma centers. The prediction of outcomes of each triage component in the FTS has not been evaluated for TBI. This study aimed to estimate the prediction performance of each component of FTC on hospital outcomes in TBI patients. **Methods:** This
is a cross-sectional observational study using a nationwide emergency medical services (EMS)-treated severe trauma (EMS-ST) database in 10 provinces Korea in 2013. Adult EMS-ST with traumatic brain injury selected by ICD-10 codes (S06.1-S06.9) were analyzed. The main exposure was each component of field triage scheme set by the Centers for Disease Control and Prevention of US (2012 version) as determined by EMS provider at the field. The outcomes were hospital mortality and disability (newly developed or worsened disability) at discharge measured with Glasgow Outcome Scale (GOS). Sensitivity, specificity, and the area under the curve (AUC) was calculated. Results: Total 5133 patients met the FTS guidelines. Of these, 21.5% died and 51.4% of patients got 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 physical 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 sensitivity for prediction of mortality. Anatomic and mechanical criteria showed low sensitivity but high specificity for mortality and disability. The altered mentality of physiologic criteria showed highest sensitivity and AUC among FTS components.

32. CHARACTERISTICS OF MEDICAL DIRECTOR REGULATION AT THE STATE AND TERRITORY LEVEL

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Background: The requirements for an emergency medical services (EMS) medical director are commonly defined by state rules and regulations and are not nationally standardized. It is unclear the extent of
variability in the requirements to be an EMS medical director in the US. The objective of this study is to evaluate the state requirements to function as an EMS medical director in the US. We hypothesized that while a medical license (DO, MD) is common, few states, if any, have included Emergency Medicine (EM) and EMS board certification as specific requirements. **Methods:** This was an evaluation of the rules and statutes governing the current requirements to function as an EMS medical director in the US. The regulations and governmental statutes were reviewed from all 50 states and 5 territories using publicly available governmental websites. Data were collected in July 2018 on the specific qualifications required to work as an EMS medical director. Data were tabulated, and descriptive statistics were calculated.

**Results:** Data were collected from 49 states and 2 territories (51/55, 93%); there was no information accessible for 1 state and 3 territories. Being a licensed physician was the minimum requirement in 48 states and 1 territory (49/51, 98%). Board certification in Emergency Medicine was required by 18% (9/51). One state, Montana, allowed for medical direction by a physician or a physician assistant. There was no specific requirement for EMS subspecialty as a prerequisite training element. **Conclusions:** Requirements for EMS medical direction across the US are not standardized. Many states require a medical license, but EM board certification and EMS sub-specialization is not a common requirement. Future work will focus on additional standards and educational requirements per state and the specific duties required of medical directors by statutes.

33. SUDDEN CARDIAC ARREST SURVIVAL IN HEARTSAFE COMMUNITIES

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**CATEGORY OF SUBMISSION:** CARDIAC

**Background:** The HEARTSafe Communities program attempts to strengthen the American Heart Association "chain of survival" by promoting efforts by communities to improve their systems for treating sudden cardiac arrest (SCA). The program was founded in 2002, and has representation in 16
states. This study examined whether SCA survival rates differ between towns that do and do not have the HeartSAFE designation in Connecticut. The study hypothesis was the rates of SCA survival to admission, discharge, and discharge with good neurologic status (CPC score 1 or 2) would be higher in HEARTSafe designated communities. **Methods:** The Connecticut Office of EMS supplied a list of towns that are HeartSAFE designated, and dates of designation. De-identified data from the Cardiac Arrest Registry to Enhance Survival (CARES) were obtained for all SCA from 2013 to 2017 in the 70 Connecticut cities/towns that participate in CARES. For each SCA, it was determined whether the town in which it occurred was HeartSAFE designated at the time of the case. Fisher’s exact tests and t-tests were used to compare groups. **Results:** Of 2922 SCA cases, 749 survived to admission, 236 survived to discharge, and 207 had discharge CPC scores of 1 or 2. Of the 2922 cases, 1569 (54%) occurred in towns that were HEARTSafe designated at the time. There were slightly more males and more white patients in designated towns, and the mean age was slightly greater in the designated towns (mean 65.4 vs 63.7 yrs, p=0.017). Witnessed status, SCA etiology (cardiac/noncardiac), and SCA location type were similar in the two groups. There were no significant differences in survival to admission (24.5% non-HeartSAFE vs 26.6% HeartSAFE, p=0.22), survival to discharge (7.6% vs 8.5%, p=0.41), or survival with good neurologic outcome (6.4% vs 7.7%, p=0.17). A sensitivity analysis re-categorized cases occurring in towns that had previously been HeartSAFE designated but whose designation had lapsed, on the assumption that the SCA response system likely did not change much. Moving these cases from not designated to designated did not change the findings. **Conclusions:** SCA survival rates do not differ between HEARTSafe communities and non-HEARTSafe communities in Connecticut.

34. SYSTEM WIDE EVALUATION OF HYPOGLYCEMIA WITH DEXTROSE 10% (D10) VERSUS D50% (D50)
Background: Hypoglycemic patients are routinely evaluated and treated by EMS in the prehospital setting. The previous standard of care was an empiric dose of 25 grams of 50% dextrose IV, for blood glucose levels (BGL) less than 60 mg/dL. This practice often results in an iatrogenic hyperglycemic state. Recent studies have shown that glucose ranges outside 140 to 180 mg/dL have negatively impacted a patient's morbidity and mortality upon admission to the hospital. The goal of this study is to assess if there is a significant difference in the post-treatment BGL of hypoglycemic patients who receive 10% vs. 50% solutions of dextrose. Methods: This study is a retrospective chart review of our hypoglycemic patient's BGL when given either D10 or D50. Data was collected when the EMS system changed from a D50 protocols to D10 Protocol. Units used whatever D50 remained during the crossover period until D50 was no longer available. Two cohorts were created from 1096 consecutive prehospital hypoglycemic cases between October 2015 to June 2018. 197 cases were excluded for missing data, IO vascular access, glucose PO or glucagon IM. Mean blood glucose levels of the two cohorts were compared post treatment. The primary outcome is the change in blood glucose level (BGL) between D10 (n=177) and D50 (n=722). Results: There was no confounding between D10 and D50 by age, gender, or race. The difference in initial BGL verse median post-treatment BGL is significantly higher (p<0.0001) in the D50 (162 mg/dL) group compared to D10 (123 mg/dL). The proportion of hypoglycemic patient's post-treatment between D10 (1.7%) and D50 (1.4%) was similar. However, the proportion of normal glycemic levels (≥60 to <180 mg/dL) among patient's post-treatment was significantly different between cohorts, D10 (66%) and D50 (40%). Additionally, hyperglycemic patients (≥180 mg/dL) post-treatment were more common in the D50 group (59%) compared to D10 (32%) p<0.0001. Conclusions: This analysis demonstrates that D10 is just as effective as D50 in treating hypoglycemia and D10 is less likely to
overshoot normal blood glucose levels. Our recommendation is to continue with D10 for the treatment of hypoglycemic patients in our EMS system.

35. CONTROLLED FAST HEAD AND THORAX ELEVATION IMPROVES CEREBRAL PERFUSION PRESSURE DURING ACTIVE COMPRESSION AND DECOMPRESSION CARDIOPULMONARY RESUSCITATION WITH AN IMPEDANCE THRESHOLD DEVICE IN A PORCINE MODEL OF CARDIAC ARREST

Carolina Rojas-Salvador, Carolina Rojas-Salvador, Johanna Moore, Bayert Salverda, Guillaume Debaty, Michael Lick, Keith Lurie, Department of Emergency Medicine University of Minnesota Minneapolis, MN

CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Elevation of the head and thorax (HUP) during active compression-decompression (ACD) CPR with an impedance threshold device (ITD) doubles cerebral blood flow and cerebral perfusion pressure (CerPP) in animal models. We recently observed higher CerPP and coronary perfusion pressure (CorPP) during a progressive HUP sequence elevation (20°, 30° and 40°). However the optimal speed of elevation is unknown. We hypothesized a faster elevation rate of 4°/min over 4 min would result in a higher CerPP versus a slower 2°/min over 10 min. Methods: Female farm pigs (~40 kg) were intubated and anesthetized. After 8 minutes of untreated ventricular fibrillation (VF), pigs were placed in a HUP CPR device, such that the head and heart were 10 and 8 cm above the horizontal plane and able to elevate 22 and 9 cm to the highest position, respectively. After 2 minutes of automated ACD + ITD CPR performed with a 30:2 compression: ventilation ratio to prime the circulation, 12 pigs were randomized to a HUP rate of either 2° or 4°/min to achieve the highest elevation over 10 or 4 minutes, respectively. Two-sided unpaired t-test was used for CerPP and CorPP at 7 minutes. Results: The 4°/min group (n=6) resulted in a higher CerPP and CorPP values versus the 2°/min group (n=6). Pronounced differences were noted at 7 minutes of CPR with a CerPP (mean ± SD, mmHg) of 53±14 for the 4°/min group and 38.5±4 for the 2°/min group (p=0.02), and a CorPP of 50.8±20 and 38.3±3 (p=0.08), respectively. The
differences reached rapidly trended similarly over 19 minutes of CPR suggesting an optimal fast rise sequence. Moreover, in the absence of exogenous vasopressors CerPP and CorPP values in the 4°/min group were 81% and 73% of baseline values at minute 7, and 88% and 74% at minute 18, respectively. All pigs were resuscitated in both groups. **Conclusions:** A head and thorax elevation sequence that included priming for 2 minutes followed by elevation of 4°/min over 4 minutes resulted in a rapid and sustained benefit with CerPP>80% and CorPP>70% of pre-arrest values. This approach is now ready for further evaluation in patients.

36. **EFFECT OF ESTIMATED GLOMERULAR FILTRATION RATE (EGFR) ON INCIDENCE OF OUT-OF-HOSPITAL CARDIAC ARRESTS: A CASE-CONTROL STUDY**

**Hyouk Jae Lim, Joo Jeong, Young Sun Ro, Sang Do Shin, Ki Jeong Hong, Jeong Ho Park, So Yeon Kong, Kyong Min Sun, Sae Won Choi, Yu Jin Kim, Sola Kim, Tae Han Kim, Wonpyo Hong, You Dong Sohn, Seoul National University Hospital**

**Background:** Serum creatinine level elevations or reductions of estimated glomerular filtration rate (eGFR) are associated with increased rates of the risk of death and cardiovascular events. However, it is uncertain whether serum creatinine level or eGFR of out-of-hospital cardiac arrest (OHCA) patients would have a relation with the incidence of OHCA. The aim of this study was to determine the association of eGFR of OHCA patients on incidence of OHCA. **Methods:** This study was a case-control study using the Cardiac Arrest Pursuit Trial with Unique Registration and Epidemiologic Surveillance (CAPTURES) project dataset for OHCA case and Korea National Health and Nutrition Examination Survey (KNHANES) dataset for healthy control. Cases were defined as EMS-treated adult OHCA patients with cardiac etiology collected from CAPTURES dataset. Four controls were matched to one case with strata including age, gender, and county from the KNHANES dataset. Multivariable conditional logistic regression analysis was conducted to evaluate the effect of eGFR on incidence of OHCA. Adjusted odds
ratios (AORs) and 95% confidence intervals (95% CIs) were calculated for risk of OHCA incidence by eGFR group. **Results:** A total of 1,211 matched case-control pairs were included in the study analysis. We classified eGFR into 6 categories (≥90, 60-89, 45-59, 30-44, 15-29, and <15; unit, mL/min/1.73 m²) according to stages of chronic kidney disease. The subjects with an estimated GFR ≥90 mL/min/1.73 m² were used as the reference group. In both unadjusted and adjusted model, decreasing eGFR was significantly associated with OHCA incidence. The AOR of OHCA incidence increased sharply as the estimated GFR declined; the AOR (95% CI) for OHCA incidence was 4.09 (2.81–5.95) with an eGFR of 60 to 89, 36.59 (22.24–60.21) with eGFR of 45 to 59, 55.26(29.66-102.94) with eGFR of 30 to 44, 89.65 (37.25-215.79) with eGFR of 15 to 29, and 241.87 (73.49-796.01) with eGFR of less than 15, respectively.

**Conclusions:** In this study, we observed an significant association with a dose-response pattern between reduced estimated GFR and the risk of OHCA incidence in a large, community based population. Prevention modality for OHCA incidence should target the population with lower eGFR.

37. CHEMICAL RESTRAINT IN BEHAVIORAL EMERGENCY AND EXCITED DELIRIUM STATEWIDE TREATMENT PROTOCOLS

**Christie Fritz, Andrew Pettit, Anthony Mahoney-Pacheco, David Schoenfeld, Beth Israel Deaconess Medical Center/Harvard Medical School**

**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** Excited delirium and the spectrum of behavioral emergencies present unique challenges and dangers for EMS providers. These situations include a serious risk of injury to both EMS providers and the patients who require restraint. De-escalation techniques as well as physical and chemical restraints are the mainstays of out of hospital treatment and stabilization of behavioral emergencies. The purpose of this investigation is to describe the options for and inclusions of behavioral emergency protocols and more specifically chemical restraint in statewide treatment protocols (STP). **Methods:** Cross sectional study of STPs for inclusion of behavioral health, psychological emergency or
excited/agitated delirium protocols. Protocol revision date was also captured. **Results:** Thirty four out of fifty (68%) states issue ALS STPs, ten of which serve as guidelines. 3 of these states have no protocol for behavioral emergencies or agitated delirium. A single state has a protocol but includes no medications/chemical restraints. Benzodiazepines are the most common chemical restraint, with 28 states (93%) including at least one drug from the class in their protocols. Haloperidol is the next most common with 23 states (77%) including it in their protocols. 19 states (63%) allow for IM Ketamine and IV Ketamine is included in 8 (27%) protocols. Diphenhydramine is included in 3 protocols (10%) and single states (3%) also include Zyprexa, Geodon and Droperidol. 73% of protocols have been revised since 2015. **Conclusions:** Behavioral emergencies and agitated delirium situations present very high risk conditions for both EMS and their patients, with high mortality and injury rates. Gaining control of dangerous situations is of paramount importance to provide the safest transport possible. Most, although not all, states provide a protocol for behavioral emergencies, but there is a very large amount of variation among the medications which can be utilized for chemical restraint. This provides an opportunity for standardization as well as examination of best practices. Further study is needed to examine the barriers to introduction and optimization of medication management in behavioral emergency STPs.

38. RESPONSE, AGENCY, AND PATIENT CHARACTERISTICS ASSOCIATED WITH EMS TRANSPORT RATES

**Jeffrey Jarvis, David Phillips, Remle Crowe, Williamson County EMS/Baylor Scott & White Healthcare**

**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** The EMS 911 transport rate has important implications for current reimbursement practices and risks of negative outcomes related to non-transport. Little research exists regarding factors linked to EMS transport rate for 911 response. **Objective:** Our objective was to identify response, agency and patient characteristics associated with EMS transport rates. **Methods:** We performed a
retrospective analysis using all 911 responses with patient contact in 2017 in the ESO Solutions electronic health record. Agencies without transport capability were excluded. Independent variables of interest were identified a priori: agency type, agency volunteer status, time of day, day of week, patient sex, patient race/ethnicity, and patient age. Multivariable logistic regression modeling was used to assess for an association between the independent variables and EMS transport. Adjusted odds ratios and 95% confidence intervals are reported (aOR, 95%CI). \textbf{Results:} We analyzed 2,786,615 records; 85% resulted in EMS transport by over 900 agencies. Compared to third service agencies, private agencies demonstrated 80% greater odds of transporting (aOR:1.80, 95%CI:1.78-1.84). Compared to non-volunteer agencies, volunteer agencies demonstrated 31% increased odds of transport (aOR:1.31, 95%CI:1.26-1.36). Hispanic patients demonstrated 26% decreased odds of transport compared to non-Hispanic White patients (aOR:0.74, 95%CI:0.73-0.75). Compared to patients aged 18-39, patients in older patients had progressively greater odds of transport with each age group, the largest aOR being 2.62 (95%CI:2.59-2.65) for those over 79. Patients younger than 18 years had lower odds of transport (aOR:0.74, 95%CI:0.73-0.75). Compared to calls occurring between 7AM and 3PM, odds of transport were lower between 3PM and 11PM (aOR:0.83, 95%CI:0.83-0.85) and between 11PM and 7AM (aOR:0.88, 95%CI:0.87-0.88). Smaller, likely non-clinically significant differences in transport rates were seen for sex, day of week, and fire-based agencies. \textbf{Conclusions:} This analysis encompassing a broad range of EMS systems in various practice settings identified differences in transport rates by agency characteristics, time of day, patient race/ethnicity and age. Further work is needed to elucidate the underlying causes of these differences for each variable. Limitations include information bias due to documentation practices and potential selection bias from analyzing a single PCR provider.

39. DECLINES IN CEREBRAL OXYGENATION PRECEDE DECLINES IN MEAN ARTERIAL PRESSURE IN A HYPOXIC SWINE MODEL
Jeffrey Gould, Christopher Kaufman, Joshua Lampe, Jonathan Elliot, Norman Paradis, ZOLL Medical

CATEGORY OF SUBMISSION: CARDIAC

Background: Near-infrared spectroscopy (NIRS) has been used to continuously and non-invasively measure cerebral oxygenation. Studies have suggested that survival and neurological outcomes can be predicted using cerebral oxygenation, however, its utility to provide real-time feedback on patient status is less understood. The purpose of this exploratory study was to examine the relation between cerebral oxygenation and mean aortic blood pressure (MAP) in response to a hypoxic insult in a swine model.

Methods: Hypoxia was induced in fourteen domestic swine by reducing the fraction of inspired oxygen to ~6%. Cerebral oxygenation was measured using an investigational NIRS-based tissue oximeter (OxiplexTS, ISS) and aortic blood pressure was measured using a solid state pressure transducer placed in the thoracic aorta. The declines in the oxygenation and MAP signals were identified by finding the intersection of the initial slope of the data before the start of the insult and the steepest slope found as a result of the insult. Wilcoxon signed rank tests were used to compare changes in measurements taken before and after the hypoxic insult and the times from the start of the insult to the start of declines for the oxygenation and pressure signals. Data are reported as the median (interquartile range).

Results: Cerebral oxygenation declined in response to the hypoxic insult from 60% (55 – 64%) before the insult to 32% (29 – 38%); P=0.005 following the insult. MAP also declined from 90 mmHg (77 – 107 mmHg) to 25 mmHg (20 – 26 mmHg); P=0.005. However, the onset of signal decline following the initiation of hypoxia was less for the cerebral oxygenation signal at 28 seconds (25 – 32 seconds) compared to the decline in the mean aortic pressure signal at 115 seconds (89 – 138); P=0.005. Conclusions: Declines in cerebral oxygenation as measured using NIRS precede declines in invasive blood pressure during hypoxia in swine. Monitoring of cerebral oxygenation may be clinically useful in early detection of changes in patient status. Further studies should investigate changes of cerebral oxygenation during other physiological insults and in relation to other measured vital signs.
40. EMS FELLOWSHIP FIELD EXPERIENCE: IDENTIFYING TRENDS IN ONLINE MEDICAL DIRECTION 
CONSULTATION AND SCENE RESPONSE

Emily Pearce, Chelsea White, Jenna White, Darren Braude, *University of New Mexico* 
CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

**Background:** Our goal is to quantify the nature of online medical direction consultations (OLMDC) and scene responses (SR) by emergency medical services (EMS) fellows with assigned take-home emergency response vehicles (ERV) to better understand the potential experiential education during a 1-year fellowship. **Methods:** The University of New Mexico's EMS Consortium has 3 EMS fellows annually who handle complicated OLMDC for the local system and perform both requested and self-initiated SR in assigned take-home ERVs. Fellows take home call for two days out of every six but may respond to calls at any time. EMS fellows completed electronic surveys after each OLMDC and SR. A descriptive analysis of two years of surveys was completed. Each 12-month period received submissions from three EMS fellows. **Results:** 4,383 surveys were collected from six EMS fellows over 24 months including 3,129 OLMDC and 1,254 SR for an average of 43.5 OLMDC and 17.4 SR per fellow per month. Patient refusals accounted for 60.4% of OLMDC; the remainder included general advice (16.8%), termination of cardiac arrests (14.2%), and treatment orders (8.1%). Treatment orders were most often for narcotics (61.2%) and benzodiazepines (16%). 20.0% of SRs were cardiac arrests; the remainder included traffic collisions (12.9%), breathing difficulty (5.7%), alcohol intoxication (5.1%), penetrating trauma (5.9%), and traumatic injuries (4.8%). Fellows responded with lights and sirens to 153 (12.4%) SR, an average of 1.1 emergent responses/fellow/month. EMS fellows arrived first on-scene 50 times (4.0%). The EMS fellows' role on SR included: observation (75.7%), patient assessment (44.4%), coaching (21.9%), family discussions (21.5%), termination of resuscitation (7.6%), and hands-on interventions (7.0%). Common hands-on interventions included: ultrasound (50.0%), obtaining vital signs (17.0%), medication
administration (14.8%), and BLS airway management (10.2%). **Conclusions:** Field response is an important component of EMS fellow education. EMS fellows with access to a ERV within an EMS system that utilizes fellows for OLMDC can obtain a tremendous amount of experience within a 1-year program. Fellowship education should also include specific training related to safe emergency vehicle operations and protocols for arriving first on scene.

41. PREHOSPITAL OPIOID ADMINISTRATION TO ACUTE MYOCARDIAL INFARCTION PATIENTS: A SYSTEMATIC REVIEW

Jennifer Greene, Craig Ainsworth, Laurie Lambert, Graham Wong, Warren Cantor, Michelle Welsford, Dalhousie University

**CATEGOR Y OF SUBMISSION:** CARDIAC

**Background:** Opioids are routinely administered for analgesia to prehospital patients experiencing chest discomfort from acute myocardial infarction (AMI). We conducted a systematic review to determine if opioid administration impacts patient outcomes. **Methods:** We conducted a systematic search using MeSH terms and keywords in Medline, Embase, Cochrane Database of Systematic Reviews, Cochrane Central and Clinicaltrials.gov for relevant randomized controlled trials and observational studies comparing opioid administration in AMI patients from 1990 to 2017. The outcomes of interest were: all-cause short-term mortality (≤30 days), major adverse cardiac events (MACE), platelet activity and aggregation, immediate adverse events, infarct size, and analgesia. Included studies were hand searched for additional citations. Risk of Bias assessments were performed and GRADE methodology was employed to assess quality and overall confidence in the effect estimate. **Results:** Our search yielded 3001 citations of which 19 studies were reviewed as full texts and a total of 9 studies were included in the analysis. The studies predominantly reported on morphine as the opioid. Five studies reported on mortality (≤30 days), seven on MACE, four on platelet activity and aggregation, two on immediate adverse events, two on infarct size and none on analgesic effect. We found low quality evidence
suggesting no benefit or harm in terms of mortality or MACE. However, low quality evidence indicates that opioids increase infarct size. Low-quality evidence also shows reduced serum P2Y12 (eg: clopidogrel and ticagrelor) active metabolite levels and increased platelet reactivity in the first several hours post administration following an increase in vomiting. **Conclusions:** We find low and very low quality evidence that the administration of opioids in STEMI may be adversely related to vomiting and some surrogate outcomes including increased infarct size, reduced serum P2Y12 levels, and increased platelet activity. We found no clear benefit or harm on patient-oriented clinical outcomes including mortality.

42. HEART RATE RESPONSES OF EMS WORKERS DURING DAY AND NIGHT SHIFTS

**David Hostler, Jocelyn Stooks, Lindsey Russo, Brian Clemency, University at Buffalo** CATEGORY OF SUBMISSION: PROFESSIONAL

**Background:** Previous studies of firefighters have reported a rapid and sustained rise in heart rate in response to alarm activation. However, there are few reports of the physiologic responses of EMS workers during shifts. In this pilot study, we recruited EMS workers from a single large urban EMS agency and fitted them with ECG and activity monitors to determine the physiologic responses during emergency calls and throughout the entire shift. We hypothesized that heart rate response to alarms would be similar to previous studies of firefighters and that ventricular ectopy would be more frequent during calls. **Methods:** Fourteen, EMS workers (4 females) participated in the study. Subjects wore a 12-lead Holter monitor (Mortara) and activity monitor (Actigraph) during a single day (DAY) or overnight (NIGHT) shift. The agency identified alarm activations for each worker during the monitored shift. ECG files were analyzed and heart rates measured during the shift, immediately before and after alarms, and during each call. Groups were compared by t-test. **Results:** Providers in both groups were similar in age (27+/- 6 y) and height (176+/- 9 cm) but the DAY group had a higher BMI (33.0+/- 6.9 v. 23.2+/- 3.5). Minimum (61+/- 9), mean (88+/- 15), and maximum (143+/- 19) heart rate during the shift did not differ
by group. Each provider responded to 1-8 calls during their monitored shift. The average heart rate in the five minutes before an alarm was 90+/− 18 bpm and rose to 111+/− 18 bpm following the alarm. The highest heart rate measured during the call (129+/− 19 bpm) often did not occur immediately following the alarm but later in the call. Ten subjects (71%) experienced premature ventricular contractions during the shift and four subjects (2 DAY, 2 NIGHT) experienced greater than 20 in a shift. Overall metabolic rates were low (1.7+/− 0.3 MET) and total kilocalories expended during the shift were correlated with call volume (p=0.006). **Conclusions:** Heart rate response to alarms were similar in this group of EMS workers when compared to previous reports among firefighters but the maximal heart rate during the call was lower. Average energy expenditure during the shift approached values for sedentary activities.

43. **DO MENTAL HEALTH CONCERNS CONTRIBUTE TO PARAMEDICS LEAVING THE PROFESSION?**

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**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** While there is growing research focusing on mental health in the paramedic community, little remains known about the influence of depression, anxiety and stress on the decision to leave the profession. The purpose of this study was to determine the prevalence of anxiety, depression, and stress, and paramedics' self-reported mental health as determinants of their intent to leave the profession. Our hypothesis was that the decision to leave the paramedic profession would be influenced by poor mental health. **Methods:** Through the national Canadian Paramedic Health & Wellness survey, paramedics were asked to indicate if they intended to leave the profession in the next two years, their reason(s) for leaving, as well as the number of days of work missed for mental health reasons in the past 12 months. Levels of depression, anxiety and stress were measured using the DASS-21. Analyses were conducted using descriptive statistics and independent samples t-tests. **Results:** Based on 2,557 completed surveys, 18.5% (n=473) reported they intended to leave the profession within the next
two years, with lack of opportunities for advancement cited the primary reason (52%). Only 19% reported that being mentally unable to continue significantly influenced their decision to leave. With respect to the number days of work missed for mental health reasons, significant differences were noted between those who did (M=11.82, SD=47.80) vs did not intend to leave (M=2.92, SD 18.02); t(487.71)=-3.93, p<.001. Scores on the DASS-21 revealed that 27.9% of the respondents had mild to severe levels of depression, 22.5% had mild to severe levels of stress, and 21.1% had mild to severe levels of anxiety. Further, for those who intended to leave versus those who did not, levels of depression were significantly higher, t(604.59)=-8.324, p<.001, anxiety t(584.11)=-6.27, p<.001, and stress t(614.89)= -8.14, p<.001. **Conclusions:** While mental health was not the most frequently cited reason to leave the paramedic profession, underlying levels depression, stress, and anxiety may indirectly be contributing factors. Scores on the DASS-21 may be a good proxy for determining exit patterns from the profession.

44. **COMPLETION OF AN ALTERNATIVE PATHWAY TO PARAMEDIC CERTIFICATION BY NON-EMS PROFESSIONALS IS ASSOCIATED WITH HIGH PASS RATES ON THE NATIONAL PARAMEDIC CERTIFICATION EXAMINATION**

**William Leggio, Ashish Panchal, Michael Miller, Creighton University CATEGORY OF SUBMISSION:** PROFESSIONAL

**Background:** Hospital-based healthcare professionals often transition their skills into the prehospital setting. However, one challenge for these care providers is the knowledge gap between the two practice settings. Paramedic programs have developed alternative pathway paramedic curricula to bridge this gap but there is a paucity of data concerning whether these students attain minimal competency as a paramedic. The objective of this study was to evaluate course completion rates and first and cumulative third-attempt pass rates of students completing an alternative pathway to paramedic certification at
Creighton University. We hypothesize that non-EMS healthcare professionals who completed this pathway were able to attain minimal competence as a paramedic as assessed by the National Paramedic Certification examination. **Methods:** The alternative pathway paramedic course at Creighton University is a two-week intensive experience including didactic and psychomotor sessions, completion of 50 paramedic team-lead patient encounters, and passing the program's comprehensive final examination (score ≥ 80%). Applicants were registered nurses or higher training levels and had at least two years of acute care experience. Program demographic and performance data were collected from 2007 to 2017 along with individual performance data on the National Paramedic Certification examination (first and cumulative third-attempt pass rates). Descriptive statistics were calculated. **Results:** Over the study period, 305 students attended the course with 271 (89%) completing the program. Of these, 201 (74%) sat for the National Paramedic Certification examination. Students were mainly female (52%) and median age was 34 years old (IQR 29-42). The majority of students were registered nurses (n=291, 95%) with ≥70% (n=214) having at least a bachelor’s degree. The first-attempt pass rate for graduates was 97% (195/201) with a cumulative pass rate after three attempts being 99.5% (200/201). One student did not retest following their first unsuccessful attempt. **Conclusions:** Non-EMS healthcare professionals completing the alternative pathway to paramedic certification course had high rates of course completion as well as passing the National Paramedic Certification examination. This study is limited by being a single site evaluation and may present a high-performing curriculum. Future work will need to evaluate other alternative pathway programs and identify best practices for success.

45. PEDIATRIC VITAL SIGNS AND GLASGOW COMA SCALE SCORE CALCULATION IN THE PREHOSPITAL SETTING: A LOSING BATTLE?
Background: Transport destination decisions for injured children rely upon accurate triage, especially for the application of the physiologic criteria of the CDC Field Triage Guidelines. We aimed to evaluate the rates at which vital signs and Glasgow Coma Scale scores (GCS) are documented by EMS providers, and the inter-rater reliability (IRR) of the components of the GCS when compared to scores documented in the emergency department (ED). Methods: We queried the National Trauma Data Bank (NTDB) from 2006-2012 and extrapolated data describing pediatric patients transported by EMS. Summary statistics were presented as mean and standard deviation (SD) for continuous variables and frequencies with percentages for categorical variables. The weighted kappa statistic (κw) was used to evaluate the IRR of ordinal GCS scores between ED and EMS providers. Results: 120,012 children arrived to the hospital by EMS. Thirty-six percent were female, and mean (SD) age was 8.8 (5.7) years. Prehospital vital signs were infrequently documented: Systolic Blood Pressure (SBP) 34%, Heart Rate (HR) 37%, Respiratory Rate (RR) 36%; and GCS 37%. The κw for GCS-verbal score between EMS and ED providers was 0.698 (95% confidence interval (CI)=0.690-0.707); κw for GCS-eye score was 0.714 (0.704-0.724); κw for GCS-motor score was 0.717 (0.707-0.727); and κw for GCS-total score was 0.722 (0.714-0.730). For patients who required acute care procedures in the hospital, κw for components of the GCS were similar (GCS-V: 0.718, GCS-E: 0.714, GCS-M: 0.717, GCS-T: 0.722). For younger children (<2 years-old) the GCS-V score was impacted more by age than the rest of the scores [GCS-V: 0.608 (decreased by 0.090), GCS-E: 0.666 (decreased by 0.048), GCS-M: 0.670 (decreased by 0.047), GCS-T: 0.658 (decreased by 0.064)]. Conclusions: Prehospital vital signs and GCS calculations are infrequently documented, challenging the applicability of the physiologic criteria of the CDC Field Triage Guidelines. There is substantial agreement between EMS and ED providers in the determination of GCS scores for all pediatric trauma patients,
especially those above age 2, and those who required acute care procedures. A focus on GCS by EMS providers may aid pediatric prehospital triage and destination determination.

46. AN INCOMPLETE MEDICAL RECORD: TRANSFER OF CARE FROM EMS TO THE EMERGENCY DEPARTMENT

Akash Shah, Jeffrey Lubin, Department of Emergency Medicine, Penn State Health Milton S. Hershey Medical Center CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Transition of care from emergency medical services (EMS) to the Emergency Department (ED) represents an intersection at high-risk for error. Minimal research has quantitatively examined data transfer at this point. In Pennsylvania, this hand-off consists of a transfer-of-care form (TOC) provided by EMS to ED in addition to a verbal report. A prehospital patient care report (PCR) is filed within 72 hours after EMS concludes care. We hypothesized there would be discrepancies between the TOC and final PCR. Methods: A retrospective chart review was conducted comparing the TOC from a single EMS agency to the final PCR. Two hundred patients who received advanced life support transport over a one-month period were included. Metrics to assess discrepancy between the reports included: chief complaint, allergies, medications, systolic and diastolic blood pressure (SBP and DBP), pulse, respiratory rate (RR), Glasgow Coma Score (GCS), and prehospital treatment provided. Data was obtained using a third-party web-based charting system (emsCharts.com). The level of agreement between the two sources was reported using kappa statistics and concordance correlation coefficients with 95% confidence intervals (CCC). Results: Of the 200 encounters that met inclusion criteria, 72% had matching chief complaints between the TOC and PCR. Medications matched in 66% and allergies matched in 82%. Up to three BP, pulse, and RR were collected; only 30% of the third BP were available from the TOC, while 68% were available from the PCR. Comparing the three SBP values on the TOC to respective counterparts on the PCR showed substantial correlation (all CCC >0.95). DBP values showed poor-to-
moderate correlation (CCC: 0.767, 0.921, 0.937 respectively). Pulse had moderate-to-substantial correlation (CCC: 0.925, 0.945, 0.960 respectively). RR had poor-to-moderate correlation (CCC: 0.370, 0.840, 0.938 respectively). GCS showed poor correlation between the two forms (CCC: 0.811).

Conclusions: There were significant differences between the information transferred to the ED through the TOC compared to what was recorded in the PCR. Further evaluation of the transfer of care process is needed to improve accuracy.

47. ASSOCIATION BETWEEN QUANTITATIVE WAVEFORM MEASURES OF THE VENTRICULAR FIBRILLATION ELECTROCARDIOGRAM AND DEFIBRILLATION SUCCESS IN THE ROC ALPS TRIAL

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Background: During out-of-hospital cardiac arrest (OHCA), features of the ventricular fibrillation electrocardiogram (ECG) have been correlated with outcomes. Understanding factors affecting the variability of these features may elucidate their utility. We examined the association between quantitative waveform measures (QWM) of the VF ECG and defibrillation success in the context of the Resuscitation Outcomes Consortium (ROC) amiodarone, lidocaine and placebo (ALPS) trial. Methods: We retrospectively obtained case data for patients enrolled in the ALPS trial from the ROC data coordinating center (DCC). The primary trial enrolled emergency medical services (EMS) – treated OHCA patients with at least one failed defibrillation from 2012 to 2015 at 10 sites across the ROC network for randomization to amiodarone, lidocaine or placebo. We included all enrolled cases with an ECG file available through the DCC. ECG signals were analyzed with custom, semi-automatic software to identify shocks, parse pre-shock ECG segments, and identify pre- and post- defibrillation rhythms, including post-shock return of organized rhythm (ROOR). Three QWM – AMSA, centroid frequency (CF), and median slope (MS) – were calculated for pre-shock ECG segments. Multivariable logistic regression models
accounting for repeated shocks were constructed with outcome ROOR, adjusting for ALPS treatment arm, shock number and relevant case characteristics. **Results:** A total of 1242 cases were available for analysis, comprising a total of 5,408 defibrillation events with identifiable pre-shock VF. Mean (SD) QWM values for all shocks were: AMSA{6.74 (10.80)}, CF{3.98 (1.68)} , MS{0.02 (0.02)}. CF, but not AMSA or MS, differed significantly between ALPS treatment arms when controlling for shock number (pamio<0.001; plido= 0.016). All QWM were significantly directly associated with defibrillation success in multivariable models (ORAMSA=1.03 [95%CI: 1.02 – 1.04]; ORCF=1.35 [95%CI: 1.26 – 1.45]); ORMS=1.05 [95%CI: 1.04 – 1.06]). **Conclusions:** In the ROC ALPS trial, QWM were associated with defibrillation success independent of shock number or treatment arm.

48. STATE OF THE EVIDENCE FOR PREHOSPITAL USE OF POINT-OF-CARE LACTATE IN PATIENTS WITH SEPSIS: A REPORT FROM THE PREHOSPITAL EVIDENCE BASED PRACTICE (PEP) PROGRAM

Jennifer Greene, Alix Carter, Judah Goldstein, Jan Jensen, Janel Swain, Yves Leroux, Ryan Brown, Dan Lane, Dalhousie University

**CATEGORY OF SUBMISSION:** MEDICAL

**Background:** Early and accurate diagnosis of critical conditions is essential in emergency medical services (EMS). Serum lactate testing may be used to identify patients with worse prognosis, including sepsis. Recently, the use of a point-of-care lactate (POCL) test has been evaluated in guiding treatment in patients with sepsis. Operating as part of the Prehospital Evidence Based Practice (PEP) Program, the authors sought to identify and describe the body of evidence for POCL use in EMS and the emergency department (ED) for patients with sepsis. **Methods:** Following PEP methodology, in May 2018, PubMed was searched in a systematic manner. Title and abstract screening was conducted by the program coordinator. These studies were collected, appraised and added to the existing body of literature contained within the PEP database. Evidence appraisal was conducted by two reviewers who assigned both a level of evidence (LOE) on a novel three tier scale and a direction of evidence (supportive, neutral
Eight studies were included in our analysis. Three of these studies were conducted in the ED setting; each investigating the POCL test's ability to predict severe sepsis, ICU admission or death. All three studies found supportive results for POCL. A systematic review on the use of POCL in the ED determined that this test can also improve time to treatment. Five of the total 8 studies were conducted prehospitaly. Two of these studies were supportive of POCL use in the prehospital setting; in terms of feasibility and the ability to predict sepsis. Both of these study sites used this early information as part of initiating a "sepsis alert" pathway. The other three prehospital studies provide neutral support for POCL. One study demonstrated moderate ability of POCL to predict severe illness. Two studies found poor agreement between prehospital POCL and serum lactate values. **Conclusions:** Limited low and moderate quality evidence suggest POCL may be feasible and helpful in predicting sepsis in the prehospital setting. However, there is sparse and inconsistent support for specific important outcomes, including accuracy.

49. THE CUTTING (AND BLEEDING) EDGE: TRANEXAMIC ADMINISTRATION IN STATEWIDE TREATMENT PROTOCOLS

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**Background:** Tranexamic acid (TXA) is an antifibrinolytic used for decades to treat dental and vaginal bleeding. Recent evidence (CRASH-2 and MATTERs) demonstrated mortality benefit when used within 3 hours of traumatic injury with suspected hemorrhagic shock. Given the time dependent benefit of TXA which may be maximized by early administration in the field, TXA has entered the EMS pharmacopeia despite a paucity of research in this environment. The purpose of this investigation is to describe the extent to which TXA has been incorporated into statewide treatment protocols (STPs), and characterize the indications for its use. **Methods:** Cross sectional study of STPs utilizing a standardized review for
inclusion of TXA in Paramedic level protocols, as well characteristics of the protocols. Protocol revision date was also captured. **Results:** Thirty three out of fifty states issue Paramedic STPs or guidelines. TXA is included in 11 (34%) of these as an approved medication, but with specific protocols in only 10 states. Three special cases exist, Massachusetts, which includes TXA as a medical director option with an explicit statewide protocol, North Carolina, which offers TXA as a medical director option but does not have a statewide protocol for TXA, and Ohio, which includes a specific TXA protocol for tactical emergency casualty care, but does not have a protocol for routine trauma care. Of states with TXA protocols, 8 (80%) offered specific guidance on administration using systolic blood pressure <90mmHg or heart rate ≥110bpm thresholds. Time ≥3 hours from injury was a contraindication for use of TXA in 7 (70%) of protocols. Pediatric dosing was included in 2 (20%), and provision for repeat or infusion dosing was included in 2 (20%) of protocols. **Conclusions:** While the benefit of TXA in the prehospital setting has yet to be proven, 34% of STP states include TXA in their pharmacopia. The majority of protocols mirror the criteria used in the CRASH-2 study while others provide little guidance on its use. Further study is needed to examine the efficacy and safety of prehospital TXA administration by paramedics as well as determination of optimal criteria for administration in STPs.

50. CHARACTERISTICS OF NATIONALLY-CERTIFIED PREHOSPITAL PATIENT CARE PROVIDERS IN THE UNITED STATES

**Madison Rivard, Rebecca Cash, Ashish Panchal, National Registry of Emergency Medical Technicians**

**CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS**

**Background:** Emergency medical services (EMS) professionals function as a key part of the healthcare continuum. However, there is a paucity of current information that describes the national EMS workforce who provides patient care and the roles and settings in which they work. The objective of this study was to describe the workforce characteristics of nationally-certified EMS professionals who
provide patient care in the U.S. 

**Methods:** We completed a cross-sectional analysis of EMS professionals who recertified their National EMS Certification between October 1, 2017-March 31, 2018. During the recertification process, EMS professionals completed an optional 10-question workforce profile collected for administrative purposes containing questions on job characteristics. We included EMS professionals who were between ages 18 and 85, currently working as a patient care provider, and certified as an emergency medical technician (EMT) or higher. Descriptive statistics were calculated.

**Results:** In the study period, 87,471 EMS professionals (response rate=82%) completed the profile, with 66,063 patient care providers included in our analysis. Most respondents providing patient care were male (74%), non-Hispanic white (84%) and were a median age (IQR) of 35 years (28-44). Over half (54%) were certified as an EMT, 5% as advanced EMTs, and 41% as paramedics. Most patient care providers (75%) worked full-time at their main EMS agency. Nearly half (45%) of patient care providers worked for fire agencies, while 21% worked for private agencies. A total of 69% of patient care providers primarily provided 911 service, with 13% providing both 911 and medical transport. More patient care providers worked in urban communities with ≥25,000 people (64%) than in rural communities (36%).

**Conclusions:** In this sample of nationally-certified EMS patient care providers, the majority worked full-time, at fire or private agencies, and provided 911 service while working in urban settings. This analysis provides the largest, current snapshot of patient care providers in the prehospital setting. Limitations include the potential exclusion of EMS professionals who hold a primary role of supervisors or preceptors yet provide patient care. Future work should describe regional variations in characteristics of EMS professionals, as well as EMS professionals working in multiple roles.

51. COMPARISON OF SURVIVAL OUTCOMES AND FACTORS ASSOCIATED WITH OUT-OF-HOSPITAL CARDIAC ARREST FROM PRESUMED OVERDOSE ETIOLOGY IN PENNSYLVANIA
Background: The opioid epidemic is a national crisis. We sought to compare survival and characteristics among etiologies of out-of-hospital cardiac arrest (OHCA), including overdose. We hypothesized that OHCA from drug overdose would be less likely to be witnessed or have a shockable rhythm and therefore less likely to survive. Methods: The Cardiac Arrest Registry to Enhance Survival was queried to identify OHCA cases that had resuscitation attempted by emergency medical services from 2013 to 2017 in Pennsylvania. Return of Spontaneous Circulation (ROSC), overall survival, and survival with good neurological outcome (cerebral perfusion score of 1 or 2) were compared among the following OHCA etiology groups: presumed overdose (OHCA-OD), presumed cardiac etiology (OHCA-cardiac), and all other (OHCA-others). Results: A total of 25,784 OHCA cases were identified, demonstrating the proportion of overdose etiology patients increasing each year from 2013-2017 (1.7%, 2.2%, 3.5%, 6.1%, 10.5%, respectively; p<0.001). When comparing characteristics of OHCA-OD patients to OHCA-cardiac and OHCA-other patients, respectively, they are younger in years (35.7, 65.9, 55.5; p<0.001), have more unwitnessed arrests (75.7%, 47.1%, 34.5%; p<0.001), have fewer initial shockable rhythms (4.2%, 19.9%, 5.9%; p<0.001), and are less likely to receive epinephrine (82.2%, 86.6%, 84.8%; p=0.02). Those with OHCA-OD had an increased chance of achieving ROSC (32.7%) compared to those with OHCA-cardiac (25.9%; OR=1.4, 95% CI 1.2 to 1.6), but a decreased likelihood compared to OHCA-other (37.6%; OR=0.8, 95% CI 0.7 to 0.9). Those with OHCA-OD had an increased chance of overall survival (13.2%) compared to those with OHCA-cardiac (8.4%; OR=1.6, 95%CI 1.2 to 2.0) and compared to OHCA-other (9.6%; OR=1.4, 95%CI 1.0 to 1.8). Among the survivors, OHCA-OD had an increased chance of favorable neurologic outcome (93.9%) compared to OHCA-cardiac (81.1%; OR=2.7, 95%CI 1.3 to 5.5) and OHCA-others (65.9%; OR=6.1, 95%CI 2.6 to 14.3). Conclusions: The proportion of OHCA from overdose in Pennsylvania is rising. These patients are more likely to survive and have favorable neurologic recovery.
among survivors, when compared to presumed cardiac and all other etiologies. This may be a result of younger age, better overall health, or misdiagnosis of respiratory depression as cardiac arrest in overdose patients.

52. PARAMEDIC ACCURACY IN NEEDLE THORACOSTOMY SITE SELECTION

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Background: Tension pneumothorax is an immediate threat to life. Treatment in the prehospital setting is commonly achieved by needle thoracostomy (NT). Classic teaching is to perform NT in the second intercostal space at the mid-clavicular line (2nd ICS MCL). Previous literature has suggested that Emergency Physicians have difficulty with identifying the correct anatomic location for NT. We hypothesized that civilian paramedics would also have difficulty in accurate identification of the location for NT. Methods: A prospective, observational study was performed to assess paramedic ability to identify the location for treatment with NT. Participants were recruited during a statewide EMS conference. Subjects were asked the anatomic site for NT and asked to mark the site on a shirtless male volunteer. The site was copied onto a transparent sheet lined up against predetermined points on the volunteer’s chest. It was then compared against the correct location that had been identified using palpation, measuring tape, and ultrasound. Results: Twenty-nine paramedics participated, with 24 (83%) in practice for more than 5 years and 23 (79%) doing mostly or all 9-1-1 response. All subjects (100%) reported training in NT, six (21%) had never performed a NT in the field. Nine paramedics (31%) recognized the 2nd ICS in the MCL as the desired site for NT, with 12 (41%) specifying only the 2nd ICS, 11 (38%) specifying 2nd or 3rd ICS, and 6 (21%) naming a different location (3rd, 4th, or 5th ICS). None (0%) of the 29 paramedics identified the exact 2nd ICS MCL on the volunteer. Mean distance from the 2nd ICS MCL was 1.37 cm (IQR: 0.7-1.90) in the medial-lateral direction and 2.43 cm in the superior-
inferior direction (IQR: 1.10-3.70). Overall mean distance was 3.12 cm from the correct location (IQR: 1.90-4.50). Most commonly, the identified location was too inferior (93%). Allowing for a 2 cm radius from the correct position, 8 (28%) approximated the correct placement. Twenty-five (86%) were within a 5 cm radius. **Conclusions:** In this study, paramedics had difficulty identifying the correct anatomic site for needle thoracostomy. EMS Medical Directors may need to rethink training or consider alternative techniques.

53. **PLACE-PROVIDER-MATRIX OF BYSTANDER AND OUTCOMES OF OUT-OF-HOSPITAL CARDIAC ARREST: A NATIONWIDE OBSERVATIONAL CROSS-SECTIONAL ANALYSIS**

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**CATEGORY OF SUBMISSION:** CARDIAC

**Background:** The concept consisting of place-provider-matrix (PPM) for cardiopulmonary resuscitation (CPR) program is the combining method between place factor and provider factor. We hypothesized that different PPM groups would have different effect size on the time interval to initiation of CPR and defibrillation and eventually survival and neurologic outcome. This study aims to test the association between place-provider-matrix (PPM) of bystander CPR and outcomes in out-of-hospital cardiac arrest (OHCA).

**Methods:** Adults OHCA with cardiac etiology from 2012 to 2016 in Korea were analyzed, excluding cases with unknown place, unknown type of bystander, and unknown outcomes. The PPM was categorized by place (public versus home) and provider (dedicated for first responder, family, layperson); Public-Trained, Public-Family, Public-Layperson, Home-Trained, Home-Family, and Home-Layperson. Outcomes were survival to discharge and good cerebral performance category (CPC) 1 or 2. Multivariable logistic regression analysis was performed to test the association between PPM and outcomes, adjusting for potential confounders to calculate adjusted odds ratios (AORs) and 95% confidence intervals (CIs) (reference group= Public-Trained). To compare the effect size of PPM across
the event time, we tested the interaction between PPM group and daytime versus night time of the event. **Results:** Total 58,493 patients were analyzed; Public-Trained (372, 0.6%), Home-Trained (N=197, 0.3%), Public-Family (N=1113, 1.9%), Home-Family (N=47320, 80.9%), Public-Layperson (N=5243, 9.0%), and Home-Layperson (N=4248, 7.3%). AORs (95% CIs) for survival to discharge by Home-Trained, Public-Family, Home-Family, Public-Layperson, and Home-Layperson were 0.63 (0.33-1.19), 0.88 (0.62-1.25), 0.42 (0.31-0.57), 1.25 (0.92-1.70), and 0.47 (0.34-0.65), respectively. AORs (95% CIs) for good CPC by Home-Trained, Public-Family, Home-Family, Public-Layperson, and Home-Layperson were 0.76 (0.35-1.67), 1.03 (0.67-1.58), 0.45 (0.31-0.66), 1.38 (0.94-2.02), and 0.43 (0.29-0.66), respectively. In interaction model, AORs (95% CIs) of the Public-Family group showed 1.15 (0.92-1.44) in daytime (06:00-18:00) and 1.28 (1.05-1.56) in night time (18:00-06:00). The other groups were not different between day time and night time. **Conclusions:** The Place-Provider-Matrix can efficiently categorize OHCA population by CPR provider and arrest place. This analysis can help focus on which group has lower CPR outcomes and distribute social resources effectively. Private place with family and layperson needs further resources to improve CPR outcomes.

54. EMERGENCY MEDICATION SHORTAGES: STRATEGIES TO MAINTAIN CONTINUOUS MEDICATION AVAILABILITY FOR EMERGENCY MEDICAL SERVICES

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**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** Emergency medication shortages are an ongoing concern and may adversely affect prehospital care. Mitigation strategies have been proposed, but there are few data quantifying which strategies have been utilized by EMS providers. We sought to examine the extent of such shortages and to determine the most frequently employed strategies to maintain medication availability in one
Methods: A 10-question survey was electronically distributed to 30 public advanced life support (ALS) provider agencies (over 600,000 annual 9-1-1 calls) to assess provider agency characteristics, prevalence of medication shortages, types of shortage mitigation strategies implemented, and interest in use of alternative analgesics to opioids. Descriptive statistics were calculated, including frequencies and proportions. Results: Survey responses were received from 29 of 30 provider agencies (97%) between 5/14/2018 and 7/6/2018. The majority (97%) of responding agencies were impacted by medication shortages. Agencies employed various strategies to maintain supplies: 71% used alternative vendors, 54% rotated medications from low to high volume units, 50% utilized FDA expired medication extensions, 43% substituted medication with better availability, 32% borrowed medications from other agencies, 29% utilized expired medications with medical director approval, 18% diluted medications to obtain desired concentration, 14% reduced minimum periodic automatic replacement (PAR) levels, and 14% used alternate medication concentrations/formulations. Epinephrine (0.1mg/mL) was the most frequently reported medication shortage (67% of agencies) followed by morphine (52%), dextrose 10% (41%), normal saline (33%), epinephrine (1mg/mL) (26%), atropine (15%), sodium bicarbonate (11%), other medications (11%), and fentanyl (7%). None of the provider agencies self-reported adverse events due to the shortages. When queried about interest in expanding paramedic scope of practice to include administration of non-opioid analgesics, 57% of agencies supported the addition of ketamine, 57% supported ketorolac, 21% supported intravenous acetaminophen, and 25% did not support expanding scope. Conclusions: Emergency medication shortages impacted an overwhelming majority of ALS provider agencies in this regional urban-suburban EMS system. Provider agencies implemented a broad range of mitigation strategies and no adverse events were reported. A majority of agencies demonstrated interest in expanding paramedic scope of practice to include use of non-opioid analgesics as an additional mitigation strategy.
ASSOCIATION BETWEEN A TEXT MESSAGE ALERT SYSTEM FOR TRAINED VOLUNTEERS AND RESUSCITATION OUTCOMES AFTER OUT-OF-HOSPITAL CARDIAC ARREST: A BEFORE-AND-AFTER POPULATION-BASED STUDY

Sun Young Lee, Sang Do Shin, Young Sun Ro, Kyoung Jun Song, Ki Jeong Hong, Jeong Ho Park, Tae Han Kim, So Yeon Kong, Seoul National University Hospital CATEGORY OF SUBMISSION: CARDIAC

Background: Dispatcher-activated bystander resuscitation programs have been proposed for increasing bystander cardiopulmonary resuscitation (CPR) and defibrillation. Smart phone applications or text message alert systems have been tried to give information of OHCA event location or nearest public access defibrillator (PAD) to pre-registered lay persons or citizen volunteers. This study aimed to investigate the effect of a text message (TM) alert system implemented in a metropolis on the outcomes of out-of-hospital cardiac arrest (OHCA). Methods: A population intervention study was conducted for resuscitation-attempted OHCA from 2013-2014 (before) and from 2015-2016 (after) in selected districts of a metropolis with population of about 2 million. The intervention consisted of text messages (TM) that were sent by a dispatch center to registered volunteers to inform them of the OHCA event, location of victim, and nearest available automatic external defibrillator. The number of registered volunteers, PAD, and TM alerts were 43,082, 4,868, and 382 in after-period, respectively. The endpoints were good cerebral performance scale (CPC) 1 or 2 at hospital discharge and survival to discharge. A multivariable logistic regression analysis was performed to determine the effect of the intervention, and adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated, adjusting for potential confounders. Results: A total of 2,587 eligible OHCA cases (1,241 controls before, and 1,346 cases after the intervention) were evaluated. The bystander CPR rate increased during the before and after-intervention periods (54.4% in before and 59.6% in after periods; p-value<0.01). However, there was no difference in bystander defibrillation in before-and after-intervention (0.9% vs. 0.6%; p=0.3848).
outcomes during the before-and after-intervention periods were 4.3% and 7.4% for good neurological outcome (p<0.0001) and 8.8% and 11.7% for survival to discharge (p<0.0001). The AORs (95% CIs) for good CPC and survival to discharge during the before-and after-intervention periods were 3.47 (1.96-6.16) and 2.27 (1.53-3.39), respectively. **Conclusions:** The TM alert service for OHCA was associated with better outcomes through an increase in bystander CPR but not in bystander defibrillation. (Clinical trials registration; NCT02010151)

56. EFFECT OF SUPRAGLOTTIC AIRWAY DEVICE ON CAROTID BLOOD FLOW DURING CARDIOPULMONARY RESUSCITATION IN A PORCINE CARDIAC ARREST WITH PROLONGED RESUSCITATION DURATION

Tae Han Kim, Sang Do Shin, Kyoung Jun Song, Ki Jeong Hong, Young Sun Ro, Jeong Chan Lee, Yoon Ha Joo, Department of Emergency Medicine, Seoul National University Boramae Medical Center CATEGORY OF SUBMISSION: CARDIAC

**Background:** Clinical studies on out-of-hospital cardiac arrest (OHCA) have reported the Supraglottic airway device (SGA) was associated with poor outcomes than endotracheal intubation (ETI) in cardiopulmonary resuscitation (CPR), which was explained by a selection bias or dislodge of tube. We hypothesized the SGA can compromise the blood flow in the neck vessels due to compressing pressure to the neck vessels. The study aimed to compare the carotid blood flow over time in prolonged resuscitation duration in cardiac arrest porcine model providing between SGA and ETI. **Methods:** This is a case-cross over experimental study using 12 porcine CPR models with 40-50 kg weight. ETI and 3 different SGAs (Combitube, l-gel, laryngeal mask airway) were inserted alternatively after induction of cardiac arrest according to randomized sequences. Chest compression was provided using the same mechanical device. Carotid blood flow (CBF) was repetitively measured and compared between each period of SGA insertion and preceding ETI. Trends of CBF and mean arterial pressure (MAP) according to type of airway device transition (ETI to SGA transition or SGA to ETI transition) during course of
prolonged resuscitation were calculated and plotted. **Results:** Physiologic parameters of 12 pigs during CPR were measured. Reduction of CBF was significant after inserting I-gel and Combitube compared to ETI (mean difference (95% CI): -685 ml (-1052/-318) for Combitube, -369 ml (-623/-114) for I-gel). MAP decreased subsequently after transitioning airway devices regardless of device types as resuscitation was prolonged (mean MAP change (95% CI) in ETI to SGA transition: -2.8 mmHg (-4.6/-0.9), SGA to ETI transition: -3.6 mmHg (95% CI -5.6/-1.6). However reduction of CBF was relatively spared when transitioning of airway device was from SGA to ETI (mean CBF change (95% CI) in ETI t0 SGA transition: -480 ml (-675/-286), SGA to ETI transition: -4 ml (95% CI -182/175). **Conclusions:** SGA insertion was associated with decreased CBF during CPR in porcine experimental model. As resuscitation is prolonged, CBF reduction is aggravated after SGA insertion compared to reduction after endotracheal intubation.

57. **ASSESSING SLEEP QUALITY, DAYTIME SLEEPINESS AND HEALTH RELATED QUALITY OF LIFE AMONG EMS PROVIDERS BEFORE AND AFTER A CHANGE IN THEIR SHIFT LENGTH AND END TIME**

**Patricia Dowbiggin, Allison Infinger, Jonathan Studnek, Mecklenburg EMS Agency**

**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** Our objective was to determine if changes in primary shift length and end time among EMS providers effect perceived sleep quality, daytime sleepiness, and health-related quality of life. **Methods:**

This prospective cohort studied EMS providers from a single agency from 12/2017 to 06/2018. Participants remained full-time EMS providers during the study period and self-selected new shift assignments on 01/2018. After the new shift assignments participants were evaluated for shift change exposure, defined as: changing shift length by ≥2 hours, or changing end time by ≥4 hours. Further, all participants experienced a change in weekly workload from 42-hours to a 40-hour shift. Prior to shift change, an initial survey was deployed to assess sleep quality (Pittsburg Sleep Quality Index, 0-21 best to worst), daytime sleepiness (Epworth Sleepiness, 0-24 best to worst), and health-
related quality of life (CDC’s Health Related Quality of Life, 1-5 best to worst) prior to shift change. Other variables collected included demographics and total number of years employed. Participants completed follow-up surveys one and three months after shift change. Paired t-tests were used to assess differences. **Results:** A total of 50 eligible participants completed all three survey cycles, with 32 (64%) exposed to shift change. The cohort was 28% female, 52% married, with a mean age of 34.7 years and 7.2 years of employment. The initial survey showed poor sleep quality (6.6, 95% CI 5.66-7.54), minimal daytime sleepiness (7.76, 95% CI 6.74-8.78), and "good" self-reported health (2.6, 95% CI 2.39-2.85). There was no significant difference in sleepiness (7.82, 95% CI 6.70-8.94), sleep quality (6.9, 95% CI 5.71-8.09), or quality of life (2.6, 95% CI 2.34-2.86) before or after exposure. There were no significant differences when assessing the change to a 40-hour week workload. **Conclusions:** EMS providers self-reported poor sleep quality with minimal daytime sleepiness and good health. However, neither exposure to a change of shift nor weekly workload were associated with decreased health, worsened sleep quality, or increased daytime sleepiness. Further research should aim to reduce loss to follow up and increase sample size while exploring associations in shift variables and fatigue.

58. BARRIERS AND ENABLERS TO VOLUNTEER EMS PROVIDER RECRUITMENT AND RETENTION

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**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** Volunteers play a vital role in staffing ambulances, especially in rural areas. Of the 751 licensed Emergency Medical Service (EMS) agencies in Maine, New Hampshire, and Vermont, 482 (65%) rely at least partially on volunteer providers. Many ambulance services are experiencing difficulty recruiting and retaining volunteers. The **OBJECTIVES** of this study were to characterize volunteer ambulance services in northern New England, evaluate their ability to respond to emergency medical calls, and identify barriers and enablers to recruitment and retention of EMS volunteers. **Methods:** In
the first phase of this two-part, mixed-METHODS study, a 27 question, online survey was emailed to representatives of all agencies in Maine, New Hampshire, and Vermont that report utilizing volunteer providers. The survey focused on agency structure, benefits offered to providers, and their ability to meet staffing needs. In phase two of the study, a subset of survey respondents were interviewed by phone to further investigate their experiences. **Results:** In phase one, there were 201 responses for a response rate of 46%. Only 21% of respondents reported being adequately staffed and 33% reported missing calls at least monthly due to staffing. In phase two, 22 interviews were conducted from which we identified 8 major themes. Interviewees reported that the most common reasons providers join volunteer EMS is to help their communities and to gain experience. They most often leave due to the time demands of training. Workday calls are hardest to cover and agencies often rely on just a few members to cover most calls. New volunteers are most successfully recruited through EMT/EMR classes, but many agencies have had to hire staff to help provide coverage. Overtime, agencies have seen a trend towards fewer volunteers and more calls. **Conclusions:** The current EMS system in northern New England is struggling to meet the demands of the communities. The increasing prehospital scope of practice and resulting increase in educational requirements is creating time demands that surpass the abilities of most volunteers. As a result, many departments are currently in a transition from staffing entirely with volunteers to relying more heavily on paid providers to cover calls.

59. PREHOSPITAL FEASIBILITY AND ACCURACY OF INTRAVENOUS BOLUS DOSE NITROGLYCERIN IN SYMPATHETIC CRASHING ACUTE PULMONARY EDEMA PATIENTS

**Casey Patrick, Brad Ward, Jordan Anderson, Kevin Crocker, Robert Dickson,** *Montgomery County Hospital District EMS-Assistant Medical Director*

**CATEGORY OF SUBMISSION:** CARDIAC

**Background:** The necessity of both preload and afterload reduction in patients with sympathetic crashing acute pulmonary edema (SCAPE) is well established. In the prehospital setting, this has typically
been accomplished via nitroglycerin, given either topically or sublingually. SCAPE patients are often diaphoretic and concurrently receiving non-invasive positive pressure ventilation which makes topical and sublingual drug administration suboptimal. The purpose of this study is to assess the safety and accuracy of prehospital intravenous bolus nitroglycerin in SCAPE patients treated by a single, high-volume, ground based EMS agency. **Methods:** This is a retrospective case series. Inclusion criteria for treatment with IV bolus nitroglycerin included both hypertension, defined as systolic blood pressure (SBP) ≥160 mmHg, and acute respiratory distress in the setting of paramedic clinical presumption of SCAPE. An initial dose of 1mg intravenous nitroglycerin was administered slowly and repeated in 5 minutes if SBP remained greater than 160mmHg. Data sources included both EMS and receiving hospital electronic medical records. **Results:** Ten patients have been treated thus far with an average nitroglycerin dose of 1.4mg +/-0.52mg. Average initial EMS SBP=206 +/-20 with an average initial emergency department (ED) SBP of 178 +/-24. No significant episodes of hypotension occurred, either en route, or upon arrival to the ED (lowest ED arrival SBP=142). 100% of the patients treated have had ED chest X-Ray findings consistent with pulmonary edema, volume overload and/or pleural effusion. Average ED BNP=1747 +/-1222. None of the patients were intubated by EMS during transport and only 2/10 were intubated within 6 hours of hospital arrival. Additionally, 3/10 patients were admitted to the ICU. There were no reported adverse events during transport. **Conclusions:** This preliminary data suggests that prehospital administration of bolus dose IV nitroglycerin in SCAPE patients may be safe and effective. Paramedic diagnosis of SCAPE was highly correlated with a confirmatory ED diagnosis as well. Studies with larger sample sizes are needed to further investigate the effects of bolus dose nitroglycerin on patient morbidity and mortality.

60. INTER-RATER RELIABILITY OF THE FAST-ED IN THE OUT-OF-HOSPITAL SETTING
**Background:** Patients experiencing a large vessel occlusion stroke (LVOS) require endovascular-capable centers and may benefit from direct transport to such facilities, creating a need for an accurate prehospital assessment. The Field Assessment Stroke Triage for Emergency Destination (FAST-ED) was created as a secondary scale to identify LVOS. Currently, there is limited prospective evidence validating the use of the FAST-ED in the prehospital environment. The objective of this study was to evaluate the inter-rater reliability of the FAST-ED between patient care providers in the prehospital setting. **Methods:** This prospective study was conducted between March and May 2018 in a single municipal EMS agency that staffs two providers per ambulance with at least one being a paramedic. Patient inclusion was based on paramedic impression that the patient was both having a stroke and greater than 18 years old. A 1-hour didactic training session on the FAST-ED was conducted for all providers the month prior to study initiation. Each provider independently performed and documented a FAST-ED assessment on eligible patients. FAST-ED assessments were classified as performed by the primary or secondary care giver; this classification was used to perform Coehn's Kappa comparing FAST-ED score agreement by aggregate (score ≥ 4) and by individual item between providers. A sub-analysis was performed to determine if kappa changed when the primary and secondary caregivers hold the same level of EMS certification (paramedic). **Results:** There were 231 patients included in this analysis with an average age of 68.5 years and 135 (58.4%) males. In aggregate, there was 92.2% (Kappa=0.81) agreement between primary and secondary care giver with minor changes in agreement when comparing paramedic/EMT crews (92.5%; Kappa=0.82) and paramedic/paramedic crews (91.2%; Kappa=0.80). Inter-rater reliability was substantial at the aggregate level and slightly attenuated when compared to the item level with agreement at 70.1% (Kappa=0.65). **Conclusions:** This study demonstrated high inter-rater reliability of the FAST-ED scale, in aggregate, when performed in the prehospital setting on patients suspected of...
having a stroke. There were no differences in reliability based on crew configuration and item level analysis indicated moderate inter-rater reliability.

61. AN INVESTIGATION OF EMERGENCY HEALTHCARE PROVIDERS' BELIEFS AND THIRD-PERSON PERCEPTIONS OF HYPERTENSION USING CONSTRUCTS OF THE HEALTH BELIEF MODEL

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CATEGORY OF SUBMISSION: PROFESSIONAL

Background: While emergency healthcare professionals (EHCPs) are equipped with knowledge about hypertension and its treatments, they are not invincible to being diagnosed with the disease. Conditions exist, however, for healthcare providers, to believe they are less affected by hypertension because of a sense of comparative optimism. We predicted EHCPs would feel they were less susceptible to hypertension than their patients, the condition would be less severe for them, if afflicted, and their motivations to stay healthy would be higher than those they treat. Methods: We surveyed 288 EHCPs (mean age=40.07, SD=12.29) about their knowledge of hypertension and how the condition affects them. Using constructs from the health belief model (HBM) and third-person perception (TPP), we asked participants about their knowledge of hypertension and health motivations, if they personally felt susceptible to the condition, and, if afflicted, hypertension and its associated consequences would be severe. Respondents answered similar questions about their perceptions of those elements in patients.

Results: As expected, EHCPs have higher than average knowledge about hypertension and its associated risks and treatments (M=6.22, SD=0.50). As hypothesized, EHCPs perceive patients as more susceptible to hypertension (M=4.37, SD=1.10) than they are, themselves (M=3.73, SD=1.56), t(178)= -4.63, p <.001. They also perceive greater severity in hypertension and its associated negative outcomes for patients (M=3.2, SD=1.09) than for themselves (M=3.04, SD=1.14), t(174)= -2.24, p =.03. Furthermore, EHCPs believe they are more motivated for health maintenance behaviors (M=4.91, SD=1.15) than their
patients (M=2.71, SD=0.97), t(174)=18.99, p <.001. **Conclusions:** Programs exist to help healthcare workers manage their own health and wellness. Campaigns to address the feelings of TPP in EHCPs are lacking, which can prove dangerous for those who have undiagnosed or poorly treated hypertension. The **RESULTS** of this study can inform programs for and by EHCPs to reduce morbidity and mortality associated with these problems and improve quality of life for patients and practitioners, alike.

62. **EVALUATING PARAMEDIC COMFORT, CONFIDENCE, AND CULTURAL COMPETENCY IN PROVIDING CARE TO TRANS POPULATIONS IN A PROVINCIAL AMBULANCE SYSTEM**

**Lyon Kengis, Judah Goldstein, Robin Urquhart, Kim McIver, Dalhousie Department of Emergency Medicine -Division of Emergency Health Services. CATEGORY OF SUBMISSION: PROFESSIONAL**

**Background:** Close to 2 million transgender (trans) individuals live in the United States and Canada. Trans communities frequently report emergency care avoidance and negative health care experiences. Of note, there is currently no research on the paramedic perspective of caring for trans populations. Our objective was to explore paramedic comfort, confidence, and cultural competency in providing emergency care to trans individuals. **Methods:** A cross-sectional, semi-structured electronic survey was administered by email to paramedics registered with the College of Paramedics of Nova Scotia (n=1225) from April 9th to May 7th, 2018. The survey included previously validated questions from other medical settings. Three survey reminders were sent at weekly intervals following survey initiation. A 4-point Likert scale and qualitative open-ended questions were included to evaluate paramedic comfort, confidence, and cultural competency. Descriptive statistics were used to describe respondent characteristics. Open ended questions pertaining to paramedic needs were evaluated using constant comparative analyses consisting of open coding to identify themes. **Results:** Of the 387 paramedics who participated (response rate=32%), 77.8% (n=301) worked ground ambulance in a mixed rural/urban location (32.6%, n=126) within Nova Scotia (94.5%; n=365). Most respondents were between the ages of
41-50 (29.5%; n=114), with ≥ 20 years' experience (25.1%; n= 97), and male sex assigned at birth (56.1%; n=217). Over half (54.8%; n=212) identified as cisgender men. The majority (66.1%; n=256) reported caring for a patient who identified as trans. 74.7% (n=289) have never had formal education on trans health. Only 4.1% (n=16) felt very knowledgeable about providing optimal care to trans communities and 26.6% (n=103) felt very comfortable in providing optimal care. Most (70%; n=271) were interested in obtaining formal education. 41.9% (n=162) reported observing transphobia in the work place.

**Conclusions:** The frequency of trans patient contact by paramedics is perceived to be high. Although comfort and knowledge are relatively low and transphobia witnessed in the work place relatively high, there was strong interest and expressed need for education on trans related health.

### 63. INCREASED FREQUENCY OF ADVERSE EVENTS OBSERVED AFTER KETAMINE USE FOR PSYCHIATRIC EMERGENCY AS COMPARED TO BENZODIAZEPINES AND ANTIPSYCHOTICS

**Kordik Samuel, Chris Smith, David Page, Remle Crowe, Brent Myers, David Wampler, Cypress Creek**

**EMS CATEGORY OF SUBMISSION:** PROFESSIONAL

**Background:** Ketamine may be favorable to benzodiazepine or antipsychotic medications for prehospital treatment of patients experiencing a psychiatric emergency. Data are limited on the safety profile of ketamine for this indication. This study evaluated adverse events after administration of ketamine compared to benzodiazepines or antipsychotics in the prehospital treatment of psychiatric patients.

**Methods:** A retrospective analysis was performed using patient care records from the ESO Solutions (Austin, TX) research database from 2017. Inclusion criteria were: patients over 13 years experiencing a psychiatric emergency and receiving a single dose of ketamine, benzodiazepine, or antipsychotic. Psychiatric emergencies were defined by dispatch type or paramedic primary impression consistent with psychiatric emergency. Included medications were categorized as ketamine, benzodiazepine or antipsychotic. Adverse events were defined as: non-invasive airway management (Cricoid Pressure,
Manual Airway, NPA, OPA, Suction), non-invasive ventilation (CPAP, BVM), invasive airway management (supraglottic airway, ETI), and cardiac arrest. The frequency of adverse events was compared between ketamine versus benzodiazepines or antipsychotics. **Results:** Of the 3,020 patients were included, 337 (11%) received ketamine, 2,155 (71%) received a benzodiazepine, and 528 (17%) received an antipsychotic. The median age of all patients was 36 (IQR 23-49), 1,492 (50%) were male, 764 (25%) had a psychiatric history, 192 (7%) had a substance abuse history, and 912 (30%) had admitted or known drug or alcohol use. In the ketamine group, 0.9% (n=3) of patients received non-invasive ventilation versus 0.3% in the comparison group (n=9) (OR 2.7, 95% CI 0.72-9.9). Ten percent (n=34) of ketamine patients received non-invasive airway management, versus 0.8% (n=22) (OR 13.6, 95% CI 7.8-23.5). In the ketamine group, 2% (n=7) of received invasive airway management versus 0.6% (n=15) (OR 3.8, 95% CI 1.5-9.3). One ketamine patient experienced cardiac arrest versus five in the comparison group (OR 1.6, 95% CI 0.2-13). **Conclusions:** The adverse event rate for all psychiatric patients administered sedation was ≤11%. For psychiatric patients requiring treatment, those who received ketamine received significantly more airway management than patients who received a benzodiazepine or antipsychotic. Limitations for this study include not knowing patient agitation level or hospital outcomes.

**64. HOW DO PARAMEDICS PERCEIVE THEIR ROLE IN THE EMERGENCY DEPARTMENT?**

**Melissa Snyder, Donald Eby, Schulich School of Medicine, Western University**

**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** Inter-disciplinary interaction in the Emergency Department (ED) is critical for good patient care. The perception of paramedics’ experience in this interaction is not well described in the literature. This project gives voice to paramedics' understanding of their role in the ED. **Methods:** Qualitative thematic framework analysis of digitally recorded, semi-structured, telephone interviews of 11 paramedics from one urban and one rural Paramedic Service in Southern Ontario. Recordings and field
notes were repeatedly reviewed and discussed by two researchers. A conceptual framework was constructed from themes emerging from the data. Results: Paramedics interviewed had 7-33 years of primary, advanced, or critical care experience. Three major themes emerged. (1) Patient advocate - Paramedics present the patient prehospital context and course of care information. They feel this information is essential and must be communicated. (2) Communication - Concerns raised that information is not listened to and valuable information is lost or ignored. A formal 30-second 'pause' for a structured paramedic to ED staff handover was seen as beneficial. Paramedics also want clinical feedback and outcome information from ED staff. No formal mechanism exists to obtain this. (3) Respect - When it exists, it is often based upon personal relationships between individuals. Paramedics feel when ED staff don't understand their scope of practice, their skills and abilities are ignored. In smaller EDs, paramedics also see themselves as a resource to help the ED staff with technical procedures. They need respect to do this. Conclusions: Paramedics' perceive themselves as providing valuable information and advocacy for their patients in the Emergency Department. In order to present this information, they require uninterrupted time, as short as 30-seconds, for communication. Their relationship with the ED staff is further strengthened by mutual respect and understanding of each discipline's scope of practice and interdisciplinary teamwork. Paramedics would like more feedback on clinical outcomes and on their prehospital care. Some areas for practice change suggested by this study include: time for un-interrupted communication of prehospital information, formal feedback, and reflection on how to improve interdisciplinary interactions.

65. UTILITY OF GLUCOSE TESTING AND ADMINISTRATION OF GLUCOSE IN PATIENTS IN OUT-OF-HOSPITAL CARDIAC ARREST: A PREHOSPITAL PERSPECTIVE
Background: Many emergency medical services (EMS) treatment protocols for out-of-hospital cardiac arrests (OHCA) continue to include point-of-care (POC) glucose measurement and administration of dextrose despite the American Heart Association removing hypoglycemia as a cause of cardiac arrest for adults from the 2010 guidelines. In-hospital cardiac arrest data suggests that dextrose administration may be associated with worse outcomes. This study describes the incidence of hypoglycemia and dextrose administration by EMS for OHCA and subsequent patient outcomes within a large, regional system. Methods: This is a 6-year retrospective analysis of all OHCA patients treated by paramedics from 2011-2017 with available prehospital data. Patients ≥18 years old with non-traumatic OHCA and attempted field resuscitation were included. Hypoglycemia was defined as glucose <60 mg/dl. Data on glucose levels, dextrose and glucagon administration, and outcomes were extracted from EMS data registries. Survival to hospital discharge (SHD) and neurologic outcome for transported patients were obtained from cardiac arrest receiving centers. The primary outcomes were frequency of POC glucose measurement, hypoglycemia, and dextrose administration. We describe outcomes for patients with hypoglycemia, including field return of spontaneous circulation (ROSC), SHD and survival with good neurologic outcome, defined as cerebral performance category (CPC) 1 or 2. Overall outcomes serve as a system reference. Descriptive statistics are presented, including frequencies and proportions. Results: There were 46,211 OHCA during the study period. Glucose levels were measured in 33,851 (73%) cases, of whom 2,335 (7%) were hypoglycemic. Among hypoglycemic patients, 929 (40%) received dextrose and an additional 30 patients received glucagon by EMS. Field ROSC was achieved in 286 (30%) of patients who received dextrose and/or glucagon. Final outcome was determined for 1,714 of the hypoglycemic cases: 120 (7%) had SHD and 66 (55%) of survivors had good neurologic outcome. Among
survivors with hypoglycemia, 48 (40%) were treated in the field. SHD for all OHCA was 8%, 2751 of 33679 patients with known outcomes, and 1567 (57%) of survivors had good neurologic outcome.

Conclusions: In this regional EMS system, hypoglycemia and dextrose administration in OHCA were rare events. Outcomes for patients with hypoglycemia were similar to overall outcomes within the same system.

66. ASSOCIATION BETWEEN NEIGHBORHOOD CARDIOPULMONARY RESUSCITATION TRAINING EXPERIENCES AND CHANGES IN SURVIVAL OUTCOMES AFTER OUT-OF-HOSPITAL CARDIAC ARREST OVER 5 YEARS: A MULTILEVEL ANALYSIS

Young Sun Ro, Kyoung Jun Song, Sang Do Shin, Seoul National University Hospital CATEGORY OF SUBMISSION: CARDIAC

Background: Associations between neighborhood environments and survival outcomes after out-of-hospital cardiac arrests (OHCAs) have been proposed. The purpose of this study was to examine the association between neighborhood cardiopulmonary resuscitation (CPR) training experience and improvements in survival outcomes after OHCA over 5 years. Methods: Emergency medical service (EMS)-treated OHCAs with cardiac etiology between 2012 and 2016 were analyzed, excluding cases witnessed by EMS providers. The main exposure of interest was CPR training experiences at the community level, which was surveyed and measured in 254 counties in Korea in 2016. Proportion of positive answer for CPR training experience was used among about 1000 respondents who were selected with a novel stratification method in each county for annual Community Health Survey. The endpoint was survival with good neurological recovery after OHCA. We compared the difference of risk-adjusted outcomes between 2012 and 2016 according to quartile groups of communities by the proportions of residents with CPR training experiences using a difference-in-differences design. Demographic and Utstein factors (individual factor) and CPR training experience (aggregate factor) were
used in the multilevel analysis. **Results:** A total of 81,250 OHCAs in 254 communities were analyzed. The risk-adjusted good neurological recovery rates increased from 5.4% in 2012 to 7.1% in 2016 [adjusted rates difference: 1.6% (1.2–2.1)]. The OHCAs that occurred in communities with the highest proportions of residents with CPR training experiences were more likely to survive with good neurological recovery (adjusted rates: 5.2% in 2012 and 7.4% in 2016, difference: 2.2% (1.5–2.9)) than were those occurred in the lowest CPR training communities [adjusted rates: 5.9% in 2012 and 6.0% in 2016, difference: 0.1% (-1.1–1.2)]. The difference-in-differences was 2.1% (0.8–3.5). **Conclusions:** A high proportion of neighborhood CPR training experience was associated with significant improvements over 5 years in good neurological recovery rates after OHCA in the communities. The neighborhood CPR training experience can be considered as a potential candidate for monitoring effect of an implemented CPR program.

67. PREHOSPITAL INTRANASAL GLUCAGON FOR HYPOGLYCEMIA (PINGH): A CASE SERIES

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**Background:** Glucagon is a critical alternative for hypoglycemic patients who are unable to tolerate oral glucose and lack intravenous (IV) access. While intranasal (IN) glucagon has demonstrated pharmacologic efficacy, is easily administered, and does not carry a risk of needlestick injury, its effectiveness in the prehospital realm has yet to be established. We present a case series of patients treated with prehospital IN glucagon and explore its effectiveness in treating hypoglycemia. **Methods:** We conducted a retrospective chart review of patients administered IN glucagon via mucosal atomization device from January 2015 to May 2018 in a large urban EMS system. The primary outcome was change in patient’s clinical condition post-administration as determined by the treating paramedic. Secondary outcomes were change in blood glucose level and proportion of patients with post-
administration glucose level ≥ 60 mg/dL. Descriptive statistics were used for analysis using STATA 12.1.

**Results:** A total of 131 patient encounters were identified. In 64 (48.8%) cases, co-administration of oral glucose, IV dextrose, IM glucagon, or other medications (e.g., naloxone) occurred. In patients receiving only IN glucagon (n=67), paramedics reported an improved patient condition in 37 (55.2%), with no reported clinical deterioration. The median change in glucose level for those receiving only IN Glucagon with pre and post glucose levels recorded (n=38) was +5 mg/dL (IQR 0-22 mg/dL, range 34-167 mg/dL), with 11 (29.0%) reaching ≥60 mg/dL. Of all patients for whom repeat glucose level was checked ≥15 minutes post-administration (n=35), median change in glucose level was +21 mg/dL (IQR 0-88 mg/dL, range 31-312 mg/dL), with 15 (42%) having a repeat glucose level of ≥60 mg/dL. **Conclusions:** In this limited case series, IN glucagon shows value in improving clinical condition in the majority of patients with prehospital hypoglycemia as reported by treating paramedics. However, improvement in blood glucose level was modest when measured soon after IN glucagon administration. Future controlled studies are needed to determine the effectiveness of IN glucagon as compared to other forms of hypoglycemia treatment.

68. SAFETY OF DISPATCHING ONLY THE NEAREST BASIC LIFE SUPPORT AMBULANCE FOR PATIENTS WITH ABDOMINAL PAIN IN A LARGE, URBAN 911-EMERGENCY MEDICAL SERVICE SYSTEM

**Tiffany Abramson, Stephen Sanko, Saman Kashani, Marc Eckstein, Keck School of Medicine, University of Southern California**

**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** Abdominal pain is one of the most common reasons people call 911 to request an ambulance. Though 85% of 911-incidents for abdominal pain require only Basic Life Support (BLS) transport to the emergency department, many dispatch systems continue to send Advanced Life Support (ALS) resources, sometimes with the closest first responder units. In 2015, a large, urban fire department implemented an internally developed tiered dispatch system. Under this dispatch system,
patients reporting a chief complaint of abdominal pain received the closest BLS ambulance dispatched alone emergency if located within 3 miles of the incident. **Methods:** The objective was to determine how many 911-patients with abdominal pain required ALS resources for a time-sensitive intervention. This was a retrospective review of electronic medical records for 911-incidents dispatched as non-traumatic abdominal pain from May 2015 - May 2018. Cases were included if the patient’s chief complaint was abdominal pain, the patient was the caller or was in close proximity to the caller (i.e., first or second party call), the patient was over age 15, and the patient was awake and alert. The primary outcome was the prevalence of time-critical prehospital ALS intervention, defined as: CPR; defibrillation; airway management (including use of bag-valve-mask, supraglottic airway, or endotracheal intubation); the presence of hypotension (defined as initial systolic blood pressure <90 mm Hg); or the prehospital 12 lead-electrocardiogram showing STEMI or wide complex arrhythmia. Descriptive statistics are presented, including frequencies. **Results:** During the study period, 31,478 calls met inclusion criteria. The mean age was 45.7 years (range 16-93), and 13,951 patients (44.3%) were male. Critical ALS intervention was provided in 264 cases (0.8%). CPR was required in 6 cases (0.02%), defibrillation in 1 case (0.003%), airway management in 13 cases (0.04%), and hypotension occurred in 242 cases (0.77%). A 12-lead electrocardiogram was obtained in 2213 abdominal pain dispatches (7.03%) of which 9 (0.03%) showed STEMI and 4 (0.01%) showed wide complex arrhythmia. **Conclusions:** Among adult 911-patients with a chief complaint of abdominal pain, the need for ALS intervention was exceedingly rare. Dispatching a BLS ambulance without a closer first responder appears to be safe.

69. **WHY ARE LONG SPINAL BOARDS USED IN PREHOSPITAL CASES WITH A RETROSPECTIVE HOSPITAL DIAGNOSED SPINAL CORD INJURY?**
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CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Many Emergency Medical Services (EMS) systems have sought to eliminate use of long spinal boards (LSBs) for spinal immobilization, yet many agencies still carry and use them for operational efficiencies such as patient lifting, extraction, transfer, etc. We sought primarily to determine the reasons that patients with acute traumatic spinal cord injury (SCI) were placed on LSBs, and secondarily, the reasons LSBs were not removed before transport. Methods: This retrospective observational study included encounters from a state EMS database (660,084) matched to hospital discharge data between 1/1/2013 and 6/30/2015, linkage rate 86% (567,719). After removing duplicate records, cases from agencies who implemented a protocol to reduce/eliminate LSB use were identified (cases occurring after an agency specific protocol implementation date plus a three-month run-in period). From this cohort, patients with SCI on hospital discharge (ICD-9 codes 806.x or 952.x) were identified. Using a qualitative methodology, two independent reviewers determined the most likely reasons why patient placed on LSB, and why the LSB was not removed for EMS transport. Analyzed using simple descriptive statistics. Results: For this study, 131 unique cases of SCI were identified and 82 excluded: LSB not used (38), non-traumatic (7), unable to determine method of immobilization or reason for immobilization (33), or inter-facility transport (4). From 49 cases included, the most common reasons for LSB placement were: ease of lifting (63%), placed by non-transporting agency (18%) and extrication (16.3%). High suspicion of spinal cord injury was determined as the primary or secondary reason for not removing LSB in 63%, followed by multiple transfers required (20%), and critical illness (10%). In 26% of cases, there was not a clear reason for maintaining full spinal precautions throughout transport. Conclusions: Among a group of patients with acute traumatic SCI, prehospital providers commonly used LSBs for extrication and lifting. After transfer of the patient to an EMS gurney, high suspicion of SCI was the most common
reason for continued use of the LSB. EMS educators and medical directors should consider including specific educational content to address these factors when implementing a protocol that aims to reduce or eliminated LSB use.

70. CAN A SUB-PERFECT GLASGOW COMA SCALE MOTOR SCORE (GCS-M) REPLACE THE CDC FIELD TRIAGE GUIDELINE (FTG) PHYSIOLOGIC CRITERIA IN CHILDREN?

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CATEGORY OF SUBMISSION: TRAUMA

Background: Applying the physiologic criteria of the CDC FTGs may be cumbersome in pediatric trauma patients, and is dependent upon vital signs and GCS scores which are infrequently documented. It has been reported that a sub-perfect GCS-M performs similarly to total GCS score in predicting severe injury in adults and may simplify prehospital triage. We aimed to determine if the GCS-M would perform similarly in pediatric patients, and sought to evaluate the predictive value of GCS-M when compared to the remaining components of the CDC FTG physiologic criteria. Methods: We conducted a retrospective review of the National Trauma Data Bank (NTDB) (2006-2012) to identify pediatric patients, ages 1-17 years old, with GCS≤13 and compare them to those with GCS-M <6 for select trauma outcomes (total mortality, hospital admission, need for ICU care, and need for operative intervention). For the same outcomes, we compared GCS-M <6 to the systolic blood pressure <90mmHg (SBP) and respiratory rate (10<RR<29 or need for ventilatory support) of the physiologic criteria. We performed descriptive statistics and calculated sensitivities and specificities to derive the area under the receiver operation characteristic curve (AUC). Similar to prior studies, we decided a-priori that a difference of <5% was clinically insignificant. Results: GCS-M <6 performs similarly to total GCS ≤13 in predicting the select outcome measures, with relative differences of less than 5% for AUC (Δ in AUC ranged from 0.002 to 0.017). In comparison to SBP, GCS-M<6 also performed similarly for total mortality, admissions, and
need for ICU care (Δ AUC 0.0028-0.0317). However, SBP performed notably better than GCS-M <6 in predicting the need for operative intervention (Δ AUC 0.0723). GCS-M <6 had similar predictive value when compared to the respiratory criteria of the FTG (Δ AUC 0.0002 - 0.0274). Conclusions: GCS-M <6 has similar predictive value as the individual components of the physiologic criteria of the CDC FTGs for select trauma outcomes in children. GCS-M may serve as a binary tool to simplify prehospital triage for injured children.

71. EMERGENCY PHYSICIAN TELEHEALTH: PREDICTING ALTERNATE TRANSPORT IN EMS
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Background: Emergency Medical Services (EMS) dispatch systems engage algorithms to process patient information to methodically direct the appropriate response/resource to medical emergencies. Traditionally, EMS dispositions; patient treatment and transport decisions are established by the medic patient assessment, system protocols and off-line medical direction. Conversely, prehospital telehealth utilizes emergency physicians to assess and determine patient disposition. At present, a scarcity of research exists regarding EMS dispatch codes linkage with emergency physician telehealth patient dispositions. The aim of this study was to identify EMS dispatch complaints codes associated with alternate transport of Emergency Telehealth and Navigation (ETHAN) dispositions. Methods: We conducted a retrospective review of consecutive EMS patients triaged by telehealth emergency physicians in a major metropolitan urban fire-based EMS system from December 2014 through June 2018. Telehealth technology exists on all EMS units; accordingly, medics complete a patient assessment and determine ETHAN criteria. If eligible, the medic transfers the ePCR and contacts the physician, who accesses the patient via real-time video/voice conferencing and determines the appropriate disposition. All cases where the ETHAN protocol was employed were abstracted from the ePCR system. Those
complaint codes in which 90% of patients were dispositioned for alternate transport (taxi cab, self -
transport or no transport) were recorded. Descriptive statistics describe study characteristics and a 95%
confidence interval was calculated for telehealth alternate transport dispositions. **Results:** During the
study period 18,235 patients within 72 distinct dispatch complaint codes encountered the ETHAN
protocol. We identified and recorded 12,323 patients among 44 dispatch complaint codes that met our
definition. Of those, 91% (95% CI 91% to 92%) patients were dispositioned by emergency physicians for
alternate transport. Moreover, the mean physician talk-time was 5.2 minutes and these patients were
exclusive to 12 dispatch complaint codes. The mean age was 44 years (range 1-99 years), 52% were
female and no patient adverse events were reported. **Conclusions:** In this population, emergency
physician led telehealth alternate transport dispositions were significantly associated with EMS dispatch
complaint codes. Further research is warranted to understand if these ePatient telehealth codes could
be integrated into the dispatch phase of EMS systems with tiered responses.

72. PAIN ASSESSMENT AND ANALGESIA IN PEDIATRIC TRAUMA PATIENTS DURING HELICOPTER
EMERGENCY MEDICAL SERVICES (HEMS)

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Medicine*

**CATEGORY OF SUBMISSION:** PEDIATRIC

**Background:** Pediatric trauma patients transported by EMS rarely have their pain assessed and few
receive analgesia. In 2014, protocol changes were implemented in a local HEMS service that included
didactic training for pediatric analgesia, the addition of the Wong-Baker and FLACC scales for pain
assessment, and standing orders for opioid pain medication without medical consultation. The aim of
this study is to assess whether these protocol changes have improved prehospital pain assessment and
analgesic administration to pediatric trauma patients. **Methods:** We reviewed patient records two years
before and after the date of protocol change. Inclusion criteria consisted of transportation via HEMS,
age ≤15 years, and a chief complaint of traumatic injury. Exclusion criteria included allergies to any opioid, intubation, and hypotension, defined as a maximum systolic blood pressure <70 + 2 (age). The primary outcome was a reduction in pain score while secondary outcomes included changes in proportion of pain assessments and of patients receiving an opioid. Results: A total of 534 pediatric patients with traumatic injuries were transported via HEMS before protocol change and 491 after change. Pain assessment occurred in 252/483 (52.2%) of eligible patients before protocol change and 283/454 (62.3%) after change (p=0.002). Of patients who had any pain assessment ≥ 5, administration of an opioid occurred in 62/76 (81.6%) before protocol change and 80/91 (87.9%) after change (p=0.253). Of patients who had any pain assessment ≥ 5, a final pain score <5 was present in 56/80 (70.0%) before protocol changes and 75/92 (81.5%) after changes (p=0.077). Of patients with any non-zero pain score, 87/160 (54.4%) of patients had a reduction in pain score ≥ 1 prior to the protocol change and 97/177 (54.8%) after the change (p=0.937). Conclusions: The 2014 protocol changes are associated with an increased incidence of pain assessment in pediatric trauma patients but did not significantly affect the incidence of opioid administration, final pain score, or the proportion of patients with an improved pain score. Further changes to protocols are warranted to address oligoanalgesia in this population.

73. PRELIMINARY EVALUATION OF THE AMERICAN HEART ASSOCIATION TERMINATION OF RESUSCITATION CRITERIA IN THE PEDIATRIC POPULATION USING THE CARDIAC ARREST REGISTRY TO ENHANCE SURVIVAL

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CATEGORY OF SUBMISSION: PEDIATRIC

Background: Survival for patients with out-of-hospital cardiac arrest (OOHCA) is known to vary widely across patient ages, with the lowest in infants <1 year of age. The American Heart Association (AHA) BLS and ALS guidelines for field termination of resuscitation (FTOR) are not recommended for pediatric
patients. We sought to compare the accuracy of variants of these FTOR models in identifying pediatric OOHCA patients who do not survive. **Methods:** The Cardiac Arrest Registry to Enhance Survival (CARES) identified 4,623 OOHCA patients under the age of eighteen years, from a sample of 174,009 OOHCAs. We applied three variants of AHA FTOR criteria: (BLS1) Arrest unwitnessed by EMS, no return of spontaneous circulation (ROSC) and no defibrillation; (BLS2) Unwitnessed arrest, no ROSC, and no defibrillation; and (ALS) Unwitnessed arrest, no bystander CPR, no ROSC, and no defibrillation. CARES records whether sustained ROSC was achieved, which was used as a surrogate for ROSC in the AHA criteria models. The positive predictive value (PPV) was calculated for each set of FTOR criteria, along with the percentage and number of patients reported who met each model but survived to discharge. The data was analyzed in the following inclusive age groups: <1 year, 1-7 years, 8-12 years, and 13-17 years old. **Results:** When applying the three models across these age groups, BLS2 in <1-year-old group has a PPV of 0.992 (95% CI 0.987 to 0.996; 0.8% left behind [14/1,817]) and ALS in <1-year-old group has a PPV of 0.994 (95% CI 0.987 to 0.998; 0.6% left behind [6/1,000]). All other models and pediatric age ranges were associated with ≥1% survival. When applied to the <1-year-old group, 69.4% of the BLS2 group and 38.2% of the ALS group would have been candidates for FTOR by the criteria, compared to 31.3% and 18.4% respectively for adults. **Conclusions:** More pediatric patients meet criteria for FTOR than adults, but the ALS FTOR criteria applied to patients <1 year of age was the only model and age range that predicted less than 1% survival. This study ignores the emotional impact of FTOR in children, which has important implications.

74. PARAMEDICS PROVIDING PALLIATIVE CARE AT HOME: A RETROSPECTIVE COHORT COMPARING SYMPTOM MANAGEMENT OF BREATHLESSNESS AND PAIN IN CANCER VERSUS NON-CANCER CONDITIONS
Background: In Nova Scotia, under the Paramedics Providing Palliative Care program, paramedics can now manage symptom crises in patients with palliative goals of care and often at home without the need to transport to hospital. Growing recognition that non-cancer conditions benefit from a palliative approach is expanding the program. Our team previously found treatment of pain and breathlessness is not optimized, pain scores are underutilized, and paramedics were more comfortable (pre-launch) with a palliative approach in cancer versus non-cancer conditions. Our objective was to compare symptom management in cancer versus non-cancer subgroup. Methods: We conducted a retrospective cohort study. The Electronic Patient Care Record and Special Patient Program were queried for patients with palliative goals from July 1, 2015 to July 1, 2016. Descriptive analysis was conducted and results were compared with a t-test and Bonferroni correction (alpha= p<0.007). Results: 1909 unique patients; 765/1909 (40.1%) cancer and 1144/1909 (59.9%) non-cancer. Female sex: cancer 357/765 (46.7%), non-cancer 538/1144 (47.0%). Mean age cancer: 73.3 (11.65), non-cancer 77.7 (12.80). Top non-cancer conditions: COPD (495/1144, 43.3%), CHF (322/1144, 28.1%), stroke (172/1144, 15.0%) and dementia (149/1144, 13.0%). Comorbidities for cancer patients (range): 0 to 3; non-cancer 0 to 5. Most common chief complaint (CC) for cancer and non-cancer: respiratory distress, 10.8% vs 21.5%. Overall, no difference in proportion treated cancer vs non-cancer, 11.5% vs 10.1%, p=0.35. Some difference in individual therapies: morphine 83/765 (10.8%) vs 55/1144 (4.8%), p<0.001, hydromorphone 9/765 (1.2%) vs 2/1144 (0.2%), p=0.014, salbutamol 38/765 (5.0%) vs 5/1144 (0.4%), p<0.001 and ipratropium 27/765 (3.5%) vs 134/1144 (11.7%), p<0.001, in addition to any support with home medication which is not queriable. Pre-treatment pain scores were documented more often than post-treatment in both groups [58.7% vs 25.6% (p<0.001), 57.4% vs 26.9% (p<0.001)]. Conclusions: Non-cancer patients represent an important proportion of palliative care calls for paramedics. Cancer and non-cancer
patients had very similar CC and received similar treatment, although low proportions, despite pre-
launch findings that non-cancer conditions were likely to be undertreated. Pain scores remain
underutilized. Further research into the underlying reason(s) is required to improve the support of non-
cancer patients by paramedics.

75. PATIENT RISK OF REFUSAL BASED ON DISPATCH COMPLAINT: A RETROSPECTIVE ANALYSIS

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SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

Background: Patients who refuse emergency department (ED) transport after emergency medical
service (EMS) dispatch represent a significant risk to EMS systems. Current EMS literature has shown
varying results regarding the characteristics and demographics of patients who refuse EMS care. The
purpose of this study was to identify and explore the current demographics and characteristics of
patients who refuse EMS transport. Methods: The Delaware EMS activation database for 2017 was
retrospectively reviewed. Logistic regression analysis was used to evaluate patient characteristics on
likelihood of decision for transport. Results: Delaware EMS responded to 113,879 incidents in 2017 with
108,249 (95%) having complete information for analysis. In the cases analyzed there were 9,730 refusals
of transport (9%). There was weak correlation (r<0.1) for age, gender, and season. The most common
dispatch complaints when transport was refused was Traffic Accident (16.7%), Falls (16.4%), Sick Person
(10.6%) and Diabetic Problem (8.2%). With logistic regression analysis compared to Sick Person the
highest odds of refusal were Fuel Spill Odor (OR=86.44; 95%CI 9.83-760.25), Strange Odor (OR=48.63;
95%CI 11.70-202.17), Gas Leak (OR=29.90; 95%CI 11.69-76.51) and Water Rescue (OR=21.56; 95%CI
8.33-55.82). Most common EMS provider primary impression for patients who refused transport were
No Apparent Injury (27.3%), Pain (11.1%), Other (11.0%) and Hypoglycemia (5.6%). Logistic regression
showed highest primary impression odds of refusal were Patient Assist (OR=17.11; 95%CI 9.56-30.61), Hypoglycemia (OR=10.16; 95%CI 7.75-13.31) and No Injury (OR=5.35; 95%CI 4.19-6.83). Conversely the most common dispatch complaints for transported patients were Sick Person (19.1%), Transfer (12.4%), Breathing Problem (10.3%) and Falls (8.4%) with provider impressions of Fracture (OR=26.90; 95%CI 10.96-66.05), Burns (OR=18.10; 95%CI 3.57-91.85) and GI Bleed (OR=16.85; 95%CI 3.32-122.42).

**Conclusions:** Refusal of transport of patient remains a varied group and represents risk exposure to the EMS system. The most common dispatch complaint that resulted in refusal was traffic accidents. But the highest odds for refusal based on logistic regression analysis of dispatch complaint were related to odor and smell complaints. The highest odds of refusal were EMS impressions of no injury, pain, and hypoglycemia. Further study should be conducted into refusal patterns that may affect resource allocation and utilization.

76. **DIFFERENTIAL EFFECTS OF PREHOSPITAL HYPOTENSION AND INJURY SEVERITY IN ISOLATED VERSUS MULTISYSTEM MAJOR TRAUMATIC BRAIN INJURY**

**Daniel Spaite, Chengcheng Hu, Bentley Bobrow, Bruce Barnhart, Vatsal Chikani, Joshua Gaither, Kurt Denninghoff, Amber Rice, Samuel Keim, The University of Arizona**

**CATEGORY OF SUBMISSION:** TRAUMA

**Background:** In hospital-based studies, hypotension (HT, SBP <90) is more likely to occur in multisystem traumatic brain injury (MTBI) than isolated (ITBI). However, there are few EMS studies on this issue. Hypothesis: Prehospital HT is associated with differential effects in MTBI and ITBI and these effects are influenced by the severity of primary brain injury. **Methods:** Inclusion: TBI cases in the EPIC Study (NIH 1R01NS071049) before TBI guideline implementation (1/07-3/14). ITBI: Major TBI cases (CDC Barell Matrix Type 1) that had no injury with ICD9-based Regional Severity Score [RSS (AIS equivalent)] ≥3 in any other body region. MTBI: Type 1 TBI plus at least one non-head region injury with RSS ≥3. **Results:** Included were 13,435 cases [Excl: age <10 (5.9%), missing data (6.2%)]. 10,374 (77.2%) were ITBI, 3061
(22.8%) MTBI. Mortality: ITBI: 7.7% (797/10,374), MTBI: 19.2% (587/3061, p<0.0001). Prehospital HT occurred 3.5 times more often in MTBI (14.8%, 453/3061 vs 4.2%, 437/10,374; p<0.0001). Among HT cases, 40.8% (185/453) with MTBI died vs 30.9% with ITBI (135/437; p<0.0001). In the hypotensive moderate/severe TBI cohort (RSS-Head 3/4), MTBI mortality was 2.4 times higher (17.2%, 40/232) than ITBI (7.1%, 17/240, p=0.001). However, in the hypotensive very/extremely severe TBI group (RSS-Head 5/6), mortality was almost identical in MTBI (73.4%, 141/192) and ITBI (72.1%, 116/161, p=0.864).

**Conclusions:** Among major TBI patients with prehospital HT, those with MTBI were much more likely to die than those with ITBI. However, this association varied dramatically with TBI severity. In mod/severe TBI cases with HT, MTBI mortality was 2.4 times higher than in ITBI. In contrast, in very/extremely severe TBI with HT, there was no identifiable mortality difference. Thus, in cases with substantial potential to survive the primary brain injury (mod/severe), outcome is markedly worse in patients with multisystem injuries. However, in very/extremely severe TBI, non-head region injuries have no apparent association with mortality. This may be because the TBI is the primary factor leading to death in these cases. The main EPIC study is evaluating whether this severity-based difference in “effect” has implications for TBI guideline treatment effectiveness.

77. OPPORTUNITIES FOR EMERGENCY MEDICAL SERVICES INTERVENTION AND PREVENTION OF OPIOID OVERDOSE MORTALITY

**Elizabeth Herman Barefoot, Julianne Cyr, Jane Brice, Michael Bachman, Jefferson Williams, Jose Cabanas, University of North Carolina, Department of Emergency Medicine**

**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** The opioid crisis is a growing cause of mortality in the United States and may be mitigated by innovative approaches to identifying individuals at-risk of fatal opioid overdose. We examined Emergency Medical Services (EMS) utilization among a cohort of individuals who died from opioid
overdose in order to identify opportunities for intervention. **Methods:** Individuals who died of unintentional opioid overdose in a large North Carolina (NC) county between 01/01/2014 and 12/31/2016 were studied in a retrospective cohort. Death records obtained from North Carolina Vital Records were linked to EMS patient care records obtained from the county EMS system to determine the number of encounters each decedent had with EMS in the year preceding their death. Patient demographics and EMS encounters were analyzed to identify encounter types that may be targeted for intervention. Chi-square tests were used to evaluate the statistical significance of differences in group proportions. **Results:** Of the 218 individuals who died from unintentional opioid overdose in the study interval, 30% (n=66) utilized EMS in the year before their death and 17% (n=38) had at least one EMS encounter with documented drug or alcohol use (i.e. "drug-related encounter"). The mean age at death was 38 (range 19-74) years, 30% were female, 89% were White, and 8% were Black/AIDS American. Factors associated with higher incidence of EMS utilization included age, gender, and race. Decedents aged 55-65 had the highest EMS utilization (47%) and patients aged <25 and 25-35 had more drug-related EMS encounters (29% and 20%, respectively). The most common reasons for EMS utilization were "other medical" (27%), "non-traumatic pain" (20%), "traumatic injury" (16%), and "poisoning/drug ingestion" (14%). Drug or alcohol use was documented by EMS in 33% of all encounters and an opioid prescription was reported in 22% of encounters. **Conclusions:** Nearly one-third of individuals who died from accidental opioid overdose utilized EMS in the year before their death and nearly one-fifth had a drug-related encounter. EMS encounters may present an opportunity to identify a substantial percent of individuals at-risk of fatal opioid overdose and, ultimately, reduce overdose mortality.

78. IMPLEMENTATION OF A MEDICAL AMNESTY/GOOD SAMARITAN POLICY BY A LARGE PUBLIC UNIVERSITY IS NOT ASSOCIATED WITH AN INCREASE IN EMERGENCY MEDICAL SERVICES (EMS) ALCOHOL RELATED PATIENT ENCOUNTERS
Background: Excessive and underage alcohol consumption on U.S. college campuses is a significant problem despite systematic interventions. One environmental level strategy to reduce alcohol-related harm is the Medical Amnesty/Good Samaritan (MAGS) policy which eliminates sanctions against students seeking help when concerned about danger of serious harm or death from alcohol use promoting prompt medical evaluation and transport. The goal of this study is to determine if there was an increase in alcohol related Emergency Medical Services (EMS) call volume associated with implementation of a MAGS policy at a large public university campus. Methods: This retrospective review was conducted using patient care records (PCRs) from a collegiate EMS agency responding exclusively to on-campus 911 calls. Based on changes in dispatch method and agency response zone, only call data from 23 recognized undergraduate residence halls was analyzed. The incidence of total and alcohol related 911 calls were compared between one academic year (AY) prior to (pre-MAGS, AY2015) and two years after MAGS implementation (post-MAGS, AY2016/17). Total 911 call volume was based on the number of PCRs generated. Alcohol related 911 call volume was based on PCRs which included a primary or secondary impression of "Alcohol, Alcohol Intoxication, or Alcohol Ingestion" or a call in which the patient explicitly admitted to alcohol use. Relative risk (RR) with 95% confidence Intervals (CI) [Stata 15 (College Station, Texas)] were used to describe the results. Results: Over the three year study period, 706 PCRs were generated and none excluded as all were complete. There were 221 pre-MAGS and 485 post-MAGS total 911 calls during AY2015 and AY2016/17 respectively. There were 115 (52.0%) pre-MAGS and 238 (49.1%) post-MAGS alcohol related 911 calls during AY2015 and AY2016/17 respectively. RR 0.94 (95% CI 0.81-1.10; P=0.465). Conclusions: Implementation of a MAGS policy eliminating sanctions against students when concerned about alcohol related harm was not
associated with a significant change in the number of alcohol related 911 calls from undergraduate residence halls at a large public university. Further research evaluating the effectiveness of MAGS policy interventions to see if this improves student safety and increases EMS system utilization is indicated.

79. EVALUATING THE IMPLEMENTATION OF A NEW T-CPR PROTOCOL IN AN URBAN 911 DISPATCH CENTER

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Background: More than 350,000 people experience out of hospital cardiac arrest (OHCA) each year in the United States (US). The average survival rate in the US is about 10.6%. Survival rate can improve up to 20% in communities with strong bystander cardiopulmonary resuscitation (CPR). The American Heart Association has a Class 1 recommendation of initiating Telephone-CPR (T-CPR) for unresponsive patients who are not breathing normally. This study aims to describe the frequency of correctly identified cardiac arrest (CA) cases in a 911 Dispatch Center before and after implementation of a new T-CPR protocol.

Methods: This is a retrospective analysis of a 911 Dispatch Center type code entry over a 30 month period. The Dispatch Center is a 2nd public safety answering point for 14 fire agencies. The new T-CPR protocol consisted of asking the reporting party if the patient was "conscious" and if patient was "breathing normally". If answer was "no" to both questions in such order, 911 dispatch assisted hands only CPR would proceed. CA chief complaint incidents were obtained from electronic patient care records obtained from the field. CA cases were compared to dispatch call type codes 12 months prior to protocol implementation and 18 months after. Descriptive data is presented in proportions, with corresponding p-value and 95% CI from chi-square analysis. Results: A total of 1,460 cardiac arrest cases were analyzed during the study period. Out of the 564 CA cases before protocol implementation, 46%
55% (490/896) were correctly identified by dispatch. This is an improvement by 9%. (p=0.0008 [95% CI 3.73 to 14.19]). The most commonly missed type code prior to protocol implementation was "Unconscious" at 42% (128/307), followed by "Breathing Difficulty" at 20% (60/307), and "Fall" at 3% (9/307) compared to "Unconscious" at 40% (162/406), followed by "Breathing Difficulty" at 18% (72/406), and "Altered Level of Consciousness" at 7% (28/406) after protocol implementation.

Conclusions: The implementation of a new T-CPR protocol in an urban 911 Dispatch Center improved cardiac arrest identification by 911 dispatchers.

80. WHAT ARE THE ETIOLOGIES OF CHEST COMPRESSION PAUSES DURING OUT-OF-HOSPITAL CARDIAC ARREST RESUSCITATION?

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CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Frequent and prolonged pauses in chest compressions have been shown to contribute to poor outcomes in out-of-hospital cardiac arrest (OHCA). The objective of this retrospective observational study was to characterize the frequency, reasons, and duration of pauses in chest compressions. Methods: OHCA audio recordings, ECG rhythm, and impedance chest compression data were captured using either the LIFEPAK 500 (AED) and/or LIFEPAK 12/15 defibrillator (Physio-Control). All OHCA patients who received chest compressions from Seattle Fire Department between 2007-2015 were included. Variables collected included CPR start time, CPR stop time, and compression pause duration. Pauses greater than 1 second were classified into categories based on interpretation of audio recordings. Results: We analyzed 26,858 pauses from 3,243 OHCA patients between 1/2007 and 12/2015. Among all pauses ≥1 s, median pause duration decreased from 14 s (IQR 8-23 s) in 2007 to 7 s
(IQR 5-11 s) in 2015. Among all pauses ≥10 s, median pause duration decreased from 20 s (IQR 15-28 s) in 2007 to 15 s (IQR 12-21 s) in 2015. The median total pause duration per case decreased from 110 s (IQR 52-195.5 s) in 2007 to 72 s (IQR 38-123 s) in 2015. Pauses for combined rhythm-check and pulse-check accounted for 29.7% of total pause time, with an overall median pause duration of 9 s (IQR 6-14 s). Other significant pause etiologies included AED analysis (18 s, 13-24 s), intubation (18 s, 10-33 s), moving the patient (12 s, 7-21 s), and defibrillation (5 s, 4-7 s). Conclusions: Median pause duration of all pauses ≥1 s decreased by 50% from 2007-2015. Combined rhythm-check and pulse-check was the most common pause etiology. Limitations include the lack of data generalizability due to a retrospective analysis of a single EMS system. Strengths include that the reasons for pauses were abstracted from audio recordings of the resuscitation efforts. Shortening pauses of common etiologies should continue to be a focus of rescuer education and quality improvement.

81. SUPRAGLOTTIC AIRWAY DEVICES VARIABLY GENERATE NEGATIVE INTRATHORACIC PRESSURES DURING AUTOMATED CARDIOPULMONARY RESUSCITATION WITH AND WITHOUT AN IMPEDANCE THRESHOLD DEVICE

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Background: Negative intrathoracic pressure (ITP) during the decompression phase of cardiopulmonary resuscitation (CPR) is essential to refill the heart, lower intracranial pressure, maintain coronary and cerebral perfusion, and improve survival. Human studies have shown an impedance threshold device (ITD) lowers ITP during CPR when ventilating through an endotracheal tube (ETT). Based on the assumption that the more negative the decompression phase ITP, the better the airway seal, the hypothesis was some supraglottic airway (SGA) devices do not seal the airway as well the standard ETT.
**Methods:** Airway pressures (AP) were measured as a surrogate for ITP in 7 recently deceased human cadavers (3F, 4M) of varying body habitus. CPR was performed with an automated CPR device (LUCAS2) with and without an ITD-16 (ResQPOD16), which impedes inflow of air. Positive pressure ventilation was delivered through an ETT and 5 SGA devices (Combitube, King LT-D, LMA Protector, Air-Q LMA, i-gel), tested in a randomized order, at a rate of 10 breaths/min, with tidal volume 600 ml with a compression: ventilation rate of 10:1. The primary outcome was comparison of the decompression AP generated by the ETT to the decompression AP generated by each SGA device. **Results:** With an ETT, APs (mmHg) were -0.3 ± 0.4 without the ITD-16 and -9.6 ± 1.0 with the ITD-16 during decompression (p<0.001). ETT comparison to the SGA devices was as follows: -7.7 ± 3.5 with LMA Protector (p=0.19), -6.8 ± 3.3 with Air-Q LMA (p=0.05), -6.4 ± 2.9 with i-gel (p=0.02), -3.1 ± 2.5 King LTS-D (p<0.001), and -2.6 ± 1.7 for the Combitube (p<0.001). **Conclusions:** In human cadavers undergoing automated CPR, the ITD-16 was required to generate significant negative ITP. The magnitude of the ITD effect on AP was similar to prior reports in patients during CPR. The ability to generate a seal with different SGAs with the ITD-16 varied. The LMA protector, i-gel, and Air-Q LMA generated decompression AP relatively similar to the ETT whereas the APs with the King and Combitube were significantly worse. These differences in SGAs should be considered when attempting to optimize cardiac arrest outcomes.

82. **DEEP SEDATION IS ASSOCIATED WITH INCREASED MORTALITY IN MECHANICALLY VENTILATED AIR TRANSPORT PATIENTS: A COHORT STUDY**

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**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** Intubated patients with acute respiratory failure are commonly transported by air ambulance and require sedation for mechanical ventilation. Prior work has shown that depth of
sedation influences ventilation duration, delirium, and survival among critically ill adults. These relationships have not been tested in the prehospital environment. The primary objective of this study is to measure the relationship between air ambulance sedation during transfer and patient outcomes.

**Methods:** A retrospective cohort study of mechanically ventilated patients transferred by air ambulance to a single 812-bed Midwestern academic medical center from July 2013 to May 2018. Prehospital sedation medications and depth of sedation [Richmond Agitation-Sedation Scale score (RASS)] were investigated. Primary outcome was delirium. Secondary outcomes were lengths of hospital stay and mechanical ventilation, in-hospital mortality, and need for neurosurgical procedures. Univariate analyses were used to measure the association between sedatives (and drug combinations) and clinical outcomes. Multivariable models adjusted for potentially confounding covariates to measure the impact of predictors on delirium and mortality. **Results:** Three hundred twenty-seven patients were included. Amongst those patients, 156 (47.7%) received benzodiazepines, 155 (47.4%) received opiates, 90 (27.5%) received long-acting paralytics, 77 (23.5%) received propofol, and 25 (7.6%) received ketamine. No association existed between any medication and development of delirium. Benzodiazepines were associated with a mean increase of 2.9 days in the hospital (95% CI, 0.7-5.1). In multivariable modeling, for every one-unit increase in prehospital RASS score (e.g. -4 to -3), there was a 24% decrease in odds of death (OR, 0.76; 95% CI, 0.65-0.90); for every one-unit increase in emergency department (ED) RASS score, there was a 43% decrease in odds of death (OR, 0.57; 95% CI, 0.41-0.79). Delirium was not associated with prehospital or ED RASS scores. **Conclusions:** Benzodiazepines were the most commonly administered prehospital sedative and are associated with increased hospital length-of-stay. Deep sedation in both the prehospital and ED settings was associated with increased mortality. Sedative administration during air transport is a modifiable risk factor and requires prospective study.
VALIDATION OF AMERICAN HEART ASSOCIATION TERMINATION OF RESUSCITATION CRITERIA AND COMPARISON TO SHIBAHASHI CRITERIA IN A UNITED STATES OUT-OF-HOSPITAL CARDIAC ARREST POPULATION

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CATEGORY OF SUBMISSION: CARDIAC

Background: The American Heart Association (AHA) guidelines contain BLS and ALS criteria for field termination of resuscitation (FTOR). Shibahashi recently proposed new FTOR criteria for adult patients that are more objective than the AHA criteria and do not require an attempt at resuscitation prior to application. We sought to compare the accuracy of these FTOR models in identifying out-of-hospital cardiac arrest (OOHCA) patients who did not survive to hospital discharge.

Methods: The Cardiac Arrest Registry to Enhance Survival (CARES) was used to identify 169,386 adult OOHCA patients. We applied three variants of AHA FTOR criteria: (BLS1) Arrest unwitnessed by EMS, no return of spontaneous circulation (ROSC) and no defibrillation, (BLS2) Unwitnessed arrest, no ROSC, and no defibrillation, and (ALS) Unwitnessed arrest, no bystander CPR, no ROSC, and no defibrillation. Additionally, Shibahashi FTOR criteria were applied: age ≥73 years, unwitnessed arrest, and non-shockable initial rhythm. CARES records whether sustained ROSC was achieved, which was used as a surrogate for ROSC in the AHA criteria models. The Positive predictive value (PPV) was calculated for each set of FTOR criteria, along with the percentage and number of patients reported who met each model but survived to discharge.

Results: BLS1 criteria demonstrated a PPV of 0.996 (95% CI 0.996 to 0.996) with respect to identifying those who would not have survived to hospital discharge, with a "left behind" rate of 0.4% [304/75,223]. BLS2 criteria demonstrated a PPV of 0.997 (95% CI 0.997 to 0.998; 0.3% left behind [144/53,003]). ALS criteria demonstrated a PPV of 0.997 (95% CI 0.996 to 0.997; 0.3% left behind [101/31,179]). Finally, the Shibahashi criteria have a PPV of 0.984 (95% CI 0.982 to 0.992; 1.6% left behind [341/21,181]). The percentage of patients that meet criteria for each model for FTOR are 44.4% for BLS1, 31.3% for BLS2,
18.4% for ALS, and 12.5% for Shibahashi. **Conclusions:** The AHA FTOR criteria are associated with fewer survivors left behind and identify more candidates for FTOR than the Shibahashi criteria. BLS1 criteria have the most opportunity for FTOR, while Shibahashi criteria identified a modest number of patients for which resuscitation need not be initiated.

84. **PERFORMING RAPID SEQUENCE INTUBATION EN ROUTE VIA HELICOPTER IS ASSOCIATED WITH LOWER INTUBATION SUCCESS**

Daniel Davis, David Olvera, David Stuhlmiller, Allen Wolfe, *Air METHODS Corporation* CATEGORY OF SUBMISSION: MEDICAL

**Background:** The most appropriate location to attempt an advanced airway in the prehospital setting has been a topic of discussion for many years. The purpose of this study is to explore intubation success for air medical flight crews during helicopter transport. **Methods:** This was a retrospective observational review of all patients requiring rapid sequence intubation (RSI) in the prehospital setting with a national air medical transport company. After completion of a flight, the crew completed an airway continuous quality improvement (CQI) form documenting multiple aspects of the procedure. For this analysis, all patients undergoing RSI by air medical providers were included. Patients in whom the RSI procedure was performed en route via helicopter were compared to other patients with regard to intubation success (overall success, first attempt success, and first attempt success without oxygen desaturation). Multivariate logistic regression was used to explore the association between RSI performance en route via helicopter and intubation success after adjusting for multiple co-variables (traumatic mechanism, age, gender, and anticipation of a difficult airway based on HEAVEN criteria (Hypoxemia, Extremes of size, Anatomic difficulties, Vomit/blood/fluid in the airway, Exsanguination, Neck mobility issues). **Results:** A total of 8,861 RSI patients were included with an overall intubation success rate of 97%. A total of 674 (7.6%) underwent the procedure en route via helicopter, with lower overall intubation success vs. other
patients (94.7% vs. 97.3%, p<0.001) but similar first attempt success (89.8% vs. 91.3%, p=0.171) and first attempt success without desaturation (88.1% vs. 89.3%). Patients undergoing RSI en route via helicopter had fewer HEAVEN predictors of a difficult airway (0.88 vs. 1.15, p<0.001). After adjusting for multiple co-variables, performing RSI en route via helicopter was associated with lower overall intubation success (OR 0.34, 95% CI 0.23-0.50, p<0.001), first attempt success (OR 0.64, 95% CI 0.49-0.84, p=0.0011), and first attempt success without desaturation (OR 0.68, 95% CI 0.53-0.88, p=0.0032). **Conclusions:** Performing RSI en route via helicopter is associated with lower intubation success rates. Air medical providers appear to appropriately select patients with fewer difficult airway predictors for RSI en route, with similar first attempt intubation success rates as a result.

85. CASE SERIES ILLUSTRATING ADVERSE REACTIONS TO PREHOSPITAL ADMINISTRATION OF LOW DOSE KETAMINE FOR PAIN CONTROL

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**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** Expanding the list of medications available for the management of pain in the prehospital setting is critical. Sub-dissociative dose ketamine is one alternative. However, in the prehospital setting, the risk of low dose ketamine is frequently overlooked with some large case series reporting no adverse reactions to sub-dissociative dose ketamine. The purpose of this study is to describe observed adverse reactions after prehospital administration of sub-dissociative dose ketamine. **Methods:** This was a retrospective review of prospectively collected quality improvement data from January 1 through December 31 of 2016. Ketamine was introduced into a pain management protocol, which allowed administration of 0.2mg/kg of ketamine intravenously (IV) if: the patient was allergic to morphine or pain was not adequately controlled after administration of 4mg of IV morphine. Following
administration of ketamine, the administering paramedic, and nurse at the receiving facility documented any adverse reactions. Data was then entered into a de-identified database for review. Here we report adverse reactions and correlate those reactions with high dose (≥0.2mg/kg) or low dose (≤0.2mg/kg) of ketamine. Results: Ketamine was administered to 31 patients with pain from both traumatic and medical causes. Adverse reactions were reported in 7 patients with 2 patients experiencing two adverse reactions. Adverse reactions reported included: asymptomatic hypertension (4), tachycardia (1), hallucinations (1), hypotension (1), emesis (1) and CNS depression (1). Ketamine dose ranged from 0.17mg/kg to 0.29mg/kg. Six of the 7 patients with reported adverse reactions were given a dose at or above 0.2mg/kg. Conclusions: When given at a low dose ketamine represents an attractive alternative for pain control in the prehospital setting. Although in this small study, no conclusion can be reach regarding the overall incidence of adverse reactions to prehospital sub-dissociative dose ketamine, it is important to remember that no drug is without the potential for adverse effects. When administering ketamine for pain control, EMS providers should both be aware of potential adverse reactions and balance the risk of an adverse reaction with the potential benefit of improved pain control.

86. CHARACTERISTICS OF SCENE-TRAUMA PATIENTS DISCHARGED WITHIN 24 HOURS OF AIR MEDICAL TRANSPORT

Christopher Gilliam, David Evans, Chance Spalding, Josh Burton, Howard Werman, The Ohio State University College of Medicine CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Helicopters play an important role in trauma however this service comes with safety risks, high transport costs, and downstream care charges. Our objective was to determine the characteristics of early discharged trauma patients (<24 hours length of stay) in order to reduce over-triage. Methods: Eligible patients included adult scene-trauma patients transported by helicopter to a Level I trauma
center over a two year period. Patient factors such as age, gender, loaded miles, payer source, and transportation costs were collected. Additionally trauma type, mechanism of injury, injury severity score (ISS), revised trauma score (RTS), and prehospital vital signs were documented. Driving distances between home of record to local hospital and home of record to the Level I Trauma Center were calculated. Results: 153 out of 584 total patients (26.2%) were discharged within 24 hours of helicopter transport from the accident scene to trauma center. The average age of early discharged patients was 40.46 + 15.26 with 73.9% being male. The average loaded miles was 50.51 + 14.99 with average transport charges being $27,921.19 + $3,536.61. Only 2% of patients were age 70 or older. The average vital signs were: systolic BP 138.99 + 21.77 mmHg, pulse of 92.68 + 15.45, and a RR of 17.69 + 4.80. No patient discharged within 24 hours had a prehospital systolic BP < 90 mmHg. 96% of patients sustained blunt trauma. The average ISS was 4.29 + 3.63. The median GCS was 15 with an interquartile range (IQR) of 1 and the median Revised Trauma Score was 7.84 with an IQR of zero. 21% of patients were self-pay. Finally, families typically drove 71.7 + 123.23 miles to the trauma center versus 28.74 + 40.62 to their local emergency department. Conclusions: A significant number of patients transported from the scene are discharged within 24 hours of admission to a trauma center. These patients rarely have a prehospital systolic BP less than 90 mmHg, receive more than 1000 ml of crystalloid, or are over 70 years of age. One out of five patients has no third-party coverage and assumes $27,921.19 in average transport charges.

87. ACCURACY OF PREDICTION INSTRUMENTS IN DETERMINING LARGE VESSEL OCCLUSION STROKE

Anna Cole, Sara Brown, Kaitlyn Gutwein, Fen Lei Chang, Parkview Mirro Center for Research and Innovation, IU School of Medicine CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: This study aims to assess the performance of the Cincinnati Stroke Triage and Assessment Tool (C-STAT), the National Institutes of Health Stroke Scale (NIHSS), or a combination of the two in
identifying large vessel occlusions (LVO). Stroke treatment is time-sensitive. Therefore, it is important to be able to triage patients to appropriate stroke centers based on the type of stroke. Quick and easy-to-use stroke scales may help aid EMS in their triage decision en route to the hospital. C-STAT is one of these potential prehospital stroke scales. **Methods:** This is a retrospective chart analysis, looking at patients being evaluated for stroke between January 2017-May 2018. If C-STAT scores were not recorded by EMS, they were estimated using baseline NIHSS scores upon hospital arrival. **Results:** 356 patients met the inclusion criteria. C-STAT scores were recorded or estimated for 345 patients, and NIHSS scores were recorded for 324 patients. C-STAT was shown to have a sensitivity of 58% (95% CI 45-70%) and a specificity of 80% (95% C: 76-85%). The difference between NIHSS scores of patients with an identified LVO compared to those without an LVO was statistically significant (p<0.0001). NIHSS of scores >10 had a sensitivity of 65% (95% CI 55-74%) that decreased as the cut-off score increased, and a specificity of 77% (95% CI 72-83%) that increased as the cut-off score increased. A combination of C-STAT and NIHSS did not indicate a greater ability to predict LVO. However, using a combination of gaze deviation, arm weakness, and extinction and inattention instead of the typical C-STAT item set increased sensitivity to 59% and specificity to 89%. **Conclusions:** Neither C-STAT nor NIHSS have both a high sensitivity and specificity, and are comparable to other stroke scales that have been assessed. However, there may be potential in investigating the individual items of the NIHSS, and using combinations of them to amend old scales or create a new scale that will have a greater ability to predict LVO in a prehospital setting.

88. CERVICAL SPINE MOTION OF PATIENTS DURING AMBULANCE TRANSPORT WITH TWO FORMS OF SPINAL PRECAUTIONS

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**Background:** As spinal motion restriction guidelines continue to evolve, clinically relevant evidence that is generalizable to actual trauma patients is needed. Very limited research on patient movement during ambulance transport exists to address this phase of patient care. An absence of data exists on passive, vehicle-induced versus active, patient-induced motions to stabilization. **PURPOSE:** To quantify cervical spine kinematics in patients for two types of spinal stabilization during ambulance transport arising from vehicular and patient induced motion. **Methods:** Three miniature, wireless inertial measurement units (sampling rate: 128 Hz) were attached to the head, sternum and stretcher of patients with suspected spine injuries during ambulance transport (n=9; SI=4; female=6). Patients were treated according to local guidelines, which allow for either a cervical collar (SMR) or traditional spinal immobilization (SI) with a cervical collar, head blocks, and a long spine board. **Results:** Transport durations (16.7±2.1 mins) and ambulance accelerations (0.27±0.01m/s²) did not differ between spinal precaution methods (p>.17) and compliant vs non-complaint categories (p>.58). Average cervical spine angular motion was low throughout transport (flexion/extension: 1.3±0.3°; axial rotation: 2.4±1.4°; side-flexion: 2.4±0.6°); however the maximal displacements of 17.4±3.9° of F/E, 11.6±2.6° of AR and 16.6±3.3° of SF were substantially greater. There was no difference between SI and SMR in F/E (p>.39) or AR (p>.23), however more SF was detected in SI (22.5±5°) compared to SMR (10.7±2.6°, p<.05). In calm/compliant patients, F/E (7.2±1.0°), AR (5.8±1.0°) and SF (10.6±3.3°) were substantially lower than non-compliant patients (F/E 22.2±7.3°, p<.05; AR 13.9±4.4°, p=.08; SF 18.1±5.8°, p=16). Similarly, substantial cervical spine accelerations were observed (7.5±1.8 m/s²) during transport, independent of immobilization type (p>.26). Compliant patients had lower accelerations (4.2±0.9 m/s²) than non-compliant patients (10.1±2.6 m/s²)(p<.05). **Conclusions:** This study used innovative technology to provide novel, clinically-relevant data on cervical motion in trauma patients with suspected spine injuries. Patient-induced motion may be a greater contributor to cervical spine movement than vehicle-induced motion, independent of treatment method (more restrictive treatment approaches did not appear to reduce...
movement). Future studies should investigate determinants of patient motion using larger sample sizes and a range of patient presentations.

89. PREHOSPITAL USE OF KETAMINE, MORPHINE, OR FENTANYL FOR THE MANAGEMENT OF ACUTE PAIN FOLLOWING TRAUMATIC INJURY

Jeffrey Jarvis, Lauren Curtis, Williamson County EMS CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Ketamine has shown equivalent analgesia when compared with morphine and fentanyl in hospitalized patients. In this study, we compare the analgesic effects of low-dose ketamine, fentanyl, and morphine for the treatment of acute, traumatic pain in the prehospital environment. Methods: Using a national EMS reporting platform (ESO, Austin, TX), we performed a retrospective chart review of all 911 calls answered by 883 EMS agencies between January 5, 2017 and December 31, 2017 in which patients were treated with ketamine, fentanyl, or morphine following traumatic injury. Patients included were ≥12 years old, had pain of traumatic etiology, an initial pain score of ≥ 5, at least one subsequent pain score, and received either low-dose ketamine, fentanyl, or morphine. Due to poor weight documentation, low-dose ketamine was defined as <70 mg, parenterally. Our primary outcome was differences in the proportion of patients in each group with a clinically significant reduction in pain, defined as a decrease of ≥1.3 points on the numeric rating scale. We performed a chi-square test on the binomial proportion of pain reduction. We also described changes in Glasgow Coma Scale, pulse oximetry, end-tidal CO2, systolic blood pressure, heart rate, and respiratory rate following therapy.

Results: Of 35,906 patients that met inclusion criteria, 28,738 (80.0%) received fentanyl, 6,534 (18.2%) received morphine, and 634 (1.8%) received ketamine. 84.8%, of patients in the ketamine group, 85.8%, of patients in the fentanyl group, and 83.6% of patients in the morphine group had a clinically significant reduction in pain. There was no significant difference in pain when the ketamine group was compared to
either the fentanyl group or the morphine group, but fentanyl was associated with clinically significant reduction in pain compared to morphine (p<0.0001). Median single dose of ketamine was 15 mg, fentanyl 50 mcg, and morphine 4 mg. **Conclusions:** In the prehospital setting, ketamine, compared to fentanyl and morphine, was associated with an equivalent proportion of patients with significant pain reduction. Fentanyl, compared to morphine, was associated with a larger proportion of patients with significant pain reduction. Limitations include inability to calculate weight-based doses and possibility of under-dosing of morphine.

90. EVALUATING THE IMPACT, ACCURACY AND SAFETY OF A PROTOCOL PERMITTING EMS TRANSPORT TO A FREE-STANDING EMERGENCY DEPARTMENT

Peter Antevy, Paul Pepe, Joseph Del Campo, Jorge Gonzalez, Daniel Moran, Julie Downey, Michelle Bernstein, Kenneth Scheppke, Jake Lieberfarb, Raymond Fowler, Davie Fire Rescue CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** Although free-standing emergency department (FSED) services have become commonplace in many communities, they can be inconsistent operationally with respect to relative capabilities. It was hypothesized that a data-driven protocol (and monitoring system) authorizing FSED-transport would: 1) improve "ready-for-duty" ambulance availability; and 2) delineate patients who could be safely managed in the more convenient FSED without frequent secondary transfer to traditional facilities. **Methods:** A "FSED-transport" protocol was designed by EMS and FSED team-members prior to opening a neighborhood FSED. The protocol was initiated (and closely monitored) following a one-year FSED start-up period. Data, including demographics, presenting symptoms, discharge diagnoses, dispositions and follow-up information, were collected over the ensuing 12 months of operation (07/01/17-06/30/18). **Results:** Among 625 consecutive FSED-transported patients (mean age 39 years; 55% woman; 7% of all EMS transports), common conditions included: "minor injury" (29%)
such as lacerations/vehicular collision, "musculoskeletal" complaints (22%), "neurological" symptoms (9%) such as dizziness and headache, and "altered mental status (AMS)" (9%). Of the 625, 16% (n=100) were later transferred for hospital-based admission including 42% (n=25) of AMS patients (4% of the 625 total) and 24% (n=14) of the neurological cases (2% of the 625) versus only 9% of minor injury, 6% musculoskeletal and 5% gastrointestinal cases. In follow-up reports, no patients were found to have worsened outcomes or morbidity from delayed care due to secondary transfers, but 3.2% did leave the FSED early (against medical advice) and 2.9% were referred to police and psychiatric facilities. While in-facility turn-around intervals were reduced somewhat (mean 16 min. vs. 18 min.), the total "unavailable for service" period improved substantially, largely because of closer proximity of the FSED (6.49 min. mean transport time) versus the more distant traditional receiving hospitals (10.35 min, including emergent transport cases), thus affecting both transport and return-to-territory time. **Conclusions:** Although some lower-volume conditions incurred more frequent transfers for admission, overall, the FSED-transport protocol appeared to be both feasible and safe while significantly improving EMS turnaround time. Protocol adjustments (for AMS and neurological patients in particular) have been instituted. Revised protocols will be continually monitored, refined, re-evaluated and reported.

91. CHARACTERISTICS OF VOLUNTEER COMPARED TO PAID EMS PROFESSIONALS IN THE UNITED STATES

**Rebecca Cash, Madison Rivard, Ashish Panchal, National Registry of EMTs**

**CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS**

**Background:** In many areas in the US, emergency medical response is provided by volunteer emergency medical services (EMS) and Fire organizations. However, little is known about those who serves as volunteers in EMS, especially as a main EMS job. Understanding volunteerism can help drive recruitment and retention for this subset of EMS professionals. Our objective was to compare the characteristics of nationally-certified volunteer and paid EMS professionals in the US. **Methods:** This was a cross-sectional
evaluation of EMS professionals who recertified their National EMS Certification between October 1, 2017-March 31, 2018. Workforce demographics of the National EMS Certification recertification application were used to determine volunteer status, demographics, and EMS-related characteristics. We included currently-working EMS professionals aged 18-85 years. Volunteer was defined as receiving nominal or no compensation for the provision of EMS services at an agency. We compared EMS professionals whose main EMS job was a volunteer position to those with a non-volunteer/paid position. Descriptive and comparative statistics were calculated. Results: We received 87,471 responses (response rate=82%). Of the 81,122 EMS professionals that met inclusion criteria, 10,139 (13%) volunteered at their main EMS job. The median ages (IQR) of volunteers and non-volunteers were 40 (30-52) and 36 years (29-45, p<0.001), respectively. More volunteers (38%) were female than non-volunteers (23%, p<0.001). Volunteers were mostly emergency medical technicians (EMTs) (83%), while only 48% of non-volunteers were EMTs (p<0.001). Three-quarters (74%) of volunteers reported working in rural (<25,000 people) communities compared to 31% of non-volunteers (p<0.001). More volunteers than non-volunteers provided primarily 911 response (81% vs. 65%, p<0.001). The states with the largest proportion of volunteers to any currently-working EMS professionals who recertified during the study period were Vermont (n=380/783, 49%) and North Dakota (n=411/932, 44%). Conclusions: Volunteers comprised over 10% of the EMS workforce in a sample of nationally-certified EMS professionals. More volunteers were EMTs and from rural communities than their paid counterparts. Limitations include not assessing the paying occupation of volunteer EMS professionals nor their time spent volunteering in EMS. Future work is needed to understand the regulations and policy implications that promote volunteerism in the EMS profession.

92. ESMOLOL USE FOR REFRACTORY VENTRICULAR FIBRILLATION: A PREHOSPITAL CASE SERIES
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CATEGORY OF SUBMISSION: CARDIAC

Background: There are few effective interventions for patients with out of hospital cardiac arrest beyond early defibrillation and CPR. Antidysrhythmics haven’t been shown to be any more effective for ventricular fibrillation (VF) than placebo. There is limited evidence that beta blockade may be effective for these patients. Our suburban EMS system adopted esmolol for use in VF arrests refractory to multiple dual sequence defibrillations, epinephrine, and two doses of amiodarone. Objective: Describe the characteristics of patients in refractory VF treated with esmolol. Methods: This was a retrospective case series of all patients given esmolol for persistent VF at our single suburban EMS system. All patients first received the normal course of resuscitation with epinephrine, continuous metronome-driven, "pit crew" CPR, intubation, dual sequence defibrillation, and two doses of amiodarone. An equal number of patients remaining in VF after the second dose of amiodarone who did not receive esmolol were also included as a comparison group. Two experienced paramedics reviewed each chart using a structured chart review. All discrepancies were reviewed by an additional paramedic and an EMS physician. Descriptive statistics were calculated for each group and the groups compared using an omnibus chi-square test for categorical data and student’s t-test for continuous data. Results: Between October 2017 and June 2018, thirteen patients received esmolol 500 mcg/kg bolus followed by an infusion. The median age was 68 (56, 73), 84.6% were male, 92.3% were white, 53.8% were witnessed, none had pre-arrival AED use. The initial rhythm was VF in 61.5%, asystole in 30.8%, and PEA in 7.7%. 38.5% has ROSC, 46.2% had the resuscitation terminated in the field, 46.2% were transported with CPR in progress, 30.8% died in the ED, and 1 (7.7%) was discharged alive with a CPC score of 2. There was no significant difference between the esmolol and non-esmolol groups on any variable. Conclusions: In this suburban EMS system, VF refractory to multiple doses of epinephrine, amiodarone, defibrillation, "pit crew" CPR,
and intubation was rare. The use of esmolol did not improve outcomes but it did decrease the proportion of patients transported with CPR in progress.

93. THE TIME INTERVAL BETWEEN THE R-WAVE AND MAXIMUM AORTIC PRESSURE AFFECTS CHEST COMPRESSION HEMODYNAMICS IN A SWINE MODEL OF PSEUDO ELECTRO-MECHANICAL DISSOCIATION

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CATEGORY OF SUBMISSION: CARDIAC

Background: The prevalence of pseudo electro-mechanical dissociation (P-EMD) as an initial cardiac arrest state is increasing. P-EMD manifests a weak ventricular contraction, which is not sufficient to sustain life. However, the presence of a weak ventricular contraction may lead to interference with or synergy with the blood flow generated by a chest compression depending on the time interval between the compression and ventricular contraction. HYPOTHESIS: We hypothesize that the interval between a chest compression and the ventricular contraction during P-EMD will influence the hemodynamics created by the chest compression. Methods: Using our well established hypoxic P-EMD model, we measured blood pressures and ECG during mechanical chest compression (100 CPM, 2”). A nearest-neighbor analysis determined the time interval between the R-wave and the peak aortic pressure, defined as tpeak AOP - tRwave. Peak aortic pressures that had more than one R-wave nearest neighbor were excluded. 1,497 chest compressions were analyzed. Intervals were divided into quartiles, and hemodynamic parameters were compared between the quartiles using a repeated measure ANOVA with Bonferroni correction. Results: Interval (int) quartiles were defined as: Q1: int ≥ 100 ms; Q2: 100 ms ≥ int ≥ 0.0 ms; Q3: 0.0ms ≥ int ≥ -90 ms; Q4: -90 ms ≥ int. Mean arterial pressures (MAP) in mmHg as a function of interval are: Q1: 33.8+/-0.6; Q2: 41.1+/-0.6; Q3: 38.3+/-0.6; Q4: 33.1+/-0.6. The MAP value for compressions with an interval in Q2 was higher than the other quartiles (p ≥ 0.05). Coronary perfusion pressures (CPP) in mmHg as a function of interval are: Q1: 11.7+/-0.5; Q2: 15.3+/-0.5; Q3:
15.6+/-0.5; Q4: 12.9+/-0.5. The CPP values for compressions with an interval in Q2 or Q3 was higher than the other quartiles (p ≥ 0.05). **Conclusions:** The interval between the R-wave and the peak aortic pressure generated by a chest compression has a significant effect on the resulting hemodynamics. Shorter intervals, both positive and negative are associated with improved blood pressures during resuscitation from P-EMD. These data suggest that delivery of standard CPR during P-EMD can result in a mix of effective and less effective compressions.

94. THE EFFICACY OF INTRANASAL MIDAZOLAM FOR THE TREATMENT OF PREHOSPITAL PEDIATRIC SEIZURES: A NON-INFERIORITY STUDY

**Denise Whitfield, Nichole Bosson, Amy Kaji, Marianne Gausche-Hill, Los Angeles County EMS Agency/ Harbor-UCLA Department of Emergency Medicine**

**CATEGORY OF SUBMISSION:** PEDIATRIC

**Background:** Intranasal (IN) midazolam is a rapid, painless route of administration to treat pediatric seizures. IN midazolam may be preferred in the prehospital setting if it is as efficacious as intramuscular (IM), intravenous (IV), and intraosseous (IO) administration. This study evaluated the efficacy of IN midazolam for terminating pediatric seizures in the prehospital setting. We hypothesized that initial IN administration would not increase midazolam redosing compared to initial IM/IV/IO administration.

**Methods:** This was a retrospective non-inferiority study using data from a regional Emergency Medical Services (EMS) system from 1/1/2010 to 12/31/2017. Pediatric patients ≤ 14 years treated by EMS with midazolam for non-traumatic seizures were included. The primary outcome was the proportion of patients who required redosing of midazolam in the field after initial treatment with IN midazolam versus IM/IV/IO routes; a risk difference of 6.5% was set as the non-inferiority margin. The age-adjusted odds of midazolam redosing was also determined. Secondary outcome was the odds of requiring bag-mask-ventilation (BMV). The risk difference with 95% confidence interval for midazolam redosing was calculated and comparisons were assessed using the Cochran-Mantel-Haenszel chi-square test. **Results:**
EMS administered midazolam (0.1mg/kg) to 2,796 pediatric patients with non-traumatic seizures; 2,034 were included in the final analysis after exclusion of 762 without documentation of administration route. The median age was 6 (IQR 3-10); 55% were male. Initial administration routes were: 461 (23%) IN, 547 (27%) IM, 1024 (50%) IV, and 2 (0.1%) IO. Midazolam was redosed in 116 patients (25%) treated initially via the IN route versus 222 (14%) treated initially via IM/IV/IO routes, risk difference 11% (95%CI 7-15%). The age-adjusted odds ratio (OR) for redosing midazolam in the field after IN administration compared to IM/IV/IO administration was 2.0 (95% CI 1.6-2.6). For all routes, redosing most commonly occurred via the same route initially administered. Thirty-one patients (7%) in the IN group received BMV versus 88 (6%) in the IM/IV/IO group, OR 1.3 (95% CI 0.8-1.9). Conclusions: Prehospital treatment of pediatric seizure with IN midazolam was associated with increased midazolam redosing compared with other administration routes, but no difference in the odds of BMV by EMS.

95. COMPARISON OF COMFORT AND PRESENCE OF SKIN IRRITATION IN NON-INJURED VOLUNTEERS WEARING SEMI-RIGID AND SOFT CERVICAL COLLARS

Michael Hudson, Jason Lin, Christopher Eppich, Philipp Hannan, Melissa Hartley, Amber Rice, Joshua Gaither, Classic Air Medical CATEGORY OF SUBMISSION: TRAUMA

Background: Reducing cervical spine movement using a semi-rigid cervical collar (c-collar) to reduce spinal cord injury has been considered the prehospital standard of care for several decades. However, there has been little evidence to support the benefit of the semi-rigid c-collar over other types of c-collars. Some have suggested that the risk of semi-rigid c-collar use might outweigh the benefit. In order to better understand this risk, we hypothesize that use of a soft c-collar would improve comfort and reduce skin irritation when compared to a semi-rigid c-collar. Methods: We performed a retrospective review of data collected as part of an ongoing quality improvement project in which 40 volunteers (paramedics and nurses) were asked to wear either a semi-rigid or a soft c-collar. Volunteers wore a c-
collar type for a one-hour period and then switched to the type for another hour. Volunteers were then surveyed, and rated their comfort on a scale from 1 to 10 (1 being the most comfortable and 10, the least) and described physical or subjective symptoms, such as skin irritation/breakdown or redness. The primary outcome was comfort and the presence/absence of skin irritation following soft or semi-rigid c-collar use. Paired t-tests were used to compare symptoms after wearing different collar types. **Results:** Of the 40 volunteers who offered to wear either the semi-rigid or soft c-collar, 40 wore the semi-rigid collar for the full study period and 40 wore the soft collar for the full study period. The average comfort level in the semi-rigid group was 6.98 compared to 3.48 in the soft group (p<0.0001). In the semi-rigid group 67.5% reported redness at the collar site as compared to 7.5% in the soft collar group (p<0.0001). Similarly, 45% of the semi-rigid group reported skin irritation symptoms, while only 12.5% of the soft collar group reported the same (p<0.0001). **Conclusions:** In this population of healthy volunteers without traumatic injury, wearing a soft c-collar was associated with improved comfort and reduced skin irritation when compared to the same group wearing a semi-rigid c-collar.

96. INITIAL AND MULTIPLE NALOXONE ADMINISTRATIONS IN A MIDWESTERN EMS AGENCY: TRENDS AND CORRELATES

**Morgan Anderson, Lori Boland, Jessica Jeruzal, Jonathan Kamrud, Andrew Stevens, Charles Lick, ImageTrend, Inc.** CATEGORY OF SUBMISSION: MEDICAL

**Background:** Prehospital naloxone administrations are on the rise nationally, but regional variability in use is known to exist. The purpose of this work was to examine trends and correlates of naloxone administration in an emergency medical services (EMS) agency, with particular focus on the initial naloxone administration (INA) and multiple naloxone administrations (MNAs). **Methods:** This work was conducted at a large ambulance service providing coverage in and around the Minneapolis-St. Paul, Minnesota metropolitan area. We retrospectively analyzed all patient encounters involving naloxone
administration from 2012-2017. MNA was defined as documentation by the prehospital clinician in the electronic patient care record of administration of ≥ 1 dose of naloxone during the encounter. Logistic regression was used to compute the odds ratio for MNA associated with gender, age category, duration of time with EMS, route of INA (intravenous/intraosseous (IV/IO), nasal, or intramuscular (IM)) and dosage of INA (≤ 0.8mg or ≥ 0.8mg). Results: During the study timeframe, 1870 patient encounters that involved naloxone administration were identified, with MNA documented in 604 (32%). The annual proportion of encounters that involved MNA over the six years from 2012 to 2017 were 29%, 26%, 30%, 29%, 40%, 34%, and 32%, respectively. Between 2012 and 2017, the proportion of patients who received an INA via IV/IO decreased steadily from 93% to 69%, while the proportion who received an INA nasally increased from 5% to 24%. Male patients had slightly greater odds of MNA than female patients (OR=1.24, 95% CI=1.02-1.52). After adjustment for gender and duration of time with EMS, increased odds of MNA were also found for patients whose INA was administered nasally (versus IV/IO; OR=2.11, 95% CI=1.65-2.71) and for patients whose INA was ≤ 0.8mg (versus ≥ 0.8mg; OR=2.61, 95% CI=1.95-3.51). Conclusions: In our EMS agency, use of nasal INA increased, while INA via IV/IO decreased from 2012 to 2017. Correlates associated with increased odds of receiving MNAs included male gender, receiving an INA nasally, and an INA dose ≤ 0.8 mg. These RESULTS suggest further review of INA dosage amount is warranted.

97. ADENOSINE TRIPHOSPHATE (ATP) BIOLUMINESCENCE SURVEILLANCE OF STANDARDIZED PROTOCOL EFFECTIVENESS ON AMBULANCE CLEANLINESS

Mitchell Butterbaugh, Marshall Washick, Keith Wesley, Prasanthi Govindarajan, HealthEast Medical Transportation CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

Background: ATP bioluminescence is a USDA approved method of measuring cleanliness in the food industry and is rapidly being adopted by hospitals. Despite the evidence that ambulances are
contaminated with drug resistant organisms, there is little published research or industry standards for ambulance cleaning. This study addresses this dilemma by quantifying the effectiveness of a standardized protocol using innovative technology. **Methods:** Study was conducted in a metropolitan ambulance service consisting of 35 ambulances. 5 ALS ambulances were selected at convenience to establish a pre-implementation baseline. 8 locations designated as “high-touch points” were selected for measurement. Surfaces were sampled for the presence of ATP using an ATP bioluminescence monitor and reported as Relative Light Units (RLU). A result of less than 500 RLU defined a surface as clean. Measurements were taken weekly for one month prior to and after the implementation of a standard cleaning protocol. Crews were instructed on a standard ambulance cleaning protocol and required to demonstrate proficiency in its use. The protocol addressed the location of “high-touch points”, correct application of cleaning products according to manufacturer instructions, and required cleaning schedule. Measurements were taken before and after crews performed the protocol and the results shared with them. Weekly surveillance of all ambulances was initiated seven months after implementation of the cleaning protocol. **Results:** Initial surveillance demonstrated 20% of “high-touch points” were clean with mean/median RLU results of 2730/1459. One month following protocol implementation 29% of locations were clean with mean/median RLU results of 1445/817. Reduction of mean RLU was significant (p<0.01). After 1 month of surveillance, 53% of locations were clean with mean/median RLU readings of 1022/459. Seven months following protocol implementation, mean RLU reduction was significant when compared to both initial baseline and month following implementation (p<0.01). Of note, the stretcher rail was consistently one of the least likely locations to be clean. **Conclusions:** In the absence of a standardized cleaning protocol, ATP bioluminescence demonstrates that the majority of “high-touch points” in ambulances fail to meet accepted thresholds for cleanliness. Implementation of standardized ambulance cleaning protocol results in a significant improvement in overall cleanliness.
Background: For children with an asthma exacerbation, steroids reduce ED length-of-stay, hospitalization rates, and relapse rates, and those effects are most marked when given within the first hour of ED arrival. Evidence-based ED asthma guidelines therefore recommend administration of steroids for asthma patients of all severities. By logic, even earlier prehospital steroid administration would be preferred. However, little is known regarding the epidemiology of prehospital treatment of pediatric asthmatics. Methods: This was a retrospective, observational study of prehospital asthma patients ages 2-18 years from 2011-2016 in Florida using EMSTARS, Florida's statewide EMS database. Patients were included if their chief complaint was 'Respiratory Distress', if they received at least one albuterol treatment (to indicate an acute exacerbation), and if they were transported to a hospital. Patients with an injury or trauma were excluded. Results: A total of 11,226 patients from 2011-2016 met inclusion criteria. The median age was 9 years, 60% were male, and 49% were African-American. Only 1036 (9.2%) patients received methylprednisolone and 12 (<1%) patients received dexamethasone. Patients who received methylprednisolone were older (p<0.0001) and had longer median transport and scene times (p<0.0001). Methylprednisolone use also varied by gender (p=0.02), but not by race (p=0.06) or ethnicity (p=0.16). Notably, there was no difference in methylprednisolone use based on respiratory rate (p=0.5) or pulse oximetry (p=0.7), but use did vary by EMS-documented respiratory effort, level of alertness, and NHLBI severity score (both p<0.0001). Adjusted logistic regression revealed the greatest predictors of methylprednisolone administration was IV placement (OR 33, 95% CI 24-45), magnesium sulfate administration (OR 5, 95% CI 3-7), an IM or SQ injection (OR 3.6, 95% CI 1.2-10.3),
and Atrovent administration (OR 2.4, 95% CI 2-2.8). **Conclusions:** This statewide study demonstrates underutilization of prehospital steroids for pediatric asthmatics. This is likely due to protocols only authorizing intravenous methylprednisolone, which in practice reserves steroids for the most severe patients and/or those with long transport times. The efficacy and feasibility of alternative steroid delivery METHODS for children should be explored.

99. **EFFECT OF CRITICAL CARE TRANSPORT ON SHORT-TERM MORTALITY OF CRITICALLY ILL PATIENTS UNDERGOING INTERHOSPITAL TRANSPORT**

**Tae Han Kim, Kyoung Jun Song, Sang Do Shin, Young Sun Ro, Ki Jeong Hong, Department of Emergency Medicine, Seoul National University Boramae Medical Center** CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** To provide the effective treatment and prevent harmful incident during interhospital transport, critical care transport (CCT) unit named “Seoul Mobile Intensive Care Unit (SMICU)” was organized and initiated its service within city of Seoul in 2015. The study aimed to compare the effect of CCT on hospital outcomes for critically ill patients. **Methods:** A retrospective observational study was designed for patients who were transported between hospitals in Seoul during 2016. Main exposure was use of CCT service, which was provided by dedicated emergency medicine physicians and trained emergency nurses/ emergency medical technicians using intensive care devices and drugs, versus non-CCT service, which was provided by non-dedicated general physicians or only nurses/ EMTs with basic devices and drugs. Primary outcomes were mortality within 24 hours after hospital admission. Data (CCT versus non-CCT) were identified and sampled with matching process using propensity score collected in the National Emergency Department Information System (NEDIS), to balance covariate between two groups. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) by CCT service were calculated using multivariable logistic regression analysis on the outcome, adjusting for potential confounders.
**Results:** Among 42,188 ED patients transported between hospitals in 2016, 482 (1.1%) of patients were transported by CCT service. Mortality of CCT and non-CCT was 4.6% and 1.5% for original dataset and mortality of CCT and non-CCT was 4.6% and 6.6% for propensity matched dataset, respectively. AORs (95% CIs) for 24-hour mortality was 0.45(0.26–0.81) in original cohort and was 0.34 (0.16–0.71) for propensity-matched cohort, respectively. **Conclusions:** CCT service than non-CCT service showed much lower 24-hour hospital mortality in critically ill patients transported between hospitals. Further specific research on the effect of CCT services on outcomes in specific critical conditions is needed.

100. PREHOSPITAL OXYGEN ADMINISTRATION TO SUSPECTED ACUTE MYOCARDIAL INFARCTION PATIENTS: A SYSTEMATIC REVIEW AND META-ANALYSIS.

Jennifer Greene, Michelle Welsford, Craig Ainsworth, Laurie Lambert, Warren Cantor, Graham Wong,

*Dalhousie University* CATEGORY OF SUBMISSION: CARDIAC

**Background:** Oxygen is commonly administered to prehospital patients presenting with acute myocardial infarction (AMI). We conducted a systematic review to determine if oxygen administration, in AMI, impacts patient outcomes. **Methods:** We conducted a systematic search using MeSH terms and keywords in Medline, Embase, Cochrane Database of Systematic Reviews, Cochrane Central, clinicaltrials.gov and ISRCTN for relevant randomized controlled trials and observational studies comparing oxygen administration and no oxygen administration. The outcomes of interest were: mortality (≤30 days, in-hospital, and intermediate 2-11 months), infarct size, and major adverse cardiac events (MACE). Risk of Bias assessments were performed and GRADE methodology was employed to assess quality and overall confidence in the effect estimate. A meta-analysis was performed using RevMan 5 software. **Results:** Our search yielded 1192 citations of which 48 studies were reviewed as full texts and a total of 8 studies were included in the analysis. All evidence was considered low or very low quality. Five studies reported on mortality finding low quality evidence of no benefit or harm. Low
quality evidence demonstrated no benefit or harm from supplemental oxygen administration. Similarly, no benefit or harm was found in MACE or infarct size (very low quality). Normoxia was defined as oxygen saturation measured via pulse oximetry at ≥ 90% in one recent study and ≥ 94 % in another.

**Conclusions:** We found low and very low quality evidence that the administration of supplemental oxygen to normoxic patients experiencing AMI, provides no clear harm nor benefit for mortality or MACE. The evidence on infarct size was inconsistent and warrants further prospective examination.

101. A COMPARISON OF OUTCOMES FOLLOWING A CHANGE FROM THERAPEUTIC HYPOTHERMIA TO TARGETED NORMOTHERMIA IN PATIENTS SUFFERING OUT-OF-HOSPITAL CARDIAC ARREST

**Ryan Overberger, Arun Thomas, Kamran Mohiuddin, Einstein Medical Center Philadelphia**

**CATEGORY OF SUBMISSION: CARDIAC**

**Background:** Patients experiencing out-of-hospital cardiac arrest (OHCA) are treated with multiple modalities to increase the likelihood of neurologically intact survival. Targeted Temperature Management (TTM) is a widely used cerebral protection therapy, but it remains unclear whether induction of hypothermia or maintenance of normothermia is superior. In 2014 our tertiary-care academic-affiliated hospital overhauled our TTM process and adjusted the standard temperature goal from 33°C to 36°C. We hypothesized that there would be no effect on survivorship or neurologic outcomes following this change. **Methods:** We retrospectively compared the rate of TTM utilization, overall survival rate and neurological outcome for patients who were admitted to the hospital after OHCA. Data was obtained from the Cardiac Arrest Registry to Enhance Survival (CARES) for the post-intervention period (Nov 2014 to Dec 2017) compared with a control group prior to the change (Jan 2012-Oct 2014). **Results:** There were 114 patients admitted in the control group and 138 in the post-intervention group. The patient populations were well matched for age (mean 61 vs 64 years), initial rhythm and other demographic features. There was an increase in bystander CPR (11 vs 23%),
compression only CPR (25 vs 60%) and ROSC at ED arrival (47 vs 59%). There was no difference between the rate of TTM utilization (53.5 vs 54.4% p=0.89), overall survival (24.6 vs 20.3% p=0.42) and discharge with favorable cerebral performance score (CPC=1 or CPC=2: 53.6 vs 50.0% p=0.57) in patients before or after the new protocol. There was a decrease in the number of patients discharged in coma/vegetative state (CPC=4: 32 vs 4% p=0.003). There was no difference for good cerebral performance (CPC=1: 39.3 vs 17.9% p=0.051), moderate disability (CPC=2: 14 vs 32% p= 0.28) or severe disability (CPC=3: 14 vs 46% p=0.062). **Conclusions:** Change in target temperature from 33°C to 36°C did not affect survival or favorable neurologic prognosis after OHCA, and less patients were discharged in a coma/vegetative state. Possible confounders include improvement in prehospital treatment and other process changes during this interval. The possible decrease in the good (CPC=1) neurologic outcomes, while not statistically significant, would be clinically important and warrants further study.

102. THE MANY WAYS TO REFUSE: DESCRIBING VOIDS AND VARIABILITY OF REFUSAL OF CARE IN STATEWIDE TREATMENT PROTOCOLS

**Anthony Mahoney-Pacheco, Andrew Pettit, Christina Loporcaro, David Schoenfeld, Tufts Medical School**

**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** Prehospital refusal of care presents a difficult medico-legal dilemma in balancing patient safety with patient autonomy, resulting in high-risk engagements for patients, prehospital providers and EMS physicians. Statewide Treatment Protocols (STPs) attempt to reduce risk and improve patient care by standardizing EMS practice, however, prior studies demonstrate considerable variability among STPs. The purpose of this investigation is to describe refusal of care protocols and the variability in their components among STPs. **Methods:** Cross-sectional study of STPs utilizing a standardized review of refusal of care protocols in order to determine variability across multiple characteristics. Characteristics include; establishment of decision making capacity, EMS refusal procedures and the role of online
Results: Thirty-six out of fifty states (72%) issue STPs, 25 (69%) of which are mandatory. Of those, 24 (67%) contain refusal of care protocols and 4 (17%) include a protocol to treat and release without a refusal. It is explicitly stated that a patient must understand the risks of refusing care in 18 (75%) of the protocols. Medical decision-making capacity is revoked in patients with altered mental status in 20 (83%) STPs, and with suicidal ideation in 17 (71%). A signature is required in 18 (75%) protocols upon refusal of care. Only 16 (67%) explicitly require EMS to advise the patient to seek further care if symptoms worsen. Consultation with online medical direction is required for high-risk chief complaints in 10 (42%) STPs. If impairment due to drug or alcohol is suspected, 10 (42%) protocols require medical control consultation. Conclusions: Prehospital refusal of care presents a significant risk to patients and a challenge for EMS providers, both of whom may benefit from the use of standardized protocols. The absence of a specific refusal protocol in 12 of the 36 STPs and lack of direction in determining patient capacity brings to light an alarming void in protocol. This places stress and potential for legal harm on EMS providers and medical direction physicians alike. These results prompt the need for standardization across STPs, identification of other gaps in refusal protocols and investigation into best practices to protect both patients and providers.

103. LINKAGE OF EMERGENCY MEDICAL SERVICES PATIENTS TO HEALTH SYSTEM OUTCOMES: A COMPARISON OF TWO APPROACHES

Ian Blanchard, Paul Ronksley, Daniel Lane, Daniel Niven, Hude Quan, Tyler Williamson, Brent Hagel, Stafford Dean, Gerald Lazarenko, Christopher Doig, Eddy Lang, Alberta Health Services/University of Calgary

Category of submission: Student, Resident, Fellow

Background: Linking Emergency Medical Services (EMS) patients to their health system outcomes is critical to informing paramedic care. Limited research exists on EMS data linkage, especially reducing selection bias from non-linkage. Patient groups such as trauma and cardiac arrest may have higher non-
linkage due to missing or incomplete patient identification information. PURPOSE: To describe the linkage rate and characteristics of unlinked patients using the current strategy employed by an EMS system and an optimized strategy. Methods: A random sample of 4,150 EMS events was created from a fiscal year of data (2016/2017) within a metropolitan centre of 1.2 million people. These patient level data were linked to the National Ambulatory Care Reporting System (a national health information repository), using the current deterministic strategy of a unique provincial health number, hospital and date/time of arrival. Patients not linked using this strategy underwent linkage optimization consisting of deterministic linkage to Sunrise Clinical Manager (a local emergency department repository), using provincial health number, name, date of birth, sex, hospital record number, hospital, and date/time of arrival. All linkages were reviewed manually to ensure no false positive links. Descriptive statistics are provided. Results: The current strategy resulted in 3,650 out of 4,150 (88.0%) linked records (95% CI 86.9%, 88.9%). Of the 500 non-linked records, a further 381 were linked using the optimized strategy, which improved the linkage rate by 9.1% (97.1%; 95% CI 96.6%, 97.6%). There were no instances of false positive linkages in either strategy. The highest proportion of linkage failure with the current strategy occurred in 25 to 34 year olds (n=93/478, 20%), Echo level events (n=15/77, 20%), penetrating trauma (n=6/17, 35%), cardiac arrest events (n=12/46, 26%), and events involving emergency (lights and siren) transport to hospital (n=45/231, 20%). The optimized strategy improved linkage in these groups by 64/93(69%), 6/15(40%), 5/6(83%), 5/12(42%), and 23/45(51%) respectively. Conclusions: The current linkage strategy RESULTS in exclusion of patients from important subgroups. This selection bias can be reduced by employing the optimized linkage strategy. Selection bias due to linkage should be considered by end-users of linked EMS and health system data, particularly among key patient subgroups.

104. Impact of a Change in Stroke Destination Protocol
Background: Accurate prehospital identification of hyperacute stroke allows for transport to an appropriate stroke center. To improve triage of patients with the greatest likelihood to benefit from advanced interventions, a recent change in prehospital stroke protocol redirected all Cincinnati Prehospital Stroke Scale (CPSS) 3/3 strokes to tertiary stroke centers. However, it is unclear what impact this has had on secondary centers who continue to receive Cincinnati 1/3 and 2/3 patients. Objective To assess the positive predictive value (PPV) of the CPSS for patients with hyperacute stroke brought to a secondary stroke center before and after the implementation of a change in destination protocol.

Methods: A retrospective analysis was conducted of all patients brought to an urban, academic secondary stroke center for a period of 10 months prior and 10 months after the implementation of a change in destination protocol. Patients were identified from two separate administrative databases that included all stroke patients brought to the ED. All patients brought by ambulance and not transferred from another hospital were included. Prehospital and in-hospital charts were reviewed by a single data extractor. The PPV of the CPSS, proportion thrombolyzed at the secondary center, number of transfers for thrombectomy and number of CPSS 3/3's were calculated. Results: In the 10 months prior to protocol change, 304 patients were transported to the secondary stroke center, whereas 188 were transported in the 10 months following, a 38% decrease. The PPV in the pre-cohort was 86.8% and 88% in the post cohort, p=0.74. Comparing the pre and post cohorts, the proportion thrombolyzed decreased from 21.7% to 16.0% (p=0.12), transfers for thrombectomy proportionally increased slightly from 5.9% to 6.4% (p=0.83), and CPSS 3/3s decreased from 39 patients to 17. Conclusions: Following a change in destination protocol, the PPV showed no significant difference. The implementation of this change to the destination protocol appears to have successfully redirected some patients with more severe
strokes to a tertiary stroke center. However further efforts to identify patients who may benefit from thrombectomy prior to arrival should continue as transfers to a tertiary stroke center were still required.

105. UNRECOGNIZED SEIZURES IN CHILDREN BY PREHOSPITAL PROVIDERS RESULTS IN DELAYED ANTIEPILEPTIC THERAPY

Tiffany Abramson, Emily Rose, Yvette Kearl, Angelica Loza-Gomez, Keck School of Medicine, University of Southern California CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Pediatric status epilepticus is the most common pediatric neurologic emergency and a frequent cause for emergency medical services (EMS) activation. Administering antiepileptic drugs (AEDs) early is paramount to prevent morbidity and mortality. Prior studies show that more than 50% of patients do not receive AEDs in the prehospital setting. Pediatric seizures are a high stress and low frequency event for many prehospital providers. This in combination with fear of respiratory depression may explain their hesitancy in administering AEDs. We hypothesize that it may also be due to paramedics' failure to recognize seizure activity. This study describes paramedic identification of pediatric seizures on arrival to the emergency department and whether there is an association between seizure identification and AED administration. Methods: This is an ongoing prospective, single site, observational study at an urban pediatric emergency department. The study included patients 15 years and younger that arrived by ambulance with a chief complaint of seizure during the 12-month period from May 2017 through April 2018. After patient stabilization, a survey was completed by the emergency physician which included patient's clinical status, paramedic assessment, and prehospital AED use. The emergency medicine attending's assessment was considered the gold standard for determining active seizure. Descriptive analysis was performed and is presented in proportions. P-values were calculated using the chi-squared test. Results: There were a total of 288 pediatric seizure cases in the study period, 222 cases were analyzed after 66 were excluded due to incomplete data. The cases
were 43% (96) female with an average age of 3.84 years (range 15 days-15 years). Upon arrival to the emergency department, 15.3% (34/222) cases were actively seizing. The paramedics correctly identified 53% (18/34) of the active seizures. Seizures were missed in 7% (16/222) of all cases and in 47% (16/34) of cases with active seizures. Of the actively seizing cases, 88.9% (16/18) of the correctly identified seizure cases received prehospital AEDs versus only 50% (8/16) of the seizures that were missed by paramedics (p=0.014). **Conclusions:** Paramedics correctly identified 53% of active pediatric seizures. Patients with recognized seizures were significantly more likely to receive prehospital AEDs.

106. SAFETY AND EFFICACY OF IM MIDAZOLAM FOR AGITATED PATIENTS IN THE PREHOSPITAL ENVIRONMENT

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**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** The severely agitated and violent patient in the prehospital setting is challenging and may be dangerous to both EMS providers and patients. Studies have shown that agitated patients are a primary source of injury to patients and providers during ambulance transport. Medications for sedation for managing these patients should be given as a single dose with a route of delivery that is safely and easily administered. This study aims to determine the efficacy and safety of single-dose intramuscular midazolam for the sedation of the violently agitated patient in the prehospital setting. **Methods:** A retrospective analysis was conducted from May 2016 through February 2017 for severely agitated patients 15 years of age or older who were administered a single dose of Midazolam 10 mg IM in a large urban metropolitan area. Patient care reports and telephone questionnaires with paramedics were reviewed. Adequate sedation was measured by obtaining a RASS score of +1 or less. Adverse outcomes were also measured which included a RASS score of -5, hypotension (SBP<90), hypoxia (SpO2 <92%), use
of BVM, cardiac arrest, advanced airway management and bradycardia. **Results:** During the ten month study period, a total of 400 patients were enrolled in the study, 69% of which were male and 31% female. Ages ranged from 15 to 99 years of age with a mean age of 38 and mean weight of 82 kg. Of the patients studied, 86.3% were found to have a RASS score of +1 or less after a single dose of Midazolam IM. Overall, only 20 patients (5%) experienced an adverse event including: 7 (2%) had a RASS score of -5, 7 (2%) experienced hypotension, 5 (1.4%) experienced hypoxia and 1 (0.3%) required use of BVM. There were 0 cardiac arrests, 0 intubations, and 0 episodes of bradycardia. Of note, all patients who had hypotension were fluid responsive. **Conclusions:** The administration of Midazolam 10 mg IM was associated with a low incidence of adverse events without any observed intubations, persistent hypotension, or cardiac arrests. The limitations of this study included its retrospective nature and lack of hospital outcomes.

107. THE ASSOCIATION BETWEEN SCENE TIME INTERVAL AND NEUROLOGIC OUTCOME FOLLOWING ADULT OUT-OF-HOSPITAL CARDIAC ARREST IN THE UNITED STATES

**Ryan Coute, Brian Nathanson, Michael Kurz, Bryan McNally, Timothy Mader, University of Alabama at Birmingham**

**CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW**

**Background:** Our objective was to analyze the association between scene time interval (STI), defined as the time from Emergency Medical Services (EMS) arrival at the patient's side to the time the ambulance left the scene, and survival with favorable neurologic outcome following adult non-traumatic EMS-treated out-of-hospital cardiac arrest (OHCA). **Methods:** We performed a retrospective analysis of prospectively collected data from the national Cardiac Arrest Registry to Enhance Survival (CARES) database from January 2013 to December 2017. All adult non-traumatic, EMS-treated, bystander-witnessed OHCA with complete data were included in the analysis. Patients with STI times ≥60 min,
unwitnessed OHCA, nursing home events, and EMS-witnessed OHCA were excluded. The primary outcome was survival with functional recovery Cerebral Performance Category (CPC)=1 or 2). We used multivariable logistic regression to quantify the association of STI with the primary outcome. STI was modeled using restricted cubic splines and as a linear predictor. Results: There were a total of 57,520 patients who met inclusion criteria with 10,300 (17.9%) surviving with functional recovery. The mean age (SD) was 63.8 (15.8) and 34.4% were female. Mean STI (SD) for survivors with CPC 1 or 2 was 18.9 (8.4) and 23.4 (11.2) for those who died or survived with CPC 3 or 4, p<0.001. For every 1-minute increase in STI, the adjusted odds of a poor outcome (death or CPC 3 or 4) increased by 3.7%; odds ratio=1.037; 95% CI (1.029, 1.045); p<0.001. The restricted cubic spline analysis showed increased risk of poor outcome after approximately 15 minutes. Conclusions: Longer STI times are strongly associated with poor neurologic outcome in bystander-witnessed OHCA patients. After an STI duration of approximately 15 minutes, the associated risk of a poor neurologic outcome increased more rapidly.

108. FIRST PASS SUCCESS RATES OF OUT-OF-HOSPITAL ADVANCED AIRWAY MANAGEMENT IN ADULTS AND CHILDREN

Jeffrey Jarvis, David Wampler, Henry Wang, Williamson County EMS, Baylor Scott & White Healthcare

CATEGORY OF SUBMISSION: MEDICAL

Background: Prehospital advanced airway management (AAM, including endotracheal intubation (ETI) and supraglottic airway insertion (SGA)) of children is difficult. Multiple AAM attempts are associated with increased adverse events. We sought to compare AAM first-pass success (FPS) rates between adults and children in a national cohort of EMS agencies. Methods: We used 2017 clinical data from ESO, a national electronic health record system encompassing over 2,000 EMS agencies. We included all patients receiving any AAM attempts. FPS success was self-reported. Using multivariable logistic regression, we compared the odds of ETI FPS between adults (age ≥14 years) and children (age <14
years), adjusting for gender, ethnicity, primary impression, and drug facilitation. We repeated the analysis for SGA FPS. We further compared FPS rates between pediatric age subsets (<1 year, 1-5 years, 6-10 years, 11-14). Results: During the one year period, 731 EMS agencies attempted AAM on 29,369 patients (median 18 per agency [IQR 6, 43]), including 28,846 (98.2%) adults and 523 (1.8%) children. Most AAM were ETI; adults 22,049 (76.4%) and children 471 (90.1%). Most patients were white (65%), male (60.5%), and undergoing AAM for cardiac arrest (67.3%). ETI FPS was lower in children than adults; 58.6% vs 72.7%, OR 0.56 [95% CI 0.46 to 0.68], p <0.001. SGA FPS was similar between children and adults; 84.6% vs 89.8%, OR 0.62 [0.30 to 1.43], p=0.31. Among children, ETI FPS was higher with increasing age: <1 year 55.7% (42.4-68.5%), 1 to <6 years 54.8% (48.9-60.7%), 6 to <10 years 62.7% (48.1-75.9%), 10 to <14 years 73.5% (61.4-83.5%); p-trend <0.001. Among children SGA FPS was not associated with increasing age group: <1 80.0% (28.4-99.5%), 1 to <6 95.2% (76.2-99.9%), 6 to <10 57.1% (18.4-90.1%), and 10 to <14 84.2% (60.4-96.6%; p-trend 0.44. Conclusions: ETI FPS is lower in children than adults. SGA FPS does not differ between children and adults.

109. THE STATE OF THE EVIDENCE FOR EMERGENCY MEDICAL SERVICES CARE OF ADULT PATIENTS WITH SEPSIS: AN ANALYSIS OF APPRAISED RESEARCH FROM THE PREHOSPITAL EVIDENCE-BASED PRACTICE (PEP) PROGRAM

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Background: The Prehospital Evidence-Based Practice (PEP) program is an online, freely accessible, continuously updated Emergency Medical Services (EMS) evidence repository. This summary describes the research evidence for the identification and management of adult patients (age 16) with sepsis or septic shock. Methods: PubMed was searched in a systematic manner. One author reviewed titles and abstracts for relevance and two authors appraised each study selected for inclusion. Primary outcomes
were extracted. Trained appraisers scored studies on a three-point Level of Evidence (LOE) scale (based on study design and quality) and a three-point Direction of Evidence (DOE) scale (supportive, neutral, or opposing findings based on the studies' primary outcome for each intervention). LOE and DOE of each intervention were plotted on an evidence matrix (DOE x LOE). **Results:** Eighty-eight studies were included for 15 interventions listed in PEP for adult patients with sepsis. The most frequently studied interventions were related to identification tools (n=26, 30%) and early goal directed therapy (EGDT) (n=21, 24%). Common identification tools included the Systematic Inflammatory Response Syndrome (SIRS) score, quick Sequential Organ Failure Assessment (qSOFA) score. The most common primary outcomes were related to final diagnosis (n=30, 34%), mortality (n=40, 45%) and treatment goals (e.g. time to antibiotic) (n=14, 16%). The evidence matrix rankings for the supported interventions were: supportive-high quality (n=1, 7%) for crystalloid infusion, supportive-moderate quality (n=7, 47%) for identification tools, prenotification, point of care lactate, titrated oxygen, temperature monitoring, and supportive-low quality (n=1, 7%) for vasopressors. The benefit of prehospital antibiotics and EGDT remain inconclusive with a neutral DOE. There is moderate level evidence opposing the use of high flow oxygen. No evidence was found for the use of hypertonic saline. **Conclusions:** EMS interventions for the management of sepsis are informed primarily by moderate quality supportive evidence. Prehospital assessments, crystalloids, oxygen, and prenotification were supported by moderate to high quality evidence, but the optimal identification tool remains unclear. Limited evidence is available supporting prehospital use of standard in-hospital therapies such as antibiotics and EGDT. This evidence analysis can guide the implementation of prehospital management by paramedics.

110. PARAMEDIC FIRST PASS SUCCESS RATES IMPROVE WITH VIDEO LARYNGOSCOPY
Background: Video Laryngoscopy (VL) using the “GlideScope Ranger” device was introduced to our prehospital EMS system in late 2010. After a short introductory period our airway standing order protocols were changed to make VL the primary device for intubation. There have been conflicting studies on the benefit of VL for improving first pass success rates. We hypothesized that first pass success rates improved after introduction of VL as a primary device. Methods: Design: Retrospective multihospital cohort of prehospital patients that were intubated by paramedics. Setting: 21 New Jersey suburban and urban ground paramedic units. Population: Patients intubated by paramedics from 1/1/2007 (the year that Rapid Sequence Intubation (RSI) was introduced) to 12/31/2016. Protocol: We identified patients intubated using an electronic medical record, and analyzed the first pass intubation attempt. Data analysis: We computed the first pass success rates for direct laryngoscopy (DL) from 2007-2009, to VL from 2014-2016. We a priori chose to compare to the latest 3 years of data, to allow for paramedic proficiency using VL. We calculated the difference in first pass success rates and the 95% confidence interval. Results: The database contained 1,247 intubations using DL from 2007-2009 and 1,277 intubations using VL from 2014-2016. Comparing the period of DL from 2007-2009 to VL from 2014-2016 first pass success rates improved from 76% in 2007-2009 to 81% in 2014-2016, a statistically significant increase of 5% (95% CI, 2% to 9%). Conclusions: Consistent with our hypothesis we found that first pass success rates for VL improved modestly in comparison to DL.

111. EFFECTIVENESS AND EFFICIENCY OF AIRWAY CONTROL USING THREE DIFFERENT PROVIDER POSITIONING TECHNIQUES: A MANIKIN STUDY
Warren Doyle, Akash Shah, Jeff Lubin, Penn State Hershey Medical Center Emergency Medicine Department CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Endotracheal intubation can be a critical skill in prehospital care. EMS providers are often required to intubate patients in difficult positions, including patients supine on the ground. There is little research on how provider positioning impacts intubation success. In this study, we explored three different provider positions during intubation via direct laryngoscopy to evaluate which method was most effective. Methods: Participants were recruited from a single prehospital program with ground and helicopter EMS units. Manikins were placed supine on the ground and participants were asked to intubate three times each at three different positions: the provider lying prone at the patient’s head, the provider kneeling at the patient’s head, and the provider anteriorly straddling the patient. Subjects performed the intubations in one of six predetermined randomized orders. A generalized estimating equations model was used to test the differences in success rates between positions. Group comparisons were made for each outcome and the p-values for these comparisons were adjusted for multiple testing using the Bonferroni method. Results: There were 45 participants recruited for the study. Thirty-six participants were paramedics and 9 were prehospital registered nurses. The average estimated number of career intubations was 220 with an average of 6 intubations over the last year. Sixty-four percent of providers preferred the prone position. Ninety-seven percent of providers successfully intubated while kneeling without failure, while only 91% were successful without failure in the prone position. In the kneeling position, providers intubated fastest on average (kneeling: 3.85 sec, prone: 4.88 sec, straddling: 5.5 sec) and with the lowest maximum time on first attempt (kneeling: 4.39 sec, prone: 4.90 sec, straddling: 5.16 sec). Neither prone nor kneeling were statistically significantly faster across the three attempts (p=0.228). Prone and kneeling were significantly faster than the straddle position (p=0.003; p<0.001, respectively). Conclusions: In this manikin study, there was no
statistically significant difference in intubation success and speed between prone and kneeling at the patient’s head. Both were superior to straddling the patient while intubating.

112. EFFECT OF PHYSICIAN RESPONSE TO THE SCENE ON EMS SYSTEM PERFORMANCE AND PATIENT CARE

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Background: Many EMS fellowships, have a physician response component with varied response models. The structure and impact of such programs have not been explored. The objective of this study was to assess the effect of physician response to the scene of a 911 EMS call on system performance and patient care. Methods: We performed a retrospective matched cohort study of EMS patient care records in a large urban municipal EMS system. Data from 7/1/2013 to 6/30/2017 were collected from computer-aided dispatch data and electronic patient care reports. Exposure was defined as an ambulance response with an EMS physician also on scene. Unexposed responses were identified through review of 911 calls dispatched during the same month without physician response recorded. Responses were matched based on response priority, call type (dispatch impression), time of day (0600-1800hrs or 1800-0600hrs), and day of week (weekday or weekend). Each exposure was matched to three unexposed calls. On-scene time, response outcomes (transported, patient refusal, cease resuscitation/pronouncement, other), time to first medical contact, transport priority, and administration of Naloxone, midazolam, or analgesics were assessed for differences between groups.

Results: A total of 347 responses with an EMS physician on scene were matched for a total of 1,388 analyzed responses. On-scene time increased in calls with a physician response (mean=20.8 minutes, 95% CI: 19.4-22.2 vs. no physician response mean=17.5 minutes, 95% CI: 16.8-18.1; p<0.0001). There was a significant difference in a patient's disposition by exposure status with those call receiving a
physician response being of a higher acuity nature (n=18, 5.2% vs, n=19 1.8%). Time to first medical contact, transport priority, and administration of medications were not statistically different between the groups. **Conclusions:** In our study, physician response to prehospital emergencies was associated with changes in on-scene time and favored response to less frequent call types. These associations may be driven by differences in scene management, participation in providing care, and self-dispatching to active calls for service.

113. EFFECT OF PREHOSPITAL EPINEPHRINE ON SURVIVAL OUTCOMES AFTER OUT-OF-HOSPITAL CARDIAC ARREST; A NATIONWIDE PROPENSITY MATCHED ANALYSIS

YuSung Lee, Youngsun Ro, KyoungJun Song, SangDo Shin, *Department of Emergency Medicine, Seoul National University Hospital* CATEGORY OF SUBMISSION: CARDIAC

**Background:** Prehospital epinephrine use for out-of-hospital cardiac arrest (OHCA) has been controversial. Recent controlled or on-controlled trials have shown that the use of prehospital epinephrine increased the rate of return of spontaneous circulation but has a negative impact on neurological outcomes. The aim of this study was to determine the effect of prehospital epinephrine on the neurological outcomes of OHCA. **Methods:** This study was a cross-sectional study using nationwide OHCA registry in Korea from 2015 to 2016. All EMS-treated adults OHCAs with presumed cardiac etiology were included. The primary outcome was good neurological recovery. Potential confounders were demographics, Utstein, and EMS factors. Study population were allocated using propensity-score matching method into epinephrine (EPI) and non-epinephrine (Non-EPI) group. The effect of EPI versus Non-EPI was calculated with adjusted odds ratios (AORs) and 95% confidence intervals (CIs) for the primary outcome using multivariable logistic regression analysis. Interaction analysis was performed to compare the effect of EPI according to cardiopulmonary resuscitation (CPR) time interval group. **Results:** Of total 58,922 patients with OHCA during study period, 37,635 were included in the analysis. There
were 3,256 patients (8.7%) who received prehospital epinephrine. By the propensity-score matching method, each 3,239 patients were allocated into each group. Survival to discharge and good neurological recovery were 5.0% and 2.5% in EPI group while 9.4% and 5.9% in Non-EPI group, respectively (all p-values<0.01). AORs (95% CIs) of EPI versus Non-EPI on outcomes were 0.38 (0.28-0.51) for good neurological recovery and 0.47 (0.38-0.58) for survival to discharge, respectively. AORs (95% CIs) of EPI versus Non-EPI on outcomes in CPR time interval group 1 (10 min.), group 2 (10-20 min.), group 3 (20-30 min), and group 4 (30 min or longer) were 0.36 (0.19-0.70), 1.79 (1.21-2.65), 1.99 (1.15-3.47), and 0.14 (0.07-0.29) for good neurological recovery and 0.83 (0.48-1.43), 1.73 (1.28-2.34), 1.74 (1.22-2.50), and 0.16 (0.10-0.26) for survival to discharge, respectively. **Conclusions:** Prehospital epinephrine use was associated with poor neurological recovery as well as survival to discharge in propensity-score matched OHCA patients. In the EPI group, more than 10 min and less then 30 min CPR time interval showed better outcomes.

114. PREHOSPITAL FIRST-PASS SUCCESS RATES ARE SIMILAR USING VIDEO-ASSISTED VERSUS DIRECT LARYNGOSCOPY DURING CARDIAC ARREST CALLS BUT OVERALL SUCCESS RATES ARE HIGHER USING VIDEOSCOPIES

**Katherine Raczek, Craig Cooley, David Miramontes, C.J. Winckler, Joan Polk, Joi Shumaker, Scott Bower, David Wampler, UTHSCSA**

**Background:** Prehospital intubation remains a controversial topic as it poses several unique challenges. Many EMS systems also utilize video laryngoscopy (VL) for intubation. There have been mixed results of studies comparing VL and direct laryngoscopy (DL). The goal of this study was to compare the overall success rates and first-pass success rates of prehospital intubation using DL versus VL during cardiac arrest calls. **Methods:** This was a retrospective analysis of prospectively collected data abstracted from the cardiac arrest database maintained by the Office of the Medical Director from a large urban EMS
system. All calls were reviewed from January 2013 to December 2017. Intubation was performed by Paramedics using either DL or VL. Attempts included were all those which were primarily attempted by DL or VL; those that were categorized as a first attempt with an airway adjunct (King LT) or no advanced airway maneuvers were excluded. The primary outcome was the success of all intubation attempts using DL versus VL with secondary outcome being success of first attempts. Student t and chi-square tests were used to provide statistical analysis of continuous and categorical variables, respectively. Results: Within the 2013-2017 cardiac arrest database, 5,755 runs qualified as “cardiac arrest.” Of those, intubation using DL or VL on first attempt was tried in 4,408 patients. The rest of the patients either had missing data or the primary attempt was other than endotracheal intubation. DL was the first choice in 4,016 and VL was the first choice in 392. 2,051 (68.6%) were successfully intubated in the primary DL group, with a 74.4% first-pass success rate. Of the VL group, 334 (85.2%) were successfully intubated, with a 79.6% first-pass success rate. The primary outcome of overall success rates is statistically significant (p-value=0.0062). There was no difference between the first-pass groups (p-value=0.4571).

Conclusions: In a large urban EMS system where DL is the primary intubation attempt of most cardiac arrest runs, there is no difference between success rates with DL versus VL use during the first pass, however success rates are overall improved when using videoscope assistance.

115. EVALUATION OF A PATIENT SELECTION TOOL FOR EMS ALTERNATE TRANSPORT DESTINATIONS: FIRST PHASE OF THE ALTERNATIVE DESTINATION E(MT) DECISION STUDY (UNAIDED)

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CATEGORY OF SUBMISSION: PROFESSIONAL

Background: Historically, EMS providers have been presented with one solution to meet a patient’s further healthcare needs; transport to an emergency department (ED.) Contemporary thought has introduced the concept of EMS agencies transporting patients to alternate transport destinations (ATDs)
such as urgent care centers, rather than EDs. Selection of appropriate patients for these ATDs must be accurate and reliable. Purpose: To validate a screening tool that was developed to assist EMS providers in selecting patients who are appropriate for ATD referral. Hypothesis: A screening tool used by prehospital providers can provide appropriate sensitivity and specificity in assisting with the selection of patients who can be appropriately managed at an ATD without further referral to an ED or hospital admission. Methods: We found 420 consecutive patients transported to EDs with identifiers removed. We retrospectively applied the tool’s criteria to assess which patients would have been referable to an ATD. We then obtained de-identified ICD-10 codes, DRGs and ultimate ED disposition for each. A nurse and EMS physician rater each determined which codes were likely versus not manageable in an ATD. The tool was then compared to the physician’s judgment, as well as to the disposition. Results: Of the 420 cases, 217 would have been referred to an ATD using only tool criteria. Using a physician standard via the ICD-10 and DRG, the sensitivity of the tool was 61.8% and specificity 59.6%. Using the tool to predict admission, these were 57.52% and 74.07% respectively. There was a high correlation between MD and RN retrospective review (Phill=0.77). Conclusions: A screening tool was helpful in selecting patients for transportation to ATDs but appears to need enhancement via supplemental criteria to better predict whether an ATD is suitable to provide definitive care for the patient. The human factors of provider judgment or experience and on-line medical direction in certain cases might improve its utility. Limitations: Not all criteria used in the screening tool were available in every case. Further study with Improved data reliability and provider involvement would be needed to evaluate improvements in the sensitivity and specificity of the tool.

116. CLINICAL OUTCOMES OF OUT-OF-HOSPITAL CARDIAC ARREST WITH CORONARY ANGIOGRAPHY WITHOUT PERCUTANEOUS CORONARY INTERVENTION: A NATIONWIDE CROSS-SECTIONAL OBSERVATION STUDY
Ki Hong Kim, Sang Do Shin, Young Sun Ro, Kyoung Jun Song, Ki Jeong Hong, Joo Jeong, Department of Emergency Medicine, Seoul National University Hospital CATEGORY OF SUBMISSION: CARDIAC

Background: Clinical outcomes of out-of-hospital cardiac arrest (OHCA) patients who underwent coronary angiography (CAG) without percutaneous coronary intervention (PCI) has not been studied. This study was conducted to compare the clinical outcomes of OHCA patients underwent CAG with and without PCI. Methods: A nationwide cross-sectional observation study was conducted. Presumed cardiac origin adult OHCA with recovery of spontaneous circulation (ROSC) from January 2016 to December 2017 were included. Patients groups were categorized in 3 groups; No CAG group, CAG with PCI group and CAG without PCI group. Primary outcome was good neurologic recovery and secondary outcome was survival to discharge. Multivariate logistic regression analysis was conducted with absolute differences (AD) with 95% confidence intervals (CIs). Subgroup analysis for patient underwent CAG and additional analysis after propensity score matching were performed. Results: The final analysis included a total of 5,784 eligible patients (No CAG 4,697, CAG with PCI 553, CAG without PCI 534). The survival rate was 24.9% and good neurologic recovery was 15.6% for all (No CAG 14.5%/6.6%, CAG with PCI 68.9%/55%, CAG without PCI 70.8%/53.7%). There were significant differences in multivariable logistic regression analysis (AOR and 95% CI, reference: No CAG group): CAG with PCI 4.70 (3.73-5.91) and CAG without PCI 7.16 (5.67-9.05) for survival to discharge, CAG with PCI 5.92 (4.62-7.59) and CAG without PCI 7.02 (5.47-8.99) for neurologic outcome, respectively. In subgroup analysis in CAG group, survival rate was higher in CAG without PCI group (reference CAG with PCI group): 1.58 (1.14-2.9) for survival and 1.23 (0.91-1.66) for neurologic outcome. After propensity score matching, additional analysis showed similar results: 1.10 (0.72-1.66) for survival and 0.82 (0.57-1.20) for neurologic outcome. Conclusions: Clinical outcomes of OHCA patients underwent CAG without PCI have no significant difference compared to CAG with PCI group in the observational study. Half of patients who received CGA did not
require the PCI. Further study on OHCAs who underwent CAG without PCI is needed to define the potential candidate for PCI.

117. PENETRANCE OF BRAIN TRAUMA FOUNDATION GUIDELINES INTO PREHOSPITAL PROTOCOLS: 11 YEARS AFTER PUBLICATION

Amanda Lauren Ventura, Dustin LeBlanc, Jason McMullan, University of Cincinnati CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: The Brain Trauma Foundation's (BTF) Guidelines for Prehospital Management of Traumatic Brain Injury have not been updated since 2007. In 2012, we found variable penetrance in a sample of EMS protocols. In this study, we reassess the same sample of protocols for incorporation of BTF guidelines, hypothesizing there will be improved adoption of the BTF guidelines, now, 11 years after publication. Methods: Our original 61 protocols were purposefully sampled from across the United States with a mixture of individual, county, regional, and state jurisdictions; fire-based and third service agencies were included. We re-evaluated current versions of these previously reviewed protocols with the same 23-item tool to capture elements of assessment and treatment of TBI patients as outlined in the BTF guidelines. Chi-square was used to evaluate difference in proportions between 2018 and 2012 protocols. Results: Current versions were available for 53/61 protocols, original protocols that did not have an updated counterpart were excluded from analysis. Updated protocols demonstrated that there is still a significant deficit in the adoption of the evidence based BTF guidelines. While 16/23 (70%) BTF guideline items evaluated showed increased uptake between 2012 and 2018, only 8/23 (35%) appear in more than half of protocols. Significant increases were seen in assessments of hypoxemia (87% vs 100%), Glasgow Coma Scale after resuscitation (4% vs 23%) and before paralytics (0% vs 21%), orbital trauma (17% vs 34%), and herniation (19% vs 47%) (all p<0.05). However, definitions of asymmetric (1/53) or fixed pupils (0/53) are rare and only 6/53 prescribe hyperventilation for signs of clinical
Conclusions: Brain Trauma Foundation guideline recommendations for prehospital care remain under-represented in a broad sample of EMS protocols, with some improvement in individual items. Several key issues, including detection and treatment of herniation, still need widely increased adoption.

118. EFFECTS OF A NEW DISASTER TRAINING CURRICULUM IN A MULTI-ORGANIZATION CAMPUS ON SELF-ASSESSMENT OF DISASTER COMPETENCY

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CATEGORY OF SUBMISSION: DISASTER

Background: Healthcare disaster preparedness is attracting renewed attention with the increased number of incidents. Recently, a unique program was designed to teach a new campus-wide coordination plan and basic emergency management principles. This new emergency coordination plan integrates the incident response in one of the few campuses containing multiple healthcare organizations coexisting in the same geographic space. This five-session program over four months included didactic lectures and experiential education (role-playing scenarios). This study examined the effect this newly created disaster preparedness training program would have on participants' comfort level with key competencies in disasters.

Methods: Subjects were voluntarily recruited from program participants. Participants were management-level personnel of various disciplines from 6 separate healthcare organizations. The survey instrument contained 10 questions, each covering one of 10 previously described disaster preparedness core competencies. Participants' self-assessed their comfort in each competency area by rating their ability on a 5-point Likert scale before and after attending the program. Mean scores on each question pre-versus post-training were compared.

Results: Statistically significant improvements were found in participants' self-rated confidence to effectively communicate (mean 3.67 pre, 4.20 post, p=0.006), identify resources (3.62, 4.12, p=0.039), consider ethical challenges (3.60, 4.20, p=0.003), and understand legal issues (3.31, 3.96, p=0.010) in disasters. No significant
changes were seen in the mean scores in the other areas. **Conclusions:** This novel disaster preparedness training program resulted in an increase in participants' confidence in their ability in some, but not all, emergency preparedness core competencies. Further research is needed analyzing what factors influence comfort level in each area, as well as correlation with actual performance. Such research will better prepare the healthcare sector for future disasters.

119. **ANALYSIS OF THE INCIDENCE AND OUTCOMES OF TRAUMATIC PNEUMOTHORAX ON THE CONTEMPORARY BATTLEFIELD**


**Background:** Traumatic pneumothorax (PTx) and tension pneumothorax (TPTx) are proximate causes of up to 4% of potentially survivable battlefield deaths. Objective: Analyze US combat casualty records from the U.S. Department of Defense Trauma Registry, focusing on PTx epidemiology, interventions and outcomes. **Methods:** Retrospective cohort of casualties with AIS code 442204 (TPTx) or ICD9 code 860 (PTx and subtypes), from September 2007 through June 2011. We abstracted injury mechanism, demographics, 30-day outcome, out-of-hospital needle decompression and chest tube thoracostomy (if performed). ICD9 codes 860.2 and 860.3 (isolated closed or open hemothorax) were excluded. Our IRB reviewed and exempted this study. **Results:** 8913 cases were available. 353 had PTx (4%), with 11 progressing to TPTx (3% of PTx). 335 survived (95%). The combined case fatality rate was 5%. 201 cases were associated with a blast-injury mechanism (57%). Among TPTx cases, 8 survived (73%). Of TPTx survivors, two received needle decompression (25%). Of the 327 patients who survived simple PTx, 41 underwent prehospital needle decompression (13%) and 15 received a chest tube (5%). Of the 18 PTx-associated deaths, 3 had TPTx (17%); none had documented decompression. Of the remaining 15 PTx-associated deaths, two had evidence of needle decompression (13%). For TPTx, OR for death was
reduced to zero (CI95% 0 to 17) with chest decompression. Review of all cases for ICD Code 512.1 (iatrogenic pneumothorax) resulted in no cases with this diagnosis. Conclusions: PTx remains ubiquitous on the contemporary battlefield, and continues to contribute to morbidity and mortality if untreated. In this sample, out-of-hospital chest decompression of PTx was associated with improved survival. Blast injuries should trigger focused chest exams, closer observation, and more aggressive management of suspected TPTx.

120. THE INFLUENCE OF A ZOMBIE APOCALYPSE SCENARIO ON INTEREST IN DISASTER PREPAREDNESS TRAINING

Jeffrey Luk, Tyler Haas, Amy Pound, University Hospitals Cleveland Medical Center/CWRU School of Medicine CATEGORY OF SUBMISSION: DISASTER

Background: Disaster drills (DDs) are critical to ensuring preparedness. Organizations have utilized zombies to disperse DM education and interest. This study evaluates whether personnel in a single ED would have increased interest and participation in a DD if it were zombie-themed or if other factors are influencing DD participation. Methods: A survey link was e-mailed via REDCap three times to all personnel employed in a single ED from June 2017 to May 2018. Instructions were provided to complete it once. Responses were anonymous. Participation was voluntary. The IRB deemed this study as quality improvement. Results: 105 individuals responded. 49 (46.7%) had participated in DM training while 55 (52.4%) had not. Of those that had participated, 89.5% of them enjoyed it and/or found it educational. On a Likert scale of 1 (not interested) to 10 (very interested), 74.7% selected a score of ≥ 6 for participating in a DM drill. A desire to be prepared and acknowledging that disaster preparedness is an important skill to know were the top two reasons for interest. However, 60% had a comfort level of <5 with DM on a Likert scale of 1 (not comfortable) to 10 (completely comfortable). The most popular reason for not being interested in DM training was being too busy. The majority of respondents (42,
41.6%) selected a zombie apocalypse as the DD they would least likely attend. The same number of respondents selected a generalized DM simulation or classroom event as the type of DD they would most likely attend. The primary reason given was how likely the event would occur. No clear preference existed for time of day; length of training; personnel attending; host; presence of food; personal home schedule; or payment to attend. **Conclusions:** We found that a zombie apocalypse-themed DD would not increase interest in attending. Personnel were much more interested in a realistic DD. While a strong interest in DM training exists, comfort for DM needs to be improved. Time needs to be dedicated and protected for DM training. Further research should evaluate specific interventions to overcome these obstacles so that disaster preparation is improved.

121. EVALUATION OF A NOVEL PROTOCOL FOR PREHOSPITAL IDENTIFICATION AND MANAGEMENT OF PEDIATRIC SEPSIS

**Nicolas Wyhs, Karen Keller Baker, Jennifer Anders, Bel Air Volunteer Fire Dept, Harford County, Maryland**

**CATEGORY OF SUBMISSION:** PEDIATRIC

**Background:** Identification and management of sepsis in the prehospital arena can be challenging, particularly for pediatric patients. In July 2016 Maryland introduced a state-wide protocol to assist prehospital providers with identification and treatment of pediatric patients suffering from sepsis. The protocol combines an age modified SIRS criteria along with physical exam findings suggesting hypoperfusion. With the expectation that the protocol should achieve moderate specificity, it groups patients into two categories. The first identifies patients with moderate risk of sepsis, and directs supportive care and pre-arrival alert to receiving hospitals. The second category identifies patients in septic shock and directs additional treatment including fluid boluses and vasopressors. **Objective:** To evaluate the accuracy with which providers apply a new protocol to classify potentially septic children. **Methods:** We performed a retrospective review of pediatric sepsis patients transported by Maryland EMS over the
first 24 months of the new protocol. Cases were included for review if the prehospital record had either a primary or secondary impression of sepsis in the prehospital report or documentation of a "sepsis alert" to the receiving hospital. Cases were excluded if detailed review indicated that the sepsis labels had been chosen in error. From the prehospital record, we collected data including demographics, vital signs, high risk factors, and EMS provider impressions. Results: 78 emergency (911) calls were identified over the study period, 60 of which were high priority. Of those, 37 (62%) were accurately classified under the sepsis protocol. EMS providers most commonly used temperature (n=49, 60%), heart rate (n=36, 46%) and mental status decline (n=23, 30%) as inclusion criteria. 86% (n=30) of patients that met the protocol criteria received a "sepsis alert." The two most common EMS provider co-impressions associated with septic children were seizures (n=13, 17%) and respiratory distress (n=10, 13%). Conclusions: With clearly defined criteria, prehospital providers can appropriately triage potentially septic children. Future efforts are needed to both improve accuracy and to increase the number of patients treated under the protocol.

122. A NATIONWIDE SURVEY OF EMS STROKE SEVERITY SCREENING AND TRIAGE PRACTICES

Layne Dylla, Erik Rueckmann, Christopher Zammit, Jeremy Cushman, Courtney Jones, University of Rochester, Department of Emergency Medicine CATEGORY OF SUBMISSION: MEDICAL

Background: According to the American Stroke Association Mission Lifeline guidelines, EMS providers should assess for stroke severity and triage potential large vessel occlusions (LVOs) to an endovascular-capable stroke center when such transport does not preclude timely alteplase (tPA) administration. The purpose of this study was to determine the extent to which EMS providers implement these recommendations. Methods: We conducted a national cross-sectional survey of EMS providers affiliated with American Medical Response (AMR). AMR provides prehospital care in 38 states and is responsible for approximately 20% of EMS care in the US. Subjects were recruited over a three month period in 2018
via an email-linked REDCap survey distributed by regional clinical leaders. The survey instrument was developed using an iterative process and was pilot tested by content experts and EMS providers. Survey questions assessed EMS practices with regards to: identifying potential tPA and embolectomy candidates; tools employed to assess stroke severity; and indications and ability to bypass a primary stroke center for an endovascular-capable stroke center. Descriptive statistics were used to quantify responses. **Results:** 255 EMS providers from 15 different states completed the survey. The study population was 67.6% male, 91.8% Caucasian, with a mean age of 36 years. On average, subjects had 7.2 years of BLS experience and 8.8 years of ALS experience. Approximately half of respondents (52%) indicated they further assess for stroke severity and possible LVO when evaluating a suspected stroke patient. The most common reason for not screening was a lack of formal training or protocols to do so (67%). Of those screening for LVO, only 50% used a formal stroke severity scale, usually the Cincinnati Prehospital Stroke Severity Scale (55%). The majority, 66%, reported stroke severity influencing destination selection. **Conclusions:** While limited by a convenience sample, these data identify a discrepancy between current EMS practices and Mission Lifeline recommendations. A large proportion of EMS providers report not screening for stroke severity and even less use a formal stroke severity scale. Future studies are needed to fully understand the barriers to implementation of the Mission Lifeline guidelines.

**123. DO PATIENTS GIVEN NALOXONE ACTUALLY HAVE OPIOID TOXIDROMES?**

*Brian William Walsh, Daniel Johnson, Ryan Guzik, David Feldman, Morristown Medical Center*

**CATEGORY OF SUBMISSION: MEDICAL**

**Background:** Naloxone is administered frequently for the reversal of presumed opioid toxidromes causing life threatening hypoventilation. A recent ACEPNow publication warns of the possible anchoring bias by emergency department providers resulting from naloxone administered prehospitaly. The
The purpose of this study was to determine the ultimate diagnoses of patients treated with prehospital naloxone with attention to the physiologic response to treatment. **Methods:** Setting: A large, suburban, two-tiered EMS system with approximately 25,000 Advanced Life Support (ALS) requests per year. Design: Retrospective cohort study. Population: Consecutive patients treated prehospital by ALS providers with naloxone over a 60-month period. Appropriate patients for naloxone were defined as patients with a GCS<14 and hypoventilating (initial respiratory rate (RR) <10 or a pulse oximetry <92%). A positive response was defined as an increase of 4 or more breaths per minute or final pulse oximetry >95%. The disposition diagnoses were determined from the hospital’s medical record. These diagnoses were classified into three predetermined categories including opioid overdose, mixed overdose, and non-toxicological diagnoses. **Results:** The median age of the patients was 52 (IQ Range [34-68]). Sixty-two (36.6%) patients were female. Overall, 169 patients received naloxone by ALS. Of these, 38 (22.4%) were diagnosed with primary opioid overdose, 36 (21.3%) with mixed overdose and 95 (56.2%) with other non-toxicological diagnoses. Compared to non-responders, those with a positive response to treatment were diagnosed more frequently with primary opioid overdoses (46%, vs. 13%, p <0.001). As expected, non-responders had a higher likelihood of non-toxicological diagnoses than did those that had a positive response (69% vs. 26%, p<0.001). Surprisingly, there were a significant number of responders who had non-toxicological diagnoses. **Conclusions:** Of the patients administered naloxone prehospital, the majority had a diagnosis other than an opioid overdose. While primary opioid overdose was more frequent in those with a positive response to treatment, a significant number of positive responders with non-opioid related diagnoses were also found. It is prudent to maintain a broad differential diagnosis for patients with encephalopathy and a presumed opioid toxidrome, independent of their response to naloxone.

124. TRANSITION FROM MILITARY PREHOSPITAL MEDICINE TO CIVILIAN EMS
BACKGROUND: Nearly 10,000 veterans with medical experience enter the civilian workforce each year. A current manpower shortfall exists in civilian EMS systems, with some estimating a need for 12,000 more EMTs and paramedics annually. We sought to identify the percent of military medics who obtained civilian prehospital certification and possible reasons for those who did not receive civilian EMS certification. METHODS: The National Association of EMTs (NAEMT) created a 21-question survey administered online to any willing participant. Participants were solicited through the NAEMT website, personal connections and social media. All survey responses remained anonymous and no identifiable information was collected. Survey questions were compiled and are reported here as percentage of respondents. Upon completion of survey administration, the results will be analyzed with a logistic regression model to determine relationship of military characteristics to likelihood of certification, and intent to transition to civilian EMS. RESULTS: Preliminary data results include 423 military medic respondents. 284 (71%) had prehospital experience and 230 (57%) had Emergency Department (ED) experience while in the military. Over 36% of respondents had 18+ months of ED or combat related duty. Civilian prehospital certification was obtained by 360 respondents, 155 (37%) EMT and 154 (37%) paramedic. However, 114 (28%) of respondents say they will not work in civilian EMS. Top selected reasons for not pursuing civilian EMS careers include pursuing a medical career that was not prehospital (27%), pay disparity (19%), and no interest in civilian prehospital medicine (16%). Free-text responses communicate frustration with the certification process and a desire to get recognition for military experience when transitioning to the civilian sector. Respondents also expressed a desire for higher-level medical certifications to better match the skills they gained while in the military. CONCLUSIONS: Based on preliminary data analysis, nearly 3/4 of the military medic respondents obtained civilian EMS certification, yet 28% do not intend to enter the civilian EMS workforce. Further efforts to identity and
eliminate barriers for military prehospital providers transitioning to civilian EMS may reduce current and future EMS provider shortfalls.

125. THE EMERGENCY MEDICAL SERVICES SYSTEM OF NAVY MEDICINE WEST

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CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: The Navy Medicine West (NMW) emergency medical services (EMS) system provides prehospital care to over 665,000 beneficiaries over a diverse and expansive geographical region. The management of such a vast and varied organization requires an understanding of the basic utilization and resources of the system. The objective of this study was to provide an overview of the resources, training, workload, and quality assurance programs of the EMS systems under the supervision of NMW.

Methods: Our assessment of a process improvement database was approved as exempt from our local Institutional Review Board. Local Medical Directors began submitting monthly reports to NMW in January 2017. A retrospective review of prospectively collected data was conducted using the January through December 2017 reports from the 14 EMS systems in NMW. Advanced Life Support (ALS) versus Basic Life Support (BLS) determination was made using standard definitions of care provided by Center for Medicare and Medicaid Services. Results: During 2017 there were 57 total EMS units operating in NMW, of which 58% were BLS units, 5% were Intermediate level (ILS) units, and 37% were ALS units. These were operated by 857 prehospital providers, of which 89% were NR-EMT, 4% NR-AEMT, and 7% NR-Paramedics. Of the 4327 recorded runs, 845 (20%) were non-transports. The acuity of the transports was 30% ALS and 70% BLS. Critical indications for EMS transport included 34 (0.8%) out of hospital cardiac arrests, 790 (18.3%) traumatic injuries, 44 (1.0%) cerebrovascular accidents. Local medical directors conducted quality assurance review of 24% of patient care records. These RESULTS reflect a
limited data set based on the 46% of monthly reports currently submitted. **Conclusions:** In this limited data set, the NMW EMS system delivered prehospital care to 4327 patients in 2017, including 868 (20%) patients suffering from time-sensitive conditions. Quality assurance review was completed for less than 25% of runs and may present an opportunity for process improvement. Further investigation is needed to determine the most common types of calls and how to best allocate resources to optimize prehospital care throughout NMW.

126. PARAMEDIC-OPERATED PREHOSPITAL POINT OF CARE ULTRASOUND FOR PATIENTS WITH UNDIFFERENTIATED DYSPNEA: A PILOT STUDY

Jacob Schoeneck, Ryan Coughlin, David Cone, Kevin Burns, Daniel Joseph, Ian Medoro, Cristiana Baloescu, Sharmin Kalam, Amanda Medoro, Rachel Liu, Christopher Moore, Yale New Haven

CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

**Background:** Thoracic ultrasound is frequently used in the emergency department (ED) to evaluate patients with shortness of breath, but prehospital use is not widespread. Systematic studies are needed to assess the ability of non-physician EMS personnel to adequately obtain and accurately interpret thoracic ultrasonography in patients with undifferentiated pathology. **Methods:** A prospective observational pilot study assessed the ability of paramedics to identify B-lines, lung sliding, pleural effusions, and pericardial effusions using a pocket ultrasound in the prehospital setting. Paramedics completed a 90-minute didactic session followed by hands-on training in the ED. Adult prehospital patients with shortness of breath showing signs or symptoms of respiratory distress were eligible for inclusion. Paramedics recorded their findings and their most likely pre- and post-ultrasound diagnoses. Repeat point-of-care ultrasounds were performed by trained physicians upon arrival to the ED. All clips were reviewed by a point-of-care ultrasound expert. Statistical analyses determined simple test characteristics and interrater agreement. **Results:** Sixty-three paramedics completed both the didactic
and hands-on training; 22 performed prehospital ultrasounds, enrolling 69 patients. Forty-five patients received ED ultrasounds. There was no significant difference in the paramedic and physician interpretations for significant B-lines (p=1.0), lung sliding (p=0.06), or pericardial effusions (p=0.33), but interpretation for pleural effusion was significantly different (p=0.01). There was a positive Spearman correlation between the finding of bilateral significant B-lines and a change in the paramedic’s pre-ultrasound of diagnosis of “COPD/Asthma” to the post-ultrasound diagnosis of “CHF” (R=0.2624; p=0.05). Of 117 paramedic images, 63% were adequate for interpretation, with moderate interrater agreement for significant B-lines (κ=0.46). Paramedic-performed ultrasound had a sensitivity of 64% and specificity of 81% for significant B-lines. Conclusions: This pilot study suggests that paramedic interpretation of prehospital thoracic ultrasound assessing for significant B-lines is comparable to that of ultrasound performed by physicians in the ED. Coronal lung views for pleural effusion may be more challenging for paramedics to perform. Discovery of pathologic ultrasound findings can change paramedic diagnostic decision-making. Further study is needed to determine any effect on patient-centered outcomes.

127. DESCRIBING PREHOSPITAL DELIVERIES IN MICHIGAN

David Eisenbrey, Robert Dunne, Kris Torossian, William Fales, Robert Swor, Beaumont Health System, Department of Emergency Medicine CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

Background: We observed clinically that prehospital deliveries locally appeared to have a high rate of complications. There is scant literature that addresses prehospital deliveries across a state. Objectives: To describe utilization, complications, and short term outcomes of EMS attended prehospital deliveries in Michigan in 2015; and, to describe the relationship between prehospital delivery and socioeconomic status (SES). Methods: We queried the Michigan EMS Information System (MI-EMSIS) for prehospital
deliveries. We identified candidate cases, using a combination of narrative, demographic and procedural search strategies. Cases were included if birth was prior to hospital arrival. We abstracted demographics, birth circumstances, complications, and birth outcome. Duplicate reviews of 20% of cases were performed to assure interrater reliability. Categories of complications were constructed post hoc. To assess relationship of SES to frequency of EMS delivery we utilized mean income of patient residence zipcode. Income brackets were stratified by $10,000 increments starting with <$40,000 and continuing up to $100,000 and greater. Test of correlation was determined by Pearson's correlation coefficient. Results: Michigan Vital Statistics reported 1,577 out of hospital (excluding birthing center) births in 2015, and identified 228 EMS attended deliveries from 1.6 million MI-EMSIS records. Mothers' median age was 28 (range 15-41). The majority (59.2%) were Caucasian. Most were normal vaginal deliveries on scene or enroute to hospital (92, 40.0%), or delivered prior to EMS arrival (58, 25.4%). Maternal or fetal complications were identified in 71(31.1%) deliveries. Complications included non-viable fetus (13, 5.7%), fetal demise (12, 4.8%), post-partum hemorrhage (8, 3.5%), non-transient apnea (7, 3.0%), and extreme prematurity (7, 3.0%). Frequency of prehospital delivery was inversely related to estimated patient income (p=0.023). Conclusions: EMS deliveries were rare and most were normal vaginal deliveries, but almost a third had complications. Although an imperfect measure of patient SES, frequency of delivery was inversely related to patient income. These data suggest that those EMS service providers that cover lower income zip codes, would benefit from targeted obstetrical education, training and equipment.

128. IMPLEMENTATION OF A PREHOSPITAL PATELLA DISLOCATION REDUCTION PROTOCOL

Jeremy Cushman, Spencer Lord, James Brodell, Heather Lenhardt, Michael Dailey, Christopher Fullagar, Division of Prehospital Medicine, University of Rochester CATEGORY OF SUBMISSION: TRAUMA
**Background:** Acute patella dislocations account for up to 3% of all knee injuries. Prehospital care of patella dislocation often includes knee immobilization and pain management, but patella reductions are often performed in the wilderness environment by basic life support providers. Given the potential benefits of early reduction, the perceived low risk of harm and ease with which the procedure can be performed, patella reduction was added to the EMT scope of practice in New York State. To our knowledge, there are no studies reporting the RESULTS of prehospital personnel performing patella reductions. Our objective was to characterize the mechanism of patella related injuries and describe the success rate, complications, and EMS provider experience with a prehospital patella reduction protocol.

**Methods:** This was a retrospective review of a pre-existing quality assurance database. EMS providers who attempted patella reduction between October 1, 2016 to June 30, 2018 were asked to complete a survey at the time of care documentation. Data was collected using Research Electronic Data Capture (REDCap, Vanderbilt University) and included mechanism of injury, reduction attempt result, pre-and post-reduction pain scores, observed complications, and transport decision. **Results:** Fifty-one patients underwent an attempt at patella reduction at one of 34 EMS agencies during the study period. 47/51 (92%) were successfully reduced. Mean age was 21.4 +/- 13.8 years (Range 8-88). Mechanism of injury included sports injuries (35, 68%), falls (8, 16%), twist and fall (2, 4%), non-sport contact (2, 4%), motor vehicle accident (1, 2%), and unknown (3, 5%). Median initial pain score was 8.2, final pain score was 2.7. 12/51 (24%) had pain medication prior to, and 11/51 (22%) after reduction. Eight (16%) declined transport to the hospital. There were no reports of complications during or after reduction. Two of the four unsuccessful reductions were due to pain. **Conclusions:** While a convenience sample, our RESULTS provide preliminary evidence that patella reduction can be performed by EMS providers with infrequent complication and offer significant pain relief.
CHARACTERISTICS OF EMS TRANSPORT REFUSAL FOLLOWING GLUCOSE OR NALOXONE ADMINISTRATION

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BACKGROUND: EMS responses resulting in transport refusal are of interest due to clinical outcome, liability and financial risks. Treat and release protocols are being increasingly developed for hypoglycemia and opioid overdose. Scant literature exists comparing the characteristics of refusals between patients given naloxone, glucose, or neither drug. Objective: We sought to describe the characteristics of transport refusal among patients who received glucose, naloxone, or neither medication. METHODS: Using 2017 ESO Solutions electronic patient care record (ePCR) data, we performed a retrospective analysis of all 911 responses with patient contact. Our outcome was transport refusal. Patients were classified as having received naloxone, glucose, or neither. Multivariable logistic regression was used to control for other covariates including response characteristics (time of day, day of week), agency characteristics (type, volunteer status), and patient characteristics (age, gender, race/ethnicity). Adjusted odds ratios and 95% confidence intervals are reported (aOR, 95%CI). RESULTS: We excluded 1,219 patients who received naloxone and glucose, leaving 2,778,921 records. Overall, 399,766(14%) of all responses resulted in transport refusal. 2,838(7%) of those given naloxone refused, 16,548(39%) given glucose refused, and 380,380(14%) given neither drug refused (p<0.001). Of patients given naloxone, 60% were male, compared to 53% given glucose and 46% given neither (p<0.001). More patients receiving naloxone were white, non-Hispanic (80%) compared to those given glucose (67%), or neither (71%) (p<0.001). About half (47%) of those given naloxone were 18-39 years old, compared to 14% of those given glucose and 22% of those given neither. After controlling for patient, agency, and response characteristics, odds of non-transport for patients given glucose were over four-fold higher (aOR:4.67, 95%CI:4.57-4.77) and odds of non-transport for patients given naloxone were 54% lower (aOR:0.46,
95%CI:0.44-0.48) compared to patients given neither. **Conclusions:** In this large, multi-agency sample of EMS patient contacts, transport refusal rates were higher for those given glucose and lower for those given naloxone compared with those given neither. Patients given naloxone tended to be younger, male, and white, non-Hispanic. Limitations include retrospective analysis and use of data from a single ePCR vendor.

130. IMPROVING SURVIVAL FROM OUT-OF-HOSPITAL CARDIAC ARREST IN DETROIT

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**CATEGORY OF SUBMISSION:** CARDIAC

**Background:** Prior publications have highlighted survival rates from out-of-hospital cardiac arrest (OHCA) in Detroit below 1% a decade ago. Due to a resurgence in the city and improvements in public services, we hypothesized that the survival rate of OHCA patients in Detroit has improved and is associated with an increasing trend in bystander cardiopulmonary resuscitation (CPR). **Methods:** A retrospective, observational review of all non-traumatic OHCA responded to by Emergency Medical Service (EMS) was performed across Wayne, Oakland, and Macomb counties from 2015 through 2017. Data was abstracted from the Cardiac Arrest Registry to Enhance Survival (CARES registry). Those cases without run sheets or medical records were excluded. We defined good neurological outcome as cerebral performance scores of 1 or 2. We identified all OHCA that occurred in Detroit and used all OHCA that occurred within the remaining suburban tri-county area as comparison. We used univariate statistics to compare frequencies and test of trend over the 3-year period. **Results:** Analysis included 10,796 OHCA, of which 3,132 occurred in Detroit and the remainder occurred in the suburban region. Patients with OHCA in Detroit were overall younger (61.7 vs. 66.3 years, p<0.001), more frequently female (44.5% vs. 39.4%, p<0.001), and more frequently presented with a non-shockable rhythm (85.8% vs. 81.6%, P<0.001). While rates of layperson bystander CPR remained unchanged in the suburban
region (35.8% to 35.1%), there was a significant increase in Detroit (27.4 to 35.6%, p<0.001). Detroit also had a substantial increase in first responder-initiated CPR (10.0% to 22.8%, p<0.001). Rates of shockable rhythms increased in Detroit from 12.9% to 15.1%, though this trend did not reach statistical significance (p=0.079). Whereas survival to hospital discharge remained unchanged (8.5% to 8.2%) in the suburban region, Detroit saw a significant increase in survival (5.3% to 7.3%, p=0.026). **Conclusions:** In Detroit, OHCA survival has significantly improved alongside improvements in bystander and first-responder CPR between 2015 and 2017.

131. CARDIOVASCULAR EVENTS AFTER THE SEWOL FERRY DISASTER

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**CATEGORY OF SUBMISSION:** CARDIAC

**Background:** The Sewol ferry disaster, which occurred on April 16, 2014 in Korea and resulted in about 400 deaths or lost, was the most terrible event. Most people would experience serious psychologic stress because the live TV news repetitively reported the scene of rescue failure and immersed ferry with passengers. After 3 weeks of the event, the president announced a formal decision on abandonment for rescue activity. We hypothesize that such a traumatic national disaster might be a trigger strong enough to cause an increase in the incidence of emergency cardiovascular events.

**Methods:** Using the National Emergency Department Information System (NEDIS) covering about 130 hospital emergency departments, we extracted all adult patients (≥18 years) who visited emergency departments from 15 March to 17 June in each year of 2011-2014 (from 4 weeks before to 8 weeks after 16 April) and were diagnosed with cardiovascular events (acute myocardial infarction, angina, and cardiac arrhythmias) coded with international classification of disease-10. Poisson regression models were used to calculate the incidence rate ratios (IRRs) comparing the weekly changes in the occurrences of cardiovascular events from the week of Sewol (April 16-22) to 8 weeks after the disaster (June 11-17),
adjusting for calendar years (years 2011~2014) and environmental factors. **Results:** During the study periods, cardiovascular events were assessed in 73,823 patients. When the cardiovascular incidents of each week until the 8<sup>th</sup> weeks after Sewol were compared with the control period, on the week of Sewol disaster and 3 weeks after the disaster showed significant increase in the cardiovascular emergencies; 1.09 (95% CI, 1.03-1.15) and 1.08 (95% CI, 1.02-1.15), respectively (p<0.01 for both). In particular, there was 21% increase in incidence of arrhythmia (IRR=1.21; 95% CI=1.02-1.44; p=0.03).

**Conclusions:** We found a significant increase in the incidence of cardiovascular events during the week of and on the 3 weeks after the Sewol ferry disaster in 2014. These additional cardiac emergencies may be triggered by emotional stress in relation to the tragic catastrophe, suggesting the importance of considering the potential public health impact on the society as a whole, including those with indirect exposure to tragic catastrophe.

132. **ALCOHOL USE, SUBSTANCE USE, AND MENTAL HEALTH IN PARAMEDICINE**

Elizabeth Donnelly, Renee MacPhee, Steven Fischer, Dwayne Barris, *University of Windsor* **CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** The amount of empirical research that has investigated alcohol and substance use among paramedics is sparse, at best. The purpose of this study was to determine the prevalence of alcohol and substance use among Canadian paramedics, to describe their reported reasons for use, and to ascertain if a relationship exists between alcohol and substance use and levels of depression, anxiety, and stress. Our hypothesis was that alcohol and substance use would be prevalent, and significantly related to levels of stress, anxiety, and depression. **Methods:** Through the national Canadian Paramedic Health & Wellness survey, paramedics were asked if they consumed alcohol or controlled substances, and to identify their reasons for use. Levels of depression, anxiety and stress were measured using the DASS-21. Analyses were conducted using descriptive statistics and independent samples t-tests. **Results:**
Based on 2,557 completed surveys, 80.8% had consumed alcohol and 8.2% used controlled substances. The average number of drinks consumed in a week was M= 5.97 (SD= 6.97). Ninety-six percent reported that alcohol was for recreational purposes, 4.1% reported it was for pain control, and 5.7% cited "other" reasons, with the most frequent "other" reason was mental health concerns (42.4%, n=50). Respondents who reported using alcohol for mental health concerns had significantly higher levels of stress, depression, and anxiety (p<.001). Respondents who had mild to severe levels of depression, anxiety, and stress drank more alcohol than those who did not have mental health concerns (p<.001). Respondents who reported using controlled substances, 65.2% reported it was for recreational use, 34.8% for pain control, and 34.8% for "other" reasons. The most frequent "other" reason was mental health concerns (42%, n=32). Respondents who reported using controlled substances for mental health reasons had significantly higher levels of stress, depression, and anxiety (p<.001). **Conclusions:** These results indicate that paramedics do consume alcohol and controlled substances, and for some, that use is related to their mental health. The significant relationship between alcohol use, controlled substance use, and mental health indicates that there is a need for holistic services that address both concerns for paramedics.

133. PUBLIC PERCEPTION TOWARDS THE DECISION TO PERFORM BYSTANDER CARDIOPULMONARY RESUSCITATION

**Torben Becker, Sarah Gul, Scott Cohen, Carolina Maciel, Travis Murphy, Teddy Youn, Emmett Martin, Joseph Adrian Tyndall, Carlos Alviar, University of Florida**

**CATEGORY OF SUBMISSION:** CARDIAC

**Background:** Bystander cardiopulmonary resuscitation (CPR) after out-of-hospital cardiac arrest (OHCA) improves survival and neurological outcomes. Unfortunately many OHCA victims do not receive bystander CPR during a witnessed arrest. It is known that gender disparities play a role with lower rates of bystander CPR in women suffering OHCA in public places. Our aim was to identify potential factors
influencing the decision to perform bystander CPR. **Methods:** Participants at CPR training events were surveyed prior to training. Using different scenarios, subjects were asked about their comfort level performing CPR on female, geriatric, and pediatric victims. Anonymous responses were collected and transformed into categorical variables by a psychometrist. **Results:** Of the 677 participants, 585 (86.4%) responded to the survey, with 87.5% between 18-29 years of age, 58.8% without prior CPR training and 93.3% without prior CPR experience. Reasons to hesitate starting bystander CPR in women included concern about exposing the victim (12.9%), being accused of sexual assault (6.1%), and possible pregnancy (6.5%). In participants with prior CPR training, 61.1% reported concerns about performing CPR on women, with 18.9% having concerns about performing chest compressions in relation to breast location. In participants without prior CPR training, 73.2% reported having concerns about performing CPR on women. Causing injury and exposing the patient were top concerns to perform CPR in women amongst participants who were uncomfortable (30.5% and 17.5% respectively) and comfortable (14.5% and 9.8% respectively) performing CPR in public. Causing injury was the top concern in performing CPR on geriatric (45.4%) and pediatric patients (41.7%), followed by fragility (18.1% and 10.2% respectively). Lack of skills to perform CPR on children was reported in 22% of CPR-trained participants. **Conclusions:** Public perception of OHCA victims influences willingness to perform bystander CPR. Factors such as age, gender, fear of injury, pregnancy status and sexual assault concerns can negatively impact this lifesaving intervention. Awareness of the importance of bystander CPR on any cardiac arrest victim must be improved.

134. TRENDS IN CALLS TO PARAMEDICS FOR SUSPECTED OPIOID OVERDOSES IN TORONTO, CANADA.

**Russell MacDonald, Chris Olynyk, Adam Thurston, Jennifer Liang, Kandace Ryckman, Toronto Paramedic Services / University of Toronto** CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS
**Background:** Health surveillance data sources specific to opioid overdose are not well defined. A novel collaboration between Toronto Paramedic Services (TPaS) and Toronto Public Health (TPH) allows for real-time monitoring of calls to TPaS for suspected opioid overdoses. A review of trends was conducted to better understand and respond to the opioid overdose crisis in Toronto, Canada. **Methods:** Electronic patient care records for suspected opioid overdoses from August 2017 to July 2018 were reviewed. Suspected opioid overdoses were cases where paramedics suspected an opioid overdose on clinical grounds, naloxone was administered prior to paramedic arrival, or naloxone was administered by paramedics. Trends in the number and proportion of suspected opioid overdose calls by patient demographics, time of call, and geographic location were examined. Significant differences were estimated using overlapping confidence intervals calculated using a Poisson approximation of the binomial distribution. **Results:** A total of 3,110 calls for suspected opioid overdoses were attended by paramedics, including 172 fatal cases. Significant differences were observed by sex (65% male; 95% CI: 63-67%), and age (31% between 30-39 years; 95% CI: 29-32%). There was a significant increase in calls during summer months compared to winter months, and during social assistance payment periods at the end of each month. Geographic trends indicate a strong concentration of non-fatal calls in the downtown core area, whereas fatal calls were more evenly distributed across the city. **Conclusions:** Monitoring calls to paramedics for suspected opioid overdoses can provide situational awareness for local paramedic services and partner agencies addressing the opioid overdose issue. These findings also have implications for health system planning through the identification of high-risk patient demographics, time periods, and geographic locations for opioid overdoses.

135. COMMUNITY PARAMEDIC PILOT PROGRAM OPERATIONAL METRICS AND IMPACT ON PATIENT EMERGENCY MEDICAL SERVICES UTILIZATION
Background: Community Paramedicine (CP) is an expanding area of interest within the field Emergency Medical Services (EMS). Few studies have established operational metrics and outcome measures for CP programs. We aimed to evaluate operational metrics and change in 9-1-1 use among patients enrolled in a pilot, fire department-based, CP program. Methods: We performed a retrospective cohort study of adults enrolled in a CP program from 2016-2018. Patients were voluntarily enrolled in the CP program if they frequently used a community emergency department or 9-1-1 services. A select group of experienced paramedics received targeted training in relevant concepts (e.g., motivational interviewing, community resources). Paramedics contacted patients on a regular basis via both in-home visits and phone calls based on perceived clinical need. Through a review of electronic medical records, we collected patient demographic and clinical information and program operational metrics. The primary outcome of interest was the change in 9-1-1 use after enrollment. These two groups were compared using a paired t-test. Results: Of 29 patients that met inclusion criteria 24 were successfully enrolled, and data was available for 22 of the patients. Of these, 19 patients (86.3%) were female and 3 (13.6%) were male. 13 (59.1%) had a medical history of mental illness, 7 (31.8%) had a history of substance abuse, and 5 (22.7%) had a history of both. Total number of patient contacts was 742. Of these, 415 (54.9%) were in-person contacts and 334 (45.1%) were phone contacts. 265 (63.8.1%) of the in-person visits involved two paramedics and 150 (36.2%) involved one provider. Pre-enrollment 9-1-1 calls totaled 268, averaging 22.3 calls per month over the preceding 12 months. Post-enrollment 9-1-1 calls totaled 137 from enrollment date to present, averaging 11.1 calls per month. Average calls per month decreased by 50.2% (p=.004) post-enrollment, a reduction of 133 calls per year. Conclusions: Following enrollment in a CP pilot program, participants' use of the EMS
system decreased by 50%. CP programs may be an effective way to support the most vulnerable patients and decrease EMS use. Further studies to more rigorously evaluate patient outcomes and assess the level of intervention are needed.

136. CAN 911 DISPATCHERS RELIABLY IDENTIFY PATIENTS SUFFERING A STROKE

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Background: The utilization of calls to 911 has been the primary access point for a majority of the US population. These PSAP (public safety access points) are not all treated equal. Some agencies may use a recognized EMD (emergency medical dispatch) process while others may not. When a person calls 911 the time to treatment is critical. Dispatchers are tasked with taking call information and sending resources based on established response plans. Early recognition of stroke improves outcomes. Emergency Medical Dispatch is the one method used to determine the priority and type of the call.

Objective: To evaluate the ability of a 911 dispatcher to reliably identify a patient who is suffering a stroke or transient ischemic attack (TIA).

Methods: A retrospective analysis of de-identified data from the ESO® Austin, TX database was used. The data set considered only run types listed as 911 responses with health data exchange (HDE) hospital outcomes of stroke or TIA from January 1, 2017 to December 31st 2017. Patient outcomes with ICD-10 the following codes were used: I60 - non-traumatic subarachnoid hemorrhage; I61 - non-traumatic intracerebral hemorrhage; I62 - other and unspecified non-traumatic intracranial hemorrhage I62; I63 - cerebral infarction; G45 - transient cerebral ischemic attacks and related syndromes. Calculations for sensitivity and specificity of dispatcher identified stroke was incorporated to establish the confidence intervals displayed in the respective tables. Results: A total of 2,199 cases were identified for inclusion and analysis. Dispatchers with in the given parameters of the study were able to correctly identify a stroke patient 39% of the time. Sensitivity of 38.9% (95% CI
36.88% to 41.00%), Specificity of 97.7% (95% CI 97.53% to 97.83%), Positive predictive value of 48.9%
(95% CI 46.84% to 51.00%), Negative predictive value of 96.6% (95% CI 96.45% to 96.67%). **Conclusions:**
Dispatchers are not able to reliably identify a patient suffering a stroke or TIA. Preliminary results showed that this is valid no matter the type of dispatch software that was being used.

137. UTILITY OF PREHOSPITAL CARDIAC BUNDLES OF CARE FOR IMPROVING KEY INTERVENTIONS PROVIDED TO CHEST PAIN PATIENTS IN THE FIELD

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**CATEGORY OF SUBMISSION:** PROFESSIONAL

**Background:** 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 care bundle on key interventions provided to patients presenting with chest pain and for the subset set of these patients that were experiencing ST Elevation Myocardial Infarction (STEMI). **Methods:** Atypical chest pain, typical chest pain and STEMI bundles of care for patients ≥ 30 years old presenting with chest pain or other symptoms of acute coronary syndrome (ACS) were implemented in an urban EMS system in 2015. Key interventions in the care bundles included acquiring a 12 Lead EKG, acquiring a 12 Lead EKG in <10 Minutes, Aspirin administration, IV access attempt and IV access success. Retrospective chart reviews on intermittent months were conducted comparing the pre intervention month of December 2014 to 2015-2018 performance. For patients presenting with STEMI, the percentage of cases meeting First Medical Contact (FMC) to Device Time <90 minutes was compared from 2015-2018. **Results:** Compared to the pre intervention month of December 2014 (155 cases), there was significant monthly improvement in key care bundle intervention completion from 2015-2018. In May 2018 (170 cases) 12 Lead EKG acquisition improved from 76.5% to
96.5% (p <0.0001), 12 lead EKG acquisition in <10 minutes improved from 70.6% to 87.7% (p=0.0008), Aspirin administration improved from 60.1% to 85.9% (p <0.0001), IV attempted improved from 68.5% to 75.2% (NS p=0.2089) and IV successfully placed improved from 60.3% to 68.2% (p=0.0467). For the subset of patients presenting with STEMI meeting AHA Mission: Lifeline® inclusion criteria FMC to Device Time <90 minutes improved from 54.5% in 2015 (55 cases) to 91.7% through July 2018 (24 cases) (p=0.0016) **Conclusions:** The implementation of prehospital cardiac patient bundles of care resulted in significant performance improvements in accomplishing key interventions for patients presenting with atypical & typical chest pain & STEMI. Patient care bundles may have significant utility to improve patient care and safety in the prehospital setting.

138. CLIMATOLOGIC FACTORS ASSOCIATED WITH USE OF EMERGENCY MEDICAL SERVICES (EMS)

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**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** Fluctuations in EMS responses can have a substantial impact on the ability of agencies to meet resource needs within an EMS system. We aimed to identify climatologic characteristics as potentially predictable factors associated with EMS responses. **Methods:** We reviewed hourly counts of scene responses documented by 24 EMS agencies in Western Pennsylvania between January 1, 2014 to December 31, 2017 and compared rates of responses to climatologic characteristics. Responses to counties nonadjacent to the studied weather reporting station and interfacility/scheduled transports were excluded. We identified the mean temperature, visibility, dew point, wind speed, total inches of precipitation, and presence of rain or snow in 6-hour windows prior to dispatch, in addition to temporal factors of time of day and weekend versus weekday. Analysis was performed using multivariable linear regression of a negative binomial distribution, reporting incidence rate ratios (IRR) with 95% confidence.
intervals (CI). Stratified analyses were performed for trauma and pediatric dispatches (<18 years). **Results:** We included 529,058 responses (54.8% female, mean age 57.2 +/- SD 24.7 years). Incidence of response was associated with (IRR, 95% CI) each degree increase in ambient temperature (Celsius, 1.04, 1.04-1.04), following rain (1.07, 1.06-1.08) or snow (1.04, 1.02-1.06), increased wind speed (miles per hour, 1.02, 1.02-1.02), and during daytime (06:51-18:50, 1.62, 1.61-1.64) compared to night (18:51-06:50). Lower incidence of responses occurred with higher dew point (Celsius, 0.97, 0.97-0.97) and on weekends (0.84, 0.83-0.84). Trauma cases (n=82,107) occurred more at warmer temperatures (1.04, 1.04-1.04), following rain (1.05, 1.02-1.07) or snow (1.13, 1.09-1.17), with each increasing inch of precipitation (1.15, 1.05-1.27), during daytime (1.36, 1.34-1.38) during weekends (1.03, 1.02-1.05), and with increased wind speed (1.01, 1.01-1.01). Pediatric cases (n=35,650) had a greater association with increased temperature (1.05, 1.05-1.05), rain (1.08, 1.04-1.11) and snow (1.10, 1.04-1.15) compared to adult associations with temperature (1.04, 1.03-1.04), rain (1.07, 1.05-1.08), and snow (1.03, 1.02-1.05). **Conclusions:** EMS responses increased by 4% for each Celsius degree increase and following rain and snow. Temperature had a greater effect on EMS utilization in children. These findings may assist in planning by EMS agencies and emergency departments to identify periods of greatest resource utilization.

139. PREHOSPITAL MANAGEMENT OF PEDIATRIC ASTHMA PATIENTS

*Sylvia Owusu-Ansah, Sriram Ramgopal, Christian Martin-Gill,* *Children's Hospital of Pittsburgh*

**CATEGORY OF SUBMISSION:** PEDIATRIC

**Background:** Asthma is a common pediatric diagnosis for Emergency Medical Services (EMS) transports, however there are a paucity of data on prehospital asthma management. The purpose of this study was to describe prehospital management of pediatric patients with suspected asthma exacerbation.

**Methods:** We conducted a retrospective review of electronic reports from 24 EMS agencies in
Southwestern Pennsylvania between January 1, 2014 to December 31, 2017. We identified patients 2-17 years with documented wheezing, excluding those with suspected anaphylaxis. Patients with documented respiratory distress, agitation, fatigue, grunting, labored and assisted breathing, nasal flaring, retractions, tachypnea for age, hypoxia (SpO2 <90%), or cyanosis were classified as severe asthma. We abstracted and reported descriptive statistics of demographics, vital signs, and management including administration of medications (bronchodilators, magnesium, steroids, epinephrine, intravenous fluids) and procedures (intravenous [IV]/intraosseous [IO] access, continuous positive airway pressure [CPAP], endotracheal intubation [ETI], and supraglottic airways). Results: Of 19,246 pediatric transports, 956 (4.9%) patients had documented wheezing. Of these, 487 (51%) met criteria for severe asthma. Approximately half of patients with nonsevere asthma were in the 2-5 year age group (n=232, 49%). Patients with nonsevere asthma were majority male (n=292, 61%) and 179 (37%) were Black Non-Hispanic. Treatments given included albuterol (n=269, 56%), combination albuterol/ipratropium (n=195, 41%), methylprednisolone (n=12, 2.5%), oxygen (n=110, 20%), and epinephrine (n=2, 0.4%). 37 patients (7%) received a peripheral IV line. Patients with severe asthma were primarily in the ≥12 years group (n= 241, 50%). 266 (55%) were male and 207 (42%) were Black Non-Hispanic. Treatments given for severe asthma included albuterol (n=322, 66%), combination albuterol/ipratropium (n=191, 39%), methylprednisolone (n=64, 13%), oxygen (n=147, 30%), and epinephrine (n=14, 3%). 124 (26%) had an IV placed and 2 were given CPAP (0.4%). There was no use of ETI, supraglottic airway, IOs or magnesium in any patient in this cohort. Conclusions: In this study, severe pediatric asthmatics transported by EMS were predominantly older, male, Black Non-Hispanic. Steroid usage was low in those with severe asthma, representing an area of process improvement. These data provide a baseline to determine potential for further interventions that may improve outcomes.
EFFECT OF CANCER HISTORY ON POST-RESUSCITATION CARE IN OUT-OF-HOSPITAL CARDIAC ARREST

Saee Byel Kang, So Yeon Kong, Young Sun Ro, Kyoung Jun Song, Sang Do Shin, Department of Emergency Medicine, Seoul National University Hospital CATEGORY OF SUBMISSION: CARDIAC

Background: As the global burden of cancer increases, number of out-of-hospital cardiac arrest (OHCA) patients with malignancies also increases. Recent studies show effect of percutaneous coronary intervention (PCI) is similar between cancer patients and non-cancer patients. The objective of this study is to investigate to evaluate the influence of cancer history on post-resuscitation therapies among OHCA patients with ROSC. We hypothesize that OHCA patients with cancer history receive lower post-resuscitation treatments compared with those without cancer history. Methods: All adults OHCA patients with presumed cardiac etiology and sustained return of spontaneous circulation (ROSC) from 2009 to 2016 were included in this study. Main exposure was history of cancer which was obtained from medical record review process in the national OHCA registry database. The type and stage of malignancy was not classified. The primary outcome was accessibility of post-resuscitation treatment including PCI and therapeutic targeted temperature management (TTM). The secondary outcomes were survival to discharge and good neurological recovery. Multivariable logistic regression was used to determine the association between cancer and post-resuscitation treatments, PCI and TTM, respectively, Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were calculated with adjusting for potential confounders such as demographics, Utstein, EMS, and hospital factors. Results: Total 33,760 patients were included for final analysis. Of these, OHCAAs with cancer history was 3,453 (10.2%) and OHCAAs received PCI and TTM were 2,714 (8.0%) and 3,331 (9.9%), respectively. Multivariable logistic regression analysis showed that cancer patients were significantly less likely to receive PCI and TTM compared to who did not have cancer history. AOR (95% CI) 0.29 (0.24-0.37) was for PCI and 0.66 (0.58-0.77) for TTM. The AORs (95% CIs) for survival to discharge and good neurological recovery of the cancer patients were
0.47 (0.42-0.53) and 0.39 (0.33-0.46), respectively. **Conclusions:** OHCAs with cancer history were significantly less likely to undergo PCI and TTM than non-cancer patients. The results of this study are expected to provide a better understanding of post-resuscitation treatments given to OHCA patients with cancer history. Further studies on post-resuscitation care for OHCAs with cancer history considering type and stage are needed.

141. TOLERABILITY OF REMOTE ISCHEMIC CONDITIONING IN CHEST PAIN PATIENTS TRANSPORTED BY EMERGENCY MEDICAL SERVICES

**Mehul Patel, Bryan Chadwick, Austin Lucke, Joseph Grover, Rachel Stemerman, Timothy Platts-Mills, Joseph Rossi, University of North Carolina at Chapel Hill CATEGORY OF SUBMISSION: CARDIAC**

**Background:** Remote Ischemic Conditioning (RIC) is a promising prehospital therapy that may protect the heart during an acute ST-elevation myocardial infarction (STEMI). RIC is administered non-invasively with timed inflations and deflations of an upper arm cuff. We are currently assessing tolerability in chest pain patients administered RIC by EMS during transport to the hospital. **Methods:** We are conducting a pilot study of the feasibility of prehospital delivery of RIC in a U.S. EMS system. From July-December 2018, we are enrolling 30 patients experiencing chest pain symptoms (but not meeting STEMI criteria) and requesting 9-1-1 response and ambulance transport to an academic emergency department. Using an automated device, the 40-minute RIC procedure (four cycles of five minutes inflated and five minutes deflated) is initiated by paramedics during ground transport. Upon completion of the procedure, patients are asked to rate the level of discomfort due to RIC on a scale from 0 (no discomfort) to 10 (maximum possible discomfort). We also conduct semi-structured interviews of patients’ experiences with RIC. **Results:** In July 2018, six participants were enrolled. The mean age was 54 years, and 67% were female. Three participants (50%) completed all four cycles while one had an unexplained interruption after the second cycle. In two participants, a device or operator error occurred during initiation. Of four
participants receiving at least two cycles, the mean discomfort reported was 2.75. Two participants (50%) reported discomfort during the procedure though none asked to have RIC stopped due to discomfort. Common themes from participant interviews were that RIC felt like a blood pressure cuff and that RIC squeezed and felt tight around the arm. **Conclusions:** Our preliminary results suggest that RIC is well tolerated by chest pain patients transported by EMS. To our knowledge, our ongoing pilot study is the first in the U.S. assessing the feasibility of initiating RIC during ground ambulance transport. We intend to use these pilot data to inform the design of a prehospital trial of RIC in acute STEMI.

142. CHARACTERISTICS AND SPATIAL DISTRIBUTION OF VOLUNTEER EMS PROFESSIONALS IN MASSACHUSETTS

**Rebecca Cash, Madison Rivard, Ashish Panchal, National Registry of EMTs**

**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** Volunteers working in EMS are believed to cluster in rural areas; however, little is known concerning the geographic distribution of volunteers and community demographics where volunteerism is high. Our objective was to determine the spatial distribution of volunteers in Massachusetts and compare community characteristics of high and low volunteer areas. **Methods:** We completed a cross-sectional analysis of EMS professionals in Massachusetts that recertified their National EMS Certification from October 1, 2017 to March 31, 2018. EMS professionals that completed a workforce profile were classified as paid or volunteer (volunteer was their main EMS job) and geocoded to census tracts. High volunteer areas were defined as census tracts with ≥ 50% volunteer EMS professionals. Spatial clustering was determined using Moran’s I, nearest neighbor ratio (NNR), and the Getis-Ord Gi* statistic. Census tract-level demographic characteristics (population density, median household income, educational attainment) were determined using 2016 American Community Survey 5-year estimates. Chi-square and Wilcoxon rank sum tests were used to compare community characteristics in high and low volunteer areas.
areas. **Results:** A total of 3,971 EMS professionals from Massachusetts completed the workforce profile, and 3,692 (93%) were included after geocoding. Of these, 7% reported working as a volunteer at their main EMS job. The median age of volunteers and paid employees was similar (33 versus 36 years, \( p=0.12 \)), but there was a higher proportion of females in the volunteers (35%) compared to paid (21%, \( p<0.001 \)). There was significant clustering of high volunteer areas (Moran's I, \( p<0.001 \); NNR=0.758, \( p<0.001 \)) with clusters primarily in the western and central regions. Comparing community characteristics between high and low volunteer areas, we found no difference in median population density (2284.5 versus 2109.2 people/square mile, \( p=0.71 \)) or median household income ($73,160.50 versus $74,598, \( p=0.48 \)). There was a significantly higher proportion of the population with a bachelor's degree in high volunteer areas (23%) compared to low volunteer areas (19%, \( p<0.001 \)). **Conclusions:** About 7% of recently recertified EMS professionals in Massachusetts volunteer at their main EMS agency. Volunteers were spatially clustered, with high volunteer areas in the western and central regions of Massachusetts. Limitations include evaluating a single state that may not be generalizable to other areas.

143. PREHOSPITAL END-TIDAL CO2 MEASUREMENT IN NON-INTUBATED TRAUMATIC BRAIN INJURY PATIENTS: CONCORDANCE BETWEEN EMS PROVIDER DOCUMENTATION AND NON-INVASIVE MONITOR DATA TRACKING

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**Background:** End-Tidal CO2 (ETCO2) monitoring is valuable in the management of traumatic brain injury (TBI). In intubated patients it helps prevent hyper/over-ventilation. In non-intubated patients, placing a sensor in the nares allows accurate monitoring of respiratory rate and has other promising uses (e.g.
monitoring ETCO2 trends in worsening TBI, COPD, etc). Objective: To identify how accurately EMS providers document ETCO2, we compared the values recorded in EMS patient care records (PCR) to monitor data in non-intubated TBI patients. **Methods:** Cases from 6 EMS agencies reporting continuous monitor data (Philips MRx) in the EPIC Study (NIH R01NS071049) were evaluated (4/13-3/17). All ETCO2 data available for this post-hoc review were displayed and accessible to the EMS providers during care. Concordance was defined in two ways (for both highest and lowest ETCO2): ≤5 and ≤3 mmHg difference between the monitor data and PCR-documented values. **Results:** 106 cases were included [median age: 47 (range: 9-91), 66% male]. The highest PCR-recorded vs monitor ETCO2 values had excellent concordance for a difference of ≤5 mmHg (85.9%) and it was good (76.4%) even when defined at the limits of instrument precision (≤3mmHg for ETCO2 compared to actual pCO2). However, for lowest ETCO2, concordance was very poor (only 42.5% for ≤5mmHg, and only 31% for ≤3mmHg). **Conclusions:** The failure to accurately document low ETCO2 in a “passive-ventilation” setting may have significant implications for improving ventilatory care among intubated patients because identifying and correcting hypocapnia/hyperventilation in actively-ventilated cases is extraordinarily important. The low concordance rates may be due to the emphasis on discreet, intermittent vital sign documentation rather than ongoing identification and documentation of significant ETCO2 variation.

144. ASSOCIATION BETWEEN AWARENESS TIME INTERVAL AND OUTCOMES OF OUT-OF-HOSPITAL CARDIAC ARREST

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**Background:** Early calling for Emergency medical services (EMS) can lead early dispatch detection of out-of-hospital cardiac arrest (OHCA), early EMS response, and consequently provide early cardiopulmonary
resuscitation (CPR) and defibrillation processes. This study aimed to determine the association between the time interval from awareness of OHCA to call for EMS service by lay person and outcomes in OHCA. **Methods:** EMS-treated, witnessed, and adult OHCA (≥ 15 years) with presumed cardiac etiology between 2013 and 2016 were analyzed, excluding patients with unknown time factors and outcomes. The main exposure was awareness time interval (ATI) from time interval from awareness of OHCA to calling EMS service. Patients were classified with four ATI groups; group 1(0-119 seconds), group 2(120-239 seconds), group 3(240-359 seconds), and group 4(360-seconds). The outcomes were cerebral performance category 1 or 2 (good CPC). Multivariable logistic regression analysis was performed to calculate adjusted odds ratios (AORs) and 95% confidence intervals (CIs) for outcomes by one-minute delay of ATI and ATI group (reference=group 1). We compared the effect size of ATI on outcomes across three witness groups (Layperson, Family, and Unknown) **Results:** A total 30,291 OHCA (49.4% (group 1), 14.4%(group 2), 10.5% (group 3), and 25.7%(group 4)) were finally analyzed. Good CPC were 7.2% for total OHCA, 9.1% for groups 1, 10.1 % for groups 2, 2.4% for groups 3, 2.4% for group 4, respectively. AORs (95% CIs) by one-minute delay was 0.95 (0.94-0.97) for outcome. AORs (95% CIs) by group 1 ATI for outcome were 1.02 (0.88-1.17) for group 2, 0.75 (0.62-0.91) for group 3 and 0.51 (0.42-0.61) for group 4, respectively. AORs (95% CIs) by group 1 for outcome were 2.24 (1.90-2.63) for group 2, 1.65 (1.32-2.06) for group 3 and 0.58 (0.45-0.75) for group 4 in Layperson-witnessed OHCA, 1.07 (0.88-1.14) for group 2, 0.65 (0.61-0.85) for group 3 and 0.34 (0.32-0.42) for group 4 in Family-witnessed OHCA, respectively. **Conclusions:** A longer ATI in witnessed adult OHCA was associated with poor neurological recovery. A one-minute delay in ATI was associated with a 5% decreased of good neurological recovery and the effect was significantly increased in Family-witnessed OHCA.

145. NUMBER OF PREHOSPITAL DEFLIBRILLATION ATTEMPTS AND NEUROLOGICAL FAVORABLE OUTCOME IN OUT-OF-HOSPITAL CARDIAC ARREST WITH INITIAL SHOCKABLE RHYTHM
Background: The early and timely defibrillation in shockable rhythm of out-of-hospital cardiac arrest (OHCA) by prehospital EMS providers is crucial for successful resuscitation. In emergency medical service (EMS) systems, where advanced cardiac life support could not be fully provided before hospital transport, optimal range of prehospital defibrillation attempts is debatable. We evaluated association between the number of prehospital defibrillation attempts and survival outcomes in OHCA patients who were unresponsive to field resuscitation and defibrillations. Methods: This is a retrospective, observational study using a nationwide registry of Korea from 2013 to 2016. Adult EMS-treated OHCAs with presumed cardiac origin with shockable initial ECG rhythm were enrolled. Final analysis was performed in patients who did not achieve return of spontaneous circulation (ROSC) on scene before hospital transport. We categorized the number of prehospital defibrillation attempts into 3 groups: ≤3 attempts, 4-5 attempts and ≥6 attempts. Primary outcome was favorable neurological recovery (cerebral performance category 1 or 2) at hospital discharge. Multivariable logistic regression modeling was used to evaluate association between neurological outcome and defibrillation attempts, adjusting for potential confounders. Results: A total 6,679 patients were enrolled for final analysis. Among total ≤3 defibrillations were attempted in 5,015 patients (75.1%), 1,050 patients (15.7%) for 4-5 attempts, 614 patients (9.2%) for ≥6 attempts. Although survival to discharge rate was highest in the group with ≤3 defibrillation attempts (8.1% vs. 7.0% vs. 2.9%, p<0.01), survival rate with favorable neurological outcome was highest in group with 4-5 defibrillation attempts (3.0% vs. 4.5% vs. 2.1%, p=0.02). As 4-5 attempts group reference, adjusted odds ratio for favorable neurological outcome of ≤3 attempts was 0.66 (95% CI 0.46 – 0.94) and of ≥6 attempts was 0.47 (95% CI 0.25 – 0.89), respectively. Conclusions: For patients with shockable cardiac rhythm who were unresponsive to field defibrillation and
resuscitation, too small a number (less than 3) or too large a number (more than 6) of defibrillation attempts in the field were associated with poor neurological recovery compared to moderate defibrillation attempts (4-5). This study suggests that the number of defibrillation attempts at the scene in limited service systems for providing advanced life support should be protocolized and optimized.

146. A VARIETY OF SUPRAGLOTTIC AIRWAY DEVICES ARE SAFE FOR USE DURING HEAD UP CARDIOPULMONARY RESUSCITATION

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Background: Head Up (HUP) cardiopulmonary resuscitation has potential to improve neurological survival after cardiac arrest. Practical information regarding HUP CPR implementation is needed as it is poised to enter human evaluation. It is unknown if there is an optimal supraglottic airway device (SGA) for performance of HUP CPR, which involves a transition of head and shoulder elevation during resuscitation. Methods: Active Compression-Decompression (ACD) CPR with an Impedance Threshold Device (ITD) was performed in the flat and HUP positions for periods of 20 seconds in a human cadaver model. Airway pressures (AP), Intracranial Pressure (ICP), and aortic pressures were continuously measured using high fidelity pressure catheters. Positive pressure ventilation was provided by endotracheal tube (ETT) and 5 SGA devices (Combitube, King LT-D, LMA Protector, Air-Q, LMA, i-gel), tested in a randomized order among cadavers at a rate of 10 breaths/min, with tidal volume 600 ml with a compression: ventilation rate of 10:1. Student’s t-test and one-way ANOVA tests were performed for analysis. Results: 7 cadavers were studied. The mean decompression airway pressures (mean ± SD, mmHg) were similar between airway devices flat (ETT -3.1 ± 3, Combitube -2.6 ± 3, King LT-D -2.1 ± 3, LMA Protector -5.5 ± 4, Air-Q -4.0 ± 3, i-gel -4.0 ± 3, p=0.08) and HUP (ETT -5.2 ± 4, Combitube -1.8 ± 1.5,
The mean HUP-flat difference among all devices was -0.43 mmHg (95% CI -1.6 - 0.8). The mean Cerebral Perfusion Pressure (CerPP) (mean ± SD, mmHg) flat was 3.6 ± 1.6 and HUP 7.3 ± 1 (p <0.001) including all devices. The mean decompression ICP (mean ± SD, mmHg) was -0.3 ± 0.9 flat and -5.1 ± 0.4 HUP (p <0.001) including all devices. **Conclusions:** Similar APs were observed across devices in flat and HUP positions, suggesting safe use of a variety of airway devices during ACD+ITD HUP CPR. An increase in CerPP and decrease in ICP were observed with ACD+ITD HUP CPR, consistent with previous cadaver studies.

147. STRENGTHENING MANAGEMENT OF BRONCHOSPASM: STEROID ADMINISTRATION FOR ASTHMA IN STATEWIDE TREATMENT PROTOCOLS

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**Background:** Asthma is a common emergency department complaint, accounting for ~1.8 million ED visits yearly in the U.S. Inhaled bronchodilators as well as steroids are mainstays in treatment for acute exacerbations. Research has demonstrated that early steroid administration significantly reduces hospital admission for adults as well as pediatrics, as well as preventing relapses. This benefit is greatest when administered in the first hour of ED admission. The purpose of this investigation is to describe the overall prevalence of steroid administration in asthma Statewide Treatment Protocols (STPs) and the characteristics of these protocols. **Methods:** Cross sectional study of STPs utilizing a standardized review of protocols for asthma, wheezing or respiratory distress. Protocol revision date was also captured.

**Results:** Thirty four out of fifty (68%) states issue ALS STPs, ten of which serve as guidelines. IV steroids are included as an approved medication for wheezing or asthma in 24 (71%) of STPs. Methylprednisolone is the most common steroid with 23 (96%) of states including it in their wheezing protocols. Dexamethasone was included in 6 (25%) STPs, hydrocortisone was included in 2 (8%)
protocols, and oral Prednisone was found in one protocol (4%). Multiple steroid options were available in eight STPs. 76% of protocols have been revised since 2015. **Conclusions:** EMS administration of steroids for bronchospasm would serve as the earliest administration point in the emergency response system. Despite demonstrated benefit of early administration of steroids, 29% of states do not allow for EMS administration of steroids. Protocol revision cycles are unlikely to be a primary contributor as most protocols have been revised within three years. Further study is needed to examine the barriers to introduction of steroids for asthma in STPs.

148. EVALUATION OF PHYSICIANS' ATTITUDES REGARDING TRANSPORT MODALITIES

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**Background:** Hospital mergers have made interhospital transfers necessary in the consolidation of medical services. Physicians must make decisions on the level of interfacility transport modalities (ITMs). Previous studies examined the importance of factors involved in choosing ITMs. Little is known about physicians’ perception of ITMs and factors considered when transferring patients. We sought to assess physicians’ knowledge of and comfort with ITMs. **Methods:** An electronic survey was distributed via REDCap to 2510 physicians in a large healthcare system. A reminder survey was sent eleven weeks later with instructions to avoid duplicate responses. Participation was voluntary. Respondents were assured anonymity. Overall mean and median Likert values (LVs) were calculated. Mean and median LVs for emergency medicine physicians (EMPs) and critical care physicians (CCPs) were compared to those for non-critical care physicians (NCCPs) using the t-test and Mann-Whitney test, respectively. The IRB deemed this study exempt. **Results:** 181 physicians responded. 63% practice in a tertiary academic facility. 31% practice in a community hospital. Mean and median LVs were 5.49 and 6 for knowledge of ITMs; 6.06 and 7 for comfort in choosing ITMs; and 5.67 and 7 for knowledge in choosing ground vs. air
critical care transport (CCT), respectively. Of the 169 physicians that identified a specialty, 69 were EMPs/CCPs and 100 were NCCPs. For the aforementioned categories examined, mean and median LVs were statistically significantly higher for EMPs/CCPs compared to NCCPs ($p < 0.0001$ among all categories). The most important factor for using ground or air CCT was patient stability with the second most important factor being speed. 60% of all respondents (50% of EMPs/CCPs and 67% of NCCPs) believed air CCT to be typically faster than ground. The majority (77%) believes that consultation with the accepting physician assists with ITM choice. 23% of respondents do not factor patient comfort into their ITM decision. **Conclusions:** This study shows that EMPs/CCPs seem to be more comfortable with different ITMs than NCCPs. Educational activities about the use of appropriate ITMs should be targeted towards NCCPs. Further research should evaluate whether educational interventions lead to a more appropriate use of the various ITMs.

149. PERFORMANCE AND QUALITY COMPARISONS FOR DISPATCHER-ASSISTED TELEPHONE CARDIOPULMONARY RESUSCITATION (DATCPR) INSTRUCTIONS ACHIEVED BETWEEN EMERGENCY MEDICAL TECHNICIANS (EMTS) AND REGISTERED NURSES (RNS)

Patrick Chow-In Ko, Mei-Fen Yang, Kah-Meng Chong, Hui-Chih Wang, Chun-Wei Chen, Chun-Hua Hu, Fu-Ping Yen, Yao-Chang Wang, Hong-Yi Hsiao, Matthew Huei-Ming Ma, Yu-Wen Chen, National Taiwan University Hospital

**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** Performance and quality of DATCPR instructions between EMT and RN are not well known. In vertical dispatch style, call-taker and CPR instructor would be the same EMT; in horizontal dispatch style call-taker would be EMT while CPR instructor could be RN to takeover the calls of recognized OHCA case. This study was to compare the quality of DATCPR instructions performed between EMTs and RNs.

**Methods:** This was a one-year observational database prospectively collected from a metropolitan OHCA-DATCPR registry with one centralized dispatch center and EMT as all call-takers. After call-takers
recognizing patients as cardiac arrest, they could directly launch DATCPR instructions by themselves (iEMT) or transfer calls to RN (iRN) for DATCPR instructions. Both of them were well trained for DATCPR skills. All audio call records eligible for non-traumatic OHCA were assessed by experienced third person afterward. The quality outcomes included: bystander-starting chest compressions (CC), persistent online CPR instruction until ambulance arrival (I-persistence), continual instruction and accompany bystander until compressions handover by paramedics at scene (I-handover), and time periods between recognition, instruction, and CC. The comparisons were adjusted with patient age and sex. **Results:** A total of 1,574 eligible patients and call records were analyzed (252 calls with CPR instructed by iRN and 1,322 calls by iEMT). Bystander CCs were delivered on 83.8% of patients, no difference between iEMT and iRN (84.4% versus 80.6%, p=0.13). iEMT had higher rates of I-persistence (81.3% versus 69.9%, p<0.01; aOR:1.9 [95% CI 1.4-2.5]) and I-handover (59.8% versus 34.4%, p<0.01; aOR:2.8 [95% CI 2.1-3.8]) than iRN. There was no time difference from initiating instruction till first CC between two groups (iEMT 79.8 sec versus iRN 80.6 sec, p=0.83). Time from OHCA recognition to CPR instruction was faster while instructors were iEMT (34.2 sec versus 47.4 sec, p<0.01). **Conclusions:** Well-trained EMTs may perform better DATCPR instructions than RNs for persistence and continuity until chest compressions handover by paramedic professionals, and shorter time from recognition-to-instruction.

150. URBAN-RURAL DIFFERENCES IN PREHOSPITAL TIME INTERVALS FOR SUSPECTED ST-ELEVATION MYOCARDIAL INFARCTION PATIENTS IN NORTH CAROLINA


**Background:** Acute ST-elevation myocardial infarction (STEMI) is a high-risk, time-sensitive condition. Timely emergency medical services (EMS) response, care, and transport can significantly reduce delays to life-saving treatment with percutaneous coronary intervention (PCI). We compared prehospital time
intervals for suspected STEMI patients in North Carolina (NC) between urban and rural areas. **Methods:** Using data from the NC Prehospital Medical Information System, we identified EMS encounters for patients suspected of having a STEMI from 2011-2017. Specifically, we included 9-1-1 calls for patients at least 35 years old with EMS provider impression of chest pain, use of a suspected cardiac/STEMI protocol, or prehospital STEMI activation. Median (and interquartile range, IQR) response, scene, and transport times (in minutes) were calculated and compared by patient demographics (age, gender, race), incident year, and county population density (urban, suburban, and rural). Quantile regression was used to estimate the association of county-level population density with median prehospital times adjusted for individual-level factors. **Results:** We identified 5,764 EMS encounters that met our definition of suspected STEMI (mean age 63.3 years; 36% female; 67% White). Median total prehospital time (EMS notified to hospital arrival) was 45 (IQR 34-57) minutes. Median response, scene, and transport times were, respectively, 8 (IQR 6-11) minutes, 16 (IQR 12-21) minutes, and 18 (IQR 10-29) minutes. Median prehospital times were comparable between patient demographic groups. On average, transport times were longer in 2016-2017 (median 23 minutes) compared to those in 2011-2012 (median 15 minutes). Transport times were also longer in suburban (median 25 minutes) and rural (median 27 minutes) counties than in urban counties (median 14 minutes). After adjusting for patient demographics and incident year, median transport time was 12.4 minutes longer in rural counties and 9.3 minutes longer in suburban counties compared to urban counties. **Conclusions:** In NC, average EMS transport times for suspected STEMI patients increased from 2011-2017 and were substantially longer in non-urban areas. This finding is possibly due to destination protocols that direct EMS to transport to a PCI-capable center, which may not be the closest hospital. Future research should investigate delays to PCI and ways to improve STEMI systems of care.
Background: Dispatcher-assisted cardiopulmonary resuscitation (CPR) is the important CPR program to increase the bystander CPR rate for out-of-hospital cardiac arrest (OHCA). Standard traditional basic life support (ST-BLS) program is not including contents related with DA-CPR process such as calling telephone with speaker-function, following CPR instruction, and understanding caller-dispatcher interaction. A training program, dispatcher-assisted basic life support (DA-BLS) which include the DA-CPR process, was newly developed and was compared with ST-BLS program for the CPR quality.

Methods: This was a clustered randomized trial conducted in dedicated CPR training centers of three counties in a metropolis between 2016 and 2017. Each center provides CPR training with about 20,000 to 40,000 citizen every year. Training classes were randomly allocated with two groups (DA-CPR and ST-CPR). Both programs are including the standard contents recommended by the American Heart Association 2015 in one-hour video-clip. Turning-on speaker function, following instructions for compression, and understanding what dispatcher is talking were incorporated into only DA-BLS program. Resuscitation manikins (ResusciAnne QCPR, Laerdal, Stavanger, Norway) to measure CPR quality were used. Primary outcome was total number of chest compressions during the course of each training class. Secondary outcomes were other CPR quality parameters (including total score, compression depths and percent adequate release). Difference in difference (DID) analysis was additionally performed to show whether CPR quality parameters were improved from baseline to last session during the training class period.

Results: A total of 152 classes (1,929 trainees) were randomized
and analyzed. The DA-BLS group (n=73 classes) showed significantly higher average number of chest compression compared with the ST-BLS group (n=79 classes) (604 vs. 431, p-value <0.01). Overall, trainees in the DA-BLS group showed better CPR quality indicators compared with ST-BLS group throughout the course (all p-values <0.01). However, both groups showed decreased in CPR quality parameters from baseline to last session. DID analysis showed less changes in all of the quality parameters from baseline to last session in DA-BLS compared with ST-BLS (p<0.01 for all). **Conclusions:** The new DA-BLS training program provided more number of chest compressions training and resulted overall better CPR quality parameters than ST-BLS training.

152. USING EMERGENCY MEDICAL SERVICES PROVIDERS AND CRISIS CLINICS IN THE WAKE OF THE MENTAL HEALTH CRISIS: ASSESSMENT OF THE ACCURACY AND SAFETY OF A NOVEL PROTOCOL

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**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** With the increase in mental health patients seeking Emergency Department (ED) care, the burden of lengthy boarding, overcrowding, and limited resources grows. Engaging Emergency Medical Services (EMS) and other healthcare facilities in the care of these patients may provide a solution. EMS in one large North Carolina (NC) county developed a program to assess mental health patients and provide transport to an ED or to a mental health crisis center (MHCC) based on screening criteria. The purpose of this study was to evaluate the accuracy and safety of the EMS protocol for assessing and transporting mental health crisis patients. **Methods:** This was a retrospective cohort study of patients evaluated by Advanced Practice Paramedics (APP) between August 2013 and July 2014. Prehospital patient care records, APP records, and hospital records were linked. Protocol accuracy and safety were evaluated using: correct APP application of screening criteria; and agreement of protocol-recommended destination; and actual transport destination. Patient demographics and disposition were described.
Results: In total, 1,369 patients were transported by APPs. The sample included 52.0% males, 62.2% white, and 94.7% not Hispanic or Latino. Median age was 40 years. Of this sample, 334 patients were transported to a MHCC and 1,035 were transported to an ED. Forty-three percent (n=546) of patients passed all screening criteria. Of these patients, 16.8% (n=216) were transported to a MHCC; secondary transfers to an ED occurred in 18 documented cases. Of patients who failed screening criteria, 51.8% (n=666) were transported to an ED and 5.7% (n=73) were transported to a MHCC. Compared to the ED, admissions and discharges home were lower for MHCC patients (26.2% vs. 42.5% and 18.3% vs. 33.2%, respectively), while transfer to detox or inpatient psychiatric care was higher (40.8% vs. 22.0%).

Conclusions: Prehospital transport to a MHCC is an under-utilized avenue to mental health and substance abuse crisis care. Compared to ED patients, MHCC patients were more often transferred to detox and inpatient psychiatric care and relatively few cases necessitated secondary transport to an ED. Further APP training in applying screening criteria and communicating patient care options are necessary.

153. POPULATION-BASED ESTIMATES OF AMBULANCE UTILIZATION AND TREATMENT PATTERNS FOR OPIOID-RELATED OVERDOSE IN A NATIONAL SAMPLE

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Background: Drug overdose led to more than half a million deaths in the United States in the last ten years, two thirds of which were opioid-related. This data comes from emergency department and hospital records, but does not describe the burden to the 911 system. In this study, we use the National EMS Information System (NEMSIS) database to estimate the volume of emergency calls, interventions, and demographics of patients with suspected opioid overdose. Methods: We performed an observational, cross-sectional study of patients with an EMT (Emergency Medical Technician) impression
of “Alcohol Intoxication or Drug Overdose” in the years 2014 and 2016. To identify opioid overdose, we
further filtered by EMT treatment of patients with naloxone. To examine the severity of the overdose,
we organized data by level of response, interventions performed and transport destination. To explore
patient and geographic differences, we analyzed age, sex, race/ethnicity, and metropolitan status.
Results are presented as proportions with 95% Confidence Intervals (CIs) with statistical tests of
significance used, as appropriate. **Results:** We identified a total of 1,037,556 (1.86% 95% CI: 1.86 – 1.86)
emergency calls for patients with provider primary impression of alcohol and/or drug overdose. Of
those, 81,336 (7.84%, 95% CI: 7.79 – 7.89) patients were given naloxone. Naloxone utilization increased
from 28,838 (6.59%, 95% CI: 6.52 – 6.67) administrations in 2014 to 52,498 (8.75% 95% CI: 8.68-8.82) in
2016. Men were 1.61 times more likely to be given naloxone (95% CI: 1.59-1.62, p <0.001). The burden
was highest in urban areas (0.49%, 95% CI: 0.48 – 0.49). **Conclusions:** This study represents an important
description of the increasing severity and prevalence of the opioid epidemic on a national level from
2014 to 2016. By better understanding the burden on the EMS system from a national perspective, we
can reduce opioid-related deaths by optimizing the efficiency of the EMS system.

154. DESCRIPTIVE ANALYSIS OF ADVANCED LIFE SUPPORT INTERCEPTS FOR BACK PAIN MANAGEMENT

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**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** Acute pain is a common reason for requesting EMS. In the current opioid crisis, the
indiscriminate use of narcotics for pain management has received renewed scrutiny. The purpose of the
current study was to describe ALS intercepts for management of acute back pain. **Methods:** This was a
retrospective descriptive analysis of intercepts performed between January 2017 and April 2018 by a
single ALS agency serving multiple sites, including urban, suburban, and rural communities.Intercepts
were identified based on label of run outcomes. Included runs were exported to a Microsoft Excel database and analyzed for patient characteristics, primary impression, and interventions as documented by the intercepting paramedics. **Results:** 456 requests were made for ALS intercept, of which 21 (4.6%) were requested for back pain. 13 (61.9%) were female. 14 (66.7%) were classified as medical etiology, while 7 (33.3%) were classified as acute traumatic pain. Average age was 45.4 +/- 17.3 year for trauma, compared with 50.6 +/- 10.2 years for medical causes. Twenty (95.2%) patients received parenteral opioid analgesia for back pain, more frequently than other intercepts (OR 61.31, 95% CI 8.31-462.27). 18 (85.7%) intercepts were coded as an emergent response for intercept by dispatch. One (4.8%) was transported emergently. Scene time during the intercept resulted in a 26 min 4 sec +/- 6 min 35 sec delay to reinitiating transport to definitive care. **Conclusions:** ALS intercepts for back pain management were not uncommon in our patient cohort. The vast majority received parenteral opioids for pain management. Intercepts resulted in substantial delays to definitive care. These results suggest opportunities for system improvement and education at both the ALS and BLS levels.

155. ASSOCIATION BETWEEN SERUM ABLUMIN LEVEL AT EMERGENCY DEPARTMENT AND RESUSCITATION OUTCOMES AFTER OUT-OF-HOSPITAL CARDIAC ARREST

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**Category of Submission:** Student, Resident, Fellow

**Background:** Serum albumin has been known as a strong predictive value of mortality in various disease conditions, but little is known of the effect of serum albumin level on out-of-hospital cardiac arrest (OHCA) patients. This study was performed to investigate the effect of serum albumin level on the outcome of OHCA. **Methods:** This study was a prospective hospital-based patient cohort study, conducted during January to December 2014 at 27 emergency departments in Cardiac Arrest Pursuit Trial with Unique Registration and Epidemiologic Surveillance (CAPTURES) project. Study target was
adult and emergency medical services-treated OHCA with cardiac etiology, excluding patients without serum albumin information and without outcome information at discharge. Serum albumin level was obtained and measured at the time of starting resuscitation at emergency department (ED) or at the time of survived to arrival at ED after EMS resuscitation. The primary outcome was good neurological recovery at discharge measured by the cerebral performance category (CPC 1 or 2). Multivariable logistic regression analysis was done for calculating adjusted odds ratios (AORs) with 95% confidence intervals (CIs) to estimate the effect of serum albumin level groups (lower versus higher by albumin level=3.5 mg/dL) for outcome, adjusting for potential confounders. Results: Of 1,616 EMS-treated OHCA patients with presumed cardiac etiology, total 1,013 OHCAs were analyzed. OHCAs who had serum albumin level less than 3.5g/dL was 452 (44.6%) patients. The higher albumin group showed much better outcomes than lower albumin group; 18.5% vs. 3.9% for good neurological recovery (p-value <0.01) and 23.8% vs. 9.0% for survival to discharge (p-value <0.01), respectively. AORs (95% CIs) of higher albumin group than lower albumin were 2.94 (1.57-5.49) for good neurological recovery and 1.74 (1.10-2.76) for survival to discharge, respectively. Conclusions: Lower serum albumin levels than 3.5 mg/dL measured at the time of arrival to emergency department of OHCA patients was associated with poor outcomes than higher serum level.

156. EPIDEMIOLOGY AND OUTCOMES OF SPORTS-RELATED TRAUMATIC BRAIN INJURY IN CHILDREN

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CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Traumatic brain injury (TBI) in children is an important health concern that results in many emergency department (ED) visits and hospitalizations. Sports injuries are a common cause of pediatric
TBI. However, information on the demographic, clinical characteristics, and outcomes of sports-related TBI is limited. **Methods:** This is a multi-center observational study using the Emergency Department–Based Injury Surveillance System (EDISS) database of Korea. Patients between 5 and 18 years, who had unintentional, sports-related head injury between January 2011 and December 2016 were included. Patients with unknown information about the type of sports were excluded. The main exposure was the type of sports. Sports type was classified into 6 categories (field sports, floor sports, bicycle & street sports, water sports, racket sports, others). The primary outcome was TBI, and secondary outcome was admission. Multivariable logistic regression analysis was performed to calculate adjusted odds ratios (AORs) with 95% confidence intervals (95% CIs) for outcomes by exposure group (reference, field sports group). **Results:** Of 1,537,617 injured patients, 10,717 (0.7%) patients were eligible pediatric TBI for study inclusion. The most prevalent sports type category was field sports (51.8%). Most of the patients were male (87.5%), and proportion of TBI and admission were 15.7% and 3.5%, respectively. The AOR of TBI compared to field sports was 1.77 (1.37-2.28) in bicycle and street sports, 0.87 (0.76-0.99) in floor sports, 0.59 (0.44-0.79) in water sports, and 0.27 (0.18-0.40) in racket sports. The AORs of admission compared to field sports were 2.21 (1.39-3.52) in bicycle and street sports, 1.83 (1.21-2.76) in racket sports, and 0.37 (0.16-0.85) in water sports. **Conclusions:** The TBI and admission rate of pediatric sports-related head injury was highest in bicycle and street sports. The clinical characteristics of pediatric sports-related TBI are affected by sports type and significantly different. The study proposes prevention strategy for sports-related TBI can be developed by sports type.

**157. DEVELOPMENT OF ANTHROPOMETRIC GUIDANCE FOR FIELD FITTING OF TRAUMA DEVICES (TOURNIQUETS AND PELVIC STABILIZERS) FOR INJURED CHILDREN**

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**CATEGORY OF SUBMISSION:** PEDIATRIC
**Background:** Weight and age are the most commonly used metrics for determining dosing and sizing of pediatrics interventions. However, often, neither are readily available in the acute prehospital or Emergency Department setting. While height is commonly used to estimate weight, we looked to see if height alone was more accurately correlated with pelvic and extremity circumference to aid in the fitting of point of injury interventions like pelvic stabilizers and tourniquets. **Methods:** We recruited healthy subjects aged 1-14 years. Subject height & weight were obtained from parents, medical record, or measured directly. Subjects were also measured on the Broselow Tape™ and fitted for the Pediatric PelvicBinder™ and the Small SAM Pelvic Sling™. Pelvic, upper extremity and lower extremity circumferences were measured directly. Extremity circumferences were obtained at the most proximal practical location to best match the location of emergency tourniquet placement. Descriptive statistics, univariate & multivariate regression methods were utilized to determine variables associated with pelvic stabilizer fit, pelvic and extremity circumferences. **Results:** Age, height and weight were all good predictors of pelvic, arm and leg circumference when taken individually in univariate analysis (p<0.001). However, only weight showed significant correlation with all the circumferences in multivariate analyses. Multivariate coefficient P-values are: Age [p-value: 0.59 (pelvic circumference); p-value: 0.02 (arm circumference); p-value: 0.21 (leg circumference)], Height [p-value: 0.68 (pelvic circumference); p-value: 0.25 (arm circumference); p-value: 0.26 (leg circumference)], and Weight [p-value: 0.00 (pelvic circumference); p-value: 0.00 (arm circumference); p-value: 0.00 (leg circumference)]. When height on the Broselow Tape™ was taken as a dichotomous variable, regression analysis showed perfect prediction of fit for pelvic stabilizers. All subjects with height within the Broselow Tape™ range fit the Pediatric PelvicBinder™ and all those taller than maximum length fit the Small SAM Pelvic Sling™. **Conclusions:** Weight was the most accurate predictor of pelvic and extremity circumferences, consistent with common current practice for pediatric dosing and equipment selection. However, Broselow Tape™ was an excellent screen for pelvic stabilizer fit and height showed a strong univariate
correlation to circumferences. Both height and weight are practical measures for prehospital use as pelvic binders and tourniquets become more common.

158. HEMODYNAMICS IN AEROMEDICAL PATIENTS UNDERGOING RAPID SEQUENCE INTUBATION WITH ETOMIDATE OR KETAMINE

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CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: Rapid sequence intubation is frequently performed by aeromedical providers to establish control of the airway. Common induction agents are etomidate and ketamine, both touted to have relatively stable hemodynamic profiles. There is limited data comparing these medications in the aeromedical setting. This study compares administration of ketamine and etomidate on peri-intubation hemodynamics. Methods: A retrospective, prehospital chart review of intubations performed by an aeromedical program from January 2012 to September 2017 was completed. Primary outcome measures included percentage change in heart rate (HR), percentage change in systolic blood pressure (SBP), and incidence of hypotension with the use of etomidate or ketamine as induction agents. A p-value <0.05 was considered statistically significant. Results: In our study, 258 patients were induced with etomidate and 48 with ketamine. Etomidate patients showed a -1.2% (SD +/-22.7) change in HR and 0.52% (SD +/-25.0) change in SBP. Ketamine patients showed a -4.7% (SD +/-16.7) change in HR and 15.3% (SD +/-39.8) change in SBP. The p-values for percentage change in HR and SBP between etomidate and ketamine were 0.0094 and 0.0206, respectively. There were 25 episodes of post-administration hypotension with etomidate and 2 with ketamine (p=0.028). Conclusions: Both ketamine and etomidate are appropriate induction agents for intubation in the aeromedical environment. Ketamine was preferentially selected for induction of known hypotensive patients with a statistically
significant improvement in SBP. Although hypotensive events were statistically significant, neither agent caused overtly increased incidences of hypotension.

159. COMPARING CHEST COMPRESSION QUALITY BETWEEN USING STRETCHER AND TRANSFER SHEET FOR OUT-OF-HOSPITAL CARDIAC ARREST PATIENT TRANSPORT IN HIGH-RISING BUILDING

Patrick Chow-In Ko, Chien-Yu Chi, Desmond Mao, Mei-Fen Yang, Chih-Wei Yang, National Taiwan University Hospital CATEGORY OF SUBMISSION: CARDIAC

Background: Traditionally, stretcher is usually used for patient transport. However, it may be limited in confined space, like in elevator. Using a transfer sheet instead may be an alternative way especially in high-rising building that has not been explored before. This study aimed to compare the quality of manual chest compression (CC) for patient transport in high-rising building between using a stretcher and a transfer sheet. Methods: This was a crossover stimulation study. The subjects were emergency medical technicians (EMT) and were assigned to twelve three-staff teams. Each team performed six runs of manikin transport for cardiac arrest scenario from thirteenth floor to ground floor by elevator, including two runs by transfer sheet (TS) and four runs by stretcher which was adjusted to 45-degree (S45) or 90-degree (S90) head-up when entering elevator. Chest compression quality was measured by a manikin (Resusci-Anne Modular System, Laerdal Inc.) before (on-scene phase) and after (transport phase) the manikin was moved to transfer sheet or stretcher. The elevator was 1.6 meter in length, 1.5 meter in width and 2.2 meter in height. Results: There was no chest compression quality difference between each group in on-scene phase. In transport phase, using transfer sheet had greater mean chest compression depth (TS: 54.4 +/- 4.2 mm vs S45: 39.6 +/- 7.2 mm, p<0.001; TS: 54.4 +/- 4.2 mm vs S90: 40.05 +/- 8.30 mm, p<0.001), greater percentage of deep enough compression (TS: 50.0 +/- 26.6% vs S45: 22.5 +/- 19.3%, p<0.001; TS: 50.0 +/- 26.6% vs S90: 30.2 +/- 21.7%, p<0.01), and shorter transporting time (TS: 143.1+/-11.4 sec vs S45: 151.6+/13.8 sec, p<0.01; TS: 143.1+/-11.4 sec vs S90: 151.6+/-13.8 sec, p<0.01).
167.1+/−25.6 sec, p<0.001). In the contrary, using transfer sheet had lower percentage of fully recoil compared with using stretcher in 45-degree (TS: 42.3+/−30.5% vs S45: 60.7+/−28.6%, p=0.04). There was no difference of no flow fraction, percentage of correct hand position and mean rate of compression between TS and stretcher in transport phase. **Conclusions:** Using transfer sheet seems a better alternative way than using stretcher for cardiac arrest patient transport in high-rising building.

160. COMPARISON BETWEEN COLOR-CODED SYRINGES AND AN FDA-APPROVED VALIDATION METHOD FOR PEDIATRIC DOSING USING MIDAZOLAM

**Caitlin Howard, Kristy Jeffers, Allyson Arana, Diana Montez, Stephen Rahm; SAUSHEC Military EMS and Disaster Medicine Fellowship** CATEGORY OF SUBMISSION: PEDIATRIC

**Background:** Nearly 30% of pediatric medications are administered incorrectly. We assessed the use of a novel color-coded syringe for accuracy and as a means of reducing medication errors when administering midazolam. This method was compared to a U.S. Food and Drug Administration (FDA)-approved validation method. **Methods:** A prospective, block-randomized, crossover trial was conducted to compare the dosing accuracy and timeliness of the color-only method versus the validation method. Twenty participants prepared pediatric midazolam doses according to their preferred method, an FDA-approved validation method, and a color-coded syringe (color-only method) in a simulated setting. Primary endpoints included dosing accuracy and time to medication administration. Secondary endpoints included participant’s perceived personal error rate and the ease of use, perceived stress reduction, and perceived potential for error reduction by the color-only method. Continuous outcomes (time to completion, percent errors) between the color-only and validation methods were compared using Wilcoxon signed rank test for paired non-normal data and the median of the paired differences with distribution-free 95% confidence intervals was calculated. **Results:** The preferred 3 kg calculations had a median margin of error of 5.6%, a median time to completion of 55.6 seconds, and critical errors
occurred in 8/20 trials. The color-only method took less time to complete than the validation method (median time 29.5 seconds vs. 58.2 seconds [95% CI: -32.0 - -21.3]). There was no statistically significant difference in errors between the color-only method and the validation method. None of the participants reported making a mistake using the color-only method, whereas 25% (5/20) thought they made a mistake using the validation method. Only 20% (4/20) of participants believed that the validation method found or eliminated any mistakes. There were eight medication errors identified when participants employed the method of choice, one with the color-only method, and four with the validation method. Conclusions: There were no significant difference in dosing errors between the FDA-approved validation method and the color-only method. Use of a color-coded syringe did reduce time to medication administration when compared to a preferred method and an FDA-approved validation method.

162. A SURVEY TO DETERMINE KNOWLEDGE OF MASS CASUALTY POLICY AT A LEVEL-1 TRAUMA CENTER

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CATEGORY OF SUBMISSION: DISASTER

Background: Merriam Webster defines disaster as “a sudden calamitous event bringing great damage, loss, or destruction.” Hospitals nationwide train for disaster response. Never has this training been more important given the uptick in mass casualty events. Victims from a mass casualty incident will present to a hospital ED. Thus, it is important that all ED physicians are well versed in the hospital disaster response plan and policy. The purpose of this study was to survey EM residents and staff physicians to assess their level of knowledge of the disaster response plan and policy at a Level-1 Trauma Center. Methods: A knowledge assessment test was created and administered using REDCap. The test was sent to all ED staff physicians and residents (n=52). This test assessed the level of basic knowledge of the hospital’s disaster response plan (100 points possible). All identifiers were removed from test responses.
data was analyzed using The Chi Squared Test of Association. Continuous data was assessed using the Independent t-test and Analysis of Variance with a post-hoc analysis (Tukey). **Results:** The response rate of tested individuals was 100%. Residents scored 54.8 ± 13.4 points on 11 knowledge based questions. Staff physicians scored 64.5 ± 13.5 points (p=.014). Knowledge of some key information was less than optimal. This information included knowledge of ventilator availability, and locations for non-emergency care. Knowledge was <40% correct in these areas. Resident training year was not associated with test score (p=.104). Only 15.4% of physicians felt well prepared for a mass casualty event. **Conclusions:** Although ED residents and staff physicians receive more training than other specialties, there is a need for improvement on disaster response knowledge. Also, because of no or limited training outside of the Emergency Department, disaster response knowledge may be even lower hospital-wide. Additional training and exercises could help better prepare this hospital to deal with a mass casualty event. While this was a single site assessment, disaster planning and education and resultant knowledge may also be limited elsewhere.

163. PEDIATRIC MASS CASUALTY TRIAGE ALGORITHMS: A COMPARATIVE STUDY ANALYZING SPEED, ACCURACY, AND INTER-RATER RELIABILITY

*Katherine Staats, Tabitha Cheng, Nicole D'Arcy, Kian Niknam, J. Joelle Donofrio, Stanford University, Department of Emergency Medicine* CATEGORY OF SUBMISSION: DISASTER

Background: Multiple algorithms exist to rapidly triage children during mass casualty incidents (MCIs), but there is still no consensus on which algorithm should be used. The ideal MCI algorithm would have high inter-rater reliability, be able to be used accurately, and would not require much time to perform.

Methods: This was a pediatric tabletop study utilizing prehospital providers (EMTs/paramedics) to compare six methods of pediatric MCI triage: pediatric Simple Treatment And Rapid Transport (JumpSTART), Sort-Assess-Lifesaving interventions-Treatment/transport (SALT), Pediatric Triage Tape
(PTT), CareFlight (CF), Sacco Triage Method (STM), and "No Algorithm" (NA). Providers were split into six groups, given a focused session on the specific algorithm they would use in the study, and then were provided a solo timed tabletop disaster with a defined set of 25 pediatric trauma cases. Triage designations for each patient and time to completion of triage (min:sec) were collected. Providers' under-triage (UT), over-triage (OT), and overall accuracy in use of the algorithm were reported as means, with the overall inter-rater reliability between algorithms presented with kappa scores. Results: There were 107 providers total with 15-28 providers per group. Rates of provider UT, OT, and accuracy varied widely with UT ranging from 2.4% (STM) to 16.3% (SALT), OT from 7.0% (NA) to 25.5% (PTT), and accuracy 67.8% (PTT) to 89.4% (STM). The inter-rater reliability kappa was moderate for PTT (0.56) and SALT (0.60); substantial for CF (0.64), NA (0.69), and JumpSTART (0.74); and almost perfect in STM (0.81). The three quickest algorithms for providers to perform were CF, SALT and NA (<04:30) followed by JumpSTART at 05:00 and with PTT and STM the slowest at ≥08:00. Conclusions: This study demonstrates the challenges inherent to optimizing triage systems. We saw that as accuracy and kappa are improved, the speed of an algorithm slows (STM). The faster algorithms are performed, the less precise the designations are: the three quickest algorithms were three of the four least accurate (CF, SALT, and NA). In this study, NA and JumpSTART were the two MCI triage systems that demonstrated a balance of the qualities crucial for the ideal pediatric triage algorithm.

164. EPIDEMIOLOGY OF PREHOSPITAL CARE AT THE SAN DIEGO-TIJUANA BORDER CROSSING

Jennifer Farah, Mathew Goebel, Jodie Pierce, J Joelle Donofrio, UC San Diego Department of Emergency Medicine, Chula Vista Fire Dept, San Diego Fire-Rescue Paramedic Program CATEGORY OF SUBMISSION: MEDICAL

Background: San Diego has the busiest international land border crossing in the world. The epidemiology of prehospital care at the San Diego-Tijuana border crossings are previously unreported.
Investigators sought to describe prehospital care provided at the San Diego border crossings. **Methods:** This was a retrospective data collection from April 2014 to March 2017 evaluating prehospital provider (PHP) contacts at one of two border addresses. The 911 dispatch center and first response were provided by a single municipal fire agency with ambulance transportation provided by a contracting private agency. Patient CAD data and electronic patient care records were queried for patient demographics, PHP arrival time, incident complaint, assessment narrative, and treatments provided. Natural language processing techniques were applied to map the narrative to the National Library of Medicine's Unified Medical Language System. Descriptive analysis was performed in the R software program. **Results:** A total of 6,261 PHP patient contacts were made at two border crossings during the study period. 87% of the calls were at the San Ysidro border crossing compared to 13% at Otay Mesa. The population, composed of 50.8% males, had ages ranging from 0 days-103 years old, with a median age of 45 years old. There were 606 (9.7%) pediatric patients (<18 years) and 1,416 (22.6%) geriatric patients (≥65 years). The top three incident complaints were blunt trauma (14.6%), abdominal pain (12.6%), and weakness (10.5%) and the top 3 medications provided were oxygen (481, 7.7%), normal saline (393, 6.3%) and ondansetron (352, 5.6%). **Conclusions:** This was the first study of PHP assessment and care at the San Diego-Tijuana border crossings. We found a large diversity in patient ages. Blunt trauma and abdominal pain the most frequent complaints with oxygen the most frequent treatment. Understanding the epidemiology of prehospital care at border crossings may assist EMS agencies with optimizing staff and equipment. Further research is needed in this subject.

165. THE EFFECT OF PREVIOUS EMERGENCY PSYCHIATRIC CONSULTATION ON SUICIDE ATTEMPTS ON THE RESULTS OF CURRENT EMERGENCY DEPARTMENT VISITS DUE TO SUICIDE ATTEMPTS: A MULTICENTER OBSERVATIONAL STUDY
Background: The previous suicidal attempt has known to be the greatest risk factor for successful suicide. Emergency department (ED) is one of the first gateways where suicide attempters seek health care services. Few studies were reported on the effect of emergency psychiatric consultation for suicide attempter for the next suicide attempt. This study aimed to prove the hypothesis that people who received emergency psychiatric services in previous suicide attempts will have a lower mortality rate in current ED suicide attempts. Methods: This is a cross-sectional study using an emergency department injury surveillance system database. Adult patients over 18 years old visited six emergency departments due to suicide re-attempts from January 2007 to December 2016 were analyzed. The main exposure was previous emergency psychiatric consultation (EPC) defined whether psychiatric treatment was given in previous suicide attempts. The outcome was hospital mortality including death-on-arrival, emergency department death, and death at discharge. Secondary outcome was selection of fatal suicide method defined as Columbia Suicide Severity Rating Scale (C-SSRS) and the case fatality rate. Potential confounding variables were age, gender, alcohol consumption, previous method of suicide attempt. Multivariable logistic regression analysis was used to determine the association between the main exposure and outcomes. Results: A total of 1,821 suicide re-attempters with previous suicide attempts history were analyzed; 1,062 positive EPC and 759 negative EPC patients. Hospital mortality was significantly different between positive EPC (n=34, 3.2%) and negative EPC (n=48, 6.3%) (p<0.01). The positive EPC group looked to select non-fatal suicide methods such as drug overdose, while negative EPC group was more likely to select fetal suicide methods such as hanging, poisoning, and gas inhalation (p<0.01). AOR (95% CI) of positive EPC was 0.52 (0.32-0.83) for hospital mortality and 0.37 (0.30-0.47)
for selection of fatal suicide method. **Conclusions:** Suicide re-attempt patients who had received an emergency psychiatric consultation for the previous suicide attempt showed lower hospital mortality, which was likely to be associated with selecting less fatal suicide method for current suicide attempt. Emergency medical services destination protocol for suspected suicide patients should consider the capacity of emergency psychiatric consultation of the hospital.

166. SIMULATION TRAINING AND EMS COMFORT WITH PEDIATRIC PATIENTS

Daniel Joseph, Lucas Butler, Mark Cicero, Megan Lavoie, Khoon-Yen Tay, Travis Whitfall, Marc Auerbach, Yale Department of Emergency Medicine, Section of EMS

**CATEGORY OF SUBMISSION:** PEDIATRIC

**Background:** Critically ill pediatric patients are some of the most challenging encounters for prehospital providers. These cases are infrequent for EMS, and limited experience in addition to variations in physiology, vital signs, and drug dosages may predispose to errors. The aim of this study is to describe the availability of pediatric simulation-based training and explore the association of exposure to simulation with provider confidence. We hypothesized that EMS provider exposure to simulation would be correlated with higher confidence in caring for critically ill pediatric patients. **Methods:** This study surveyed prehospital providers in Pennsylvania (8/1/2015-12/30/2015) and Connecticut (6/1/2017-7/15/2017) at two statewide EMS conferences and via email distribution lists for EMS providers. The survey included three sections: comfort with 23 pediatric skills on a five-point Likert scale (1=very uncomfortable 3=neutral 5=very comfortable), 16 questions related to pediatric training (requirements, faculty, frequency, instructional design, satisfaction) and 4 demographic questions (licensure, certifications and experience). Provider comfort was defined as a likert scale of 4 or 5. **Results:** A total of 233 respondents participated in this study. 45% were EMTs, 42% were paramedics, and the remainder were PHRNs. 36% of respondents reported exposure to simulation. Providers were most comfortable
with procedures such as administering oxygen, maintaining cervical spine precautions, and transporting children properly secured in an ambulance (95%, 91% and 88% respectively). They were least comfortable with procedures more unique to pediatrics such as stabilizing a patient with increased ICP, managing a child with special healthcare needs, and pediatric endotracheal intubation (39%, 47%, and 54% respectively). 55% of providers felt that their pediatric training was adequate to meet their management needs. Providers with simulation training were significantly more likely to feel adequately prepared to care for pediatric patients (61% vs 53%, p<0.001). Simulation exposure was particularly associated with higher comfort with pediatric intubation (73% vs 34%, P<0.001), pediatric intraosseous line placement (82% vs. 55%, p=0.001) and pediatric hemorrhage control (92% vs. 75%, p=0.002).

**Conclusions:** Pediatric simulation training is associated with improved confidence and comfort among prehospital EMS providers. Further studies are needed to see if simulation exposure improves outcomes and reduces error.

167. CERVICAL SPINE MOTION DURING PRE-TO IN-HOSPITAL TRANSFER OF CARE DELAYS INDUCED BY VOLUNTARY MOVEMENT IN PATIENTS WITH SUSPECTED SPINE INJURY

**Neil McDonald, Rob Pryce, Erin Weldon, Dean Kriellaars, University of Winnipeg**

**CATEGORY OF SUBMISSION:** TRAUMA

**Background:** In some jurisdictions, there can be substantial delays between the time of ambulance arrival at an emergency department and the transfer of patient care. In patients treated with spinal precautions, delays have been reported to average 30 minutes and ranging up to seven hours. The effect of these delays (and expected discomfort, anxiety, and agitation) on patient movement has not been examined. **Purpose:** To quantify the linear and angular kinematics of patient-induced cervical motion during the in-hospital transfer of care period. **Methods:** Three miniature, wireless inertial measurement units (sampling rate: 128 Hz) were attached to the head, sternum and stretcher of
patients with suspected cervical spine injury during the in-hospital transfer of care period (n=7, SI=3; female=4). Patients were treated according to local guidelines, which allow for either a cervical collar (SMR) or traditional spinal immobilization (SI) with a cervical collar, head blocks, and a long spine board, depending on patient presentation. **Results:** Transfer of care delay ranged from 1.1 to 32.6 mins (14.0±3.9 mins). Stretcher acceleration during care delay was negligible (0.08±0.02m/s²). Average voluntary motion was also low (flexion/extension: 2.5±0.8°; axial rotation: 1.1±0.2°; side-flexion: 2.1±0.6°); however voluntary displacements of up to 15.4±4.8° of F/E, 12.0±4.6° of AR and 12.3±3.8° of SF were significant. There was no difference between SI and SMR for any movement direction (p>.30). In calm/compliant patients F/E (6.3±1.6°), AR (5.3±1.2°) and SF (5.7±0.7°) were considerably lower than non-compliant patients (F/E: 27.6±6.5°, AR: 21.0±8.3°; SF: 21.1±6.0°)(p<.05). Substantial linear accelerations of the cervical spine were detected (4.9±1.2 m/s²), with no difference between SI and SMR (p>.22). Compliant patients had lower accelerations (3.0±0.3 m/s²) compared to non-complaint patients (7.4±2.1 m/s²)(p=0.06). **Conclusions:** An innovative technique allowed novel assessment of cervical spine motion during this phase of patient care. For in-hospital transfer of care, the magnitude of cervical spine motion is similar to that of ambulance transport with non-compliant patients having dramatically higher motion independent of spine precaution method. Future research should investigate how patient presentation contributes to overall cervical spine motion.

168. ADVANCED LIFE SUPPORT FIRST RESPONDERS IMPROVE OUTCOMES IN THE HELICOPTER TRANSPORTED TRAUMA PATIENTS

**David Wampler, Tasia Long, Randall Schaefer, Rena Summers, Brian Eastridge, The University of Texas Health Science Center as San Antonio**

**CATEGORY OF SUBMISSION:** TRAUMA

**Background:** In remote settings, a significant proportion of seriously injured patients are transported by helicopter EMS (HEMS). First responders treat the patient until HEMS arrives. First responder teams
capable of providing advanced life support (ALS) should provide a higher level of care to the seriously injured, by performing lifesaving interventions that are beyond the scope of practice of basic life support providers. The goal of this study was to validate the benefits of ALS first responder management prior to HEMS transport of the trauma patient. **Methods:** This is a two year retrospective review of the Texas Trauma Service Area - P regional trauma registry. All patients transported to a Level I trauma center by HEMS were included. Patients were dichotomized based upon the first responding agency level, ALS or basic life support (BLS). Patient acuity was stratified by Injury Severity Score (ISS). The primary outcome was overall survival. Secondary outcomes were hospital length of stay (LOS) and ICU LOS. Fisher exact test was used for categorical data, and t-test was utilized for continuous data, statistical significance was considered significant p value ≥ 0.05. **Results:** A total of 561 patients were transported to a Level I trauma center by HEMS. Of these 513 (87%) were initially treated by an ALS provider. The mean ISS of the cohort was 12.8+-10.7 (95% CI 12 to 14). The mean ISS of the ALS cohort was 12.8+-10.5 and the mean ISS of the BLS cohort was 13.1+-12.6 (p=0.9). There was no difference in ISS greater than 25 between the two groups (2% vs 1%). There was a significant survival benefit 92% (475/513) versus 83% (40/48) (p<0.05) by ALS versus BLS, respectively. The mean hospital LOS for ALS was 7 +/- 9 days for both groups (p=0.9) and the mean ICU LOS was 3.6 +/- 7 days for BLS and 3.0 +/- 6 days for ALS (p=0.56). **Conclusions:** In this two year retrospective study there was an overall survival benefit to having an ALS first responder. There were no differences in injury severity, hospital length of stay, or ICU length of stay.

169. TRENDS IN UTILIZATION OF A STATEWIDE ALS SYSTEM WITH PREDICTION MODELS OF FUTURE USE

Mark Merlin, Michael Carr, Robert Bauter, Navin Ariyaprakai, Ammund Deep Tagore, Jim Tanis, Janae Hohbein, Joslyn Joseph, Alex McKechnie, Newark Beth Israel Medical Center MONOC EMS CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW
**Background:** In this study, we aimed to trend patterns of utilization in an EMS system to identify the needs of a growing population and to allow for a better understanding of how the EMS system is being used on a basis of call volume, EMS transportation, and frequency of chief complaints. Using this information, we developed a prediction model that showed how our EMS system will be used in future years. **Methods:** A retrospective epidemiologic survey of emergency medical services (EMS) system data was performed. We extracted systems data using the electronic medical records (Zoll) of our EMS system and our computer-assisted dispatch (CAD) database between 2010 and 2017. The 9-1-1 utilization, total transport, EMS system utilization, and ALS cancel rates were calculated and trended over the study period. Utilization based on call type was also recorded and trended. The methods of prediction were assessed through linear forecasting to determine future utilization of call volume. **Results:** The annual 9-1-1 call volume increased by 34.3% with an annual average increase in call volume of 4.43%. The captured population of the catchment area increased by 1.37%. The 9-1-1 utilization rate (calls per 1000 people grew from 45 calls per 1000 people to 60 calls per 1000 people (32.49% increase) with an average annual increase of 4.23%. The total number of patients transported to the hospital increased from 47 per 1000 people to 62 per 1000 people in the study period (32.22% increase) with an average annual increase of 4.67%. Prediction models were applied, and utilization was trended up to 2021 which demonstrated a consistent, dramatic increase of 9-1-1 use for the next 4 years. **Conclusions:** We demonstrated an overwhelming increased use of and a possible increased future burden on our 9-1-1 EMS response system. There is an urgent need for alternative pathways to care in our system which relies heavily on EMS transportation to hospitals for triage, treatment, and management.

170. VALIDATION OF A PALLIATIVE OR END-OF-LIFE CARE CASE-FINDING MEASURE IN EMERGENCY MEDICAL SERVICES
Background: The novel Paramedics Providing Palliative Care at Home program has been developed to address the mismatch between traditional paramedic practice and patient's goals of care. Case-finding is key to estimate potential impact for systems looking to establish such programs, continuous quality improvement once operational, and for prospective identification of patients who might benefit from referral to palliative care. Typical paramedic charting templates do not provide direct identification of these cases. Our objective was to test the validity of a previously derived Palliative Support Composite Measure (PSCM) and two modifications. Methods: A priori Gold Standard criteria for determining whether a response was appropriate for a paramedic palliative care approach were identified by expert consensus. Excluding chief complaints and clinical conditions that were universally identified as not appropriate for paramedic palliative support, these criteria were applied by two trained chart abstractors to 500 consecutive charts to classify calls as appropriate for paramedic palliative support, or not. The PSCM and modifications (added criteria call location type and registration in a palliative care program, text mining terms) were applied to the same cohort, and sensitivity, specificity, positive and negative predictive (PPV/NPV) values calculated. Results: Of the 500 cases, 21 (4.2%) were classified as appropriate for paramedic palliative support by the Gold Standard (kappa 0.734). 9 cases with initial disagreement were reviewed with 8 ultimately being deemed to fit the palliative support criteria. The PSCM performed poorly (using the "potential palliative" cut point): sensitivity 71.4% (95%CI: 47.8-88.7), specificity 71.4% (95%CI: 67.1-75.4) and PPV of 9.9% (95%CI: 7.5-12.9) and NPV of 98.3% (95%CI: 96.7-99). The modified PSCM: sensitivity 61.9% (95% CI: 38.4-81.9), specificity 99% (95%CI: 97.6-99.7), PPV 72.2% (95%CI: 50.5-86.9) and NPV 98.3% (95%CI: 97.2-99). A Modified PSCM plus pall* text term performed similarly: sensitivity 100% (83.9-100), specificity 97.3% (95% CI: 95.4-98.5), PPV 61.8%
(95%CI: 48.6-73.4) and NPV100%. **Conclusions:** A modified PSCM provides moderate sensitivity, specificity and PPV, improved by the text term Pall* if feasible. This query will be helpful to systems considering a paramedic palliative care program or when

171. PREHOSPITAL HEMODYNAMIC IMPROVEMENT IN PATIENTS TREATED FOR SUSPECTED SEPSIS

**Bradley Emmerich, Amber Sampson, Jacob Waller, Julie Stilley, Christopher Sampson, University of Missouri School of Medicine**

**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** The objective was to evaluate the effectiveness of University of Missouri Healthcare's protocol on the management of prehospital sepsis. **Methods:** Retrospective identification of patients transported by University of Missouri Healthcare EMS to University of Missouri Hospital (UMH) from 06/01/2017 to 07/31/2018 was performed. Patients suspected of having sepsis, a complete set of EMS and ED vitals, and prehospital sepsis labs (serum lactate, aerobic/anaerobic cultures) were included. Resulting sample size was 45 patients. 22 patients met criteria for severe sepsis. **Results:** Patients treated according to University of Missouri Healthcare EMS sepsis protocol exhibited hemodynamic improvement between first EMS vitals and first ED vitals. Time between vitals was 29+/−8 minutes (mean+/−SD). In these patients, average temperature decreased by 0.7°C (p<0.01), HR decreased by 3.5 beats/minute (p<0.05), systolic blood pressure increased by 8.3 mmHg (p<0.01), SpO2 increased by 1.6% (p<0.05), and GCS increased by 0.6 (p<0.05). Other vital signs approached statistical significance: respiratory rate decreased by 1.6 breaths/minute (p=0.079) and diastolic blood pressure increased by 4.6 mmHg (p=0.054). 14 patients had a prehospital lactate ≥2.0 mmol/L. 16 patients had positive blood cultures. **Conclusions:** Implementation of a robust prehospital sepsis protocol lead to hemodynamic improvement in patients with suspected sepsis.

172. EMERGENCY MEDICAL SERVICES RESPONSE TO THE ROHINGYA REFUGEE CRISIS IN BANGLADESH
Samann Kashani, Sam Dercon, Parveen Parmar, Steve Sanko, Marc Eckstein, Meredith Walsh, Keck School of Medicine of USC, Department of Emergency Medicine CATEGORY OF SUBMISSION: DISASTER

Background: We aim to describe the experience of Hope Foundation (HF), a single EMS provider in response to the Rohingya Refugee Crisis near Cox's Bazaar, Bangladesh. The Rohingya people have now become the world's largest stateless population. The largest "mega" camp is estimated to be home to 954,000 refugees. While numerous humanitarian agencies have established field hospitals, there is no comprehensive medical transport system, staffing, training, documentation or dispatch algorithms for those agencies with ambulances. Methods: There are 3 HF ambulances which are staffed with Bangladeshi midwives, available from 0800 to 1700hrs daily. Overnight transport is provided by a handful of motorized rickshaws. Descriptive statistics of the patient population, reason for transport, transport destination, and patient's camp were retrospectively collected from March-May 2018. HF ambulances are primarily available in the "mega" camp which serves a population of approximately 700,000 refugees. Ambulances were active prior to this time but no record keeping was done. Results: HF ambulances transported 167 unique patients to 22 facilities. Of the 167 patients, 100 (60%) were female. The mean age was 22.2 years (IQR 26, median 20) and 31 patients (18.6%) were less than 1 year old of which 13 (42%) were newborns. Obstetric emergencies and trauma were the most common reason for transport, each accounting for approximately 13% of call volume, followed by respiratory distress (8.4%), musculoskeletal problems (7.2%), abdominal pain (6.6%), fever (5.4%), and neonatal distress (4.8%). Acute watery diarrhea, malnutrition and mental health crises each accounted for approximately 3% of transports. 30% of transports were for non-emergent chief complaints, which require an ambulance because refugees may not leave the camps without a formal medical referral. Patients were most commonly transported to Médecins Sans Frontières (MSF) Field Hospitals (29.9%), followed by the local district hospital (25.2%) and the Hope Foundation Hospital for Women (15.6%).

Conclusions: This is the first description of the EMS response to the Rohingya refugee crisis. While data
quality was limited these results may be used to focus provider training, identify gaps in care, and to improve both emergent and non-emergent referral mechanisms.

173. EMERGENCY TELEMEDICINE SUPPORTED BY ONSITE EMERGENCY RESPONDER TECHNICIANS REDUCES EMS TRANSPORTS AND EMERGENCY DEPARTMENT VISITS FROM SKILLED NURSING FACILITIES

Colby Redfield, Shoma Desai, Matthew Chang, Katherine Davis, Jill Griffin, Jason D’Amore, Claritza Rios, Lauren Post, Tracy Jalbuena, Sylvan Waller, Timothy Peck, Jonathan Fisher, Tallahassee Memorial Healthcare CATEGORY OF SUBMISSION: MEDICAL

**Background:** In emergent medical situations, there are limited alternatives to ambulance or Emergency Department (ED) visits, particularly during off hours. This is magnified in skilled nursing facilities, and literature suggests that many of these visits are unnecessary and avoidable. **Objective:** To examine the efficacy of an Emergency Telemedicine Service staffed by Emergency Medicine physicians supported by embedded/on-site Clinical Care Specialist (CCS) technicians (specialized EMT/Paramedics), in reducing unplanned EMS to ED transports from skilled nursing facilities (SNFs). **Methods:** A retrospective review of patient encounters over a one-year period. The staff at multiple SNFs were trained to activate the Emergency Telemedicine Service in the same manner they would use to call the patient’s physician in an emergency. Patients were evaluated and treated bedside by the Emergency Telemedicine Service Physicians in conjunction with the SNF staff and the onsite CCS. Patient care included, but was not limited to, a standard history and physical, bedside diagnostic testing and medication administration when necessary. Key quality metrics, including chief complaint, hospital transfer avoidance rates and relevant clinical outcomes were analyzed between 7/12017 and 6/30/2018. Descriptive statistics as well as confidence intervals and interquartile ranges were calculated using Microsoft Excel. **Results:** During a one-year period, 4,008 patients were seen by the Emergency Telemedicine Service. 67.8% (CI 66.3 - 69.2%) of patients were treated in the SNF and avoided transports to the ED by EMS. 26.2% (CI 24.9-
27.6%) of patients were transferred to the ED. The median response time by a physician was 8 minutes (IQR 3-15 minutes). **Conclusions:** Through the use of an advanced Emergency Telemedicine Service, a high proportion of patients traditionally transported to the hospital for emergent medical conditions were treated in the SNF itself, thereby reducing EMS activations and ED visits. Further investigation should focus on establishing the scope of practice, cost savings, and integration of EMS with Emergency Telemedicine Services.

174. EARLY DOUBLE SEQUENCE DEFIBRILLATION IMPROVES SURVIVAL TO THE EMERGENCY DEPARTMENT BY 22%

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**Background:** In 2016 our EMS system, located in New Jersey, implemented a double sequence protocol to utilize double sequence defibrillation after three single shocks from any source, including AEDs prior to arrival, which failed to regain spontaneous return of circulation. Our two-tier, double medic system is in an unique position to test early double sequence defibrillation as each ALS unit is equipped with both a Physio-Control LifePak 15 and a LifePak 12. Double sequence defibrillation was preformed using two LifePak monitors each shocking at 360 Joules, with both shock buttons pressed simultaneously.

**Methods:** We performed a retrospective chart review after implementation of our DSD protocol utilizing double sequence defibrillation between 2016 to 2017. We identified 105 cases of double sequence defibrillation use after single defibrillations over two full years. Cases of traumatic cardiac arrest (two cases) or exsanguination causing cardiac arrest (one case) were excluded. All other causes of cardiac arrest, both witnessed and unwitnessed, were included. **Results:** 103 patients were included in analysis with a mean age of 65.8 +/- 14.4 years. All ages and pregnancy were included in our data collection. The
cardiac arrest was unwitnessed in 38 cases (36.89%), witnessed by a layperson in 57 cases (55.34%) and witnessed by EMS in 8 cases (7.77%). In subgroup analysis there was no statically significant difference or confounding found in either Age, Weight, Gender or Race. There was a statically significant (p=0.05) difference in the greater than 3 single defibrillation group (100% mortality) compared with the double sequence group with 80 cases (77.67%) having no ROSC at arrival to the ED. 23 cases (22.33%) achieved ROSC by arrival to the ED utilizing double sequence defibrillation after previously failed single defibrillation. **Conclusions:** Double sequence defibrillation showed an improvement in ROSC to the Emergency Department compared with successive single defibrillations. The timing of when to use double sequence defibrillation in the management of refractory ventricular fibrillation and whether the changing of the vectors of defibrillation or the increase in energy produces the improvement in outcomes remain questions which require further study.

175. EFFECT OF DISPATCHER-ASSISTED CARDIOPULMONARY RESUSCITATION ON EARLY DEFIBRILLATION AND EARLY RETURN-OF-SPONTANEOUS CIRCULATION WITH SURVIVAL

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**CATEGORY OF SUBMISSION:** CARDIAC

**Background:** Dispatcher-assisted cardiopulmonary resuscitation (DA-CPR) program has been implemented to increase provision of bystander CPR and improve outcomes of out-of-hospital cardiac arrest (OHCA) patients. To understand the pathway of how DA-CPR improves outcomes of OHCA, this study aimed to evaluate the effect of DA-CPR on early defibrillation and early return-of-spontaneous circulation (ROSC) with survival. We hypothesize that dispatcher-assisted bystander CPR leads to early defibrillation, which results in early ROSC with survival in patients with OHCA. **Methods:** A population-based observational study was conducted for all emergency medical services-treated adult OHCA patients with cardiac etiology between 2013 and 2016 using national OHCA registry. Cases without witness, occurred
in hospital, witnessed by EMS provider, and defibrillated by layperson were excluded. Exposure was bystander CPR status: no bystander CPR (No BCPR), bystander CPR without dispatcher-assistance (NDA-BCPR), and bystander CPR with dispatcher assistance (DA-BCPR). The observation time was set to a maximum of 90 minutes for survival analysis. The primary outcome was first ROSC leads to survival discharge within 90 min (ROSC with survival). The secondary outcome was first defibrillation within 90 min (defibrillation). The multivariable Cox proportional hazard regression analysis was performed to calculate adjusted hazard ratios (AHRs) according to bystander CPR status adjusting for potential confounders. 

**Results:** Of 25,450 eligible OHCAs, NDA-BCPR provided for 3,193 cases (12.5%) and DA-BCPR provided 12,154 cases (47.8%). ROSC with survival was observed in 13.2% in NDA-BCPR and 12.0% in DA-BCPR. Compared with No BCPR, both NDA-BCPR and DA-BCPR groups were associated with 44% and 55% increase in early ROSC with survival (AHRs, 95% CIs; 1.55, 1.41 to 1.69 for NDA-BCPR and 1.44, 1.27 to 1.63 for DA-BCPR). DA-BCPR was also associated with early defibrillation compared with No-BCPR considering ROSC as a competing risk (AHR, 95% CIs; 1.16, 1.12 to 1.21).

**Conclusions:** Compared with no bystander CPR provided, both bystander CPR with and without dispatcher assistance were associated with significantly early defibrillation and early ROSC with survival.

176. DELAYS IN CARE AT A STATESIDE MILITARY TREATMENT FACILITY: BALANCING PATIENT CARE AND FORCE PROTECTION

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**CATEGORY OF SUBMISSION:** STUDENT, RESIDENT, FELLOW

**Background:** Patients suffering from time-sensitive medical emergencies, such as myocardial infarction, stroke and traumatic injury have better outcomes when they receive timely treatment. Military medical treatment facilities (MTF) must balance the desire to optimize the care of the patient with force protection. At our facility, current protocols mandate the activation of the Emergency Medical Services
(EMS) system to respond and evaluate a patient at the gate with uncertain access privileges. If emergency treatment is warranted, the patient is then transported to the emergency department for evaluation and treatment. This study reviewed EMS activations related to use of this protocol and associated time-sensitive patient conditions that may have been worsened by a delay in care. **Methods:** We retrospectively reviewed EMS runs from 01 JAN 2017 to 12 NOV 2017 to hospital access points to assess patients who were denied access to the MTF. Time from EMS activation until delivery at the Emergency Department and number of time-sensitive complaints are reported. Time sensitive complaints were defined as chief complaints associated with myocardial infarction, stroke, traumatic injury, or abnormal presenting vital signs (HR ≥100, SBP <90 or ≥210, RR <6 or ≥30, SpO2 <90%). Number of prosecutions for unauthorized attempts to access a military facility are also reported. **Results:** There were 42 EMS activations for a patient with a medical emergency presenting to our MTF. Mean time delay from EMS activation until patient delivery to the Emergency Department was 12.2 minutes. Of the 42 activations, 10 had a complaint concerning for a time-sensitive condition. Two were diagnosed with time-sensitive conditions. One had an ischemic cerebral infarct and the other had ACS. None of the 42 access attempts that resulted in EMS activation were prosecuted for unauthorized attempt to access a military facility. **Conclusions:** During our 11 month period of review, we identified 42 delays in care related to EMS activation at hospital access points. 10 were associated with a time-sensitive complaint and none were later deemed unauthorized access attempts. We will collaborate with security forces to review the current security protocol to prevent any adverse patient outcomes related to delays in patient care.

177. INCLUSION OF BLS NEBULIZED BRONCHODILATORS FOR ASTHMA IN STATEWIDE TREATMENT PROTOCOLS
Background: Asthma is a prevalent disease process, affecting over 8% of adults and children and accounting for ~1.8 million emergency department visits annually in the United States. Inhaled bronchodilators, such as short-acting beta agonists like Albuterol, are the mainstay in the management of acute asthma exacerbations. The administration of nebulized medication is not included in the national EMT scope of practice model, but is included for AEMT and Paramedic level providers. The purpose of this investigation is to describe the overall prevalence of Statewide Treatment Protocols (STPs) that allow for BLS nebulizer administration of bronchodilators in asthma protocols. Methods: Cross sectional study of STPs utilizing a standardized review examining asthma, wheezing or respiratory distress protocols for inclusion of BLS administration of nebulized bronchodilators. Protocol revision date was also captured. Results: Thirty five out of fifty (70%) states issue BLS STPs, twenty four of which are mandatory, while the remainder serve as guidelines. Of the twenty four states that issue mandatory BLS STPs, only ten (42%) include albuterol nebulizers as an approved medication. Four (36%) of the guideline protocol states allow for BLS bronchodilator administration. Pediatric administration is allowed in nine (90%) of the mandatory protocols. Twenty nine (83%) of the STPs have been revised since 2015. Conclusions: Bronchodilators are a life-saving mainstay for the treatment of asthma and bronchospasm. EMT administration of bronchodilator nebulizers would allow the initiation of treatment at an earlier point with relatively low risk of adverse effect to the patient. The National Scope of Practice does not allow for BLS administration of nebulized bronchodilators but almost half of states with mandatory protocols allow for administration. The large majority of protocols have been revised within the past 3 years, demonstrating that out-of-date protocols are unlikely to be the cause of this limitation. Further
investigation is needed to examine obstacles to including bronchodilator nebulizers in BLS STPs and consideration for inclusion in the National Scope of Practice Model.

178. THE USE OF VENOUS LACTATE LEVELS IN THE PREHOSPITAL SETTING

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Morristown Medical Center CATEGORY OF SUBMISSION: MEDICAL

Background: Sepsis protocols have been developed in Emergency Departments to identify and treat patients quickly. It follows that identification of septic patients in the prehospital setting would provide additional benefit. To this end, we began obtaining venous lactate levels in the prehospital setting. We sought to describe our initial experience and to determine the utility of its use prehospitally. Methods: Setting – A suburban, hospital-based, two-tiered EMS system in which the Advanced Life Support providers treat about 25,000 patients annually. All patients have online medical control. Subjects – Consecutive patients in whom a venous lactate level was obtained prehospitally. Protocol – Beginning in March, 2016, paramedics were instructed to assess lactate levels on patients with “sepsis, shock, suspected infection, or when it might be helpful” -- there are no specific guidelines for its use. We calculated the amount of IV fluids ordered and whether the lactate drawn was “useful.” 95% confidence intervals (CI) were also calculated. For the purpose of this study, we defined a “useful” prehospital lactate as one drawn in a patient with a possible infection and either a systolic blood pressure <90 or one of the following SIRS criteria: fever, respiratory rate >20, or tachycardia >90.

Results: 2,295 patients had lactates drawn. The average age was 75 and 48% were male. Of all the patients with lactates drawn, the average SBP was 138, DBP was 80, heart rate was 92, and respiratory rate was 20. 56% (CI 54, 58) of the lactates drawn were considered “useful.” 38% (CI: 36,40) of the lactates were elevated above 2.0. Those with elevated lactates were given an average of 432 ml (CI: 381, 484) of normal saline IV, and those with normal lactates were given an average of 370 ml (332, 408)
Conclusions: Over half of prehospital lactate levels drawn would be considered useful in treating a patient with potential SIRS / sepsis. The lactate testing did not result in additional treatment prehospital, and it is unclear if the results had an effect on treatment in the ED or patient outcomes.

179. INTERACTION EFFECT OF ENDOTRACHEAL INTUBATION AND PREHOSPITAL TIME INTERVAL ON NEUROLOGIC RECOVERY IN OUT-OF-HOSPITAL CARDIAC ARREST

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CATEGORY OF SUBMISSION: CARDIAC

Background: Prehospital advanced airway management (AAM) or has been a serious controversial issue in cardiopulmonary resuscitation (CPR) by emergency medical service (EMS) providers in out-of-hospital cardiac arrest (OHCA). Early ETI can disrupt the continuous CPR and followed by defibrillation while late ETI can limit the enough oxygenation to the OHCA patients. This study was conducted to evaluate the interaction effect of prehospital ETI with prehospital time interval (PTI) for CPR at the scene on neurologic outcome in OHCA. Methods: A nationwide cross-sectional observation study was conducted. Presumed cardiac origin adult OHCA with emergency medical service (EMS) resuscitation and who underwent AAM by EMS provider from January 2015 to December 2016 were included. Prehospital advanced airway was categorized in two groups: endotracheal intubation (ETI) vs supraglottic airway (SGA). Primary outcome was survival and secondary outcome was good neurological recovery. Multivariable logistic regression analysis was conducted to calculate adjusted odds ratios (AOR) with 95% confidence intervals (CIs) by ETI versus SGA on outcomes. PTI for CPR and transportation was defined as elapsed time from arrival of EMS to the scene and arrival to hospital emergency department. Interaction analysis between ETI and PTI for outcomes. Results: The final analysis included a total of
16,103 eligible patients (ETI 2,320, SGA 13,783). The survival rate was 7.6% (ETI 6.9%, SGA 7.7%) and good neurologic recovery was 4.7% for all (ETI 3.8% SGA 4.8%). There were no significant differences (AOR and 95% CI) by ETI in multivariable logistic regression analysis compared with SGA; 0.81 (0.63-1.05) for survival to discharge and 0.92 (0.76-1.12) for good neurologic recovery. In interaction analysis between prehospital AAM type and PTI, ETI showed favorable main outcomes than SGA in longer PTI group (≥30min): Survival 1.34 (1.03-1.73), Good neurologic recovery 1.37 (1.12-1.68). **Conclusions:** AAM type (ETI and SGA) was not associated with better outcomes in a nationwide observational study. However, the prehospital ETI was significantly associated with highest odds of survival and good neurologic recovery for OHCA patients with over 30 minutes or longer prehospital intervals.

180. ADVANCED LIFE SUPPORT (ALS) INTERCEPT FOR BEHAVIORAL HEALTH COMPLAINTS: A DESCRIPTIVE ANALYSIS

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**CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS**

**Background:** EMS agencies frequently respond to behavioral health complaints. The purpose of the current study was to describe ALS intercepts for behavioral health complaints initially attended by Basic Life Support (BLS) providers, and to determine the nature of ALS provided in these intercepts. **Methods:** Data were retrospectively collected from a single ALS agency serving multiple urban, suburban and rural communities for all requests for intercepts where the primary impression documented was behavioral health-related. Incidents were analyzed for patient characteristics, interventions provided by intercepting paramedics, and outcomes. **Results:** Between January 2017 and April 2018, there were 456 requests for ALS intercepts, of which 28 were Behavioral (6.1%). Compared with other intercepts, behavioral health intercept patients were younger (46.5 ± 21.2 years versus 58.9 ± 23.3 years, p<0.05) and female (57% versus 47%, p=0.30). Intercepts were categorized as Alcohol Abuse/Intoxication (25%),
Anxiety/Hyperventilation (36%), Suicidal/Threat to Self/Others (18%), and Other (21%). All responses used lights and sirens, but no patients were transported with lights and sirens. ALS interventions other than IV access and crystalloid infusion were provided in 8 cases (29%), less often than in other intercept calls (OR 0.30, 95%CI 0.13-0.69). Sedatives (midazolam, lorazepam, haloperidol) were administered more frequently (n=5) than during other intercepts (OR 4.71, 95%CI 1.69-13.11), primarily for patients with Anxiety/Hyperventilation (n=3, OR 31.87, 95%CI 7.59-133.78). Other ALS interventions for behavioral patients included IV dextrose, ondansetron, and fentanyl. Conclusions: Advanced interventions were rarely required in behavioral health ALS intercepts. Compared with other intercept calls, these patients more frequently received sedative medications, especially in patients categorized as Anxiety/Hyperventilation. No category of behavioral health call could clearly forego ALS intercept. Further study is needed to determine which patients actually benefit from ALS intercept, guiding future training and dispatch guidelines at both the BLS and ALS levels of care.

181. COMMUNITY PARAMEDIC POST-DISCHARGE PROGRAM: REDUCING THE COST OF CARE AFTER HOSPITALIZATION

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CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

Background: A private hospital established a Community Paramedic (CP) program for patients discharged from the hospital with an acute exacerbation of congestive heart failure (CHF) or chronic obstructive pulmonary disease (COPD). This program aimed to improve appropriate healthcare utilization and to reduce readmissions in this population, thereby reducing overall cost of care. Objectives: To quantify the impact of a post discharge CP program on the rate of healthcare utilization and estimated healthcare cost savings during the 90 and 180 days following hospitalization for patients
admitted with an acute CHF exacerbation. **Methods:** Local area resident, English-speaking inpatients with CHF who did not have home-care services at discharge were offered visits by a CP for up to 30 days post-discharge. Patients who consented had a CP visit them in the home 1-2 times per week for 4 weeks following discharge. Healthcare utilization was analyzed descriptively using means and standard deviations and was compared to a population not receiving CP visits using Wilcoxon rank sum tests. Cost data was calculated using expected cost per day and average length of stay for a comparable control group of CHF and COPD patients. **Results:** 115 patients enrolled between February 2015 and June 2018. As of July 2018, 50 patients had completed the program with complete data. Compared to control patients, CP patients had significantly fewer hospital admissions during the 90 days (p=0.0265) and 180 days (p=0.0311) following completion of CP visits, corresponding to an estimated cost difference of $476,000 over 180 days. Though there was no difference in emergency department visits at 90 days, CP patients had significantly fewer visits in the 180 days following CP visit completion (p=0.0486), corresponding to an estimated cost difference of $31,000. There was no significant difference in clinic visits during the 90 and 180 days following completion of CP visits between the two groups. **Conclusions:** Home visits by a CP for 30 days after hospitalization can be successful in reducing readmissions and ED visits and reducing healthcare costs for patients with CHF and COPD. These results suggest the possibility of health system-wide costs savings through implementation of a CP program.

182. 911-EMERGENCY MEDICAL SERVICES REKINDLES IN THE CITY OF LOS ANGELES

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**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** A "rekindle" is an industry term for a patient requiring a second EMS response in the same calendar day, and is a desirable safety metric that is unfortunately hard to track due to the limited ability of 911-agencies to perform patient matching or bill for non-transport services. The objective of this study was
to describe the prevalence and characteristics of patients with 911-rekindles in the City of Los Angeles.

**Methods:** This was a retrospective, descriptive study of electronic health records for the Los Angeles Fire Department (LAFD) for cases occurring between January 2012-July 2017. Patients were included if they had sufficient data to assign a Patient ID number (PIN), which required both two or more transports in a calendar year as well as the presence of at least two of the following data elements on each encounter: social security number, date of birth, phone number or address. Critical rekindles were defined as a second EMS response on the same calendar day of service where on the second encounter the patient received "ALS2" criteria as defined by the Centers for Medicare and Medicaid Services or they were found dead on arrival. The primary endpoint was the prevalence of same day rekindles.

**Results:** Among the 2,062,069 EMS incidents occurring during the study period, 688,562 (33.4%) included a patient for whom a PIN could be assigned; 104,530 of these incidents resulted in a non-transport; and 7120 (1.0%) resulted in a same-day rekindle. This rekindle rate increased from 0.6% in 2012 to 1.2% in 2017. There were 38 critical rekindles during the study period (0.006% of incidents and 0.04% of all rekindles), and the rate of critical rekindles remained stable over time. Critical rekindles had an average age of 67.1 years (IQR 55-76 years), were 53.8% male, tended to have multiple comorbidities and frequently occurred following vague initial encounter complaints (such as weakness or flu-like symptoms). **Conclusions:** In this limited data set from a large urban 911-EMS provider, rekindles for 911 patients initially released on scene were found to occur at rates similar to those published for emergency departments.

183. QUALITATIVE ASSESSMENT OF PEDIATRIC EMERGENCY CARE COORDINATORS AND SKILLS COMPETENCY VERIFICATION IN EMS AGENCIES
Background: Ensuring EMS providers are equipped to care for children is challenging. National recommendations propose EMS agencies have pediatric emergency care coordinators (PECC) to promote education, improve processes, enhance protocols, and ensure supply availability for children. This and having process for providers to demonstrate competency using pediatric-specific equipment are metrics the EMS for Children (EMSC) program has recently assessed. Purpose: The purpose of this study was to identify practices from EMS agencies in several states that have identified a PECC and/or a method of verifying skills competency with pediatric-specific equipment. Methods: This was a qualitative health services study of EMS systems in six states. EMSC-based interviewers identified systems representing varied geography, response levels, and administrative structures that had a PECC or skills competency verification process. They contacted EMS agency administrators to conduct audio-recorded, semi-structured interviews to assess current practices in their systems. Interviews were transcribed, and two investigators used constant comparison analysis to code themes until saturation was reached. Results: Several themes emerged from the 17 interviews. Three were identified about the PECC: roles and responsibilities; staffing model; and impact. All PECCs focused on quality improvement, and most had pediatric-specific roles in education promotion, supply oversight, community collaboration, and protocol review. Most PECCs were full-time EMS agency paramedics or physicians, and many had responsibilities integrated into existing roles. The PECC's main benefit was enhancing provider confidence with pediatric patients, while the primary challenge was insufficient time fulfilling the role's responsibilities. Four themes for physical demonstration of competency using equipment were: training process; equipment items; personnel needed; and impact. Most agencies reported hands-on skills verification worked better than didactic trainings to increase staff competence. Most have their
medical director present, and demonstrating equipment use identified ways to minimize user error. **Conclusions:** EMS agency administrators identified promising practices that their systems implemented to have a PECC or skills competency verification process. They identified the primary benefit of both as enhancing provider confidence with pediatric patients. Future research should focus on measuring patient-centered outcomes in having a PECC and skills verification processes, and identifying practical ways to overcome the barriers to having them.

184. FADE TO BLACK: ANALYSIS OF THE EVOLUTION OF BATTLEFIELD EPIDEMIOLOGY AND TACTICAL COMBAT CASUALTY CARE BETWEEN TWO OF AMERICA’S CONTEMPORARY CONFLICTS

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CATEGORY OF SUBMISSION: DISASTER

**Background:** Compare and contrast U.S. battle casualty epidemiology, interventions, and outcomes between engagements in Mogadishu 1993 ("Black Hawk Down") and Sadr City 2004 ("Black Sunday"), respectively. Identify episodes of successful knowledge translation and enduring capability gaps.

**Methods:** Retrospective case series with meta-analysis of all U.S. battle casualties sustained during both engagements. **Results:** Both populations were comparable in terms of demographics, mechanism of injury and epidemiology. Of 26 fatalities, 19 (73%) were adjudicated non-survivable (high-velocity penetrating trauma to the head, aortic or coronary injury, hemi-section). Seven (27% of fatalities, 3.5% of casualties) were adjudicated potentially survivable. After stratification, the case fatality rate for Mogadishu was 14% vs. Sadr City 11.1% (OR 1.35, CI 0.51 to 3.6); potentially survivable deaths were Mogadishu 28% vs. Sadr City 25% (OR 1.15, OR 0.13 to 11.84). All potentially survivable deaths (both cohorts) were associated with uncompressible torso or junctional hemorrhage, and unavoidable delays in extrication and evacuation. No fatalities in either cohort were associated with airway obstruction, intrathoracic tension or compressible extremity hemorrhage. **Conclusions:** Despite 10 years intervening,
both populations experienced comparable battle casualty rates, mechanisms of injury and primary
wound types, and both had similar rates of potentially survivable death. While underpowered, the trend
toward lower case fatality and potentially survivable deaths was coincidental to full application of TCCC
guidelines and permissive-hypotensive resuscitation. Non-compressible hemorrhage and traumatic
coagulopathy remain primary contributors to potentially survivable battlefield death.

185. COUNTY-WIDE ASSESSMENT OF EMERGENCY MEDICAL SERVICES PROVIDERS’ RESEARCH
AWARENESS AND INVOLVEMENT

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Stony Brook University Hospital CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: To assess the current state of research awareness through a county-wide survey of
prehospital providers, and identify opportunities to improve the use of and participation in out-of-
hospital research. Methods: A 35-question survey containing demographic and experience items was
beta tested and distributed to the county EMS system, comprised of approximately 5000 providers.
Responses to various statements were graded on a 5-point Likert scale and analyzed with Chi square
tests, p<0.05 for significance. Results: Of 1000 responses, 120 were excluded (duplicate identifier, non-
licensed provider level). Of 880 analyzable surveys, a majority of respondents were male (65%), and
included paramedics (36%), EMT-Critical Care (19%), and EMT-Bs (45%). Mean age was 38 years with a
mean of 13 years of EMS experience. 58% held college degrees, 44% subscribed to medical journals, and
read articles a couple times a week (18%), month (38%), or year (32%). 87% disagreed spending 5
minutes to complete clinical trial paperwork would be unacceptable. Providers most likely to frequently
read research articles included paramedics (64% vs 51% non-paramedics, p<0.001) and college
graduates (59% vs 52% non-graduates, p=0.043). Those who frequently read articles were more likely to
agree more prehospital research would improve care prehospital care (94% vs 87% who rarely read
articles, p<0.001). Those more likely to agree protocols should be based on clinical trial results included paramedics (88% vs 78% non-paramedics, p<0.001), college graduates (86% vs 77% non-graduates, p=0.001), and frequent article readers (85% vs 79% infrequent readers, p=0.015). Providers most interested in participating in clinical trials include paramedics (92% vs 81% non-paramedics, p<0.001), and frequent article readers (90% vs 78% infrequent readers, p<0.001). Providers most interested in attending journal clubs include paramedics (56% vs 46% non-paramedics, p=0.004), frequent article readers (59% vs 38% infrequent readers, p<0.001), and college graduates (54% vs 44% non-graduates, p=0.004). **Conclusions:** In this cohort of EMS providers, awareness of and interest in participating in prehospital research was significantly higher in paramedics, college graduates, and frequent readers of journal articles. This highlights the importance of educating prehospital providers on fundamentals of research consent, and how to find, read, and evaluate medical research literature.

186. MEASURING EMS PERFORMANCE IN OBSTETRIC PREHOSPITAL CARE

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**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** Essential to effective patient care is the accurate and complete documentation of prehospital interventions. Analysis of prehospital records advances improvement in patient care and provides opportunity for intervention through EMS education. The low-volume and high-risk nature of obstetric prehospital emergencies should prompt EMS systems to carefully monitor care of these patients. **Objective:** The goal of this study is to characterize documentation of EMS performance for obstetric emergencies in North Carolina (NC). **Methods:** NC EMS patient records between January and December 2013 were retrospectively reviewed for pregnant or six-week post-partum women ages 10-56 who were transported to a hospital by EMS. There were no exclusion criteria. Patient characteristics (e.g., age, race, obstetric emergency) and EMS performance measures (e.g., intravenous access, blood
pressure measurement, newborn assessment) were assessed using descriptive and inferential statistics (a=0.05). **Results:** Of 9,107 obstetric patients, 53% were Black/African American, 36% White, and 11% Other. Rural patients comprised 54% of cases. Cases were classified according to obstetric emergency, including "Pregnancy without delivery" (75%), "Vaginal bleed" (17%), "Miscarriage with bleeding" (3%), "Pregnancy with delivery" (2%), "Post-partum" (2%), and "Miscarriage without bleeding" (1%). Performance measures were consistently underreported during prehospital care (e.g., 45% IV success, 30% APGAR scoring, and 17% correct medication administration, where indicated by obstetric emergency). Significant differences in EMS performance were found by patient age, race, rurality, and obstetric emergency. Regression analysis showed IV placement was lowest for younger Black/African American patients receiving post-delivery care in urban counties (p≤0.05). **Conclusions:** EMS performance and documentation are dependent on the type of obstetric emergency and patient demographics. Performance measures were documented in fewer than 50% of cases. Reasons may include poor documentation or inconsistent application of protocols. New education for EMS personnel and improvement in protocol application are required to increase EMS skills and knowledge of these rarely encountered obstetric emergencies. Certain performance measures, such as early hospital notification, are not available in prehospital documentation, providing limitations in EMS performance analysis.

187. SCENARIO-BASED PILOT TESTING OF EMS PROVIDER INTERPRETATION OF A NOVEL PEDIATRIC TRIAGE PROTOCOL

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**CATEGORY OF SUBMISSION:** PEDIATRIC

**Background:** Pediatric care is increasingly concentrated in a small number of hospitals. No widely operative triage protocols guide EMS’ pediatric destination decision for non-trauma patients. The
PDTree tool is an evidence based protocol developed to assist EMS providers’ in choosing a pediatric destination facility capable of definitive care. The PDTree defines four tiers of pediatric care (specialty/trauma center, comprehensive pediatric facility, regional pediatric facility and closest ED), and matches patients by condition and EMS assessment. Objective: To pilot test the PDTree tool with practicing EMS providers for accuracy of interpretation and performance across the range of practice levels and prior experience. Methods: Maryland EMS providers voluntarily participated in this online pilot testing. Demographic information included certification level, location of primary EMS jurisdiction, and years of experience. Providers were provided with a copy of the PDTree tool and given 14 patient scenarios. For each scenario, providers were asked to name their most likely destination, to indicate why they chose that destination, and to select the level of care suggested by the PDTree tool. Results: 100 providers (52 ALS, 48 BLS) completed the electronic pilot test. Providers named a destination hospitals with appropriate capabilities in 60% of scenarios. Providers’ interpretation of the PDTree’s advised destination level agreed with the intended response for 71% of scenarios. Greater than 90% agreement was seen for burns, witnessed child abuse, and cervical spine injury. Less than 50% agreement was seen for shock and a non-distressed child with a tracheostomy. Rates of agreement differed for diabetic ketoacidosis and non-distressed medically complex child based on provider level, and for elbow injury with deformity with years of experience (Chi Square p value=0.01 and p value=0.04, respectively). Conclusions: EMS providers accurately interpreted the PDTree tool to determine the advised destination for a majority of pediatric scenarios. Future evaluation will focus on conditions with lower rates of agreement to determine if educational interventions or tool alterations are required. Virtual pilot testing using clinical vignettes is a reasonable first step in assessing the usability of a novel clinical decision-making tool.
Background: Considering the recent rise in school shootings and mass casualty incidents, disaster preparedness training continues to be a vital component in the education of healthcare professionals. Physicians and nurses are expected to work effectively as a team in these rare and dire situations. We aimed to measure the impact of interprofessional critical incident response training on team-based performance among nursing and medical students. Methods: We developed a critical incident response course as a graduation requirement for senior medical and nursing students. The course consisted of online modules reviewing interprofessional communication, prehospital triage and decontamination principles, public health, and disaster response. The course concluded with a half-day hands-on experience in which students rotated through two prehospital modules (decontamination scenario and triage of a mass casualty active-shooter incident), as well as medical simulations of resuscitations that required them to work as a team. We evaluated overall impact by administering a mandatory pre/post course assessment. Measures included the TeamSTEPPS Teamwork Attitudes Questionnaire (TAQ), and the University of Washington Macy Assessment Team’s Pre-Assessment Evaluation of Teamwork Knowledge, Attitudes, and Skills for Health Sciences Students (UW). Descriptive analyses and significance testing of pre/post difference scores were performed with nonparametric tests in Stata 13 IC. Results: We report results comparing medicine and nursing (n=256, medical=123, nursing=133). Pre/post course assessments showed statistically significant improvements in reported performance in team-based healthcare activities, as well as the reported performance in settings that bring together students of other professions. Medical students’ reported scores for team-based healthcare performance increased 5%, whereas nursing increased 11%. Medical students’ reported scores for performance in
interprofessional settings increased 9%, whereas nursing increased 19%; p-values comparing these differences were 0.05 and 0.01, respectively. **Conclusions:** Teamwork and interprofessional performance improved for both medical and nursing students, however, there was a greater improvement among nursing students. We believe that implementation of interprofessional critical incident response training can enhance the collaborative dynamic between physicians and nurses; not only for disasters and mass casualty incidents, but also for day-to-day patient care.

189. HUMAN FACTORS IN PREHOSPITAL PEDIATRIC EMERGENCIES

*Casey Dolen, Mustafa Ozkaynak, Kathyrn Rappaport, Kathleen Adelgais, University of Colorado School of Medicine* CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

**Background:** Pediatric emergencies represent a high risk, low frequency event for many Emergency Medical Services (EMS) agencies. Errors are common in pediatric prehospital care, however there is limited information on the role of team dynamics, human factors, and non-technical skills as a root cause. The objective of this study is to quantify human factors associated with medical errors in the prehospital management of pediatric emergencies. **Methods:** This exploratory study utilizes task analysis of teams of 3-6 EMS providers from a metropolitan fire department participating in pediatric high-fidelity simulations. Scenarios included a 15-month-old with seizure activity and a 1-month-old with hypoglycemia. Each scenario required management of cyanosis from respiratory failure, decompensated shock, and medication administration. One investigator performed task analysis via video review and quantified time to task completion (minutes:seconds) and number of providers involved. Human factors were evaluated using the standardized and validated Anesthetists Non-Technical Skills (ANTS) instrument scoring aspects of team management on a 1-5 scale; scores <3 representing patient safety risks. **Results:** A total of 112 EMS providers participated in 24 unique pediatric simulations. Task analysis revealed the following median times to interventions: oxygen delivery 1:52 (IQR: 1:18, 2:08),
intravenous access: 5:03 (IQR: 3:55, 6:40), medication administration: 5:26 (IQR: 4:49, 6:59). From start of seizure, median time to recognition was 0:33 (IQR: 0:22, 0:49); all teams responded by changing management. Numerous tasks (i.e., checking pulse and breath sounds) were repeated by various team members without communicating findings to team members or for reassessing after interventions. Overall mean ANTS score was 2.2 with the following subcategory averages: task management: 2.2; teamwork: 2.2; situational awareness: 1.9; decision making: 2.4. Errors were observed in recognizing shock, safe administration of intravenous fluid, bag mask ventilation rate control, and using age appropriate restraint for transport. Conclusions: In this exploratory study we noted that few providers demonstrated closed-loop communication, situational awareness, and role clarity. Interventions such as defining responsibilities, utilizing checklists, and effective communication may reduce errors in the prehospital care of children.

190. EPIDEMIOLOGY OF ACCELERATED USE OF 911-EMERGENCY MEDICAL SERVICES IN CITY OF LOS ANGELES, 2012-2016

Stephen Sanko, Marc Eckstein, Keck School of Medicine of the University of Southern California

CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

Background: The volume of 911-emergency medical service (EMS) incidents in Los Angeles has markedly accelerated in recent years. The objective of this study was to describe population cohorts that appeared to be using 911 more frequently between 2012-2016. Methods: This was a retrospective, descriptive study of all electronic health records for the Los Angeles Fire Department (LAFD) for EMS incidents occurring between January 2012 -December 2016. Age, gender, incident location by battalion, and EMS provider impression are reported. Demographic data is based on 2010 US Census. The geography of LAFD's 14 battalions, classification of its 68 provider impression categories, trauma center criteria and policies relating to use of prehospital trauma and mental health interventions were all
unchanged during the study period. **Results:** From 2002-2011, the number of LAFD 911-EMS incidents increased on average 1.9% per year. From 2012-2016, average number of annual 911-EMS incidents increased to 4.8%. Systemwide, the rate of EMS incidents increased from 64.0 to 75.1 incidents per 1000 residents, while in a single South LA battalion the rate increased from 72.9 to 106.9 incidents per 1000 population. There was a bimodal distribution of age groups with accelerating use in both men and women, with ages 25-39 and 55-69 accounting for 29.2% and 35.2% of attributable growth, respectively. 74.1% of growth was attributable to three groups of EMS provider impressions: vague symptoms (29.5%, "weakness," "flu-like symptoms," "unknown medical"); "traumatic injury" (24.4%); and mental health exacerbations (20.1%, "anxiety," "depression," "behavioral" and "psychiatric emergency"). 68% of traumatic injuries and 50% of mental health exacerbations required no prehospital interventions, and these rates were stable throughout the study period. 25-39 years-olds, especially in South Los Angeles, showed disproportionate increased use of 911 for mental health exacerbations, while accelerated use by seniors was driven primarily by injuries and vague provider impressions. **Conclusions:** Accelerated use of 911 from 2012-2016 appears to be driven by disproportionate use among select geographic and age-cohorts, whose provider impressions suggest the need for increased access to timely and acuity-appropriate injury and mental health care options. This data is limited by a lack of ED or hospital outcomes.

191. THE ROLE OF PARAMEDICS PROVIDING PALLIATIVE CARE: A QUALITATIVE STUDY OF THE EXPERIENCES AND PROFESSIONAL IDENTITY

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**Background:** In 2015, the 'Paramedics Providing Palliative Care at Home' program was implemented in a provincial EMS system (Nova Scotia). Such expanded paramedic roles are part of the evolving identity of this profession. This study explored the experiences of those working in and with this program, the alignment of paramedic palliative support with professional identity, and the challenges. **Methods:** In this qualitative study, paramedics and palliative health care providers (HCPs) were recruited for focus groups to explore: [1] understanding of and experiences with the expanded paramedic role in palliative care, [2] program alignment with paramedic professional identity, and [3] challenges. Data were collected until saturation and concurrently thematically analyzed. **Results:** Of the 11 paramedics who participated, 8 (72.7%) were advanced care level, and all had experience caring for palliative patients. Of the HCPs (n=20), 14 (70.0%) were nurses, 5 (25.0%) in other HCP/administrative roles, and 1 (5.0%) physician. For experiences with this program, three themes emerged: 1) the value of patient centered care and increased job satisfaction, 2) bridging a gap in care when the usual care team is delayed/unavailable, and 3) the value of providing psychosocial support to patients/families in crisis. For paramedic professional identity, four themes emerged: 1) palliative care demonstrates the ongoing evolution of paramedics as skilled clinicians, 2) providing this care and helping people in the community is of great value, 3) the paramedic skill set aligns well with palliative care needs, and 4) this fills a gap in the health system. Themes related to challenges were: 1) a change in mindset (from stabilize and transport to comfort as a goal of care and non-transport), 2) small/rural communities where paramedics personally know patients, and 3) paramedics not feeling part of the patient's palliative team -perceiving communication and conflict issues with HCPs. **Conclusions:** This study identified the experiences of paramedics and HCPs caring for palliative patients at home and found this expanded role is a positive evolution of paramedicine. Paramedics have increased satisfaction serving these patients, and this expanded role is a good fit with their professional identity. Challenges were identified that will be helpful for creating program improvements.
192. STATEWIDE SURVIVAL AFTER PEDIATRIC OUT-OF-HOSPITAL CARDIAC ARREST

Kevin Seaman, Bryan McNally, Melanie Gertner, Karen O’Connell, Jennifer Anders, Medical Director

CATEGORY OF SUBMISSION: PEDIATRIC

Background: The American Heart Association has identified cardiac arrest as a leading cause of death and committed to doubling survival rates by 2020. Despite this important commitment, little is known about pediatric cardiac arrest survival. Hypothesis: Participation in a cardiac arrest registry will provide data that will better characterize the demographics and epidemiology of cardiac arrest in children.

Methods: All EMS agencies and acute care hospitals in Maryland began participation in the Cardiac Arrest Registry to Enhance Survival (CARES) in 2016. Calendar Year 2017 was the first reporting period in which 12 full months of data, including patient outcomes, was available statewide. Prehospital care was recorded into the electronic patient care report and, after quality checks, cases were uploaded to the CARES database. Hospitals entered outcomes for patients that survived to discharge.

Results: For the 2017 calendar year there were 6886 non-traumatic cardiac arrests in Maryland; 154 (2.2%) were pediatric. Demographic and outcomes data were reported by age: infants (0 to 11 months), children (1 to <12 years) and teenagers (12 to 18 years). The majority were infants (90; 58.4%), followed by children (36; 23.4%), then teenagers (28; 18.2%). There were no shockable initial rhythms for infants. For children 1 to <12 years, 3 of 36 were shockable (8.3%). For teenagers 12 to 18 years, 6 of 28 were shockable (21.4%). Overall survival was 3.3% for age 0 to 11 months, 16.7% for 1 to <12 years and 10.7% for 12 to 18 years. Utstein survival (Witnessed arrest, shockable initial rhythm, discharged alive) was 0%, 8.3% and 21.4% for the respective groups. Utstein survival for teenagers with shockable rhythms was 50% (3/6).

Conclusions: Participation in CARES helped characterize pediatric cardiac arrest in Maryland, with shockable rhythms being uncommon in infants and young children; rates of survival increased with age. Utstein survival is rare in infants, suggesting that alternate performance measures may be
appropriate for this group. Utstein survivors for children and teenagers occurred solely from shockable initial rhythms. Contributing cardiac arrest data to CARES can facilitate the assessment of educational and training interventions on pediatric outcomes over time.

193. EMERGENCY MEDICAL TECHNICIAN (EMT) AND PARAMEDIC SATISFACTION WITH PATIENT TRANSFER OF CARE IN THE EMERGENCY DEPARTMENT (ED)

Gerard Carroll, Rick Hong, Katelyn Levy, Bryan Wilson, Brigitte Baumann, Cooper Medical School of Rowan University

CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

Background: To examine perceptions and satisfaction of EMTs and Paramedics with the patient care transfer process in the ED. Methods: Prospective survey using a convenience sample, where emergency medical service (EMS) providers who transported patients to our tertiary, inner city ED (excluding transfers/trauma alerts) were approached for inclusion during June 2017. Survey completion was voluntary, anonymous, single-blinded and the study was IRB approved. Standardized data forms collected EMS provider demographic data, EMS experience, and satisfaction with patient care transfer. Survey item agreement was noted on a "100 mm ruler" 100-point Visual Analogue Scale, where the respondent placed a perpendicular line on the ruler. Complete disagreement and complete agreement corresponded to 0 and 100, respectively. Data are reported as means with standard deviations (SD). Comparisons were done using t tests. Results: Of 125 enrolled, 104 were EMTs and 21 were paramedics (P). There were differences in mean age 34.6 (9.5) (EMT) vs 39.6 (11.2) (P), p=0.03 and number of years of EMS provider experience: 11.0 (7.9) vs. 18.6 (10.2), p<0.005. Mean number of transports/week did not differ: 11.9 (EMT) vs. 12.9 (P), p=0.2. Impression that patients received appropriate attention on arrival was high: 84.2 (EMT) vs. 84.0 (P), p=0.8, and frustration level was low: 20.1 (EMT) vs. 27.5 (P), p=0.2, with no significant difference between groups. Responders were asked if they were inclined to provide less information when frustrated with patient care transfer; in both groups, this was unlikely:
The majority agreed with feeling like they were part of our patient care team, 75.0 (EMT) vs. 70.4 (P), p=0.5. Overall satisfaction with our ED was high; 86.2 (EMT) vs. 78.1 (P), p=0.06. Satisfaction with other EDs was lower and differed between EMTs (73.1) and paramedics (61.3), p=0.047. Willingness to bring patients to our ED over another, based on treatment at the other ED was moderate: 69.9 (EMT) vs. 62.8 (P), p=0.4. **Conclusions:** Overall satisfaction and positive perceptions was high in responders. Dissatisfaction with other EDs was more pronounced in paramedics and both expressed some willingness to reroute patients based on previous ED experiences.

194. **UTILIZING THE NEMSIS DATABASE TO ASSESS FOR AN ASSOCIATION BETWEEN STATE OPEN CARRY LAWS AND EMS ACTIVATIONS FOR FIREARM INJURIES**

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**CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS**

**Background:** Firearms accounted for 16.9% of all injury-related deaths in the US in 2015. States have adopted different laws to regulate firearms, including permitting or banning open carry of handguns and long guns. We sought to determine the feasibility of using the 2015 NEMSIS dataset to assess for an association between a State's open carry laws and EMS activations for firearm injury. **Methods:** States were grouped according to the restrictiveness of their open carry laws (Law Group, scale of 1-5). This code was added to the 2015 NEMSIS dataset as a unique data element (NEMSIS data at the State level is not publicly available). EMS encounters were filtered according to data elements E03_01 Dispatch Code (530 Stab / Gunshot wound) and E10_01 Cause of Injury Code (9565 Firearm Injury Accidental, 9560 Firearm Assault, or 9570 Firearm Self-Inflicted). Encounters coded as E03_01 -530 Stab / Gunshot were excluded if a Firearm injury was not listed in the E10_01 Cause of Injury code. Demographic data on Gender, Race, Age, and Patient Destination were gathered. Incidence rates were calculated using 2010 US Census records. **Results:** 93,485 events were identified. 56,222 had an undefined cause of injury,
leaving 37,263 events. 24,227 were assaults, 5,543 were accidental injuries, and 7,493 were self-inflicted injuries. 17,477 events (46.9%) occurred in States (n=31) that allow permitless open carry and 6,675 events (17.9%) occurred in States (n=3) that banned the open carry of handguns but allowed open carry of long guns with a permit. 84% of patients were male, 39.72% were Black, and 66% were ages 10 - 39 years. 27,191 patients (73%) were transported by EMS and 5,516 patients (14.8%) were found dead at the scene. Incidence rates (per 100,000) for each law group were: 1 -15.12; 2 -20.86; 3 -6.59; 4 -28.49; 5 -8.95. A number of limitations, including incomplete data reporting by State EMS agencies to NEMSIS and the inability to analyze data at the State level, prevented a more robust analysis between Law Groups. **Conclusions:** With appropriate permissions, State level assessments would be possible and may help overcome some of these limitations.

195. POTENTIAL REDUCTION IN HOSPITAL ADMISSION OF EMERGENCY DEPARTMENT PATIENTS THROUGH COMMUNITY PARAMEDIC PARTNERSHIP

**Paula Miller, Tia Radant, Aaron Burnett, Sandi Wewerka, Regions Hospital**

**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** A unique Community Paramedic (CP) post-discharge program at a Level I Trauma center was launched in 2014. After piloting this program with patients discharged from the hospital with acute exacerbation of congestive heart failure, an initiative was undertaken to plan expansion of the CP program to additional patients and care areas. **Objective:** To quantify the potential reduction in inpatient and observation admissions for patients seen in the Emergency Department (ED) of a Level I Trauma Center if the treating ED provider had the option to discharge the patient with CP follow-up. **Methods:** Research staff approached ED providers at the end of each provider shift for a period of 21 days. Research staff asked each provider to report on how many patients they could have sent home instead of admitting to inpatient or observation if a CP had been available to do a home visit within 24
hours. Research staff provided a description of what a CP is if the provider requested more information, including two scenario examples and a list of what elements may be included in a CP home visit. 

**Results:** 100 provider surveys were conducted in total, including 24 from day shifts, 40 from evening shifts, and 36 from overnight shifts. Providers surveyed during this time period saw a total of 1719 patients. Of these, 297 (17.3%) were ultimately admitted as inpatients and 92 (5.4%) were admitted to observation, for a total of 389 (22.6%) patients admitted. Of these admitted patients, providers reported that 26 (6.7%) could have avoided admission if there was a CP available to visit them within 24 hours.

**Conclusions:** Increasing patient volumes in both the ED and greater hospital pose challenges in providing the correct care to each patient. Lack of bed availability can easily impact ED patient flow, resulting in delays in care. This survey shows the potential to keep inpatient beds open for those truly requiring admission by integrating a CP program allowing appropriate patients to be discharged with lower-cost healthcare services, resulting in potentially significant cost savings and increased availability of resources.

196. STANDARDIZED PREHOSPITAL EDUCATION AND mNIHSS TRAINING FOR PARAMEDICS: A PILOT STUDY


**Background:** Modified NIHSS (National Institute of Health Stroke Scale) is a 11-item, 0-31 point motor stroke deficit scale that was developed to assess stroke severity. Our objective was to test the performance of modified NIHSS (mNIHSS) for the detection of large vessel occlusion when used by paramedics. **Methods:** This is a prospective, cohort study that was conducted in a fire-based EMS agency in California, during a 20-month period (11/2016 -6/2018). We trained 40 ALS-trained
Paramedics in Emergency Neurological Life Support (ENLS) stroke curriculum and the AHA/ASA NIHSS certification program. Patients were eligible if they were over the age of 18 years, with acute neurological deficit consistent with suspected acute stroke. Non-English speaking or vulnerable patients were excluded. The paramedics obtained a stroke-specific history, completed the mNIHSS, and assessed for contraindications for acute stroke treatment. This data was linked with the hospital outcomes using unique identifiers. We calculated the test performance of mNIHSS and NIHSS in the emergency department for LVO using the gold standard CTA imaging. The reliability between paramedic and stroke team mNIHSS scores using a Bland-Altman plot. **Results:** Of the 31 patients, paramedics and stroke neurologist scores differed by 0-2 points in 42% of patients, 3-4 points in 39% patients, and greater than 4 points in 19% patients. 10 patients (32.3%) had an LVO on CTA. Of the 10 with LVO, 6 had a mNIHSS of ≥ 6 and a test sensitivity of 60.0% (95%CI: 26.2-87.8) and a specificity of 57.1% (95%CI: 34.0-78.2). **Conclusions:** In a single-center study, mNIHSS had moderate sensitivity for LVO. Paramedics were able to complete a stroke scale with high reliability.

197. PREVALENCE OF OPIOID RELATED DEATHS WITH PREVIOUS NALOXONE ENCOUNTERS IN A MIDSIZE METROPOLITAN COUNTY: A CHART REVIEW

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**Background:** The current opioid epidemic has spread nationwide. The CDC reported in 2016, drug overdoses killed 63,632 Americans with nearly two-thirds of these deaths involving prescription or illicit opioids. To understand this epidemic, there have been numerous studies examining varied parameters. However, published research does not exist examining what proportion of patients who die from an opioid related overdose had a previous EMS or emergency department (ED) naloxone administration. The purpose of this study was to analyze data for a correlation between opioid-related deaths and
previous naloxone encounters using a 29,000 transport EMS system, one city ED (65,000 visits), a suburban ED (60,000 visits), and the County Department of Health. **Methods:** This study was a retrospective chart review using EMS data spanning January 2010 through December 2017, and hospital data spanning February 2013 through December 2017. The Department of Health provided the county total for all opioid-related deaths from January 2010 through December 2017. The subset of naloxone encounters was extracted from this total, with EMS accounting for 98.5%. **Results:** Of all patients who died from an opioid-related overdose, 69.0% did not have a previous naloxone encounter, compared to 15.1% who had at least one previous encounter. This difference was statistically significant (P-value <0.0001). 15.9% of patients were excluded secondary to their initial encounter being on the date of their death. Analyzing only 2013 data identified 7.8% of opioid-related deaths were individuals who had a previous naloxone encounter. In 2017, this same population accounted for 22.0%. This difference was statistically significant (P-value=0.03). Analysis from 2010 through 2017 revealed a median time from initial encounter to the date of coroner confirmed opioid death was 309 days. **Conclusions:** Focusing on specific patients with an initial naloxone encounter, either by EMS or the hospital emergency departments, offers a unique opportunity to impact opioid-related deaths. This novel research provides evidence that there is a clearly identified window of opportunity to intervene with these high-risk patients.

198. **EFFECTS OF AN ISOLATED 30-MINUTE CPR PROTOCOL ON OUT-OF-HOSPITAL CARDIAC ARREST (OHCA)**

Jonathan Thorndike, Carlin Chuck, Janette Baird, Nicholas Asselin, Brown University CATEGORY OF SUBMISSION: CARDIAC

**Background:** In 2017 the Rhode Island Department of Health implemented a clinical protocol mandating 30 minutes of CPR prior to transport for all non-traumatic OHCA patients. This study seeks to describe
the effects of this intervention on patient outcomes. **Methods:** We queried our hospital electronic medical record (EMR) for adult patients presenting to one of three emergency departments in our system. Those with an ESI of 1 were then subjected to further chart review to identify cases of OHCA. EMR data were available from three distinct protocol phases between March 2016 and September 2017: Pre-protocol, implementation and post protocol. Cases were excluded if ROSC was achieved prior to EMS contact, or if OHCA was deemed to be traumatic. **Results:** 872 cases of OHCA were reviewed. Median patient age was 66 (IQR: 53,77); 35% were female and the number of comorbid conditions did not change across three assessed time periods. Witnessed arrest occurred in 34% of patients in pre-protocol and implementation phases, and occurred in 45.5% of OHCA post-protocol. 24.6% of patients had an initial shockable rhythm, which not change significantly across time periods. Prehospital ROSC increased after implementation of the protocol: Of 543 patients with complete documentation, 18% (n=97) had prehospital ROSC. This increased across time periods, from 12.1% to 14% to 26.4% (χ2(2)=15.6; p=0.001). When controlling for arrest characteristics, there was no significant change post-protocol implementation. EMS providers adhered to the CPR protocol and the median on-scene CPR time increased from 14 (IQR: 9,17) pre to 30 (IQR: 24,36) post-implementation. 8% of patients survived to discharge from the hospital, among whom 44-60% had a favorable neurologic outcome (CPC 1 or 2), with no significant change across time periods when controlling for arrest characteristics. More patients had supra-glottic devices or endotracheal tubes post-protocol (50% to 68%; Δ 18%; 95% CI: 12,24%). **Conclusions:** Patients suffering from OHCA had higher ROSC in the post-intervention time period, although when controlling for whether the arrest was witnessed, shockable or had bystander CPR, there was no significant change. Survival to discharge was not affected by this isolated protocol change.

199. CARDIAC ARREST RESUSCITATION EVALUATION IN LOS ANGELES: CARE-LA 2016
Stephen Sanko, Michael Stone, Marc Eckstein, Keck School of Medicine of the University of Southern California

CATEGORY OF SUBMISSION: CARDIAC

Background: This study reports the epidemiology and outcomes from out-of-hospital cardiac arrest (OHCA) in the City of Los Angeles during 2016, and compares these results to previously published findings from 2000. Methods: This was a prospective observational study of Los Angeles Fire Department (LAFD)-attended OHCA patients with attempted resuscitation from January 1-December 31, 2016. Data elements conform to 2014 Utstein template recommendations. Patients missing survival outcomes were presumed dead. The primary outcome was neurologically-intact survival at hospital discharge. Results: In 2016, 2,443 OHCA cases were treated by LAFD 911-responders (62 per 100,000 population). The mean age was 64.9 (SD=20.1) years, and 61.6% were male. 813 (33.2%) cases were witnessed, including 519 by lay bystanders (21.2%). 55.6% of all non-EMS witnessed cases had bystander CPR, while public access defibrillators were applied in only 2.6% of such cases. Using 2014 Utstein criteria, among all OHCA cases with attempted resuscitation survival to hospital discharge was 10.6% and neuro-intact (CPC 1-2) survival was 4.7%. Among shockable bystander-witnessed cases, survival to hospital discharge was 35.5% and neuro-intact survival was 21.3%. Using CARELA (2000) entry criteria, overall survival to hospital discharge improved from 2.1% to 11.1% (p<0.01) and neuro-intact survival improved from 1.4% to 4.7% (p<0.01); while shockable bystander-witnessed neuro-intact survival improved from 6.0% to 22.6% (p<0.01). Conclusions: Survival and neuro-intact survival from cardiac arrest improved in the densely urban City of Los Angeles from 2000 to 2016. Further studies are needed to pinpoint determinants of these improvements. Opportunities exist to optimize bystander intervention, including AED use.

200. PREHOSPITAL ADMINISTRATION OF TRANEXAMIC ACID (TXA) IN PATIENTS WITH MAJOR HEMORRHAGE
Background: Tranexamic acid (TXA) is an inhibitor of fibrin-degradation. By blocking the activation of plasminogen to plasmin, the body’s normal process of fibrin degradation is hindered. In massive hemorrhage, clots will remain viable and combat clinical deterioration. There are several randomized trials that have established its safety and efficacy. The purpose of this study was to retrospectively analyze demographics, biometrics, and hospital outcomes of patients who received TXA in the prehospital setting compared to a control group. Our primary outcome was survival to hospital discharge. Methods: A retrospective analysis of patients who received TXA for treatment of hemorrhage secondary to blunt and penetrating trauma, post-operative complications, or dialysis access malfunction between 5/1/2015 and 3/1/2018. Patients were given 1g of IV or IO TXA over 10 minutes. Inclusion criteria was patients over 16 years with major bleeding or a risk for major bleeding due to trauma, laceration, dialysis access malfunction, post-operative complication, or post-partum hemorrhage. The control group population was taken from 1/1/2013 and overlapped into the protocol period to 3/31/2017. Propensity score matching was used to adjust for this overlap and for confounders. Results: Seventy-seven subjects met criteria for the treatment group and 49 patients met criteria for the control group. There were no significant differences between groups in baseline demographic characteristics. There was a significant difference in treatment category as there was a greater number of patients with blunt trauma in the control group (74% compared to 66%, p=0.04). After propensity score matching on treatment category, age, sex, and weight, we demonstrated 88.33% survival to discharge in the treatment group compared to 69.44% survival to discharge in the control group (p=0.16). Conclusions: We demonstrate that it is feasible to use TXA in the prehospital setting for a variety of causes of major hemorrhage. Limitations include a retrospective analysis. Propensity score matching allowed for a clinically noticeable trend towards increased survival to discharge. Due to low power we did not
demonstrate statistical significance. Until further evidence emerges, the results of this study support the use of TXA during prehospital treatment of patients with various causes of major hemorrhage.

201. VARIATION IN BURNOUT PREVALENCE ACROSS EMS AGENCIES IN SOUTH CAROLINA AND ASSOCIATED JOB CHARACTERISTICS

Remle Crowe, Rebecca Cash, Madison Rivard, Ashish Panchal, Antonio Fernandez, Robert Wronski, Sarah Anderson, Tory Hogan, Rebecca Andridge, Amy Ferketich, The National Registry of EMTs, The Ohio State University College of Public Health CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS

Background: The prevalence of burnout may vary between EMS agencies. Further, job characteristics (demands and resources) may affect burnout in EMS, yet specific characteristics have not been explored. Our objective was to quantify burnout at the EMS agency level and evaluate associated job demands and resources. We hypothesized that increased job resources are associated with reduced burnout. Methods: A cross-sectional electronic questionnaire was administered to all licensed EMS professionals in South Carolina’s credentialing information system. Work-related burnout was measured using the Copenhagen Burnout Inventory. Agency rosters were used to calculate agency-level burnout prevalence among respondents. Generalized estimating equations with robust standard errors were used to assess the relationship between job characteristics and burnout while accounting for clustering by main EMS agency and adjusting for the following confounding variables: certification level, experience, full-time status, call volume, agency type, and urbanicity. A four-level variable was created to assess the association of burnout with low demands/high resources, low demands/low resources, high demands/high resources, and high demands/low resources. Inclusion criteria consisted of EMS professionals practicing at the emergency medical technician level or higher who had provided patient care during the month preceding the survey. Results: We received 1,490/8,059 responses (19%) and
1,271 (85%) met inclusion criteria. Agency-level burnout prevalence ranged from 0%-83% (median:37%). Compared to EMS professionals working in settings with low job demands and high job resources (32%), those exposed to high demands and low resources (30%) experienced over a nine-fold increase in odds of burnout (OR:9.50, 95%CI:6.39-14.10). Meanwhile, those with high demands and high resources demonstrated a six-fold increase in odds of burnout (OR:6.47, 95%CI: 3.61-11.59). Job resources associated with reduced odds of burnout included performance feedback from a medical director (OR:0.46, 95%CI:0.34-0.61), management support (OR:0.19, 95%CI:0.13-0.28), and adequate on-the-job training (OR:0.36, 95%CI:0.28-0.45). A non-responder survey showed no significant differences between responders and non-responders for work-related burnout. **Conclusions:** Burnout prevalence varied widely across EMS agencies. Increased job resources may have a mitigating effect on the relationship between high job demands and burnout. Limitations include the cross-sectional analysis, use of a single state study population, and potential response bias.

202. PATTERNS OF CHEMICAL RESTRAINT ADMINISTRATION AMONG PHYSICALLY RESTRAINED PREHOSPITAL PATIENTS AND IMPACT ON EMERGENCY DEPARTMENT DISPOSITION

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**CATEGORY OF SUBMISSION:** OPERATIONS, QUALITY, SAFETY SYSTEMS

**Background:** Physical and chemical restraints may be used for protection of patients and medical personnel when patients are agitated or combative secondary to psychiatric, toxicologic, or other pathology. The risks of physical restraints and of the various medications used for chemical restraint have been well described, but there is a paucity of literature describing patterns of restraint use and its potential impact on the patient's emergency department (ED) course. **Methods:** We conducted a retrospective chart survey of patients transported by our EMS system from August 1, 2015-June 30,
2018 who had a treatment intervention of physical restraint charted in the patient care record. This cohort was analyzed to determine the demographics of patients who were physically restrained (gender, age, indication), and to determine rates of medication administration for the purpose of chemical restraint. We further analyzed ED records of these patients who were transported to one hospital, looking at ED disposition as our primary outcome and ED requirement for physical restraint, chemical restraint, ED length of stay (LOS), and potential adverse outcomes from physical or chemical restraint.

**Results:** There were 446 patients who met inclusion criteria within the study period. The patients physically restrained were 67.7% male (302/446), with an average age of 37.6. The prehospital record identified a suspected psychiatric history in 31.2% these cases (139/466) and of suspected drug use in 61.7% (275/466). Paramedics administered medication for chemical restraint in 30.9% of patients (138/446), with benzodiazepines being the most common medication (109/446, 24.4%). Haloperidol was given to 34/446 patients (7.6%), and ketamine to 11/446 patients (2.5%). One hundred forty patients were transported to our hospital, and we were able to analyze records for 129/140 (92%). Prehospital administration of chemical restraints was not associated with higher rates of admission (42.5% vs. 41.6%, OR 1.04, 95% CI 0.49-2.21), or longer ED LOS (mean 261 min vs. 253 min, p value 0.767).

**Conclusions:** In our patient population, paramedics used chemical restraints in the minority of patients who required physical restraint for agitation. The addition of chemical restraints was not associated with a significant increase in ED LOS and admission rates.

203. IMPACT OF IMPLEMENTING AUTOMATED DISPENSING SYSTEMS ON THE USE OF MIDAZOLAM AND MORPHINE BY FIRE-BASED EMS PROVIDERS

Denise Whitfield, Clayton Kazan, Nicole Steeneken, Nichole Bosson, *Los Angeles County EMS Agency/ Harbor-UCLA Department of Emergency Medicine* CATEGORY OF SUBMISSION: OPERATIONS, QUALITY, SAFETY SYSTEMS
**Background:** Automated Dispensing Systems (ADS) improve in-hospital medication dispensing but have not been previously studied for EMS use. We evaluated the administration of midazolam and morphine by EMS providers before and after implementation of ADS for controlled medication re-stock. We hypothesized that the simplified re-stock process would increase administration overall and increase administration for discretionary indications, but have no effect on administration for non-discretionary indications. **Methods:** This was a retrospective analysis of fire-based EMS provider data before (7/1/2016-5/31/2017) and after (7/1/2017-5/31/2018) transition from hospital-based controlled medication re-stock to an ADS model. The primary outcome was the frequency of midazolam and morphine administration before and after ADS implementation. Sub-groups included: 1) midazolam administration for discretionary indications (sedation for anxiety/agitation and/or painful procedures) and non-discretionary indications (seizure, agitated delirium) and 2) morphine administration for discretionary indications (any traumatic injury) and non-discretionary indications (documented pain score ≥5). The risk difference with 95% confidence interval for controlled medication administration pre- and post-ADS implementation was calculated. **Results:** Out of 260,493 total patient encounters pre-ADS, paramedics administered midazolam to 1303 patients (0.5%) and morphine to 2078 patients (0.8%) as compared with 262,440 patient post-ADS in whom paramedics administered midazolam to 1711 (0.7%) and morphine to 2468 (0.9%), risk difference (RD) 0.2% (95%CI 0.1%, 0.2%) and RD 0.1% (95%CI 0.1%, 0.2%) respectively. The relative increase in midazolam and morphine administration was 30% and 18% respectively. Midazolam was administered for sedation in 70/21341 patients (0.3%) pre-ADS and 88/24676 patients (0.4%) post-ADS [RD 0.03% (95%CI -0.1, 0.1%)], for seizure in 1008/9954 patients (10.1%) pre-ADS and 1240/10585 patients (11.7%) post-ADS [RD 1.6% (95%CI 0.7, 2.4%)], and for agitated delirium in 73/264 patients (27.6%) pre-ADS and 168/558 patients (30.1%) post-ADS [RD 2.5% (95%CI -4.1%, 9.1%)]. Morphine was administered to 1528/34263 patients (4.5%) with traumatic injury pre-ADS and 1864/35355 patients (5.3%) post-ADS [RD 0.8% (95%CI 0.5%, 1.1%)]. Among patients with a
documented pain score ≥5, morphine was administered to 1,471/17,899 (8.2%) patients pre-ADS and 2,047/26,025 (7.9%) patients post-ADS, RD -0.3% (95%CI -0.9, 0.2%). **Conclusions:** ADS implementation in this fire-based EMS agency was associated with an increase in midazolam and morphine administration.

204. **EFFECT OF IMPLEMENTATION OF CARDIOPULMONARY RESUSCITATION-TARGETED MULTI-TIER RESPONSE SYSTEM ON OUTCOMES AFTER OUT-OF-HOSPITAL CARDIAC ARREST: A BEFORE-AND-AFTER POPULATION-BASED STUDY**

Sun Young Lee, Sang Do Shin, Young Sun Ro, Kyoung Jun Song, Ki Jeong Hong, Jeong Ho Park, Tae Han Kim, Seung Chul Lee, Seoul National University Hospital CATEGORY OF SUBMISSION: CARDIAC

**Background:** A multi-tiered response (MTR) system has been a controversial issue for cost-effectiveness or outcome improvement. It is uncertain, however, whether cardiopulmonary resuscitation (CPR)-targeted tiered response system is associated with better outcomes or not after out-of-hospital cardiac arrest (OHCA) or not. This study aimed to investigate the effect of the MTR on OHCA outcomes.

**Methods:** A before-and-after population intervention study was conducted for resuscitation-attempted adult OHCA. A multi-tier response (MTR) system was implemented by the national fire department in 2015 across the whole country where the single tiered ambulance response system was existed. The MTR program had three components 1) detection of OHCA by dispatcher 2) dispatch of ambulance or fire engine in addition to routine dispatch of ambulance 3) performance of team CPR. The study period of 2015-2016 was divided by 6 months (phase 1 (reference), 2, 3, and 4). The endpoints were prehospital defibrillation, prehospital return-of-spontaneous circulation (PROSC), survival to discharge, and good neurological recovery. A multivariable logistic regression analysis was performed to evaluate the effect of the intervention, and adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated, adjusting for potential confounders. **Results:** A total of 32,663 eligible OHCA cases were
evaluated during the study periods. Ambulance MTR increased from phase 1 to phase 4 (7.0% in phase 1 and 53.7% in phase 4) (p<0.01). The prehospital defibrillation also increased (23.6% in phase 1 vs. 26.9% in phase 4) (p<0.01). The study outcome was improved during the study periods from 7.4% to 12.6% for PROSC (p<0.01), from 6.7% to 9.1% for survival to discharge (p<0.01), and from 4.5% to 5.8% for good neurological outcome (p<0.01). Compared with phase 1, the AORs (95% CIs) for prehospital defibrillation of phase 4 was 1.16 (1.08 to 1.25). About survival to discharge and good neurological outcome, the AORs of phase 4 were 1.37 (1.21 to 1.56) and 1.23 (1.06 to 1.43), respectively. Conclusions: The nationwide implementation of a multi-tier response system for OHCA was associated with increased prehospital defibrillation and improved outcomes.

205. COMPARISON OF GROUND LEVEL HYPER-ANGULATED AND STANDARD-GEOMETRY VIDEO LARYNGOSCOPY TRACHEAL INTUBATION FOR PREHOSPITAL CARE IN A MANIKIN

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Background: There is consensus that Video Laryngoscopy (VL) can be very useful in the Emergency Department (ED) when difficult intubations are predicted. Emergency Medical Services providers (EMS) are also often faced with difficult, rapidly deteriorating, airway management situations; but further, many of these patient’s airways are managed with the patient lying on the floor – a much less favorable position than usual in the ED. Both HAVL and SGVL devices are becoming more commonplace in EMS. To our knowledge, there has never been a study purposefully investigating the efficacy of the distinct techniques associated with these devices vs. one another. Purpose: To investigate the efficacy of Hyper-Angulated Video Laryngoscopy (HAVL) vs. Standard-Geometry Video Laryngoscopy (SGVL) in a common prehospital intubation position. Methods: A single center, RCT crossover trial was preformed using
attending physician helicopter EMS providers. Physicians were randomized to perform 5 HAVL or SGVL intubations, followed by the subsequent technique. Intubations were performed on a ground level, Airsim™ airway management trainer to simulate intubation on the floor. Time to intubation (primary outcome), as well as first pass success (FPS), and Cormack-Lehane view were recorded for each attempt. Qualitative data were also obtained for physician preference and perceived difficulty. Results: There was no clinical nor statistically significant difference in time to intubation with HAVL vs. SGVL (15.02 seconds vs. 14.88 seconds; p-value 0.86). FPS was 100% for both techniques. More Grade 1 views were obtained with HAVL (74/75 vs. 72/75). Most physicians preferred HAVL (11/15) and felt that HAVL required less force (10/15), provided better view(8/15), and led to best chance for 1st pass success (11/15).

Conclusions: The results of this study are limited due to the static and highly favorable anatomy of a manikin vs. the variability and often-difficult anatomy of individual patients. Our results suggest that both techniques are efficacious when the patient is positioned on the floor, though provider preference does seem to vary.

206. SPATIAL ANALYSIS AND SURVEILLANCE OF OVERDOSES BY INDIANAPOLIS EMERGENCY MEDICAL SERVICE

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Background: The opioid epidemic is worsening in every region of the United States, with 66,324 fatal overdoses nationwide in 2016 (Centers for Disease Control and Prevention). Across the country, overdose tracking is often limited and varies by region. In Marion County, IN, there has been a 4-fold increase in overdose deaths since 2010; however, there is currently no formal opioid overdose tracking system in place in this county. This study aimed to understand when and where opioid overdoses are occurring in Marion County in order to understand trends in overdose events and inform overdose
Methods: This study used records from Indianapolis Emergency Medical System to conduct a geospatial analysis of opioid overdoses in Marion County from January 1 to December 31, 2017. Maps were created using qGIS 3.2 with the MMQGIS toolbox based on location to aid in identifying patterns. Comparisons were made across census blocks within Marion County. While further analysis is ongoing, general trends already have been identified which may be useful in planning outreach and intervention services. Results: Overdose calls are most frequent in central, east, and south Marion County, and naloxone administration is most frequent in or near the downtown Indianapolis area. Neither opioid overdose calls nor naloxone administration appear to be associated with race. There appears to be a strong association between lower median income and increase in overdose calls. Naloxone administration appears to have geographic, rather than economic, trends in utilization. This may relate to distribution patterns of naloxone. An outlier to this data is a census tract just southwest of the Indianapolis downtown area; this census block is of higher average income than most blocks with similar overdose call volume, but known to local public health and emergency response officials as an area with a long history of disordered opioid use.

207. TRANSPORT OF ECMO PATIENTS: THE EMS EXPERIENCE

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CATEGORY OF SUBMISSION: MEDICAL

Background: Extracorporeal membrane oxygenation (ECMO) is an invasive therapy that provides pulmonary and cardiac support to critical patients. Recent advances have increased the incidence and success of ECMO and increasingly EMS services are called upon to provide care in the uniquely difficult transport environment. There is a paucity of research on the out-of-hospital ECMO experience and significant need to define the medications, equipment, and skills needed to ensure safe transport.

Methods: This EMS chart review included all 15 ECMO patients with complete records transported to
our center from 1/17 to 4/18. Time on scene, in transit, and distance traveled was recorded. Ventilator settings, support devices, and medications during transport were noted and attention paid to any interventions en route. Patients were separated by cannulation prior to or after arrival of EMS and scene times compared. After IRB approval data was abstracted by authors on a standardized form and evaluated with descriptive statistics while times were compared between the different patient groups with an independent t-test. **Results:** Average distance traveled and transit time was 37.5 miles (.1 to 109) and 53.6 minutes (9 to 120). Mean scene time was 145.7 minutes and was significantly longer for patients cannulated after EMS arrival (213.2 vs 95.1, SD 77.8 vs 59.9, at significance 0.05 p=.0074). 14/15 patients had ventilator PEEP >5 and 4/15 had support devices including balloon pumps, percutaneous ventricular assist devices, pacers, and inhaled epoprostenol. Medications included vasopressors (12/15), sedatives (12/15), paralytics (8/15), narcotics (6/15), anticoagulants (6/15), inotropes (4/15), bicarbonate (4/15), and blood products (4/15). 8/15 had interventions en route including ventilator and drip changes, medication boluses, temperature changes, and capnography troubleshooting.

**Conclusions:** This study of ECMO transport from a non-hospital EMS perspective shows these patients require advanced ventilator management and familiarity with cardiac support devices. Transport services must be stocked with medications uncommon in prehospital care such as paralytics, inotropes, and blood. Services must be prepared for lengthy transport and scene times, especially if they assist in ECMO cannulation, and for difficulties with capnography. Our study is limited by its retrospective nature and small sample size with further research necessary to establish best practices.

208. PREDICTIVE PERFORMANCE OF MACHINE LEARNING ALGORITHM FOR GOOD NEUROLOGICAL RECOVERY IN OUT-OF-HOSPITAL CARDIAC ARREST
Background: Prediction of good neurological recovery after out-of-hospital cardiac arrest (OHCA) has been one of the difficult challenges. Recent advances in machine learning (ML) algorithms are expected to be useful in predicting the neurological outcome of OHCA. This study aimed to train and validate predictive models using ML algorithms and compare the performance of the ML models for predicting good neurological recovery after OHCA. Methods: Data from nationwide OHCA registry of adult patients with a presumed cardiac etiology and had a sustained return of spontaneous circulation (ROSC) at hospitals between 2013 and 2016 were analyzed. Eligible OHCA were randomly selected and allocated for training (80%) and validation cohort (20%), respectively. Twenty-one variables (Demographic, community, emergency medical service, and hospital cardiopulmonary factors) which could be obtained within 24 hours of ED visit were used in ML models. Primary outcome was survival to discharge with good neurological recovery. We developed ML models to predict good neurological recovery with eight machine learning algorithms (Logistic Regression, Extreme Gradient Boosting, Adaptive Boosting, Support Vector Machine, Random Forest, Elastic Net, Naive Bayes, and Neural Network). The sensitivity, specificity, and area under the receiver operation curve (AUC) with 95% confidence intervals (CIs) of each model on the validation cohort were calculated and compared. Results: A total of 19,860 patients were included. Of the 15,888 patients in the training group, 2,228 (14.0%) had good neurological recovery, and of the 3,972 patients in the validation group, 577 (14.5%) had good neurological recovery. The ML models had 65.2 (61.1-69.1) to 68.1 (64.1-71.9) of sensitivity (%), 89.0 (87.9-90.0) to 97.0 (96.3-97.5) of specificity (%), and 0.882 (0.882-0.896) to 0.949 (0.949-0.957) of AUC, respectively. There was no statistically significant difference of AUC in top performing models using Logistic Regression, Extreme
Gradient Boosting, Adaptive Boosting, Support Vector Machine, Random Forest, Elastic Net, and Neural Network, except Naïve Bayes model. **Conclusions:** Current ML algorithms accurately predicted good neurological recovery after OHCA when the patients are admitted with sustained ROSC to hospital. Further study on early prediction of good neurological recovery using limited variables obtained in prehospital setting is needed.

209. PREHOSPITAL CATH-LAB ACTIVATION FOR ST-ELEVATION MYOCARDIAL INFARCTION (STEMI) BY A RURAL VOLUNTEER, PART-TIME-ALS AMBULANCE SERVICE

Aaron Klassen, Christopher Russi, Mayo Clinic  CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

**Background:** Time to definitive treatment has been shown to improve outcomes in ST-elevation myocardial infarction (STEMI) patients. In order to shorten this time, prehospital cath-lab activation systems have been implemented, though to our knowledge these systems exist primarily in urban, high-volume, advanced life support (ALS), EMS systems. We describe the successful implementation of a prehospital cath-lab activation system for STEMI in a rural ambulance service staffed by volunteers with paramedics available only part-time (“part-time ALS”). **Methods:** In preparation for the start of the new cath-lab activation protocol, both basic life support (BLS) and ALS EMS providers in this rural ambulance service were trained to perform electrocardiography (ECG) on patients with signs or symptoms suggesting acute coronary syndrome. BLS teams used automated interpretations to activate the cath lab, ALS providers supplemented with their own interpretation. Crews who identify a STEMI contacted the local emergency communications center to request cath-lab activation. In addition, BLS providers immediately called for an ALS ground intercept or helicopter. ALS providers either transported patients emergently or called for a helicopter. Medical records for all patients for whom the cath-lab was activated by this service were analyzed. **Results:** There were 10 cath-lab activations between February
2011 and July 2014. One patient declined research participation leaving nine patients for analysis. Mean age was 62 years (+/- 9.25). STEMI was called by BLS providers in 4 cases (44%). Seven patients (78%) had ECGs diagnostic for STEMI upon cardiologist review and all these were taken to the cath lab. Median time from first medical contact (FMC) to cath-lab activation was 26 minutes (+/- 13) and FMC to device deployment was 91 minutes (+/- 23). All patients for whom percutaneous intervention was attempted were successful. Cardiogenic shock was present in 3 patients (33%). One patient died during the index hospitalization (11%); all others were alive at 1 year. Conclusions: These data demonstrate a practical system for volunteer EMS providers, including EMT-B, in a rural environment to perform ECGs and activate the cath-lab for patients with STEMI.

210. NON-AUTO-INJECTOR EPINEPHRINE ADMINISTRATION BY BASIC LIFE SUPPORT EMS PERSONNEL: A SYSTEMATIC REVIEW

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CATEGORY OF SUBMISSION: MEDICAL

Background: Many states restrict epinephrine administration by basic life support (BLS) personnel to automatic injector devices (EAs). The cost of EAs has led some agencies and EMS leaders to advocate for non-EAI epinephrine administration by BLS personnel. The purpose of this analysis was to systematically review the literature regarding the safety and efficacy of non-EAI epinephrine administration to inform a proposed NAEMSP position statement. Methods: Titles and abstracts identified through structured searches of the MedLine, CINAHL and Academic Complete databases were reviewed for relevance by two independent investigators, with adjudication by a third independent investigator when the primary reviewers disagreed. Subsequently, the full text of each retained article was reviewed, again by two independent investigators using a structured form to extract and summarize
Results: After excluding duplicates, 166 titles and abstracts were reviewed; 20 articles were retained—along with one additional article was published during the review process—for full review (overall agreement 88%; Kappa=0.54). Three of the 21 articles reported data relevant to BLS administration of non-EAI epinephrine. Collectively, these articles report 433 instances of non-EAI epinephrine administration by BLS providers, with the majority of patients (80%-90%) experiencing clinical improvement. One paper reported insufficient documentation of the indications for epinephrine in approximately 10% of the cases, but physician review of the full record confirmed administration was appropriate in all but a small number of cases (~2%). There was only one report of an adverse event attributable to epinephrine administration: an episode of near-syncope in a patient with a heart rate of 100 and a blood pressure of 135/80 mmHg. Conclusions: There is no evidence to demonstrate that BLS administration of non-EAI epinephrine is inferior to EAI-epinephrine administration in terms of either safety or efficacy. Restricting BLS epinephrine administration to EAIIs appears unwarranted.

211. COMPLICATIONS IN KING LTS-D PLACEMENT IN THE PREHOSPITAL SETTING

Lucas Myers, Haley Patterson, Boje Eric, Christopher Russi, Mayo Clinic CATEGORY OF SUBMISSION: MEDICAL

Background: The King LTS-D airway device is frequently used in prehospital settings, but this device has been reported to cause trauma to the pharynx in rare settings. Further, several case studies demonstrate laryngeal swelling following King LTS-D placement, suspected as a result of balloon over-inflation creating laryngeal venous congestion. Other complications associated with placement and use of the King LTS-D airway device have been inadequately assessed or reported on. The objective of this study was to categorize King LTS-D complications associated with placement and further describe their respective causes and clinical outcomes. Methods: This chart review (retrospective) analysis examined all patients (18 years and older) that received a King LTS-D placement from a large, single EMS provider
(ground and rotor wing air) and transported to a tertiary care center in a Midwestern city from January 2011 through May 2017. Following identification, an independent, single emergency physician review of records categorized complications as follows: 1-Device complication (i.e. ruptured balloon); 2-Anatomic complication (i.e. epiglottitis, severe mouth / facial trauma); 3-Human error (i.e. balloon over inflation)

**Results:** There were 65 patients included in the analysis. Median age was 61.9 years and 42 (64.6%) were male. There were 10 cases (15.4%) where a complication was found. Anatomic complications occurred in 5 cases (50.0%); human error was found to be the cause of one (10.0%) and device error was found in four (40.0%). Thirteen patients (20.0%) died in the emergency department and the remaining 52 (80.0%) were admitted to the hospital. All 52 admitted patients had the King device replaced; 44 (84.6%) with an endotracheal tube and 8 (15.4%) with surgical tracheostomy. **Conclusions:** Complications were noted in 10 (15.4%) cases, although device failure only occurred in 4 patients (6.2%) within this population. The highest rates of issues were due to anatomical complications. The King LTS-D is used by this service as a back-up or difficult airway device, therefore anatomical complications are expected.

212. BARIATRIC LIFT PROTOTYPE

Mary Bethany Glatz, Christina Salas, David Grow, Coffee Brown, Justin Baca, University of New Mexico, Emergency Medicine CATEGORY OF SUBMISSION: STUDENT, RESIDENT, FELLOW

**Background:** The primary objective of this study is to obtain feedback from EMS providers on the design of a bariatric lift prototype system by performing simulated patient lifts with the prototype and a standard backboard. The secondary objective of this study is to demonstrate a framework for iterative design collaboration between emergency medicine clinicians and engineers to approach common challenges in emergency medicine. **Methods:** This is a single center study with a study group of twelve participants for the initial evaluation (focus) group of end-users. A structured interview and simulated
lifting task was administered using the prototype and standard equipment. After completion of each lifting task, subjects completed a short survey rating the difficulty of the tasks with demographic questions. Results: Twelve subjects were recruited to complete the patient transfer tasks and provider feedback. Average age of participants as 35 years with average number of years performing patient transfers of 7 years. The majority of subjects (91%) stated that the bariatric lift was easy to use. 58% of subjects thought that the bariatric lift would decrease patient transfer time. 100% of subjects would use this device in the field and 91% thought the bariatric lift would help decrease injuries. Conclusions: EMS providers encounter multiple risks at work, including the risk of injury due to lifting and transporting patients. In this study we developed a prototype of a bariatric lift system and performed initial end-user testing to obtain important feedback on the design. According to our initial focus group, the bariatric lift may be an easy addition to regular backboards, allowing any backboard to become a bariatric backboard -protecting patients and EMS personnel. This study also demonstrates a framework for emergency medicine clinicians and engineers to work together to address common clinical problems in emergency medicine.